Update on Optic Neuropathy After Cataract Surgery

One of the most commonly performed surgical procedures—cataract surgery—is also considered one of the safest. Even so, it carries the risk of complications, including a rare optic neuropathy that resembles nonarteritic anterior ischemic optic neuropathy (NAION) and can cause painless, acute loss of vision.

Much of what surrounds this postcataract surgery optic neuropathy (PCSON) is up for debate. Nonetheless, it appears that patients with a history of spontaneous NAION or PCSON in one eye could be at an increased risk of PCSON in the fellow eye.

Overview of PCSON

Two types of PCSON. There appear to be two types of PCSON, said M. Tariq Bhatti, MD, at Kaiser Permanente in Roseville, California:

- an immediate optic neuropathy occurring hours to days following apparently uncomplicated surgery, and
- a delayed form that occurs several weeks or months postoperatively.

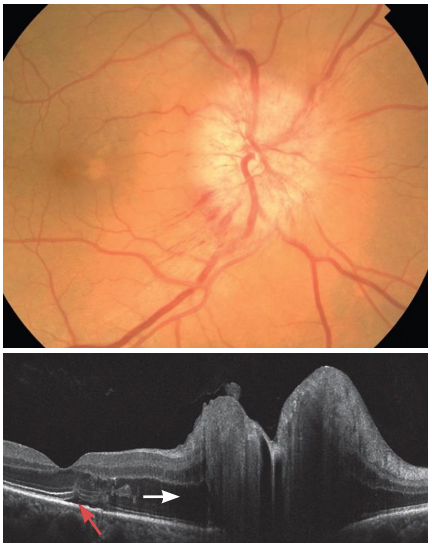
Immediate. "The cause of the immediate type is fairly well accepted," said Dr. Bhatti. "Increased intra- or perioperative IOP results in poor blood supply to the optic disc and, ultimately, ischemia." Some researchers also have suggested that vascular compression or direct optic nerve trauma from the retrobulbar injection may cause immediate PCSON, said Dr. Bhatti.

"This first type [of PCSON] makes sense, and the pathogenesis is easy to understand," said John J. Chen, MD, PhD, at the Mayo Clinic in Rochester, Minnesota.

Delayed. In contrast, IOP does not appear to be a risk factor for delayed PCSON, said Neil R. Miller, MD, at the Wilmer Eye Institute in Baltimore. Delayed PCSON "is a bit of a mystery and more difficult to understand," he said. "Because it can occur a few months or even longer following cataract surgery, the etiology doesn't appear to be pressure-related."

One theory for the occurrence of delayed PCSON is that postsurgical production of proinflammatory mediators might induce posterior pole edema, which ultimately results in compression of the optic disc microvasculature, said Dr. Bhatti. Moreover, he noted, some evidence points to etiologies that might involve posterior vitreous traction and the existence of vulnerable, already diseased microvasculature.

Overlapping risk factors? Dr. Chen added that some of the standard risk factors for spontaneous NAION may contribute to both forms of PCSON. "These include small cup-to-disc ratio, obesity, a history of smoking, and vascular issues such as diabetes mellitus, arterial hypertension, and hyperlipidemia—but, interestingly, these may be less common in PCSON than in spontaneous NAION," he said.



NAION. *(Top) Fundus image shows a swollen optic nerve with retinal nerve fiber layer hemorrhages in the peripapillary area and indistinct changes at the fovea. (Bottom) Macular line scan through the optic nerve head and fovea shows intraretinal fluid (white arrowhead) and subfoveal fluid (red arrow).*

Lack of definitive treatment. Regardless of which type of PCSON the patient has, management is problematic, said Dr. Miller. "Surgeons have tried steroids, anti-VEGF agents, and hyperbaric oxygen. Unfortunately, there is no definitive treatment, regardless of whether the optic neuropathy is immediate or delayed," he said.

Pinning Down the Cause

How common is it? The earliest publication mentioning PCSON was from Spanish researchers: in 1946, they described 10 cases of optic atrophy

BY MIKE MOTT, CONTRIBUTING WRITER, INTERVIEWING **M. TARIQ BHATTI, MD, JOHN J. CHEN, MD, PHD,** AND **NEIL R. MILLER, MD.**

among 5,000 cataract surgeries.[1] Subsequent studies in the 1950s and 1960s also suggested frequencies of up to 1 in 150 surgeries. Looking back, said Dr. Chen, those high rates were to be expected, given the extracapsular and intracapsular nature of cataract surgery during that period.

