AMERICAN ACADEMY OF OPHTHALMOLOGY®

Editorial

Needless Waste and the Sustainability of Cataract Surgery

David F. Chang, MD - *San Francisco, California*

Few health care settings are as regulated as the operating room (OR). Whether cataract surgery is performed in an ambulatory surgery center or a hospital outpatient department, OR licensure, accreditation, and regulatory compliance entail enormous costs. Operating room regulations to prevent surgical infection govern the physical facility (e.g., ventilation), staff (e.g., attire and hand hygiene), protocols (e.g., instrument cleaning and sterilization), and supplies and drugs (e.g., single vs. multiuse).[1]

Recent studies from the Aravind Eye Care System (AECS) in southern India demonstrate a significant reduction in the postoperative endophthalmitis (POE) rate after routine adoption of intracameral moxifloxacin prophylaxis.[2,3] In our retrospective study of more than 2 million consecutive cataract surgeries across their 10-hospital network over an 8-year period, intracameral moxifloxacin was associated with a 3.5-fold decline in POE rate from 0.07% to 0.02%.[3] Excluding the manual, small-incision extracapsular cataract surgeries, the POE rate in more than 335 000 consecutive phacoemulsification patients receiving intracameral moxifloxacin was 0.01%. Interestingly, this is lower than the 0.04% POE rate in the United States, as calculated by the American Academy of Ophthalmology's Intelligent Research in Sight Registry.[4] One potential explanation for this difference is the fact that intracameral antibiotic prophylaxis is not used routinely in the United States.[5]

The overwhelming majority of surgeons and nurses want more reusable options, more discretion on when to reuse products labelled for single use, and greater manufacturer consideration of carbon footprint.

Apart from the efficacy of intracameral moxifloxacin prophylaxis, what is equally striking is that the AECS reuses as many of their surgical and pharmaceutical supplies as possible. Maximizing volume, surgical efficiency, and cost effectiveness enables the AECS to perform approximately 60% of their surgical volume in charity patients for little to no cost. This requires critically assessing the necessity of every supply item and protocol, while monitoring quality through an electronic health registry that captures every operation and outcome. As a result, they simultaneously operate on multiple patients within a single large operating room and do not change surgical gowns or gloves (which they rinse with alcohol and chlorhexidine) in between patients. They routinely reuse phacoemulsification tips and tubing, irrigating solution, metal blades, cannulas, sutures, viscoelastic, intraocular drugs, and perioperative drops. Despite regularly reusing items restricted to single use in the United States, their POE rate is no higher.

These compelling data suggest that many mandated practices in Western ORs may be unnecessary and of unproven benefit for ophthalmic surgery. Indeed, many OR regulations are based on the opinions of experts advising regulatory agencies and manufacturers. The AECS study suggests that big data registries could be used to generate more evidence-based, rather than eminence-based, recommendations.[3,4,6,7] Ironically, no commercial intraocular antibiotic solution has been approved in the United States because of the lack of sufficiently large randomized controlled trials. Although American patients have no access to the commercial intracameral moxifloxacin (costing $1 [United States] per vial in India) that reduced POE at AECS by 3.5 times, rigidly enforced single-use mandates continue to generate excessive surgical waste at enormous cost without proven POE benefit.

The high and escalating volume of cataract surgery multiplies the economic impact of not reusing most surgical supplies, devices, and drugs. Recent studies show that this waste also entails considerable environmental impact by significantly increasing the carbon footprint of cataract surgery.[8–13] A British study found that 1 phacoemulsification procedure in the United Kingdom generated the same carbon emissions (approximately 130 kg carbon dioxide equivalent) as driving a car 500 km (310 miles).[8] By comparison, phacoemulsification at AECS was found to generate the same carbon emissions (approximately 6 kg carbon dioxide equivalent) as driving a car 23 km (14 miles).[9] Compared with the United States and United Kingdom, AECS's low POE rates with cataract surgery were achieved with much lower supply costs and one-twentieth the carbon emissions.[9,10] The excessive economic and environmental costs of unnecessary surgical waste will not be sustainable as global cataract volume continues to increase. This challenge urgently merits further study and deliberation.

