RESIDENT/FELLOW

RESEARCH DAY

May 17, 2002

DEPARTMENT OF OPHTHALMOLOGY AND VISUAL SCIENCES

UNIVERSITY OF IOWA ROY J. AND LUCILLE A. CARVER COLLEGE OF MEDICINE

UNIVERSITY OF IOWA HOSPITALS & CLINICS

IOWA CITY, IOWA

Braley Auditorium
01136 Lower Level
Pomerantz Family Pavilion
1:00 PM – 5:00 PM

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DEPARTMENT OF OPHTHALMOLOGY

PROFESSOR AND HEAD
Thomas A. Weingeist, Ph.D., M.D.

PROFESSORS EMERITUS
G. Frank Judisch, M.D.
Sohan S. Hayreh, M.D., Ph.D., D.Sc.
Hansjoerg E. Kolder, M.D., Ph.D.
Karl C. Ossoinig, M.D.
Edward S. Perkins, M.D., Ph.D.
H. Stanley Thompson, M.D.

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E. Lee Allen

PROFESSORS
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Keith D. Carter, M.D.
James C. Folk, M.D.
Gregory S. Hageman, Ph.D.
Ronald V. Keech, M.D.
Jeffrey A. Nerad, M.D.
William E. Scott, M.D.
Edwin M. Stone, M.D., Ph.D.
John E. Sutphin, Jr., M.D.
Michael D. Wagoner, M.D.
Michael Wall, M.D.

ASSOCIATE PROFESSORS
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A. Timothy Johnson, M.D., Ph.D.
Andrew G. Lee, M.D.
Randy H. Kardon, M.D., Ph.D.
Thomas A. Oetting, M.D.
Stephen R. Russell, M.D.
Mark E. Wilkinson, O.D.

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Hilary A. Beaver, M.D.
Sara L. Butterworth, O.D.
Ayad A. Farjo, M.D.
Karen M. Gehrs, M.D.
Brian R. Kirschling, O.D.
Young H. Kwon, M.D., Ph.D.
Andrew J. Lotery, M.D., FRCOphth
Robert F. Mullins, Ph.D.
Christine W. Sindt, O.D.

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Puwat Charukamnoetkanok, M.D.
Emily C. Greenlee, M.D.
Scott A. Larson, M.D.
Rahul T. Pandit, M.D.
David B. Petersen, M.D.

SECOND-YEAR RESIDENTS

Michael A. Grassi, M.D.
Michael G. Hunt, M.D.
John W. Kitchens, M.D.
Susan J. Quick, M.D.
Russell B. Warner, M.D.

FIRST-YEAR RESIDENTS

William J. Dupps, M.D., Ph.D.
John F. Fingert, M.D., Ph.D.
Erin L. Holloman, M.D.
Jennifer J. Lee, M.D.
Judy C. Liu, M.D.

ORTHOPTIC STUDENTS

Keith M. Wilken

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FELLOWS

CORNEA
Gregory I. Halperin, M.D.

GLAUCOMA
Edward P. Langlow, M.D.

NEURO-OPHTHALMOLOGY
Fiona E. Costello, M.D.
Julie Falardeau, M.D.

OCULOPLASTICS
Junhee Lee, M.D.

PEDIATRIC OPHTHALMOLOGY
Kenneth M. Gainer, M.D.
Deborah L. Klimek, M.D.

VITREORETINAL DISEASE
Sharam Danesh, M.D.
Calvin A. Grant, M.D.
Denise L. Kayser, M.D.
Karin R. Sletten, M.D.

VISITING RESEARCH FELLOWS
Oliver Bergamin, M.D.
Young I. Kim, M.D.
Mary Lucy Pereira, M.D.

RESIDENT/FELLOW RESEARCH DAY - 2002

SCHEDULE OF EVENTS
Friday, May 17, 2002

Morning Presentations

Afternoon, Friday, May 17, 2002

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SCHEDULE OF EVENTS
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Friday, May 17, 2002

To Be Presented at Morning Rounds

RESIDENT/FELLOW RESEARCH DAY - 2002

SCHEDULE OF EVENTS

Manuscripts Submitted

Manuscripts To Be Submitted

Puwat Charukamnoetkanok, MD, Dr. Michael Wagoner sponsor
Chemical Injuries Occurring in Manufacturing Accidents During Methamphetamine Production

David B. Petersen, MD, Drs. John Sutphin, Ayad Farjo & Michael Wagoner sponsors
Cataract Extraction Performed Before, Simultaneously, or After Penetrating Keratoplasty in Eyes with Fuchs' Dystrophy: Graft Survival and Refractive Outcome

Posterior Corneal Elevation in Keratoconus, Keratoconus Suspects, and Normals

Judy Liu, Ayad Farjo

Purpose: Keratoconus is characterized by non-inflammatory stromal thinning and anterior protrusion of the cornea. Patients with this disorder are poor candidates for refractive surgery because of the possibility of exacerbating keratectasia. The diagnosis of keratoconus is a clinical one and early disease can be difficult to detect on examination. Scanning-slit videokeratography has become a useful tool for evaluating the disease, and with the advent of its use, abnormalities in posterior corneal surface topography have been identified with keratoconus. Posterior corneal surface data is problematic because it is not a direct measure and there is little published information on normal values for each age group. In the patient with increased posterior corneal elevation in the absence of other changes, it is unknown whether this finding represents a manifestation of early keratoconus. The decision to proceed with refractive surgery is therefore difficult. The purpose of this study is twofold: (1) to quantitatively evaluate posterior elevation in keratoconus patients and suspects and compare it with that of normal subjects and (2) to establish a normative range of posterior elevation for the various age groups at the University of Iowa Hospitals and Clinics.

Methods: This will be a case-control and observational study. The following patient groups will be recruited: known keratoconus requiring penetrating keratoplasty, keratoconus with contact lens correction but not requiring penetrating keratoplasty, keratoconus suspects, normals (with a subgroup with high corneal K readings). Posterior surface topography will be obtained using OrbScan (scanning-slit videokeratography) Data will be compared between the keratoconus and control groups. Results will be statistically analyzed.

Results: Pending

Conclusion: The results of this study will be useful in determining if high posterior corneal elevation represents early keratoconus or a variant of normal. Perhaps high posterior elevation may represent a computation artifact and not necessarily keratoconus. This information will be helpful clinically in making the decision whether or not to proceed with refractive surgery in those patients with unusual posterior corneal topography.

Identification of an OPA1 mutation in a large dominant optic atrophy family and screening glaucoma patients for disease-causing OPA1 mutations

JH Fingert[1], L Affatigato[1], WLM Alward[1], VC Sheffield[1,2], EM Stone[1]
[1]University of Iowa College of Medicine, [2]Howard Hughes Medical Institute

Purpose: Dominant optic atrophy (DOA) is a degenerative disease of the optic nerve with autosomal dominant inheritance which causes decreased visual acuity in early childhood. Recently, the disease-causing gene for this disorder (OPA1) was identified. In this study, a large pedigree affected with a severe form of DOA was screened for the presence of disease-causing mutations in the OPA1 gene. Additionally, the hypothesis that some fraction of open angle glaucoma may be allelic to DOA was explored. One subset of OPA1 mutations might be associated with glaucoma while another subset is associated with DOA.

