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Étude comparative de la vitrectomie transconjonctivale sans suture 23 gauge versus 20 gauge dans la chirurgie du décollement de rétine

Magali Albrieux

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Ex. 2

UNIVERSITE JOSEPH FOURIER
FACULTE DE MEDECINE DE GRENOBLE

Année 2010

N° 5052

**Etude comparative de la vitrectomie transconjonctivale sans suture
23 gauge versus 20 gauge dans la chirurgie du décollement de rétine**

THESE

PRESENTEE POUR L'OBTENTION DU DOCTORAT EN MEDECINE

DIPLÔME D'ETAT

Magali ALBRIEUX

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Le jeudi 9 Septembre 2010

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Yours sincerely,

Christophe CHIQUET

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8ème étage

Dear Editor,

Please find enclosed a full-length paper entitled "**Comparative study of 23-gauge vitrectomy versus 20-gauge vitrectomy for the treatment of rhegmatogenous retinal detachment**" that we wish to submit to RETINA.

All authors have seen and approved the manuscript and have contributed significantly to the work. The manuscript has not been published and is not being considered for publication elsewhere. I have obtained written permission from all persons named in the acknowledgments.

This comparative nested case-control study gives new insights into the efficacy and safety of 23-G transconjunctival sutureless vitrectomy for the management of rhegmatogenous retinal detachment without severe PVR.

Given a large cohort of 1150 patients enrolled in a prospective study, we were able to match 35 new consecutive eyes operated on using 23-G TSV with 35 eyes operated on using conventional 20-G PPV. Using **matched populations** reduces the effect of selection bias and guarantees the absence of confounding factors, such as detachment of the macula, high myopia, PVR, number and extent of retinal tears, preoperative visual acuity, and duration of visual acuity loss.

This original study provides new data on the usefulness of 23-G TSV in RD surgery and showed that, especially in pseudophakic eyes, both techniques are not significantly different in terms of the single reattachment rate (77%) and the visual results. These visual and anatomical results are similar and did not confirm the superiority of one technique over the other for the repair of nonsevere rhegmatogenous RD. The 23-G TSV technique allows the surgeon to reach the same objectives as the 20-G technique, but with its own limitations and potential complications. The data and conclusion of this study should interest a large number of readers of *RETINA*.

Yours sincerely,

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POUR TOUTE CORRESPONDANCE, VEUILLEZ RAPPELER LE NOM DU SERVICE ET LE DESTINATAIRE, MERCI...

Comparative study of 23-gauge vitrectomy versus 20-gauge vitrectomy for the treatment of rhegmatogenous retinal detachment

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Key words: 23-gauge vitrectomy, pars plana vitrectomy, retinal detachment, pseudophakic, transconjunctival sutureless vitrectomy

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Abstract:

Objective: To compare the safety and efficacy of 20- and 23-gauge pars plana vitrectomy (PPV) for the management of primary rhegmatogenous retinal detachment (RD) with proliferation vitreoretinopathy (PVR) grade B or less.

Methods: This comparative nested case-control study included 35 consecutive 23-gauge transconjunctival PPV cases matched with 35 cases of 20-gauge PPV (from a prospective cohort of 1150 patients) for the baseline visual acuity (VA), axial length, lens and macular status, the location and number of breaks, and PVR grade. All patients had complete PPV, cryotherapy, fluid–gas exchange, and a minimum follow-up of 6 months. The exclusion criteria were eyes with previous vitreoretinal surgery, combined vitrectomy and cataract surgery, RD secondary to trauma or macular hole, diabetic retinopathy, aphakic eyes, giant tears, or posteriorly located breaks precluding treatment using transconjunctival cryotherapy.

Results: Baseline examination disclosed pseudophakia in 77.1%, 2.7 ± 2.2 retinal breaks / eye, attached macula in 37.1%, and PVR grade B in 24.3% of the cases. The mean operative time and intraoperative complication rate (11.4%) were similar in both groups. The single reattachment rate and the final anatomical success rate were similar in both groups, 77% and 97%, respectively. Mean preoperative VA of 1.2 ± 0.9 logMAR improved similarly in both groups to 0.4 ± 0.4 at the 6-month visit. A final vision of 20/40 or better was achieved in 61.4% of the eyes.

Conclusion: Twenty-three-gauge PPV provides anatomical and visual results similar to the 20-G technique for the management of uncomplicated rhegmatogenous RD.

Introduction

Primary pars plana vitrectomy (PPV) has gained popularity in the last 15 years in the treatment of retinal detachment (RD), especially in pseudophakic eyes, with¹⁻⁴ or without³⁻¹¹ scleral buckling. A 23-gauge (23-G) sutureless transconjunctival system was initially reported by Hilton in 1995 (ARVO meeting, known as the Visitrec Vitrectomy Unit)¹² with a two-sclerotomy technique and then developed by Eckardt in 2005¹³ with a three-way PPV technique. More recently, several authors have reported successful anatomic and visual outcomes with transconjunctival sutureless vitrectomy (TSV) in eyes with different vitreoretinal disorders, such as epiretinal membranes,^{14, 15, 16-23} macular holes,^{15, 17-23} vitreous hemorrhage,^{15, 19, 20, 23-25} and proliferative diabetic retinopathy.^{15, 20, 21, 23, 25, 26} This technique gained favor with many vitreoretinal surgeons since complication rates are considered comparable to those reported with 20-gauge (20-G) systems,^{13, 15, 21} with less induced corneal astigmatism^{16, 25, 27} and reduced patient discomfort²² but conflicting results concerning less surgically induced inflammation.^{16, 28} All these studies suggest that 23-G instrumentation is safe and effective for performing vitreoretinal surgery.

