TRANS PARS PLANA VITRECTOMY (TPPV) IN OCULAR TRAUMA

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Dissertation submitted for the degree of M.Sc. (Ophthalmology).

UNIVERSITY OF DAR ES SALAAM
FACULTY OF MEDICINE

1981

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TO MY FAMILY

Whose spirit of sacrifice
and encouragement made this
work possible.

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DECLARATION

This dissertation was composed by the undersigned who also was responsible for carrying out the clinical study described herein. The study was carried out under the supervision of Prof. A. Deutman, of the department of Ophthalmology, Faculty of Medicine University of Nijmegen the Netherlands.

Signature: ..... Date: November 1981

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TRANS PARS PLANA VITERECTOMY (TPPV) IN OCULAR TRAUMA

INTRODUCTION

The aim of this dissertation is to review established information on vitrectomy in cases of ocular trauma and study cases of TPPV in ocular trauma managed at the University hospital of Nijmegen - The Netherlands. Special interest is towards the relationship of visual results to the time period between date of injury and date of vitrectomy and classification of posterior segment injuries.

To facilitate easy understanding of the subject, the first chapter gives information on ocular trauma in general. Incidence, age, sex, aetiology, classification, management, complications and visual results are discussed.

The second chapter will outline established information on vitrectomy in ocular trauma. This will include, rationale, indications, preoperative evaluation, method and instrumentation, complications and visual results.

The third chapter will describe a study of 26 cases which had TPPV at Nijmegen University hospital after ocular trauma.

Discussion on the results of the study and tentative conclusions will be dealt with in the last chapter.



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SUMMARY

1. Trauma is the commonest cause of unilateral blindness in the world. It occurs in young healthy people, more often in males than females.

2. Actiological factors vary in different places due to socio-economic and geographical factors. For example, a dramatic rise of severe ocular injuries due to road traffic accidents has been reported in developed countries.

3. There is no standard classification of ocular trauma, but severity is determined by the site and extent of intraocular damage. Injuries involving both anterior and posterior segments are most severe.

4. Experimental and human histopathological studies have contributed much to the understanding of complications occuring after ocular trauma, Massive intraocular cellular proliferation leads to most severe complications.

5. Recent knowledge in ocular trauma together with the availability of new diagnostic methods, instruments and drugs have greatly improved the management and hence the outcome of these injuries. Even so, the visual prognosis of eyes with injuries involving the posterior segment has not improved. This demands more developments in the management of posterior segment injuries.

6. Recently trans-pars-plana vitrectomy (TPPV) has given hope to previously hopeless cases. The rationale of TPPV is to prevent or arrest intraocular cellular proliferation.

7. Careful preoperative evaluation and early intervention is of utmost importance in the prognosis of TPPV cases. Success of TPPV is assesed by the amount of visual acuity regained after TPPV.

8. A study of 26 TPPV cases after ocular trauma was carried out at Nijmegen University, the Netherlands. Special interest was towards reviewing the relationship between time-indication for TPPV and visual results; and the classification of these severe ocular injuries. Follow up after TPPV ranged from 1 months to 9 months.

8.1 The age of these patients ranged from 9 to 71 years, with a speak falling in the age group of 21-30 years. 98.5% of them were males.

8.2 Occupational trauma was the commonest aetiological factor contributing 42% of the cases. Road traffic accidents and domestic accidents came second on the list, occuring with equal frequencies.

8.3 4 patients had bilateral ocular trauma, but in each patient only one eye had indications for TPPV.

8.4 Classification of injuries in this study is primarily based on the state of the injured vitreons: i.e clear vitreons, vitreons haemorrhage or massive intraocular fibrous proliferation. These 3 were the major groups and were associated with other tissue damages: i.e lens damage retinal detachument, and or intraocular foreign bodies.

8.5 Four patients had non-perforating injuries.

8.6 Sixteen (61.5%) of the patients were referred within 14 days, and 31% more than 28 days after trauma.

8.7 65% of all patients had vitreons haemanhage plus majority of the other tissue damages.

8.8 Three patients presented with clear vitreous but had retained

intraocular foreigns bodies; with lens damage in two and retianl detachuments in one of them.

