A study on post-operative change in intraocular pressure and anterior chamber depth after retinal detachment surgery

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ABSTRACT

Background: Effect of these procedures on the intra-ocular pressure has not received much attention, so it shall be the endeavour of this study to see how different steps in the surgical procedure for retinal detachment surgery influence the intraocular pressure both on the table and in the immediate post-operative period along with changes induced in the anterior segment.

Aim & Objective: We have added an attempt to evaluate the post operative changes in the intra-ocular pressure and anterior chamber depth was analysed.

Materials and Methods: The study was conducted in 50 consecutive cases of both phakic and aphakic retinal detachments, attending the retinal services at Dr VRK Womens Medical College & Tertiary Hospital during the year June2018 – May 2019.

Results: The preoperative and immediate post operative intra ocular pressure and anterior chamber depth were measured and serial changes tabulated and analysed.

Conclusion: We conclude that, No significant change in anterior chamber depth and width of the angle of the anterior chamber is observed.

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1. Introduction

Current surgical treatment of retinal detachment is cryopexy with scleral indentation by local buckle/encircling/combination of both with or without sub-retinal fluid drainage. Here I have studied 3 procedures with SRF drainage.

These procedures alter the anatomical configuration of the globe, and there by affect. I. Intra-ocular pressure. 2. Anterior chamber depth 3. Scleral rigidity.

The intra-ocular pressure rises, the scleral rigidity decreases and the depth of AC decreases if no SRF drainage is done after these procedures. The AC depth does not change if SRF drainage is done in other procedure.1–4

Effect of these procedures on the intra-ocular pressure has not received much attention, so it shall be the endeavour of this study to see how different steps in the surgical procedure for retinal detachment surgery influence the intraocular pressure both on the table and in the immediate post-operative period along with changes induced in the anterior segment. We have added an attempt to evaluate the post operative changes in the intra-ocular pressure and anterior chamber depth, in 50 consecutive cases of both phakic and aphakic retinal detachments, attending the retinal services at Dr VRK Womens Medical College & Tertiary Hospital during the year June2018 – May 2019.

The preoperative and immediate post operative intra ocular pressure and anterior chamber depth were measured and serial changes tabulated and analysed.

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2. Aim of the study

In the case of retinal detachment the intraocular pressure is low. The mechanism lying in it is the retinal detachment is more than one quadrant. When the detachment is secondary to the tumour, haemorrhage or inflammation the intraocular pressure is frequently raised.

It is stated by Arruga in 1934 that the intraocular fluid will leave through the hole because loss of the continuity of the retina where the retinal hole is present leading to decrease of the intraocular tension. Dobbie in 1963 found that the normal secretion of the aqueous in retinal detachment cases will be decreased.

In this process when the production is reduced and the drainage is through the hole and suprachoroidal space is increased, these two processes will lead to decreasing of the intraocular tension in retinal detachment cases. In retinal detachment surgery the indentation and shortening of the length of the globe will result in reduce in the volume of the globe, this processes results in increasing in the intra ocular pressure, leading to appearance of the intraocular tension at normal level. In various levels of the surgical procedures the anatomical configuration of the eye will be changed leading to the increasing to the intraocular tension by.

1. Ciliancy body and iris lens diaphragm is pushed forwards
2. Obstruction of drainage of aqueous at papillary area and indentation of the sclera leading to aqueous drainage obstruction at that level and change in angle leading to obstruction to aqueous out flow.
3. Post operative edema leading to obstruction to aqueous outflow due to obstruction to the episcleral veins.

3. Materials and Methods

3.1. Study population & location

50 consecutive patients of retinal detachment admitted in retinal clinic in Dr VRK Womens Medical College & Hospital. Hyderabad was taken for this study.

3.2. Study period

During period 2018 - 2019.

