
COMPARISON OF POSTOPERATIVE COMFORT IN 20 GAUGE VERSUS 23 GAUGE PARS PLANA VITRECTOMY

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ABSTRACT

Purpose: Although the sutureless 23Gauge (23G) vitrectomy technique is being increasingly used, a significant number of pars plana vitrectomies are still conducted using the 20G technique. This study evaluates whether the 23G vitrectomy causes less postoperative pain, less discomfort and a shorter duration of sick leave than the 20G vitrectomy.

Methods: In 2006, a questionnaire was sent to 877 patients who had undergone either 20G or 23G pars plana vitrectomy for different indications. Postoperative pain, discomfort of the eye and duration of sick leave were evaluated. Data for analysis was obtained from 544 patients.

Results: After receiving a 20G pars plana vitrectomy, patients had a significantly increased risk of sleeping less during the first postoperative night and week, waking up because of pain during the first postoperative night and week, taking pain medication during the first postoperative night and week and using a postoperative ointment. The 20G group also experienced a longer period of postoperative discomfort and reddish eyes.

Conclusions: 23G pars plana vitrectomy causes significantly less postoperative pain and discomfort compared to 20G pars plana vitrectomy. The similar duration of leave in the patient groups could be explained because a fibrin sealant was used in the 20G group.

RESUME

But: La vitrectomie réalisée sans suture à l'aiguille 23G est utilisée de plus en plus fréquemment, bien qu'un nombre toujours croissant de vitrectomies à la pars plana soient exécutées en utilisant la technique 20G. Cette étude a pour but d'évaluer si une vitrectomie à l'aiguille 23G est associée à des dou-

leurs postopératoires et un inconfort oculaire moindres, ainsi qu'à une incapacité de travail plus courte qu'après une vitrectomie réalisée à l'aiguille 20G. **Méthodes :** Un questionnaire circonstancié a été envoyé dans le courant de l'année 2006 à un total de 877 patients ayant subi une vitrectomie à l'aiguille 20G ou 23G pour différentes indications. Le niveau de douleur allégué, l'inconfort oculaire postopératoire et la durée de l'incapacité de travail ont été appréciés. Les données de 544 patients ont ainsi été recueillies.

Résultats : Dans les suites de la vitrectomie réalisée à l'aiguille 20G, les patients ont démontré un risque significativement plus élevé d'avoir un sommeil écourté et la nécessité de recourir à des antidouleurs aussi bien au cours de la première nuit que durant la 1^{ère} semaine post-opératoire que les patients ayant bénéficié d'une vitrectomie à l'aiguille 23G. Simultanément, ce groupe 20G a dû recourir à l'utilisation plus fréquente d'une pommade postopératoire et a présenté un inconfort oculaire et un œil rouge plus longtemps que le groupe 23G.

Conclusion : La vitrectomie 23G provoque moins de douleur postopératoire et moins d'inconfort oculaire que la vitrectomie 20G. La constatation que la durée de l'incapacité de travail est comparable dans les deux groupes peut s'expliquer par l'usage de colle de fibrine dans le groupe 20G.

KEY WORDS

Pars plana vitrectomy, 23 gauge vitrectomy, 20 gauge vitrectomy, sutureless, patient comfort, quality of life

MOTS-CLES

Vitrectomie à la pars plana, vitrectomie sans suture, vitrectomie à l'aiguille 23 gauge, vitrectomie à l'aiguille 20 gauge, confort du patient, qualité de vie

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INTRODUCTION

Conventional 20 gauge (G) pars plana vitrectomy requires that a 1.20 millimeter (mm) wide sclerotomy is made after conjunctival peritomy. Both sclerotomies and conjunctival incisions should be closed with sutures. This increases the duration of surgery time. In addition, exposure of bare sclera and perioperative suturing causes more postoperative discomfort and inflammation (1,2).

Sutureless vitrectomy by self-sealing 20G sclerotomies uses the sclerotomy tunnel method, obviating the need for sutures during sclerotomies. However, resulting complications, such as intra-ocular fluid leakage from the wound, hemorrhage, vitreal or retinal incarceration and retinal breaks have been reported. In addition, this technique still requires conjunctival peritomy and suturing (1,2).