Subjects: Fifty-six members of a DOA pedigree were studied. Most affected members of this family experienced visual loss (20/40 or poorer) in the first decade of life and most (9/16 eyes) progressed to 20/800 or poorer vision by age 60. Twenty-seven clinically affected family members; 5 obligate carriers; 26 siblings; and 9 spouses were included in this study. A panel of 266 glaucoma patients (92 POAG, 92 NTG and 82 JOAG) as well as 92 control patients were also screened for OPA1 mutations.

Methods: DNA was prepared from the blood of study subjects and screened for mutations in the coding sequence of the OPA1 gene using SSCP analysis. Automated sequencing was used to identify the sequence variations detected by SSCP analysis.

Results: Two sequence variations, LEU396ARG and ALA536ALA were identified in the proband of the DOA pedigree. The LEU396ARG mutation was identified in all twenty-seven affected family members as well as in all five obligate carriers. The LEU396ARG mutation was not identified in any control subjects. The overall penetrance of the LEU396ARG mutation in this family was 77%. Mutation screening of the glaucoma populations is partially completed and several OPA1 variations have been identified.

Conclusions: A novel OPA1 mutation (LEU396ARG) associated with a severe phenotype of DOA. Completion of the mutation screening will clarify the significance of OPA1 sequence variations in glaucoma patients.

Stromal Collagen Crosslinking and Experimental Suppression of Central Islands in Excimer Laser Keratectomy

W. J. Dupps, Jr.,[1] C. Roberts.[2]
[1]Department of Ophthalmology & Visual Sciences, University of Iowa, Iowa City, IA; [2]Department of Ophthalmology and Biomedical Engineering Center, The Ohio State University, Columbus, OH

Purpose: To investigate potential mechanisms of central island generation in broad-beam refractive surgery by assessing the effect of preoperative stromal collagen crosslinking on central island formation.

Methods: A glutaraldehyde-based crosslinking reagent was applied preoperatively to the deepithelialized corneas of ten human donor globes to induce stromal collagen crosslinking. Same-donor controls were exposed only to solvent. All corneas underwent sham ablation followed by phototherapeutic keratectomy (5-mm diameter, ~100-um depth). Finally, saline was used as a hypotonic stimulus in postoperative swelling experiments to confirm effective stromal crosslinking. Triplicate stromal thickness and curvature measurements were acquired with an Orbscan scanning-slit topography system (v. 2.10B) before and after each experimental phase. Central islands were measured by subtraction of vertical meridian pachometry maps and described in terms of amplitude, width and decentration.

Results: Crosslinking was confirmed by the nearly complete suppression of stromal thickening in GTA-treated corneas during postoperative swelling experiments. Intraoperative thickness changes consistent with central island formation were detected in all non-crosslinked controls (amplitude = 15 ± 9 um (mean $\pm$ sd), width = 2.26 ± 0.37 mm and decentration = 0.07 ± 0.16 mm) and in only 50% of crosslinked corneas (amplitude = 1 ± 1 um, width = 0.77 ± 0.82 mm and decentration = 0.06 ± 0.09 mm). Sham ablations in crosslinked and control corneas did not produce central islands.

Conclusion: Preoperative collagen crosslink induction significantly decreased the incidence, amplitude ($p = .002$) and diameter ($p < .001$) of central islands in a donor model of keratectomy without alteration of the ablation algorithm. Central island formation is dependent upon the biomechanical state of the corneal stroma, and a better understanding of the relationship between stromal biomechanics and hydration may be important in the optimization of broad-beam photoablation algorithms.

A Modification of the Cutler-Beard Procedure Utilizing Donor Achilles Tendon for Upper Eyelid Reconstruction

Erin L. Holloman, M.D., John W. Kitchens, M.D., Keith D. Carter, M.D.

Purpose: Upper eyelid defects present challenges for ophthalmic reconstructive surgeons. The upper lid is a complex structure that must maintain its stability and motility for optimal function and cosmesis. Traditionally, large defects have been repaired by the two stage Cutler-Beard procedure. The first stage advancement flap only transplants soft tissue without tarsus. Without this tarsal stability, post procedure entropion and lid shrinkage have most frequently been described. Through the years, surgeons have tried many different substances to lend support to the new upper eyelid, some with complications. Currently, autogenous cartilage is most frequently used. We propose using donor Achilles tendon for increased stability of the upper lid when repairing large defects by the Cutler-Beard procedure.

Methods: A modified version of the Cutler-Beard procedure utilizing donor Achilles tendon as tarsal replacement was performed in four patients with large upper eyelid defects.

Results: Patients were examined in follow up and all cases were successful in recreating the upper eyelid. None developed infection or dehiscence. No secondary ptosis, retraction, or lid malposition have been found.

Conclusions: The replacement of upper eyelid tarsal stability with Achilles tendon as part of the Cutler-Beard procedure was successful in repairing four patients with large upper lid defects. The tendon graft is easily placed and incorporated into the normal lid anatomy. The tissue is readily available from most tissue banks. The modification produced excellent functional and cosmetic results without complications.

Wavefront and Orbscan analysis of a soft contact lens designed to mimic post-myopic LASIK optical properties

Jennifer Lee, Ayad Farjo, Christine Sindt

Purpose: The correction of myopia with excimer laser-based keratorefractive procedures, such as photorefractive keratectomy (PRK) and laser in situ keratomilieusis (LASIK), has become commonplace in the United States and around the world. A complication of these procedures is the development of halos around point sources of light. We hypothesize that these halos are caused by a multifocal epiphenomenon at the edge of the excimer laser ablation, in conjunction with patient-specific factors such as depth of ablation and pupil size. As there is also significant subjective interplay in the severity of this complication, it is difficult to predict pre-operatively which patients will be bothered by the halo effect.

Methods: Using existing topographic information of pre- and post-myopic LASIK, our goal is to design a soft contact lens that mimics post-operative anatomic and optical properties. If designed appropriately, the contact lens may be predictive of the halo effect post-operatively and may help patients judge its significance prior to proceeding with myopic excimer-laser based keratorefractive surgery. We will then complete a prospective case series from a tertiary ophthalmic center. Investigators will fit pre-myopic LASIK patients with the contact lens and determine if the contact lens simulates their post-operative anatomic and optical properties.

Surgical Induction of Chorioretinal Anastomosis in the Rabbit Model

Calvin A. Grant, M.D., James C. Folk, M.D.

Background: Central retinal vein occlusion is a major cause of visual loss in the elderly. Early visual loss may result from ischemia and edema of the retina. Presently, there are no widely clinically accepted treatments aimed at bypassing the venous obstruction.

