Surgical Technique

Chandelier-assisted pneumatic retinopexy for rhegmatogenous retinal detachment repair in young adults

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We describe the new technique of chandelier-assisted pneumatic retinopexy in repairing rhegmatogenous retinal detachments in a series of young adults. In the operating room, a 25-gauge trocar cannula is inserted at the pars plana 180° across the preoperatively detected retinal break followed by Chandelier light insertion, which is used in globe fixation and rotation. The retinal periphery is reexamined using scleral indentation and chandelier light endoillumination. Transconjunctival cryopexy is performed around the break followed by paracentesis and pure sulfur hexafluoride gas injection. Twelve eyes of 12 patients were repaired. Their mean (±SD) age was 29.4 (±3.4) years and preoperative corrected distance visual acuity (CDVA) was 0.36 (±0.32). Nine eyes had 1 break while 3 eyes had 2 breaks within 1 clock hour. Mean duration of operation was 11.7 (±1.8) min. No patient experienced major intraoperative complications, but one patient required reoperation. Mean CDVA 6 months postoperatively was 0.63 (± 0.21) ($p < 0.05$).

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DOI:
10.4103/ijo.IJO_1798_20

Quick Response Code:

Key words: Chandelier-assisted, pneumatic retinopexy, rhegmatogenous retinal detachment, transconjunctival cryopexy

Pneumatic retinopexy is a relatively fast and cost-effective minimally invasive technique that is used in the repair of rhegmatogenous retinal detachment (RRD). The technique depends on sealing of all retinal breaks using cryopexy or laser retinopexy and injection of an intraocular expansile gas, with a primary success rate between 71 and 84% in reattaching the retina in phakic eyes, a rate that is slightly less than with pars plana vitrectomy (PPV) or scleral buckling, but with postoperative visual acuity results that exceed both procedures.[1-3]

The success rate of pneumatic retinopexy can be maximized by following strict inclusion criteria including repair of detachments due to a single break or group of breaks within 1 clock hour, detachments with breaks in the superior 8 clock hours of the retina, and absence of contraindications to the procedure such as dense media opacities.[4,5] Current reports indicate that 15% of all RRD cases in the USA are repaired by pneumatic retinopexy but that it can be used to repair approximately 40% of all RRD cases and so is a markedly underutilized technique even though it might result in large cost savings with comparable results to other techniques.[4-6] This number is probably even lower in other countries where pneumatic retinopexy is less popular. This may be due to difficulties encountered in performing the procedure including lack of training, difficulty in finding small retinal breaks using indirect ophthalmoscopy, and requiring a prolonged preoperative retinal exam to detect all breaks, as well as intraoperative and postoperative complications such as operative failure, development of new breaks, missed breaks, raised intraocular pressure, and gas migration.[1,4,7,8]

Herein, we propose a new technique of performing pneumatic retinopexy under the operating microscope and a wide-angle viewing system with the assistance of chandelier light endoillumination in young adults with RRD. We hope that this technique will simplify performing pneumatic retinopexy especially in young adults and increase its utilization among vitreoretinal surgeons. To our knowledge, this is the first report of the use of this technique in the peer-reviewed English literature.

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Following local peribulbar anesthesia and sedation, a 25-gauge trocar cannula (Alcon, Chandelier lighting system, Fort Worth, TX) was inserted obliquely under the operating microscope 3.5 or 4 mm from the limbus in the inferior retinal quadrant about 180° across from the preoperatively detected retinal break followed by insertion of a Chandelier light [Fig. 1a]. Using a wide-angle viewing system (Resight, Carl Zeiss Meditec AG, Jena, Germany), and utilizing the chandelier light, careful revision of the retinal periphery was performed by 360° examination of the retinal periphery with scleral indentation to detect any retinal breaks that were missed preoperatively.

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Received: 03-Jun-2020 Revision: 01-Sep-2020
Accepted: 21-Sep-2020 Published: 16-Mar-2021

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Cite this article as: Habib AE, Abdel-Kader AA, Elnahry AG. Chandelier-assisted pneumatic retinopexy for rhegmatogenous retinal detachment repair in young adults. Indian J Ophthalmol 2021;69:979-81.