3.3. Procedure

The retinal breaks were covered with cryopexy procedures

1. An encircling/buckling/both carried out in every case using silicon band sizes 2 - 2 1/2 mm.
2. The thickness of encirclage and local buckle and combination of both the distance from limbus and the shortening procedures were noted. Sub retinal fluid was drained in all the cases.
3. Intraocular pressure was recorded by Schiotz and applanation tonometer (Perkins) and scleral rigidity also measured pre-operatively.
4. Anterior chamber depth is measured by Haag - Streit attachment I & II preoperatively
5. Gonioscopy done pre-operatively
6. Intraocular Pressure were taken daily in post-operative period with Schiotz tonometer
7. Applanation tonometry being done on 7th post operative day
8. Scleral rigidity determined by using Friedenwald nomogram
9. Anterior Chamber depth also measured with pachometer (i & ii) post operatively on 7th day.
10. Gonioscopy done on 7th post operative day

3.4. Surgery of retinal detachment (encircling/buckling/combination of both)

3.4.1. Principle

The aim of the surgery is to close break to the neurosensory retina by approximating attracted sticking retinal pigment epithium to break and releasing vitreous traction. If possible the simplest and safest operation with the greatest probability of success should be chosen. In this operation there are four steps are described.

1. Localisation of retinal hole.
2. Cryopexy.
3. Scleral buckling/Encircling/Combination of both
4. Drainage of sub retinal fluid.

Occasionally drainage of large amounts of sub retinal fluid may results in a soft eye which in turn may lead to complications such as choroidal detachment. Chorioidal haemorrhage and hyphaema in order to avoid these complications saline has to be injected into the vitreous cavity through the pars-plana. Encircling buckles are produced by using a silicon strap of 2 - 2.5 mm width placed on the sclera behind the rectus muscle insertions, and held in position by retaining sutures.

This may be use where the retina detachment is more than one quadrant and no hole is visible, and multiple holes are seen, when the proliferative vitreo retinopathy requiring reduction in intraocular volume to allow retinal reapposition. This may supplemented by radial sponge, explants are solid silicone tyres when required.

3.4.2. Pre-operative hydriasis

10% phinyle phrine home atropine drops.

3.4.3. Anaesthesia

Adults by local anaesthesia, supplemented by pre-anaesthetic medication like injection phethidine and injection phenergan.

Children by general anaesthesia.
3.4.4. Preparation
1. Consent of the patient.
2. Preparation of the eye.
3. Lacrimal test.
4. Draping of the eye.
5. Lid sutures.

3.4.5. Procedures
The conjunctiva is opened by using limbal incision, opens both Tenon’s capsule and conjunctiva. Concurrently releasing incisions are made at 3’o’ clock and 9’o’ clock position. The conjunctiva and Tenon’s capsule separated from the sclera.

The rectus muscles are isolated from the tensions capsule. The four rectus muscles are applied with traction sutures, the muscles are not detached from the globe. The globe is rotated in the required position of the surgeon for reexamination of the fundus with indirect ophthalmoscopy and scleral indentation.

Cryo applied over the sclera corresponding to the retinal break and monitored with the help of indirect ophthalmoscopy. Ice ball formation over the retina is avoided choroidal blanching is the guide line for cryoreaction i.e. optimum reaction.

Scleral buckling/encircling/combination of both done by approximate size explants. This may be a silicone sponge local explant or encircling band. Encircling bands are often supplemented by solid silicone gutter or tyres, radially placed silicon sponges.

Sub retinal fluid drainage: A radial scleral incision is made of approximately 2 - 3 mm in length down to the choroid. A 5/0 non absorbable matters sutures is sutured across, the incision. Sub retinal fluid is drained at desired level by panturing the choroid.

Conjuntiva is sutured at releasing incisions and around the limbus, followed by injection gentamycin is given subcoyendlly and pad and bandage green to both eyes.

4. Results
The following is brief report of the incidence of khegomagenous detachment and its nature observed during period of one year 1988-89 in this institution

Table 1: Total number of out patients

| Sex     | No. of cases | Percentage |
|---------|--------------|------------|
| Males   | 124272       | 52         |
| Female  | 94960        | 38         |
| Children| 38100        | 10         |
| Total   | 255087       | 100        |

70 % of the cases are total detachment in those cases the intra-ocular pressure is 4-10 mm Hg. This is low tension.