The efficacy of 23-G TSV PPV for RD surgery was suggested in recent retrospective studies^{18, 19, 21, 23, 26, 29, 30} and in two prospective studies.^{31, 32} Most of the time, the description of patients with RD is reported in a large series of patients operated on for indications other than RD, which precludes any comparisons between studies.^{21, 30} This prompted us to design a comparative nested case-control study comparing the efficacy and side effects of 23-G PPV versus 20-G PPV associated with cryotherapy and gas tamponade for the surgery of primary rhegmatogenous RD.

Methods

This nested case-control study included 70 patients (70 eyes) with primary rhegmatogenous RD who underwent 23-G TSV ($n=35$) or 20-G PPV ($n=35$), associated with cryotherapy and gas tamponade. This study followed the Declaration of Helsinki guidelines for research involving human subjects and was approved by the local Institutional Review Board (#5891). All patients enrolled in this study provided signed informed consent before the intervention.

Selection of the population

Inclusion criteria for both groups (23- and 20-gauge PPV) were patients older than 18 years who were newly referred for primary rhegmatogenous RD. Exclusion criteria were eyes with previous vitreoretinal surgery, combined vitrectomy and cataract surgery, RD secondary to trauma or macular hole, diabetic retinopathy, aphakic eyes, preoperative proliferative vitreoretinopathy (PVR) grade C, giant tears or posteriorly located breaks precluding treatment using transconjunctival cryotherapy, and dense vitreous hemorrhage precluding the assessment of retinal breaks and RD preoperatively. One eye per patient could be included in the study. All patients included in this study benefited from the technique associating complete PPV, cryotherapy of tears, and fluid–gas exchange.

A cohort of 1150 consecutive patients with previously untreated rhegmatogenous RD (IRB #5891) and operated on by two surgeons (FR and CC) was prospectively studied between 2004 and 2008, with a minimum follow-up of 6 months, using a standard data sheet at baseline on the 1st day and 1 and 6 months after surgery for all patients. Between April 2007 and December 2008, 35 consecutive patients meeting the inclusion and exclusion criteria described above were operated using the 23-G technique. The group of 20-G patients was selected from the prospective cohort of 1150 patients in order to select 35

patients matched to the 23-G group, blinded to the follow-up data, for all the following criteria: preoperative best corrected visual acuity, high myopia (axial length >26 mm), lens and macular status, the location and number of breaks in attached or detached retina, PVR grade, and duration of visual acuity loss.

Clinical data

Each patient underwent a detailed preoperative evaluation (tables 1-2) including estimation of symptom duration (floaters, photopsia, visual field loss), best corrected visual acuity (VA), intraocular pressure (IOP) measured by Goldmann applanation tonometry, as well as cornea and lens status. VA was converted to a logarithm of the minimum angle of resolution (logMAR) score for analysis³³. Pre- and postoperative fundus examination was performed using both the three-mirror (Goldmann) lens and indirect ophthalmoscopy. Axial length measurements were obtained from ultrasound imaging (Cinescan™, Quantel Medical). The following patient information was also collected: age, gender, systemic disease, previous ocular surgery, and associated eye diseases.

Retinal detachments were characterized in terms of extent (degrees), location, macular involvement, number and location of retinal breaks, and PVR. The inferior location of a break was defined by the presence of this break strictly below the 3 o'clock or 9 o'clock meridian. The PVR grade was determined according to the Retina Society classification.³⁴

Surgical technique

All patients were operated on under general anesthesia. The Accurus vitrector (Alcon™ Laboratories, Rueil-Malmaison, France) was used for all surgical procedures with a comparable cutting rate of 1500/min and a suction rate ranging between 120 and 400 ml/min. A contact wide-angle viewing system combined with an image inverter (SDI Oculus

Ile, Wetzlar, Germany) and a plane-concave lens (FCI™, ref. S5.7010, Paris, France) were used for fundus visualization. All eyes underwent complete PPV with induction of the posterior vitreous detachment (PVD) if necessary, peripheral vitreous dissection under scleral depression, cryotherapy of retinal breaks (ErboKryo AE, Erbe™, Limonest, France), either transconjunctively for the 23-G group or transsclerally for the 20-G group, then a fluid/gas exchange using 20% sulfur hexafluoride (SF6) or 16% hexafluoroethane (C2F6) with ab interno drainage in most cases (table 3). Perfluorocarbon liquid (PFCL, FCI™, ref. S5.8150, Paris, France) was used, if needed, in selected cases of bullous peripheral RD to flatten the posterior retina and help peripheral vitrectomy. Cryotherapy was limited to areas of retinal breaks, suspected zones, or predisposing lesions. No combined phacoemulsification with vitrectomy was used. Scleral buckling was not performed in any case. Laser photocoagulation was not used. Vitreous shaving was performed with scleral indentation.

