**Journal Highlights**

**NEW FINDINGS FROM OPHTHALMOLOGY, AJO, AND JAMA OPHTHALMOLOGY**

**Ophthalmology**

**Bupivacaine Injection for Comitant Strabismus**
October Ophthalmology
Published online Aug. 5, 2013

Miller et al. evaluated the clinical effectiveness and anatomic changes resulting from bupivacaine injection into extraocular muscles to treat adults with comitant horizontal strabismus. They found that the anesthetic, when injected either by itself or in combination with botulinum toxin, improves eye alignment and corrects the strabismus by inducing changes in rectus muscle structure and length.

Of the 31 patients in this observational clinical series, 19 with esodeviations averaging 18.9 prism diopters (PD) received bupivacaine injections in the lateral rectus muscle, and 12 with exodeviations averaging 31.9 PD received bupivacaine in the medial rectus. Sixteen patients with large strabismus angles also received botulinum toxin type A injections in the antagonist muscle at the same treatment session. A second round of treatment was given to 13 patients who had residual strabismus after the initial round. Primary outcome measures included clinical measures of alignment and muscle volume, maximum cross-sectional area, and shape derived from magnetic resonance imaging. Follow-up data were collected at the six-month and one-, two-, and three-year marks.

At an average of 15.3 months after the final treatment, original misalignments were reduced by 10.5 PD, with residual deviations of 10 PD or less in 53 percent of patients. In one-half of all patients, a single treatment of bupivacaine alone reduced misalignment at 11.3 months by 4.7 PD, with residual deviations of 10 PD or less. These corrections were stable for up to three years. Six months after treatment, muscle volume had increased by 6.6 percent in all patients, and maximum cross-sectional area had increased by 8.5 percent; these outcomes gradually relaxed toward pretreatment values. Computer modeling suggested that changes in agonist and antagonist muscle lengths were responsible for the enduring changes in eye alignment.

These results support previous findings that treatment with bupivacaine alone improves eye alignment and that botulinum toxin in the antagonist muscle can correct larger deviations by allowing the bupivacaine-injected muscle to rebuild at reduced length. The authors have recently updated this protocol to combine bupivacaine with epinephrine for patients with deviations of more than 20 PD; results of this treatment change will be provided in a subsequent report.

**Subgroups of Angle-Closure Suspects Identified**
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In the first use of an objective method to classify patients with angle-closure glaucoma, Nongpiur et al. investigated whether subgroups of patients could be classified based on anterior segment optical coherence tomography (AS-OCT) and biometric parameters. Although AS-OCT cannot image the ciliary body, the authors were able to identify three distinct subgroups of primary angle-closure suspects and characterized them as having either a large iris area or a large lens vault (LV) or elements of both.

For this cross-sectional study, the authors evaluated 243 primary angle-closure suspects as a primary group and 165 additional suspects as a validation group. All patients underwent gonioscopy and AS-OCT. The authors chose four parameters—iris area, anterior chamber depth, anterior chamber width, and LV length—and used hierarchical clustering to group these parameters on the basis of correlations. In addition, a Gaussian mixture model was employed to partition the patients into subgroups. All results were cor-
Residents and Preferred Practice Pattern Guidelines

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How well do residents in training follow the Academy’s Preferred Practice Pattern (PPP) guidelines? 
Ong et al. examined this question with regard to care of primary open-angle glaucoma (POAG) patients and found that residents’ compliance with POAG guidelines was high for most elements—with a few notable lapses.

For this retrospective chart review, researchers pulled 103 charts of POAG patients who underwent follow-up evaluations at the resident ophthalmology clinic of a Veterans Affairs Medical Center in North Carolina. The charts were evaluated for documentation of 19 elements as identified in the PPP guidelines. Compliance rates for the 19 elements were also averaged in all charts and compared among eight residents in either their first or second year of residency.

The overall compliance rate for all elements was 82.6 percent for all charts, 78.8 percent for first-year residents, and 81.7 percent for second-year residents. These results were comparable to those found for residents’ compliance with the cataract PPP (81 percent) and higher than that found for compliance with the diabetic retinopathy PPP (52.5 percent)—both of which were evaluated in earlier studies.

