

## GLAUCOMA EMPHASIZING SURGICAL GLAUCOMA

FRIDAY 10 JUNE

### Paper #42

#### Preservative exposure and surgical outcomes in glaucoma patients: the PESO study

Corey Boimer, Catherine Birt

**Purpose** To study the impact of benzalkonium chloride (BAK) exposure from eye drops on subsequent time to trabeculectomy failure.

**Study Design** Retrospective chart review of 128 glaucoma patients who had undergone a trabeculectomy between 2004 and 2006.

**Methods** The number and type of ophthalmic drops used preoperatively and relevant demographics were recorded. Surgical failure criteria included inadequate pressure lowering or need for postoperative ocular anti-hypertensives, laser trabeculoplasty, 5-fluorouracil needling, or repeated surgery. Patients were examined for these criteria over a minimum postoperative period of two years. Data was assessed using Kaplan-Meier and Cox regression models.

**Results** Median patient age was 72 (SD 11.7). Average postoperative follow up time was 4.3 years, ranging from 2.0 to 6.3 years. Complete surgical success was achieved in 47.7% of patients. Patients received between one and eight BAK-containing drops daily, with a median of three. Time to surgical failure in patients receiving higher preoperative daily doses of BAK was shorter than in patients who had less BAK exposure ( $P=0.008$ ). Proportional hazard modelling identified uveitic and neovascular glaucoma as significant confounders of the univariate model ( $P=0.024$ ), although the main effect of BAK exposure was maintained with a hazard ratio (HR) of 1.21 ( $P=0.032$ ). The number of different medications used to control intraocular pressure did not significantly affect survival time in a secondary Cox model ( $P=0.948$ ).

**Conclusions** Increased preoperative exposure to ophthalmic solutions preserved with BAK is a risk factor for earlier surgical failure, independent of the number of medications used. This study supports earlier findings of potential adverse effects of ophthalmic preservatives on surgical outcomes and extends those findings to the modern pharmacopeia used in the medical management of glaucoma.

## GLAUCOMA EMPHASIZING SURGICAL GLAUCOMA

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### Paper #43

#### Mechanisms of benzalkonium chloride toxicity in a human trabecular meshwork cell line

Cindy Hutnik, Angela Q. Zhang, Christopher Byrne, Grayson A. Roumeliotis, Cindy Shao, Hong Liu

**Purpose** To evaluate mechanisms of benzalkonium chloride toxicity in a human trabecular meshwork cell line and the possible role of gap junctions.

**Study Design** Basic science cell culture

**Methods** A human trabecular meshwork (HTM) cell line was established in culture. Cells were treated with increasing concentrations of benzalkonium chloride (BAK) ranging from 0.002% to 0.01% for 1, 3, 10 and 30 minutes and cell death was measured using the MTT assay. Cells were treated with a 0.001% BAK for 30 minutes to assess apoptosis by caspase-3 activity and ELISA. HTM cells were up-regulated by retroviral transfection with Cx43-GFP and down-regulated with a dominant negative G138R mutant. Connexin43 expression was measured with Western Blot and RT-PCR. Gap junction intercellular communication was determined with scrape loading/dye transfer assay with 5% Lucifer yellow.

**Results** HTM cells exhibited time and dose dependent decrease in cell viability when treated with 0.002 to 0.01% BAK for 1 to 30 minutes. Up-regulation of connexin43 enhanced cell viability while down-regulation contributed to further cellular demise.

**Conclusions** BAK induces time and dose dependent HTM cell cytotoxicity. Connexin43 is affected by the cytotoxic effects of BAK in this cell type. The toxic effects of BAK on the HTM cells should be further explored for potential influences in the management of glaucoma.

## GLAUCOMA EMPHASIZING SURGICAL GLAUCOMA

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### Paper #44

**Comparison of pre- and post-surgical intraocular pressure control in patients with corneal edema who have undergone DSAEK with patients who have undergone PKP.**

**Lulu L. Bursztyn, Elizabeth Golesic, Rookaya Mather, David Tingey**

**Purpose** Corneal endothelial disorders can result in corneal edema and significant vision loss requiring surgical intervention. Conventional penetrating keratoplasty (PKP) is known to potentially worsen intraocular pressure control in patients with chronic glaucoma. Worsening or induction of glaucoma can potentially lead to corneal graft failure and permanent visual loss. Descemet's stripping with automated endothelial keratoplasty (DSAEK) is a newer less invasive approach to replacing corneal endothelium and reversing corneal edema. We compared the effect of DSAEK versus PKP on intraocular pressure.

**Study Design** Retrospective chart review

**Methods** Charts were obtained for all patients who had undergone PKP or DSAEK by a single surgeon at the Ivey Eye Institute between 2003 and 2010. Intraocular pressure and all IOP lowering medications were recorded pre-op and at 1, 4, 8, 12 and 24 weeks post-op. Visual acuity, complications, graft survival and glaucoma surgeries were also recorded.

**Results** Data from 26 eyes with full-thickness penetrating keratoplasty were compared with 28 eyes having undergone Descemet's stripping automated endothelial keratoplasty. There was no significant difference in mean pre-op IOP in PKP eyes compared to DSAEK eyes ( $15.8 \pm 4.8$  vs.  $14.1 \pm 3.8$ ;  $p=0.23$ ). However, IOP was significantly higher at 4 weeks post-op in PKP eyes than DSAEK eyes ( $21.2 \pm 5.8$  vs.  $15.5 \pm 4.0$ ;  $p<0.001$ ). At 24 weeks, IOP was not significantly different, ( $18.9 \pm 5.6$  for PKP and  $17.1 \pm 5.6$  for DSAEK;  $p=0.45$ ) but more topical medications were required to achieve this control ( $1.3 \pm 1.1$  for PKP vs.  $0.3 \pm 0.8$  for DSAEK;  $p<0.01$ ) and more glaucoma surgeries were performed (3 for PKP eyes vs 0 for DSAEK eyes).

**Conclusions** Intraocular pressure following keratoplasty was significantly lower 4 weeks after DSAEK compared to PKP. After 6 months, IOP control was achieved using fewer topical medications and no surgical intervention in DSAEK eyes compared to PKP eyes. Therefore, DSAEK may be a better option than PKP for patients with pre-existing glaucoma and corneal edema requiring keratoplasty.

## GLAUCOMA EMPHASIZING SURGICAL GLAUCOMA

FRIDAY 10 JUNE

### Paper #45

#### The effect of beclomethasone nasal spray on intraocular pressure in ocular hypertension or controlled glaucoma

Darana Yuen, Yvonne M. Buys, Tariq Alasbali, Yaping Jin, Graham Trope

**Purpose** Systemic, periocular and topical ophthalmic steroids have long been associated with increased intraocular pressure (IOP). Up to 35% of the general population and up to 90% of patients with primary open-angle glaucoma (POAG) are steroid responders. Allergic and non-allergic rhinitis affects millions of adults in North America. Topical nasal steroids are the most effective treatment option. However studies evaluating the effect of nasal steroids in glaucoma patients are limited. The purpose of our study was to evaluate the effect of 6 weeks of nasal steroids on ocular hypertension (OHT) or controlled POAG patients with or without rhinitis.

**Study Design** Prospective randomized double-masked controlled trial.

**Methods** The study was approved by the hospital ethics board and registered as a clinical trial. The study was carried out at a university-based tertiary care glaucoma practice between January 1st 2010 and July 31st 2010. Inclusion criteria included the following: age 18-85 years inclusive; mild to moderate POAG with cup-disc ratio of <0.8 vertically and mean deviation of <-12.00 dB on Humphrey perimetry; well controlled disease defined by IOP being at target and no visual field or disc progression for at least 6 months. Exclusion criteria included the following: any form of steroid medication use within the last 6 weeks; previous intra-ocular or refractive surgery; no light perception vision. Patients were randomized to nasal steroid spray (400mcg/day) versus placebo saline spray. Both investigators and study participants were masked to the treatment arm. There were a total of 4 study visits: baseline and weeks 2, 4, 6 after starting the spray. Each study visit was at the same time +/- 1 hour. Primary outcome measure was IOP. Secondary measures included visual acuity, anterior segment changes, patient reported side effects and compliance. Study endpoint was 6 weeks from the start of treatment or an IOP increase of >20% from baseline. A sample size calculation indicated that 8 patients in each arm would be required to detect a difference of 3.2 mmHg with a power of 80%.

**Results** 19 consecutive consenting subjects completed the study-- 9 in the steroid arm and 10 in the placebo arm. There were no statistically significant differences between groups in baseline characteristics, IOP at each study visit, or change in IOP from baseline at any time point. At 6 weeks the change in mean IOP from baseline was  $+0.50 \pm 1.52$  versus  $+0.70 \pm 1.44$  mmHg in the steroid and saline nasal spray groups respectively ( $p=0.77$ ).

**Conclusions** OHT and POAG subjects showed no evidence of IOP elevation following 6 weeks use of beclomethasone nasal spray.

## GLAUCOMA EMPHASIZING SURGICAL GLAUCOMA

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### Paper #46

#### Early Effects of Laser Peripheral Iridotomy (LPI) on Intraocular pressure (IOP) in Primary Angle Closure Suspects (PACS) and Primary Angle Closure Glaucoma (PACG) Patients

Nir Shoham, Gyanesh Verma, Mahmoud F. Rateb, Brian J. Chan, Garfield Miller, Ike Ahmed

**Purpose** To evaluate the early effects of YAG LPI on IOP in PACS and PACG patients. The relationship between net change in IOP with the total number of LPI applications and energy used was explored.

**Study Design** This is a prospective, nonrandomized cohort study.

**Methods** A total of 62 eyes (44 with PACS and 18 with PACG) underwent temporal YAG LPI. IOP was measured preoperatively and 1 hour postoperatively. The number of LPI applications and total energy used were recorded. Paired t-tests were used to evaluate the effects of LPI on IOP. Pearson's r correlation was used to assess the relationship between the net change in IOP with the total number of applications and energy used.

**Results** Mean IOP for all study participants (N=62) was  $13.91 \pm 2.9$  mmHg preoperatively and  $16.9 \pm 5.2$  postoperatively ( $p \leq 0.001$ ). In the PACS group (N=44), mean IOP was  $14.15 \pm 2.9$  mmHg preoperatively, and  $17 \pm 4.7$  postoperatively ( $p \leq 0.001$ ) and  $13.33 \pm 2.8$  and  $16.66 \pm 6.5$  pre and postoperatively respectively, in the PACG ( $p=0.047$ ). Moderate correlation was found between the net change in IOP with the number of LPI applications ( $r=.331$   $p=0.01$ ) and total energy used ( $r=.333$   $p=0.009$ ). Two patients in the PACS, and 3 in the PACG experienced an elevation of IOP  $\geq 10$  mmHg.

**Conclusions** Both PACS and PACG experienced significant one hour IOP elevation that may not be clinically significant. However, 8% of patients had a potentially serious IOP spike above 10 mmHg. Total number of laser applications and total energy used appear to correlate to the increase in IOP postoperatively.

## GLAUCOMA-TUBE-SHUNTS AND GLAUCOMA RISK FACTORS

FRIDAY 10 JUNE

### Paper #47

#### The Ahmed versus Baerveldt (AVB) Study: 2-year results

Panos G. Christakis, David Zurakowski, James C. Tsai, Jeffrey W. Kalenak, Jeffrey A. Kammer, Louis B. Cantor, Paul Harasymowycz, Ike Ahmed

**Purpose** To report 2-year results of the Ahmed versus Baerveldt (AVB) Study, which compares the two most frequently implanted aqueous drainage devices in a population of patients with refractory glaucoma.

**Study Design** Multicenter randomized clinical trial.

**Methods** Patients were recruited from 7 international clinical sites and operated on by 10 surgeons. Inclusion criteria required patients to be at least 18 years old and have uncontrolled glaucoma refractory to medical, laser and surgical therapy. Eligible patients were randomized to receive either an Ahmed-FP7 valve implant or a Baerveldt-350 implant using standardized surgical technique. Outcome measures included intraocular pressure (IOP), visual acuity (VA), glaucoma medication use, complications and required interventions. The IOP goal was 5mmHg-18mmHg inclusive with a reduction of at least 20% from baseline. Failure was defined as two consecutive visits at or after 3 months in which the IOP goal was not met, additional glaucoma surgery, devastating complications, or progression to no light perception.

**Results** Two hundred thirty-eight glaucoma patients were enrolled between October 2005 and January 2009, including 124 in the Ahmed group and 114 in the Baerveldt group. There were no significant differences in baseline demographic and ocular characteristics between the two groups. Prior to surgery, the study group had a mean IOP of 31.4±10.8 mmHg on a mean of 3.1±1.0 glaucoma medications with a median Snellen VA of 20/100. At 2-years, the mean IOP was 16.1±6.4 mmHg in the Ahmed group and 14.5±6.6 mmHg in the Baerveldt group (p=0.12). The mean number of glaucoma medications required was 1.8±1.4 in the Ahmed group and 1.0±1.2 in the Baerveldt group (p<0.001). Median Snellen VA was 20/150 in both groups (p=0.99). Postoperative complications occurred in 61 (49.2%) patients in the Ahmed group and 69 (60.5%) patients in the Baerveldt group (p=0.08). Postoperative interventions were required in 40 (32.3%) patients in the Ahmed group and 54 (47.4%) patients in the Baerveldt group (p=0.02). The cumulative probability of failure was 47.6% in the Ahmed group and 30.7% in the Baerveldt group (p=0.02).

**Conclusions** At 2-years, the Baerveldt group had a lower probability of failure and required a fewer mean number of glaucoma medications than the Ahmed group. However, a greater number of interventions were required in the Baerveldt group to achieve this result. The two groups had comparable visual acuities, mean IOPs and experienced a similar number of postoperative complications.

## GLAUCOMA-TUBE-SHUNTS AND GLAUCOMA RISK FACTORS

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### Paper #48

#### Modified techniques of Baerveldt implantation: comparison with Ahmed drainage implant in the early post-operative phase

Toby Chan, David Tingey

**Purpose** For the Baerveldt implant, various modified techniques to prevent early post-operative hypotony have been described in the literature, including ligation sutures, slits, and occluding suture stents. However, no study in the past had compared the clinical outcome between different modified techniques in Baerveldt implants with Ahmed implants. The objectives of our study were: 1) to describe a modified technique for the Baerveldt implant BG101-350 with proximal tube ligation, two slits, and a 10-0 vicryl suture as a stent to hold open one of the slits; 2) to compare this modified technique with Baerveldt with ligation and slits alone, and with the Ahmed FP-7 implant, in terms of clinical outcome in the early post-operative phase.

**Study Design** Retrospective comparative interventional study

**Methods** Post-operative data up to 3 weeks from glaucoma patients of one surgeon (D.T.) that required either Ahmed or Baerveldt drainage implants for intraocular pressure (IOP) control over the past two years was reviewed. There were 26 cases for Baerveldt implant with ligation suture, slits and stent (Group 1), 38 cases for Baerveldt implant with ligation suture and slits alone (Group 2), and 33 cases for Ahmed implants (Group 3). Outcome measures include IOP and number of glaucoma medications at the following time points: pre-operatively, post-operative day 1, week 1 to week 3.

**Results** No significant difference was found in IOP and number of medications pre-operatively between groups. IOP of group 2 was significantly higher than other groups' at post-operative day 1 (Baerveldt with stent:  $13.0 \pm 9.0$  mmHg, Baerveldt with slits:  $21.2 \pm 13.2$  mmHg, Ahmed:  $11.0 \pm 5.1$  mmHg) and week 1 (Baerveldt with stent:  $13.9 \pm 7.8$  mmHg, Baerveldt with slits:  $22.2 \pm 12.4$  mmHg, Ahmed:  $10.1 \pm 4.7$  mmHg), but from week 2 onwards there was no significant difference in IOP between groups. Number of medications was significantly higher for group 2 compared to other groups at weeks 2 to 3. Group 1 (Baerveldt with stent) demonstrated similar IOP profile as group 3 (Ahmed) in the entire post-operative period examined.

**Conclusions** Our modified technique using slits with 10-0 vicryl stent allowed the Baerveldt implant to perform similar to the Ahmed implant, and thus a better pressure profile (lower IOP) than the Baerveldt with slits alone, in the early post-operative phase.

## GLAUCOMA-TUBE-SHUNTS AND GLAUCOMA RISK FACTORS

FRIDAY 10 JUNE

### Paper #49

#### **Buccal mucous membrane grafts combined with corneal lamellar patch grafts for the repair of eroded glaucoma drainage devices: mid-term outcomes in a large series**

**Stephanie A. Low, Dan B. Rootman, Graham Trope, David S. Rootman**

**Purpose** Glaucoma drainage devices (GDD) are used in the surgical management of medically refractory glaucoma. One rare, but serious late complication is erosion and exposure of the tube or plate. Surgical revisions with autologous conjunctiva alone often result in re-erosion. In these cases, other tissues can be transplanted. In this study, we evaluated the effectiveness of oral buccal mucous membrane allografts with corneal lamellar grafts for the repair of GDD erosions.

**Study Design** Retrospective consecutive observational case series.

**Methods** All patients who underwent buccal membrane transplants with corneal allografts for the repair of GDD erosions between 2006 and 2010 were included in this study. Primary outcomes were categorized as: a) success: coverage of the GDD without further repair, b) qualified success: minor peri-operative complications or additional procedures required to maintain success, or c) failure: GDD re-erosion requiring surgery.

**Results** 20 eyes from 18 patients with 21 GDDs were reviewed, of which there were 20 Ahmed valves and 1 Molteno valve. The mean (SD) number of ocular surgeries prior to the buccal membrane transplant was 4.7 (2.9). The mean (SD) time to exposure from the original GDD procedure was 4.3 (3.7) years. Buccal membrane repairs were considered a surgical success in 67% of cases with a mean (SD) follow-up of 1.7 (1.2) years. There were no qualified successes reported. Of the 7 failures, all underwent repeat buccal membrane transplants procedures. Five of these cases had viable grafts covering the GDD at the time of last follow-up, and two required removal of the device.

**Conclusions** The use of buccal mucous membrane allografts combined with corneal lamellar patch grafts in the repair of GDD erosions is a useful modality. While not always successful, the procedure may be useful in difficult cases of tube erosion that do not respond to other surgical interventions.



## GLAUCOMA-TUBE-SHUNTS AND GLAUCOMA RISK FACTORS

FRIDAY 10 JUNE

### Paper #50

#### Comparison of glaucoma drainage devices with combined cataract extraction.

Simran S. Takhar, Nir Shoham, Panos Christakis, Iqbal Ike K. Ahmed

**Purpose** To examine the surgical outcomes of combined phacoemulsification (Phaco) with either the Ahmed Glaucoma Valve (AGV) or the Baerveldt Glaucoma Device (BGD).

**Study Design** Retrospective, single surgeon study. Ethics approval for this study was obtained from the Institutional Review Board Services.

**Methods** This study compared outcomes of combined phacoemulsification with either AGV (N=41) or BGD (N=25). Intraocular pressure, glaucoma medications and visual acuity data were collected at each visit alongside complications and interventions. At each follow up visit a surgical outcome was assigned. Surgical success was defined as reduction in intraocular pressure (IOP) >20%, an absolute 5 mmHg  $\leq$  IOP  $\leq$  18 mmHg, with or without glaucoma medications, no loss of light perception, no vision threatening complications and without further glaucoma surgery. Failure was defined as the absence of surgical success on two consecutive visits after 3 months or if one of the following occurred; a final vision of no light perception, a vision threatening complication (suprachoroidal hemorrhage, corneal decompensation, etc.) or if an additional glaucoma procedure was required (shunt implantation). Patients were excluded if cataract extraction occurred by means of an extracapsular method or if a glaucoma drainage device other than AGV or BGD was used in the combined surgery. Patients were also excluded if there was not a minimum of 3 months follow up.

**Results** There was no difference in the baseline demographic or ocular characteristics between two study groups. The mean IOP and glaucoma medication use at 1-year were comparable between the two groups. The Phaco/Baerveldt group had a significantly higher IOP than the Phaco/Ahmed group at 1 day ( $p < 0.001$ ) and 1 week ( $p < 0.001$ ) and a higher use of glaucoma medication classes at 1 week ( $p < 0.001$ ) and 1 month ( $p < 0.001$ ). When comparing rates of total success at one year (complete and qualified) between the groups 77.3% (17/22) of eyes in the Phaco/Ahmed group and 68.4% (13/19) in the Phaco/Baerveldt group ( $p = 0.725$ ) achieved success. There was no difference between the proportions of eyes with improved visual acuity, maintained visual acuity and loss of visual acuity between the two groups ( $p = 0.565$ ). There was no difference between the total number of complications between the groups ( $p = 0.699$ ), however, the Phaco/Baerveldt group required a greater number of postoperative interventions ( $p = 0.022$ ).

**Conclusions** There was no significant difference in the intraocular pressure control, success rate, visual outcomes and complication rates between the Phaco/Ahmed and the Phaco/Baerveldt groups, at one year after surgery.

## GLAUCOMA-TUBE-SHUNTS AND GLAUCOMA RISK FACTORS

FRIDAY 10 JUNE

### Paper #51

#### Clinical and Demographic Risk factors for Primary Open Angle Glaucoma: A Systematic Review and Meta-Analysis

Hussein Hollands, Davin Johnson, Simon Hollands, Delan Jinapriya, Sanjay Sharma

**Purpose** To determine the relationship between clinical and demographic features and the risk of Primary Open-Angle Glaucoma (POAG).

**Study Design** Systematic Review and Meta-analysis

**Methods** We conducted a detailed review of the English language literature using OVID MEDLINE from 1950 to October week 4 2010 to retrieve articles that reported the diagnostic accuracy of IOP, disc parameters (i.e. cup:disc ratio, disc asymmetry, disc hemorrhages), gender, race, myopia, family history, and systemic comorbidities in diagnosing POAG. Two authors independently reviewed all abstracts and reviewed references and citations to identify further articles. We included only level 1 or 2 evidence defined as independent comparisons of signs with a gold standard using a large number of consecutive patients from a population-based study. All statistical analyses were done with Comprehensive Meta Analysis 2 (Borenstein 2005). The analyses were executed using a random effects model taking account both between study variability and subject level sampling error and thus did not assume that the methodology of each study was homogeneous.

**Results** Our literature search identified 4088 articles, of which 47 articles pertaining to 33 studies were relevant for the review; an additional seven articles were found from reviewing references. Of these 40 studies, 31 were level 1 or 2 evidence and used for the primary analyses. Increasing cup-to-disc (CD) ratio and increasing CD asymmetry was associated with higher specificity and lower sensitivity for the diagnosis of POAG. For example five studies (n=18,123) looked at CD ratio  $\geq 0.7$  and found sensitivity of 0.34 (0.22-0.39) and specificity of 0.98 (0.98 - 0.99) for POAG. Similarly increasing intraocular pressure (IOP) was associated with higher specificity and lower sensitivity for the diagnosis of POAG. For example, eight studies (n=21,066) looked at IOP of  $\geq 21$  mmHg and found sensitivity 0.62 (0.44-0.77) and specificity 0.94 (0.90-0.96). A positive family history of POAG was associated with a positive likelihood ratio (LR+) of 4.67 (2.29-9.51; 10 studies, n=27,938), disc hemorrhage had a LR+ of 8.9 (1.85-43.14; 5 studies, n=18,063) and diabetes mellitus had a LR+ of 1.57 (1.00-2.46; 5 studies, n=14,482). Increasing levels of myopia was associated with higher association with POAG. For example, myopia of  $\geq -1.00$  Diopters was not significantly associated with POAG (3 studies, n=11,601) whereas myopia of  $\geq -3.00$  Diopters had a LR+ of 2.50 (1.41 -4.41; 3 studies, 11,114).

**Conclusions** These results may be useful for physicians and public health workers in identifying risk factors for POAG.

## COMMUNITY HEALTH

FRIDAY 10 JUNE

### Paper #52

#### Did Delisting Eye Care Services in Ontario Reduce Access to Eye Care Services?

Yaping Jin, Yvonne M. Buys, Wendy Hatch, Graham Trope

**Purpose** Effective November 1, 2004, the Ontario Ministry of Health and Long-Term Care delisted routine eye exams for Ontarians aged 20-64. Since then, Ontario residents in this age group have been paying for these vision services, or have had the cost of the exams covered by private insurance. We examined whether delisted eye exams reduced the public's access to eye care providers.

**Study Design** Cross-sectional survey.

**Methods** We compared the utilization rate of eye care providers (ophthalmologists or optometrists) amongst Ontarians aged 12 years or over in 2000/2001 (n=39,234 before delisting) to the utilization rate in 2007/2008 (n=43,835 after delisting) using data from the Canadian Community Health Survey. Utilization of eye care providers (or realized access) was defined as self-reports of having seen or talked on the telephone with an eye care provider over a 12-month period.

**Results** The overall utilization after delisting decreased slightly (29.2% vs 27.5%) for people aged 20-39 years, remained stable (41.2% vs 40.3%) for those aged 40-64 years, but increased for persons aged 12-19 years (39.7% vs 43.7%) or 65 years or older (59.2% vs 63.9%) who were not affected by delisting. Amongst Ontarians aged 40-64, significantly reduced utilization (-7.2%,  $p < 0.05$ ) after delisting was observed for those who did not have a secondary school graduation certificate. The reduction after delisting was -0.7% ( $p > 0.05$ ) for those who completed secondary school or higher. A reduction of -5.4% was also observed amongst Ontarians in the lowest income quintile. This is in contrast to an increased utilization in all other income groups.

Before delisting, the gap in utilization between people without a secondary school graduation certificate and those with secondary school or higher was -4.7% (37.4% vs 42.1%,  $p = 0.0010$ ). This gap doubled significantly to -11.2% (30.2% vs 41.4%,  $p < 0.0001$ ) after delisting ( $p < 0.05$ ). The disparity in eye care utilization between highest and lowest income quintile was -4.5% before delisting (39.3% vs 43.8%,  $p = 0.0003$ ) and -12.0% after delisting (33.9% vs 45.9%,  $p < 0.0001$ ).

**Conclusions** Delisting appears to have promoted reduced access to eye care providers amongst the socially disadvantaged. The effects of delisting seem to contradict the objectives of the Canada Health Act.

## COMMUNITY HEALTH

FRIDAY 10 JUNE

### Paper #53

#### Canadian Uncorrected Refractive Error Study - the Brantford pilot study

Keith D. Gordon, Barbara E. Robinson, Desmond Fonn, Craig Woods, Deborah Gold, Yunwei Feng

**Purpose** Visual impairment in older populations increases the likelihood of nursing home placements, falls and hip fractures, increased use of community services and increased risk of death. Uncorrected refractive error is the leading cause of reversible visual impairment in the world. The primary purpose of this cross-sectional study in Brantford, Ontario was to measure the prevalence of uncorrected refractive error in a representative sample of the adult population.

**Study Design** The target population included all older than 40 years of age in the City of Brantford. Study participants were selected using a cluster sampling strategy based on postal codes and were recruited by door-to-door recruitment. Recruited participants were assessed according to the methods outlined below.

**Methods** Presenting distance and near VAs were measured with the participant's habitual spectacle correction, if any. Best corrected visual acuities were determined for all participants who had a presenting distance visual acuity of less than 6/7.5 in either eye.

**Results** The study included 768 residents 39 to 94 years of age; 55.7% were female. One hundred and twenty-six participants or 16.4% (95% CI, 13.7% to 19.5%) were found to have presenting distance visual acuity less than 6/7.5 in their better seeing eye (75 female, 51 male). Nearly 3% of the sample had a presenting distance visual acuity in the better eye that was less than 6/12, (95% CI, 1.7% to 4.43%). Best corrected visual acuities improved by one to five lines for 85 of these 126 study participants (67.5%). A large number of people with uncorrected refractive error were 65 years of age and older (39 out of 85, 45.9%)

**Conclusions** There is a high prevalence of uncorrected refractive error in the City of Brantford. This finding is similar to what has been found in studies in the United States of America, the United Kingdom and Australia. The majority of people with decreased distance visual acuity can be corrected with new glasses. Encouraging all adults to have regular eye examinations and use appropriate eyeglasses should be a part of any public health program.

## COMMUNITY HEALTH

FRIDAY 10 JUNE

### Paper #54

#### **Inequities in Eye Care Utilization among Canadian Adolescents: Evidence from the Canadian Community Health Survey**

**Kunyong Xu, Graham Trope, J. Ray Buncic, Yaping Jin**

**Purpose** Many but not all Canadian provincial health insurance plans cover eye care services for children younger than 18 years of age. We examined how provincial eye care coverage and selected socio-demographic and health factors affect adolescent's access to eye care providers.