Purpose: To evaluate the surgical induction of chorioretinal anastomosis in the rabbit model.

Methods: Twelve experimental animals were placed under general anesthesia. A long 25 gauge needle on a 3 cc syringe was inserted through the pars plana. The needle punctured a vein, neural retina, and choroid. The instrument was withdrawn. The anastomosis site matured for 45 days. Fundus photography, fluorescein angiography, and histology were performed.

Results: Chorioretinal anastomses were induced in a significant percentage of eyes with adequately deep surgical wounds. There were no significant hemorrhage, late neovascularization, or other complications with our methodology.

Comparison of Digital to Film-based Fundus Fluorescein Angiography

Russell B. Warner, M.D., Stephen R. Russell, M.D.

Objective: To simultaneously obtain digital and 35-mm film fundus images using a beam splitter. Digital to film fundus fluorescein angiographs are compared for resolution and contrast using a forced choice methodology.

Methods: Digital cameras are widely used to obtain fundus photographs. To date there has been little data indicating equivalence or advantages in digital imaging in evaluating fundus disorders compared to conventional film images. We have incorporated a beam splitter in the recording optical path of a fundus camera to simultaneously record digital and film based images. The spectral integrity of the device was evaluated by imaging a diffuser bowl illuminated by a halogen source. Quantitative measurement of the spectral transmission was performed for each output of the beam splitter.

IRB approval was obtained to use fundus images of patients seen at the University of Iowa Hospital and Clinics. Photograph images are recorded using standard film and flash settings utilizing a Nikon 35-mm camera and an Escalon 12-bit digital camera. Digital images (640 x 866 pixels) will be stored in 12-bit resolution (4096 gray levels). 12-bit digital images will be transferred to 35 mm film media and compared to direct film images using a forced choice method. Film images will be digitized at 16-bit contrast, quantitatively compared to direct 12-bit images and qualitatively compared using a forced choice method.

Results: Spectral throughput analysis was performed on the beam splitter assembled by the Kestrel Corporation (Albuquerque, NM) to test the transmittance of halogen light through the beam splitter. There was a 27% radiance transmitted through port number one compared to 68% radiance transmitted through port number two with 5% loss of light intensity. The division of light was successful at each wavelength of light with no null points of lost transmission.

Conclusion: The beam splitter reliably divides light at each wavelength in a 70/30 ratio with no null points of lost transmission. We will show that images can be reliably obtained using the beam splitter and that the images obtained are not detectable different from images obtained separately without a beam splitter. Once we show that images can reliably be obtained using the beam splitter, we plan to compare the accuracy of detecting subtle retinal lesions using digital compared to film based images.

Ametropic Amblyopia Due to High Hyperopia in Children

Deborah L. Klimek, M.D.[1,2]; Oscar A. Cruz, M.D.[1]; William E. Scott, M.D.[2], Bradley V. Davitt, M.D.[1]
[1] Departments of Ophthalmology and Pediatrics, Saint Louis University School of Medicine, St. Louis, Missouri.
[2] Department of Ophthalmology, University of Iowa, Iowa City, Iowa

Purpose: To identify children with isoametropic amblyopia due to moderate to high hyperopia and evaluate associated findings and visual acuity outcome.

Methods: Charts from two university's pediatric ophthalmology clinics were reviewed. Healthy children with ≥+4.5D spherical equivalent who did not have anisometropia ≥1.5D were selected for data collection. The charts of qualifying children with bilateral amblyopia (visual acuity of 20/40 or worse) were further analyzed.

Results: 418 children were identified with the above set of criteria for hyperopia and 36 of these children had isoametropic amblyopia (bilateral amblyopia). This gives an estimated prevalence of isoametropic amblyopia of 8.6% in children with at least 4.5D of hyperopia. The children with isoametropic amblyopia presented at a later age (5 years, 1 month) than the overall group of hyperopes. Strabismus was less prevalent in this group than in the entire population of children with high hyperopia. These children's amblyopia responded well to treatment with glasses, and patching in some cases. Surgical intervention for residual strabismus was necessary in very few cases.

Conclusion: Hyperopia is the most common refractive error in children. Children with hyperopia ≥4.5D have an increased risk of amblyopia and strabismus that further threatens their future visual function. Isoametropic amblyopia is a real risk in these children and is often detected at a later age. Based on these results, hyperopic correction should be prescribed for children with ≥4.0D of hyperopia to reduce this risk. Our practice is to prescribe glasses for 4.0D or greater of hyperopia in all children by 1 year of age. Children with 3.0 to 4.0D of hyperopia are re-examined in 6 months to determine if their hyperopia is increasing or decreasing. If the hyperopia is increasing, then glasses are prescribed. If the hyperopia is decreasing we follow them until it is less than 3.0 D. Screening programs should also be in place to identify these children at an early age.

Intraocular Steroids for the Complications of Posterior Uveitis

J.W. Kitchens[1], K.T. Oh[2], H.C. Boldt[1], J.C. Folk[1].
[1]Ophthalmology, University of Iowa, Iowa City, IA; [2]Ophthalmology, University of North Carolina, Chapel Hill, NC.

Purpose: To report the results of a series of patients who were treated with intravitreal steroids for the complications of posterior uveitis.

Methods: Retrospective descriptive case series. Six patients with posterior uveitis from various etiologies underwent at least one intravitreal treatment with either 4 mg triamcinolone acetonide or 500 mcg dexamethasone. Diagnoses included multifocal choroiditis, panuveitis and diffuse subretinal fibrosis (3), serpiginous choroidopathy (1), sympathetic ophthalmia (1), and phacoantigenic uveitis (1). In three cases, recurrent inflammation was noted prior to treatment despite maximal medical therapy with systemic and sub-Tenon's steroids and immunosuppressive agents.

Results: Follow-up ranged from three to nine months (median: six months) following treatment. Five patients received intravitreal triamcinolone acetonide and one received intravitreal dexamethasone. Three of the six patients underwent multiple injections. Two patients demonstrated choroidal neovascularization associated with the uveitis while the remaining four demonstrated inflammatory changes secondary to their active uveitis. Improvement in inflammation and/or reduction of the choroidal neovascular membrane was observed in all six of the patients following treatment. Visual improvement was observed in five patients. Four of the six patients developed mild ocular hypertension.

Conclusion: Intravitreal steroids provide an effective alternative in the management of patients with posterior uveitis.

Visual Outcome in Aggressively Patched Eyes in Cases of Unilateral Infantile Cataract or Unilateral PHPV

Susan J. Quick, M.D., Mark E. Wilkinson, O.D.

Purpose: To determine if the normal eye of patients with unilateral infantile cataract or PHPV has more myopic progression compared to age-matched controls or has evidence of occlusion amblyopia after aggressive patching.

Methods: A retrospective chart review will select patients with unilateral infantile cataract or PHPV. Other eye diseases or a history of trauma are excluded.

Results: Type of patching, compliance, age at start of patching, and duration of patching will be compared. Vision and refraction of both the normal and abnormal eyes will be compared.