8.9 Massive intraocular fibrous proliferation was observed in 6 patients who either had retinal detachument, failed attempts to remove intra-ocular foreign bodies or were referred late.

8.10 Ten patients presented with intraocular foreign bodies, 9 of whom had metallic and reactive foreign bodies.

8.11 Most patients (84%) presented with poor vision of below 0.1, mainly due to unclear media and retinal detachument.

8.12 Accurate projection of light was found to be a good prognostic sign for visual improvement.

8.13 (61.5% of the patients were a success (had visual improvent); with an overall 42.3% having good visual improvement. Good visual results occured in patients who had TPPV before 28 days after injury; and even better between 1 to 3 weeks. Good results also occured when TPPV was done in eyes which had remained functionally and morphologically intact for more than 3 months after trauma.

8.14 Poor results (visual deterioration) occured in 2 patients. It was interesting to observe that the poorest results occured in patients who had TPPV between 6 weeks and three months after injury.

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CHAPTER I

OCULAR TRAUMA

Trauma to the eye can be mechanical, chemical, thermal, radiational or electrical. In this dissertation trauma refers to mechanical trauma. This can be either perforating or non-perforating injury to the eye.

Trauma is the commonest cause of unilateral blindness in the world. The incidence of ocular trauma varies in different localities depending on social, economic and geographical factors; as well as expertise and referal patterns. For example:

(i) In the United States of America, ocular trauma accounts for approximately 3% of blindness (Ryan 1978).

(ii) In the year 1979/80, 18% of all the ophthalmic inpatients at Muhimbili Hospital (Tanzania) were trauma cases.

(iii) A rise in the number of perforating ocular injuries has been reported by Johnston (1971 & 1975) at Belfast Royal Victoria hospital; largely contributed to by the civil war in Northern Ireland.

1. Age: Generally speaking ocular trauma commonly occurs in young healthy people (Ryan 1978). 86% of all perforating injuries studied by Eagling (1976) fall within the age of 0 - 40 years. Roper Hall (1959) and Johnston (1971) observed a similar pattern.

2. Sex: Ocular trauma occur more frequently among males than females. A male to female ratio of about 3.5:1 has been reported by Eagling (1976) Roper Hall (1959) and Johnston (1975).

3. Aetiology: The aetiology of ocular trauma has been traditionally classified as follows:

3.1 Domestic (including children at play)
3.2 Occupational
3.3 Traffic accidents
3.4 Assault
3.5 Sports

The aetiological pattern has changed. Civilisation and preventive measures have greatly contributed to this change. Although domestic accidents have remained the commonest cause of ocular injuries, a dramatic rise in the percentage of ocular trauma caused by traffic accidents has been reported; while the incidence of occupational trauma has fallen considerably (Johnston, 1975; Eagling, 1976, and Ryan, 1980).

3.1 Domestic trauma.

This group includes children at play. It remains the largest group of all ocular trauma. However, Johnston (1976) observed a fall from 46% to 30%; and also Eagling (1976) observed 47% to 40% drop. Prevention of the production and use of dangerous toys has contributed much to this.

3.2 Occupational ocular trauma

In the past, this was among the commonest aetiological factor. Recently the percentage of cases has fallen due to preventive measures enforced at work. In 1959 Roper Hall reported 41% of all perforating injuries to be industrial. Eagling reported a fall from 41% to 15%; while Johnston, (1976) (1975) reported an incidence of 14 - 20%.

3.3 Traffic accidents

Ocular trauma due to traffic accidents form an increasingly important and preventable group of perforating ocular injuries: Mackay (1975) studies the incidence of trauma to eyes of car owners and reported that motor-car accidents cause severe injuries to the eye, front seat passengers were the victims of more severe injuries and at least 70% of the injuries were associated with toughened glass windscreens. Out of 205 perforating ocular trauma due to traffic accidents, Johnston (1975) reported 195 cases to have been associated with toughened glass and zone tempered windscreens. He also reported 148 cases to have been drivers, 48 cases front seat passengers and 5 cases back seat passengers; but he did not associate the severity of trauma with the front seat position. Johnston, (1975) stresses the importance of waring seat belts and using laminated windscreens in the prevention of traffic accident ocular trauma.