Documentation rates were high (greater than 90 percent) for all elements in the following categories: physical examination (visual acuity, slit-lamp, intraocular pressure, optic nerve, and visual field evaluations); follow-up (appropriate follow-up interval and interval adjustment after medication changes); and management (reconsideration of treatment regimen, use of alternative agent, discussion of compliance, reconsideration of current and target intraocular pressure, and gonioscopy, if needed). However, discussion of local or systemic problems with medications was documented in only 58.4 percent of all charts, and documentation of patient education was particularly poor, occurring in only 5.2 percent of all visits. Another area receiving minimal attention was referral for low-vision or social services, which was documented in only 16.1 percent of all charts.

The researchers suggested using the Academy’s PPP guidelines as an objective and standardized way to evaluate resident performance across programs.

Imaging Ciliary Body and Choroidal Pseudomelanoma

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Shields et al. described a series of cataract patients who were suspected of having uveal melanoma but were subsequently found to have pseudomelanoma. Using ultrasound imaging, the authors offered several recommendations on how to differentiate the two conditions in patients with hypermature cataracts. Specifically, features such as an acoustically hollow center with a dense rim, a lack of contiguity with the uvea, a lack of sentinel vessels, and a lack of a trans-illumination shadow were all suggestive of pseudomelanoma.

This case series included 20 patients who had unilateral hypermature cataracts and opaque media with no view of the fundus. All were referred with the presumptive diagnosis of melanoma; this diagnosis was based on ultrasonographic imaging, which gave the impression of a dome-shaped intraocular mass. In 17 of the patients, the mass appeared to be in the ciliary body; in the remaining three, it appeared to be in the choroid. In 18 of the patients, the cataractous lens was in an anatomic position; in two, it was subluxated. In every case, correct diagnosis of the pseudomelanoma was made using ultrasonography in A- and B-scan modes, ultrasound biomicroscopy, anterior segment optical coherence tomography, or a combination of these modalities. All diagnoses were confirmed after cataract surgery.

The authors concluded that oblique imaging of a hypermature cataract could produce a picture similar to that of a melanoma and noted that high-resolution ultrasonography or ultrasound biomicroscopy could help successfully diagnose the condition and limit unnecessary treatment. If confusion remains, they suggested that magnetic resonance imaging may also be helpful: Melanoma will enhance with gadolinium contrast, while the lens will not.

American Journal of Ophthalmology

Lifetime Risk of Blindness in Open-Angle Glaucoma

October AJO

Peters et al. determined the lifetime risk and duration of blindness in patients with manifest open-angle glaucoma. They found that approximately 1 out of 6 patients included in this retrospective chart review was bilaterally blind from glaucoma at the last follow-up visit. Of these bilaterally blind patients, 86 percent were aged 80 years or older when they became blind, and the median duration of bilateral
ischemia grade was independently pre-
also noted that while a worse macular
eyes with established ischemia. They
ranged from 5 percent to 10 percent in
veal avascular zone (FAZ) enlargement
They found that the annual rate of fo-
analyzing fluorescein angiography.

The authors reviewed the records
of 592 deceased glaucoma patients and
noted visual field status, visual acu-
ty, and the presence of low vision or
blindness at the time of diagnosis and
during follow-up. Records of visual
acuity and/or visual field examination
during the three years prior to death
were required for inclusion in the
study. In these records, 367 patients
(62.0 percent) were female, and 372
(62.8 percent) had glaucoma in both
eyes. Median time between last visit
death was eight months, and me-
dian age at death was 87 years.

At the time of the final visit, 250
patients (42 percent) had at least one
blind eye due to glaucoma, while 97
patients (16 percent) were bilaterally
blind. Twelve patients (0.5 percent)
had low vision. Median time with a
glaucoma diagnosis was 12 years, me-
dian age when bilateral blindness first
developed was 86 years, and median
duration of bilateral blindness was
two years. The cumulative incidences
of blindness in at least one eye and
bilateral blindness were 26 percent and
5 percent, respectively, after 10 years;
these incidences increased to 38 per-
cent and 13 percent, respectively, at 20
years.

The authors noted that because of
longer life expectancies, glaucoma pa-
tients will have the disease for a longer
period of time, and it is therefore pos-
sible that the lifetime risk of glaucoma
blindness may increase even further.