Conclusions: Pending conclusion of this study.

Natural history of patients with Stargardt-Like Dominant Macular Dystrophy associated with recently described ELOVL4 mutations

D.L. Kayser, J.L. Andorf, C.M. Taylor, H.L. Haines, E.M. Stone

Purpose: To determine the natural history of patients with ELOVL4-associated Stargardt-Like Dominant Macular Dystrophy.

Background: In 1988, we examined a thirty-two member family affected with a condition that ultimately became known as Stargardt-Like Dominant Macular Dystrophy (SLDMD). In 1994, chromosome linkage analysis of this family revealed the disease-causing gene to be located on the long arm of chromosome 6. In 2001, Zhang and co-workers showed that this phenotype is caused by a 5 base-pair deletion in the ELOVL4 gene.

Methods: We re-examined nine of the original family members and one newly diagnosed child to document the natural history of the disease over the thirteen years since the family was first examined. The ELOVL4 gene was screened to confirm the presence of the previously reported 5 base-pair deletion in all affected individuals.

Results: Fundus examination in the nine follow-up patients revealed enlargement of their central atrophic lesions and an increase in the number of flecks in the macula. The majority of patients over the age of 20 had visual acuities of 20/200 or less. The newly diagnosed 11 year-old patient had best corrected visual acuities of 20/180 OD and 20/150 OS. However, his 62 year-old molecularly affected grandfather had 20/25 vision OU and his 34 year-old mother had acuities of 20/65 OD and 20/63 OS.

Conclusion: The natural history of the 5 base-pair mutation in the ELOVL4 gene is early central vision loss followed by progressive enlargement of the zone of macular atrophy and progressive fleck deposition. However, a few patients demonstrate significantly fewer funduscopic abnormalities and better visual acuity suggesting that variations in one or more other genes may be able to modify the phenotypic expression of this mutation.

A Review of Intraocular Lens Implantation in the Pediatric Population at the University of Iowa

Kenneth M. Gainer, M.D., Ronald V. Keech, M.D.

Purpose: A retrospective analysis of intraocular lens implantation following cataract extraction at the University of Iowa.

Methods: A retrospective chart review and analysis of all cases of intraocular lens implantation following cataract extraction within the pediatric population at the University of Iowa was performed. The type of cataract, etiology, duration, laterality, pre- and post-operative BCVA, pre- and post-operative refractive errors, predicted refractive error, implant calculation method, type of implant, surgical method, type of posterior capsulotomy, rate of posterior capsular opacification (PCO) and subsequent need for YAG capsulotomy was determined.

Prognostic value of the Retinal Nerve Fiber Layer in patients with Compressive Optic Neuropathy

Julie Falardeau, M.D., Randy Kardon, M.D., Ph.D, Susan Anderson, B.S., Andrew Lee, M.D., Michael Wall, M.D.

Background: Other than the degree of pallor of the optic nerve, currently there are no means available to assess visual prognosis in patients with compressive optic neuropathy who are being evaluated for treatment. The number of viable ganglion cells is likely to be related to the thickness of the retinal nerve fiber layer and could be used to assess the reversibility of compressive visual field loss.

Purpose: To assess the prognostic value of optical coherence tomography (OCT) of the retinal nerve fiber layer in predicting visual recovery in patients with compressive optic neuropathy and visual field loss.

Methods: 18 eyes (14 patients) with compressive optic neuropathy from Graves orbitopathy (6), optic nerve sheath meningioma (4), pituitary adenoma (6), cavernous sinus meningioma (1) and ophthalmic artery aneurysm (1) were evaluated by OCT and visual field testing (Humphrey SITA 24-2) before and after treatment (surgery or radiation). The average retinal nerve fiber layer thickness was compared in eyes that improved in mean deviation after treatment with those that did not.

Results: A significant correlation was found between the average thickness of the retinal nerve fiber layer and the post-treatment mean deviation of the Humphrey visual field ($R = 0.96$). No significant correlation was found between the average retinal nerve fiber layer thickness and the pre-treatment mean deviation.

Conclusion: Measurement of the retinal nerve fiber layer thickness by Optical Coherence Tomography provides a new means of assessing the reversibility of visual loss and prognosis in compressive optic neuropathy.

Characterstics and Course of Patients with Deteriorated Monofixation Syndrome

Michael G. Hunt, M.D., Ronald V. Keech, M.D.

Background: Monofixation syndrome is characterized by small angle strabismus with vergence fusional amplitudes and "peripheral fusion". Although it is considered a relatively stable condition, some patients with this syndrome deteriorate resulting in an increasing tropia and diplopia. Deteriorated monofixation syndrome is well known among clinicians, however, there are no studies describing the course and outcomes for these patients.

Purpose: To assess the clinical characteristics and course of patients with monofixation syndrome who deteriorate, including their response to treatment.

Methods: We will identify all patients from our database with deteriorated monofixation syndrome. From this group we will assess patient demographics, clinical characteristics, clinical course and response to therapy.

Results and Conclusion: Pending.

Early Central Vision Loss In Glaucoma

Edward P. Langlow, M.D., Young H. Kwon, M.D.,Ph.D., Wallace L. M. Alward, M.D.

Background: Visual acuity loss is usually, but not always, a late finding in glaucoma. In some patients, the central vision is lost with relatively intact peripheral visual fields remaining.

Purpose: To present a case series of open-angle glaucoma patients presenting with relatively early loss of visual acuity.

Methods: A retrospective case series was reviewed on patients with open angle glaucoma. The clinical characteristics of the visual losses and the visual fields were evaluated.

Results: Full qualification of the study results is pending.

Longitudinal, Quantitative Analysis of Cup-to-Disc Ratio in Primary Open-Angle Glaucoma

Kim YI, Pereira MLM, Zimmerman MB, Montague PR, Alward WLM, Kwon YH

Purpose: To longitudinally evaluate cup-to-disc ratio in treated patients with primary open-angle glaucoma (POAG).

Methods: Fifty one eyes of 51 treated POAG patients with a minimum of 10-year longitudinal series of stereoscopic optic disc photographs were studied. Eyes with any other ocular disease except for mild cataract were excluded. Each set of stereoscopic photographs was digitized and viewed stereoscopically on computer screen using a hand-held stereoscope (Screen-VU, Portland, OR). Computer-assisted planimetry was performed on each set of photographs with examiner-defined cup and disc margins, using custom-made software. The software computed linear cup-to-disc ratios (LCDR) for the entire disc as well as 4 disc quadrants. Both inter-rater (3 raters) and intra-rater variabilities were evaluated in a masked fashion, using intra-class correlation. Changes in LCDR were estimated using linear regression over time.