3.4 Assault Trauma

This is becoming a more frequent cause of ocular trauma. Roper Hall (1959) reported only 1%. But Eagling (1976) reported a rise of from 1% to 8%. Johnston (1975) also reported a rise from 8% to 15%.

3.5 Sports Trauma

Has been reported by Roper Hall, (1959) and Eagling (1976) to constitute 2 and 3% of eye injuries respectively. According to Rousseau, (1979), hockey is the most frequent cause of severe eye injuries; accounting for 31% of sports trauma to the eye. Other sports activities contributing to eye sports trauma include Racquet sports. 10.3%, Baseball and soft ball 8.2%, fish hooks 4.1%, basket ball, golf and boxing 2.7%, and sking injuries 2.1%.

4. Classification of Ocular Trauma

The severity of ocular injuries is determined largely by the site and extent of intraocular damage. An attempt of classification should therefore be based on these important criteria. This type of classification is useful in assessing severity and hence the method of management. Furthermore it is helpful in predicting the visual outcome after treatment. Unfortunately there is no standard established classification.

Most authors divide ocular trauma into 2 major groups of:

4.1 Perforating injuries

4.2 Non-perforating injuries

Each group can be further sub divided into:

a) Anterior segment injuries

b) Posterior segment injuries

4.3 According to Ryan, 1979

a) Anterior segment trauma includes involvement of the anterior corneascleral coat, the uvea and the lens. (with no involvement of the vitreous, retina or choroid).

b) Posterior segment trauma involves the vitreous, retina or choroid. Ryan includes mixed injuries, involving both the anterior and posterior segments, in the second group as the degree of posterior segment involvement determined both severity and prognosis of his cases.

4.4 Eaglings Classification

Eagling (1976) divides the 2 major groups into 4 grades:

Grade I - Laceration of the cornea and/or anterior sclera

Grade II- Laceration of the cornea and/or anterior sclera with lens involvement.

Grade III- Posterior segment trauma with vitreous loss.

Grade IV- Mixed trauma with involvement of both the anterior and posterior segment.

4.5 Adhikary's Classification

Adhikary et al (1976) also attempted to classify his cases of perforating trauma. He grouped them into 3 degrees:

1st degree = Perforating injuries of any length of cornea or sclera without lens, uvea or vitreous involvement and with no foreign body.

2nd degree = Injuries of any size to cornea or sclera with lens, vitreous or uveal involvement or intra-ocular foreign body.

3rd degree = Double perforation of the globe caused by gunshot or other metallic particle#, extensive ramified lacerations of anterior segment and/or posterior pole; and injuries with massive haemorrhage leading to vitreous organisation.

4.6 Neubauer's classification of anterior segment perforating injuries:

Neubauer (1976) classified anterior segment injuries into 7 more detailed groups in order of severity (group 1 the least severe

1. Scleral perforation under 6μm
2. Corneal perforation under 6μm
3. Cornea - Scleral trauma with single involvement of the limbus
4. Limbus parallel burst injuries
5. Large ramified corneal injuries without limbus involvement.
6. Large scleral perforation
7. Large ramified corneal injuries with multiple limbus involvemen

Neubauer claimed this classification to have shown a correlation between site and extent of trauma with visual prognosis. The large the extent of tissue involvement and limbus involvement, the worst the prognosis.

Comments:

4.3 Ryan's classification includes mixed injuries involving both the anterior and posterior segment into the Posterior segment group. It is felt that mixed injuries should be grouped separately as in Eaglings classification.

4.4 Eaglings classification is simple with clear cut definition of each grade. However she does not mention non-perforating trauma and retained intraocular foreign bodies. Although these can still fit well in the classification without altering it, it is felt that retained intraocular foreign bodies should be mentioned in the classification considering their possible specific complications.

4.5 Adhikary's classification mentions retained intraocular foreign bodies but does not group the cases into anterior segment and posterior segment trauma. I find the 3rd degree of trauma rather difficult to define.