The two-step 23-gauge Dutch Ophthalmic Research Center system (DORC™, Zuidland, Holland) was used: a disposable Eckardt vitrectomy trocar system (ref. 1272.ED06), a disposable pneumatic vitrectome (ref. 2267.NMD06), and a disposable triple-port fiber (ref. 3269.D06). The technique of displacement of the conjunctiva and tunnelization was similar to that previously reported.¹³ At the end of surgery, the microcannulas were withdrawn and gentle pressure was applied on the sclerotomy with a cotton tip applicator. Vitrectomy was applied on the scleral surface in order to relieve the vitreous at the external site of each sclerotomy. Then 10% povidone-iodine solution was applied on the ocular surface for 3 min followed by a rinse with BSS. Antibiotic and steroid (dexamethasone) ointment was applied on the eye before patching.

With the 20-G system, the sclerotomies and conjunctiva were closed with Vicryl 8.0 sutures. A steroid (dexamethasone) was injected subconjunctively at the end of surgery before patching.

Postoperative follow-up

All patients maintained postoperative head positioning defined by the tear location for a duration ranging from 8 to 14 days, depending on the type of gas used, SF₆ or C₂F₆, respectively. All patients in both groups systematically had a short course of oral acetazolamide (250 mg 3×/day) for 48 h.

Postoperatively, a complete ocular examination was performed on the 1st day and at 1 and 6 months. The clinical data recorded included best corrected VA (at 1 and 6 months), presence of conjunctival leaks, anterior chamber examination (depth, inflammation), IOP, and fundus examination. The definition of hypotony was IOP 5 mmHg or less.^{30, 35} Cataract development was defined as an increased LOCS III of 2.⁴

The outcome measures studied were the primary reattachment rate (complete reattachment of the retina at the 6-month visit, major clinical endpoint), the final anatomical success rate, the postoperative VA, and intra- and postoperative complications (table 4). All patients were assessed for a minimum follow-up of 6 months. Table 5 reports the results of all patients, including those who had surgery for cataract ($n=7$), silicone oil removal ($n=2$) or additional RD surgery ($n=16$), with final examination considered 3–6 months after the second procedure.

Statistical analysis

The nested case-control study design^{36, 37} was used to compare the group of patients operated on with 20-G and the group operated on with 23-G PPV. The primary outcome measure of the study was the postoperative single-operation success rate. The secondary outcome measures were postoperative visual acuity (LogMAR units) and the complication rate. Quantitative data were expressed as mean \pm standard deviation (SD). The two surgery

groups were compared using the paired *t*-test for quantitative data and chi-square analysis (McNemar test) for qualitative data. Based on an alpha risk of 0.05, a beta risk of 0.2, a 20% difference in success rate between the two groups (90% in the 20-G and 70% in the 23-G group), the calculated sample size (number of pairs of patients) was 35.³⁸ The statistical analysis was performed using the Statistical Package for the Social Sciences program (SPSS 17.0 for Windows, Chicago, IL, USA). Statistical significance was defined as a two-tailed *P*-value of less than 0.05.

Results

Baseline characteristics (Tables 1 and 2)

The preoperative demographics of the 70 patients are summarized in Table 1. No significant differences between the two groups were observed for baseline epidemiological, ocular, and RD characteristics. Forty-two percent of patients were women and the mean patient age was 62.4 ± 16.1 years. Severe myopia was present in 22.6% of the eyes. Most patients were pseudophakic (77%). The time between cataract surgery and retinal detachment was 53.6 ± 42.5 months; the time between capsulotomy and retinal detachment was 42.7 ± 44.9 months. Phakic patients had no cataract at the time of RD diagnosis.

The characteristics of RD are listed in Table 2. As expected, both groups were similar for the main prognostic factors such as initial VA, macular detachment, number and location of retinal breaks, and PVR. Most RDs were related to superior retinal breaks and PVR was grade A in 27.1% and grade B in 24.3%.

Surgery (Table 3)

The surgical technique with cryotherapy, ab interno drainage, and complete vitrectomy was similar in both groups. As stated in Table 3, the type of gas tamponade was significantly different, with most cases treated with SF₆ in the 23-G group and C₂F₆ in the 20-G group. The total duration of surgery (70.6 ± 21.9 min) showed no significant difference between the two groups.

Anatomical outcomes (Tables 4 and 5)

All 70 patients had a minimum postoperative follow-up of 6 months (range, 6–23; mean, 8.5 ± 4.1) and the total follow-up was similar in both groups ($p=0.2$). The single-

operation success rate (complete primary reattachment of the retina) was achieved in 77.1% of the eyes, similar in the two groups. Subsequent redetachment occurred in 22.9% and the majority of patients were cured with a second surgery (using a 20-G system). Redetachments were mainly observed during the 1st postoperative month (range, 0.5–2.1 months; mean, 1.3 ± 0.4) and the rate did not differ depending on the group ($p=0.99$). The most common cause of redetachment stemmed from previously unseen breaks and/or the development of new retinal breaks (57% in the 23-G group and 44% in the 20-G group) and/or PVR (43% in the 23-G group and 22% in the 20-G group). The association of new retinal breaks and PVR was seen in 22% of the 20-G group. There was only one case with no visible tear during the first surgery with 20-G PPV. Finally, the retina was reattached (after silicone oil removal) in 97.1% of the cases.

In the 23-G group, the reoperation technique included a 20-G PPV ($n=6$), cryotherapy ($n=6$), gas ($n=5$) or silicone tamponade ($n=1$), and scleral indentation ($n=5$). One patient had scleral buckling surgery. Five eyes achieved a reattached retina with a second surgery and one eye with a third surgery. One patient still had a detached retina at the final examination after two surgeries and refused the third surgery.