Results: We studied 20 men, 51 Caucasians. The mean age at the beginning of the study was 61.6 ± 7.78 years (range, 46 to 81 years). The mean follow-up period was 14.3 ± 3.54 years (range, 9.58 to 22.33 years and median, 13.92 years). Total number of each photographs were 173 (3.4 ± 1.3 per patient). The initial and final LCDRs were 0.63 ± 0.15 and 0.73 ± 0.14 respectively. The intra-rater and inter-rater intraclass correlations were 0.97 (95% CI: 0.94-0.98) and 0.76 (95% CI: 0.61-0.87). Using linear regression the rate of LCDR change was +0.007 ± 0.006 per year. The rates of LCDR change in the 4 disc quadrants were 0.006 ± 0.008 (SN), 0.005 ± 0.007 (ST), 0.007 ± 0.011 (IN), and 0.008 ± 0.010 (IT) per year.

Conclusions: The intra-rater variability was very good (0.97) while inter-rater variability was moderate (0.76). In patients treated for POAG, the rate of progressive cupping was slow (LCDR of +0.007 per year).

Salzmann's Nodular Degeneration: Clinical Presentations and Course

Gregory I. Halperin, M.D., Ayad A. Farjo, M.D., John E. Sutphin, M.D., Michael D. Wagoner, M.D.

Purpose: Salzmann's nodular degeneration of the cornea may be associated with ocular discomfort secondary to recurrent epithelial erosions or epitheliopathy or impaired vision secondary to induction of irregular astigmatism. It may occur as a result of chronic environmental exposure, contact lens wear, or idiopathically. We will retrospectively review all cases of Salzmann's nodular degeneration presenting to the Cornea and External Disease Division of the Department of Ophthalmology and Visual Sciences between January 1, 1999 and December 31, 2001 with the intention of identifying risk factors for development of this disorder, initial clinical findings and their subsequent progression, and therapeutic outcomes with the medical and surgical intervention.

Methods: Retrospective chart review based on diagnosis code

Results: Pending

Conclusion: Salzmann's nodular degeneration is an under-recognized, treatable cause of visual symptoms. Elucidation of risk factors, classification, clinical features, and effective treatments could greatly improve clinician recognition of this disorder as well as improve current treatment strategies.

Outcomes of Photodynamic Therapy for Subfoveal Choroidal Neovascularization at One Year

Karin R. Sletten, M.D., Stephen R. Russell, M.D., James C. Folk, M.D., Karen M. Gehrs, M.D., H. Culver Boldt, M.D., Edwin M. Stone, M.D., Ph.D., Andrew Lotery, M.D., Thomas A. Weingeist, Ph.D., M.D.

Background: Photodynamic therapy (PDT) with verteporfin (Visudyne) is a new treatment for choroidal neovascularization due to age related macular degeneration (AMD), pathologic myopia, presumed ocular histoplasmosis syndrome (POHS) and other diseases. PDT utilizes a light activated drug, verteporfin, to create free radicals within the choroidal neovascular complex, causing thrombosis and collapse of the complex. Prior randomized controlled trials have shown that PDT with Visudyne may offer a benefit to patients with choroidal neovascularization due to AMD, POHS or pathologic myopia by decreasing or stopping the rate of vision loss by causing thrombosis and collapse of the neovascular complex, with a low complication rate.

Purpose and Methods: We propose to retrospectively analyze our results of PDT with Visudyne during the first year of its availability. Data analyzed will include visual acuity at each follow up visit, fluorescein angiographic appearance of the choroidal neovascular complex at each visit, number of treatments during the one year and complications following treatment. This will give the ophthalmic community important information about the utility of this treatment when used outside of the study setting.

Evidence for Axon Loss in the Retinal Nerve Fiber Layer in Patients with Recovered Optic Neuritis

Fiona Costello, M.D., Randy Kardon, M.D., Ph.D., Mary Lucy Pereira, M.D., Andrew Lee, M.D., Julie Falardeau, M.D., and Michael Wall, M.D.

Purpose: To assess the prevalence of retinal ganglion cell loss in patients with previous optic neuritis and to correlate this with visual field loss at the time of presentation sensitivity.

Methods: 14 patients with previous optic neuritis were studied at least 4 months following the acute event (range 4 - 164 months). Optical Coherence Tomography (OCT) was performed on both eyes using a 1.73mm radius circular scan of the peripapillary retina (retina surrounding the optic nerve head) and the retinal nerve fiber layer thickness was determined. Each patient also had visual field testing performed (Humphrey automated threshold test 24-2 and/or Goldmann kinetic perimetry) and a neuro-ophthalmologic evaluation. Information was also recorded about the acute event, neurologic status, and cranial Magnetic Resonance imaging.

Results: 13 of the 14 patients with recovered optic neuritis showed some degree of thinning of the retinal nerve fiber layer compared to the normal fellow eye or compared to normal subjects. In 9 patients, there was loss of greater than 15 microns in the nerve fiber layer thickness of the affected eye, as compared to the fellow (unaffected) eye. These patients tended to have worse visual field function at presentation, as compared to individuals who showed less than 15 microns difference in the retinal nerve fiber layer between the affected and the unaffected eye.

Conclusions: Axon loss in the retinal nerve fiber layer was common in the patients studied who had recovered optic neuritis. The degree of axon loss was correlated with the severity of the initial visual field loss.

Role of Hereditary Thrombophilia in the Pathogenesis of Central Retinal Vein Occlusion

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Background: Central retinal vein occlusion (CRVO) is due to thrombosis of the central retinal vein. Both the factor V Leiden and the prothrombin G20210A mutations have been associated with an increased risk for venous thromboembolism. Combined these mutations have been identified in over 5% of the general population. It is controversial as to whether these factors predispose to CRVO and under what circumstances they should be tested.

Purpose: The purpose of this study is to investigate the prevalence of the factor V Leiden and prothrombin G20210A mutations in the largest yet assembled cohort of patients diagnosed with CRVO.

Methods: A prospective study will be conducted of all of the patients that have been diagnosed in the Ocular Vascular Clinic at the University of Iowa Hospitals with CRVO.

A multiplex polymerase chain reaction for the factor V Leiden and prothrombin G20210A mutations will be performed on a cheek swab sample collected from each patient as well as an age and sex matched control.

Results: We will analyze the prevalence of the factor V Leiden and prothrombin G20210A mutations in patients with CRVO as compared to control subjects. In addition, subgroup analysis will be performed for 1) personal or family history of thrombotic events and 2) age less than 45 at time of diagnosis.

Velocity of Levator Palpebrae Superioris in Involutional Blepharoptosis

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Purpose: To evaluate the movement parameters of the levator palpebrae superioris in cases of involutional blepharoptosis.

Methods: An infrared camera with a 1000 Hertz sampling rate was used to trace the time course of pupil occlusion by the upper eyelid during blinks. This allowed calculation of velocity and acceleration of the eyelid margin as it traveled over the pupil. A 60 Hertz video camera was used to record the movement characteristics of the upper eyelid during maximal excursions from downgaze to upgaze. Eyelids with involutional blepharoptosis were compared to age-matched control eyelids, and/or normal eyelids of opposite eyes.