**Study Design** Cross-sectional survey.

**Methods** Data was collected from the Canadian Community Health Survey 2007/2008. Utilization of eye care services was measured using the question "[Not counting when you were overnight patient, in the past 12 months], have you seen, or talked to an eye specialist, such as an ophthalmologist or optometrist?" Respondents aged 12-17 were included in the analysis (n=11,015) since 12 was the youngest in the survey. Associations of interest were assessed by prevalence ratios (PR).

**Results** Canada wide, 45.6% of adolescents utilized eye care services over a 12 month period. Utilization varied greatly by geographic location: significantly higher (46.4%) in provinces with eye care coverage (British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec), lower (35.9%) in provinces with partial or no coverage (Newfoundland and Labrador, New Brunswick, Nova Scotia, and Prince Edward Island), and lowest (27.1%) in the three territories with a dearth of eye care professionals (Yukon, North West, and Nunavut).

Compared to adolescents in provinces with eye care coverage, those with partial or no coverage were 24% less likely to utilize services (PR=0.76, 95% confidence interval (CI): 0.67-0.85); whereas those in the three territories were nearly 40% less likely to utilize eye care providers (PR=0.63, 95% CI: 0.48-0.83). Significantly lower utilization rates were also found among males (10% less likely than females), those with dwellings not owned by a member of the household (19% less likely than those owned), and those reading less than 3 hours weekly (13% less likely than those reading 3 or more hours) not counting school reading. Adolescents with diabetes were 67% more likely to utilize eye care services (PR=1.67, 95% CI: 1.29-2.15) than those unaffected. Lower level of household highest education, spending less than 1 hour on a computer weekly, and having children aged 5 or younger in the household were all associated with a non-statistically significant reduction in utilizing eye care services.

**Conclusions** Inequities in eye care utilization were observed amongst Canadian adolescents. Factors associated with significantly less utilization were: partial or no provincial eye care coverage, lack of eye care professionals, male gender, living in dwellings not owned, non-diabetic, and spending less time reading.

## OCULOPLASTICS-2

FRIDAY 10 JUNE

### Paper #55

#### Non-surgical retrieval of retained stenting material.

**Liat Attas-Fox, François Codere**

**Purpose** It has been documented that failure of probing with intubation can be iatrogenic, caused by retained foreign body material (silicone sleeves or knots). Typically, dacryocystorhinostomy (DCR) is required to remove the foreign body despite patency of the duct.

Our purpose is to describe a novel non-surgical technique to retrieve retained stenting material in the lacrimal system that may prevent the requirement for DCR surgery.

**Study Design** Consecutive case series.

**Methods** Chart review of three pediatric cases with dacryocystitis due to retained foreign body material post probing with intubation. In these cases, the lacrimal system was patent during irrigation.

We employed a novel non-surgical technique to explore and retrieve retained foreign body material in the lacrimal sac.

This is achieved by performing an intubation of the superior canaliculus with both arms of silicone tubes. This forms a loop of silicone tubing that can be retrieved from the nose after passing along the lacrimal duct and sac lumen. As the loop of the silicone tubes passes through the lacrimal sac, the foreign body material is retrieved and extracted through the nose.

**Results** In all three cases the epiphora and dacryocystitis resolved without need for a DCR.

**Conclusions** Retained stenting material can be responsible for persistent epiphora and dacryocystitis in patients following lacrimal intubation.

Passage of the two arms of a silicone tube through one canaliculus should be considered in patients where a retained piece of stenting material is known or suspected prior to considering DCR to explore the lacrimal sac.

## OCULOPLASTICS-2

FRIDAY 10 JUNE

### Paper #56

**Success rates of probing for congenital nasolacrimal duct obstruction in children younger than 11 years of age.**

**Sourabh Arora, Keyvan Koushan, John T. Harvey**

**Purpose** To evaluate success rates of probing and irrigation performed for congenital nasolacrimal duct obstruction (NLDO) and approximate the age at which there is a significant increase in risk of procedure failure.

**Study Design** Retrospective chart review.

**Methods** Records for probing procedures from 2002 to 2010 were reviewed. Successful probing was defined as complete resolution of epiphora after treatment. Success rates were compared among 3 groups: children aged less than 24 months (group 1), children between 24 to 60 months old (group 2), and children between 60 months and 11 years of age (group 3). For children with failed probing, results of Crawford tubing were also analyzed.

**Results** 170 eyes (130 children, mean age 31.7+/-1.8 months) had undergone a probing procedure, and the overall success rate was 71.2% (121/170). The mean age of children in group 1 (100 eyes) was 18.3+/-0.3 months, group 2 (49 eyes) was 39.8+/-1.8 months and group 3 (21 eyes) was 96.3+/-4.8 months. Group 1's success rate, 76% (76/100 eyes), was not significantly different from that of group 2 (73.5%) based on Fisher's exact test ( $p=0.84$ ). Group 3's success rate was 42.9% (9/21). A multivariate analysis with group 1 serving as the reference group demonstrated that age was a significant risk factor for a failed probing ( $p=0.015$ ). Group 2 was not at increased risk of failure ( $p=0.83$ ; OR=1.09, 95%CI=0.49-2.46), while group 3 did have an increased risk of failing a first time probing ( $p=0.004$ ; OR=4.35, 95%CI=1.59-11.9). Crawford tubing had an overall success rate of 93.8% and showed no difference if performed prior to, or after age 60 months, based on Fisher's exact test ( $p=0.13$ ; OR=0.13, 95%CI=0.01-1.54).

**Conclusions** Contrary to reports that probing is most successful if attempted before 24 months of age, this study shows that the success rate of probing is not significantly reduced when performed between the ages 24 and 60 months. The risk of a failed probing only significantly increases in children aged 60 months and older. Tubing should be attempted on children who fail probing, regardless of age.

## OCULOPLASTICS-2

FRIDAY 10 JUNE

### Paper #57

#### Management of unilateral versus bilateral lacrimal drainage system dysfunction in Down's Syndrome

Yasser Al-Faky

**Purpose** The aim of this study is to evaluate treatment outcomes of unilateral versus bilateral congenital nasolacrimal duct (NLD) obstruction in Down's syndrome patients and highlight the effect of associated features that may result in poor outcomes.

**Study Design** Retrospective interventional cohort study

**Methods** The charts of Down's syndrome patients with congenital NLD obstruction who had been treated in a university hospital with irrigation, probing and silastic intubation between 1998 and 2008 were reviewed. Clinical features were correlated to the documented intraoperative observations and postoperative results.

**Results** A total of 34 lacrimal drainage systems (LDS) were treated in 22 patients with Down's syndrome of mean age 47 ( $\pm 41.8$ ) months. Patients with unilateral disease had higher success rate (n=10; 90%) than bilateral cases (n=24; 45.8%) regardless type of the procedure. Most of the treated LDS above the age of 64 months were successful (n=11/12; 91.7%). Single LDS had irrigation only (2.9%) but failed, probing had 60% success (n=10; 29.4%) and silastic intubation had 60.9% success (n=23; 67.7%). Four LDS were treated successfully by Y-V plasty simultaneously with silastic intubation. Lower end NLD obstruction at the level of Hasner's valve showed 100% success (n=7) compared to multiple obstructions with 41.7% success rate (n=27).

**Conclusions** Unilateral disease and lower end NLD obstruction are good prognostic factors. Careful punctal evaluation and management is advisable and possible delay of operative intervention in bilateral cases beyond the age of 5 aiming at improvement of hypotonia may be a wise decision.



## OCULOPLASTICS-2

FRIDAY 10 JUNE

### Paper #58

**Unsuspected ciliary body and choroidal melanoma diagnosed after evisceration and enucleation: A series of cases seen at the University of Ottawa Eye Institute from 1996-2010**

**Andre Jastrzebski, Seymour Brownstein, David Jordan, Steve Gilberg, Brian Leonard**

**Purpose** To show the clinicopathologic data over time of two patients diagnosed, unexpectedly, with a ciliary body and/or choroidal melanoma after evisceration or enucleation of a blind, painful eye. To present the incidence of unexpectedly eviscerating or enucleating an eye containing a posterior uveal melanoma for our centre and for the population which we serve (the greater Ottawa/Gatineau region).

**Study Design** Retrospective series of all cases processed by our laboratory since August 1996.

**Methods** A total of two cases were included in the study group. An incidence rate is calculated by comparing the study group with the total number of eviscerations and enucleations performed at The Ottawa Hospital since August 1996 and with the average population of the health region over the timeframe of the study (using data obtained from Statistics Canada).

**Results** A 55-year-old man underwent enucleation of a blind, painful right eye secondary to a history of neovascular glaucoma. Histopathological examination revealed an unsuspected ring melanoma. Three months later, orbital exenteration was done for local recurrence. Examination for metastatic disease was negative for eight years; however, CNS and pulmonary metastases subsequently developed leading to radiotherapy and multiple resections of metastases. The patient is alive after 13 years of follow up. An 86-year-old woman underwent left eye evisceration secondary to endophthalmitis following a bevacizumab (Avastin) injection. Histopathological examination revealed a necrotic melanoma, unsuspected by preoperative ultrasonography. There was no evidence of metastatic disease at the time of diagnosis. The patient died prior to the planned follow up and enucleation. No autopsy was performed.

The incidence of unsuspected choroidal/ciliary body melanoma at our laboratory is 3.4/1000 eviscerations and 4.8/1000 enucleations. A rate of 0.12 unsuspected melanomas/1,000,000 population/year was calculated for the greater Ottawa/Gatineau region over the last 14 years (approximate population 1,192,500).

**Conclusions** Unsuspected ciliary body or choroidal melanoma at the time of evisceration or enucleation of an eye is a rare finding that was diagnosed in only two patients over a 14 year period by our ophthalmic pathology laboratory following histopathological and immunohistochemical examinations. To the best of our knowledge, we present the first single-centred and population based data on the incidence of this complication from a complete record of cases since the advent of modern diagnostic technologies.

## OCULOPLASTICS-2

FRIDAY 10 JUNE

### Paper #59

#### Primary, unilateral ocular adnexal lymphoma: disease progression and long-term survival

Dan B. Rootman, Jack Rootman, Ioannis Mavrikakis, Joseph M. Connors

**Purpose** Ocular adnexal lymphoma (OAL) are relatively rare overall. However, they represent a significant portion of orbital masses overall, and thus present to ophthalmology with some frequency. Most published series group primary and secondary disease together, however these are likely different entities. Additionally, often unilateral and bilateral disease are described together although the latter is conceptually more akin to secondary disease (ie: more than one site). This study aims to specifically characterize primary unilateral OAL in terms of lymphoma classification and long term outcome.

**Study Design** Observational cohort study.

**Methods** All consecutive biopsy confirmed cases of lymphoma confined to a single ocular adnexa over a 30-year period were included. All histologic classification conformed to the WHO/REAL classification. Descriptive statistics and standard survival analyses were performed.

**Results** The most common primary unilateral OAL were indolent B cell lymphomas (mucosa-associated lymphoid tissue (MALT)-type marginal zone, follicular and small lymphocytic lymphoma) representing 80% of cases. Aggressive lymphomas were found in only 7% of patients. Patients were most commonly treated with radiation therapy on presentation (82.8%). Initial therapy resulted in complete regression for 91.6% of patients. Overall, 24.4% of patients experienced progression of their disease after initial therapy, the majority occurring within 5 years. The most common site of progression was distant lymph nodes in 12 cases (40.0%), progression to the contralateral ocular adnexa was found in 6 patients (20.0%) and recurrence in the ipsilateral ocular adnexa was found in 2 cases (6.7%). For the 80% of OAL of indolent B cell type progression free and disease specific survivals were 71% and 98% at 5 years and 61% and 90% at 10 years, respectively. Diffuse large B cell lymphoma was more likely to progress ( $p < 0.01$ ) and did so sooner (log rank,  $p < 0.01$ ) and these patients were also more likely to succumb to disease ( $p < 0.01$ ) in a shorter interval (log rank,  $p < 0.01$ ).

**Conclusions** The majority of primary unilateral OALs are indolent lymphomas with good prognosis for survival and freedom from progression. However, the minority that present as higher-grade lymphomas require more aggressive management and have more guarded prognoses.

## OCULOPLASTICS-2

FRIDAY 10 JUNE

### Paper #60

#### Incidence of Discordant Temporal Artery Biopsies in the Diagnosis of Giant Cell Arteritis.

Bethany Durling, Andrew Toren, David Jordan, Steve Gilberg, Vivek Patel

**Purpose** Investigate the incidence of discordant biopsies in patients who underwent immediate bilateral temporal artery biopsies.

**Study Design** A prospective cohort study.

**Methods** Consecutive patients undergoing temporal artery biopsy were enrolled and had immediate bilateral biopsies as routine practice. Positive biopsies were defined based on accepted histological definitions. Pathology results, including biopsy length (as measured by the pathologist), and laboratory information (i.e. serum erythrocyte sedimentation rate [ESR] and C-reactive protein [CRP] levels) were collected from digital patient records for statistical analysis.

**Results** Of the 258 consecutive patients enrolled, 256 underwent bilateral temporal artery biopsies. Giant cell arteritis (GCA) was confirmed in 62 (24.2%) of these patients, including 3 patients with biopsies recorded as healed arteritis. The rate of discordant biopsy was 17.7% with 11 unilaterally positive biopsies. There was no statistical difference between the length of the left- and right-sided biopsies in either the unilaterally or bilaterally positive groups ( $p=0.21$  and  $p=0.44$ , respectively). In the unilaterally positive group, the average length of the biopsy-positive side was 118mm. This was not significantly different from the biopsy-negative side which was 117mm ( $p=0.95$ ). The average ESR value for the bilateral group (64.3mm/hr) was significantly higher than the average ESR value for the unilateral group (30.7mm/hr,  $p=0.01$ ). The average CRP value for the bilateral group was 62.5mg/l and 28.6mg/l for the unilateral group ( $p=0.28$ ). The percentage of patients on steroid treatment at the time of biopsy was 80% and 73% ( $p=0.62$ ) for the bilateral and unilateral group, respectively.

**Conclusions** The incidence of discordant biopsies in patients who underwent immediate bilateral temporal artery biopsies was considerable in our patient cohort. The incidence was not related to biopsy length, the use of steroids, or serum CRP. Elevated serum ESR was correlated with bilaterally positive biopsy results. We recommend immediate bilateral temporal artery biopsies to reduce the risk of misdiagnosing giant cell arteritis.

## CATARACT SURGERY

FRIDAY 10 JUNE

### Paper #61

#### A Comparison of Techniques-Informed Consent for Resident Involvement in Cataract Surgery

Rajeshvar K. Sharda, Jeffrey H. Sher, Brian J. Chan, Lawrence Kobetz, Keith Mann

**Purpose** To compare three different techniques of obtaining informed patient consent and the relative acceptance rates for resident involvement in cataract surgery. The techniques differed with regards to physician-patient interaction, resident-patient interaction, and how resident involvement was presented.

**Study Design** A retrospective cohort study in a tertiary care ophthalmology department with a recently established residency training program.

**Methods** Charts of all patients undergoing cataract surgery by 3 cataract surgeons from October 2009 to March 2010 were reviewed. Patient demographics, the documentation of a specific request for resident participation, and the patient response were recorded. Response rates were analyzed between the three different techniques/surgeons.

**Results** Consent to resident participation was found to range from 21% to 86%. Higher acceptance rates were associated with direct personal conversation between surgeon and patient. Resident interaction with patients increased the acceptance rate.

**Conclusions** Resident surgical training is a crucial component to the advancement of the field of ophthalmology. It is imperative that teachers optimize the opportunities for residents to learn while providing an atmosphere for fully informed patient consent. High acceptance rates can be achieved with full disclosure of resident involvement and further enhanced by resident-patient interaction during the consent process.

## CATARACT SURGERY

FRIDAY 10 JUNE

### Paper #62

#### Effects of cognitive distraction on performance of simulated ophthalmic surgical tasks

Kathy Y. Cao, Marisa Sit

**Purpose** To determine the effect of cognitive distraction, consisting of a continuous series of mental arithmetic problems, on ophthalmic microsurgical task performance by ophthalmology residents, fellows and medical students with varying levels of surgical experience, using the validated EYESI virtual reality simulator by VRMagic.

**Study Design** Prospective randomized within-subject controlled study

**Methods** Ophthalmology residents, fellows and medical students from University of Toronto were invited to participate in this study between June and September 2009. Participants performed 2 simulated tasks of dissimilar level of difficulty (cataract forceps training (CFT) and cataract bimanual training (CBT)) in duplicate, under 2 different conditions (distracted and undistracted), for a total of 8 tasks. Continuous cognitive distraction consisted of a series of medium-level arithmetic problems posed by the experimenter while the participant performed each task. After obtaining informed consent, participants were randomized to start with distraction or no distraction. Main outcome measures included scores generated by the EYESI program software: overall score, time to task completion, and surgical error, which comprised of injured cornea, injured lens, and iris contact scores.

**Results** Twenty-six ophthalmology residents, ten fellows and two medical students from University of Toronto voluntarily participated in this study. The overall score for CFT was significantly higher when undistracted compared to distracted ( $79.39 \pm 21.58$  vs  $75.00 \pm 23.95$ ,  $p=0.01$ ), but was similar under both conditions for CBT ( $50.20 \pm 19.23$  vs  $49.42 \pm 17.81$ ,  $p=0.74$ ). The time to completion was significantly higher when distracted compared to undistracted for both CFT ( $83 \pm 52$ s vs  $62 \pm 35$ s,  $p<0.01$ ) and CBT ( $94 \pm 42$ s vs  $79 \pm 36$ s,  $p<0.01$ ). There was no significant difference in the surgical error scores for all tasks with or without distraction. With subgroup analysis, the fourteen senior surgical residents and fellows consistently exhibited higher overall scores, shorter time to task completion and lower surgical error scores for all tasks when compared with the twenty-four junior residents and medical students. In particular, the overall score for both CFT ( $85.89 \pm 15.25$  vs  $86.68 \pm 10.71$ ,  $p=0.74$ ) and CBT ( $49.39 \pm 17.20$  vs  $51.54 \pm 16.64$ ,  $p=0.56$ ) and the time to completion for CFT ( $53 \pm 20$ s vs  $57 \pm 22$ s,  $p=0.58$ ) and CBT ( $65 \pm 18$ s vs  $75 \pm 22$ s,  $p=0.07$ ) were not significantly different when undistracted or distracted for senior surgical residents and fellows.

**Conclusions** Cognitive distraction appears to negatively influence ophthalmic microsurgical task performance by increasing time to completion, but not surgical error, with the greatest impact on novice surgeons with no or minimal surgical experience. Further studies are needed to assess effects of different types of distraction found in the operating room and on different steps of cataract surgery.

## **CATARACT SURGERY**

**FRIDAY 10 JUNE**

### **Paper #63**

#### **Toxic Anterior Segment Syndrome (TASS) outbreaks in Canada: Annual update from the Canadian Ophthalmology Society TASS Task Force 2010**

**Alex P. Lange, Gregory Moloney, Rene Carbana, Simon P. Holland**

**Purpose** To summarize the investigation, outcome, and etiology of recent TASS outbreaks following cataract surgery in Canada 2009-10

**Study Design** Descriptive and retrospective case series

**Methods** Six TASS outbreaks in Canada reported to the TASS Task Force Oct 2009 to Sep 2010 were analyzed for possible causation, investigation, intervention, and outcome. Data collected included number of affected patients, location, duration, surgical reprocessing methods, all components of the surgical procedure in each location, recent changes prior to the outbreak, and outcomes. Specific testing such as endotoxin sampling and electron microscopy performed as indicated. Retrospective case studies performed in one outbreak.

**Results** Four of 6 outbreaks underwent detailed investigation, 3 with resolution of the outbreak. Likely causes were use of enzymatics in cleaning instruments (3), debris/bioburden in irrigation and aspiration (I&A) cannulas, gloves (1) and re-usable cannulas. Two hospitals closed their ophthalmic operating rooms during the outbreak.

**Conclusions** TASS outbreaks are continuing in Canadian hospitals and a potential cause of poor surgical outcomes despite widely available information on TASS prevention. Some hospitals are reluctant to make the required changes to lessen TASS risks such as switching to disposable instruments, replacing I&A cannulas, avoiding use of enzymatics and maintaining ophthalmic instrument sterilization protocols.

## CATARACT SURGERY

FRIDAY 10 JUNE

### Paper #64

#### The dose and administration of intracameral moxifloxacin

Steve A. Arshinoff

**Purpose** To calculate the most appropriate dose and determine the optimum administration method for intracameral (IC) moxifloxacin.

**Study Design** Review of literature and experience of many surgeons with intracameral antibiotics.

**Methods** The world literature on intracameral prophylaxis and resistant strain MICs was reviewed, along with our own experience with IC moxifloxacin, and that of other corresponding surgeons. Many considerations were weighed and balanced to arrive at a proposal for an appropriate dose and delivery method.

**Results** 150 µg/ml x 0.2 ml achieves a mutant prevention level of moxifloxacin in aqueous up to 45 minutes post-operative and exceeds the MIC90 of the most resistant strains cultured from cases of endophthalmitis, to date, for one hour and 45 minutes post op. The injected solution is made up of 3 parts topical moxifloxacin drops and 7 parts balanced salt solution, yielding 150 µg/ml moxifloxacin with approximate pH 6.9 and osmolality 295 mosm/kg. Injection technique will be illustrated.

**Conclusions** The appearance of resistant strains of Staphylococci has caused a need for calculation of an effective dose and procedure of administration for intracameral moxifloxacin.

## **CATARACT SURGERY**

**FRIDAY 10 JUNE**

### **Paper #65**

#### **Practice Patterns of COS Members in Cataract Surgery - Survey 2011**

**Lindsay Ong-Tone**

**Purpose** To establish the practice patterns of the members of the Canadian Ophthalmological Society (COS) in cataract surgery and to determine any continuing trend.

**Study Design** Web based questionnaire.

**Methods** Since 2009, members of the COS have been surveyed on an annual basis. The first survey in 2009 was an e-mail attached questionnaire while the 2010 one was on Survey Monkey. The 2011 survey will also be done using Survey Monkey in January 2011.

**Results** The response rate was 20.7% in 2009 and 32.5% in 2010. There was a definite trend in starting NSAID eye drops earlier preoperatively, an increase in the use of 1 piece hydrophobic aspheric blue blocking acrylic intraocular lenses and of the fourth generation fluoroquinolone gatifloxacin in the first 2 surveys. It will be interesting to see if this trend continues in 2011.

**Conclusions** The study is scheduled for January 2011. The results will be compared to those of previous years.



## CATARACT SURGERY

FRIDAY 10 JUNE

### Paper #66

#### **A survey: how cataract patients' risk of developing age-related macular degeneration affects intraocular lens recommendations**

**Matthew B. Schlenker, Rosa M. Braga-Mele**

**Purpose** Investigate whether Cataract Surgeons are factoring Age-Related Macular Degeneration (AMD) and its risk factors into intraocular lens (IOL) recommendations and whether a newly developed AMD genetic test would influence these recommendations.

**Study Design** Anonymous electronic survey.

**Methods** Emails inviting Cataract Surgeons to participate anonymously were sent through the Ocular Surgery News (OSN) and The Canadian Ophthalmology Society (COS) listserves. 66 Cataract Surgeons responded (response rate=18%). Respondents provided practice profile information and were polled to 1) determine whether they consider AMD risk factors when assessing a patient for cataract surgery, 2) assess the utility of knowing a patients' genetic risk for AMD before recommending IOLs, and 3) determine how long they could spend explaining the test and up to what cost they would recommend it. Main Outcome Measures included blue filter and multifocal IOL recommendation rates, and whether an AMD genetic test would affect these rates.

**Results** 80% of respondents consider AMD before cataract surgery. One-half recommend blue filter IOLs to the average patient, though two-thirds recommend them in patients with AMD. Two-thirds recommend multifocal IOLs to the average patient, though almost no respondents recommend them to patients with AMD. One-half are familiar with genetic advances in AMD, and 36% and 64% of respondents believe the results of a new genetic test for AMD would affect their recommendations regarding blue filter and multifocal IOLs respectively. 41% would recommend the genetic test as part of a routine cataract surgery assessment, and of these respondents over three-quarters would recommend the test up to a cost of \$150. Almost all respondents would have less than 5 minutes to explain the test to patients.

**Conclusions** Most Cataract Surgeon respondents do consider AMD and its risk factors before cataract surgery. They are more likely to recommend blue filter IOLs in patients that have AMD and perceive multifocal IOLs as contraindicated in these patients. Respondents are interested in a genetic test for AMD risk assessment prior to cataract surgery, though hurdles include cost, lack of education regarding the test, and time needed to explain the test.

## GLAUCOMA-ANCILLARY TESTING, NEW GLAUCOMA DEVICES AND TECHNIQUES

FRIDAY 10 JUNE

### Paper #67

#### Rates of global visual field change before and after trabeculectomy

Majed Alotaibi, Paul H. Artes, Marcelo T. Nicolela

**Purpose** To assess rates of global visual field change before and after trabeculectomy in patients with glaucoma.

**Study Design** Retrospective interventional case series

**Methods** Visual field data from patients followed up in the Eye Care Center at the QEII Health Sciences Center, Halifax were reviewed. Patients who had 10 or more HVF (full threshold or SITA) were assessed for eligibility. Patients were enrolled if they had trabeculectomy and if at least 5 visual fields before & 5 visual fields after surgery were available for analysis. Linear regression analysis was used to calculate global rates of change before and after surgery.

**Results** Data from 37 eyes of 32 patients were enrolled. Mean age at surgery date was 69.7  $\pm$  9.4 years. Mean number of visual fields was 26.7 ranging from 11 to 41 fields. Mean number of preoperative visual fields was 17.6 ranging from 5 to 32 fields. Mean number of postoperative visual fields was 9.2 ranging from 5 to 22 fields. Mean MD of first visual fields was -5.37  $\pm$  9.4. Mean MD rate decreased from  $-0.59 \pm 0.99$  dB/year before surgery to  $-0.25 \pm 0.67$  dB/year after surgery (58% reduction;  $p= 0.17$ , Wilcoxon)

**Conclusions** Rates of MD deterioration were, on average, less rapid after trabeculectomy. This difference, however, was not statistically significant. The relatively small sample size, imprecise determination of MD rate based on a relatively small number of visual fields and the fact that some patients were operated because of elevated IOP without necessarily showing a significant MD slope before surgery might all contribute to explain this lack of significance.

## GLAUCOMA-ANCILLARY TESTING, NEW GLAUCOMA DEVICES AND TECHNIQUES

FRIDAY 10 JUNE

### Paper #68

#### The Diagnostic Accuracy of Flicker Defined Form Perimetry, Confocal Laser Scanning Tomography and Frequency Doubling Technology Perimetry in Glaucoma Detection A Population-Based Assessment: The Toronto Epidemiology Glaucoma Survey

Ziad Butty, John G. Flanagan, Yaping Jin, Ayako Anraku, Delan Jinapriya, Graham Trope

**Purpose** To evaluate the diagnostic accuracy of Flicker Defined Form (FDF) Perimetry, Confocal Laser Scanning Tomography (HRT III) and Frequency Doubling Technology (FDT) Perimetry as screening methods for glaucoma.

**Study Design** Prospective, cross-sectional study.

**Methods** One hundred and eighty participants with a mean age of  $61.6 \pm 8.7$  years from the Toronto Epidemiology Glaucoma Survey were included. All participants underwent a comprehensive ophthalmic assessment at the Glaucoma Service of the Toronto Western Hospital. 102 participants (56.66%) were screened with FDF (S-30 screening test), using a prototype Heidelberg Edge Perimeter that used a preliminary normal database. 169 participants (93.88%) were screened with HRTIII (Moorfields Regression Analysis), Heidelberg Technology and 175 participants (97.22%) with FDT (N-30-5, Humphrey Matrix), Zeiss Perimeter. The glaucoma diagnosis was made by the senior glaucoma subspecialist based on modified criteria from the Rotterdam Study and Foster and associates.

**Results** All participants completed the clinical ophthalmic assessment. Five (2.77%) were not tested by any of the screening tests. One year after testing, 15 participants (8.33%) had a diagnosis of glaucoma and/or probable glaucoma, 32 participants (17.77%) were diagnosed as glaucoma suspect, and 133 participants (73.88%) had no glaucoma. Based on the clinical diagnosis, the sensitivity and specificity were 81.81% (95% CI, 52.30-94.86) and 53.85% (95% CI, 43.66-63.72) for the FDF, 61.54% (95% CI, 35.52-82.29) and 85.26% (95% CI, 78.85-89.97) for the HRT III and 33.33% (95% CI, 15.18-58.29) and 81.88% (95% CI, 75.18-87.07) for the FDT respectively. Combined FDF and HRTIII gave a performance with a sensitivity of 44.4% (95% CI, 18.9-73.3) and a specificity of 93.2% (95% CI, 85.9-96.8).