In the 20-G group, reoperation included 20-G PPV ($n=6$), cryotherapy ($n=6$), gas ($n=8$) or silicone tamponade ($n=1$), with scleral indentation in all cases. Three patients had a scleral buckling surgery. All eyes achieved retinal reattachment with a second surgery except one eye. This patient refused a third surgery.

At the 6-month visit, the fundus examination reported macular abnormalities in 17.6% of the cases, mainly epiretinal membranes (10.3%) and macular hole (4.4%). The patients with macular holes in both groups refused a secondary surgery.

Visual functional outcomes (Tables 4 and 5):

For all eyes enrolled in the study, the mean VA improved from 1.2 ± 0.9 to 0.4 ± 0.5 ($p < 0.001$). The gain in logMAR was higher in patients with macula OFF RD (1.38 ± 0.9) vs macula ON (0.3 ± 0.7 , $p = 0.001$). There was no significant difference between the VA at 6 months and at the final examination. The visual gain was not significantly associated with the extent of RD, severity of myopia, occurrence of intraoperative complications or the operation time.

Complications:

Intraoperative complications:

The rate of intraoperative complications (11.4%, Table 3) was similar in both groups. In the 23-G group, we noted three cases of iatrogenic retinal tears (including one case of sclerotomy-site-related retinal tear) and one case of choroidal detachment secondary to a dislodgment of the infusion line. Two cases of subconjunctival hemorrhage at the trocar site were not considered a complication per se. Technical problems were encountered but were not complicated, with dislodgement of the 23-G cannulas in two cases and temporary blockade of instruments in the trocar system in one case. Suturing the sclerotomy sites was required in two eyes (5.7%, on two sites in one eye and on the infusion site in the other eye) because at the end of the surgery, conjunctival sutures were required in 51% of the eyes (or 21% of the sclerotomies sites) in order to reduce the potential risk of scleral exposure at the entry site in cases of conjunctival laceration. Other complications such as lens or posterior capsule touch and conversion to the 20-G system were not encountered.

In the 20-G group, there were two cases of iatrogenic retinal breaks with one giant tear due to retinal incarceration and one sclerotomy site related to retinal tear, as well as one case of choroidal detachment at the infusion site.

Early postoperative complications:

The mean IOP at day 1 was similar in the two groups. No case of hypotony was diagnosed after surgery. One patient operated on using 23-G TSV had IOP of 8 mmHg on day 1 with no choroidal detachment and returned to normal IOP values (10 mmHg) on day 2. In the 20-G group, eight patients had IOP higher than 21 mmHg (range, 24–40 mmHg) versus six patients in the 23-G group (range, 23–40 mmHg). In all patients, intraocular hypertension was then controlled by topical and systemic hypotensive treatment.

Chemosis was noted in eight eyes in the 23-G group, with no leak. Choroidal detachment, loss of gas under the conjunctiva, or insufficient filling of the vitreous cavity (gas volume < 50%), and acute endophthalmitis were not observed in any eyes in either group.

Discussion

This comparative prospective study of 23-G and 20-G PPV for RD repair showed similar anatomical and visual outcomes and showed that 23-G TSV is a safe and reproducible technique for the management of noncomplex RD.

The validation of a new technique, here 23-G TSV, in a selected indication should first refer to the capacity of obtaining at least the same rate of functional and anatomical results and an acceptable rate of adverse events when compared to the standardized technique (i.e., 20-G PPV). Only a prospective comparative study can answer these questions, ideally with a randomized clinical trial. As demonstrated by previous reports,¹⁻⁴ the comparison of a technique in RD is difficult due to the variability of the initial presentation and the several clinical factors that have an effect on the anatomical and visual prognosis. Based on hypothesized differences on anatomical or functional criteria, these clinical trials included between 75 and 200 patients per group (calculated sample size, 75 patients/group based on the reattachment rate,^{6, 10} calculated sample size of 200 patients/group based on the difference in VA change).³⁹ In this field with wide variation in the clinical characteristics of RD, treatment can also be evaluated by designing a prospective study with matched cases,⁴⁰ reducing the effect of selection bias and adjusting for several variables at once, limiting the impact of confounding factors. Therefore, we selected a matching procedure based on the major clinical factors being predictive of anatomical or functional prognosis.

The anatomical success rate noted in this study is comparable to those of recent prospective studies using 20-G PPV alone (without scleral buckling) in pseudophakic (single-operation anatomic success rate between 62% and 100%^{3-5, 7-11, 41, 42} or phakic patients (64–80%).^{4, 5} As suggested by a recent retrospective comparative study (25-G vs 20-G),⁴³ our results show that 23-G TSV with retinopexy and gas tamponade is also an effective

technique in eyes without severe PVR, providing a single-operation anatomic success rate of 77%. Especially in pseudophakic eyes, predominant in this series, PPV has been shown to offer advantages over SB surgery, including lower operating time,⁴¹ accurate diagnosis of retinal breaks, sometimes after performing a posterior capsulotomy or removing vitreous hemorrhage,^{4, 7, 41} a higher reattachment rate with a single surgery^{4, 11, 41}, and no postoperative axial length changes.^{11,41}