In a 20G transconjunctival vitrectomy, incisions are made through the conjunctiva and sclera together, and absorbable sutures are used to simultaneously close the scleral and conjunctival wounds at the end of the procedure. The need for suturing still causes discomfort to the patient, but can, however, be reduced by using fibrin glue to close the conjunctiva (2, 3).

With the newer 23G and 25G transconjunctival sutureless vitrectomy techniques, no sutures are necessary. This is enabled by the reduced sclerotomy diameter of these methods (4). Scleral incisions are made through the conjunctiva and are small enough to be self-sealing. This procedure causes no surgical trauma to the conjunctiva, requires no scleral suturing and causes less postoperative discomfort. (5, 6). Although the smallest incision size is used in 25G surgery (0.5 mm), this approach has its limitations. The 25G instruments are too flexible and generally too small for most of the complicated tasks performed during vitrectomy. In addition, secondary suturing of sclerotomies for hypotony due to leakage is often necessary because of the perpendicular scleral incision (4-8).

When performed with 23G instruments, sclerotomies have a width of 0.72 mm. While this would normally require suture closure, such closure can be avoided by means of a tunnel incision that achieves self-sealing closure. Instead of a usual perpendicular incision through

the sclera as in 25G surgery, a tunnel-like tangential incision is made at a 30 to 40 degree angle through the sclera. Suture closure is not required because the wound borders will close the incision in a valve-like manner via the intraocular pressure. The transconjunctival scleral tunnel incision created for 23G instruments guarantees an almost 100% rapid self-sealing closure rate for sclerotomies (4). Compared to 20G vitrectomy, both 23G and 25G vitrectomy have the same advantages: little or no trauma to the conjunctiva and sclera, no suture-related inflammation or discomfort, and no postoperative astigmatism. In addition, the transconjunctival technique does not interfere with present filtration blebs or future filtration surgery (2). The major advantage of 23G vitrectomy over 25G vitrectomy is that it can successfully perform in most complicated cases. Eckardt stated that 23G surgeries are possible in all cases except for the removal of 5000 centistoke silicone oil, removal of a foreign body, or removal of subretinal membrane, which requires angled instruments (4).

Although the sutureless 23G technique is being used more and more frequently, a significant number of pars plana vitrectomies are still conducted using the 20G technique. The present retrospective study compares the postoperative pain, discomfort and duration of sick leave after 20G *versus* 23G vitrectomy surgeries.

METHODS

In this retrospective study, we sent a questionnaire to all 877 patients who underwent either 20G or 23G pars plana vitrectomy by the same surgeon (PS) between Jan 1, 2005 and September 30, 2006 in our department at University Hospital, Leuven, Belgium. At that time, there was a gradual transition from 20G to 23G surgery in our hospital with improving instrumentation availability. In that period, 23G was used for macular surgery (e.g. macular hole, pucker), whereas 20G surgery was used for all other indications (e.g. retinal detachment, diabetic retinopathy).

If patients had vitrectomies in both eyes during this period, only one eye, chosen at random, was included for the purposes of this study. If patients had several vitrectomies during this period, only one vitrectomy, also chosen randomly, was investigated.

A questionnaire was developed and sent to these patients in October 2006; answers were received until December 2006.

Responses were obtained from 357 patients who underwent 20G vitrectomy (the 20 gauge group) and from 187 patients who underwent 23G vitrectomy (the 23 gauge group).

The following questionnaire was sent to the patients:

1. What is your profession? Student/Retired/Employee/Independent
2. During the first night after your operation, did you sleep less because of eye pain? Yes/No
3. During the first week after your operation, did you sleep less because of eye pain? Yes/No
4. During the first night after your operation, did you wake up at night because of eye pain? Yes/No
5. During the first week after your operation, did you wake up at night because of eye pain? Yes/No
6. During the first night after your operation, did you take any pain medication to ease eye pain? Yes/No
7. During the first week after your operation, did you take any pain medication because of eye pain? Yes/No
8. Did you use any ointment for your eye after the operation because of pain or discomfort? Yes/No
9. If so, for how many weeks did you use this ointment?
10. For how many weeks after the operation did you feel eye discomfort?
11. For how many weeks after the operation did your eye look reddish?
12. For how many weeks after the operation did you have to use sick leave?