Results: Data obtained by 60 Hz video camera indicated a significant slowing of upward eyelid excursion in patients with involutional blepharoptosis. Data obtained by 1000 Hz infrared camera also demonstrated slowing of the up-phase of spontaneous blinks in ptotic patients, although the data did not show statistical significance.

Conclusions: Although generally regarded as a disinsertion or stretching of the attachments of the levator palpebrae superioris to the tarsus, involutional blepharoptosis may have a significant contribution from actual muscular weakening.

Cataract Extraction Performed Before, Simultaneously, or After Penetrating Keratoplasty in Eyes with Fuchs' Dystrophy: Graft Survival and Refractive Outcome

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Purpose: To determine graft survival and refractive outcome following cataract extraction performed before, simultaneous with or after penetrating keratoplasty in eyes with Fuchs' Dystrophy.

Methods: Records of all patients with a tissue diagnosis of Fuchs' Dystrophy who had penetrating keratoplasty at the University of Iowa Hospitals and Clinics from January 1, 1990 to December 31, 1999 have been reviewed retrospectively. Charts including data from 227 eyes have been reviewed and the raw data entered into a data base. Those in whom cataract surgery was also performed have been divided into three groups. Group 1 consists of patients who underwent cataract extraction with IOL implantation followed subsequently by penetrating keratoplasty, comprising 25 eyes. Group 2 consists of patients who underwent cataract surgery with IOL placement simultaneous with penetrating keratoplasty (triple procedure), comprising 154 eyes. Group 3 consists of patients who underwent cataract extraction with IOL placement after penetrating keratoplasty, comprising 48 eyes. The average follow up time is over 4 years.

Results: Preliminary review of the numbers seem to show a significant improvement in visual acuity in all groups. There may possibly be a better refractive outcome in group 3 compared to groups 1 or 2 due to more accurate IOL calculations with post-PKP keratometry readings. But there is an early suggestion that graft survival may be better in groups 2 and 3 compared to group 1, possibly due to damage to the graft endothelium with the subsequent intraocular surgery.

Conclusions: Based on these results, we will be able to recommend that cataract extraction be done before, simultaneously, or after penetrating keratoplasty in patients with Fuchs' Dystrophy and cataract, depending on the magnitude of the differences in graft survival and refractive status. In addition, we hope to use the pachymetry readings obtained at the time of surgery in group 1 to determine the interval between cataract surgery and PKP and subclassify patients into low- and high-risk groups.

Chemical Injuries Occurring in Manufacturing Accidents During Methamphetamine Production

Puwat Charukamnoetkanok, M.D., Michael Wagoner, M.D.

The purpose of the study will be to document the spectrum of sight-threatening injuries that can occur as a result of chemical injuries that occur while engaging in the illegal manufacture of methamphetamine. We believe that chemical injuries occurring during transport and use of anhydrous ammonia in the production of methamphetamine, as well as following unexpected explosions, are relatively common and often result in significant ocular injury, morbidity, and visual loss. This complication of methamphetamine production has not been adequately studied and reported.

Comparison of Structure and Function of the Retinal Nerve Fiber Layer (RNFL) in Patients with Unilateral and Asymmetric Glaucoma

Mary Lucy M. Pereira, Young H. Kwon, Susan Anderson, Randy H. Kardon

Supported in part by Veterans Administration Merit Review Grant, and Research to Prevent Blindness

Purpose: To investigate the correlation between structure and function of the RNFL and optic nerve of patients with pure unilateral glaucoma and in patients with asymmetric glaucoma.

Methods: 15 patients with asymmetric glaucoma (Humphrey 24-2 SITA visual field mean deviation difference between the two eyes >2.5dB) and 10 patients with unilateral glaucoma were tested by automated perimetry, Heidelberg Retinal Tomography (HRT) of the optic nerve, and Optical Coherence Tomography (OCT) of the retinal nerve fiber layer thickness. Patients with any other eye disease that could affect the results of the tests were excluded from the study.

Results: The linear correlation between the average RNFL thickness (100 points, circular peripapillary scan, 1.73mm radius) and the average visual field sensitivity was much better in unilateral glaucoma (correlation coefficient R2=0.68) compared to asymmetric glaucoma (R2=0.35). A similar difference was found when the linear cup/disc ratio (HRT) was correlated with the average visual field sensitivity (unilateral glaucoma, R2= 0.72; asymmetric glaucoma, R2=0.23). The most significant finding was that for the same degree of RNFL thinning, there was less visual field loss in the asymmetric glaucoma group compared to the pure unilateral glaucoma patients.

Conclusion: These results may have uncovered new evidence for a compensatory mechanism in the visual system that maintains light perception sensitivity at a level higher than would be predicted by the amount of RNFL atrophy (thinning on OCT). Further studies investigating factors such as age, length of time following damage, tempo of damage, and mechanism of damage may help to explain the difference found between unilateral and asymmetric glaucoma.

Thrombocytosis as a Marker of Disease Activity in Giant Cell Arteritis

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Introduction/Purpose: Giant Cell Arteritis (GCA) is an inflammatory condition in which serum acute phase reactants, including erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), are used to monitor disease activity. Thrombocytosis, or elevated serum platelet count, is a non-specific marker of systemic inflammation. The purpose of this study was to determine the reliability of serum platelet count as a marker for active GCA, as compared to serum ESR and CRP.

Materials and Methods: A retrospective chart review was performed on a cohort of GCA (biopsy proven) patients. The serum platelet count was determined before and after the initiation of corticosteroid therapy. The number of patients with thrombocytosis was determined at the time of presentation. Serum platelet count, ESR, and CRP were followed as markers of disease activity in response to corticosteroid therapy over time.

Results: There were 101 patients (74 women, and 27 men) with GCA, in whom the serum platelet count was known prior to the initiation of corticosteroid therapy. Sixty two patients had vision loss (Group 1), and 39 patients had no vision loss (Group 2) associated with GCA. The mean platelet count for all patients was 441 x 10^9/L (range 201 to 1008 x 10^9/L), and 65 (64%) patients had thrombocytosis (serum platelet count > 400 x 10^9/L). The mean serum platelet count was comparable between GCA patients with vision loss (Group 1, mean = 442 x 10^9/L) and those without vision loss (Group 2, mean = 439 x 10^9/L). In patients with thrombocytosis, the serum platelet, ESR, and CRP decreased with corticosteroid therapy.

Conclusions: Thrombocytosis is associated with the active phase of GCA, and the serum platelet count does normalize over time in response to corticosteroid therapy. Serum platelet count, however, is not as reliable as ESR or CRP in terms of monitoring disease activity.

Accuracy of the IOLMaster in Intraocular Lens Calculations

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Purpose: The IOLMaster is becoming increasingly more popular as a method of biometry in the preoperative evaluation of patient's for cataract surgery. It offers the advantage of ease and speed over the traditional contact biometry and keratometry. The purpose of this study is to evaluate the repeatability of the accuracy of the IOLMaster's (Zeiss Humphrey, Dublin, Calif.) ability to calculate the correct power for intraocular lenses used in cataract surgery.

