

## Small-gauge Surgery in Vitreoretinal Disorders – There is More than Meets the Eye

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**Disclosures:** Andrea Grosso and Claudio Panico have no conflicts of interest to declare. No funding was received in the publication of this article.

**Received:** 24 February 2014 **Accepted:** 6 May 2014 **Citation:** *European Ophthalmic Review*, 2014;8(1):44–5 DOI: 10.17925/EOR.2014.08.01.44

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*“Every truth has two sides; it is as well to look at both, before we commit ourselves to either.”*  
Aesop

The impact of ageing-associated diseases has increased exponentially due to the known factors of longer life expectancy (the ‘silver tsunami’), greater demands by the elderly for a good quality of life and the progress and increased availability of diagnostic and treatment options. In this era of consumerism, patients are overwhelmed by information from all sides – whether it be doctors’ recommendations, dissenting experts, confusing statistics or testimonials on the Internet – and are therefore more involved in the decision-making process with potentially expanding medical–legal controversies. The classic model of medical decision-making based on economic theory developed by the mathematician Daniel Bernoulli became unsatisfactory and problematic in medicine where outcome and utility are not measurable in money. We should ask healthy people how much they think a given medical condition would affect their quality of life. Some people are maximalist and want everything done; others are minimalists who desire the least treatment necessary. Another group take a naturalist approach, looking for natural solutions and, finally, there are the believers who are certain that they will find a good solution for their condition. Both patients and physicians are deeply influenced by dramatic stories. Vitreoretinal surgery may carry an elevated risk of complications because we work on tissue with a thickness of microns.<sup>1</sup>

We are living in an age of an accelerating information explosion and visual tasks are becoming more compelling thanks to the widespread diffusion of smartphones, tablets and personal computers. Furthermore, patients continue to drive in their eighties and nineties. The impact on the patient’s life of distressing symptoms, such as visual distortions or floaters, is comparable with a loss in lines of visual acuity. In this direction, the criteria used to offer surgery are also changing. The visual acuity thresholds are only one step in the decision-making process. We may also operate on patients who retain good visual acuity in terms of quantity, but who are not comfortable with their quality of vision.

Another matter to be taken into account is the increased volume of cataract surgery. The skills and the expertise in vitreoretinal surgery techniques are becoming of fundamental importance in managing vitreoretinal complications during, or after, complicated cases of

*“One should not only say what is true but also what causes error.”*  
Aristotle and Nicomachean Ethics

cataract surgery. We believe that a cataract surgeon should have some vitreoretinal training and vice versa. In Italy, almost all vitreoretinal surgeons also perform cataract surgery. In our hospital in Torino, we perform combined cataract and vitrectomy surgery in complicated cases and in patients over 65 years old with macular pathology. However, diagnosis-related group-based (DRG) reimbursement does not include cataract surgery and vitreoretinal surgery in the same procedure: our clinical goal is to only take our patients to the surgical theatre once in patient-orientated surgery.<sup>2–4</sup>

Historically, the most common surgical platforms for vitrectomy surgery, since its introduction in 1997, have been the Alcon Accurus<sup>®</sup> and Bausch & Lomb Millennium<sup>®</sup> vitrectomy systems, followed by DORC platforms. In parallel to the technological progress of vitrectomy platforms and small-gauge trocar systems, the new concepts of core vitrectomy and full vitrectomy emerged according to the vitreoretinal pathology, macular conditions or retinal detachment, respectively. The philosophy behind the choice of the core or central vitrectomy benefited from dye-assisted vitrectomy and from our improved knowledge of the role of the vitreous in a healthy retina. We thought that 23-gauge could be the standard in vitreoretinal surgery when coupled with the Accurus or DORC platform systems.<sup>5,6</sup> However, when we pioneered 23-gauge surgery, we experienced an increased rate of retinal detachment following macular surgery.<sup>7</sup> Furthermore, we registered an increased rate of endophthalmitis<sup>7</sup> in comparison to 20-gauge surgery, mainly centred on wound stability and imperfect architecture of sclerotomies. Nonetheless, we thought that we were right. We were sure that a new technological revolution was coming in the ophthalmology world and that a transition towards the ‘small calibre is better’ paradigm would be the future.