**Conclusions** The combination of FDF Perimetry and HRT III resulted in high specificity. Sensitivity was poor but the number of true glaucomas was small. These two devices show potential as screening tests for glaucoma in population based studies.

## GLAUCOMA-ANCILLARY TESTING, NEW GLAUCOMA DEVICES AND TECHNIQUES

FRIDAY 10 JUNE

### Paper #69

**Peripapillary choroidal thickness in glaucoma patients with focal, diffuse and sclerotic optic disc damage, and in healthy controls.**

**Kenneth F. Roberts, Paul H. Artes, Glen Sharpe, Alexandre S. Reis, Marcelo T. Nicolela**

**Purpose** To examine peripapillary choroidal thickness in healthy controls and glaucoma patients with focal, diffuse, and sclerotic optic disc damage.

**Study Design** Prospective cohort study.

**Methods** Healthy controls (n=92, mean 56 years, 45-67) and glaucoma patients with focal (n= 31; MD = -7.15), diffuse (n = 37, MD = -4.16) and sclerotic (n = 34, MD = -3.75) optic disc damage were imaged with Optical Coherence Tomography (OCT, Spectralis, Heidelberg Engineering, 3.4 mm circular scan around the optic nerve head). Global peripapillary choroidal thickness (PCT) was defined as the average distance between the automatically segmented retinal pigment epithelium/Bruch's membrane and the manually outlined interface between posterior choroid and the anterior sclera.

**Results** The anterior border of the sclera was visible over more than 95% of the scan circumference in all but 6 subjects (2 controls, 4 patients). PCT was similar in healthy men and women (p=0.24) and decreased linearly with age (-12.5  $\mu\text{m}$  / decade; p<0.001), with a mean of 138  $\mu\text{m}$  (at age 70, 95% prediction interval [PI], 61-215  $\mu\text{m}$ ). In glaucoma patients, mean PCT was 119  $\mu\text{m}$  (at age 70, 95% PI, 53-186  $\mu\text{m}$ ). There was a small but statistically significant increase in PCT with visual field damage (2.3  $\mu\text{m}/\text{dB}$  Mean Deviation, p=0.002, r<sup>2</sup>=0.11). In comparison to patients with diffuse optic disc damage, those with sclerotic and focal damage had thinner PCT (-26  $\mu\text{m}$ , p<0.001; -12  $\mu\text{m}$ , p=0.12, respectively).

**Conclusions** Peripapillary choroidal thickness decreases with age and is reduced in patients with glaucoma, particularly so in patients with sclerotic optic disc damage. The relationship between choroidal thickness and the severity of optic disc damage deserves further study.

## GLAUCOMA-ANCILLARY TESTING, NEW GLAUCOMA DEVICES AND TECHNIQUES

FRIDAY 10 JUNE

### Paper #70

#### Summary of Glaucoma Testing Accuracy: A Comprehensive Systematic Review of Clinical Studies Assessing Heterogeneity

**William G. Hodge, Zainab Khan, Kevin Warriar, Francie Si, Cindy Hutnik, Alex Mao, Irene Pan, David Moher, Ron Goeree, Fatemeh Yazdi, David Tingey**

**Purpose** Many studies now exist that evaluate imaging technologies for glaucoma. However there are many new studies weekly and assimilating this information into a useful synthesis is now overdue for both clinicians and policy makers. We undertook this task to assimilate the studies from 3 new technologies OCT, HRT and GDx compared to the gold standard of optic disc photography and white on white visual field.

**Study Design** Meta-analysis

**Methods** Standard Information retrieval methods, inclusion and exclusion criteria, study selection methods, screening and data abstraction and analysis were performed as per the Agency for Health Care and Quality Systematic Review Protocols. 1035 articles were screened and after exclusions based on our a priori protocol, 303 articles were used for data extraction. The QUORUM Statement was used to assess quality and a PRISMA flow diagram was generated. Inter-rater reliability was rated with the kappa statistic. Synthesized sensitivity, specificity and diagnostic odds ratios (DOR) were calculated vs the gold standard methods. Both point estimates and 95% confidence intervals were created. ROC curves were also aggregated whenever possible. A test for heterogeneity was performed-I<sup>2</sup>.

**Results** Of most importance, the I<sup>2</sup> was well over 50% for all technologies and all categories. This was because 138 different methods have been used as cutoffs for these three technologies. In terms of accuracy, both OCT (DOR 29.8 95% CI: 21.7,40.8) and GDx (DOR: 28.3, 95% CI: 21.6, 36.8) had similar accuracy compared to white on white perimetry but HRT lagged behind (DOR:20.9, 95% CI: 16.2, 27.2). Stratified data by new technology (Stratus OCT, OCT 2000, OCT1, GDx VCC, GDx FCC, HRT 1, 2 and 3) showed similar results to the overall results for each technology.

**Conclusions** The synthesized data favors GDx and OCT over HRT for diagnostic accuracy in glaucoma compared to a gold standard of white on white visual field. However all I<sup>2</sup> values are high indicating great heterogeneity in terms of chosen cutoffs and their values. Hence a more agreed upon uniform methodology to assess each technology consistently is needed and content experts in this field should work toward this goal.

## GLAUCOMA-ANCILLARY TESTING, NEW GLAUCOMA DEVICES AND TECHNIQUES

FRIDAY 10 JUNE

### Paper #71

#### Cost analysis of Ex-PRESS™ miniature glaucoma shunt versus trabeculectomy

Hussain Y. Patel, Lilach Wagschal, Graham Trope, Yvonne M. Buys

**Purpose** The Ex-PRESS device has been developed as a modified filtration procedure. To our knowledge, no previous reports have compared the cost difference between this shunt and trabeculectomy. This study aimed to compare the cost differences between Ex-PRESS and trabeculectomy.

**Study Design** Prospective, randomised, non-masked, comparative study.

**Methods** 40 patients were enrolled: 20 each in Ex-PRESS and trabeculectomy. Surgical cost difference was analysed using the list price supplied by the vendor with only differences between operations analysed. 1 year post-operative cost difference was analysed for cost of follow-up visits, additional procedures and medication. The cost of follow-up visits and additional procedures required were analysed using billing information provided by the Ontario Health Insurance Plan (OHIP). Cost of medications was estimated using the amounts reimbursed by the Ontario Drug Benefit Formulary.

**Results** Insertion of the Ex-PRESS device had a net surgical cost of CAN \$1005 greater than trabeculectomy due to the cost of the Ex-PRESS device (\$900) and viscoelastic (\$129) minus the cost of the disposable superblade (\$24) used for trabeculectomy. The mean surgical time was not significantly different for Ex-PRESS (27 +/- 7 min) vs trabeculectomy ( 25 +/- 5 min, p = 0.6). Interim analysis of patients with 1 year follow up data (n = 20) revealed no significant difference in mean total post-operative costs (\$736 ± \$553 vs \$677 ± \$408, p = 0.7), cost of follow up visits (\$358 ± \$163 vs \$361 ± \$112, p = 0.9), additional procedures (\$262 ± \$316 vs \$223 ± \$270, p = 0.7) or medication (\$103 ± \$100 vs \$79 ± \$62, p = 0.6) for Ex-PRESS vs trabeculectomy respectively. For the province of Ontario, the incremental cost of Ex-PRESS would be + \$1,800,000 per year and for our department + \$200,000 per year (based on 2009 OHIP billing).

**Conclusions** This study demonstrates that the Ex-PRESS device is associated with greater surgical costs compared to trabeculectomy. However, based on interim data there does not appear to be a significant difference in post-operative costs.

## GLAUCOMA-ANCILLARY TESTING, NEW GLAUCOMA DEVICES AND TECHNIQUES

FRIDAY 10 JUNE

### Paper #72

#### **Comparison of The Efficacy and Safety of Ex-PRESS Shunt Implanted Under Scleral Flap Versus Trabeculectomy : A Prospective Randomized Study, Interim results.**

**Lilach Drori Wagschal, Graham Trope, Delan Jinapriya, Yvonne M. Buys**

**Purpose** To evaluate the efficacy and complications of the Ex-PRESS miniature glaucoma device implanted under a scleral flap compared to standard trabeculectomy.

**Study Design** Prospective randomized unmasked comparative study.

**Methods** Consecutive eligible patients with open-angle glaucoma uncontrolled medically were randomized to trabeculectomy or Ex-PRESS shunt and followed for 1 year. The surgical procedure was standardized and mitomycin C was used in all cases. The main outcome measures were mean intraocular pressure (IOP) and success. Complete success was defined as IOP between 5-18 mmHg and 20% reduction from baseline without medication and qualified success was defined as above with or without medication. Hypotony was defined as  $IOP \leq 4$ . Secondary outcomes included number of glaucoma medications, visual acuity, complications, pachymetry and endothelial cell counts.

**Results** To date 42 subjects have been enrolled, 20 in the trabeculectomy group and 22 in the ExPRESS group. 32 have completed 6 months and 17 have completed 1 year follow-up. At baseline, 6 months and one year the mean IOP was  $22.8 \pm 8.4$  vs  $21.2 \pm 10.4$  ( $p=0.59$ ),  $10.7 \pm 4.4$  vs  $10.2 \pm 4.4$  ( $p=0.76$ ) and  $14.7 \pm 4.1$  vs  $10.7 \pm 3.6$  ( $p=0.047$ ) in the trabeculectomy vs ExPRESS groups respectively. At 6 months and one year complete success rates were 69% vs 56% ( $p=0.72$ ) and 29% vs 70% ( $p=0.15$ ) for the trabeculectomy vs ExPRESS groups respectively. Qualified success rates were 88% vs 69% ( $p=0.39$ ) at 6 months and 57% vs 80% ( $p=0.59$ ) at 1 year for the trabeculectomy vs ExPRESS groups respectively. There were no statistically significant differences in number of glaucoma medications, visual acuity, pachymetry, and endothelial cell count. A similar rate of hypotony was found in both groups.

**Conclusions** To date our interim results found no significant difference in complete or qualified success between the groups however at one year the ExPRESS group had a significantly lower mean IOP ( $p=0.047$ ).

## INTERNATIONAL OPHTHALMOLOGY

FRIDAY 10 JUNE

### Paper #73

#### The Effectiveness of Using Pictograms to Educate Low-Literacy Populations on the Use of Post-operative Cataract Medication.

Puneet S. Braich, Simon Hollands, David Almeida

**Purpose** To examine the effectiveness of pictograms on educating low literacy patients in order to improve adherence and compliance to postoperative cataract regimens.

**Study Design** Multi-center single-blinded randomized controlled clinical trial.

**Methods** A subset of patients screened for cataract surgery across India (N = 225), all below a tenth grade education, were divided into 3 groups with 75 patients per group. Each group was educated differently regarding medication use and frequency. The control group was given verbal instruction only. Experimental group 1 (EG1) was taught with pictograms in the clinic. Experimental group 2 (EG2) was identical to EG1 but was given the pictograms to take home. Each group was given three 10-point oral exams on the operative day (Test 1), postoperative day 7 (Test 2), and day 28 (Test 3). During the patients' final visit, medication bottles were measured to objectively ascertain consumption over the entire postoperative period.

**Results** Test 1 showed no significant difference in mean scores between groups. For Test 2, EG1 and EG2 both scored similar, but significantly better than Control (5.77: Control Group, 7.33: EG1, 7.62 EG2  $p < 0.001$ ). For Test 3, EG2 scored significantly better than Control and EG1 (4.37 Control group, 5.44: EG1, 7.17: EG2  $p < 0.001$ ). The only parameters significant for a higher test score was the participants' educational level. Higher test scores were significantly associated with greater medication consumption ( $p < 0.001$ ).

**Conclusions** Taking the pictograms home proved to be the most effective way to educate low-literacy level patients and increase adherence for regimens  $\geq 28$  days. Education through pictograms solely in the clinic was sufficient for short regimens ( $\leq 7$  days). Pictogram-based education may be a viable way to increase adherence and compliance to ophthalmic treatment regimens in low-literacy patients.



## INTERNATIONAL OPHTHALMOLOGY

FRIDAY 10 JUNE

### Paper #74

#### International Electives: Current trends and practices among Canadian Ophthalmology Residents

Sylvia H. Chen, Andrew Toren, Ralf Buhrmann

**Purpose** To assess the level of interest, barriers to participation, and previous experiences with international electives in developing countries among ophthalmology residents in all Canadian training programs

**Study Design** A cross-sectional survey of all current and recently graduated ophthalmology residents in Canada

**Methods** A weblink to a pre-tested online survey was emailed to all residents via personal email addresses and list-serves in October and November 2010

**Results** The overall response rate for the survey was 62% (141/229). 93% were current residents, while 7% were recently graduated residents. Within residency programs, there was a range of 42% (Sherbrooke University) to 95% (University of Ottawa) in response rate. 78% were interested in participating in an international elective in a developing country prior to residency, 86% during residency, and 79% after residency. The presence of an international elective in one's respective programs was ranked as "important" or "very important" in 66% of respondents and "not important" or "not important at all" in 10%. 64% of residents report travel to a developing country in the past and 22% have lived in a developing country. Prior to residency training, 31% had previous international developing country elective experience. Currently in residency, 13% reported participating in at least one elective ranging from 1 week to 2 months duration. These electives consisted of mainly clinical hands-on training with surgical hands-on training and teaching playing a smaller role. They were consistently less recommended to junior (PGY 2-3) residents and were highly recommended (82%) to senior (PGY 4-5) residents. Barriers to participating in an international elective included lack of information (43%), lack of elective time (41%), lack of financial support (40%), as well as family obligations and commitments to residency training and further career planning.

**Conclusions** There is a high level of interest in international developing country electives amongst Canadian ophthalmology residents. However in practice, few residents have participated in such electives before residency and even fewer during residency. Barriers to active participation are multifactorial including the lack of a developed infrastructure within residency programs as well as other personal commitments.

## CORNEA- CONTROVERSIES IN CORNEA AND REFRACTIVE SURGERY

FRIDAY 10 JUNE

### Paper #75

#### **Bilateral Refractive Lensectomy are Simultaneously Operated for Ametropia.**

**John F. Blaylock, Zhaomin Si, Mark Petrik**

**Purpose** To evaluate intra-operative and postoperative complications and postoperative outcomes of simultaneous bilateral refractive lens exchange (SBRLE).

**Study Design** Retrospective cases series.

**Methods** Nine hundred and ten eyes with SBRLE, including 64 cases of monofocal AcrySof IQ and Rayner, 320 cases of multifocal AcrySof ReSTOR, 37 cases of accommodating Tetraflex, 30 cases of AcrySof and Rayner Toric, and 4 cases of accommodating Crystalens IOLs performed from June 2004 to Oct 2010 by one surgeon, were retrospectively analyzed on visual acuity (VA), refraction and complications.

**Results** Preoperative manifest spherical equivalent (MSE) ranged from -18.5 diopters (D) to +9.13 D. Preoperative best corrected VA of 20/32 or better was 87.0% of eyes in monofocal and 99.6% of eyes in multifocal, 98.4% of eyes in accommodating and 93.5% of eyes in toric IOLs. Postoperatively, 88.0% of patients with monofocal and 94.8% with ReSTOR, 96.9% with accommodating and 93.8% with Toric IOLs achieved binocular uncorrected VA of 20/32 or better without laser enhancement. MSE within  $\pm 1.00$  D of target was 97.4% of eyes in monofocal, 97.2% in ReSTOR, 98.4% in accommodating and 100.0% in Toric IOLs. Overall, one eye had intra-operative posterior capsule tear; from 1 to 39 months postoperatively there were 2 cystoid macular edema, 2 retinal tears, 4 retinal detachments and 5 epiretinal membranes; 327 eyes had YAG laser capsulotomy and 152 eyes underwent corneal laser surgeries to refine vision. There was no IOL exchange and no uveitis or endophthalmitis seen.

**Conclusions** Simultaneous bilateral refractive lens exchange with posterior chamber IOL implantation is safe and predictable. It provided excellent visual acuity and refractive outcomes with few complications.

## OCULOPLASTICS-3

FRIDAY 10 JUNE

### Paper #76

#### **Combining Alloplastic Orbital Implants with Autoplastic Dermis- Fat Grafts and Pearl Fat Grafts in Severe Loss of Soft Tissue of the Orbit and Eyelids**

**Amal Al- Sayyed**

**Purpose** To report a pan- technique in reconstructing severely shrunken sockets associated with loss of periorbital soft tissues using different types of synthetic orbital implants combined with multiple ways of fat grafting.

**Study Design** Retrospective, consecutive, nonrandomized interventional case series.

**Methods** Patients with severe loss of soft tissue of orbit and/ or periorbital area with seeing and non-seeing eyes after trauma, chemical burns, shrunken skin grafts, orbital tumors , orbital radiotherapy, blepharoplasty, evisceration and enucleation were treated with synthetic orbital implants combined with orbital and eyelids dermis and pearl fat grafts harvested from other parts of the body. Patients underwent a mean follow-up of 2 years.

**Results** All patients who underwent orbital and eyelid fat grafting noted improvement of periorbital hollowness, deep upper lid sulcus, conjunctival fornices, and orbital volume and shape comparing to the other orbit. They also noted stabilization of ocular prosthesis over longer period of time.

**Conclusions** Orbital and periorbital dermis and pearl fat grafting is a promising procedure in reconstructing severely atrophied orbital and periorbital tissues.

## OCULOPLASTICS-3

FRIDAY 10 JUNE

### Paper #77

#### Horizontal eyelid shortening and retractor reinsertion for lower eyelid involutional entropion

Liat Attas-Fox, Xi Huang, Bryan Arthurs

**Purpose** Lower eyelid involutional entropion is a common condition affecting the elderly population. There are many different surgical techniques for the repair of entropion.

We report the surgical outcomes of lower eyelid entropion repair using a modification of the “Bick” procedure in combination with reinsertion of the lower eyelid retractors. This combined procedure addresses both horizontal and vertical eyelid laxity.

**Study Design** A retrospective chart review.

**Methods** This single-surgeon, retrospective case series included 108 eyelids of ninety-four patients with involutional lower eyelid entropion who were operated on using a modification of the “Bick” procedure. This modification of the Bick procedure involves a laterally placed wedge resection to address horizontal lid laxity combined with resection and advancement of the inferior retractors to correct vertical laxity.

**Results** One hundred and eight eyelids in 94 patients (41F, 53M; Age  $74.8 \pm 1.1$ ) who underwent a modification of the “Bick” procedure along with reinsertion of retractors at the Montreal General Hospital between 2006 and 2010. One hundred and two eyelids underwent primary repair of age-related involutional entropion. Six eyelids had re-operations after failure of a previous entropion repair. Preoperative horizontal eyelid laxity was  $5 \pm 1.6$ mm, vertical eyelid laxity was 3+ (scale 0 - 4+). Patients were reviewed at  $31 \pm 2$  days post-operatively. We observed five complications during the follow-up period. Three eyelids had a wound dehiscence that was repaired. Two eyelids demonstrated a pyogenic granuloma at the wound site and these were removed in the office.

**Conclusions** A modification of the “Bick” procedure with reinsertion of the inferior retractors yields excellent results in patients with involutional entropion.

## **OCULOPLASTICS-3**

**FRIDAY 10 JUNE**

### **Paper #78**

**The presentation and clinical characteristics of orbital/ocular pain, with a surprising summary of etiology**

**Royce L. Johnson**

**Purpose** To review ophthalmic pain, and present a novel but common etiology of pain and suggest guidelines for investigation and management

**Study Design** Clinical review of etiologies of pain, with cinematographic analysis of the most common etiology

**Methods** practice review and literature review

**Results** enhanced clinical practice

**Conclusions** enhance patient care with reduction of interventions and investigations for the most common etiology of orbital and ocular pain

## OCULOPLASTICS-3

FRIDAY 10 JUNE

### Paper #79

#### **Kimura's disease versus angiolymphoid hyperplasia with eosinophilia of the orbit and ocular adnexa: a case report and clinicopathologic review**

**Elizabeth M. Palkovacs, Yasser A. Khan**

**Purpose** To highlight the clinicopathological differences between angiolymphoid hyperplasia and Kimura's disease, two entities often confused in the ophthalmic literature.

**Study Design** We report a case of Kimura's disease involving the lacrimal gland of a 17-year old Asian male with a painlessly enlarging right upper eyelid mass. Laboratory investigation revealed increased serum levels of IgE and peripheral blood eosinophilia. Magnetic resonance imaging of the lesion showed hypointensity relative to orbital fat on T1-weighted images, and isointensity relative to orbital fat on T2-weighted images, with enhancement after gadolinium administration. Histopathology was consistent with Kimura's disease.

**Methods** Extensive PubMed literature review.

**Results** The clinical and histopathological findings of the present case were consistent with Kimura's disease, not angiolymphoid hyperplasia with eosinophilia. A survey of the current ophthalmic literature indicates that these two diagnostic entities are often used synonymously, despite distinction in the pathology literature.

**Conclusions** The ophthalmic literature does not clearly reflect the current understanding that Kimura's disease and angiolymphoid hyperplasia with eosinophilia are best-considered two separate clinicopathologic entities and should be included in the differential diagnosis of orbital lesions occurring in adults.

## **OCULOPLASTICS-3**

**FRIDAY 10 JUNE**

### **Paper #80**

#### **Sclerosing Orbital Pseudotumor in a Five Month Old Child**

**Natasha Dang, Robert Henderson, Albert Y. Wu, Dan DeAngelis**

**Purpose** To report an extremely challenging and rare Pediatric Oculoplastics case of a five month old child with biopsy proven sclerosing orbital pseudotumor. We report the youngest case of pediatric orbital pseudotumor, and, the only pediatric biopsy-proven case of the sclerosing variant. We also aim to discuss diagnostic and management dilemmas.

**Study Design** Case Report

**Methods** N/A

**Results** We report a case of a five month old female with biopsy-proven sclerosing orbital pseudotumor, an exceedingly rare diagnosis. She presented with a three month history of gradually increasing unilateral lid swelling, hypoglobus, and proptosis treated with antibiotics in the periphery as 'cellulitis' without improvement. On presentation to our service, clinical examination and neuro-imaging findings were suspicious for rhabdomyosarcoma, however, intra-operative fresh frozen sections yielded a diagnosis of sclerosing orbital pseudotumor.

There are only eight reported cases of pediatric orbital pseudotumor in the literature, and no report of a biopsy-proven pediatric case of the sclerosing variant. Furthermore, currently, the youngest reported case of pediatric orbital pseudotumor is in a two year old child. Accordingly, we report the youngest case of pediatric orbital pseudotumor here, and, the only case of biopsy-proven sclerosing orbital pseudotumor in a child.

**Conclusions** N/A

## **OCULOPLASTICS-3**

**FRIDAY 10 JUNE**

### **Paper #81**

#### **A rare case of metastatic oncocytic adenocarcinoma of the lacrimal sac**

**Jerrod Kent, Larry H. Allen**

**Purpose** To report a rare case of an oncocytic adenocarcinoma arising from the lacrimal sac and extending to the orbit with cervical metastasis.

**Study Design** Case report.

**Methods** A case report describing a rare malignancy with pertinent review of the literature.

**Results** A previously well 45 year-old male presented with fullness in the left medial canthal region. Computer Tomography (CT) revealed a mass arising from the lacrimal sac and extending close to the medial and inferior rectus muscles. Incisional biopsy confirmed an oncocytic adenocarcinoma of the lacrimal sac. The patient had good visual acuity and opted not to have a complete exenteration. Tumor resection was carried out with medial canthal reconstruction and concurrent cervical lymph node dissection. Surgical pathological evaluation revealed positive margins and positive lymph nodes. Adjunct radiation therapy and chemotherapy were initiated post-operatively.

**Conclusions** Oncocytic adenocarcinomas (also know as malignant oncocytoma) are extremely rare tumors of the head and neck. To our knowledge, there have only been seven previously reported cases arising from the lacrimal sac, two of which were considered to be low-grade. This is only the second case to have cervical lymph node metastasis and is the youngest reported case.



## OCULOPLASTICS-3

FRIDAY 10 JUNE

### Paper #82

#### Surgical and Systemic Management of Merkel Cell Carcinoma

Andrea K. Leung, Yeni Yucel, Gilbert Hurwitz, John Lee, Navdeep Nijhawan

**Purpose** Merkel cell carcinomas of the eyelid are aggressive skin malignancies which grow rapidly. Early diagnosis and management is crucial as the prognosis tends to be poor due to local recurrence and early nodal and distant metastases.

**Study Design** Case report

**Methods** We present a case of Merkel cell carcinoma and discuss the diagnosis and management.

**Results** A 76 year old healthy male presented with 6 month history of a slowly enlarging erythematous right upper lid lesion with no madarosis. Full thickness incisional biopsy was performed. Histopathology markers were used to confirm a diagnosis of Merkel cell carcinoma. No distant metastases were noted on computed tomography (CT) of the thorax and abdomen. The patient underwent right upper lid excision of the lesion with frozen section control of margins and reconstruction with a lower to upper eyelid bridge flap using a free tarsal spacer graft from the contralateral lid. Technetium sentinel node scan revealed transit of the radiotracer to the preauricular and superior nodes of the neck. Superficial parotidectomy and selective neck dissection with sentinel node biopsy were performed at the time of the original surgery. The lymph nodes were negative for malignancy. Multiple further surgeries were required over subsequent months to repair an upper lid notch, lid malpositions and trichiasis.

Five months after his first lid resection, the patient noted a 4 centimetre right neck lump which was confirmed on fine needle aspiration biopsy to be a recurrence of the Merkel cell carcinoma in a cervical lymph node. A CT scan of the neck showed several enlarged lymph nodes with invasion of the sternocleidomastoid muscle, but a repeat CT of his chest and abdomen was negative for metastasis. The diagnosis of nodal metastatic disease in light of a previous neck dissection was concerning and a repeat neck dissection, parotidectomy and resection of the skin with flap reconstruction was performed, followed by postoperative radiation therapy.

**Conclusions** This case illustrates the high rate of metastasis typical of Merkel cell carcinomas despite aggressive imaging and sentinel lymph node biopsy and surgery. The surgical challenges that arise after lid reconstruction, such as lid notches and lid malpositions, can be effectively treated via subsequent minor lid procedures. A multidisciplinary team approach and long term follow-up is crucial in managing these patients as it allows for detection and prompt treatment of metastatic disease.

## **OCULOPLASTICS-3**

**FRIDAY 10 JUNE**

### **Paper #83**

#### **Novel technique for pre-operative photography of Blepharoplasty patients**

**Royce L. Johnson**

**Purpose** To review current photographic standards for pre-op Blepharoplasty patients and present an efficient and effective technique.

**Study Design** New procedure

**Methods** to use technical staff and standard camera for photos, and present typical cases

**Results** excellent and inexpensive photos for patient, chart, and medicolegal purposes

**Conclusions** A useful technique for medicolegal purposes

## UVEITIS- COMPLICATIONS AND TREATMENT OF UVEITIS

SATURDAY 11 JUNE

### Paper #84

#### A systematic review on the efficacy of TNF-alpha inhibitors in the treatment of uveitis

Nihal Haque, Zainab Khan, Patrick Prendergast, William G. Hodge

**Purpose** Severe uveitis can lead to vision loss through mechanisms such as cataract formation and macular edema. There have been many reports of the use of TNF-alpha inhibitors (etanercept, infliximab and adalimumab) in the treatment of severe uveitis. We performed a systematic review to survey the literature for the efficacy of TNF-alpha inhibitors in the treatment of uveitis.

**Study Design** Systematic Review

**Methods** A literature search was performed in MEDLINE, EMBASE, Cochrane Library, Proquest Dissertations, Scopus and Web of Science for the time period 1995 - June 2010. Title and abstract screening (1327 articles) and full text screening (250 articles) were performed to produce a final list of 105 articles which was used for data abstraction. Articles were classified by type of outcome (ie, Anterior Inflammation Grade, Posterior Inflammation Grade and Visual Acuity) for data analysis.