In 30% of the cases partial detachment is seen in them, the intra-ocular pressure is 10 – 12.2 mm Hg.

Table 2: Number of cases diagnosed as retinal Detachment

| Sex     | No. of cases | Percentage |
|---------|--------------|------------|
| Males   | 150          | 65         |
| Female  | 90           | 35         |
| Total   | 240          | 100        |

In the present study, there is a male preponderence

Table 3: Ratio of PHAKIC/APHAKIC

|          | No. of cases | Percentage |
|----------|--------------|------------|
| Phakic   | 15           | 30         |
| Aphakic  | 35           | 60         |

Retinal detachment is more common in aphakic individuals

Table 4: Age wise incidence of primary retinal detachment

| Age group | No. of Cases | Percentage |
|-----------|--------------|------------|
| 5-10      | -            | -          |
| 11-10     | -            | -          |
| 21-30     | 8            | 16         |
| 31-40     | 4            | 8          |
| 41-50     | 4            | 8          |
| 50 and above | 34       | 68         |

In the present study, series of cases there is 68% of retinal detachment cases are above the 50 years age group.

Table 5: Sex incidence

| Sex     | No. of cases | Percentage |
|---------|--------------|------------|
| Males   | 46           | 92         |
| Female  | 4            | 8          |
| Children| -            | -          |

It is more common in males

Table 6: Eye incidence

| Eye      | No. of cases | Percentage |
|----------|--------------|------------|
| Right eye| 33           | 66         |
| Left eye | 17           | 34         |

It is more common in right eye

Table 7: Incidence of type of retinal detachment & No. of holes

| Type of hole | No. of cases | Percentage |
|--------------|--------------|------------|
| Round or oval holes | 30          | 60         |
| Horse-shoe hole  | 15           | 30         |
| Dialysis      | 5            | 10         |

Most of the patients i.e. 60% of them are with round of oval holes.

Table 8: Tonometry

| Level of IOP in mm hg | No. of Cases | Percentage |
|-----------------------|--------------|------------|
| 0-5                   | 10           | 20         |
| 6-10                  | 25           | 50         |
| 11-20                 | 15           | 30         |
| 21-25                 | -            | -          |

In this series of cases the intra-ocular pressure is pre-operatively (i.e.10 mm/Hg) in 70% of the cases and it is normal in 30% of the cases.
Table 9: Intra-ocular recorded 1\textsuperscript{st}, 3\textsuperscript{rd} and 7\textsuperscript{th} P.O. period.

| Post-operative day | No. of cases | Level of the pressure | Percentage |
|--------------------|--------------|-----------------------|------------|
| 1\textsuperscript{st} day | 50 | 17.3-21.9 mm Hg | 100 |
| 3\textsuperscript{rd} day | 25 | 17.3-19.00 mm Hg | 50 |
| Dialysis | 5 | 10.2-14.6 mm Hg | 100 |

In this series of cases immediate post-operative day there is a rise of intra-ocular pressure. After 48 hours there is a fall of tension in 50% and came to normal intra-ocular pressure on 7\textsuperscript{th} day in all the cases.

Table 10: Scleral rigidity (Before surgery) (Normal scleral rigidity: 0.246-0.0493)

| Cases | Percentage | Normal Cases | Percentage | Above normal Cases | Percentage |
|-------|------------|--------------|------------|--------------------|------------|
| 3     | 6          | 40           | 80         | 7                  | 14         |

In this series of cases the normal scleral rigidity is noted pre-operatively.

Table 11: Scleral rigidity (Post surgery)

| Cases | Percentage | Normal Cases | Percentage | Above normal Cases | Percentage |
|-------|------------|--------------|------------|--------------------|------------|
| 50    | 100        | -            | -          | -                  | -          |

Post operatively all the cases have shown (100%) low sclera rigidity.