Predictive Factors for the Progression
of Diabetic Macular Ischemia
October AJO
Sim et al. investigated the predic-
tive factors for progression of
diabetic macular ischemia by
analyzing fluorescein angiography.
They found that the annual rate of fo-
veal avascular zone (FAZ) enlargement
ranged from 5 percent to 10 percent in
eyes with established ischemia. They
also noted that while a worse macular
ischemia grade was independently pre-
dictive for progression, diabetic macu-
lar ischemia progression itself was pre-
dictive of the loss of visual function.

For this retrospective, longitudinal
study, the authors collected data from
79 patients with type 2 diabetes who
had mild, moderate, or severe ischemia
grades and who had undergone mac-
ula-centered fluorescein angiography
imaging at least twice in the previous
six months. Severity of macular isch-
emia was assessed using Early Treat-
ment Diabetic Retinopathy Study pro-
tocols, and custom software was used
to quantify FAZ area.

The median FAZ areas at baseline
for mild, moderate, and severe grades
were 0.28, 0.37, and 0.73 mm², re-
spectively, and significantly increased
at the final fluorescein angiography.
The authors found that FAZ enlarge-
ment rates were greater in more severe
grades of ischemia, ranging from an
increase per year from baseline of ap-
proximately 5 percent in mild grades
to 7 percent and 10 percent in moder-
ate and severe grades, respectively.
En-
largement rates were at least threefold
higher in eyes that showed a deterio-
ration of visual acuity (19 percent) than
in eyes that did not (5.6 percent). A
loss of more than 0.05 logMAR or one
line of Snellen visual acuity per year
was associated with eyes that had an
increase in FAZ area of more than 10
percent per year.

The authors concluded that al-
though no treatment currently exists
for visual loss attributable to macular
ischemia, understanding its natural
history might be of particular impor-
tance in the management of patients
undergoing treatment for concurrent
macular edema.

Liquid Culture Media in the Diagnosis
of Microbial Keratitis
October AJO
In a retrospective case series, Bha-
dange et al. evaluated the role of
liquid culture media in the diagnosis
of microbial keratitis and found that
the media increased the chance of iso-
lating bacteria in pure bacterial and/or
mixed infection; however, their role in
isolating fungus was limited.

The authors evaluated corneal
scraping samples from 114 infectious
keratitis patients. Samples were pro-
cessed by corneal smear microscopy
(using potassium hydroxide with cal-
cofluor white and Gram stains) and
a liquid culture examination (using 5
percent sheep blood agar, sheep blood
chocolate agar, Sabouraud dextrose
agar, brain heart infusion, thioglycol-
late broth, and Robertson’s cooked
meat broth). For inclusion in the study,
all cases were required to have signifi-
cant growth in the liquid culture.

Of the 114 cases, 44 were bacte-
rial, 62 were fungal, and eight were
mixed infection. Thirty-eight cases
of bacterial keratitis were diagnosed
by solid media alone; six of the 44 cases
required liquid media for diagnosis.
In fungal keratitis, all but one of the
cases were diagnosed using solid me-
dia alone, while a single case required
liquid media for diagnosis. In mixed
infection, none of the cases required
liquid media for diagnosis of the fun-
gal component; however, all eight cases
required liquid media for establishing
the bacterial component.

Owing to overlap in clinical diag-
nosis of bacterial and fungal keratitis,
the authors recommended inclusion of
both solid and liquid culture media in
the laboratory diagnosis of microbial
keratitis.

Neurosensory Recovery Following
Anti-VEGF Therapy for AMD
October AJO
In this interventional cohort study,
Munk et al. evaluated neurosensory
recovery in patients with wet age-
related macular degeneration (AMD)
receiving monthly intravitreal anti-
VEGF therapy. Although the authors
identified significant gains over one
year in distance visual acuity and reti-
nal sensitivity, there was no improve-
ment in reading acuity and reading
speed.

Sixty-four treatment-naive neo-
vascular AMD patients with subfoveal
lesions were treated and examined
monthly for distance visual acuity,
reading acuity, maximum reading speed, and contrast sensitivity. Using microperimetry, the authors evaluated the percentage of absolute and relative scotoma and mean central retinal sensitivity weighted by area. Improvements were determined by a random-slope and random-intercept model, and the recovery pattern of parameters was compared by correlating the individual slopes of each variable.