More than 90% of ophthalmologists agree that OR waste is excessive and concerning, according to a newly published survey conducted by the Ophthalmic Instrument Cleaning and Sterilization Task Force.[14] Comprising experts representing the American Academy of Ophthalmology, the American Society of Cataract and Refractive Surgery, the Outpatient Ophthalmic Surgery Society, and the Canadian Ophthalmological Society, the Ophthalmic Instrument Cleaning and Sterilization Task Force surveyed cataract surgeons belonging to these 4 societies, along with their OR nurses. More than 1300 respondents completed the survey, including more than 1000 surgeons.

https://doi.org/10.1016/j.ophtha.2020.05.002
ISSN 0161-6420/20

Most respondents reported that surgical supply manufacturers play a substantial role in generating excessive waste. Those surveyed dispute the notion that surgeons and patients are driving the trend toward more single-use products. Ten times as many surgeons would prefer reusable versus disposable instruments (79% vs. 8%) if they are of equal cost and functionality. Roughly 95% consider single-use product packaging wasteful, want more reusable supply and device options, and believe that manufacturers favor single-use products to increase profit and limit liability. Nearly all ophthalmologists were willing to use perioperative topical medications (97%) or commercial intraocular drugs (90%–95%) on multiple patients. Most were open to reusing many of the supplies and products labelled for single use, but currently reused at AECS, including phacoemulsification tips (92%), irrigating solutions and tubing (78%), metal blades (78%), cannulas (74%), and iris or capsular retractors (72%).

Most respondents believed that licensing and accrediting agencies (82%) and ambulatory surgery center and hospital outpatient department regulations (74%) that limit surgeon discretion over when and which supplies or drugs can be reused are also major contributors to surgical waste. At least 93% want regulatory agencies and product manufacturers to allow surgeons more discretion to reuse products labelled as single use. Unnecessarily rigid single-use mandates also may render the healthcare system more vulnerable in times of crisis and supply chain interruption. One reason for suspending elective surgery during the current coronavirus pandemic was the need to conserve personal protective equipment, such as surgical masks, gowns, and gloves.[15] Although the survey was conducted before the pandemic, at least 95% of respondents already were, or would consider, eliminating the full-body drape and wearing 1 surgical mask all day. Divergent willingness to consider not changing surgical gowns (64%) or gloves (17%) in between cases was reported. Most respondents either currently were using or would consider using short-cycle sterilization (91%), sending unused topical medications home with patients (93%), and donating unused surgical supplies (97%). Only one third of surgeons were opposed to performing immediately sequential bilateral cataract surgery.

Most respondents (87%) believed that their medical societies should advocate for reducing the OR carbon footprint; only 6% disagreed. This is consistent with 91% of respondents being concerned about climate change. After these results were shared with the American Society of Cataract and Refractive Surgery and American Academy of Ophthalmology leadership, these 2 organizations became the first from ophthalmology to join 27 other major medical associations in the Medical Society Consortium on Climate and Health (https://medsocietiesforclimatehealth.org). The consortium was established in 2017 to inform policy makers and the public about the harmful health effects of climate change. Another goal of the consortium is to reduce the carbon footprint of the healthcare system.

A strong consensus exists among cataract surgeons and nurses that surgical waste is excessive and is driven by unnecessarily rigid regulation, product liability concerns, and manufacturers' profit incentive. The overwhelming majority of surgeons and nurses want more reusable options, more discretion on when to reuse products labelled for single use, and greater manufacturer consideration of carbon footprint. It has been estimated that the healthcare sector accounts for approximately 10% of greenhouse gas emissions in the United States, with the operating room being a leading source.[16] That the AECS has reduced the cost and carbon footprint of cataract surgery dramatically while achieving a lower POE rate than the United States average suggests that much of our surgical waste is excessive and unnecessary. Because ophthalmology has the highest surgical volumes in medicine, we have an exceptionally important opportunity to educate and work with regulatory agencies and the surgical manufacturing industry to reduce needless OR waste. The economic and environmental sustainability of cataract surgery worldwide may depend on our collaboration and leadership.