The chandelier light was held by one hand and used in fixating and rotating the globe while being simultaneously directed towards the site indented by the other hand. This allowed easy and effective examination of the retinal periphery under the magnification and wide-field viewing provided by the operating microscope and wide-angle lens system, respectively. In the circumstance where a contraindication to pneumatic retinopexy was detected during intraoperative examination, such as the presence of an inferior retinal break (in the inferior 4 clock hours of the retina), the procedure could be easily converted to a standard PPV or chandelier-assisted scleral buckling. This, however, was thoroughly explained to the patient preoperatively and included in the preoperative informed consent form. After examination, transconjunctival cryotherapy was then performed around the retinal break under direct visualization by the operating microscope and wide-angle viewing system [Fig. 1b]. Paracentesis was then done; then, intravitreal injection of 0.5 mL of pure sulfur hexafluoride gas using a 30-gauge needle through the pars plana was performed, followed by repeat paracentesis when needed (see Video Clip 1, showing the surgical steps of chandelier-assisted pneumatic retinopexy). All these steps were performed under direct visualization by the operating microscope, which helped in avoiding injury to the lens and retina by directly observing the needle and allowed observation of the perfusion status of the central retinal artery during and after gas injection. The patient was positioned postoperatively according to the site of retinal break. Postoperatively, the patient was examined on the 1st, 3rd, 7th, 14th, and 30th postoperative day followed by a monthly examination for 2 months then every 3 months thereafter.

Results

Twelve eyes of 12 patients with RRD underwent chandelier-assisted pneumatic retinopexy. Their preoperative characteristics are summarized in Table 1. Eight patients were males, while four patients were females. The mean age of the patients was 29.4 ± 3.4 years (range 24–33 years). The mean preoperative Snellen corrected distance visual acuity (CDVA) was 0.36 ± 0.32 (decimal). The mean duration of RD before the operation was 5.9 ± 1.4 days (range: 3–8 days). Five eyes had macula-involved RD, while sevn eyes had macula on RD. Ten eyes were phakic, while two eyes were pseudophakic. All eyes had no significant media opacities and had grade A proliferative

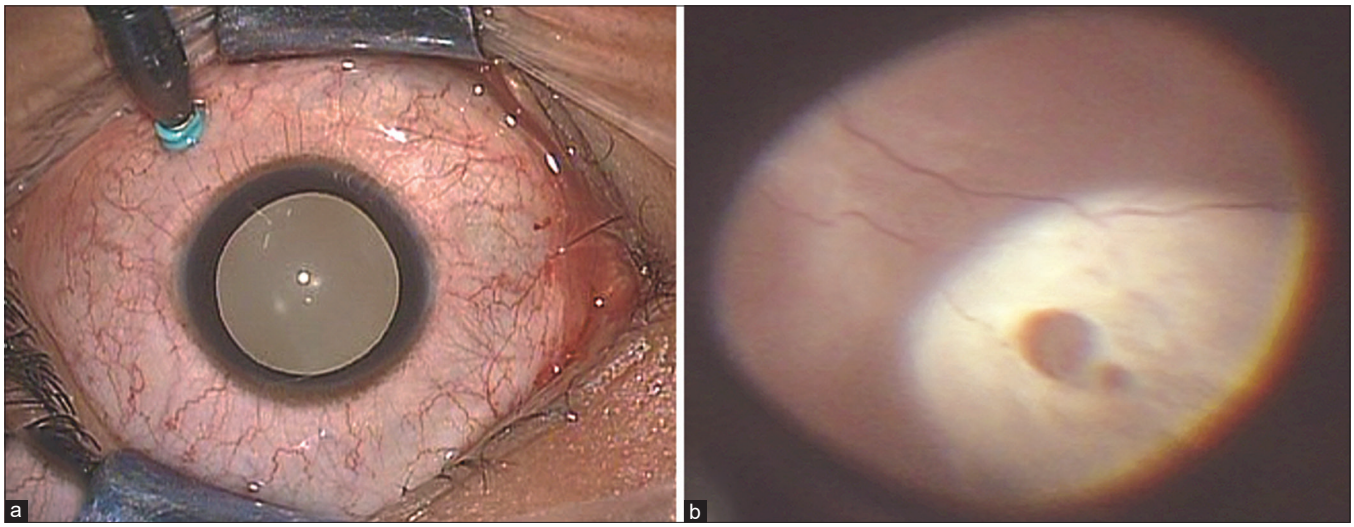

Figure 1: Intraoperative photography showing Chandelier light in place (a) and cryopexy marks around a retinal break seen through a wide-angle viewing system (b)

Table 1: Preoperative characteristics of patients that underwent chandelier-assisted pneumatic retinopexy