**Results** Only before-after case series were identified. Anterior inflammation grade (SUN classification) was examined in 13 studies for a total of 143 patients. The pooled median anterior inflammation grade decreased from 2+ to 0 ( $p < 0.05$ ). The median follow-up period was 21.1 months and the median age at TNF-alpha administration was 26 years. Juvenile Idiopathic Arthritis and Behcet's disease were the most responsible etiologies (37% and 33% respectively). Posterior inflammation grade (vitreous haze) was examined in 6 studies for a total of 57 patients. The pooled median posterior inflammation grade decreased from 2+ to 0 ( $p < 0.05$ ). The median follow-up period was 12 months and the median age at TNF-alpha administration was 29.5 years. Behcet's disease and idiopathic disease were the most responsible etiologies (42% and 21% respectively). Visual Acuity was examined in 22 studies for a total of 241 patients. The pooled median visual acuity (in logMAR) improved from 0.38 to 0.18 ( $p > 0.05$ ). The median follow-up period was 21.1 months and the median age at TNF-alpha administration was 34 years. Behcet's disease and idiopathic disease were the most responsible etiologies (34% and 22% respectively).

**Conclusions** Even though there was a statistically significant improvement in anterior and posterior inflammation grade, there was no statistically significant improvement in visual acuity. Given the high cost of TNF-alpha inhibitors and the potential benefit in treating the inflammation in uveitis, a randomized controlled trial is warranted.

## UVEITIS- COMPLICATIONS AND TREATMENT OF UVEITIS

SATURDAY 11 JUNE

### Paper #85

#### Use of the dexamethasone intravitreal implant in severe bilateral chronic panuveitis

Rustum Karanjia, Bernard R. Hurley, Chole Gottlieb, Micheal O'Connor

**Purpose** To describe the use of dexamethasone 0.7 mg sustained-release intravitreal implant in a patient with refractory uveitis

**Study Design** Case report

**Methods** A 13 year-old male developed severe, bilateral chronic idiopathic granulomatous panuveitis. Over three years, treatment with multiple immunosuppressive agents including topical, systemic and pulse intravenous steroids, methotrexate, adalimumab, mycophenolate mofetil and cyclosporine A, as well as vitrectomy did not control the inflammation. Visual acuity worsened to 20/100 OD and 20/70 OS secondary to cystoid macular edema and vitritis. Adjuvant intravitreal triamcinolone injections were highly effective at controlling the inflammation, but the suppression was short-lived. The positive response to intravitreal triamcinolone suggested that a longer acting, sustained-release steroid preparation might be of value. At age 16, following informed consent, special access was obtained for bilateral implantation of a dexamethasone 0.7 mg sustained-release intravitreal implant (Ozurdex; Allergan).

**Results** There was a rapid and sustained reduction in inflammation in both eyes for two months following intravitreal dexamethasone implantation, with return of visual acuity to 20/20 OD and 20/25 OS. During this time, further therapy with infliximab was initiated. An early elevation in intraocular pressure was successfully managed without surgical intervention.

**Conclusions** The dexamethasone intravitreal implant appeared to be an effective and safe therapy for interim control of inflammation of bilateral panuveitis in this patient. Sustained-release intravitreal steroid implants may have an adjuvant role in the management of selected cases of chronic posterior uveitis. We believe this is the first reported case of the use of a sustained-release dexamethasone implant in a pediatric patient.

## CORNEA- REFRACTIVE SURGERY SYMPOSIUM

SATURDAY 11 JUNE

### Paper #86

To evaluate the performance and acceptability of variable spot scanning refractive surgery

W. Bruce Jackson, Kashif Baig, John F. Blaylock, Joseph King, George Mintsioulis, David S. Rootman, James Wiens

**Purpose** To evaluate the efficacy, safety and acceptability of the Variable Spot Scanning (VSS) technology as part of the STAR S4 IR™ Excimer Laser Platform. VSS Refractive is an alternative for conventional treatment when a WaveScan measurement is not available.

**Study Design** A prospective, multi-center, open-label, non-randomized clinical trial was initiated at 5 centers in Canada.

**Methods** 57 myopic patients (110 eyes) were enrolled and treated with LASIK using the IntraLase femtosecond laser for flap creation. 46 patients were low and 11 high myopes. 56% were male and the mean age was  $31.9 \pm 7.67$  years. Treatment was based on the manifest refraction.

**Results** Preoperatively, mean spherical equivalent (MRSE) was  $-4.19 \pm 1.94$  D (range: -1.25 to -10.25 D). At three months postoperatively, 90.1% of patients achieved a UCVA of 20/20 or better and 100% had 20/40 or better. Mean MRSE was within 1.0 D in 99% of patients and within 0.50 D in 74.3%. No patients (0%) had a BCVA of worse than 20/25. Mean change in refractive stability was  $+0.01 \pm 0.29$  (95% CI: -0.05, +0.07) between months 1 and 3.

**Conclusions** VSS with the STAR S4 IR™ Excimer Laser Platform provided excellent visual and refractive outcomes in myopic patients with a high degree of refractive stability. It may become the preferred alternate to conventional treatment.

## CORNEA- REFRACTIVE SURGERY SYMPOSIUM

SATURDAY 11 JUNE

### Paper #87

#### Examining the characteristics of post Laser-assisted in situ Keratomileusis (LASIK) corneal ectasia patients

Ravinder D Bhui, Simon P. Holland

**Purpose** To investigate the preoperative, perioperative, and postoperative characteristics of patients who developed corneal ectasia after Laser-assisted in situ Keratomileusis (LASIK).

**Study Design** Retrospective chart review

**Methods** 17 eyes from thirteen patients referred to a university cornea clinic during a five year period for ectasia after LASIK were evaluated. Preoperative, perioperative, and postoperative data including visual acuity, refraction, pachymetry, residual stromal bed depth, and topographical readings were obtained and scrutinized.

**Results** The patients ranged in age from 24 to 48 years and the preoperative best corrected visual acuities ranged between 20/20 and 20/30. The average preoperative spherical equivalent was -6.07 and varied from -3.63 to -11.75. Mean preoperative pachymetry was 551 micrometers. The residual stromal bed depths ranged from 189 to 383 micrometers with an average of 294 micrometers. Three eyes exhibited forme frust keratoconus (17.6%), four had keratoconus (23.5%), and two had pellucid marginal degeneration (11.8%). Four patients scored between 0 and 2 on the Randleman Ectasia Risk Factor Scoring System. Documented onset of ectasia ranged from 6 months to 8 years post operatively. Seven of the eyes (44%) had undergone retreatments after the initial surgery.

**Conclusions** Multiple factors contribute to the risk of developing ectasia post LASIK surgery. It is important to be aware that a relatively large proportion of patients can develop ectasia after their retreatment procedures. Patients with residual stromal bed depths of greater than 250 micrometers can still develop ectasia and their candidacy for LASIK should be considered in the context of other risk factors including asymmetric topography and high refractive error.

## CORNEA- REFRACTIVE SURGERY SYMPOSIUM

SATURDAY 11 JUNE

### Paper #88

#### Sutures management of recalcitrant LASIK flap striae

Salima Hassanaly, Eser Adiguzel, Avi Wallerstein, Mark Cohen, Pierre Demers, Mona Harissi-Dagher

**Purpose** To examine the outcomes of sutures in the management of recalcitrant flap striae after laser in situ keratomileusis (LASIK).

**Study Design** Multi-centre, retrospective chart review

**Methods** Retrospective chart review of 15 eyes (13 patients) that underwent LASIK from August 1999 to March 2010 in which recalcitrant post-LASIK flap striae were treated with interrupted sutures. Between 5-9 sutures were placed and removed 2-4 weeks later. Non-sutured, LASIK-operated contralateral eyes of unilaterally-affected patients served as internal controls. Primary outcome measurements were comparisons and changes of UCVA, BCVA, and manifest refraction to control eyes. Paired t-tests and repeated-measures ANOVA followed by post-hoc tests were performed.

**Results** 5 eyes required sutures for striae post-primary LASIK and 10 eyes post-enhancement. Mean interval from procedure to suturing was  $5.2 \pm 3.5$  months, with follow-up time of  $5.9 \pm 5.5$  months. Cylinder, UCVA and BCVA were significantly impaired in eyes with flap striae compared to control eyes ( $-0.62 \pm 0.50$  vs.  $-0.25 \pm 0.18$  D,  $p=0.05$ ,  $0.23 \pm 0.13$  vs.  $0.05 \pm 0.08$  logMAR,  $p<0.001$  and  $0.09 \pm 0.08$  vs.  $0.03 \pm 0.05$  logMAR,  $p=0.03$ , respectively). Sutures significantly improved UCVA (to  $0.07 \pm 0.11$  logMAR,  $p<0.001$ ) to levels similar to control eyes. There was a slight improvement in cylinder (to  $-0.39 \pm 0.36$  D,  $p=0.21$ ) and BCVA (to  $0.04 \pm 0.09$  logMAR,  $p=0.10$ ). All patients reported significant improvement in subjective quality of vision.

**Conclusions** Treatment of recalcitrant flap striae post-LASIK with sutures resulted in improvements in UCVA and BCVA, and resulted in outcomes similar to contralateral control eyes.

## CORNEA- REFRACTIVE SURGERY SYMPOSIUM

SATURDAY 11 JUNE

### Paper #89

**The four-year outcomes from a prospective Canadian clinical investigation of an angle-supported phakic lens.**

**Simon Holland, Thaddeus Demong, Francis Roy, Theodore Rabinovitch, Mihai Pop**

**Purpose** To investigate clinical outcomes of an investigational angle-supported phakic lens designed for the correction of moderate to high myopia.

**Study Design** A prospective, multicenter study conducted in Canada, 120 adult subjects (18 to 49 years old) received AcrySof Cachet Phakic Lens implants.

**Methods** The preoperative mean SE was  $-10.60 \pm 2.13$  diopters (D) (N=120). Study criteria excluded previous corneal or intraocular surgery, a history of glaucoma,  $<3.2$  mm anterior chamber depth including the cornea, or non-qualifying corneal endothelial cell density (ECD). First-eye outcomes assessed at the 4-year visit included evaluation of spherical equivalent (SE), predictability of refraction, and endothelial cell density.

**Results** Four years after implantation, mean SE was  $-0.34 \pm 0.42$  D (N=54). Predictability of refraction was within  $\pm 0.5$  D of target for 77.8% (42/54) of subjects, and within  $\pm 1.0$  D of target in 96.3% (52/54). Mean central ECD at 4 years post-op was  $2713.6 \pm 378.7$  cells/mm<sup>2</sup> (N=54), compared with  $2909.5 \pm 264.8$  cells/mm<sup>2</sup> (N=120) preoperatively. Mean annualized percent change in central ECD was -1.6% (N=52) from 6 months to 4 years postoperative.

**Conclusions** Clinical results with the AcrySof Cachet Phakic Lens at 4 years postoperatively revealed stable and predictable refractive outcomes, and acceptable corneal endothelium outcomes. The study will continue through 5 years postoperative.



## GLAUCOMA- GLAUCOMA CHALLENGES IN DAILY PRACTICE

SATURDAY 11 JUNE

### Paper #90

#### Evaluation of the Canadian Glaucoma Guidelines - Results of a survey of Canadian Ophthalmologists

Enitan A. Sogbesan, Yvonne M. Buys, Paul E. Rafuse, Karim F. Damji

**Purpose** To evaluate awareness of Canadian ophthalmologists regarding the recommendations of the Canadian Glaucoma Guidelines (CGGs) and to establish baseline data for future impact assessment.

**Study Design** Cross Sectional Survey

**Methods** A validated web based online questionnaire was sent to members of the Canadian Ophthalmological Society (COS). The questionnaire focused on awareness of the CGGs and current practice patterns with regards to 40 key recommendations in the CGGs. Data was collated and analyzed.

**Results** Total of 207 responses were obtained - a capture rate of 26%. Most respondents were in comprehensive (50%) adult practices (41%). Of the sub specialist respondents (30%), anterior segment/cataract (44%) and glaucoma (42%) predominated. 57% of respondents were community based and majority (47%) had 20 plus years of practice. Only 18% were within the first 5 years of practice.

91% were aware of the existence of the CGGs and 74% had read the guidelines. 81% of respondents were familiar with the recommendations and 76% felt the CGGs were relevant or highly relevant to their current practice. About a half (47%) felt the recommendations would change their practice.

68% agreed or strongly agreed to follow the guidelines. 11% were in disagreement with one or more of the recommendations. Currently, full agreement and adherence to the recommendations ranged from 60 to over 80% for most of the recommendations with the exception of combined cataract and glaucoma where adherence ranged from 50% to all the time.

Though 66% of the respondents felt there are some barriers to following the recommendations of the guidelines, most of the ophthalmologists (80%) had adequate trained personnel in their practices for clinical work but less so for stereo photos (47%) and eye health education (40%).

For staging glaucoma, most (71%) were familiar with the guideline. However, only 42% staged the disease all the time and 35% frequently. 47% set target pressures all the time and an additional 40% frequently. 70% of the ophthalmologists determined patient's baseline data all the time and 28% frequently.

**Conclusions** Adherence to the CGGs practice guidelines varied substantially. Most of the respondents were familiar with the CGGs and agreed with the recommendations, though less than half felt that they would change their practices. Some barriers and limitations to implementation were identified. However, the evaluation of the CGG provided helpful information for planning future CME programs and revisions.

## GLAUCOMA- GLAUCOMA CHALLENGES IN DAILY PRACTICE

SATURDAY 11 JUNE

### Paper #91

#### The effect of pharmacological pupillary dilation on intraocular pressure measurement using Goldmann applanation tonometry and hand-held transpalpebral tonometry

Cynthia Xin-ya Qian, Salima Hassanaly, Jean Duperré, Mona Harissi-Dagher

**Purpose** To measure and compare the changes in the intraocular pressure (IOP) pre-and post dilation with a combination agent of phenylephrine hydrochloride 5% and tropicamide 0.8% (Diophenyl-T) in non-glaucomatous normal subjects using two instruments, the Goldmann applanation tonometer (GAT) and the Diaton tonometer.

**Study Design** Prospective sequential study of patients using two types of tonometry

**Methods** Thirty five patients referred to the general eye clinic were recruited. Only patients with normal anterior segments, no suspicion of glaucoma, and open angles were included. Their IOP pre-dilation and 45 minutes post instillation of Diophenyl-T were measured using GAT and the Diaton (Ryazan State Instrument-Making) hand-held transpalpebral tonometer. Following examination, central corneal thickness and additional parameters were measured to rule out any predisposition to glaucomatous changes.

**Results** IOP OD was measured in 35 patients. The mean GAT IOP was 16.5+/-2.4mmHg pre-dilation and 15.7+/-2.5mmHg post-dilation ( $p=0.28$ ). The mean change from baseline was 1.9 (CI: 1.45-2.35). Post-dilation, IOP decreased in 20% of patients (7/35), increased in 57% (20/35), and remained the same in 23% (8/35). The Diaton measured a mean IOP of 11.7+/-3.1mmHg and 11.3+/-2.7mmHg pre and post dilation respectively within the same patient group. The change from baseline was 2.5 (CI 1.98-3.02). There was a statically significant difference ( $p<0.001$ ) between GAT and Diaton measurements. Correlation between the two eyes was 0.93 on GAT vs. 0.55 with Diaton tonometry.

**Conclusions** Pupillary dilation has little effect on IOP in patients with no predisposition to glaucoma. Hence it is unnecessary to measure IOP pre-dilation in these patients. The Diaton readings generally underestimate IOP, correlate poorly with GAT and hence should not be used as its substitute in routine clinical settings.

## GLAUCOMA- GLAUCOMA CHALLENGES IN DAILY PRACTICE

SATURDAY 11 JUNE

### Paper #92

**Rates of change in patients with glaucoma and different patterns of optic disc damage.**

Alexandre S. Reis, Paul H. Artes, Balwantray C. Chauhan, Marcelo T. Nicolela

**Purpose** To investigate the speed of visual field and optic disc change in patients with open angle glaucoma (OAG) and distinct patterns of optic disc damage.

**Study Design** Prospective longitudinal study.

**Methods** A group of 133 patients with focal (n = 46), diffuse (n = 43) and sclerotic (n = 44) optic disc damage were enrolled in a prospective longitudinal study. Patients were examined every 4 months with standard automated perimetry (SAP, SITA Standard, 24-2 test, Humphrey Field Analyzer) and confocal scanning laser tomography (HRT 2, Heidelberg Retina Tomograph) for a period of 4 years. During this time patients were treated according to a predefined study protocol to achieve a target intraocular pressure (IOP). Rates of change were estimated by robust linear regression of MD (dB) and global rim area ( $\text{mm}^2 \times 10^{-3}$ ) with follow-up time as the independent variable.

**Results** Rates of visual field change were fastest in patients with focal optic disc damage (mean, -0.35 dB/y), followed by patients with sclerotic and diffuse optic disc damage, respectively (mean, -0.14 dB/y and 0.007 dB/y,  $P = 0.001$ ). Rates of optic disc change were fastest in patients with focal optic disc damage (mean,  $-12 \times 10^{-3} \text{ mm}^2/\text{y}$ ), followed by patients with diffuse and sclerotic optic disc damage, respectively (mean,  $-9.2 \times 10^{-3} \text{ mm}^2/\text{y}$  and  $-0.4 \times 10^{-3} \text{ mm}^2/\text{y}$ ,  $P = 0.09$ ). IOP reduction and mean IOP during the follow-up were similar among the 3 groups ( $P = 0.25$  and  $P = 0.09$ ).

**Conclusions** Patients with focal optic discs have faster rates of visual field and optic disc rim deterioration when compared to patients with diffuse and sclerotic discs, despite similar IOP reductions during follow-up.

## GLAUCOMA- GLAUCOMA CHALLENGES IN DAILY PRACTICE

SATURDAY 11 JUNE

### Paper #93

#### **A Randomized Prospective Study of Selective Laser Trabeculoplasty versus Argon Laser Trabeculoplasty in Open Angle Glaucoma and Ocular Hypertension due to Pseudoexfoliation Syndrome**

**Shefalee S. Kent, Cindy Hutnik, Catherine Birt, Karim F. Damji, Paul Harasymowycz, Andrew Crichton**

**Purpose** To evaluate the efficacy of Selective Laser Trabeculoplasty (SLT) versus Argon Laser Trabeculoplasty (ALT) in lowering intraocular pressure (IOP) in patients with open angle glaucoma secondary to pseudoexfoliation (PXF).

**Study Design** A Randomized Prospective Study.

**Methods** A prospective randomized clinical trial was conducted comparing IOP lowering in eyes treated with SLT versus ALT at 6 months and 1 year. Baseline variables included age, gender, angle grade and pigmentation and number of glaucoma medications. Patients with prior laser trabeculoplasty, ocular surgery within 6 months, previous glaucoma surgery, advanced visual field defect, monocular patients, and current steroid use were excluded from the study. Intraocular pressure (IOP) measurements were recorded before each procedure and at various time points including 6 and 12 months after initial trabeculoplasty. The primary outcome was the change in IOP from baseline and the secondary outcome included number of glaucoma drops post-SLT therapy. Differences in group means of continuous, normal variables were tested using unpaired Student's t-test. The chi-square test was used for categorical and Kruskal-Wallis test for categorical-ordinal (i.e. grading scale) variables. Finally, the primary outcome were calculated and compared between the treatment groups by unpaired Student's t-test. Statistical significance was set at 0.05.

**Results** Seventy-six eyes of 60 patients  $\geq 18$  years of age with PXF underwent either 180-degree SLT or 180 degree ALT. The baseline IOPs in the SLT and ALT groups were 23.3 mmHg and 25.6 mmHg respectively. The IOP reductions 6 and 12 months post SLT were -6.4 mmHg and -7.2 mmHg, respectively. The IOP reductions post ALT were -7.9 mmHg at both 6 and 12 months. The 0.8 mmHg IOP reduction superiority of ALT at 6 months was not statistically significant ( $p$  value 0.1302) and was no longer apparent at 12 months ( $p$  value 0.9037 ) The ALT group had increased use of glaucoma drops at 1 year with an average of 1.0 versus 0.8 in the SLT group. Differences noted between all groups were statistically insignificant at both 6 and 12 months.

**Conclusions** ALT and SLT are equivalent in lowering IOP at 6 and 12 months post laser treatment in patients with PXF.

## NEURO-OPHTHALMOLOGY-1

SATURDAY 11 JUNE

### Paper #94

#### Partial IIIrd cranial nerve palsy: clinical features and surgical management

Jesia Hasan, Michael Flanders

**Purpose** Incomplete recovery from injury to the IIIrd cranial nerve results in ocular misalignment and associated diplopia. In this subset of patients, there is sufficient residual motility to permit restoration of functional, single binocular vision with strabismus surgery.

**Study Design** A retrospective review of twelve patients with partial IIIrd cranial nerve palsy who underwent strabismus surgery.

**Methods** Twelve patients with residual IIIrd nerve palsy (post-trauma, aneurysm or ischemic event), were selected from the clinical practice of Dr Michael Flanders. A complete, initial ophthalmologic exam, along with pre and post-operative clinical and photographic documentation of ocular alignment and motility was performed in each case. The 7 patients with primarily vertical deviations, had chin-up head positions, elevation deficits and hypotropias. The remaining 5 patients had combinations of vertical and horizontal deviations with elevation and adduction deficits and exohypotropias. Strabismus surgery included isolated contralateral superior rectus recession with or without ipsilateral inferior rectus recession, vertical transposition of horizontal recti, horizontal rectus muscle surgery, or combined horizontal and vertical muscle surgery. Surgical success was defined as: absence of diplopia in functional positions of gaze, elimination of preoperative abnormal head posture (AHP) and ocular alignment in primary position within 5 prism diopters (PD) of orthotropia.

**Results** The mean preoperative vertical and horizontal deviations were 19 PD hypotropia (8 - 40 PD) and 19 PD exotropia (6 - 40 PD) respectively. The mean postoperative deviations were 2 PD hypotropia (0 - 8 PD) and 1 PD exotropia (0 - 6 PD). Elevation, adduction and associated head posture improved in all patients. Complete surgical success was achieved in 7/12 patients. Partial success was attained in 5/12 patients, who experienced significant improvement but required postoperative use of a prism. The average follow-up was 23 months (range of 4 to 81 months).

**Conclusions** This study demonstrates that patients with incomplete IIIrd cranial nerve paralysis can enjoy good functional and cosmetic outcomes with strabismus surgery.

## NEURO-OPHTHALMOLOGY-1

SATURDAY 11 JUNE

### Paper #95

#### Cyclic vertical ocular deviations in adults - evaluation and treatment in three cases

Gillian Roper-Hall

**Purpose** Cyclic ocular deviations are uncommon but well recognized. Most occur as alternate-day esotropia in children. Only a few cases of cyclic exotropia or hypertropia have been published. Acquired cyclic deviations in adults are uncommon. We investigated three cases.

**Study Design** We present three cases of cyclic hypotropia in adults. The cyclic pattern was documented on consecutive days. The outcomes of treatment and probable mechanism will be discussed.

**Methods** Case reports:

Three adults developed 48-hour cyclic hypotropia. All described alternating “good” and “bad” days. The pattern was so predictable that each patient planned family activities for the following weekend according to whether Saturday or Sunday would be the “good” day.

**Results** All had preexisting ocular disease. The first patient began the cycle one day after orbital decompression OD for thyroid exophthalmos. The second underwent neurosurgery for a middle cranial fossa tumor; two months after muscle surgery for residual hypertropia he reported vertical diplopia every other day. The third patient had a three-year history of Graves disease and the alternating cycle began spontaneously. The cycles in all three patients continued unbroken for 7, 11 and 24 months respectively.

**Conclusions** The mechanism for cyclic ocular deviations is not well understood. Our cases of cyclic hypotropia had characteristics of ocular neuromyotonia (ONM) except that the spastic phase occurred on alternate days and lasted all day. ONM is a rare disorder probably caused by ephaptic transmission and can affect any muscle or nerve. It has been reported following radiation to the skull base and in Graves disease. Two of our cyclic cases had Graves disease. We postulate that the mechanism in our cases may be similar to ONM as it responded to membrane stabilizers in cases 1 and 2. (Case 3 underwent a spontaneous resolution.) (7 references.)

## NEURO-OPHTHALMOLOGY-1

SATURDAY 11 JUNE

### Paper #96

#### Characteristics of Acquired Early Onset Nystagmus as a Presenting Sign of Optic Pathway Glioma in Infants

Arun Reginald, Anamika Tandon, Gary Nicolin, Joanne Dondey, Ute Bartel, J. Ray Buncic

**Purpose** Optic pathway glioma (OPG) accounts for 25% of intra-cranial tumours during infancy. 25% of OPG affect the chiasm. In infancy, nystagmus may be the first and only sign of chiasmal OPG. This series attempts to identify the characteristics of the nystagmus in infantile cases of OPG. In our series of 27 cases, we identify signs suggestive of a neurological rather than an ocular aetiology and suggest guidelines for early imaging.

**Study Design** Retrospective case series analysis of the last two decades of our experience at the Hospital for Sick Children Toronto.

**Methods** All new cases of OPG presenting to the Hospital for Sick Children (HSC), Toronto between 1988 and 2008 were identified. Those presenting with nystagmus were retrospectively analysed further. The onset, nature, laterality, amplitude and frequency of the nystagmus were noted clinically by a single paediatric neuro-ophthalmologist (JRB). Concurrent ophthalmic signs and systemic conditions, radiological data and pathology results are presented. The data does not include eye movement recordings.

**Results** 155 new cases of OPG were identified. 92 had an ophthalmic presentation. 27 cases presented with nystagmus. All had radiological evidence of involvement of the chiasm. Other ophthalmic signs and systemic signs were rare (n=4/27 and n=6/27 respectively).

Features atypical of 'ocular' nystagmus included;

- 1) Multiplanar nystagmus (n=17/27).
- 2) Asymmetry (n=13/27).
- 3) Dysconjugacy (n=6/27).
- 4) Onset of nystagmus after 3 months of age was seen in 22/27 cases. This was the only atypical sign in 4 cases of nystagmus otherwise typical of infantile 'motor' nystagmus. Onset of nystagmus after 6 months did not recognise 3/4 of these cases and was seen in 15/27 cases.

**Conclusions** In this study, all 27 cases of could be identified clinically as being suspicious of a neurological cause with application of the following observations regardless of the paucity of other ophthalmic signs;

- 1) onset of any form of nystagmus after 3 months of age
- 2) multiplanar nature
- 3) dysconjugacy
- 4) asymmetry

Presence of these signs should alert the clinician to possible neurological aetiology and expedite neuro-

imaging.



## PEDIATRICS: PEDIATRIC REFRACTIVE SURGERY AND ANTERIOR SEGMENT PATHOLOGY

SATURDAY 11 JUNE

### Paper #97

#### The comparative accuracy of four IOL power calculation formulae in pediatric eyes undergoing cataract surgery

Santa Heede, William F. Astle

**Purpose** To analyze and compare the accuracy of intraocular lens (IOL) power calculation formulae (SRKT, Holliday 1, SRK II, Hoffer Q) in pediatric eyes undergoing cataract surgery with an IOL.

**Study Design** Retrospective case series

**Methods** 46 eyes of 36 children with congenital, developmental, or acquired cataracts who underwent cataract surgery with IOL implantation were included. The surgeries were performed by a single surgeon between 2007 and 2010. 4 common IOL power calculations formulae (Holliday1, SRKT, Hoffer Q, SRK II) were used to predict refractive outcome. Axial length (AL), measured with immersion technique, keratometry (K) and manufacturer's A constants were employed in the four formulas. All measurements were obtained under general anesthesia in the operating room. Retinoscopy was measured at 4 to 10 weeks after surgery and converted to spherical equivalent. For analysis, eyes were grouped by age at surgery, axial length and mean keratometry power. Prediction error (PE) was calculated for each eye, comparing the results between the four IOL formulas. The formula that gave the best prediction (minimum PE) was determined.

**Results** The mean age at surgery was 2.8 years. The mean PE for all patients was .99D. The mean absolute PE for Holliday 1 was -0.61 D, for SRK/T was -0.09D, for Hoffer Q was -1.61D and for SRK II was -1.64D. There was a difference between predictability for small eyes (AL≤22mm eyes) and long eyes (AL>22mm). For small eyes the mean deviation was -1.09 D for Holliday 1, 0.14 D for SRK/T, -2.21 D for Hoffer Q, and -0.82 D for SRK II. For long eyes the mean deviation for Holliday 1 was -0.72 D, for SRK/T -0.76 D, for Hoffer Q -1.04, and for SRK II -3.27D. In cases with both steeper and flatter corneas (mean K 43.5 D) SRK/T was the most accurate formula of the four, but more accurate in PE with steep corneas (mean K > 43.5 D) than flat corneas (mean K < 43.5 D). Of the 4 formulas, SRK II was the least accurate and the most variable formula.