References

1. Chang DF, Mamalis N; Ophthalmic Instrument and Cleaning Sterilization Task Force. Guidelines for the cleaning and sterilization of intraocular surgical instruments. *J Cataract Refract Surg*. 2018;44:765–773.
2. Haripriya A, Chang DF, Ravindran RD. Endophthalmitis reduction with intracameral moxifloxacin prophylaxis; analysis of 600,000 surgeries. *Ophthalmology*. 2017;124:768–775.
3. Haripriya A, Chang DF, Ravindran RD. Endophthalmitis reduction with intracameral moxifloxacin in eyes with and without surgical complications: results from two-million consecutive cataract surgeries. *J Cataract Refract Surg*. 2019;45:1226–1233.
4. Pershing S, Lum F, Hsu S, et al. Endophthalmitis after cataract surgery in the United States: a report from the Intelligent Research in Sight Registry, 2013–2017. *Ophthalmology*. 2020;127:151–158.
5. Chang DF, Braga-Mele R, Henderson BA, et al. Antibiotic prophylaxis of postoperative endophthalmitis after cataract surgery: results of the 2014 ASCRS member survey. *J Cataract Refract Surg*. 2015;41:1300–1305.
6. Szajewska H. Clinical practice guidelines: based on eminence or evidence? *Ann Nutr Metab*. 2014;64:325–331.
7. Williams RD. Of eminence-based and evidence-based medicine. *EyeNet*. 2018;(9):12.
8. Morris DS, Wright T, Somner JE, Connor A. The carbon footprint of cataract surgery. *Eye*. 2013;27:495–501.
9. Thiel CL, Schehlein E, Ravilla T, et al. Cataract surgery and environmental sustainability: waste and lifecycle assessment of phacoemulsification at a private healthcare facility. *J Cataract Refract Surg*. 2017;43:1391–1398.
10. Le HG, Ehrlich JR, Venkatesh R, et al. A Sustainable model for delivering high-quality efficient cataract surgery in southern India. *Health Affairs*. 2016;35:1783–1790.
11. Tauber J, Chinwuba I, Kleyn D, et al. Quantification of the cost and potential environmental effects of unused pharmaceutical products in cataract surgery. *JAMA Ophthalmol*. 2019;137:1156–1163.
12. Khor HG, Cho I, Lee KRCK, Chieng LL. Waste production from phacoemulsification surgery. *J Cataract Refract Surg*. 2020;46:215–221.

13. Chandra P, Gale J, Murray N. New Zealand ophthalmologists' opinions and behaviours on climate, carbon, and sustainability. *Clin Exp Ophthalmol*. 2020:1–7.
14. Chang DF, Thiel CL. Survey of cataract surgeons' and nurses' attitudes toward operating room waste. *J Cataract Refract Surg*. 2020;46:933–940.
15. Bauchner H, Fontanarosa PB, Livingston EH. Conserving supply of personal protective equipment—a call for ideas. *JAMA*. 2020;323(19):1911.
16. Eckelman MJ, Sherman J. Environmental impacts of the U.S. health care system and effects on public health. *PLoS One*. 2016;11(6):e0157014.

Footnotes and Financial Disclosures

Financial Disclosure(s): The author(s) have made the following disclosure(s): D.F.C.: Consultant – J&J Vision, Carl Zeiss.

Dr. Chang is co-chair of the Ophthalmic Instrument Cleaning and Sterilization Task Force.

Correspondence:
David F. Chang, MD, Altos Eye Physicians, Altos Eye Physicians, 762 Altos Oaks Drive, Los Altos, CA 94024. E-mail: dceye@earthlink.net.