Table 12: Anterior chamber depth (Normal A.C. depth: 2.4 mm-3.2 mm) (Pre-operative)

| Phakic A.C Depth | No. of cases | Percentage | Aphakic No. of cases | Percentage |
|------------------|--------------|------------|----------------------|------------|
| Shallow          | 5            | 10         | -                    | -          |
| Normal           | 15           | 30         | 20                   | 40         |
| Deep             | -            | -          | 10                   | 20         |

Post operatively there is no significant change of anterior chamber depth is observed.

Table 13: Anterior chamber depth (Normal A.C. depth: 2.4 mm-3.2 mm) (Post-operative)

| S. No | A.C Depth | No. of cases | Percentage | No. of cases | Percentage |
|-------|-----------|--------------|------------|--------------|------------|
| 1.    | Shallow   | 5            | 10         | -            | -          |
| 2.    | Normal    | 15           | 30         | 20           | 40         |
| 3.    | Deep      | -            | -          | 10           | 20         |

Post operatively there is no significant change of anterior chamber depth is observed.

Table 14: GOINOSCOPY

| Nature of the angle | No. of cases | % |
|---------------------|--------------|---|
| Open (Grade- (III-IV) | 50 | 100 |

All the 4 angles of anterior chamber are open pre and post operatively. There is no significant change in width of angle of anterior chamber.

Table 15: Visualacuity (Preoperative)

| S. No | No. of Cases | Visual acuity | Percentage |
|-------|--------------|---------------|------------|
| 1     | 5            | PL            | 20         |
| 2     | 40           | HM            | 80         |
Table 17: Post operatively on 7th day

| S. No | No of cases | Visual Acuity | % |
|-------|-------------|---------------|---|
| 1     | 5           | 6/18          | 10 |
| 2     | 5           | 6/36          | 10 |
| 3     | 5           | 6/60          | 10 |
| 4     | 25          | 4 mts.        | 50 |
| 5     | 10          | 5 mts         | 20 |

Table 18: Intra-ocular pressure in relation to extent of theretal detachment

| S. No | Retinal detachment | IOP mm Hg | No. of Cases | % |
|-------|--------------------|-----------|--------------|---|
| 1     | Total              | 4-10      | 35           | 70 |
| 2     | 3 Quadrants        | 10-13     | 10           | 20 |
| 3     | 2 Quadrants        | 13 and above | 5 | 10 |
| 4     | 1 quadrants        | -         | -            | - |

5. Discussion

Buckling Procedure alter the anatomical configuration of the ball a result in change in the intro-ocular pressure. The depth of the anterior chamber may get reduced (Shallow) due to the temporary displacement ciliary body by the operative procedures. After forty eight hours post operatively the relaxation iris ciliary diaphragm will revert the lens to its original position, as the physiological re-adjustment of retina takes place.

The scleral rigidity is found to be significantly lowered post-operatively in all the cases, probably because in all the cases sub-retinal fluid drainage procedure has been adapted. A similar finding is noted by A. Sinha et al.7

In the present series of 50 consecutive cases the range of intra-ocular pressure pre-operatively was 4 - 12.2 mm Hg. During the 1st post operative day the intro-ocular pressure was ranging from 17.3 - 21.9 mm Hg. A similar finding has been reported by Sinha et al.7

During the 7th post operative period the intra-ocular pressure normalized due to the tissue adjustments and haemodynamics of the eye ball. The day to day intra-ocular pressure recording suggested that the adjustment of the tissue rigidity takes place after 48 hours. Since the 3rd post operative day there is a fall of intra-pressure comparative to 1st post operative day i.e. 12.2 - 19.3 mm Hg. Final reading was taken on 7th post operative day with Schiotz and Applanation (perkins) tonometers has shown ranging 10.2 - 14.6 mm Hg Schiotz, Applanation.