**Conclusions** SRK/T was the most predictable of the four formulas. In almost all cases, all four formulas clinically under corrected from the targeted IOL power, but SRK/T was the most accurate of the four regardless of variability in AL and K readings. In this study, new theoretic IOL calculation formulas outperformed older regression formulas like SRK II.

## PEDIATRICS: PEDIATRIC REFRACTIVE SURGERY AND ANTERIOR SEGMENT PATHOLOGY

SATURDAY 11 JUNE

### Paper #98

#### Parental Comprehension Following Informed Consent for Pediatric Cataract Surgery

Vasudha Erraguntla, Irina Serbanescu, Sunita Vohra, Mohamed Abdoell, Martin McKneally, Alex V. Levin

**Purpose** To investigate the effectiveness of information transfer by the pediatric cataract surgeon to parents/guardians of children during the informed consent process.

**Study Design** Prospective case series

**Methods** Using a checklist developed in consultation with other pediatric cataract surgeons, the surgeon discussed the nature of the disease, the course without surgical intervention, the surgical procedure, the risks and benefits, and the postoperative care. Immediately after, parents were invited to complete a questionnaire to assess information recall. Analysis of variance and t-test were used to determine associations between questionnaire scores and demographic variables. The surgeon subsequently called parents and discussed again the issues that they did not remember correctly, as identified by the questionnaire responses.

**Results** Of 31 parents, 18 (58%) overestimated their understanding of the informed consent discussion. Parents scored well on questions about the nature of the disease, and the post-operative follow-up, but lower on questions regarding surgical risks and outcomes. Parents identified several barriers to understanding, including the large amount of information, stress, and preoccupation with their child. No association was noted between the level of understanding and demographic factors.

**Conclusions** Parents may overestimate their understanding of informed consent discussions. Some parents may be overly optimistic about risks and outcomes. Surgeon follow-up communication with parents addressing aspects insufficiently understood at initial discussion provided the means to improve comprehension.

## CORNEA- MEDICAL & SURGICAL CORNEA

SATURDAY 11 JUNE

### Paper #99

#### **Development of Biocompatible Nanocomposites in Contact Lenses for Local Delivery of Growth Factor in Chemical Burns**

**William G. Hodge, Jin Zhang, Hyung Kim, Adrienne Willoughby**

**Purpose** This research project aims at the development of a robust and biocompatible nanocomposite-based patch for ocular wound healing and vascularization after chemical burns.

**Study Design** Basic Science

**Methods** Basic fibroblast growth factor (bFGF) was encapsulated into gelatin nanoparticles. The average diameter of gelatin nanoparticles is about  $180\pm 10$  nm, which was measured by the scanning electron microscopy (SEM). Following that, the protein loaded nanoparticles were incorporated into a co-polymer of hydroxy and amino forms of ethyl methacrylate membrane.

**Results** The release profile of the bFGF from nanocomposite-based patch was monitored for over 14 days. Furthermore, Stress-Strain studies showed that the Young's modulus of the nanocomposite-based patch is twice of that of plain polymer membrane. Human Umbilical Vein Endothelial Cells (HUVEC) were used to verify the biocompatibility of the nanocomposite patch.

**Conclusions** This innovative structure can deliver sustainable nutritive substances and growth factors through nanoparticles loaded in a hydrogel patch. It may benefit the growth of vascularization of the ischemic ocular surface and epithelialization of the cornea on the wound bed in chemical burns.

## **CORNEA- MEDICAL & SURGICAL CORNEA**

**SATURDAY 11 JUNE**

### **Paper #100**

#### **Gonococcal ophthalmia in adults: conjunctivitis, ulcerative keratitis and corneal perforation**

**Mayte Arino, Nicolas Alejandro, Blanca Garcia, Ignacio Jimenez-Alfaro**

**Purpose** Gonococcal ophthalmia in adults is a sexually transmitted disease that presents as a rapidly progressive conjunctivitis with propensity to involve the cornea. This is a serious ophthalmological condition, extremely rare in developed countries, that remains widely unrecognized by ophthalmologists and a delay in diagnosis can result in permanente loss of vision

**Study Design** Three clinical cases of gonococcal ophthalmia

**Methods** We present here three different features of gonococcal ophthalmia in adults. We describe the follow-up, the systemic and topical therapy and the final outcome of treatment.

**Results** Two men who have sex with men with an hyperacute conjunctivitis and a corneal perforation respectively and a woman, that went on a trip to Cuba, with an ulcerative keratitis.

**Conclusions** When hyperacute conjunctivitis is diagnosed in an adult a Gram stain and confirmatory culture are mandatory because the final outcome depends on the severity of the disease at the start of treatment. The prevalence of Quinolone-Resistant N. Gonorrhoeae (QRNG) has increased and has led to the use of systemic cephalosporins as first-line therapy.

## CORNEA- MEDICAL & SURGICAL CORNEA

SATURDAY 11 JUNE

### Paper #101

#### A rare case of corneal crystalline deposits as initial presentation of multiple myeloma

King Chow, Katherine Monkman, Kulbir S. Gill, Leonard Minuk, Rookaya Mather

**Purpose** To report the case of a 58-year-old lady who was referred for blurry vision with unusual corneal changes bilaterally. Diagnosis of multiple myeloma.

**Study Design** Case report.

**Methods** We discuss the initial presentation of this case, with its differential diagnosis, work-up and inter-disciplinary management. The challenge was the solitary corneal findings and effective treatment for this condition.

**Results** This 58-year-old lady presented to her optometrist initially complaining of blurry vision and was given a diagnosis of dry eyes. Subsequent referral to her ophthalmologist revealed a visual acuity of 20/30 OD and 20/25 OS. Slit lamp examination demonstrated fine subepithelial/anterior stromal iridescent flecks in a verticillata-like distribution from limbus to limbus horizontally and over 7mm vertically, with intact epithelium. Early investigations with bloodwork and conjunctival biopsy suggested a hematologic etiology, and after referral to the Hematology Service a bone marrow biopsy confirmed a diagnosis of multiple myeloma.

Three years after initial diagnosis, the patient was asymptomatic and required only close observation. However, her vision continued to worsen, with rising IgG levels and with development of anemia, it was felt that she had progressed from smoldering myeloma to symptomatic multiple myeloma which required treatment. She was started on induction chemotherapy followed by autologous stem cell transplant.

The patient tolerated the procedures and treatment regiment extremely well. Surprisingly, after the stem cell transplant, her vision improved with complete resolution of the corneal crystal deposits.

**Conclusions** The management and outcome of this case demonstrates the importance of a multi-disciplinary approach to complex and unusual patient presentations. It also illustrates the very likely possibility that this was a rare case of multiple myeloma presenting initially only with corneal crystal deposition.

## CORNEA- MEDICAL & SURGICAL CORNEA

SATURDAY 11 JUNE

### Paper #102

#### Successful treatment of acute ocular involvement in Stevens-Johnson Syndrome with Amniotic Membrane Transplantation: A Case Report

Tiiu M. Hess, Hall F. Chew

**Purpose** To report successful management of the acute stage of Stevens-Johnson Syndrome (SJS) with amniotic membrane transplantation (AMT).

**Study Design** Interventional case report

**Methods** A 44 year-old woman developed severe Stevens-Johnson Syndrome (SJS) from a subclinical herpetic infection. Forty eight hours after presentation, she developed severe ocular surface disease with bilateral total corneal epithelial defects, bulbar and tarsal conjunctival ulceration, symblephara, forniceal foreshortening, and visual acuity of counting fingers OU. She underwent urgent bilateral amniotic membrane transplantation (AMT) to cover the entire ocular surface including all fornices as well as upper and lower lid margins.

**Results** Re-epithelialization occurred within 48 hours in both eyes. At 6 months following her operation, visual acuity was 20/25 OU. Biomicroscopy showed no signs of corneal vascularization or scarring. Fornices were well-formed with no signs of symblepharon. There were no signs of trichiasis and the patient had no pain or photophobia.

**Conclusions** The use of AMT should become the standard of care in the initial treatment for SJS/TEN with ocular involvement. Early and definitive management of SJS using AMT prevents the devastating inflammatory, cicatricial, and corneal complications that affect so many patients who survive this rare mucocutaneous disease.

## CORNEA- MEDICAL & SURGICAL CORNEA

SATURDAY 11 JUNE

### Paper #103

#### What are the indications and outcomes of keratoprosthesis implantation in patients with previous ocular surface stem cell transplantation?

Clara C. Chan, Edward J. Holland

**Purpose** To evaluate the indications for surgery and outcomes of Boston Type 1 Keratoprosthesis (Kpro) implantation in patients with previous ocular surface stem cell transplantation (OSST).

**Study Design** Retrospective case series.

**Methods** A computer database retrospectively identified all patients with previous OSST at the Cincinnati Eye Institute with Kpro implantation from November 2004 to May 2010. Patient records were reviewed with respect to demographics, etiology of limbal stem cell deficiency, indications for Kpro, preoperative comorbidities, visual improvement, complications and device retention. A minimum follow-up of 6 months was required.

**Results** There were 67 eyes from 54 patients, 34 (63%) were male. Mean age at Kpro surgery was 47.3 years (range 12-81 years). Indications for Kpro included immunologic keratoplasty failure (35 eyes, 52%), OSST failure (11 eyes, 16%), both penetrating keratoplasty (PK) and OSST failure (10 eyes, 15%), hypotony with PK failure (5 eyes, 7%), infected PK (4 eyes, 6%), and PK trauma (2 eyes, 3%). Limbal stem cell deficiency was from congenital aniridia in 30 eyes (45%), chemical injury in 19 eyes (28%), Stevens Johnson Syndrome (SJS) in 11 eyes (16%), ocular cicatricial pemphigoid (OCP) in 4 eyes (6%), and iatrogenic causes in 3 eyes (5%). Glaucoma, the most common preoperative ocular comorbidity, was present in 52 eyes (77%). Preoperative best-corrected visual acuity (BCVA) ranged from 20/50 to light perception and was 20/200 or worse in 88% of eyes. At an average follow-up of 24 months (range 6-71 months), BCVA improved to better than 20/200 in 52% of eyes. Vision improved in 44 eyes (66%), remained stable in 15 eyes (22%), and decreased in 8 eyes (12%). No intraoperative complications occurred. Key postoperative complications included retroprosthetic membrane (28 eyes, 42%), retinal detachment (11 eyes, 16% - 1 painful blind eye was eviscerated), Kpro melt (8 eyes, 12%), tube revision (8 eyes, 12%), glaucoma progression (8 eyes, 12% - 7 medically controlled, 1 required tube shunt surgery), infectious keratitis (6 eyes, 9% - 3 required Kpro exchange), and endophthalmitis (2 eyes with SJS, 3%). 65 Kpros (97%) were retained - extrusions needing Kpro replacement occurred in 1 patient with OCP and 1 with SJS.

**Conclusions** OSST improves the ocular surface environment and allows for successful Kpro implantation. Long term Kpro retention rates are excellent in these eyes. BCVA can improve in most patients. Complications can occur and require frequent follow-up for monitoring and surgical management. With excellent patient compliance, good anatomic and functional outcomes can be maintained.

## CORNEA- MEDICAL & SURGICAL CORNEA

SATURDAY 11 JUNE

### Paper #104

#### Long-term Results Regarding the Impact of Glaucoma on Vision following Boston Keratoprosthesis Type 1 Surgery

Julia Talajic, Sébastien Gagné, Younes Agoumi, Mona Harissi-Dagher

**Purpose** To determine glaucoma prevalence, progression, treatment, and impact on vision in patients having undergone implantation of Boston Keratoprosthesis type 1 (KPro).

**Study Design** Retrospective interventional case series.

**Methods** This chart review included 38 consecutive eyes in 38 patients with KPro implantation since 2008 at Hôpital Notre-Dame. Pre-operative notes, operative protocol, and progress notes were studied. Information gathered included: corneal diagnosis, pre- and post-operative visual acuity (VA), intraocular pressure (IOP), visual fields (VF), optic nerve examination, glaucoma medications, glaucoma surgery, glaucoma-related complications, and other pathologies limiting VA and VF.

**Results** Mean follow-up was 15.8 months. Pre-KPro, 74% of patients were known to have glaucoma: 37% had had previous glaucoma surgery and 42% were on glaucoma medication. Post-KPro, 89% of patients were deemed to have glaucoma; 66% of patients had advanced glaucoma, meaning they either had a cup to disc ratio above 0.9 or visual field loss within 10 degrees of fixation. 68% of patients' glaucoma medication was increased postoperatively, and 18% of patients were deemed to have definite progression (VF progression and/or need for surgery). 37% of patients had a C/D ratio exceeding 0.85. 5 patients needed surgery for uncontrolled IOP on maximal medication. 2 underwent Ahmed tube implantation followed by pars plana vitrectomy (PPV) combined with endocyclophotocoagulation; the third also had an Ahmed tube implanted, then developed corneal melt requiring a tectonic corneal graft. Another patient underwent transcleral cyclophotocoagulation. The fifth patient had a PPV for vitreous obstruction of a pre-existing shunt, then developed hyperfiltration and choroidal detachment (CD). Two other patients experienced complications due to hypotony: the first experienced hemorrhagic CD due to hyperfiltration of a pre-existing shunt, and the second developed CD one year postoperatively while on two IOP-lowering drops. 14 patients' VA was limited by glaucoma (37%), 12 of which had a VA of 20/200 or worse. Five patients had a dramatic improvement in VA, then progressed to end-stage glaucoma (with loss of fixation), whereas the other 7 patients already had poor vision immediately post-operatively due to prior advanced glaucoma damage. 66% of patients had VF limited by glaucoma, with an average MD of -20.26 decibels.

**Conclusions** Longer term follow-up of KPro patients reveals a greater number of patients with glaucoma progression and advanced glaucoma than previously reported. It is likely that clinicians underestimate IOP with digital palpation. Patients require rigorous monitoring for glaucoma progression, especially in the face of advanced cupping. Serial VFs are paramount in the detection of glaucoma progression in KPro patients and are often the first indication of progression. A very low threshold should be used to



treat suspicion of even slightly elevated IOP.

## RETINA-1

SATURDAY 11 JUNE

### Paper #105

#### **Diagnostic accuracy of clinical examination plus Optical Coherence Tomography in the diagnosis of Neovascular Age-Related Macular Degeneration**

**Hussein Hollands, Michael H. Brent**

**Purpose** To determine in a real world setting if intravenous fluorescein angiography (IVFA) is required in addition to clinical history, eye examination, and Optical Coherence Tomography (OCT) to diagnose new cases of neovascular age-related macular degeneration (AMD).

**Study Design** The study design is a masked prospective diagnostic accuracy study.

**Methods** The study population is recruited from a tertiary retina practice and includes new and existing patients with category III or more severe AMD on clinical examination who require a work-up for possible neovascular AMD. Specifically, patients who are suspected of having wet ARMD will be included in the study. All patients undergo a clinical history, eye examination, OCT, and IVFA. A preliminary diagnosis will be made using only information gathered from the history, examination, and OCT. The options for the preliminary diagnosis will include wet AMD, dry AMD, other, or 'requires IVFA to make diagnosis'. The definitive diagnosis will then be made using all information gathered from the history, examination, OCT, and IVFA. The proportion of times that an IVFA was required for the investigator to confidently make the definitive diagnosis will be reported. In addition, the results will be analyzed using traditional diagnostic accuracy statistics including sensitivity, specificity, and likelihood ratios comparing the preliminary diagnosis to the definitive diagnosis that includes interpretation of IVFA.

**Results** Preliminary results show that investigators require the use of IVFA to be confident in making a definitive diagnosis of wet AMD in less than 20% of cases. In the majority of cases where investigators do not feel that IVFA is necessary to make the diagnosis then the combination of clinical history, eye examination, and OCT have extremely high sensitivity and specificity compared to the definitive diagnosis that includes the interpretation of IVFA.

**Conclusions** Preliminary results indicate that IVFA may not be required to make an accurate diagnosis of wet AMD in the majority of cases in a tertiary care retina practice. Consideration should be given to using clinical history, eye examination, and OCT as a preliminary work-up and IVFA only when required in more challenging cases. This approach has the potential save money and decrease morbidity associated with IVFA.

## RETINA-1

SATURDAY 11 JUNE

### Paper #106

#### **Intravitreal Ranibizumab in exudative age-related macular degeneration patients with vision worse than 20/400 : A retrospective review**

**Mathieu Caissie, Louis Giavedoni, Rajeev Muni, David Wong, David Chow, Filiberto Altomare, Alan Berger**

**Purpose** Based on pivotal studies (ANCHOR, MARINA and PrONTO), intravitreal injection of Ranibizumab is the gold standard treatment for neovascular age-related macular degeneration (AMD) in patients with vision of 20/400 or better. In contrast, if the visual acuity is worse, no published articles exist to support the treatment of Ranibizumab. The goal of this study is to assess the effectiveness of Ranibizumab in patients with neovascular AMD with initial visual acuity worse than 20/400.

**Study Design** Retrospective study

**Methods** Charts were reviewed from the Ophthalmology and Vision Science Department at St-Michael's Hospital from October 2007 to February 2010. Charts included treatment-naïve eyes of patients who received intravitreal Ranibizumab for neovascular AMD with initial vision worse than 20/400 on the Snellen chart and with a follow-up of at least 12 months. For analysis purpose, Snellen visual acuity was converted to logMAR. For each chart, visual acuity results, the presence of an intra-vitreous injection of Ranibizumab, Optical coherence tomography (OCT) results and adverse events were recorded and compared at each visit for one year.

**Results** A total of 31 charts were included. All patients had initial vision of Counting Finger (1.8 logMAR). Treatment protocol was established by the staff preference: 5 patients had intravitreal Ranibizumab planned every month while 26 received the drug on a pro re nata (PRN) dosing schedule. In the last group, retreatment was done if active signs were present on OCT or the patient's vision decreased. After 12 months, the mean final visual acuity 20/300(1.24 logMAR) was significantly greater when compared to the initial visit.( $p < 0.05$ ) A gain of 3 lines of vision or more was observed in 35% of patients at 12 months. Mean number of injection was 6.46 in the PRN dosing schedule. Mean retinal thickness on OCT decreased from 373.2 to 353.67 ( $p < 0.05$ ). No adverse events were noted with the intravitreal injections.

**Conclusions** Our retrospective study demonstrates a benefit in regards to stabilizing and improving visual acuity when treating patients with poor baseline vision. Further studies are required to confirm our findings.

## RETINA-1

SATURDAY 11 JUNE

### Paper #107

#### Is antibiotic prophylaxis following intravitreal injections effective in preventing endophthalmitis?

Crystal S. Cheung, Amanda Wing Tung Wong, Alex Lui, Peter J. Kertes, Robert G. Devenyi, Wai-Ching Lam

**Purpose** To determine whether different prophylactic antibiotic strategies can reduce the incidence of endophthalmitis following intravitreal injections.

**Study Design** Retrospective comparative case series

**Methods** A total of 15,895 intravitreal injections (9,453 ranibizumab, 5,386 bevacizumab, 935 triamcinolone acetonide, 121 pegaptanib sodium) were performed for 2,465 patients between January 5, 2005 and August 31, 2010. The number of injections was determined from billing code and patient records. The indications for injection included predominately age-related macular degeneration (AMD), diffuse or cystoid macular edema (CME) from diabetic retinopathy, central and branch retinal vein occlusion (RVO) and miscellaneous causes. The injections were given as an office-base procedure with the use of povidone-iodine, topical anesthetic and lid speculum as a part of preinjection preparation. Three strategies of topical antibiotic prophylaxis were used by the respective surgeons: 1) antibiotics given for five days after each injection 2) antibiotics given immediately after each injection 3) no antibiotics given. The primary outcome measure was the incidence of sterile and infectious endophthalmitis.

**Results** Nine eyes of nine patients with suspected endophthalmitis post-injection were identified. Three of the nine cases were culture-positive. The incidence of suspected endophthalmitis and culture-proven endophthalmitis following injection was 0.057% and 0.019% respectively. Taking into account of both sterile and infectious endophthalmitis, the incidence per injection was 0.061% (five cases out of 8,259 injections) for patients who were given antibiotics for five days post-injection, 0.083% (two cases out of 2,370 injections) for those who received antibiotics immediately after each injection, and 0.038% (two cases out of 5,166 injections) when no topical antibiotics were given. The risk of endophthalmitis after intravitreal injection also varied among agents that are used. Among the nine endophthalmitis cases, irrespective of prophylactic strategies employed, the incidence of endophthalmitis per injection was 0.214% for triamcinolone acetonide (2 cases out of 935 injections), 0.0317% for ranibizumab (3 cases out of 9,453 injections) and 0.0743% for bevacizumab (4 cases out of 5,386 injections).

**Conclusions** The use of topical antibiotic, given immediately or for five days after the injection, showed greater rates of endophthalmitis per injection compared to those without antibiotics. The higher incidence observed in antibiotic usage might be attributed to colonization of antibiotic-resistant bacterial strains. Special attention should be paid to patients receiving triamcinolone acetonide, as the incidence of endophthalmitis per injection is the highest. However, the overall low endophthalmitis rates

lend support to the safety of intravitreal injections.

## RETINA-1

SATURDAY 11 JUNE

### Paper #108

#### Risk factors for macular atrophy in pathologic myopia

Jean Chuo, Leo Mok, Steve Schendel, Angela Chang, Patrick Ma, Maberley Alan, David Maberley

**Purpose** To evaluate ocular and systemic associations and visual function related to myopic macular degeneration and vision loss in individuals with pathologic myopia.

**Study Design** Case-control study

**Methods** All newly diagnosed individuals with pathologic myopic attending retinal specialists' clinics at UBC between 2001 & 2003 were offered participation. Inclusion criteria included spectacle refraction of  $\geq -6$  diopters and/or axial length  $\geq 26$  mm. Subjects underwent the following evaluations:

-A complete eye exam.

-Stereo color fundus photography.

-Standardized A-scan axial length measurements and 3D ultrasound (to confirm staphyloma location).

-Risk-factor questionnaire administered by research assistants investigating various topics including demographics, ocular history, medical history, quality of life, and exposure to potential risk factors pertaining specifically to males or females (e.g. treatments that alter the concentration or properties of a sex hormone).

-Harvard service food frequency questionnaire administered by research assistants reviewing the participant's dietary intake over the past month by estimating selected nutrient intake and comparing it to the recommended dietary allowance

Subjects were defined as cases if there was evidence of central macular RPE atrophy in at least one eye. Controls were pathologic myopes who did not have macular atrophy. Those with central vision loss from non-atrophic causes were not included as cases. Only one eye per subject (the worst eye) was included in the study.

Univariate analyses and multivariate analyses were performed to evaluate association between risk factors and outcome.

**Results** Macular atrophy was significantly associated with increasing age, female gender, longer axial length, the presence of a macular staphyloma, dietary abundance of trans-fatty acids and stearic fatty acid.

**Conclusions** Longer axial length, increasing age, and central staphyloma are understandable risk factors for myopic macular atrophy. A dietary abundance of trans-fats and stearic fatty acid (a saturated fatty acid) is associated with vascular endothelial dysfunction and raised plasma inflammatory markers, which may lead to subsequent retinal damage in predisposed individuals such as those with pathologic myopia. The effect of female gender is not as easily explained.

## RETINA-1

SATURDAY 11 JUNE

### Paper #109

#### **Prospective Evaluation of the Effects of Optical Coherence Tomography on Visual Acuity in Exudative Age-related Macular Degeneration.**

**Shahrukh N. Bakar, Michael J. Potter, David A. Albiani, Cheryl C. Claudio, Andrew B. Merkur**

**Purpose** To determine whether optical coherence tomography affects visual acuity in patients with exudative age-related macular degeneration.

**Study Design** Prospective pre-post characterization study.

**Methods** Thirty eyes of 30 subjects with exudative age-related macular degeneration (AMD) were studied. After obtaining informed consent, subjects were recruited from a vitreoretinal practice at a single tertiary care centre. Inclusion criteria included age over 50, a baseline visual acuity between 20/40 and 20/400, and a clinical diagnosis of exudative AMD requiring ongoing treatment. Subjects with prior eye surgery (except cataract removal) or other retinal comorbidities were excluded from this study. The standard ETDRS protocol was used at a testing distance of 2 metres. Baseline visual acuity was measured after the use of dilating eye drops. Subjects then underwent optical coherence tomography, after which visual acuity was reassessed at 5, 15, and 30 minutes. One-way repeated-measures ANOVA and prospectively planned Student's t-tests were used to test whether visual acuity at each timepoint changed significantly over baseline. A linear mixed model was fitted to determine within-subject standard deviation and test-retest variance.

**Results** Visual acuity decreased significantly at the 5-minute timepoint ( $P = 0.018$ ,  $df = 28$ ) but did not change significantly at the 15-minute or 30-minute timepoints. The within-subject standard deviation was 2.9 ETDRS letters (0.06 logMAR units). Test-retest variance was 8.3 ETDRS letters (0.17 logMAR units), which agreed well with several estimates in the literature. A Bland-Altman plot comparing baseline and 30-minute timepoints showed no difference between subjects with low and high visual acuity.

**Conclusions** Optical coherence tomography significantly decreases visual acuity after 5 minutes but not after 15 or 30 minutes in subjects with exudative age-related macular degeneration. These findings may have implications for the appropriate timing of visual acuity assessment following OCT in routine clinical practice.

**CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS**

**SATURDAY 11 JUNE**

**Paper #110**

**Incidence of ocular surface squamous neoplasia in pterygium specimens: an 8-year canadian survey**

**Sonia N. Yeung, Peter Kim, Alejandro Lichtinger, Maoz D. Amiran, Elie Cote, Sabrina Teitel, Allan R. Slomovic**

**Purpose** The purpose of this study was to evaluate the rate of histopathologically detected ocular surface squamous neoplasia (OSSN) in routine pterygium specimens at the Toronto Western Hospital.

**Study Design** Retrospective case series.

**Methods** All pterygium specimens collected from consecutive patients from July 2002 to July 2010 were submitted for histopathologic examination and reviewed. The rate of OSSN was determined.

**Results** There were no cases of OSSN in 1127 sequential pterygium specimens.

**Conclusions** These results suggest that primary pterygium specimens in geographic areas further from the equator where UV exposure is lower have a low rate of OSSN.



## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #111

#### Effect of cryopreservation on donor ocular tissue

Tenley Bower, Guillermo Rocha

**Purpose** The purpose of our study is to discover the effects of cryopreservation on corneoscleral donor tissue that tested positive for microbial agents. Our hypothesis questioned the current practice of the our eye bank's standard policy of preservation of donor ocular tissue to examine if the donated tissue continued to harbor organisms after antibacterial preservation and cryopreservation.

**Study Design** The study was a prospective quality assurance study of microbiological cultures.

**Methods** All donor tissue obtained by the Lions Eye Bank of Manitoba and Northwestern Ontario during the period of January 2009 to January 2010 were examined for inclusion in our study. The criteria of this study was applied to whole globes from humans post-enucleation according to the preservation procedures followed under Eye Bank Association of America (EBAA) standards and Lions Eye Bank of Manitoba and Northwestern Ontario policies and procedures. Enucleated globes were soaked with 2.5% povidone iodide for five minutes, rinsed with normal saline, and then cultured on Sabhi plate, chocolate agar, and Thioglycolate broth. The globe was then moistened with Optimyxin and preserved in Optimyxin Plus before cryopreservation for one month. After one month time had passed the globe was thawed to room temperature and cultures were repeated.

**Results** Over a one year period 28 corneoscleral rim specimens satisfied the inclusion criteria of our study. There were seven bilateral donors and 14 unilateral donors. One specimen was discarded due to bacterial contamination. The most common causes of donor death were cancer (including lung, pancreatic, breast, prostate, and gastric) in 33.3% and heart disease (including congestive heart failure, cardiomyopathy, and myocardial infarction) in 29.6% of the specimens. The average age of donor death was 69 years old (standard deviation 11.8). Most of the globes (89%) were harvested within 12 hours from donor death. The most common type of bacteria isolated from the corneoscleral rim of donor globes was coagulase negative Staphylococcus (37.2%) followed by Staphylococcus epidermidis (25.6%). Upon secondary culture of the donor specimens there was not a single culture media that remained positive. There was no further growth or isolation of organisms in 100% of the samples after allowing complete thawing and return to room temperature of the donor specimens.

**Conclusions** Donor tissue that has been reported with positive microbiological culture will be safe for surgical use after a method of antibiotic preservation and a period of cryopreservation. It is safe to conclude that even if donor tissue has been reported with a positive culture report before cryopreservation it is still safe for surgical use after a period of one month of cryopreservation following our methods.

## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #112

#### **Combined use of subconjunctival and intracorneal bevacizumab injection for corneal neovascularization**

**Sonia N. Yeung, Alejandro Lichtinger, Peter Kim, Maoz D. Amiran, Allan R. Slomovic**

**Purpose** To report on the safety and clinical use of combined subconjunctival and intracorneal bevacizumab for corneal neovascularization.

**Study Design** Retrospective interventional case series.

**Methods** The charts of 12 consecutive patients with corneal neovascularization who received combined subconjunctival and intracorneal injections of bevacizumab (2.5 mg/0.1 ml) were reviewed. Patients received 1 to 3 injections of 2.5 mg bevacizumab (1.25 mg/0.05 ml subconjunctival and 1.25 mg/0.05 ml intrastromal). Morphologic changes were assessed clinically by one investigator.

**Results** Combined subconjunctival and intracorneal injections of bevacizumab were effective and well-tolerated. No significant ocular or systemic adverse events were observed during 6.4 months (range, 0.25 to 22 months) of follow-up. All patients showed a reduction in the neovascularized area.

**Conclusions** Short-term results suggest that combined subconjunctival and intracorneal injections of bevacizumab are an effective method for reducing corneal neovascularization. It may thereby be a useful option or adjunct to other treatments in stabilizing or improving vision.

## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #113

#### Tissue quality of eye bank prepared lamellar grafts for Descemet's stripping automated endothelial keratoplasty

Brian Nelson, Rusty Ritenour

**Purpose** To evaluate endothelial cell density (ECD) of eye bank-prepared tissue for use in Descemet's stripping automated endothelial keratoplasty (DSAEK).

**Study Design** Prospective case series of consecutive corneal tissue prepared for DSAEK surgery.

**Methods** 18 human donors representing 29 consecutive corneas prepared by a Canadian eye bank for DSAEK surgery, beginning with the first tissue prepared for surgery by newly trained technicians. Corneal-scleral donor tissue was obtained by in-situ recovery. ECD was recorded using the EB-3000 XYZ (HAI Labs) specular microscope within 24 hours of preservation. Before the tissue was dissected, the corneal thickness was measured using the DGH-550 PACHETTE 2 (DGH Technology) ultrasound pachymeter. Eye bank technicians created an anterior lamellar flap using a 300 um Moria One microkeratome (Moria USA, Doylestown, PA). The posterior bed thickness was measured, and the anterior flap replaced. Endothelial cell count density was obtained following re-preservation.

**Results** Complete measurements were obtained for 22 out 29 corneas. The mean ECD before dissection was  $2883 \pm 295$  cells/mm<sup>2</sup>. The mean ECD after dissection was  $2786 \pm 334$  cells/mm<sup>2</sup>. There was an average loss of 97 cells/mm<sup>2</sup>.

**Conclusions** This case series confirms that ECD is preserved when DSAEK tissue is prepared in advance of surgery by trained eye bank technicians. There were challenges when obtaining cell-density measurements post-cut, possibly due to temporary tissue swelling or distortion. All 29 corneas were used in surgery, with no tissue lost due to technician error.

## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #114

#### Descemet Stripping Automated Endothelial Keratoplasty (DSAEK) Using Infant Donor Tissue

Peter Kim, Sonia N. Yeung, Alejandro Lichtinger, Maoz D. Amiran, David S. Rootman

**Purpose** To report the outcomes of DSAEK surgery using infant ( $\leq 2$  years old) donor tissue.

**Study Design** Retrospective case series

**Methods** Clinical chart review of 3 patients.

**Results** All 3 patients in this series had good visual outcomes and clear DSAEK grafts. The average ECC from infant donors was very high (4239/mm<sup>2</sup>). Similarly, the average postoperative ECC was also high (3359/mm<sup>2</sup>) with a mean endothelial cell loss of 20.9% at 11 months follow-up. One patient remarkably had an ECC of 4065/mm<sup>2</sup> at 1-year follow-up with a net endothelial cell loss of only 13.3%. No difficulties were noted using infant donor tissue including the intraoperative use of the Moria microkeratome to prepare the DSAEK donor, insertion of the donor graft, or with air bubble management.

**Conclusions** Using infant donor tissue for DSAEK surgery is safe and may be preferable, particularly for younger patients. The higher preoperative endothelial cell densities in infant donor tissue should improve graft survival and long-term maintenance of corneal transparency provided that surgery related endothelial cell loss is minimized.

## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #115

#### Graft Survival Post Penetrating Keratoplasty (PKP): A consecutive series at McGill University

Elham Rastikerdar, Si-Liang Peng, Devinder P Cheema

**Purpose** To evaluate outcomes of a single surgeon consecutive series of PKP at McGill University

**Study Design** Retrospective Consecutive Case Series

**Methods** This was a retrospective analysis of a consecutive series of PKP at McGill from 2005 to 2009. Follow-up (F/U) was calculated from time of surgery to date of last visit or when graft failure, defined as non-reversible diffuse corneal edema, occurred. Outcome measures were graft survival, post-op best vision (BCVA), and complications like infectious keratitis, glaucoma and wound dehiscence. Predictor variables were PKP indication, donor's age and endothelial cell count (ECC), patient's lens status, and time from donor's death to graft preservation and from preservation to surgery.

**Results** There were 128 eyes of 119 patients (62 males and 57 females). Mean age was 66 y.o. (15 to 87), and mean F/U was 26 months (2 to 58). 84% of cases had F/U of 1 year or more. 18 eyes had keratoconus (KC), 89 had corneal edema, 13 had a corneal scar, 6 had a stromal dystrophy, and 2 had tectonic PKP. KC patients had the highest graft survival probability (94%), followed by corneal scar (85%), stromal dystrophy (83%), corneal edema (79%), and tectonic cases (50%). KC cases had the best visual outcomes, with 44% having a final Snellen BCVA of 20/40 or better, and 50% between 20/50 to 20/200. There was no difference in terms of donor ECC, donor age, death to preservation time, and preservation to surgery time between failed and clear grafts. We found a relationship between patient's lens status and final graft status ( $p < 0.05$ ). Specifically, failed grafts had a higher number of cases with ACIOL compared to clear grafts. The most common complication post-op in all groups was elevated intraocular pressure (IOP), which occurred in 53% of cases and was controlled with drops in 91% of cases. There was one case of expulsive choroidal hemorrhage and all other complications were rare (<2%).

**Conclusions** PKP is an effective and safe long-term treatment for corneal pathology. Overall survival depends on various factors, such as surgical indication and lens status, which can be used to predict outcome. Visual outcome is variable; there is likely a role of PKP indication and other associated eye diseases in determining final results. Patients need frequent IOP monitoring. Future directions are to compare long-term survival of endothelial keratoplasty with PKP in select cases.

## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #116

**Long-term outcomes of descemet stripping endothelial keratoplasty (DSEK): Up to 5-years follow-up.**

**Peter Kim, Sonia N. Yeung, Alejandro Lichtinger, Maoz D. Amiran, David S. Rootman, Manreet Alangh, Allan R. Slomovic**

**Purpose** To report the long-term visual outcome, graft survival and endothelial cell loss of descemet stripping endothelial keratoplasty (DSEK).

**Study Design** Retrospective cohort study.

**Methods** This study involved the review of clinical records of patients who had DSEK surgery with up to 5 years follow-up at the Toronto Western Hospital.

**Results** Seventy-eight eyes of 77 patients (32 male; 45 female) were included. The mean age at DSEK surgery was  $71.1 \pm 12.1$  years (range 23 to 96). The indications for surgery included Fuchs endothelial dystrophy in 58 eyes (74.4%), pseudophakic bullous keratopathy in 16 eyes (20.5%), corneal decompensation secondary to glaucoma surgery in 3 eyes (3.9%) and following implantable collamer lens in 1 eye (1.3%). Thirty-six of 78 eyes (46.2%) had DSEK alone whilst 42 eyes (53.8%) had combined surgery.

Mean preoperative logMAR best corrected visual acuity (BCVA) was 0.85 (20/140; range 20/40 to HM), with 13 of 78 eyes (16.7%) having visual acuity 20/40 or better. Mean postoperative logMAR BCVA was 0.54 (20/70; range 20/20 to CF), with 39 of 78 eyes (50%) achieving visual acuity 20/40 or better. The mean follow-up following DSEK surgery was  $37 \pm 10$  months (range 24 to 60).

Of the 78 eyes, 12 (15.4%) required rebubbling for early postoperative donor detachment and 3 eyes (3.8%) had early postoperative IOP spike. The mean endothelial cell loss at final follow-up was 52.7%. Five of the 78 eyes (6.4%) had failed DSEK and only 1 eye (1.3%) had documented endothelial rejection at final follow-up.

**Conclusions** DSEK surgery is an effective intervention in patients with corneal endothelial decompensation. Long-term endothelial cell loss and graft survival following DSEK is comparable to the published penetrating keratoplasty literature.

## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #117

**Riboflavin cross-linking treatment increases corneal epithelial and stromal thickness in keratoconus patients.**

Hugo F. Sutton, Steven Ma, David P. Schwirtz, Sharon T. Wong, Eric Pharand

**Purpose** We demonstrate that corneal thickness profile maps increase in keratoconic eyes following collagen cross linking (CXL) treatments with riboflavin and UVA.

**Study Design** Case study measurements in human subjects.

**Methods** Epithelial and stromal thickness profiles were measured *in vivo* by Artemis® (A2) very-high frequency (VHF) digital scanning ultrasound (50 MHz) across the central and peripheral corneal diameter before CXL treatment for keratoconus (10 mm zone), and after 3 to 6 months post-CXL. Manifest refraction, traditional surface corneal topography, and Oculus Pentacam® measurements were also monitored. Epithelial and stromal thickness changes were cross-correlated with corneal topography changes.

**Results** CXL reduced the amount of myopia/astigmatism by 0.50D on average, improved best corrected Snellen visual acuity by 1-3 lines, and improved symmetry of central corneal curvature. A2-VHF showed post-CXL epithelium thickening by 1-2  $\mu\text{m}$ , and increased stromal layer thickness by 5-13  $\mu\text{m}$ .

**Conclusions** CXL treatment improves visual outcome, flattens corneal steepness, and increases corneal epithelial and stromal thickness in keratoconus eyes.

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## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #118

#### Corneal Collagen Cross-Linking with Riboflavin and Ultraviolet-A Light in Keratoconus: One-Year Analysis of First 100 Treated Eyes

Sadhana V. Kulkarni, Kashif Baig, George Mintsioulis, W. Bruce Jackson

**Purpose** To assess the one-year visual, keratometric (K), safety, and efficacy outcomes in keratoconus patients treated with corneal collagen cross-linking (CXL) with riboflavin and ultraviolet-A (UVA) irradiation.

**Study Design** Single center, retrospective, interventional cohort study.

**Methods** Following epithelial removal, corneas of eligible keratoconus patients were treated with CXL and followed prospectively for 1 year. Uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), sphere, cylinder, K-readings, and pachymetry were measured preoperatively and at 1-year follow-up. Paired t-tests were used to analyze the changes. Incidence of infection and corneal haze were documented.

**Results** Interim results of 36 eyes at 1-year reveal statistically significant improvement in BCVA (pre-op logMAR  $0.6 \pm 0.3$ ; 1-year =  $0.7 \pm 0.3$ ,  $p=0.002$ ), decrease in cylinder (pre-op mean =  $3.4 \pm 1.9D$ ; 1-year =  $2.5 \pm 1.9D$ ,  $p=0.002$ ), flattening of minimum K (pre-op =  $46.1 \pm 4.1D$ ; 1-year =  $45.3 \pm 3.6D$ ,  $p<0.0001$ ), and reduction in central pachymetry measurements (pre-op =  $495.6 \pm 38.5\mu$ ; 1-year =  $476.2 \pm 46.4\mu$ ,  $p<0.0001$ ) and thinnest pachymetry measurements (pre-op =  $456.8 \pm 41.1\mu$ ; 1-year =  $438.1 \pm 50.5\mu$ ,  $p<0.0001$ ). There were no significant differences in UCVA, sphere, or mean K-readings. No eyes had infections or superficial corneal haze attributed to CXL treatment. Four eyes had less than one line loss of BCVA. One-year data on 100 CXL eyes will be presented.

**Conclusions** At 1-year, CXL appears to be a safe and efficacious procedure in improving BCVA, reducing the refractive cylinder, compacting the cornea and stabilizing the corneal curvature in patients with keratoconus.



## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #119

#### Corneal Collagen Crosslinking in Canada

Victor Penner, Adam Muzychuk, Ahmed Al-Ghoul, Martin McCarthy, Guillermo Rocha

**Purpose** To demonstrate the long-term effect of riboflavin and ultraviolet-A-induced collagen crosslinking (CXL) on progressive keratoconus and post LASIK ectasia in clinical practice across Canada.

**Study Design** Ongoing retrospective chart review of patients having undergone riboflavin and ultraviolet-A collagen crosslinking. Patient data was collected from the databases of four sites across Canada, including private practices and University centers.

**Methods** 103 eyes of 94 patients diagnosed with either keratoconus or post LASIK ectasia were included in this retrospective study. The maximum follow-up was 1 year. Pre- and postoperative data included refraction, uncorrected (UCVA) and best corrected (BCVA) visual acuity, keratometry, pachymetry, elevation maps and high order aberrations using videokeratography, Scheimpflug imaging and wavefront aberrometry.

**Results** Of the 103 eyes, 23 had reached the 6 month follow-up. The average mean refractive sphere became more hyperopic by  $1.6 \pm 2.8D$  (95% CI 1.3) and refractive astigmatism increased by  $0.3 \pm 1.7D$  (95% CI 0.8).

Uncorrected visual acuity improved by 2 lines or more in 42% of eyes, stayed the same or improved by only one line in 42% of eyes and decreased one or more lines in 16% of eyes. Pre operatively 5 eyes had uncorrected vision 20/400 or worse, 15 eyes were between 20/300 and 20/40, and 3 eyes had vision of 20/30 or better. Post operatively 4 eyes now had uncorrected vision 20/400 or worse, 14 eyes were between 20/300 and 20/40, and 5 eyes had vision of 20/30 or better.

Of all 23 eyes the best corrected vision improved by 2 lines or more in 30%, improved one line or stayed the same in 40%, and decreased one line or more in 30%.

Central pachymetry decreased by  $16.4 \pm 27.5$  microns (95% CI 11.2), and the average thinnest local pachymetry also decreased by  $10.5 \pm 21.6$  microns (95% CI 8.8). Average pre operative keratometry was 49.06D, the post operative average was flatter by  $0.04 \pm 1.54$  (95% CI 0.62) at 49.02D. Flat keratometry readings steepened by  $0.2 \pm 2.6D$  (95% CI 1.0), while the steep meridian flattened by  $0.3 \pm 1.6D$  (95% CI 0.6). At 6 months, 9 eyes had pre and post operative aberration data. There was an average increase (microns) in coma  $0.32 \pm 0.48$  (95% CI 0.31), spherical aberration  $0.10 \pm 0.39$  (95% CI 0.25) and secondary astigmatism  $0.04 \pm 0.45$  (95% CI 0.29). Trefoil decreased by  $0.16 \pm 0.56$  microns (95% CI 0.37).

**Conclusions** While data regarding the efficacy of this procedure in Canada is still emerging, our data seems to indicate corneal curvatures appear to be stable with improved or stable visual outcomes as demonstrated by the best corrected visual acuity. The use of collagen cross-linking appears to be a promising procedure in managing corneal ectasia in Canada.

## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #120

#### Is collagen cross-linking (CXL) for keratoconus with simultaneous topographical-guided photorefractive keratectomy (TG-PRK) effective?

Simon Holland, David Lin

**Purpose** To evaluate early results of efficacy and safety of simultaneous TG-PRK with collagen cross-linking.

**Study Design** 105 eyes of 72 patients with contact lens intolerant keratoconus (KC) underwent TG-PRK with an Allegretto Wavelight laser with simultaneous CXL.

**Methods** Degree of refractive correction based on residual stromal depth of 300 microns. Pre-operative vision (UCVA), best corrected vision (BSCVA), keratometry (K), efficacy, and safety were evaluated at one year.

**Results** 32 eyes completed one year follow-up, 22 (70%) had UCVA of 20/40 or better with all achieving BSCVA of 20/40 or better. 19 (59%) increased BSCVA, 8 (25%) no change, 4 (12%) lost one line, and one incomplete. Mean astigmatism decreased from -2.60 diopters (D) pre-operatively to -1.05 D at one year. Only 5/22 was using refractive correction at one year with symptom improvement in 19/22. Complications included delay in epithelial healing beyond one week in four and one developed herpetic keratitis with all five recovering pre-operative BSCVA.

**Conclusions** Simultaneous topographically-guided PRK with CXL offers promising early results for contact lens intolerant KC. Improved uncorrected vision was obtained in 70%, but the extent of refractive correction is limited by low pachymetry in keratoconus.

## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #121

#### Collagen cross-linking and TCAT for keratoconus and post-LASIK ectasia

Dwight Silvera, Eser Adiguzel, Avi Wallerstein, Mark Cohen

**Purpose** To determine efficacy, safety, and outcomes of CXL (corneal collagen cross-linking) and CXL combined with TCAT (Topography-Computer Assisted Treatment) excimer laser corneal surface ablation in treating keratoconus or post LASIK ectasia.

**Study Design** Prospective chart review

**Methods** Outcomes review of patients undergoing CXL alone or in combination with TCAT (CXL+TCAT). Inclusion criteria included obvious keratoconus or LASIK-induced ectasia on topography. All procedures were performed by a single surgeon using standardized equipment and technique for CXL. Half the cylinder magnitude was treated with TCAT. 1, 2, 3, and 6 month post-operative manifest refraction spherical equivalent (MRSE), cylinder, UCVA, BCVA, maximum corneal curvature (Kmax), and central pachymetry were compared to pre-operative measurements with repeated-measures ANOVA and Holm-Sidak post-hoc tests.

**Results** 72 eyes were treated (59 keratoconus, 13 ectasia) with average TCAT ablation depth of  $63 \pm 14 \mu\text{m}$ . There was a significant improvement in UCVA ( $1.1 \pm 0.6$  vs.  $0.5 \pm 0.5$  logMAR,  $p < 0.001$ ), BCVA ( $0.26 \pm 0.24$  vs.  $0.16 \pm 0.16$  logMAR,  $p = 0.009$ ), MRSE ( $-3.58 \pm 3.15$  vs.  $-3.13 \pm 2.6$ D,  $p = 0.005$ ), and reduction in cylinder ( $3.63 \pm 2.24$  vs.  $2.88 \pm 2.14$ D,  $p < 0.001$ ). Cumulative post-op UCVA was 20/25, 20/30, and 20/40 or better in 12.5, 25, and 50% of eyes, respectively, compared to pre-op 1.5, 1.5, and 16% respectively. One eye lost two lines, 1 eye lost 1 line, and 12 eyes gained one or more lines of BCVA. There were no statistically significant changes in Kmax or central pachymetry at 6 months.

**Conclusions** 6 month results indicate that collagen cross-linking alone or in combination with TCAT improves UCVA, BCVA, and MRSE, and reduces cylinder magnitude with no further progression of either keratoconus or post-LASIK ectasia.

## CORNEA- RAPID FIRE SESSION:INNOVATIONS AND FREE PAPERS

SATURDAY 11 JUNE

### Paper #122

**Comparison of tensile strength of slip knots compared to 3-1-1 knots using 10-0 nylon suture.**

**Carla R. Lutchman, Linus H. Leung, Hall F. Chew**

**Purpose** To compare the tensile strength of slip knots to traditional 3-1-1 knots using 10-0 nylon sutures.

**Study Design** In-vitro, destructive materials testing.

**Methods** In accordance with the American Standard for Testing and Materials method of testing suture materials (ASTM F2848-10), slip knots were compared to the traditional 3-1-1 knots using 10-0 nylon suture material (Ethilon, Ethicon, Somerville, NJ). Tensile testing was performed on each knot type using a tension testing machine (Instron Microtester Model 5848). Six 3-1-1 trials and four slip-knot trials were used. The maximum load required to break each suture was plotted against the extension of the suture from the original length. Scanning electron microscopy was performed on the material after failure.

**Results** Preliminary results suggest that 10-0 nylon sutures tied using a 3-1-1 knot required a higher maximum force to break than the slip knot, and also had a longer extension before failure than the slip knot, using statistical analysis. The mean maximum load was 0.66N using a 3-1-1 knot compared to the mean maximum load of 0.51N using the slip knot, while the average extension using the 3-1-1 knot was 9.23mm compared to the average extension of 8.18mm using the slip knot.

**Conclusions** In 10-0 nylon sutures, the 3-1-1 knot may have greater tensile strength than the slip knot. Compared to slip knots, the 3-1-1 knot may be preferred for use in applications where greater tensile strength for closure is required.

## PEDIATRICS 2-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #123

#### An evaluation of the ocular profile of First Nation and Métis in the pediatric population of Saskatchewan.

Nishant Sharma, Joel Post, Punam Pahwa, Vasudha Erraguntla

**Purpose** To report the ocular profile in the First Nation and Metis pediatric population in Saskatchewan as compared to non First Nation and Metis pediatric population in Saskatchewan.

**Study Design** Comparative retrospective case series.

**Methods** A retrospective chart review was conducted in which ethics approval was obtained as per the University of Saskatchewan Research Ethics Board. We reviewed 208 charts of pediatric patients (104 of First Nation and Metis ancestry and 104 of non First Nation and Metis ancestry) that presented to the Eye Care Centre in Saskatoon, a tertiary centre, between 2005-2010. The average age for the First Nation and Metis group (test group) was 6.48 yrs (SD +/- 3.9yrs) and in the control group was 6.69 (SD +/- 3.8yrs). Parameters reviewed and compared included: refractive error, strabismus, amblyopia, prematurity, and loss to follow up. We excluded patients with unknown ancestry, high refractive errors, congenital cataracts, and ocular tumors.

**Results** We found a statistically significant increase in patients presenting with myopia in the First Nation and Metis sample when compared to the non First Nation and Metis sample ( $p = 0.002$ ). Although both groups had a similar proportion of patients presenting with clinically significant astigmatism, the dioptric power was higher in the test group when compared to the control group ( $p = 0.000101$ ). There was no significant difference in patients presenting with amblyopia or strabismus (ET/XT) between both groups. The proportion of patients who had loss to follow up/missed appointments in the First Nation and Metis population was 25.0%.

**Conclusions** This is, to our knowledge, the first reported ocular profile study of its kind evaluating First Nation and Metis children in Canada. It has been well documented that the ocular profile of indigenous populations of other countries shows dramatic differences in comparison to other populations. One feature that is well documented in the indigenous populations is the high prevalence of astigmatism. In the Saskatchewan population, the prevalence of astigmatism was similar in the test group population and the control population. However, the prevalence of astigmatism  $> 1.00$  D was much greater in the test population indicating a greater need for early referrals. The prevalence of myopia was also statistically significant and higher in the test population. We also noted a striking number of patients who had failed to attend follow up appointments among this population leading us to conclude that borderline refractive errors may be corrected in the first visit with the knowledge that this may be their only ocular examination for many years.

## PEDIATRICS 2-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #124

#### Remote screening for retinopathy of prematurity (ROP) using telemedicine: experience of the Sickkids network in Ontario over two years

Nasrin Najm-Tehrani

**Purpose** We describe our experience in the novel use of RetCam™ and real-time 2 way audio video connection via the Ontario Telemedicine Network (OTN) in bringing care to infants at risk of ROP in 2 advanced level II neonatal nurseries (NICUs) in Ontario where there was no access to ophthalmologists with expertise in ROP.

**Study Design** Retrospective review of consecutive case series over two years

**Methods** The Remote Screening for ROP was first initiated between SK and HRSRH, later RVH was selected as a second remote site to partner with SK.

Neonatal nurses and physicians at HRSRH and RVH (remote sites) were trained to obtain digital images of retina following standardized protocol. Continued training during imaging was provided using real-time interaction through secure video connection via OTN between SK and remote sites. Images obtained were uploaded to a secure ftp server, reviewed by ophthalmologist at SK and report faxed to remote sites. Follow up was arranged according to agreed guidelines for ROP screening. Infants underwent binocular indirect ophthalmoscopy following discharge from NICU or if they developed type II ROP. Data was collected prospectively using previously agreed criteria including:

- Interventions for cardio-respiratory support within 24hrs of imaging
- Cessation of imaging due to oxygen desaturation / bradycardia during imaging
- Whether additional re-examination was requested due to insufficient quality of images to allow accurate assessment by SK
- Parent satisfaction surveys

**Results** To date 59 infants have undergone between 1-6 examinations each (48 from HRSRH, 11 from RVH), before discharge from NICU. No infant has developed severe enough ROP to warrant referral to SK. There were no instances where imaging had to be stopped due to systemic complications and we did not need to re image any infant within a week due to inadequate image quality and parent surveys have confirmed high levels of satisfaction.

**Conclusions** Our 2 year experience suggests remote screening for ROP utilizing telemedicine strategies is a feasible alternative. The infants in our series did not develop severe ROP requiring referral to SK. Video connection between HRSRH, RVH and SK for real-time interaction, allowed personnel without previous imaging experience to acquire images with sufficient quality for appropriate assessment. Remote screening for ROP has resulted in dramatic reduction of inter hospital transfers, health care costs and potential morbidity

## PEDIATRICS 2-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #125

#### **Determining extent of retinal vascularization in Retinopathy of Prematurity (ROP): comparison of color images and fluorescein angiograms**

**Nasrin N. Tehrani, Amila DeAlwis, Derek Stephens**

**Purpose** We wished to assess the ability of 3 clinicians with expertise in ROP, to determine the extent of retinal vascularization comparing color images (CI) and fluorescein angiograms (FFA).

**Study Design** prospective randomized controlled study

**Methods** CI and FFA were obtained (1 image per quadrant, 4 images per eye) in 9 eyes of 9 premature infants with type 1 ROP. All CI were randomly mixed, and the process repeated for FFAs. In each set of CI and FFAs, 5 randomly chosen images were presented twice through the data set. Images were displayed on a standard monitor. Three observers were asked to rate their ability to draw the demarcation line between vascularized and non-vascularized retina for each CI and FFA on 2 separate occasions at least 2 weeks apart. Images were assigned a value between 0 to 10 by each observer. The values assigned were collected by an independent observer and analyzed using mixed model analysis. ICC's were used to measure reliability for both types of images.

**Results** When analyzed using a repeated measures mixed model, all 3 observers found they were better able to determine the demarcation line on the FFA than the CI as demonstrated by a higher score ( $p < 0.0001$ ). The higher scores for FFA were consistent across all 4 quadrants. The intra-observer reliability was between 0.97 and 0.99 for FFA compared to 0.78 to 0.91 for CI, indicating a more consistent rating across the observers when using FFA.

**Conclusions** Analysis of wide-angle digital images of the retina has become a useful tool in documentation, assessment and appropriate management of ROP. In some areas with shortage of clinicians with expertise in management of ROP, examination for ROP is performed through remote analysis of images obtained from infants at risk of ROP. In our study clinicians were better able to judge the extent of retinal vascularization on FFA compared with CI in patients with type 1 ROP. The addition of FFA may better enable clinicians to grade extent of ROP and therefore allow a more accurate assessment of fundus images.

## PEDIATRICS 2-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #126

#### Outcome of paediatric open globe trauma.

**Kamiar Mireskandari, Howard Bunting**

**Purpose** Open globe trauma has a disproportionate presentation in childhood, and is the leading cause of non-congenital monocular blindness in children. This study assesses the severity of such injuries, surgical requirements during rehabilitation, and visual outcomes.

**Study Design** Retrospective case cohort study

**Methods** Children with open globe injuries presenting to a tertiary children's hospital between 1992 and 2009 were identified from the operating room and ophthalmology department database. A retrospective chart review was performed, extracting data characterizing the injury previously validated by the Ocular Trauma Classification Group, as well as information concerning surgical repair and rehabilitation, complications, and visual outcomes.

**Results** There were 107 patients identified (81 male; 26 female), with a mean age 7.3 years (range 7 months - 16 years). Penetrating injury occurred in 67% of patients; globe rupture in 27%; and perforation in 4%. An intraocular or intraorbital foreign body was found in 5 patients.

Entry through the cornea alone occurred in 75% patients; whereas anterior scleral/corneoscleral and posterior scleral entry occurred in 23% and 3% patients respectively. Retinal detachment developed after trauma in 12% of children, and endophthalmitis in 3%.

Primary repair was restricted to wound closure in 72%, while interventions including lensectomy, retinal detachment repair and intraocular foreign body removal were incorporated into the primary procedure in 17%. Injuries were seal-sealing in 10% of patients, although the majority of these required subsequent intraocular surgery. Overall, cataract extraction was necessary in 55% of patients.