We compared the answers of both the 20G and 23G groups.

For the answers to the questions about the duration of sick leave, patients from both groups were divided into subcategories by profession: student, employee, retired or independent worker.

All pars plana vitrectomies in this study were performed by the same surgeon (PS). A similar number of vitrectomies in both groups were per-

formed under either general anesthesia or local anesthesia.

The 20G vitrectomy procedure began with a conjunctival peritomy using curved scissors. Two radial incisions were made in the conjunctiva at three and nine o'clock, after which the conjunctiva was dissected from the sclera and a 270° or 360° conjunctival limbal incision was made. After that, the sclerotomies were made perpendicular to the scleral surface in the superonasal, superotemporal and inferotemporal region using a 19 gauge blade (Alcon Laboratories, Fort Worth, TX). The infusion line was inserted through the inferotemporal sclerotomy and attached using a double suture with Biosorb 7/0 (Alcon Laboratories, Fort Worth, TX). The 20G instruments were inserted in the other sclerotomies. After the procedure, the sclerotomies were closed with a double suture using Biosorb 7/0. The two conjunctival incisions were then closed using 0.5 ml of the fibrin glue Tissucol Duo 500 (Baxter, Vienna, Austria), which consists of two deep-frozen solutions in separate pre-filled syringes: 0.5 ml of Tissucol solution (fibrinogen mixed with factor XIII and aprotinin) and 0.5 ml of Thrombin-500 solution (thrombin with CaCl₂). After defrosting, the solutions were ready to use. The two components were applied sequentially using two separate syringes. Over a few seconds, a drop of both components was placed on the sclera. Next, the conjunctiva was held against the sclera using forceps for five to 10 seconds. Excess glue was removed with forceps.

The 23G procedure was initiated by pushing the conjunctiva 1.5 to 2 mm laterally (parallel to the corneal limbus) in the superonasal, superotemporal and inferotemporal quadrant using a pressure plate (DORC, Zuidland, Holland) to hold it firmly to the sclera. A 23G stiletto blade (BD Visitec, Franklin Lakes, NJ, USA) was inserted obliquely at a 30° to 40° angle through the conjunctiva and sclera. The microcannulas were then inserted through the incision and into the scleral tunnel using a specially designed blunt inserter (DORC, Zuidland, Holland). The inserter was introduced into the tunnel incision and then moved from its original oblique position to a position perpendicular to the scleral surface to enter the eye. In the next step, the inserter was removed and the cannulas stayed in place. This was done for one

infusion cannula and two instrumentation canulas. After the completion of the procedure, the cannulas were withdrawn and the place was massaged for a few seconds using a cotton-wool applicator.

The postoperative procedure was comparable in both groups. After the vitrectomy procedure was finished, a subconjunctival injection with betamethasone and clindamycin was given to each patient. An atropine ointment was applied to the eye and the eye was covered during the first night. The patients received six drops of prednisolone acetate and two drops of 1% atropine daily in the operated eye for two weeks. When there were no complications, patients stayed in our hospital for two nights after the vitrectomy. Those who had too much pain received oral pain medication (paracetamol). In the case of eye discomfort or the sensation of a foreign body in the eye, an ointment with antibiotics and corticosteroids was given to the patient instead of eye drops. People could use this ointment until they were discharged from the hospital or they could continue it at home. If examination showed an excess of glue during the first postoperative examination, this was removed using a pincet at the slitlamp. After about two weeks, patients returned for a check-up at the hospital. If the sutures still caused excessive discomfort, they were removed. At that time, the atropine drops were stopped and the application of prednisolone acetate drops tapered off (four drops a day during one week, three drops a day during the next week, two drops a day during the next

week, one drop a day during the following week and then stopped).

The obtained data were tested statistically using 2x2 tables (relative risk analysis) and the t-test (level of significance 0.05).

RESULTS

Table 1 shows the number of patients who answered positively to the questions about sleeping less, waking up or taking pain medication because of pain during the first night or week after the operation; the table also includes data on ointment use during the postoperative period.