TSV for RD repair was reported in retrospective studies using 25-G ($n=13-64$ patients)⁴³⁻⁴⁷ or 23-G TSV ($n=5-27$)^{18, 19, 21, 23, 26, 29, 30} and in noncomparative prospective studies using 25-G ($n=15$)⁴⁸ or 23-G TSV ($n=20-24$).^{31, 32} However, most retrospective studies did not report detailed data (characteristics of RD, surgical procedures, and results) concerning patients with RD. Our study differed significantly from of the study reported by Tsang et al.³¹ in the number of patients ($n=35$ vs 24), the comparison with a 20-G matched group (in our study), the characteristics of the eyes included (pseudophakic 77% vs 20.8%, inferior tears in 10% vs 29%), the surgical technique (use of cryotherapy in all cases vs cryotherapy \pm laser in 15/24 cases, no combined surgery vs combined phacoemulsification in 79% of phakic patients, SF6 and C2F6 vs SF6 and C3F8), and the follow-up time (6 vs 3 months). Both studies were comparable for the concept of the surgery associating PPV/retinopexy/gas and the frequency of macula ON RD (37%) and the PVR grade (<C). These differences preclude comparison with this study, which reported a slightly higher rate of 91.7%³¹.

Similar visual results after 23-G TSV and 20-G PPV for RD, -2.5 and -2.6 logMAR, respectively, compared favorably with other series of 20-G PPV in pseudophakic eyes (from -0.65 in pseudophakic and aphakic eyes to -0.56 in phakic eyes at 1 year follow-up⁴ and -0.82 in pseudophakic eyes at 6-12 months follow-up³). Approximately 50% of patients in

both groups achieved a visual acuity of 20/40 or better at the 6-month evaluation, which suggests that 23-G TSV has the same visual prognosis as 20-G PPV. Comparisons with other prospective studies using 20-G PPV in pseudophakic eyes are difficult since the populations studied are not always comparable (11.3% with final VA \geq 20/40 at 6 months,¹⁰ 72% at 1 year,⁴¹ and 39.7% at the final visit at 8.8 months¹). A visual and anatomical evaluation was made in patients who had undergone a secondary procedure (cataract or vitreoretinal surgery for ERM or RD redetachment). Our final results showed a slightly better visual result (60% with final VA \geq 20/40) than at 6 months, possibly because two patients evaluated at 6 months in the 23-G group were reoperated for RD, with a final reattached retina rate of 97.1%, and because eight patients (three in the 20-G group, five in the 23-G group) underwent cataract surgery after the 6-month evaluation. The rate of postoperative macular ERM or MH and cataract was also similar in the two treatment groups.

There are several potential advantages of 23-G TSV over conventional 20-G PPV, including absence of suture-related irritation or a local inflammatory reaction at the sclerectomy sites, limbal stem cell damage due to conjunctival dissection, absence of significant corneal and astigmatic changes in the early postoperative period, and increased patient comfort. In addition, the potential advantages of 20-G PPV without scleral buckling over conventional scleral buckling surgery are also expected to be the advantages of 23-G TSV. As reported earlier in macular, vitreous^{22, 24}, and RD surgery,²⁰ the surgical operating time was similar in both groups. The most important factor is the time of vitrectomy per se, as stated above. Since our study was not randomized and not designed to check this point, we cannot compare the duration of each step of RD surgery. Most studies reporting shorter surgery duration are retrospective²⁰ and included limited PPV, especially in macular surgery.

No switch to the 20-G system was necessary in this consecutive series. The 23-G surgery was not limited by the conventional halogen light source. However, in selected

indications, the use of a xenon light source with or without a transconjunctival twilight chandelier³¹ could increase visualization of the peripheral retina, especially in patients with poor pupil dilation or peripheral capsular fibrosis. Finally, we had no problems grasping the posterior hyaloids at the time of PVD induction. We found that the 23-G technique was similar to the 20-G technique, although scleral indentation was more delicate, especially on the nasal side (explaining conjunctival laceration in some cases). Intraocular manipulations were performed with equal facility.

Complications were rare and compared favorably with the 20-G group and previously reported 20-G series. RD surgery is associated with movements of the eye, scleral indentation, and moving instruments in awkward and extreme directions. The surgeon should be aware of the displacement of trocars close to the lens or the peripheral retina. No such complications were encountered in this series. In one patient, we encountered the inadvertent displacement of the infusion cannula complicated by a temporal choroidal detachment, but the surgery could be continued. At the end, choroidal fluid was passively drained via the scleral tunnel of the 2 o'clock sclerotomy. This complication was not noted previously in a personal series of 70 previous surgeries with 23-G TSV PPV but was reported to have an incidence of 1.8% in a recent paper.⁴⁹ Choroidal detachment and hemorrhage were noted in one randomized study in 23-G TSV.²²

The self-sealing nature of the incisions in TSV surgery poses theoretical concerns of a possible increased risk of hypotony, vitreous incarceration, and postoperative endophthalmitis. In contrast to what has been described in the literature,^{20, 23, 30} we did not observe frequent hypotony or postoperative choroidal detachment in the 23-G group, fluid leak, or gas sealing at the end of the surgery or during the first postoperative days. We defined hypotony as when IOP was 5 mmHg or less (clinically significant hypotony),^{30 35} somewhat different from other reports (< 6 mmHg,^{23, 50} < 8 mmHg,²¹ < 9 mmHg^{17, 31}, and <