4.6 Neubauers classification is more detailed and probably the most useful in studies of anterior segment trauma. As in Eaglings Classification, it is again felt that the classification would be more complete with a mention of non-perforating trauma and retained foreign bodies.

Considering that different parts of the retina perform specific functions, a detailed classification of posterior segment injuries, similar to that of Neubauer for anterior segment trauma, is desirable. This would allow better definition of the site and the extent of damage as well as assessment of functional prognosis.

5. Severity of ocular trauma

Anterior segment trauma is regarded as the most benign of all ocular injuries. Posterior segment involvement is the severe type of trauma; the most severe being mixed trauma involving both the anterior and posterior segments. However, bilateral involvement is regarded to be the most serious type of ocular trauma; and is reported to have increased as a result of traffic accidents (Johnston Eagling 1976, and Neubauer 1976)

6. Pathology of Intraocular fibrous proliferation

The correlation of findings in clinical, experimental and human histopathological studies have contributed much to the understanding of complications occuring after ocular trauma. The understanding has lead to the development of better curative and preventive measures (Constable 1974. Faulborn and Topping, 1978, Sugita et al 1980).

6.1 Stimulus

Ocular trauma, whether perforating or non-perforating, is one of the common causative factors in the development of intraocular fibrous proliferation. Blood and its products (iron and haemoglobin), damaged intraocular tissues and the response of the vitreous to injury are the major stimuli to cellular proliferation after trauma (Faulborn & Topping 1978)

The origin of Proliferative cells:

Certain cells in the eye are capable of proliferation when stimulated by trauma:

1. Conjuctival and episcleral cells (when perforation occurs)
2. Ciliary body epithelial cells
3. The lens capsule and epithelium
4. Retinal glial cells
5. Pigment epithelial cells
6. Choroidal connective tissue cells.

6.2 Conditions favouring proliferation

1. Prolonged inflamation
2. Disruption of normal tissue barriers for example damage to internal limiting membrane or cortical vitreous gel.
3. The presence of scaffold for proliferation (healthy vitreous acts as a scaffold)

6.3 Course

Sugita et al(1980)have reviewed the pathology of intraocular cellular proliferation and is as follows:

(i) When haemorrhage is present it organises with fibroblastic formation within 6-8 hours after injury. Absorption of vitreous haemorrhage is a slow process varying from weeks to months depending on the site and extent of haemorrhage and also on the state of the vitreous before injury. The absorption is quicker when haemorrhage is in the periferal vitreous than when it actually enters the vitreous. Quicker absorption has also been observed in aphakic eyes and in degenerate liquid vitreous.

(ii) Cellular proliferation usually begins 2-4 days after trauma. More proliferation occurs near the retina (optic Disc and retinal vessels) than in the vitreous. The rate and extent of proliferation depends on the type and extent of tissue damage. For example, lens and vitreous damage results in severe proliferative reaction. The amount of vitreous haemorrhage is directly related to the amount of intraocular tissue proliferation.

(iii) Maturation of the proliferating fibroblasts is followed by deposition of collagen and other extracellular material. In perforating injuries this new collagen is much thicker and denser, (than normal collagen) near the site of perforation.

(iv) Massive periretinal proliferation occurs about 2 weeks after injury.

(v) The final stage is contraction of the fibrotic overgrowth; causing traction on sorrounding tissues. In the anterior segment traction on the ciliary body epithelium causes hypotomy and later phthisis bulbi. In the posterior segment traction on the retina causes macular pucker, traction retinal detachment and retinal defects. This stage is reached about 4 weeks after trauma in 63% of cases.

(vi) Fibrotic overgrowth is more rapid and severe in young patients.

7. Management

The availability of new diagnostic method, treatment, and development of new instruments has revoluationised and greatly improved the management of ocular perforating injuries.

7.1 Control of infection

Infection used to be an important setback to the prognosis of perforating trauma in the pre-antibiotic days. With the development of antibiotics and sterile surgical techniques, this is no longer a prominent problem.

The incidence of infection has decreased. In 1945 snell reported an overall infection rate of 15% of his cases accounting for 38.6% of enucleated eyes. Roper Hall (1959) reported that infection was not a major problem in his cases. Eagling reported an infection rate of 2%, while Johnston did not find infection to be a feature in any of his cases.

