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Original Research Article

PNEUMATIC RETINOPEXY FOR RETINAL DETACHMENT IN SOUTH INDIAN POPULATION

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Abstract

Aim:
To study the effectiveness of Pneumatic Retinopexy for Retinal Detachment in South Indian population.

Materials and Methods:
A Retrospective analysis of medical records of 34 patients who underwent pneumatic retinopexy as per standard clinical guidelines over 3 years from January 2010 to December 2013 at a tertiary eye care hospital in South India. After appropriate positioning post-operatively, the anatomical and functional outcomes of the procedure were analyzed and the causes of failure identified.

Results:
A superior detachment was noted in 51.4% of cases with mean 5.57 clock hours of detachment. Primary anatomical success rate defined by attachment of retina was recorded in 82.4% cases increasing to 96.2% with additional injection(s). A functional success defined by improvement or stationary visual acuity post-operatively was recorded in 67.6% and 17.6% cases respectively. There was no statistical significance difference in the outcome (functional or anatomical) with the gas used or retinopexy performed.

Conclusion:
Pneumatic retinopexy is an effective treatment for the primary management of retinal detachment with comparable outcome rates. It has been found to be of especial value in young patients having fewer clock hours and superiorly located detachments. Being cost effective and having a relatively lower complication rate combined with the high anatomical and functional success, it should be used as the primary treatment modality in carefully selected patients.

Key Words: Pneumatic Retinopexy, Retinal detachment, Cost-effective

Introduction

The term ”Pneumatic Retinopexy” was introduced by Hilton and Grizzard in the mid-1980s.[1] Pneumatic Retinopexy was developed in an attempt to reduce the problems with tissue trauma, complications, high expenditure associated with other modes of surgical management of retinal detachment such as scleral buckling and vitrectomy. It has since then become a popular, easy to perform, minimally invasive, cost effective outpatient procedure with relatively fewer complications. The use of pneumatic retinopexy has declined owing to its unpredictable clinical outcome in many centres.[2] It however still remains to be a viable alternative to the more invasive and expensive methods in view of the distinct advantage of being a totally outpatient procedure with relatively fewer complication rates, obviating the need for sedation or local anesthesia and in being cost effective. Many studies have demonstrated its efficacy in providing comparable visual and anatomical outcomes as opposed to other procedures.[2-4]

The purpose of this study is to demonstrate the efficacy of pneumatic retinopexy as an alternative to other conventional procedures in the management of retinal detachments through our experience in its use over 3 years at a tertiary eye care centre in South India.

Subjects and Methods:

Retrospective analysis of medical records of patients who underwent pneumatic retinopexy over 3 years from January 2010 to December 2013 at a tertiary eye care hospital in South India. A review of medical records revealed 34 patients who had undergone pneumatic retinopexy during the chosen study period. All patients had been chosen for pneumatic retinopexy as per standard guidelines. Patients with large (> 10 clock hours) of bullous RD, presence of multiple breaks/tears more than 1 clock hours apart, significant media opacification (like cataract, vitreous hemorrhage) or a proliferative vitreo-retinopathy of Grade c or d were all excluded from the present study. Pneumatic retinopexy was done under local (peri-bulbar) or topical anesthesia with intravitreal gas injection with retinopexy aided by cryopexy or laser as per prevailing standards. The gas used for internal tamponade was chosen from silicon hexafluoride (SF_6) or Perfluoropropane (C_3F_8) based on the discretion of the ophthalmic surgeon. Appropriate post-operative positioning was maintained in all patients. The patient profile including demographics, pre-operative visual acuity and retinal detachment details, details of the surgical procedure, the anatomical and visual outcomes following surgery were retrieved and analyzed. The anatomical and functional success rates were calculated and the statistical significance of these based on the use of various gases and retinoepexy techniques was estimated (ANOVA or Student‘t’ test as necessary)

Results:

34 patients who underwent pneumatic retinopexy during the defined study period were identified from the retrospective review of medical records of which 21 (61.8%) patients were male and 13 (38.2%) patients were female. Age of the patients who underwent the procedure ranged from 15 – 73 years with a Mean Age at presentation of 45.1 years (SD 20.03 years). Almost equal number of right (54.1%) and left (45.9%) eyes were operated.