10 mmHg^{18, 20}). We finally reported no cases with IOP 5 mmHg or less and 2.8% of the cases with 10 mmHg or less, as recently reported in another prospective study on RD (4%).³¹ This low frequency probably results from the scleral incision technique, with only two cases requiring scleral sutures. This rate ranged from 0 to 14% in most studies^{18, 20-23, 30, 51} and up to 38% in one study.¹⁹ A number of factors may explain the variable rate of scleral suture such as the type of bevel, the tunnelization technique (one or two steps),¹⁹ the scleral properties of the eyes, the amount of vitrectomy (history or prior vitrectomy, vitreous base dissection),^{19, 30} use of gas tamponade¹⁹ and the surgeon's experience. To limit the effect of a possible learning curve in our study, approximately 70 vitrectomies using the same 23-G TSV system were performed before the beginning of the study. In all cases, peripheral vitreous shaving was performed, leaving a limited amount of peripheral vitreous skirt close to the sclerotomies. This suggests that vitreous incarceration was minimal and probably not responsible for the wound closing. In 25-G surgery, the disruption of the internal aspect of oblique wounds is more pronounced after the surgeon has passed the instruments through the cannula.⁵² This last point needs to be confirmed in 23-G surgery, especially in surgery with multiple intraocular manipulations that can change the wound architecture from its original construction. Two potentially protective factors were identified in our series: the presence of a large bubble of gas in the first postoperative days⁵³ and the suture of two sclerotomies at the end of the surgery, when necessary.

For similar reasons, sutureless sclerotomies may allow for persistent fluid egress across the wound and potential influx of bacterial pathogens into the vitreous cavity. In this series, the conjunctiva was sutured in 51% of the eyes because of fragile conjunctiva, favored by eye manipulations during scleral indentation and cryotherapy, especially in eyes with a shortened fornix and a narrow palpebral fissure. As stated above, using beveled 23-G incisions with adequate wound apposition,^{53, 54} examining and removing vitreous wicks from

sclerotomies, and closely checking for a water-tight sclerotomy are all important factors in the prevention of postoperative endophthalmitis.

The strengths of this study are its prospective design with a minimum follow-up of 6 months, and the same retinopexy and tamponade techniques. The follow-up period was sufficient to evaluate surgically related complications in the immediate postoperative period. Since most patients were pseudophakic (77%), the potential role of cataract formation on postoperative visual acuity was reduced. At the 6-month evaluation (the study's primary endpoint), the same proportion of eyes with cataract and eyes that underwent cataract surgery was noted in both groups (see Table 4). Therefore, the visual results at the 6-month visit are not likely to be dependent on cataract formation. The nested case-control design is being increasingly used in cohorts of patients from prospective studies and allows for statistically efficient analysis of data from a cohort with substantial savings in cost and time, with relatively minor loss in statistical efficiency.^{36, 37} In our study, the matched populations in the two groups also limited the potential bias associated with preoperative confounding factors playing a role on visual outcome, such as detachment of the macula, high myopia, preoperative visual acuity, and duration of visual acuity loss.

The interpretation of our study is partly limited by the nonrandomized nature of the study, and the selective use of cryotherapy. Endolaser photocoagulation is the other effective means used to induce chorioretinal adhesion.³¹ The only intraoperative difference noted between the 20-G and 23-G groups was the gas used for tamponade, with C2F6 used more frequently in the 20-G group. SF6 was preferentially used in the 23-G patients since those operated with 23-G TSV were managed in the center near the mountains, where SF6 was the preferred gas used. This difference in gas tamponade could be a factor enhancing intraocular hypertension and increases the time of retinal tear tamponade after surgery. This

bias could potentially favor the 20-G group in terms of anatomical success, but this was not demonstrated in this study. Other factors were not studied in this series, such as quality of life including patient comfort, which requires a randomized design.²² A recent noncomparative study reported a less than 20% rate of patients with moderate sensation of foreign body or pain.³¹

Conclusion

This prospective comparative study of Retinal Detachment surgery using the 20- or 23-G technique showed that, especially in pseudophakic eyes, the results of both techniques are not significantly different in terms of the single reattachment rate (77%) and the visual outcome (0.4 ± 0.4 logMAR at the 6-month visit), and did not confirm the superiority of one technique over the other for the repair of nonsevere rhegmatogenous RD. The 23-G TSV technique allows the surgeon to reach the same objectives as the 20-G technique, but with its own limitations and potential complications. Further prospective studies are required to evaluate the expected increase in quality of life after 23-G TSV.

Table 1: Preoperative demographics of 70 patients operated for rhegmatogenous retinal detachment by 20-gauge or 23-gauge pars plana vitrectomy

	Overall (n=70)	20-G PPV (n=35)	23-G PPV (n=35)	P-value
Sex				
Female	30.0 (42.9)	15.0 (42.9)	15.0 (42.9)	0.99
Male	40.0 (57.1)	20.0 (57.1)	20.0 (57.1)	
Eye				
Right	32.0 (45.7)	17.0 (48.6)	15.0 (42.9)	0.63
Left	38.0 (54.3)	18.0 (51.4)	20.0 (57.1)	
Age (years)	62.4 ± 16.1	61.4 ± 16.6	63.4 ± 15.7	0.68
Symptoms				
Photopsia	26.0 (37.7)	13 (38.2)	13 (37.1)	0.92
- Duration (days)	11.1 ± 43.1	5.6 ± 9.5	16.4 ± 59.7	0.66
Floaters	43.0 (62.3)	19.0 (55.9)	24.0 (68.6)	0.28
- Duration (days)	27.6 ± 68.5	14.3 ± 32.7	41.2 ± 90.5	0.30
Visual acuity loss	62.0 (89.9)	30.0 (88.2)	32.0 (91.4)	0.66
- Duration (days)	7.0 ± 7.0	7.2 ± 6.9	6.8 ± 7.3	0.59