Anterior Chamber depth 2.4 - 3.2 mm and post operatively ranging from 2.4 - 3.2 mm. Hence there is no significant change in Anterior chamber depth present series of case Probably because a wet type of surgery has been performed in all the cases ,it is believed that the change in anterior chamber depth occurs only when there is dry type of surgery due to forward movement of Iris lens diaphragm (A.S inha et al) Scleral rigidity is normal in 90% of the cases Pre-operatively and it ranging from .0230 to .0498 and during post operative period on 7th post operative day ranging from .0055 - .00176. So it is Observed from this data that there is decreased scleral rigidity.7 Gonioscopically there is no change in width of the angle of the anterior chamber from pre to post operative period in present series probably due to wet type of surgery. There was an alteration of the width of the angle of the anterior chamber in certain cases of Sinha et al.7 Probably due to the dry type of surgery (without sub-retinal fluid drainage) adapted in same cases. There was no significant difference in the changes seen in intra-ocular pressure. In both aphakic and phakic retinal detachments and this signifies that presence or absence of lens has no role in the above observations.

In this series of cases the total retinal detachment is 70% of cases are having intra-ocular pressure ranging 4 - 10 mm Hg (low intra-ocular pressure). Partial retinal detachment is seen in 30% of the cases are having the intra-ocular pressure ranging from 10 mm Hg and above. The fall of intra-ocular pressure is seen in proportionate to the extent of retinal detachment. There is an improvement of visual acuity ranging from 4 mt to 6/1.8 post operatively. The visual improvement could not be restored normal in certain cases because of long duration and macular changes, and also some extent proliferative vitreo retinal changes as in the case prior to surgery.

6. Conclusions

1. All the cases showed low intra-ocular pressure pre-operatively, during 1st post - operative day there is definite rise of intra-ocular pressure.
2. The intra-ocular pressure restored to normal on 7th post - operative day and adjustment of tissue rigidity and haemodynamics, commence from 3rd post operative day.
3. All the cases have showed normal scleral rigidity pre-operatively and post operatively the scleral rigidity decreased.
4. No significant change in anterior chamber depth and width of the angle of the anterior chamber is observed.

7. Source of Funding
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8. Conflict Interest
None

References
1. Domniz YY, Cahana M, Avni I. Corneal surface changes after pars plana vitrectomy and scleral buckling surgery. J Cataract Refract Surg. 2001;27(6):868–72.
2. Okada Y, Nakamura S, Kubo E, Oishi N, Takahashi Y, Akagi Y, et al. Analysis of changes in corneal shape and refraction following scleral buckling surgery. Jpn J Ophthalmol. 2000;44:132–8.
3. Nemeth G, Vajas A, Tsorbatzoglou A, Kolozsvari B, Modis L, Berta A, et al. Assessment and reproducibility of anterior chamber depth measurement with anterior segment optical coherence tomography compared with immersion ultrasonography. J Cataract Refract Surg. 2007;33(3):443–7.
4. Santodomingo-Rubido J. A new non-contact optical device for ocular biometry. Br J Ophthalmol. 2002;86(4):458–62.
5. Wilkinson CP, Rice TA. Michel’s retinal detachment. St. Louis: Mosby; 1997. p. 1057–8.
6. Lin J, Xu L, Zhang H. The hemodynamic changes after scleral buckling operation for retinal detachment. Chin J Ocul Fundus. 1997;13:111–2.
7. Sinha A, Tewari HK, Khosla PK. Post operative intraocular tension after retinal detachment surgery. J Ophthalm. 1982;31:206.
8. Lavanya R, Teo L, Friedman DS, Aung HT, Baskaran M, Gao H, et al. Comparison of anterior chamber depth measurements using the IOLMaster, scanning peripheral anterior chamber depth analyser, and anterior segment optical coherence tomography. Br J Ophthalmol. 2007;91(8):1023–6.
9. Goezinne F, Heij ECL, Berendschot TTJM, Tahzib NG, Cals DWKJ, Liem ATA, et al. Anterior Chamber Depth Is Significantly Decreased after Scleral Buckling Surgery. Ophthalmol. 2010;117(1):79–85.
10. Karti O, Selver OB, Ozbek Z, Oner FH, Durak I, Saatci AO, et al. Evaluation of Corneal Thickness, Anterior Chamber Depth, and Iridocorneal Angle Following Scleral Buckling Surgery With AS-OCT. Ophthalmic Surg Lasers Imaging. 2012;43(6):S97–S102.

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