In summary, we found that the 20G group had a significantly increased risk of sleeping less during the first postoperative night (Relative Risk (RR) 1.99) and week (RR 2.7), waking up because of pain during the first postoperative night (RR 1.8) and week (RR 1.9), taking pain medication during the first postoperative night (RR 1.9) and week (RR 1.7) and using a postoperative ointment (RR 1.4).

Table 2 shows the mean number of weeks the eye was reddish, duration of eye discomfort and length of ointment use. Results show that the 23G group had a significantly shorter duration of reddish eye appearance ($p < 0.0001$) and of discomfort of the eye ($p = 0.0018$). There was no significant difference in the duration of ointment use ($p = 0.065$).

Table 3 shows the duration of sick leave for all subcategories in both groups.

Table 1: Pain noted on postoperative day one and week one in 20 gauge versus 23 gauge pars plana vitrectomy.

	20 gauge	23 gauge	Relative Risk
Number of patients sleeping less because of pain during the first postoperative day	119	31	1.99
Number of patients sleeping less because of pain during the first postoperative week	68	13	2.7
Number of patients waking up because of pain during the first postoperative day	96	27	1.8
Number of patients waking up because of pain during the first postoperative week	52	14	1.9
Number of patients taking pain medication during the first postoperative day	133	36	1.9
Number of patients taking pain medication during the first postoperative week	64	19	1.7
Number of patients using an ointment in their eye during the postoperative period for pain or discomfort of the eye	97	35	1.4

Table 2: Eye-related discomfort in 20 and 23 gauge groups.

	20 gauge	23 gauge	P value
Mean number of weeks the eye looked reddish after the operation	3.93	1.84	p < 0.0001
Mean number of weeks discomfort of the eye after the operation	2.4	0.96	p = 0.0018
Mean number of weeks of using an eye ointment for pain or discomfort of the eye after the operation	0.99	0.66	p = 0.065

Table 3: Duration of sick leave (weeks) in 20 and 23 gauge groups.

	20 gauge	23 gauge	P value
Retired	N/A	N/A	N/A
Employee	3.0	3.0	0.425
Student	1.5	1.75	0.44
Independent	2.0	2.5	0.17

There was no significant difference in the duration of sick leave in each of the subcategories.

DISCUSSION

The aim of this retrospective study was to determine whether 23G vitrectomy causes less postoperative pain, discomfort and sick leave compared to 20G vitrectomy.

Our results showed that after 20G pars plana vitrectomy, patients had a significantly increased risk of sleeping less, waking up because of pain, taking pain medication during the first postoperative and week, and using a postoperative ointment. The 20G group also experienced a longer period of postoperative discomfort and reddish eye appearance.

The similar sick leave in both patient groups could be explained by the use of a fibrin sealant in the 20G group for conjunctival closure. Using a fibrin sealant is known to cause less postoperative pain and discomfort (3).

The authors recognize a possible bias in case selection because of the different indications for surgery in both groups. Patients who underwent 23G surgery had mostly been diagnosed with macular pucker or macular hole, whereas patients who underwent 20G surgery had more complex indications.

From previous studies, we know that an additional encircling procedure causes significant-

ly more postoperative pain (3, 9). A vitrectomy with encircling bands is only performed during the 20G technique because a peritomy is required. Therefore, vitrectomies with the encircling procedure were excluded from the present study.

In one patient belonging to the 23G vitrectomy group, a severe hypotony with choroidal folds was observed on the first postoperative day and recovered spontaneously on the second postoperative day. Hence, no secondary suturing was needed in any patient of the 23G group. 23G vitrectomy has many advantages over 25G vitrectomy, mainly due to the larger diameter and greater rigidity of the 23G instruments. One major advantage over the 25G instrument is that the plugs for the 23G instrument allow for the injection of silicone oil. When a narrow-wall polyamide 23G cannula is fitted on the injection syringe, a complete oil-fill can be obtained in less than one minute. Since the sclerotomies are made with an MVR-blade, a slit-like incision, instead of a round incision as for the 25G, is made obliquely in the sclera; these incisions are always self-sealing and postoperative hypotony is not an issue. The DORC 23G system can be reused, which markedly reduces the surgery cost compared to a 25G procedure (8).