Preoperative visual acuity (LogMar)	1.2 ± 0.9	1.2 ± 0.9	1.1 ± 1	0.57
Preoperative visual acuity				0.5
20/20–20/40	16.0 (22.9)	6.0 (17.1)	10 (28.6)	
20/50–20/160	17.0 (24.3)	11.0 (31.4)	7.0 (20.0)	
20/200–20/400	8.0 (11.4)	4.0 (11.4)	3.0 (8.6)	
≤ hand motions	29.0 (41.4)	14.0 (40.0)	15.0 (42.8)	
Intraocular pressure (mmHg)	13.7 ± 4.2	14.1 ± 4.4	13.3 ± 4.1	0.84
Axial length (mm)	24.1 ± 1.7	24.3 ± 1.5	23.9 ± 1.8	0.32
Severe myopia (≥26 mm)	8.0 (22.6)	4.0 (11.4)	4.0 (11.4)	0.9
Lens status				0.99
Pseudophakic	54.0 (77.1)	27.0 (77.1)	27.0 (77.1)	
Phakic	16.0 (22.9)	8.0 (22.9)	8.0 (22.9)	
Status of the posterior capsule in pseudophakic eye (n=54)				0.8
Intact capsule	26 (48.1)	13 (48.1)	13 (48.1)	
Capsular rupture	7 (13.0)	3 (11.1)	4 (14.8)	
Posterior capsulotomy	21 (38.9)	11 (40.7)	9 (37.0)	
Time between cataract surgery and retinal detachment (months)	53.6 ± 42.5	58.5 ± 43.2	49.1 ± 42.2	0.37

Time between capsulotomy and retinal detachment (months)	42.7 ± 44.9	45.6 ± 43.6	38.6 ± 49.4	0.62
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Table 2: Characteristics of rhegmatogenous retinal detachment before surgery

	Overall	20-G PPV	23-G PPV	P-value
Attached macula	26.0 (37.1)	13 (37.1)	13 (37.1)	0.99
Number of breaks:				
Preoperatively	1.4 ± 1.5	1 ± 1.3	1.7 ± 1.6	0.02
Intraoperatively	2.7 ± 2.2	2.5 ± 1.8	2.9 ± 2.5	0.96
Inferior tears	12.0 (17.1)	4.0 (11.4)	8.0 (22.9)	0.2
On detached retina	7.0 (10.0)	2.0 (5.7)	5.0 (14.3)	0.23
Number of tears with size > 1 optic disc diameter	0.4 ± 0.7	0.3 ± 0.7	0.4 ± 0.6	0.53
Proliferation vitreoretinopathy				0.6
PVR A	19 (27.1)	8 (22.9)	11 (31.4)	
PVR B	17 (24.3)	10 (28.6)	7 (20)	

Table 3: Details of surgical operations

	Overall	20-G PPV	23-G PPV	P-value
Pupillary dilation (mm)	7.8 ± 1.1	7.8 ± 1.3	7.8 ± 1.0	0.54
Total number of cryotherapy applications	7.7 ± 4.3	7.4 ± 3.7	8.03 ± 4.9	0.80
Number of applications on retinal tears	5.9 ± 3.5	5.7 ± 3.3	6.03 ± 3.8	0.86
Gas tamponade				<0.001
SF6	40.0 (57.1)	10.0 (28.6)	30 (85.7)	
C2F6	30.0 (42.9)	25.0 (71.4)	5 (14.3)	
Intraoperative complications	8 (11.4)	4 (11.4)	4 (11.4)	0.99
Operation time (min)	70.6 ± 21.9	71.3 ± 23.1	69.8 ± 20.9	0.6

Table 4: Postoperative examination at 1st day (D1), 1 month (M1) and 6 months (M6)

	Overall	20-G PPV	23-G PPV	P-value
Day 1 intraocular pressure	17.5 ± 7.2	18.4 ± 6.7	16.9 ± 7.8	0.17
Day 1 gas bubble ≥ 75% of the vitreous cavity	66.0 (94.3%)	33.0 (94.3%)	33.0 (94.3%)	0.99
M1 postoperative visual acuity (LogMAR)	0.6 ± 0.7	0.4 ± 0.4	0.7 ± 0.9	0.34
M1 visual acuity				0.3
20/20–20/40	33.0 (47.1)	17.0 (48.6)	16.0 (45.7)	
20/50–20/160	23.0 (32.9)	13.0 (37.1)	10.0 (28.6)	
20/200–20/400	5.0 (7.4)	1.0 (3.0)	4.0 (11.4)	
≤ hand motions	7.0 (10.0)	2.0 (5.7)	5 (14.28)	
M1 intraocular pressure (mmHg)	15.6 ± 4.7	16.0 ± 5.5	15.3 ± 4.0	0.72
M6 postoperative visual acuity (LogMAR)	0.4 ± 0.4	0.4 ± 0.4	0.4 ± 0.4	0.93
M6 visual acuity				0.7
20/20–20/40	38.0 (54.3)	19.0 (54.2)	20.0 (57.1)	
20/50–20/160	23.0 (32.9)	13.0 (37.1)	10.0 (28.6)	
20/200–20/400	4.0 (5.7)	1.0 (2.9)	3.0 (8.6)	
≤ hand motions	4.0 (5.7)	2.0 (5.9)	2.0 (5.7)	
M6 intraocular pressure (mmHg)	14.1 ± 2.8	14.7 ± 2.4	13.5 ± 3.1	0.19