Visual acuity equal or better than 20/40 following trauma was present in 55% children, with vision 20/200 - LP vision in 18%, and no perception of light in 6% (median follow-up 9 months; range 3 days - 15 years). Half of the 107 patients required 2 or more operations (range 0 - 7).

**Conclusions** These data are amongst the largest collected concerning paediatric open globe trauma, and demonstrate favourable visual outcomes and complication rates compared to previous studies.

However, further surgeries are often required following the initial repair. Key factors preventing visual rehabilitation are corneal scarring and astigmatism, amblyopia in younger children, and severe initial injury involving both the anterior and posterior segments.



## PEDIATRICS 2-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #127

#### Traumatic Rupture of the Inferior Rectus Muscle: Clinical Features and Surgical Management

Aisha Al Busaidi, Michael Flanders

**Purpose** Isolated traumatic rupture of the inferior rectus muscle is rare. We describe the clinical characteristics and surgical management of five such cases.

**Study Design** Retrospective interventional case series.

**Methods** Five patients ranging in age from 22 to 63 years, were referred to Dr Michael Flanders for evaluation of inferior rectus muscle injury. Full ophthalmologic and orthoptic assessments were performed. The following data was extracted from the patients' charts: mechanism of injury, type of diplopia, head position, pre and postoperative measurements of ocular alignment and motility (with photo documentation), time to initial surgical intervention and surgical procedures done.

The cause of injury in four cases was localized penetrating soft tissue trauma, and in one case, iatrogenic rupture during strabismus surgery. Only one case had additional injuries in which there was a fracture of the orbital floor and injury to the eye. All patients had vertical diplopia and some had compensatory head postures.

All initial surgical interventions included exploration. Three had early exploration (within 2 weeks of injury) and 2 late. Surgical interventions included advancement/resection of ruptured muscle (n=5), recession of the ipsilateral superior rectus (n=3) and correction of associated exotropia (n=3). Patients who postoperatively had no diplopia with minimal compensatory head posture in primary position and down gaze were considered to have a successful outcome. Those who required prism correction to achieve functional binocular vision had a partially successful outcome.

**Results** Retrieval of the ruptured muscle was achieved in all cases. The mean pre-operative primary position hypertropia was 18.4 PD (Prism Diopters), (range 10 to 30). The mean postoperative primary position hypertropia was 0.6 PD (range 0 to 2). In downgaze, the hypertropia improved from a preoperative mean of 37 PD (range 20 to 70) to a postoperative mean of 6.2 PD (range 0 to 15). The infraduction deficit improved from a preoperative mean of -2.8 (range -2 to -4) to a postoperative mean of -1.5 (range normal to -2). In order to achieve adequate infraduction in 2 cases, a compromise in supraduction with a small hypotropia in upgaze was necessary. Successful results were achieved after one or two operations in 4/5 patients. The patient with the injured globe, orbital floor fracture and large exotropia had an unsuccessful outcome despite 4 surgical attempts.

**Conclusions** In our experience with this rare entity, early surgical intervention is needed for retrieval of the ruptured inferior rectus muscle. Secondary surgeries can successfully restore a functional level of binocular vision and relief from disabling diplopia.

## PEDIATRICS 2-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #128

#### Inferior blow out fracture repair followed by residual ipsilateral incomitant hypertropia

Inas Makar

**Purpose** The purpose of this presentation is to describe the clinical picture and surgical outcome of 2 patients who received surgical repair for inferior blow out fracture and developed incomitant hypertropia similar to clinical picture of superior oblique muscle palsy will be presented and possible etiology will be discussed.

**Study Design** retrospective chart review of 2 patients who received surgery in the form of ipsilateral inferior oblique myectomy for hypertropia associated with orbital blow out fracture will be presented.

**Methods** Imaging studies, strabismus measurements, field of BSV and Lees screen preoperatively and postoperatively will be presented for both patients.

**Results** Various explanations for this uncommon clinical picture will be presented along with surgical findings.

**Conclusions** Inferior oblique muscle tightness can occur after inferior blow out fracture before or after surgical repair and responds surgically to inferior oblique muscle weakening.

## RETINA-2

SUNDAY 12 JUNE

### Paper #129

#### Understanding macular holes: macular holes that develop after retinal detachment repair

Matthew B. Schlenker, Wai-Ching Lam, Robert G. Devenyi, Peter J. Kertes

**Purpose** To present the characteristics and outcomes of macular holes (MH) that arise in eyes that have been treated for retinal detachment (RD).

**Study Design** Retrospective, interventional, consecutive case series.

**Methods** We report the demographic and clinical characteristics of patients who developed a new full-thickness MH after prior rhegmatogenous RD (n=16), rhegmatogenous/tractional RD associated with sickle cell retinopathy (n=1) and serous RD associated with an optic pit (n=1). 16 out of 18 patients offered surgical repair proceeded with Pars Plana Vitrectomy (PPV), internal limiting membrane peel, and intravitreal gas tamponade. Main outcome measure for MH repair included macular attachment status, MH closure, and postoperative BCVA.

**Results** 18 full-thickness MHs were detected from 985 eyes over a 4.5 year period (1.9% incidence). On RD presentation 14/18 RDs involved the macula. 16/18 patients had BCVA of 20/200 or worse. Regarding RD repair, 6 patients required a single PR, 4 patients a single PPV, 3 patient two PRs, 3 patients one PR and one PPV, 1 patient one PR and two PPVs (and subsequent silicone removal), and 1 patient 3 PRs and one PPV. Post RD visual acuity was 20/200 or worse in 15/18 patients. The median time to MH diagnosis after RD repair was 1 month (range: 2 days-53 months), and from MH diagnosis to MH repair 1.75 months (range: 3 weeks-8 months). 14/16 eyes (89%) undergoing surgical repair achieved MH closure, 1 requiring multiple PPVs. 11 saw at least one Snellen line improvement (median 1, range: 1-6), 2 lost vision (1 and 2 Snellen lines respectively), and 3 remained unchanged at a median follow-up of 3 months (1 month - 25 months). 6 patients had at least 20/80 visual acuity at last follow-up.

**Conclusions** MHs developed in 1.9% of eyes post RD repair. These MHs occur in younger patients and do not have the female preponderance found among patients who develop idiopathic MHs. The RDs are likely to be severe macula-off RDs requiring multiple interventions for RD repair. Post-MH repair closure rates were similar to rates for idiopathic MHs. Visual acuity outcomes were moderate and coincided with the comorbidities and degree of impairment post RD repair. The findings suggest other pathogenic mechanisms besides tangential vitreofoveal traction may be leading to these MHs, such as cystoid macular edema.

**RETINA-2**

**SUNDAY 12 JUNE**

**Paper #130**

**Snoring is associated with unexpected patient head movement during monitored anesthesia care eye surgery**

**Colin A. McCannel, Eric J. Olson, Mark J. Donaldson, Sophie J. Bakri, Jose S. Pulido, Donna Mueller**

**Purpose** To assess whether or not snoring is associated with sudden patient movement during local anesthesia with intravenous sedation.

**Study Design** Prospective, observational case series.

**Methods** Patients undergoing ocular surgery with local anesthesia with intravenous sedation were studied. The occurrence or absence of snoring, and whether or not patient movement was noted were prospectively recorded. Complications that arose from patient movement were also noted.

**Results** A total of 230 surgical procedures were included in the study. All cases were vitreoretinal surgery cases. During 37 procedures snoring was noted, and among these, 18 patients moved their head suddenly (48.6%). In contrast, movement occurred during only two of 193 (1.0%) procedures without documented snoring ( $p < 0.001$ ). Thus, sudden patient head movement was approximately 49 times more prevalent in patients that snored. No complications as a result of the movement were identified in this study.

**Conclusions** Snoring during local anesthesia with intravenous sedation predicts a high likelihood of sudden patient movement during local anesthesia with intravenous sedation. Eye surgeons should be aware of this association to help minimize the risk of complications due patient movement.

## RETINA-2

SUNDAY 12 JUNE

### Paper #131

#### Efficacy of pneumatic retinopexy

Fadwa Al Adel, Tenley Bower, Michael Kapusta

**Purpose** To evaluate the success and factors affecting outcome of retinal reattachment by pneumatic retinopexy (PR).

**Study Design** A retrospective, consecutive study involving 153 patients receiving PR as the primary treatment for retinal detachment throughout a 11 year period from a single vitreo-retinal surgical practice.

**Methods** Patients were grouped into classic and relative indications. The following information was recorded: patient age, gender, best corrected visual acuity (BCVA) on presentation, intraocular pressure, location of tear, extent of tear, extent of retinal detachment, involvement of macula, lens status (phakic, pseudophakic, amount of cataract on presentation), technique of scar formation (laser, cryotherapy, or both), and type of gas used (C3F8, SF6). Post-operative results at time intervals of one day, one week, one month, six months, one year were documented: BCVA, intraocular pressure, lens status, and retinal status. All post-operative complications were also documented.

**Results** The primary success rate of PR for retinal detachment was 55.6% (85 patients). Our results were concurrent with the rate of success in the literature. The success rate of patients with classic indications for PR was 60.5% (65 patients) and the success rate in patients with relative indications was 43.5% (20 patients) which was statistically significant ( $p < 0.05$ ). The success rate of phakic patients undergoing PR was 57.7% (82 patients) and the success rate in pseudophakic patients was 27.3% (3 patients) which was not statistically significant but showed a strong trend for higher success of PR in phakic eyes. There was no statistically significant difference found in the success rate based on the methods used for induction of retinopexy (cryotherapy or laser) or the type of gas used for (C3F8, SF6). Of the 68 patients that failed, 35% (24) were never attached while the rest were flat and then detached later. The most common time for retinal re-detachment was one month (35%) followed by one week (24%), six months (3%), and one year (3%).

Data analyzed includes: presenting characteristics relating to success of PR (early or late presentation, age, gender, refractive error, BCVA, location of tear, location and number of clock hours of retinal detachment), effect of hyaloid status on success, causes leading to further operations, time of re-retinal detachment, type of additional procedures performed, comparison of pre- and post-operative lens status, and analysis of complications.

**Conclusions** The best primary PR success was found in eyes with classic indications and was statistically significant. A very strong trend for greater success in phakic eyes was found over pseudophakic eyes. The method of induction of retinopexy and type of gas used for PR have no bearing on the success of the procedure. The most common time for retinal re-detachment is one month.

## RETINA-2

SUNDAY 12 JUNE

### Paper #132

#### **Morphologic predictors of success in pneumatic retinopexy in eyes with classic and extended treatment criteria.**

**Dan B. Rootman, Mark Mandell, Stephen M. Conti, Peter J. Kertes**

**Purpose** Classically, pneumatic retinopexy is indicated in phakic patients with a superior detachment, breaks confined to <1 clock hour, with little or no lattice and clear media. However, there is suggestion that other patients can benefit from this procedure and the indications have been extended. The purpose of this study is to define morphologic features that may be predictive of successful retinal reattachment in pneumatic retinopexy for patients with extended treatment criteria.

**Study Design** Prospective interventional case series.

**Methods** Exclusion criteria included: inferior detachment with a break between 4:00 and 8:00, media opacity preventing complete examination, no identified retinal breaks in detached retina, lack of capacity or ability to cooperate with examination or retinopexy and participation refusal. Subjects were followed with standard clinical exam at 1 day, 1 week, 1 month, 6 months and one year. Morphologic data were derived from standard 3-color fundus drawings. The primary outcome measure was treatment failure, defined as any requirement for scleral buckle or vitrectomy within the follow up period. Chi square tests were utilized to compare rates of failure for each morphologic feature. A logistic regression model was fit.

**Results** Overall sample (n=113) was 58.4% male. Failure was found in 30.4% of all subjects. Follow up was 6 months for 87% and 12 months for 60% of the sample. Morphologic criteria including the position and number of breaks, position and extent of lattice, additional breaks in attached retina as well as the size of the detached area and macula detachment status were all found not to be significantly related to failure. Only pseudophakic status (OR=2.48 [5.83, 1.05],  $p < 0.05$ ), presence of proliferative vitreoretinopathy (PVR) (OR=21.29 [181.95, 2.49],  $p < 0.01$ ) and extent of breaks > 1 clock hour (OR=2.16 [6.93, 0.67],  $p < 0.191$ ) were associated with failure at  $p < 0.20$  and met criterion for inclusion in multivariate analysis. In multivariate analysis pseudophakic status ( $p < 0.05$ , OR=4.04 [1.35, 12.12]) and presence of PVR ( $p < 0.05$ , OR=18.73 [1.76, 198.89]) gained statistical significance.

**Conclusions** Pneumatic retinopexy in capable and willing patients was found to have an overall success rate of 69.6%. Only the presence of an IOL and/or PVR was associated with an increased likelihood of failure. Pneumatic retinopexy can be attempted in any retinal detachment with detached breaks confined to between 8:00 and 4:00, however pseudophakics and those with PVR should be informed that they have an increased chance of failure.

## RETINA-2

SUNDAY 12 JUNE

### Paper #133

#### The feasibility of air travel for patients with scleral buckles and intraocular gas

Jason Noble, Navapol Kanchanaranya, Robert G. Devenyi, Wai-Ching Lam

**Purpose** To determine the feasibility of air travel for patients with scleral buckles and small volumes of postoperative intravitreal gas.

**Study Design** Prospective, comparative, cohort study at a tertiary urban ophthalmology center.

**Methods** Patients with small volumes of intravitreal gas (10%) who had undergone pars plana vitrectomy with C3F8 air fluid exchange, with or without scleral buckling, were invited to participate in this study. Patients were tested in a hypobaric chamber at the Defense Research and Development Canada Downsview test site. Simulation of flight was performed in a hypobaric chamber with an ascent rate of 300 feet/minute to an altitude of 8000 feet. This altitude was maintained for 30 minutes before beginning descent at a rate of 300 feet/minute. Intraocular pressure (IOP) was measured at baseline and then every 5 minutes during simulated flight using a slit-lamp mounted Goldman applanation tonometer. The data were entered onto a spreadsheet and basic and comparative statistics (t-tests) were done.

**Results** Eleven patients were evaluated in the study, including 6 patients with and 5 without scleral buckles. All testing was done approximately 4-6 weeks postoperatively, when intravitreal gas volumes reached 10%. During ascent, IOP steadily rose from an average of  $14 \pm 9$  mmHg at baseline to a peak of  $29 \pm 11$  mmHg at 8000 feet (a rise of  $101 \pm 57\%$ ). Patients with scleral buckles had significantly lower peak IOP's compared to those without buckles ( $20 \pm 5$  mmHg vs  $39 \pm 8$  mmHg,  $p=0.0009$ , t test) as well as lower absolute increases in IOP ( $7 \pm 1$  mmHg vs  $23 \pm 6$  mmHg,  $p=0.0002$ , t test). The percentage increase in IOP from baseline was  $62 \pm 25\%$  and  $147 \pm 50\%$  for the buckle and non-buckle groups, respectively ( $p=0.005$ , t test).

**Conclusions** Patients with small volumes of intravitreal gas demonstrate significant increases in intraocular pressure during simulated flight. The presence of a scleral buckle appears to significantly limit the magnitude of the IOP rise. It may be possible for patients with scleral buckles, low baseline IOP's, and a gas volume sizes of 10% or less to tolerate air travel in commercial aircrafts.

## PEDIATRICS 3-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #134

#### Accuracy of the corneal light reflex for clinical measurement of strabismus

Michael D. O'Connor, Jennifer Schofield, Stephen P. Kraft, Asim Ali, David Smith

**Purpose** Despite its widespread use in clinical and research practice for measurement of strabismus in infants, the value of the corneal light reflex (Krimsky) test remains unclear. This is problematic, because the validity of research and clinical outcomes in strabismus surgery in young children depends on accurate measurements. We compared the Krimsky test to near prism-and-cover test (NPCT) measurements.

**Study Design** Prospective comparative case series

**Methods** Cooperative children and adults with manifest strabismus were prospectively recruited consecutively. The Krimsky test and NPCT were performed in each subject by experienced orthoptists using an observer-masked design (n=45). Krimsky test agreement between orthoptists was tested in a subgroup of patients (n=20).

**Results** The Krimsky test measurement agreed clinically with the NPCT in only 24/45 subjects (53%, Pearson correlation coefficient  $r = 0.70$ ). Clinical agreement was defined as within 2 prism dioptres for strabismus <20 prism dioptres (PD), within 5 PD for strabismus 20 to 40 PD, and within 10 PD for strabismus >40 PD. Clinically significant disagreement in Krimsky test measurements between orthoptists arose in 6/20 cases (30%,  $r = 0.79$ ).

**Conclusions** Even in mature, cooperative subjects, we commonly found clinically significant discrepancies in Krimsky measurements compared to the NPCT. Our results highlight the significant limitations of this test, and suggest caution when interpreting Krimsky test results. These findings may suggest that successful surgical treatment of strabismus in infancy owes less to precise surgical dosage based on Krimsky test measurements than to the surgeon's clinical judgement and experience.



## PEDIATRICS 3-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #135

#### Unusual strabismus in three patients with orbital bands

Michel J. Belliveau, Brian W. Arthur

**Purpose** To describe three patients with challenging strabismus presentations who were found to have orbital bands on imaging either between extraocular muscles or from one muscle to the globe.

**Study Design** Descriptive case reports

**Methods** Three patients were evaluated for strabismus clinically including motility and alignment testing. All underwent imaging of the orbits with CT and/or MRI because of unusual findings.

**Results** A 9-month-old girl with A-pattern esotropia, without evidence of superior oblique overaction, and abnormal head posture that persisted with monocular occlusion was found to have an orbital band joining the temporal aspects of the superior and inferior recti bilaterally. MRI signal characteristics were identical to extraocular muscle. A 75-year-old man with longstanding vertical diplopia and a history of hyperthyroidism and remote left orbital fracture was found to have an incomitant right hypotropia with right inferior oblique paresis and a substantial elevation deficit. Imaging of his orbits showed orbital bands originating from the superior aspect of the lateral recti that coursed toward the levator and continued nasally in the vicinity of the superior oblique. A 4-year-old girl with intermittent exotropia and elevation deficit of her left eye was found to have a band running from the undersurface of the left superior rectus to her globe.

**Conclusions** Imaging of the orbits to detect orbital bands should be considered in challenging strabismus cases. This condition, reported to occur in 2% of strabismic patients, is likely under-recognized.

## PEDIATRICS 3-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #136

#### Choice of conjunctival incision type for horizontal rectus strabismus surgery: the first international survey

Kourosh Sabri, Mikel Mikhail

**Purpose** To assess use of limbal versus fornix conjunctival incisions in primary and repeat horizontal rectus muscle surgeries among ophthalmologists.

**Study Design** Postal and electronically mailed questionnaire survey

**Methods** A questionnaire survey was mailed to all members of the American Association for Paediatric Ophthalmology and Adult Strabismus (AAPOS). Participants were asked about their use of limbal, fornix or other incision types for horizontal rectus muscle surgery in their paediatric ( $\leq 16$  years of age) and adult ( $> 16$  years of age) patient population.

**Results** 1022 questionnaires were sent out, to members in all five continents. In total, 302 completed questionnaires were returned, of which seventeen were excluded as they were filled incorrectly. Therefore, 285 completed questionnaires (representing a 27.9% response rate), were analysed. For the majority of their paediatric patients, 40.8% of surgeons used limbal incisions, 58.1% used fornix incisions and 1.1% used other incision types when operating on virgin muscles. For re-operations in children, 58.1% used limbal incisions, 39.1% used fornix incisions and 2.1% used other incision types (0.7% not applicable).

In the majority of their adult cases, 40.1% used limbal incisions, 53.5% preferred fornix incisions and 1.4% used other incision types (4.9% not applicable) when operating on virgin muscles. For re-operations, limbal incisions were used by 63.4% of respondents, 29.9% used fornix incisions and 1.4% used other incision types (5.3% not applicable).

Among respondents who mainly used limbal incisions; 48% cited greater exposure and 23% cited better teaching as reasons for this incision choice when operating on virgin muscles, while 70% cited greater exposure and 16% cited better teaching as reasons for this choice for re-operations. Among respondents who mainly used fornix incisions, less pain (36% for first time surgeries and 39% for re-operations) and less inflammation (30% for both first time and repeat surgeries) were the most common reasons for their choice of incision.

**Conclusions** There is significant current variability regarding choice of incision for horizontal muscle strabismus surgery. Fornix and limbal based conjunctival incisions are the two main types of opening used for strabismus surgery. Among those surveyed, limbal incisions were preferred for greater intra-operative exposure and better teaching for junior surgeons, while fornix incisions were thought to cause less post-operative pain and inflammation and lead to more rapid soft tissue healing. However, a prospective, randomised study is needed to compare the post operative inflammation, healing and pain scores, between fornix and limbal incisions.

## PEDIATRICS 3-ROP, TRAUMATIC AND COMPLEX STRABISMUS

SUNDAY 12 JUNE

### Paper #137

#### Anterior segment ischemia after strabismus surgery for IIIrd nerve palsy

Tenley Bower, Michael Flanders

**Purpose** Anterior segment ischemia (ASI) is a rare but potentially serious complication of strabismus surgery. We present the case of a 44 year old female who developed a right IIIrd nerve palsy and vertical gaze palsy following embolization treatment for a cerebral aneurysm. After surgical correction of the ocular misalignment the patient developed ASI. The surgical management of the IIIrd nerve palsy and the clinical features and postoperative treatment of ASI are the object of this presentation.

**Study Design** This is a case report documenting the course and progression of the patient.

**Methods** The patient's chart was reviewed and the details of both her initial medical problem (a basilar artery aneurysm), and the ensuing treatment (embolization), were compiled. Prior to strabismus surgery, a complete neuroophthalmic and orthoptic assessment was done. Measurements of ocular alignment and motility were recorded both pre and postoperatively and documented photographically. Anterior segment angiography was done postoperatively.

**Results** Preoperatively, ocular alignment measurements showed a right (R) exotropia of 70 prism diopters (PD) and a (R) hypertropia of 30 PD. There was a marked depression deficit of both eyes, (right eye -6, left eye -4), and a marked adduction deficit of the (R) eye (-6). Elevation and depression saccades were diminished bilaterally. The first strabismus operation consisted of an adjustable (R) superior rectus recession 6 mm and a (R) inferior rectus resection of 6 mm. The second operation (performed 7 months later) consisted of an adjustable (R) medial rectus resection 9 mm and (R) lateral rectus recession 11 mm. After the two surgeries, the (R) exotropia measured 20 PD and the (R) hypertropia 10 PD. On the first day following the second surgery, there were signs of ASI such as perilimbal pallor and a mild iritis. Presence of diminished circulation to the anterior segment was confirmed with anterior segment angiography. Treatment with hourly prednisolone drops and Oral Prednisone 80 mg per day, was initiated. Prolonged treatment was necessary to control the persistent anterior segment inflammation.

**Conclusions** Finding an effective surgical solution for the large angle exotropia and hypertropia associated with a IIIrd nerve palsy is a great challenge. The postoperative anterior segment ischemia that follows this kind of surgery can have devastating consequences. Early recognition and rapid and aggressive institution of treatment is necessary in order to limit ocular morbidity.

## REFRACTIVE CATARACT SURGERY

SUNDAY 12 JUNE

### Paper #138

#### Correction of spherical aberration by personalized aspheric intraocular lens implantation based on laser ray-tracing aberrometry

Toby Chan, Bruce Nichols

**Purpose** Reduction of spherical aberration (SA) is optimal for visual quality particularly when approaching emmetropia. Previous studies on customized intraocular lens (IOL) implantation based on pre-operative corneal SA were limited by the use of different aberrometers pre- and post-operatively, or by under-reporting SA using undilated pupils. The objective of this study was to determine using ray-tracing technology whether matching aspheric IOL types with pre-operative corneal SA can achieve close-to-zero post-operative total ocular SA, measured through dilated and undilated pupils.

**Study Design** Prospective interventional study

**Methods** Consecutive patients scheduled for cataract surgery were enrolled. Pre-operatively, all subjects underwent measurements of corneal SA at the 6-mm optical zone using the iTrace aberrometer (Tracey Technologies). For each patient, corresponding IOL type was selected to target for a post-operative total ocular SA of zero: SofPort Advanced Optics (Bausch & Lomb) for corneal SA <0.08  $\mu\text{m}$ , AcrySof IQ (Alcon) for corneal SA 0.08-0.22  $\mu\text{m}$ , and Tecnis Z9002 (AMO) for corneal SA >0.22  $\mu\text{m}$ . 1 month post-operatively, corneal and total ocular SA (through dilated and undilated pupils) were measured again using the iTrace aberrometer. Mean absolute error was calculated as the difference between actual and predicted total ocular SA. Statistical analysis was performed to compare pre- versus post-operative and dilated versus undilated SA values.

**Results** 50 eyes of 43 patients were available for assessment and analysis. No SofPort was implanted as no eye was found to have corneal SA <0.08  $\mu\text{m}$ . AcrySof IQ was implanted in 5 eyes and Tecnis in 45 eyes. Pre-operative corneal SA at 6-mm optical zone was  $+0.29 \pm 0.06 \mu\text{m}$  (AcrySof IQ:  $+0.30 \pm 0.06 \mu\text{m}$ ; Tecnis:  $+0.19 \pm 0.04 \mu\text{m}$  [P=0.00]). Post-operative total ocular SA through dilated pupil was  $-0.03 \pm 0.08 \mu\text{m}$  (AcrySof IQ:  $-0.02 \pm 0.08 \mu\text{m}$ ; Tecnis:  $-0.08 \pm 0.10 \mu\text{m}$  [P=0.23]), which was significantly lower than pre-operative corneal SA (P<0.003 for AcrySof IQ, Tecnis, or all IOLs). 84% (42 of 50) eyes were within  $\pm 0.1 \mu\text{m}$  of target zero total ocular SA. Mean absolute error was  $0.07 \pm 0.06 \mu\text{m}$  for the entire population (AcrySof IQ:  $0.09 \pm 0.07 \mu\text{m}$ ; Tecnis:  $0.07 \pm 0.06 \mu\text{m}$  [P=0.56]). Total ocular SA was higher through dilated versus undilated pupils, but the difference was not statistically significant. There was no significant difference between pre- and post-operative corneal SA for both IOL groups.

**Conclusions** Customized IOL implantation based on pre-operative corneal SA can minimize post-operative SA and thus may achieve satisfactory visual outcome. Targeting for zero total ocular SA using corneal SA derived by ray-tracing aberrometry can be feasible.

## REFRACTIVE CATARACT SURGERY

SUNDAY 12 JUNE

### Paper #139

#### Measuring corneal spherical aberrations: an analysis of repeatability and comparability between four aberrometers

Stephanie C. Chan, Graham Belovay, Dwight Silvera, Ike Ahmed

**Purpose** The objective of this study is to compare the repeatability and comparability of corneal spherical aberration measurements from the ATLAS-9000 (Carl Zeiss Meditec, Jena, Germany), iTrace (Tracey Technology, Houston, USA), OPD-Scan II ARK-10000 (Nidek, Gamagori, Japan) and Pentacam (Oculus, Wetzlar, Germany).

**Study Design** This was a single-site IRB-approved prospective study.

**Methods** One eye of 33 patients with normal corneas was randomized to receive 3 consecutive scans at 6 mm from 4 aberrometers. The order of aberrometers used was varied to prevent bias. The primary outcome measure was corneal spherical aberration (SA). Simulated keratometry (SimK), first order trefoils and first order comas were also measured. The repeatability of each device was assessed by calculating the intraclass correlation coefficient (ICC) from the three consecutive measurements. Comparability between the devices was assessed with an ANOVA and Games-Howell post-hoc test.

**Results** Mean age was 58.6±13.2 years. Average corneal SA was found to be 0.231 μm, 0.251 μm, 0.384 μm, and 0.420 μm for the OPD-ScanII, ATLAS, Pentacam and iTrace respectively. The ICC for mean SA was 0.659, 0.431, 0.889 and 0.832 for the OPD-ScanII, ATLAS, Pentacam and iTrace respectively. The Pentacam corneal SA measures were significantly different than both the ATLAS ( $p<0.05$ ) and the OPD Scan II ( $p<0.05$ ). There was no significant difference between measured SA when comparing the other aberrometers.

**Conclusions** The iTrace offered good repeatability for all values analyzed, including SA. The Pentacam also offered good repeatability for SA, but SA measures were significantly different from the ATLAS and OPD Scan-II and were thus deemed non-comparable. The ATLAS, iTrace and OPD Scan-II had no statistically significant difference in measured corneal SA.