Case no	Age	Sex	Eye	Duration of RD† (days)	No of breaks	Position of breaks (clock hour)	Size of breaks (clock hours)	Preoperative CDVA[a] in Snellen acuity (Decimal)	Macula status	Bullous RD[b]
1	31	Male	OD	3	1	12	0.5	20/35 (0.6)	On	No
2	33	Male	OS	4	2	9	1	20/25 (0.8)	On	No
3	28	Female	OD	5	1	10	1	20/40 (0.5)	On	No
4	24	Male	OD	8	1	11	2	20/2000 (0.01)	Off	Yes
5	29	Female	OS	7	2	1	1	20/600 (0.03)	Off	Yes
6	33	Female	OS	6	1	11	2	20/35 (0.6)	On	No
7	29	Male	OS	8	1	2	1	20/400 (0.05)	Off	Yes
8	24	Male	OD	6	1	1	0.5	20/40 (0.5)	On	No
9	30	Female	OD	7	1	9	0.5	20/30 (0.7)	On	No
10	27	Male	OS	7	1	12	1	20/600 (0.03)	Off	Yes
11	32	Male	OS	4	2	10	1	20/40 (0.5)	On	No
12	32	Male	OD	6	1	1	1	20/600 (0.03)	Off	No
Mean±SD	29.4±3.4			5.9±1.4				0.36 (± 0.32)		

[a]Corrected distance visual acuity. [b]Retinal detachment

vitreoretinopathy. Two eyes had phakic intraocular lenses. The mean extent of RD was 3.7 ± 1.1 clock hours (range: 2–5 clock hours). Nine eyes had one retinal break, while three eyes had two breaks within 1 clock hour. All breaks were in the superior 8 clock hours of the retina and were between 0.5 and 2 clock hours in size. Eight eyes had nonbullous RD, while four eyes had bullous RD. The mean duration of the operation was 11.7 ± 1.8 min (range: 9–14 min); however, this did not include the extra time needed for injection of local anesthesia and draping. No major intraoperative complications occurred in any patient, and successful retinal reattachment was achieved in eleven eyes after a single operation. One eye, however, required PPV and gas injection for recurrent RD due to a new retinal tear that developed during the follow-up period with final successful retinal reattachment. The mean postoperative Snellen CDVA 6 months following the operations was 0.63 ± 0.21 (paired t-test, $P < 0.05$).

Discussion

The idea of retinopexy and gas injection for the treatment of RRD was described first by Rosengren in 1938.[9] He used external diathermy to create adhesions around retinal breaks followed by drainage of subretinal fluid and injection of intraocular air. Pneumatic retinopexy, however, was not widely adopted until it was revived by Hilton and Grizzard in 1986, where they performed the procedure in an office setting.[5] This was followed by many studies that evaluated the technique for the repair of RRD.[1]

Advantages of the currently reported technique compared to the standard pneumatic retinopexy technique are similar to advantages of chandelier-assisted scleral buckling compared to standard scleral buckling and include direct observation of an erect image of the fundus using a wide-field lens, magnification of the image with the help of the operating microscope, and avoidance of repeated application and removal of indirect ophthalmoscopy.[10-12] This may allow easier detection of small retinal breaks even in patients with media opacities and help shorten the duration of the procedure. Other advantages of using chandelier endoillumination compared to indirect ophthalmoscopy include using the chandelier light to rotate and fixate the globe, facilitation of education and assistance of surgeons in-training through the operating microscope as has been observed in chandelier assisted scleral buckling,[12] and reducing the risk of certain intraoperative complications such as prehyaloidal and suprachoroidal gas injection due to direct visualization of the needle, avoidance of lens injury due to its direct visualization during paracentesis, and confirmation of central retinal artery perfusion following gas injection directly under the operating microscope. Indications of the technique are similar to indications of conventional pneumatic retinopexy that primarily includes repair of primary RRD with no proliferative retinopathy in patients with certain ideal characteristics, including the presence of a single break or group of breaks within 1 clock hour, breaks in the superior 8 clock hours, and ability to position properly postoperatively as has been previously described in detail elsewhere.[4] Disadvantages of the proposed technique include that it is a slightly more invasive technique that requires special equipment such as chandelier illumination and wide-angle viewing systems, which are, however, generally available at the disposable of most vitreoretinal surgeons, and that it needs to be performed in the operating room (OR), as opposed to an ability to perform the procedure in the office without special equipment using the standard technique. Performing the procedure for young adults in the office, however, can be sometimes challenging since they are generally more anxious making them less cooperative during the procedure. Limitations of our study include the relatively small number of patients, the relatively short follow-up period, the narrow age range included, and the absence of a comparison group.

Conclusion

In conclusion, although the chandelier-assisted pneumatic retinopexy technique must be performed in the OR, it still retains many of the advantages of standard pneumatic retinopexy, namely being less invasive, less time consuming, less costly, and often associated with few complications compared to PPV and scleral buckling. In addition, in our hands, it appeared to be safer and easier to perform compared to the standard technique. Therefore, specifically for patients and surgeons who are more comfortable with procedures being performed at the OR, the procedure could be a safe and effective alternative. These observations should be confirmed in larger future comparative studies involving this new and promising technique.

Ethical approval

This study was approved by the research ethics committee of our institute and followed the tenets of the Declaration of Helsinki.

Consent to participate

All patients signed a written informed consent before inclusion in the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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