Cataract surgery before M6	3.0 (18.8)	1.0 (12.5)	2.0 (25.0)	0.49
Number of cataracts at M6	9.0 (56.3)	4.0 (50.0)	5.0 (62.5)	0.49
Single-operation success rate	54 (77.1)	26 (74.3)	28 (80)	0.6
Attached retina at M6	66.0 (94.3)	34.0 (97.1)	32.0 (91.4)	0.30
M6 macula status				0.91
Normal	56.0 (82.4)	29.0 (85.3)	27.0 (79.4)	
Epiretinal membrane	7.0 (10.3)	3.0 (8.8)	4.0 (11.8)	
Macular hole	3.0 (4.4)	1.0 (2.9)	2.0 (5.9)	

Table 5: Final examination

	Overall	20-G TSV	23-G TSV	P-value
Follow-up period (months)	8.5 ± 4.1	9.1 ± 4.5	8 ± 3.7	0.26
Final visual acuity (LogMAR)	0.4 ± 0.5	0.3 ± 0.4	0.4 ± 0.5	0.67
Final visual acuity				0.7
20/20–20/40	43 (61.4)	22 (62.9)	21 (60)	
20/50–20/160	18 (25.71)	10 (28.57)	8 (22.86)	
20/200–20/400	4 (5.71)	1 (2.86)	3 (8.57)	
≤ hand motions	5 (7.14)	2 (5.71)	3 (8.57)	
Final intraocular pressure	14.1 ± 3.0	14.5 ± 2.4	14.0 ± 3.2	0.88
Final anatomical outcomes				0.99
Reattached retina	68.0 (97.1)	34.0 (97.1)	34.0 (97.1)	
Number of cataracts at final examination	4.0 (25)	1.0 (12.5)	3.0 (37.5)	0.23
Cataract surgery after M6	7.0 (43.8)	3.0 (37.5)	4.0 (50)	0.23

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THESE SOUTENUE PAR : Magali ALBRIEUX

TITRE:

COMPARATIVE STUDY OF 23-GAUGE VITRECTOMY VERSUS 20-GAUGE VITRECTOMY
FOR THE TREATMENT OF RHEGMATOGENOUS RETINAL DETACHMENT

Etude comparative de la vitrectomie transconjonctivale sans suture 23 gauge versus 20
gauge dans la chirurgie du décollement de rétine

CONCLUSION :

This prospective comparative study of Retinal Detachment surgery using the 20- or 23-Gauge technique showed that, especially in pseudophakic eyes, the results of both techniques are not significantly different in terms of the single reattachment rate (77%) and the visual outcome (0.4 ± 0.4 logMAR at the 6-month visit), and did not confirm the superiority of one technique over the other for the repair of nonsevere rhegmatogenous RD. The 23-Gauge Transconjunctival Sutureless Vitrectomy technique allows the surgeon to reach the same objectives as the 20-Gauge technique, but with its own limitations and potential complications. Further prospective studies are required to evaluate the expected increase in quality of life after 23-Gauge TSV.

VU ET PERMIS D'IMPRIMER

Grenoble, le 15.07.2010

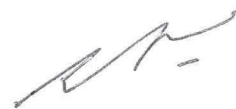
LE DOYEN



B. SELE



LE PRESIDENT DE THESE



PROFESSEUR Jean-Paul Ronanvier



SERMENT D'HIPPOCRATE

Qui dias memorem laudes, repetámque fideles
 Ingenij dotes, Hippocratisque decus.
 Democriti auditor Phœbea, ó, Coë propago,
 Certius an quis te tradidit artis opes?

En présence des Maîtres de cette Faculté, de mes chers condisciples et devant l'effigie d'HIPPOCRATE,
 je promets et je jure d'être fidèle aux lois de l'honneur et de la probité dans l'exercice de la Médecine.

Je donnerai mes soins gratuitement à l'indigent et n'exigerai jamais un salaire au dessus de mon travail. Je ne participerai à aucun partage clandestin d'honoraires.

Admis dans l'intimité des maisons, mes yeux n'y verront pas ce qui s'y passe ; ma langue taira les secrets qui me seront confiés et mon état ne servira pas à corrompre les mœurs, ni à favoriser le crime.

Je ne permettrai pas que des considérations de religion, de nation, de race, de parti ou de classe sociale viennent s'interposer entre mon devoir et mon patient.

Je garderai le respect absolu de la vie humaine.

Même sous la menace, je n'admettrai pas de faire usage de mes connaissances médicales contre les lois de l'humanité.

Respectueux et reconnaissant envers mes Maîtres, je rendrai à leurs enfants l'instruction que j'ai reçue de leurs pères.

Que les hommes m'accordent leur estime si je suis fidèle à mes promesses.

Que je sois couvert d'opprobre et méprisé de mes confrères si j'y manque.