## REFRACTIVE CATARACT SURGERY

SUNDAY 12 JUNE

### Paper #140

#### Evaluation of Piggyback Intraocular Lens (IOL) Implantation for the Correction of Postoperative Refractive Errors

Mikel Mikhail, Mahmoud F. Rateb, Ike Ahmed

**Purpose** To evaluate the implantation of secondary low-power sulcus piggyback posterior chamber intraocular lenses (PCIOL) for the correction of postoperative refractive surprises or anisometropia.

**Study Design** Retrospective chart review

**Methods** Retrospective chart review of 10 cases who had uncomplicated cataract extraction using phacoemulsification with in-the-bag PCIOL implantation. Patients underwent secondary piggyback IOL implantation with STAAR AQ5010V silicone foldable intraocular lenses (STAAR Surgical Company, Monrovia, California) through 2.8 mm clear corneal incisions. The primary outcome measure was uncorrected visual acuity (UCVA). We also evaluated for any intraoperative or postoperative complications.

**Results** The average age of patients was 63.7 +/- 10.3 years old. The mean time to piggyback lens insertion was 9.4 +/- 6.1 months and the mean follow up period was 12.4 +/- 4.8 months. Preoperatively, mean UCVA was 20/70, mean spherical equivalent refraction was  $\pm 2.3 \pm 0.66$  D and mean cylinder was  $\pm 1.05 \pm 0.86$  D. Postoperatively, mean UCVA was 20/30, mean spherical equivalent refraction was  $\pm 0.4 \pm 0.24$  and mean cylinder was  $\pm 0.48 \pm 0.36$ . No intraoperative or postoperative complications were noted in the study.

**Conclusions** Low-power piggyback sulcus PCIOL provided safe and effective refractive results in pseudophakic patients with no major complications.

## REFRACTIVE CATARACT SURGERY

SUNDAY 12 JUNE

### Paper #141

**A simple, reproducible, and cost effective axis marking system for toric lens implantation.**

**Grayson A. Roumeliotis, Cindy Hutnik**

**Purpose** Proper positioning of toric intraocular lenses (IOLs) depends upon pre-operative determination of the axis of astigmatism. We sought to validate a new pre-operative axis marking system for toric intraocular lens (IOL) implantation. We hypothesize that our method will provide accurate axis markings, while reducing costs and increasing operating room efficiency.

**Study Design** This was a technique validation study

**Methods** We added a calibrated decal to a Haag-Streit slitlamp so we could accurately set the slit at any angle, 0-180°. Typically, the axis for the insertion of the toric IOL is calculated using pre-operative keratometry and biometry. Arbitrary axes were set in our test models. To mark a selected axis on the eye, the slit-beam was positioned so that one end abutted the visual axis, and the other fell on the corneal limbus. With the slit-beam set to the desired angle, it was used to guide a linear superficial epithelial abrasion using a 30-gauge needle at the corneal limbus. For validation purposes, the horizontal axis was marked in the same way. We assessed the accuracy of this technique in two ways: A masked independent observer, blinded to the intended axis, was asked to find the superficial mark and to determine the axis using only the calibrated slit-lamp. We also compared the axis markings made with our method to a currently used intra-operative axis marker (beveled degree gauge, ASICO®).

**Results** The average error between measurements set by the marker and those estimated by the independent observer was 3.2° (SD= 2.6°). When angles set with the calibrated slitlamp were assessed using the protractor, there was no difference between the intended and the measured axis.

**Conclusions** The technique outlined can accurately mark the axis for toric IOL implantation. It also obviates the need for sterile instrument sets for pre- and intra-operative marking. The technique is thus a simple, adaptable, inexpensive, and accurate method for surgeons interested in offering toric IOL technology to their patients.

## REFRACTIVE CATARACT SURGERY

SUNDAY 12 JUNE

### Paper #142

#### Refractive predictability of the ZA9003 3-piece IOL versus the ZCB00 1-piece IOL

Zale D. Mednick, Devesh K. Varma, Ike Ahmed

**Purpose** To compare predictability of refractive outcomes following uncomplicated cataract surgery with in-the-bag implantation of the ZA9003 3-piece acrylic versus ZCB00 1-piece acrylic intraocular lens (Abbott Medical Optics Inc., Illinois, USA).

**Study Design** Retrospective review

**Methods** Charts from 99 patients who underwent cataract surgery from 2006 until present were retrospectively reviewed. 49 eyes of 30 patients that received ZA9003 IOL implants were compared with 50 eyes of 35 patients who received ZCB00 IOL implants. The primary outcome measure was refractive predictability defined as difference between optical biometry predicted refraction using optimized constants with the Holladay 1 formula and actual postoperative refraction. Secondary outcome measures included postoperative UDVA and CDVA as well as frequency of posterior capsular opacification.

**Results** The ZA9003 group was significantly younger than the ZCB00 group with mean ages  $63.3 \pm 9.2$  years and  $72.0 \pm 9.4$  years respectively ( $p=0.00001$ ). Mean axial length, anterior chamber depth, preoperative refraction and IOL power were similar between groups measuring  $23.69 \pm 1.58$ mm,  $3.19 \pm 0.46$ mm,  $-0.15 \pm 2.75$ D, and  $21.3 \pm 2.75$ D respectively. For the ZA9003 group, predicted post-operative refraction was  $-0.229 \pm 0.42$ D, and actual refraction was  $-0.28 \pm 0.66$ D, thus refractive predictability error was  $-0.017 \pm 0.56$ D. For the ZCB00 group, predicted post-operative refraction was  $-0.441 \pm 0.56$ , and actual post-operative refraction was  $-0.604 \pm 0.78$ , thus refractive predictability error was  $-0.006 \pm 0.62$ . There was no significant difference between the refractive predictability of the two lenses ( $p=0.85$ ).

**Conclusions** Both the ZA9003 and ZCB00 lenses resulted in greater myopia than predicted. While the ZA9003 showed a trend toward better refractive predictability than the ZCB00, this was not statistically significant.



## REFRACTIVE CATARACT SURGERY

SUNDAY 12 JUNE

### Paper #143

#### Comparison of Tecnis 1-piece multifocal vs. monofocal intraocular lenses

Gerd U. Auffarth, Tanja M. Rabsilber, Angela Ehmer, Il-Joo Limberger, Mike P. Holzer

**Purpose** Clinical evaluation of a new single-piece multifocal intraocular lens (IOL) in comparison to the identical monofocal model.

**Study Design** Clinical prospective, non-randomised, examiner-masked trial

**Methods** In a multicentre study the Tecnis 1-piece multifocal IOL (AMO) was compared to patients who received the monofocal Tecnis 1-piece (AMO). The same IOL model, either the monofocal or multifocal version, was implanted bilaterally. Follow-up examinations are performed up to 6 months after surgery including refraction, visual acuity (near and distance), reading speed, defocus curve, pupil size, keratometry as well as slit-lamp biomicroscopy.

**Results** First preliminary results of the study centre Heidelberg are promising: 10 eyes of 5 patients underwent uneventful cataract surgery with IOL implantation. 6 eyes received the multifocal version. One month after surgery, the following median values were found: spherical equivalent = 0.25 D, UCDVA = 0.15 logMAR, BCDVA = 0.0 logMAR, UCNVA and DCNVA = 0.1 logMAR. No further near addition was accepted. The monofocal IOLs (n=4) showed similar good results for distance, however, required a median near addition of 1.63 D to achieve a BCNVA of -0.05 logMAR (UCNVA and DCNVA = 0.45 logMAR).

**Conclusions** This new multifocal IOL combines the strength of the proven multifocal and monofocal Tecnis IOLs made of hydrophobic acrylate in the modern one-piece design.

## REFRACTIVE CATARACT SURGERY

SUNDAY 12 JUNE

### Paper #144

**Patient satisfaction and visual performance after bilateral implantation of multifocal IOLs, a prospective study.**

**George Beiko**

**Purpose** To determine the visual performance, subjective satisfaction and spectacle independence of patients followed prospectively after bilateral implantation of AMO Tecnis multifocal IOLs.

**Study Design** Prospective, non randomized multicentre clinical study.

**Methods** 250 patients from 25 sites in Canada were enrolled in the study. Presbyopic patients presenting for bilateral cataract surgery or clear lens extraction were included. Uncorrected and best distance corrected vision at distant (6 m), intermediate (70 cm) and near (comfortable distance) were measured using EDTRS charts at 1, 3 and 6 months post-op. A subjective questionnaire was administered to determine patient satisfaction.

**Results** Preliminary results on the first 125 patients enrolled who completed the one and 3 month post-op visits, after bilateral implantation will be presented. 90 patients underwent cataract surgery, 35 had clear lens extraction. At 3 months, bilateral uncorrected vision was 20/30 or better in 92% for distance, 85% for intermediate and 98% for near. 93% of patients reported rarely or never having to use spectacles for any distance. No patients reported severe dysphotopsias, 4% reported moderate dysphotopsias.

**Conclusions** : In a multicentre study of visual performance with the AMO Tecnis multifocal IOL, patients achieved 20/30 or better vision at all distances in greater than 85% with minimal dysphotopic symptoms.

## REFRACTIVE CATARACT SURGERY

SUNDAY 12 JUNE

### Paper #145

#### Results of the Synchrony dual-optic accommodative intraocular lens in cataract and refractive surgery

Gerd U. Auffarth, Angela Ehmer, Il-Joo Limberger, Mike P. Holzer

**Purpose** Evaluation of the functional results of different versions of the Synchrony dual-optic accommodative intraocular lens (IOL) (Abott Medical Optics) including the first and latest generation.

**Study Design** Clinical case series

**Methods** The latest IOL version was implanted in 9 eyes of 6 patients with a median age of 54.0 years. 1 day, 1 month and 3 month postoperatively functional results were evaluated. In addition data of the first model was acquired 7 years after surgery.

**Results** The Synchrony lens was implanted mono- and bilateral without any complications. Median IOL power was 23.0 D. 1 day postoperatively (n = 9) a median UCDVA of 0.1 logMAR and an UCNVA of 0.2 logMAR was measured. After 1 and 3 months postoperatively visual acuity further increased. Data were compared with long-term results of the Synchrony prototype with a follow-up of 7 years after surgery.

**Conclusions** The latest generation of the Synchrony lens showed excellent functional results and high patient satisfaction.

## REFRACTIVE CATARACT SURGERY

SUNDAY 12 JUNE

### Paper #146

**Precision of IOL refractive power adjustment of the Light Adjustable Lens (LAL) in post-refractive surgery patients.**

**Lawrence A. Brierley**

**Purpose** To determine whether using the postoperative refractive power adjustability of the Light Adjustable Lens would permit more accurate final refractive outcomes in patients who have undergone prior Lasik, PRK or Radial Keratotomy. Because of their altered corneal anatomy, eyes that have undergone these corneal refractive procedures are known to be the most difficult in which to achieve postoperative refractive targets using present biometry techniques.

**Study Design** Three patients presenting for cataract surgery with prior corneal refractive surgery were offered the option of having their surgery done with the Calhoun Light Adjustable Lens. This lens is presently being studied for safety and efficacy by the author as part of an international study for Health Canada. All post-refractive surgery patients who accepted to have the LAL and be enrolled in the main study were enrolled in this smaller study. None were excluded.

**Methods** At a minimum of two weeks postoperatively, patients were adjusted using the Light Delivery Device (LDD) to deliver spatially-resolved 365  $\mu$  UV light and thus alter the shape of the lens and the existing refractive error of the eye. Up to three such adjustments were performed, followed by two "lock in" treatments with the same device to polymerize any remaining free macromolecules and thereby make the final shape and refraction permanent. Final achieved refraction was then compared with the pre-adjustment target refraction. Mean absolute error of refractive outcome was then determined, as was mean residual cylinder.

**Results** In one eye the achieved postoperative refractive error was identical to the target (-1.25D). Another eye achieved +0.25/+0.25x120 (Spherical equivalent +0.37D) with a target of plano. Another achieved -2.00/+1.00x15 (SE -1.50) with a target of -1.00. The latter two eyes were in a patient having had PRK for -11D in each eye and with BCVA of 20/25 and 20/30- respectively due to post-PRK corneal pathology and possible myopic macular change. The mean absolute error for these 3 eyes was 0.29D and mean residual cylinder 0.41D.

**Conclusions** These results are much better than mean results for post-refractive surgery patients, however numbers are too small to draw any firm conclusion. We hope to have a larger sample to study by the time this paper is presented.

## RETINA-3

SUNDAY 12 JUNE

### Paper #147

#### The relationship between the onset of real world disability and visual acuity loss in diabetic retinopathy.

Kevin J. Warrian, Luciano L. Lorenzana, Dara Lankaranian, Jyoti Dugar, Sheryl S. Wizov, George L. Spaeth

**Purpose** To determine the level of visual acuity loss at which patients with diabetic retinopathy begin having significant impairment in the performance of activities of daily living.

**Study Design** Cross-sectional.

**Methods** 91 patients with diabetic retinopathy and 93 normal control subjects completed a range of clinical assessments including binocular and monocular Snellen visual acuity measurements, binocular Pelli-Robson contrast sensitivity, binocular Esterman and monocular 24-2 SITA Standard Humphrey visual fields, as well as the Assessment of Disability Related to Vision (ADREV) assessment of activities of daily living. (1) The ADREV performance-based instrument tests nine activities of daily living and has been previously validated in patients with diabetic retinopathy; however, the results of diabetic retinopathy patients on this assessment have not been compared to the performance of normal control subjects. (2) Receiver-Operator Curve (ROC) analysis was used to identify levels of actual disability when performing activities of daily living, as measured on the ADREV, that differentiated normal control subjects from patients with diabetic retinopathy. Analysis of covariance (ANCOVA) was then utilized to identify levels of binocular and monocular visual acuity loss that corresponded to the levels of actual disability identified using the aforementioned ADREV ROC analysis, while controlling for age, gender, ethnicity, total number of medical comorbidities and peripheral visual field impairment.

**Results** The average binocular Snellen visual acuity of diabetic retinopathy patients who had significant impairment in comparison to normal control subjects when performing 7 out of 9 ADREV activities of daily living was 20/50 (range 20/40 - 20/80). Diabetic retinopathy patients with binocular visual acuities as high as 20/40 (range 20/12 - 20/60) had significantly more impairment with respect to both facial expression recognition and locating objects in a room when compared to normal control subjects. Binocular visual acuity reductions shared the strongest relationship to disability when performing activities of daily living, followed by better eye visual acuity and finally worse eye visual acuity.

**Conclusions** Diabetic retinopathy patients with relatively limited binocular visual acuity loss have significant impairment in the performance of activities of daily living when compared to normal control subjects.

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## RETINA-3

SUNDAY 12 JUNE

### Paper #148

#### The effects of isoflurane and propofol anesthetics on retinal activity in an ex-vivo guinea pig model

Leah M. Wood, Francois Tremblay

**Purpose** To investigate the impact of isoflurane and propofol anesthesia on the retinal output of an ex-vivo guinea pig model using multielectrode array (MEA) technology

**Study Design** Ex-vivo experimental approach

**Methods** A dissected guinea pig retina was placed on an 8X8 MEA (30µm electrode diameter, 500µm spacing) and superfused with Ames medium while being maintained at 37 degrees Celsius. Long duration stimuli (LED 530nm, 500ms, 400 lux) were used to generate retinal ganglion cell (RGC) action potentials and ERGs. After baseline recordings, the retina was superfused with varying concentrations of isoflurane (0.13 (corresponding to 0.43 MAC) to 1.3mM) and propofol (5µg/ml to 1000µg/ml). Post-stimulus time histograms were generated by windowing RGC spiking activity. Spike counts of activity associated with ON and OFF stimuli as well as spontaneous activity of individual drug assays were determined using spike sorting software while ERG amplitude values were also recorded.

**Results** Isoflurane experiments revealed that at subclinical concentrations (<1MAC) isoflurane induced a non-significant reduction in the ON-associated RGC spiking activity and a significant reduction in the OFF-associated spiking activity. At clinical concentrations (1-2MAC) and greater (3-5MAC and >5MAC), both the ON and OFF spiking activity were reduced in a dose-dependent fashion. The amplitude of the ERG was also significantly reduced as the concentration of isoflurane was raised.

The introduction of varying concentrations of propofol to the retinal preparation revealed that at subclinical (5µg/ml) concentrations there was an increase of RGC spiking activity. At clinical (10µg/ml), 5 times clinical, and 10 times clinical concentrations there was no significant reduction in RGC spiking activity. It was not until a very high concentration of propofol (1000µg/ml) was introduced to the retina that a significant reduction of spiking activity was observed. The average ERG amplitude was not significantly reduced despite the introduction of increasing concentrations of propofol.

**Conclusions** It was determined that the retinal output, as measured by RGC activity, is selectively influenced by exposure to isoflurane even at subclinical doses. Propofol appears to have very limited effects on RGC activity and on ERGs which suggests that propofol is a more appropriate choice of anesthetic agent to use when evaluating the retinal activity. Recognition of these effects is imperative when investigating human and animal retina and cortex physiology under anesthesia.

## RETINA-3

SUNDAY 12 JUNE

### Paper #149

**Pathogenic effect of amyloid-beta on the retinal pigment epithelium and retina in an in vivo rat model.**

**R Tom Liu, Jing Z Cui, Idris Samad, Jack C. Chou, Joanne A Matsubara**

**Purpose** Age-related macular degeneration (AMD) is a leading cause of blindness among older adults in North America. The pathogenesis of AMD is not well-understood. Subretinal drusen has been implicated in retinal pigment epithelium (RPE) atrophy and choroidal neovascularization leading to photoreceptor degeneration. Amyloid-beta ( $A\beta$ ), a prominent factor in Alzheimer's disease, is found in drusen. Understanding the effect of  $A\beta$  may reveal molecular targets for primary preventative therapy. Studies on  $A\beta$  stimulation in human RPE culture have identified several candidate genes including those involved in inflammation, apoptosis and angiogenesis. This study aims to characterize the expression profile of those genes in the rat RPE and retina following  $A\beta$  stimulation in vivo.

**Study Design** Experimental animal study

**Methods** Six male five-month old Long-Evans rats were used. In each animal 5 $\mu$ L  $A\beta$ 1-40 (1.4  $\mu$ g/ $\mu$ L PBS) was injected intraocularly into the left eye and 5 $\mu$ L PBS into the right eye as control. Three rats were sacrificed 24 hours post-injection and the remaining three were sacrificed four days post-injection. Eyes were enucleated immediately after euthanasia. For each eye, total RNA was extracted from the RPE-choroid and retina separately. Real-time polymerase chain reaction was used to amplify the following genes: IL-1 $\beta$ , IL-6, TNF- $\alpha$ , iNOS, XAF1, TRAIL, RSAD2 and VEGF. Gene expression level in the  $A\beta$ -treatment samples was quantified relative to the PBS-controls via the  $\Delta\Delta$ CT method. Outcome between 24 hours and four days was compared.

**Results** Differential gene expression was observed in  $A\beta$ -treated RPE-choroid and retina compared to PBS-controls. In the 24 hour group, a mild increase in the mRNA of IL-1 $\beta$  (1.74 $\pm$ 0.12 fold, mean $\pm$ SE) and TNF- $\alpha$  (2.32 $\pm$ 0.18 fold) was observed in the RPE-choroid, and IL-6 (2.02 $\pm$ 0.29 fold) in the retina. Other inflammatory, apoptotic and angiogenic genes did not show meaningful ( $\geq$ 1.50 fold) changes in either tissue. In the four day group,  $A\beta$ -treated RPE-choroid showed a 5.06 $\pm$ 0.74 fold increase in IL-1 $\beta$  mRNA, 9.03 $\pm$ 0.61 fold in IL-6, 5.56 $\pm$ 0.76 fold in TNF- $\alpha$ , 5.26 $\pm$ 0.74 fold in iNOS, 4.38 $\pm$ 0.64 fold in XAF1, 3.22 $\pm$ 0.40 fold in TRAIL, and 3.58 $\pm$ 0.92 fold in RSAD2. In the retina, RSAD2 mRNA level decreased to 0.19 $\pm$ 0.10 fold of that in PBS-control. There was no marked elevation in other genes in the four day retina group.

**Conclusions**  $A\beta$  caused an acute rise in the expression of inflammatory cytokines in both RPE-choroid and retina of the rat within 24 hours. In four days, RPE-choroid expressed markedly higher levels of inflammatory and apoptotic genes but not angiogenic genes. Retina did not show significant increase in gene expression. This result supports the role of  $A\beta$  as an inflammation and apoptosis mediator in the RPE.



## RETINA-3

SUNDAY 12 JUNE

### Paper #150

#### Proton Beam therapy as an alternative to primary enucleation in larger (>6mm height) choroidal melanomas; does it compromise survival?

Suzannah R. Drummond, Elizabeth Macdonal, Marielena Gregory, Zoe Ockrim, Paul Cauchi, Ewan G. Kemp

**Purpose** Across Europe, choroidal melanomas up to 6mm height are treated predominantly with ruthenium106 plaque radiotherapy, which penetrates less deeply and creates less radiation side effects than Iodine plaque radiotherapy. Where Ruthenium plaques are used, debate continues regarding the optimal treatment for tumours over 6mm height with the predominant use of primary enucleation in the UK. Since 1994, our unit has utilised other methods, in particular proton beam therapy for tumours of greater size, resulting in lower enucleation rates.

**Study Design** The study was a retrospective audit looking at all treated tumours of greater than 6mm in height over a period from March 1993 to August 2009.

**Methods** All patients with tumours within the following parameters were identified using the Scottish Oncology Service database:

Medium+[M+]: height > 6mm -<=10, base <= 16mm

Large[L]: height > 10mm and or base > 16mm

Large+[L+]: height > 12mm

Size allocation was based on COMS criteria, medium+ being tumours in the medium category, of a size not adequately treatable with Ruthenium plaque.

Treatments and outcomes were identified from the case records. Mortality data was cross-referenced with death statistics from the Information Services Division Scotland (ISDS).

**Results** 158 tumours were treated over the time period (64M+, 75L and 19L+). 97(61%) received proton beam therapy (38M+, 58L, 1L+). Other modalities used were local resection +/-Ru106 plaque (14M+, 6L) and primary enucleation (12M+, 11L, 18L+). Secondary enucleation was required for 5(3%)M+ and 16(10%)L tumours. Mean time to secondary enucleation was 21 months (range 3-69 months). Primary enucleation rate was 26% overall, secondary enucleation 13% and total enucleation rates 39%. This remains low compared with published series.

Melanoma specific mortality was identified as 25%(M+), 10%(L) and 46%(L+) and 22% (combined).

Melanoma specific mortality for the L/L+ group (COMS large) was 21%. This represents a good outcome for this group compared to the literature (which quotes rates of 35-68%).

**Conclusions** The use of a multimodal approach, in particular proton beam therapy in tumours out with the treatable dimensions of a Ruthenium plaque is a safe and successful option, allowing greater eye preservation without compromising on mortality.

**RETINA-3**

**SUNDAY 12 JUNE**

**Paper #151**

**Surgical attenuation of radiation in the treatment of choroidal melanoma: report of a technique**

**Tara McCannel**

**Purpose** Although iodine-125 brachytherapy successfully achieves local tumor control, visual loss secondary to radiation affects most patients. Currently, no treatments for radiation vasculopathy are effective at saving vision. We have found that Silicone Oil 1000 cs attenuates iodine-125 by approximately 50% (Oliver et al, 2010). We report our technique of using iodine-125 brachytherapy in combination with vitrectomy and silicone oil in patients undergoing treatment for choroidal melanoma.

**Study Design** Report of a technique

**Methods** Vitrectomy surgery with silicone oil 1000 cs was performed immediately following iodine-125 plaque placement for local treatment of choroidal melanoma. After appropriate dose of radiation had been applied to the tumor, the plaque was removed and silicone oil was removed from the eye. Tumor response to treatment and surgical outcomes were evaluated.

**Results** The technique of iodine-125 brachytherapy and vitrectomy with silicone oil 1000 cs was technically feasible and expected tumor response to treatment was achieved.

**Conclusions** Iodine-125 brachytherapy and vitrectomy with silicone oil 1000 cs is a feasible strategy to potentially reduce radiation exposure to non-tumor tissue of eyes being treated for choroidal melanoma. Long-term clinical follow-up is warranted to evaluate effects of treatment including radiation attenuation on visual function.

**RETINA-3**

**SUNDAY 12 JUNE**

**Paper #152**

**Non-invasive multi-spectral fundus imaging is a useful tool for structural and functional evaluation of the choroidal vasculature**

**Brian Leonard, Alan Boate, Rick Clayton, Jeremy Gribben, Stuart Coupland, Bernard R. Hurley, Rejean Munger, Robert G. Devenyi**

**Purpose** To examine the structural and functional characteristics of the choroidal vasculature in a broad variety of pathologic conditions using non-invasive multi-spectral fundus imaging

**Study Design** observational case series

**Methods** Both eyes of 26 patients with posterior polar and mid-peripheral choroidal pathology were assessed with clinical examination, color fundus photography, spectral domain optical coherence tomography and fluorescein angiography. Multi-spectral fundus imaging was performed using a wavelength range of 450 nm to 850 nm with four million pixel spatial resolution through a 41 degree field, with images acquired by a polychromatic camera and processed with dedicated software

**Results** Multi-spectral imaging provided high resolution en face and stereo structural images slices through wavelength specific tissue depths, from vitreomacular interface to deep choroid, in a broad variety of choroidal disease. The choroidal vasculature and choroidal pathology were imaged clearly through retinal pigment epithelium. Tissue oxygenation mapping was imaged by software analysis of the ratio of oxygenated hemoglobin to deoxygenated hemoglobin in retinal and choroidal structures. Many of the diagnostic insights provided by this technology were not evident in clinical examination, spectral domain optical coherence tomography or fluorescein angiography.

**Conclusions** Multi-spectral fundus imaging may provide a non-invasive high resolution alternative to fluorescein angiography for imaging choroidal pathology

## RETINA-3

SUNDAY 12 JUNE

### Paper #153

#### Spectral domain optical coherence tomography of choroidal osteoma.

**Eduardo Navajas, Rogerio Costa, Hatem Krema, Rand E. Simpson, Filiberto Altomare**

**Purpose** To describe spectral domain optical coherence tomography (SD-OCT) findings in patients with choroidal osteoma.

**Study Design** Retrospective noncomparative case series.

**Methods** Four patients (4 eyes) with choroidal osteoma underwent complete ophthalmologic evaluation including best-corrected visual acuity (BCVA), slit lamp examination, funduscopy, fundus photography, fluorescein angiography (FA), ultrasonography and SD-OCT.

**Results** In the calcified portion of the tumour, SD-OCT revealed cavernous spaces and areas of pinpoint hyperreflectivity. In the decalcified portion of the tumour, SD-OCT revealed the apposition of an atrophic neurosensory retina to a high reflectivity structure with a lamellar configuration. It also demonstrated that large vessels seen in the fundus photos and FA were located within the tumour substance.

**Conclusions** This is the first study describing the SD-OCT findings in patients with choroidal osteoma.

## RETINA-3

SUNDAY 12 JUNE

### Paper #154

#### **Optical coherence tomography (OCT) correlation of chronic retinal changes on the surface of choroidal melanocytic lesions**

**Jose Efren Gonzalez Monroy, Hatem Krema, Sami Habal, Charles J. Pevlin, Rand E. Simpson**

**Purpose** Retinal greyish discoloration, clinically described as retinal pigment epithelium (RPE) metaplasia, is considered a sign of chronicity and a good prognostic factor. The objective here is to verify the nature of RPE metaplasia and evaluate other chronic retinal changes on the surface of choroidal melanocytic lesions using OCT

**Study Design** Retrospective case series analysis

**Methods** We reviewed 30 consecutive OCT images of chronic melanocytic lesions that were diagnosed to have RPE metaplasia, saved on the imaging database of our department. We tabulated the patients' clinical tumour characteristics, retinal changes on tumour surface, and surrounding tumour margins findings on OCT. We matched the greyish discoloration noticeable on ophthalmoscopy to the actual morphological changes noticed on OCT

**Results** 30 eyes we evaluated, morphological changes at the level of the RPE-photoreceptor layer was demonstrated in 25 eyes. Thickening of the RPE layer, disruption of the photoreceptor layer and intraretinal disruption of the normal anatomy with intraretinal cyst formation was noted. In 5 eyes thinning of the retina was the main finding

**Conclusions** OCT is helpful in evaluating the anatomy of the retina over choroidal lesions. Thickening of the RPE-Photoreceptor layer was found in 25 eyes (83.33%) of patients. 5 eyes (16.66%) with retinal thinning may be related to retinal atrophy. Greyish discoloration of the retina may represent changes on the retinal layer itself instead of metaplasia of the RPE