Methods: 94 patients had preoperative measurements performed using both the IOLMaster and traditional contact A-scan biometry and keratometry. Predicted refractive error from each were compared to actual spherical equivalent refractive error from a one month postoperative manifest refraction.

Results: The average difference between the final spherical equivalent refractive error and the IOLMaster was -0.187 diopters with a mean standard deviation of 0.769. The average difference between the final spherical equivalent refractive error and tradition contact biometry and keratometry was +0.177 diopters with a mean standard deviation of 0.706.

Conclusion: Further statistical analysis is to be performed, but from the preliminary statistical analysis it appears that the IOLMaster is as repeatable in obtaining an accurate predicted refractive error as traditional techniques.

Variation in Substructure of the Retinal Nerve Fiber Layer (RNFL) in Normal and Damaged Eyes Revealed by Optical Coherence Tomography (OCT)

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Purpose: To compare the variation in thickness and reflectivity of the RNFL circumferentially and on repeated testing in normal eyes and in eyes with different forms of optic neuropathy.

Methods: 20 normal eyes and 23 eyes with different optic neuropathies were analyzed with a third party OCT software (OCT-Pro) which defines the RNFL border based on the reflectivity pattern across the retina and also provides the mean reflectivity and total retinal thickness in addition to the RNFL thickness at 100 locations (circular scan 1.73 mm radius; 5 scans per eye). A new Gaussian filtering method was implemented so that the weight of the applied filter was varied for each individual scan until an optimum weight filter was determined by minimizing the residuals of the 100 points from the median of the 5 repetitions (Matlab, Natick, MA). The optimal weight of the Gaussian filter was determined independently for each of the 5 scans and also for parameters of RNFL thickness, total retinal thickness and reflectivity.

Results: The weight of the applied Gaussian filter provided a new parameter, which characterized the measurement variation in substructure of RNFL thickness, RNFL reflectivity, and total retinal thickness. The filtered scans were the best estimate of the structure of the RNFL. When the optimization procedure produced a higher weight filter (heavier filter), this corresponded to greater measurement variability of that particular scan compared to the median of the 5 scans. The scans requiring the highest weight filter could also be identified as "outlier" scans that contained measurement or alignment artifacts. When scans required very little filtering (low weight) the borders of the RNFL were very reproducible, defining a substructure or pattern of "jaggedness" that was characteristic for that eye. There was no difference in the weight of filtering needed for normal and abnormal eyes (no difference in measurement variability). The RNFL thickness, reflectivity, and retinal thickness were highly correlated with one another in the normal and abnormal eyes.

Conclusion: A new Gaussian filtering routine was devised that not only defined the most reproducible substructure of the RNFL for a given patient's eye, but also provided a new method for quantifying measurement variability and identification of scans with measurement or alignment artifacts.

Financial interests: none

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Variation in der Substruktur der retinalen Nervenfaserschicht (RNFS) bei gesunden und erkrankten Augen mittels Optical Coherence Tomography (OCT)

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Zweck: Die Variation der RNFS-Dicke und der RNFS-Reflektivität von gesunden und erkrankten Augen sollte verglichen werden.

Material und Methoden: Wir analysierten 20 gesunde Augen und 23 Augen mit unterschiedlichen Optikuserkrankungen mittels eines nicht handelsüblichen OCT Analyseprogramms (OCT-Pro), welches die Grenze der RNFS anhand des Reflektivitätsmusters der gesamten Netzhautdicke beurteilt. Damit konnte nebst der gesamten retinalen Dicke auch die RNFS-Dicke und deren Reflektivität an 100 Orten der Netzhaut bestimmt werden. Um die 5 verschiedenen repetitiven Messungen rechnerisch einander anzugleichen, entwickelten wir eine Filtermethode (Gaussscher Filter), welche jede Messung unterschiedlich filterte, so dass diese dem Median der ursprünglichen Messung möglichst entsprach (Matlab, Natick, MA). Die optimale Gewichtung der Filter wurde sowohl für die RNFS-Dicke, deren Reflektivität und die gesamte retinale Dicke unabhängig ermittelt.

Ergebnisse: Die Filtermethode lieferte einen neuen Parameter, welcher die Variabilität der RNFS-Dicke, deren Reflektivität und der gesamten retinalen Dicke charakterisierte. Die gefilterten Messungen entsprachen am ehesten der tatsächlichen Struktur der RNFS. Die Ermittlung von stärkeren Filtern bedeutete eine grössere Variabilität unter den 5 Repetitionen. Die vorliegende Methode identifizierte nebst dem optimalen Resultat auch mögliche „Ausreisser". Bei geringer Gewichtung der Filter war die Reproduzierbarkeit der Repetitionen gut und eine allfällig „zackige" RNFS-Grenze konnte als real bestätigt werden. Wir fanden keine spezifische Gewichtung, welche erkrankte Augen besser von gesunden unterschied. Hingegen korrelierten die RNFS-Dicke, deren Reflektivität und die gesamte retinale Dicke gut untereinander bei allen gemessenen Augen.

Schlussfolgerungen: Wir entwickelten eine Filtermethode, welche nicht nur die bestmögliche reproduzierbare Substruktur der RNFS errechnet, sondern auch die Variabilität der Messungen quantifiziert und zur Identifikation von Messartefakten hinzugezogen werden kann.

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Photodynamic Therapy and Choroidal Neovascularization due to Age-Related Macular Degeneration

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Purpose: To identify the proportion of patients with exudative age-related macular degeneration (AMD) involving the fovea who would have qualified for photodynamic therapy (PDT) with Verteporfin based on the findings from the Treatment of Age-related Macular Degeneration With Photodynamic Therapy (TAP) Study Group.

Design: Observational Case Series

Methods: Retrospective review of 195 patients with a diagnosis of AMD and choroidal neovascularization (CNV) seen between August 1, 1999 and July 31, 2000 at the University of Iowa Department of Ophthalmology who had undergone fluorescein angiography. Subfoveal exudative lesions that were found to be consistent with CNV, had at least 50% classic component, and were $\leq$ 4400 microns in greatest linear dimension (5400 micron spot size) were considered eligible for PDT.

Results: 172 patients and 331 eyes with fluoroscein angiograms were included in our study. 23 patients had to be disqualified due to poor quality images or confounding eye disease. In our study group, 142 eyes (42.9%) had subfoveal CNV. Of those with subfoveal CNV, 24 eyes (16.9%) had a subfoveal lesion that would have qualified for PDT based on angiographic criteria alone. 17 eyes (12%) met angiographic criteria and had a Snellen visual acuity between 20/40 and 20/200.

Conclusions: Based on the findings and recommendations of the TAP study, we found that only 12% of our patients with subfoveal CNV due to AMD would have qualified for PDT with Verteporfin. Our findings support the need for further investigation of the potential uses of PDT in eyes with exudative AMD.