The recent introduction of high-speed 25-gauge vitrectomy systems with duty cycle has not only allowed less trauma for the patient with speedier recovery and a decreased rate of surgical complications, but also the opportunity to complete surgical manoeuvres in a safer way with less risk of retinal tractions. The idea that ‘one size fits almost all’ is becoming true and may be translated to the everyday surgical practice.

Therefore, we support the use of 25-gauge for all kinds of surgery, except for full macular translocation, giant retinal tear management and high myopia, where 25-gauge probes are too short. Interestingly, the majority of surgical data in literature about small-gauge surgery come from the use of Accurus or DORC platforms, rather than new high-speed vitrectomy platforms. In our surgical experience at Torino Eye Hospital with high-speed 25-gauge platforms since 2011 we have not registered cases of endophthalmitis following macular surgery and retinal detachment surgery. Our results are consistent with data published in the literature.<sup>7-11</sup> We had a preliminary experience with 27-gauge vitrectomy for macular surgery and for non-complicated cases of diabetic retinopathy. We were able to shave the vitreous in periphery in cases of macular holes. In the macular surgery the light is efficient, the forceps comfortable in the hand and the duration of surgical procedure is similar to the 25-gauge vitrectomy. We use the 25-gauge chandelier illuminator when we need to introduce silicon oil.

The other revolution in the field of vitreoretinal surgery is that the combined pars-plana vitrectomy-scleral buckle for primary repair of pseudophakic rhegmatogenous retinal detachment has not been shown to offer better final visual outcomes when compared with primary 23- and 25-gauge vitrectomy in the management of retinal detachment.<sup>12-17</sup> However, further clinical studies to evaluate the safety and effectiveness of new 25-gauge high speed pars-plana vitrectomy compared to scleral buckling for primary rhegmatogenous retinal detachment through randomised controlled trials (RCT) and Health Technology Assessment (HTA) Essays are needed.<sup>12-18</sup> Furthermore, primary vitrectomy was also demonstrated to have a lower rate of complications compared with combined procedures. This evidence does not mean that the use of the scleral buckle is over, but that the trends of current practice are towards a diffusion of small-gauge vitreoretinal techniques for retinal detachment surgery. Surgeons may choose different options according to the phenotype of retinal detachment and the status of the lens.

Vitreoretinal surgery mirrors the evolution of modern medicine in becoming less invasive, with faster rehabilitations. We believe that it is important to save the conjunctiva to reduce stress-signalling pathways that lead to more inflammation and delay visual rehabilitation. We encourage the transition to 25-gauge vitreoretinal techniques as this less invasive technique offers the same results as more invasive techniques when we look to the hard outcomes (visual gain after the surgical procedure, duration of the visual gain and a lack of major complications).

In this review, written with the contribution of Italian and Spanish colleagues, we make a critical reappraisal of modern vitreoretinal techniques through an historical and economical perspective, as different socio-economic contexts may determine different preferred-practice patterns. We also stimulate a debate around what is state of the art in the management of macular diseases and retinal detachment in this era of small-gauge surgery.

We liken this surgical transition to a 'Windows revolution' in the sense of a democratisation of surgery. With the diffusion of macular surgery, the vitreoretinal techniques are opened up to a wider community of surgeons, with an overall improvement in surgical outcomes. However, we would stress that vitreoretinal surgery is a matter of hard commitment and intensive training.

To finish, we would like to underline the importance of being open-minded about these innovations and having the courage to explore new solutions. We would like to end our thoughts with a quote from an interview with the engineer Ernő Rubik, conducted 40 years after the invention of Rubik's Cube: "At the beginning, you think that the only way to resolve the cube is to go back to previous steps, but it is not. The is only one finish line, but the the roads to achieving the goal are infinite: this is why life is intriguing." ■

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