Patients presented to the retina department with a chief complaint of diminution of vision in the affected eye ranging from 2 days to 25 days (Mean 12.16 days, SD 6.86 days) prior to undergoing pneumatic retinopexy. Additional history of floaters and flashes was recorded in 5 and 2 patients respectively. 12 (35.3%) patients had

reported antecedent history of trauma prior to onset of their symptoms. 22 (64.7%) phakic, 7 (20.6%) pseudophakic and 5 (14.7%) aphakic patients were found in the group. 1 (2.9%) diabetic, 6 (17.6%) hypertensives and 1 (2.9%) hypothyroid patients were found in the selected patients.

Majority of the patients (28, 82.4%) had a pre-operative visual acuity of <6/60 and 3 (8.8%) patients each had visual acuity between 6/60 – 6/18 and 6/18 – 6/6. 7 (30.4%) of the patients were found to be myopic. A borderline intra-ocular pressure (22 mm Hg) was recorded in 1 patient pre-operatively but no evidence of glaucoma was found. All other patients had a normal intra-ocular pressure.

Retinal detachment was subtotal in 7 (30.4%), superior (superior, supero-temporal, supero-nasal) in 19 (55.8%), at posterior pole with associated optic disc pit in 3 (8.8%) and inferior in 4 (11.8%) of the patients involving a range of 1 – 10 clock hours (mean 5.57 clock hours, SD 4 clock hours). Atrophic retinal breaks, retinal tears and lattice degeneration were identified in 15 (44.1%), 19 (55.8%) and 6 (17.6%) patients respectively. These ranged from 0.5 – 2 DD in size, majority being 1 DD in size (19 eyes, 55.8%). Additionally, a posterior vitreous detachment and proliferative vitreo-retinopathy (of grade a or b) were visualized in 4 (11.8%) and 9 (26.5%) patients respectively. Macular involvement was found in 25 (67.6%) of the eyes accounting for the majority of patients having a poor pre-operative visual acuity.

Patients underwent pneumatic retinopexy in the operation theatre under strict aseptic precautions under peribulbaranesthesia in 26 (76.5%) and topical anesthesia in 8 (23.5%) patients respectively. C_3F_8 0.1 – 0.4 ml or SF_6 0.3 – 0.6 ml were injected in 19 (55.8%) and 15 (44.1%) of the patients, respectively based on the individual requirement of each case as determined by the operating surgeon and the availability of the gas. This was accompanied by cryo-retinopexy at the same sitting in 25 (73.5%) and laser (post-operatively up to day 2) in 5 (14.7%) of the cases. Cryo- or laser- retinopexy was not done in 7 (20.6%) cases due to posterior location of the breaks or involvement of the posterior pole secondary to optic disc pit (3 cases, 8.8%). Acute rise in the intra-ocular pressure was noted in 5 (14.7%) patients who required an anterior chamber paracentesis.

Patients were later instructed to maintain the appropriate head and body posture so as to maintain the internal tamponade effect on the area of retinal detachment. Patients were assessed the next day.

Post-operative complications recorded in our patients included sub conjunctival hemorrhage in 4 (11.8%) patients, a diffuse sub-conjunctival gas bleb in 1 (2.9%) patient, breaking (fish eggs) of the air bubble in 1 (2.9%) patient, raised intra-ocular pressure warranting anterior chamber paracentesis in 5 (14.7%) patients and a vitreous hemorrhage in 1 (2.9%) patient.