Compared to 20G vitrectomy, 23G also has many advantages. Since no conjunctival peritomy is needed, less discomfort and postoper-

ative inflammation is noted. At the time of the vitrectomies performed in this study, all patients stayed in our hospital for two nights following vitrectomy. However, having observed the improved patient comfort and postoperative pain following a 23G vitrectomy, nowadays most 23G patients in our hospital are released after one night and an ambulant check-up is planned on postoperative day two or three, whereas 20G patients still stay in the hospital for two nights. When making a conjunctival peritomy, suturing the infusion and suturing sclerotomies are no longer necessary in the 23G technique; this shortens surgery time. In addition, because less than half as many instruments are required, a smaller number of instruments needs cleaning after surgery, again saving time.

Some limitations still exist in 23G surgery. At the time of the study, 23G was used for macular surgery (e.g. macular hole, pucker), whereas 20G surgery was used for all other indications (e.g. retinal detachment, diabetic retinopathy). At present, our hospital performs up to 80% of its surgeries using 23G instruments. The only indications for 20G vitrectomy in our hospital are surgeries requiring encircling bands, surgeries during which curved instruments are necessary (e.g. tractional diabetic retinal detachments, macular translocations) and the removal of heavy silicone oil, such as Densiron 68 (Geuder, Germany) and Oxane HD (Bausch & Lomb).

The main disadvantage of 23G vitrectomy is the higher cost. However, when using non-disposable sets, this involves only a one-time investment. In addition, no sutures are necessary, which also reduces costs. The shorter duration of hospitalisation with 23G vitrectomy is a major additional advantage.

At present, although the sutureless 23G technique is increasing in popularity, a significant number of the pars plana vitrectomies are still conducted using the 20G technique. For indications where there is the option of choosing either 20 or 23G pars plana vitrectomy, 23G pars plana vitrectomy causes significantly less postoperative pain and discomfort than 20G

pars plana vitrectomy and therefore should be considered as an alternative technique.

REFERENCES

- (1) JACKSON T. – Modified sutureless sclerotomies in pars plana vitrectomy. *Am J Ophthalmol* 2000, 129: 116-117.
- (2) SHIMADA H., NAKASHIZUKA H., NAKAJIMA M., MORI R., MIZUTANI Y. – Twenty-gauge Transconjunctival Vitrectomy. *Jpn J Ophthalmol* 2005, 49: 257-260.
- (3) MENTENS R., STALMANS P. – Comparison of fibrin glue and sutures for conjunctival closure in pars plana vitrectomy. *Am J Ophthalmol* 2007, 144: 128-131.
- (4) ECKARDT C. – Transconjunctival sutureless 23-gauge vitrectomy. *Retina* 2005, 25: 208-211.
- (5) YOUNG J.C., JUN M.L., SUNG S.K. – Vitreoretinal surgery using transconjunctival sutureless vitrectomy. *Yonsei Medical Journal* 2004, 45: 615-620.
- (6) FUJII G.Y., DE JUAN E., J.R., HUMAYUN M.S., CHANG T.S., PIERAMICI D.J., BARNES A., KENT D. – Initial experience using the transconjunctival sutureless vitrectomy system for vitreoretinal surgery. *Ophthalmology* 2002, 109: 1814-1820.
- (7) BYEON S.H., CHU Y.K., LEE S.C., KOH H.J., KIM S.S., KWON O.W. – Problems associated with the 25-gauge transconjunctival sutureless vitrectomy system during and after surgery. *Ophthalmologica* 2006, 220: 259-265, 2006.
- (8) STALMANS P. – In my opinion, 23 gauge vitrectomy is the new standard of surgery. *Dorc Vitreotech Magazine* 9: 5-6, 2006.
- (9) MANDELCORN M., TABACK N., MANDELCORN E., ANANTHANARAYAN C. – Risk factors for pain and nausea following retinal and vitreous surgery under conscious sedation. *Can J Ophthalmol* 1999, 34: 281-285.

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