Initially, the authors identified a rapid short-term effect of anti-VEGF treatment across all functional variables. Progressive functional gain over one year was observed for distance visual acuity, contrast sensitivity, and mean central retinal sensitivity, but not for reading acuity and maximum reading speed. Decrease of absolute scotoma area did not reach statistical significance over this one-year period, nor did fixation stability improve. However, lesion size influenced the course of absolute scotoma area. Lesion type had no effect on any evaluated variable of visual function. They also noted that the individual slopes of reading acuity and distance visual acuity showed a moderate correlation, though all other variables lacked a significant correlation.

The authors concluded that visual recovery in anti-VEGF therapy is reflected in a characteristic pattern of functional changes over time, whereas distance visual acuity does not seem to comprehensively reflect overall visual function gain. Therefore, standard distance visual acuity tests may not completely reflect visual improvement in daily life.

**JAMA Ophthalmology**

Optimizing Descemet Membrane Endothelial Keratoplasty Using Intraoperative OCT

September JAMA Ophthalmology

Descemet membrane endothelial keratoplasty (DMEK) can be a challenging procedure for a surgeon, particularly because of poor visibility of the tissue due to the natural en face view through the operating microscope. In this retrospective study, Steven et al. analyzed imaging and video data to evaluate the use of intraoperative optical coherence tomography (iOCT) for improving the efficacy of DMEK. They found that iOCT technology enhanced visibility of graft orientation, rolling, and unfolding as well as monitoring of the graft attachment, thereby potentially improving the safety of the procedure.

The surgeons used iOCT in 26 eyes of 26 patients aged 39 to 93 years with corneal endothelial dysfunction undergoing DMEK. Fifteen patients with pseudophakic eyes and nine patients with phakic eyes underwent DMEK in combination with conventional phacoemulsification and posterior chamber lens implantation. In one case, DMEK was combined with pars plana vitrectomy and membrane peeling for treatment of macular hole.

The authors reported that iOCT enabled reliable visualization of all steps of the DMEK procedure. Graft-rolling behavior could be monitored without the necessity of restaining the graft with trypan blue, and iOCT allowed for exact imaging of the entire graft, even when recipient corneas had reduced transparency.

This technology also enabled the surgeons to control the entire attachment of the graft and allowed for more exact determination of time necessary for complete anterior chamber intraoperative air fill. Overall mean duration of the DMEK procedure was 25.7 minutes when using iOCT. Overall mean time for intraoperative anterior chamber air filling performed under iOCT was 236 seconds, compared with previously published air-filling times of 60 to 90 minutes.

Socioeconomic Disparity in the Use of Eye Care Services

September JAMA Ophthalmology

Individuals with age-related eye disease require eye care services for detection, assessment, and care at regular intervals. Zhang et al. explored the association between socioeconomic status and use of these eye care services among U.S. adults with self-reported age-related eye disease and found that significant differences persist.

The study sample included 6,690 participants in the 2002 (n = 3,586) and 2008 (n = 3,104) National Health Interview Survey who were at least 40 years old and reported age-related macular degeneration, cataract, diabetic retinopathy, or glaucoma. The authors used multiple logistic regression to examine the association of income-to-poverty ratio (IPR) and educational attainment with the use of eye care services after controlling for age, sex, race/ethnicity, and health insurance status. IPR compares family income with the poverty threshold established by the Census Bureau; a score of 1 is the federal poverty threshold, and a score below 1 is categorized as below that threshold.

In 2002 and 2008, survey respondents with a higher IPR were more likely than those with a lower IPR to visit an eye care provider. And in 2002, respondents with less education were less likely than their more-educated counterparts to visit an eye care provider or undergo a dilated eye examination; however, the authors did not find statistically significant trends for eye care visits or dilated eye examinations by education level in 2008. Among respondents with an IPR between 3 and 5, prevalence of eye care visits and dilated eye examinations was lower in 2008 than in 2002. And among those respondents with less than a high school education, the age-adjusted prevalence for eye care visits decreased from 57 percent in 2002 to 44 percent in 2008.

The authors concluded that appropriate and timely public health interventions targeted at adults with low education and income levels might effectively reduce this continuing disparity in eye care.