Primary anatomical success defined by re-attachment of the previously detached retina, was recorded in 28 (82.4%) of the 34 patients increasing to 96.2% (33 of 34 cases) with at least one repeat injection(s). There was no statistically significant difference in the anatomical outcome with the choice of the gas or retinopexy method used (p value = 0.1932, Student‘t’ test).Anatomical failure of retinal re-attachment with a single procedure was recorded in 6 (17.6%) patients. Table 1 demonstrates the characteristics of these patients. 1 patient had a posterior pole detachment while 2 each had a superior and supero-temporal detachment. C_3F_8 and SF_6 were used in 4 (11.8%) and 2 (5.8%) of the cases respectively. There was no statistically significant difference between the amount and type of gas used (p=0.2138, Student‘t’

test). The main cause of primary failure was identified to be non-resolution of sub-retinal fluid in 4 (11.8%) cases, poor compliance to positioning in 4 (11.8%) cases, fish eggs in 1 (2.9%) case. 3 (8.8%) patients required a single re-injection of the same agent of which 1 (2.9%) patient developed vitreous hemorrhage and warranted an alternative procedure. 3 (8.8%) patients required 2 or more injections. All patients except the case that developed vitreous hemorrhage achieved a final re-attachment of the retina.

A functional success as defined by a stationary or improved visual acuity was recorded in 6 (17.6%) and 23 (67.6%) of the patients respectively. There was again no statistically significant difference in the post-operative visual acuity based on the choice of the gas used (p value = 0.3607, ANOVA) or retinopexy performed (p value = 0.2375, ANOVA).A drop in visual acuity post-operatively was noted in 5 (14.7%) cases with the primary anatomical failure.

Discussion:

Intravitreal injection of gas was first done by Ohm in 1911. This was followed by the use of sterile air for management of an uncomplicated case of retinal detachment by Rosengren in 1938 and Silicon hexafluoride by Norten in the 1973. "Pneumatic retinopexy" was coined by Hilton and Grizzard in 1980s as a method of surgical management of retinal detachments.[1] It has since been reserved for retinal detachment cases with a single break or group of breaks not more than 1 clock hour apart, all located within the superior 8 clock hours in the presence of a clear optical media to rule out other breaks. It has also found use in posterior pole detachments with associated optic disc pits.[2] Our patients were selected based on these criteria and majority of them had superior detachments (51.4%) with limited (1 DD size) anterior breaks in them. Posterior pole detachments in 3 patients were managed in our study with a favorable outcome.

Breaks larger than 1 clock hour, Multiple breaks extending over more than 1 clock hour, Breaks in the Inferior 4 clock hours, presence of PVR grade c or d, difficult patient positioning or poor compliance of patient to positioning, severe or uncontrolled glaucoma and a hazy media preventing complete evaluation of the retina are the contra-indications to performing a Pneumatic Retinopexy. Some studies have however demonstrated success even with multiple breaks further than 1 clock hour apart, breaks more than 1 clock hour in size and inferior breaks which is comparable to other modalities of retinal detachment management.[5-8]

Pneumatic retinopexy is designed on the principle of buoyancy and surface tension of the intra-vitreal inert gas injected and the isolation of retinal break from the intra-ocular currents by the air bubble.[9, 10] The buoyancy applies upward pressure on the detached retina, the surface tension of the bubble closes the break and prevents the bubble from passing into the subretinal space. This closure of the break thus allows for the re-attachment of the detached retina and for the slow absorption of the accumulated sub-retinal fluid. The gas injected being inert and non-toxic is slowly reabsorbed from the vitreous. Table 2 demonstrates the gases used dosage and the average duration of action with the expansion.

Average age reported was 45.1 years and males comprised a higher proportion of our study (61.8%) which is similar to other studies in Nepal and USA.[2, 11, 12]

Our single surgery anatomical success rate was 82.4% increasing to 96.2% with repeated injections. Our success rate correlates with the success achieved by other reports in literature which ranges from 66 – 83%.[1-3, 5, 11, 13, 14] The success rate of

pneumatic retinopexy has been demonstrated to be lower on factors larger extent of RD, increased number of breaks, myopes, vitreous hemorrhage are associated with a lower success rate. Our study had 7 (20.6%) myopes but anatomical success was achieved in all of them. The apparent lower success in myopes is attributed to the larger size of the bubble necessary with increased axial length. Gilca et al, Modi et al and Davis et al demonstrate no significant difference in failures with pseudophakic or aphakic eyes over phakic eyes.[3, 15, 16] In our study pseudophakic eyes had no primary anatomical failure. We suggest that Pneumatic retinopexy can be a primary procedure for pseudophakicrhegmatogenous retinal detachments as well.