Echographic Reflectivity as a Risk Factor for Growth of Indeterminate Melanocytic Choroidal Lesions

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Supported in part by an unrestricted grant from Research to Prevent Blindness (New York, NY)

Objectives: To determine whether low to medium reflectivity on standard echography is a risk factor for growth of indeterminate melanocytic choroidal lesions.

Methods: A retrospective cohort study was performed in 165 patients with indeterminate melanocytic choroidal lesions who were managed initially by observation. Eligible lesions had an apical height of 1.5 to 3.0 mm and basal dimensions of 3.0 to 16.0 mm. All tumors were evaluated using indirect ophthalmoscopy and standardized echography, and most lesions were imaged with fundus photography and fluorescein angiography. Growth was defined as an increase of 0.4 mm in apical height or 0.5 mm in lateral extension. We studied 3 echographic and 12 clinical variables for their association with time to growth using univariate and multivariate models.

Results: On initial evaluation, 75/165 tumors (45%) demonstrated low to medium reflectivity (5-60% spike height) using standardized echography while 90/165 tumors (55%) demonstrated high reflectivity (61-80% spike height). One hundred and twelve patients with a mean follow-up of 37 months (interquartile range, 12.75-61.5 months) failed to grow and 53 grew. Using univariate analysis, low to medium reflective tumors were more than 10 times likely to grow than high reflective tumors [10.34, 95% confidence interval = 4.85 – 22.02). Kaplan-Meier estimates of the proportion of tumors that grew by 5 years of follow up were 12% for the high reflective and 72% for the low to medium reflective tumors. In multivariate analysis low to medium reflectivity, presence of orange pigmentation, and absence of drusen remained significantly associated with time to growth.

Conclusions: Low to medium echographic reflectivity on standardized echography is significantly associated with time to growth for indeterminate choroidal lesions. We recommend a closer follow up for these tumors when initially managed by observation.

Long-Term Effects of Trabeculectomy with Mitomycin-C on Normal Tension Glaucoma

Emily Greenlee, M.D. Sponsors: Wallace L. M. Alward, M.D., Young Kwon, M.D., Ph.D

Background: Normal tension glaucoma presents with optic nerve cupping and visual field loss despite intraocular pressures within the normal range (<21 mm Hg), as seen with diurnal curve testing. It remains a diagnosis of exclusion and is currently treated by lowering intraocular pressure. Treatment aims to lower intraocular pressures by 30% below baseline with either topical medications, laser trabeculoplasty, trabeculectomy (with or without an antimetabolite), or seton implant.

Purpose: The purpose of this study will be to analyze the surgical outcomes of trabeculectomy with mitomycin-C on patients with diagnosed normal tension glaucoma at the University of Iowa from 1988 to 2001. Our goal aims to determine if this surgical intervention reliably lowers intraocular pressures in eyes with normal tension glaucoma, thereby preventing further visual field loss within this time frame.

Methods: A retrospective study will be conducted of 67 patients and ninety-two eyes that have undergone trabeculectomy with mitomycin-C for normal tension glaucoma. Post-operative visual acuities, refractions, intraocular pressures, and medications will be examined compared to pre-operative data. This information will then be monitored for stability versus decline over time post-operatively. This analysis will allow us to determine the long-term results of trabeculectomy with mitomycin-C in lowering intraocular pressure substantially to prevent progression of visual field.

Results: To be presented.

Systemic Cyclosporine A and High Risk Corneal Transplantation

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Purpose: To evaluate the efficacy of long-term systemic cyclosporine A (CsA) in preventing graft rejection in high risk corneal transplant patients.

Methods: A retrospective review of patients undergoing corneal transplantation at the University of Iowa during the years of 1994 to 1996 was performed. Twenty patients were identified who were classified as high risk for corneal transplantation, defined as more than 2 quadrants of stromal vascularization or a previously failed graft. All patients were treated with cyclosporine A at a dose of 4 mg/kg orally prior to or beginning on the day of transplantation. Doses were adjusted to maintain serum levels of 100-150 ng/dl. Twenty controls matched for age, sex, number of prior grafts, and number of prior rejection episodes, were selected from the same time period. Charts were reviewed for the duration of the patients' care or until the end of the calendar year 2001.

Results: Mean duration of followup, rate of graft rejection, time of rejection, level of CsA at time of rejection, duration of CsA treatment, and reason for discontinuation of CsA were assessed. Therapeutic levels of CsA were obtained in 18 of 20 patients. There was a significant difference between the groups in the number of quadrants of vascularization. Kaplan-Meier estimates of graft survival did not show a significant difference in time to first rejection episode, time to immunologic graft failure, or time to graft failure from any cause. Analysis of covariance demonstrated no significant difference in change in visual acuity. Cyclosporine A was discontinued in one person due to the onset of hypertension, and in one additional patient due to the development of chronic lymphogenous leukemia with diffuse small lymphocytic lymphoma.

Conclusion: Long-term therapy with systemic CsA in high risk corneal tranplant patients did not significantly improve outcomes over controls. It was associated with minimal but significant side effects.

The Pupillary Light Reflex in Normal and Diseased Eyes: Diagnosis of Visual Dysfunction Using Waveform Partitioning

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Objective: To evaluate changes in pupil size (corresponding to neuronal firing) within different time windows of the pupil light reflex in patients and normal subjects to understand which segments of the pupil waveform are best able to differentiate normal from abnormal subjects.

Methods: 49 normal subjects and 25 patients with known unilateral or asymmetric visual field damage were tested. A dual-channel infrared pupillograph was used to simultaneously record the right and left pupil diameters at a rate of 60 Hertz. Each eye was stimulated alternately (30 degree full-field, 200 milliseconds duration every 3 seconds) over 10 different stimulus intensities. The recorded waveform of the pupil light reflex was subdivided into six time windows based on landmarks corresponding to contraction onset, maximum contraction velocity, peak contraction, and maximum dilation velocity to assess which portion was most affected by disease.

Results: The linear correlation between pupil contractions elicited by right versus left full field stimulation at different light intensities provided diagnostic parameters (slope, intercept, and correlation coefficient R^2) that were useful for differentiating normal subjects from patients and for categorizing disease. Sensitivity and specificity of the time windows were evaluated with receiver-operator curve analysis. The diagnosis of asymmetric disease was greatest at time windows that included pupil contraction, but not dilation. When the contraction phase was subdivided into an early phase and into a late phase, the late phase was the most diagnostic compared to the entire phase of contraction amplitude (onset to peak contraction).

Conclusions: Using a range of light intensity, the change in pupil size measured between the time where maximum contraction velocity occurs and the time to peak contraction provided the best response parameter for objective diagnosis of asymmetric disease of the anterior visual pathway. The waveform of the pupil light reflex may be an expression of the firing of retinal ganglion cells. Therefore, understanding which segment of the pupil light reflex provides maximal diagnostic power may give insight into how disease affects the pattern of neuronal firing rate.

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