Ophthalmology summaries are written by Jean Shaw and edited by John Kerrison, MD. American Journal of Ophthalmology summaries are edited by Thomas J. Liesegang, MD. JAMA Ophthalmology summaries are written by the lead authors.
**Virtual Teaching Module Proves Effective**

*Eye*

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Succar et al. investigated the impact of a Web-based teaching module known as the Virtual Ophthalmology Clinic (VOC) on medical student education. The authors found that use of the VOC boosted students’ performance on testing immediately after their ophthalmology rotation and 12 months later.

The VOC is an interactive program that provides a computer-based simulation of the doctor-patient relationship in a virtual consulting room. Ten cases—all of which were recorded from actual patient interviews—are included, and the program places particular emphasis on history taking and clinical reasoning skills.

In this prospective controlled trial, the researchers randomly assigned 93 medical students to a traditional hospital-based ophthalmology rotation and 95 students to the VOC program. All students attended one of four clinical schools at the University of Sydney in Australia. The length of the training ranged from three to 10 days, depending on the individual school, and student subgroups were matched according to the length of their rotations.

All students were administered knowledge tests before and after their rotations, which covered history taking, interpretation of examinations, management of eye disorders, and clinical reasoning. Those in the VOC group outscored their traditionally trained peers both immediately following the rotation and 12 months later. Overall, those in the VOC group reported that the program was easy to navigate, and they rated it as more effective than traditional teaching methods.

The authors concluded that this teaching module presents a potential solution to a number of issues in medical education, including time constraints, patient availability, and exposure to a representative selection of ophthalmic cases.

**Ocular Inflammation After Femtosecond Cataract Surgery**

*Journal of Cataract and Refractive Surgery*

Published online July 10, 2013

Abell et al. set out to assess the degree of surgical trauma induced by femtosecond laser–assisted cataract surgery. They measured the levels of postoperative ocular inflammation and found that the surgery resulted in less aqueous flare than did manual cataract surgery one day and four weeks after surgery.

For this prospective, consecutive, nonrandomized parallel cohort study, the authors evaluated 176 patients. All were treated by the same surgeon in a single center. Of these patients, 100 were assigned to the laser-assisted group; the remainder underwent conventional manual phacoemulsification.

At postoperative day 1, mean aqueous flare was 16.6 ± 8.9 photons per millisecond (ph/ms) in the laser group and 21.8 ± 12.0 ph/ms in the manual group. At four weeks, mean aqueous flare was 1.1 ± 8.1 ph/ms in the laser group and 14.6 ± 10.7 ph/ms in the manual group.

In terms of secondary endpoints, mean increase in measures of inflammation seen on optical coherence tomography was greater in the manual group, particularly with regard to outer zone retinal thickness. However, no statistically significant differences between the two groups were found during slit-lamp examinations and funduscopy.

Although both groups were treated with the same drugs for the same duration and frequency, the researchers noted that they could not rule out differences in compliance between groups, which might have produced confounding results.

**Femtosecond Laser for Cataract Surgery in Infants**

*Journal of Cataract and Refractive Surgery*

In the first published report of the femtosecond laser’s use in pediatric eyes, Dick et al. described a technique for performing laser-assisted cataract surgery in infants and found that the technique has the potential to increase the predictability, accuracy, and safety of surgery for congenital cataracts.

The authors reported on their experiences performing the procedure in four infants, aged 2 to 9 months of age. Three of the infants had congenital nuclear sclerotic cataracts; the fourth had a unilateral congenital calcified cataract. The off-label use of the femtosecond laser was performed according to a clinical protocol developed by an institutional ethics committee.

The authors noted that because the pediatric capsular bag is more elastic than its adult counterpart, a standard capsulotomy is difficult to perform and often leads to capsular tears or a large continuous curvilinear capsulorhexis; however, in three of the four cases described in this study, the anterior and posterior capsule discs were easy to remove, and no tears occurred. In the fourth case, which involved the calcified cataract, laser treatment and cataract removal were possible after a Malyugin ring was inserted. Total treatment time in these cases ranged from 24 to 50 minutes.

The researchers pointed out that because the current interface for the femtosecond laser is not intended for infants, a lateral canthotomy may be required. In addition, the substantial elasticity of the infants’ lens capsules led to final anterior and posterior capsulotomy diameters that were slightly larger than intended.

Roundup of Other Journals is written by Joan Shaw and edited by Deepak P. Edward, MD.