Failure of the primary surgery has been attributed to proliferative vitreo-retinopathy in 25% cases, detachment older than 30 days in 22% cases, large breaks in 22% cases, fresh breaks or missed breaks in 15% cases, re-opened breaks in 5% cases, and others to non-resolution of the sub-retinal fluid, poor patient compliance, occurrence of a vitreous hemorrhage by Rootman et al, Hilton et al and others in various reports.[17-19] In our 6 (17.6%) cases of primary failure, 4 (11.8%) cases had poor compliance to positioning, 4 (11.8%) with a non-resolving sub-retinal fluid and 1 (2.9%) case with fish eggs. 1 (2.9%) of the cases developed vitreous hemorrhage on re-injection and required additional procedure. Our findings were consistent with failure rates and causes as in other studies. We record lower complications rates due to proper exclusion of cases with multiple breaks or proliferative vitreo-retinopathy prior to advocating a pneumatic retinopexy. Other complications are however consistent with older studies.

Comparison of pneumatic retinopexy versus scleral buckling in numerous studies has shown that the anatomical success rate of the two did not vary significantly and visual outcome in some cases was better with pneumatic retinopexy. This was attributed to the fact of fresh and limited cases of retinal detachment undergoing pneumatic retinopexy.[20-23] Patients in our study had history of diminution of vision of less than 25 days, which reduces failure rates due to complications.

This case series is limited by its retrospective study design and the non-uniformity in the choice of gas for tamponade due to limited resources and cost-effective measures being employed to meet the demands of the poor socio-economic status of the patients. Pneumatic retinopexy hence is the most cost-effective treatment option in such a setup.[23]

Conclusion:

The current study supports the continued role of pneumatic retinopexy as an important option in the management of retinal detachment with a comparable success rate. In developing countries like India where limited economic resources and knowledge and awareness play a crucial role in the specialist eye health care seeking behaviour of the population, it forms a valuable, simple, easy to perform and cost effective primary modality in management of retinal detachments with comparable visual and anatomical outcomes over vitrectomy in specifically especially in proliferative vitreo-retinopathy (grade a or b) and superior retinal breaks with limited detachment. Though primary failures have been reported, this can significantly be reduced with repeat injections to achieve a final high success rates. The final outcome is however dependent on the contingent case selection, excellent patient compliance and close surveillance for recurrence during the follow-up period.

Table 1 – Characteristics of Primary Failure Cases

SL. NO.	EYE	RRD	GAS USED	NUMBER OF RE-INJECTIONS	FINAL FUNCTIONAL OUTCOME	CAUSE OF FAILURE
1	LE	Posterior pole	C_3F_8 (0.3 ml)	1	Decrease	Poor positioning, non-resolving SRF
2	LE	Superior	C_3F_8 (0.3 ml)	2	Stationary	Poor positioning, non-resolving SRF
3	RE	Superotemporal	SF_6 (0.5 ml)	2	Decrease	Non resolving SRF, poor positioning
4	RE	Superior	C_3F_8 (0.3 ml)	1	Decrease	Fish eggs, repeat after resolution of fish eggs
5	RE	Superotemporal	C_3F_8 (0.3 ml)	1	Decreased	Poor positioning, later Vitreous hemorrhage, needed additional procedure
6	RE	Superior	SF_6 (0.5 ml)	4	Decrease	Non-resolving SRF

RE – Right Eye, LE – Left Eye, SRF – Sub retinal fluid, C_3F_8 – Perfulouropropane, SF_6 – Silicon hexafluoride

Table 2 – Intravitreal gas characteristics

GAS	TYPICAL DOSE	AVERAGE DURATION	LARGES SIZE	AVERAGE EXPANSION
Sterile Air	0.8 ml	4 days	Immediate	Nil
SF_6	0.5 ml	12 days	36 hours	2x
C_3F_8	0.3 ml	38 days	3 days	4x

C_3F_8 – Perfulouropropane, SF_6 – Silicon hexafluoride

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