More recent studies suggest lower rates. For instance, starting in 2001, researchers at the Bascom Palmer Eye Institute in Miami found that the frequency of optic neuropathy following cataract extraction was approximately 1 in every 2,000 cases.[2] Additional studies during the past five years have found an incidence ranging from 1 in 1,000 to 1 in 3,000 cases, said Dr. Bhatti.

Is cataract surgery to blame? Does modern cataract surgery still carry an inherent risk of PCSON? While the evidence is mixed, most of the recent research points toward the affirmative, Dr. Chen said. "The [overall] risk might be decreasing given the use of topical anesthesia as well as improvements in surgical techniques, but there's still the possibility of IOP elevation and postoperative inflammation with even the most modern intraocular surgeries."

Supporting evidence. In 2019, Yang and colleagues retrospectively assessed the records of more than 1 million South Korean patients to determine if the risk of optic neuropathy increased after undergoing cataract surgery.[3]

Between 2002 and 2013, a total of 40,356 patients underwent cataract surgery, and 139 developed PCSON. (All told, 1,079 of those in the database developed NAION during that time frame.) Although the vast majority of the postsurgical cases of optic neuropathy occurred more than a year following cataract surgery, 31 occurred within one year, and 12 happened within three days. After the researchers adjusted for confounding factors, they found that the risk for acute optic neuropathy was .70% in those who had undergone cataract surgery (95% CI, .55%-.86%), versus .27% for those who had not (95% CI, .25%-.29%).

Results from a 2021 retrospective study by Drs. Chen and Bhatti and their team also suggest a link between cataract surgery and PCSON, especially for the delayed form.[4] All told, between 1990 and 2016, 23,169 cataract surgeries were performed in Olmsted County, Minnesota. Of 20 patients who developed delayed PCSON, nine did so within one year of surgery. No cases of immediate PCSON took place during the study period. Interestingly, the annual incidence rate of PCSON within two months of cataract surgery was not significantly greater than the annual incidence rate of spontaneous NAION. However, the annual rate of PCSON within one year of cataract surgery was significantly higher (38.9 per 100,000 versus 6.5 per 100,000).

A counterargument. In contrast, the results of a single-center analysis by Dr. Miller and his colleagues at the Wilmer Eye Institute in 2017 suggest that modern cataract surgery is not associated with an increased risk of PCSON.[5]

The researchers hypothesized that shorter operating times, smaller incisions, and the increasing use of topical rather than retrobulbar or peribulbar anesthesia should reduce the risk altogether. After reviewing 200 cases of ischemic optic neuropathy that occurred during a five-year period, they identified 18 cases of PCSON that developed anywhere from nine days to almost one year following cataract surgery.

They found that 1) annual incidence of PCSON was similar to that of spontaneous NAION (10.9 in 100,000 versus 10.3 in 100,000); 2) there were no statistically significant differences between the PCSON group and the spontaneous NAION cohort in terms of cup-to-disc ratio or systemic disease; and 3) there was no causal relationship between cataract surgery and any subsequent occurrences of optic neuropathy.

"Our results remain controversial," said Dr. Miller. "But we found no difference in the risk of PCSON compared with the normal population. Nor did we find unequivocal evidence that patients who have ever experienced optic neuropathy in one eye have an increased risk in the fellow eye following noncomplex cataract surgery."

Need to keep an open mind. Despite the Wilmer study findings, Dr. Miller said, the retrospective nature of their report means that cataract surgery may in fact predispose certain susceptible patients to develop PCSON.

"Given all of the superb analyses that have occurred over the past several years, all surgeons should keep an open mind about how PCSON might impact our patients," said Dr. Miller.

Looking Ahead

It may be that a causal relationship between uncomplicated cataract surgery and optic neuropathy will not be conclusively established in the literature, said Dr. Bhatti. However, the experts said, there's enough evidence to justify proceeding with caution as well as to support counseling prospective patients with a history of optic neuropathy who are electing to undergo cataract surgery in the fellow eye.

As Dr. Bhatti noted, "Thankfully, optic neuropathy following cataract surgery is relatively uncommon—again, [the incidence is] in that 1 in 1,000 to 3,000 range. But if patients have previously experienced either garden-variety spontaneous NAION or PCSON in one eye and they're considering cataract surgery in the other, it's important for the surgeon to provide full disclosure and counsel them on the possible increase of risk in that fellow eye."

1 Coro A. *Arch La Soc Oftalmologica Hisp.* 1946; 6:901-904.

2 McCulley TJ et al. *Ophthalmology.* 2001;108(7): 1275-1278.

3 Yang HK et al. *Am J Ophthalmol.* 2019;207:343-350.

4 Mansukhani SA et al. *Am J Ophthalmol.* 2021; 222:157-165.

5 Moradi A et al. *Am J Ophthalmol.* 2017;175:183-193.

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