Recently further development in the use of intracemeral antibiotics and antifungal agents is most promising in the prevention and treatment of intraocular infection.

7.2 Surgical management

Development of finer operating microscopes, finer instruments and suture material has much contributed to the success of primary surgical repair of perforating ocular trauma. The aim is no longer trying to retain a safe aye, but is to regain useful vision. However, Neubauer stresses the importance of an experienced eye surgeon in the primary management. A more experienced surgeon is more likely to anticipate and prevent possible complications than a non-experiences beginner.

The first development is achieving a watertight wound by more accurate wound closure as soon as possible after trauma (Roper Hall 1959). The operating microscope and 10-0 perlon sutures should be used to achieve accurate wound closure. This facilitates easier and more satisfactory reconstruction of the eye.

After this achievement, attention has been directed towards management of intraocular tissue damage and reduction of intraocular inflamation. Reposition of the undamaged fresh iris lead to better visual and cosmetic results. Repair of the iris diaphragm has reduced the problem of anterior and posterior synachiae. In scleral perforations, care should be taken to push back the retina in the eye when incarcerated in the wound. Immediate aspiration of damaged lens to reduce intraocular inflamation was recommended by Roper Hall (1959). This is most important when there is an associated vitreous damage. The development in the application of contact lenses and intraocular lens implants is helping to solve the problem of binocular vision and amblyopia in unilateral posttraumatic aphakia.

Prophylactic encircling procedures after primary repair and cryotherapy around the site of perforating scleral wounds is rewarding in the prevention of retinal detachment. Extensive anterior vitrectomy was recommended by Coles and Haik (1972) to prevent intraocular organisation leading to retinal detachment and phthisis bulbi.

7.3 Antiinflamatory agents

Development in the use of systemic and local antiinflamatory agents like steroids and the use of immunosuppressive drugs has proved to be useful in the control of intraocular inflamation.

7.4 Trans Pars Plana Viterectomy

More recently Trans pars plana vitrectomy has given more hope to previously hopeless cases by preventing and treating the most serious complications of ocular trauma. Direct and much safer removal of retained intraocular foreign bodies under direct visualisation is possible in combination with trans pars plana vitrectomy.

8. Visual Results and Complications

The recovery of an eye from trauma depends on the extent of the initial damage, the efficiency of management and the satisfactory management of complications. (Roper Hall 1969, Ryan 1978).

Although the severity of ocular trauma has risen, the results of treatment in general are better (Neubauer 1975). This is reflected by the general increase in the percentage of patients who get good vision after treatment (Roper Hall, Eagling and Faulborn 1977).

In the assessment of visual results good vision means visual acuity of 0.5 or more. Bad vision means inaccurate perception of light (Eagling 1976).

Eagling reported a rise of good visual outcome from 45% in 1959 to 68% in 1976. Neubauer (1975) reported a rise from 29% to 38%. Adhikary (1976) reported an overal 63% of good visual outcome.

Further analysis of the overal visual outcome shows that more patients with anterior segment trauma get good visual outcome than patients with posterior segment trauma. This reflects the following facts:

1. Anterior segment trauma is the least severe.
2. There is an improvement in the management of the anterior segment injuries.
3. Ocular trauma with involvement of the posterior segment is most severe.
4. The management of posterior segment trauma is still unsatisfactory as the retina and the optic nerve are irreplaceable structures.

8.1 Visual outcome of Eagling's series (1976)

Grade I patients: get good visual out come (94%). The factors contributing to good visual outcome in this group was complete removal of damaged lens and the absence of vitreous haemorrhage.

Grade IV : patients get the least good visual outcome (18%). These patients constituted about 25% of all perforating ocular injuries and 50% of them did not have visual potential for recovery before treatment. Among these cases with no visual potential, none gained vision. Some of the cases with visual potential for recovery, gained good vision.

Factors contributing to bad visual outcome .

Grade I: Wound astigmatism was the main cause in this group. Only 1% had bad vision.

Grade II: Ambylopia in children under 8 was the major problem · 2% had bad vision.

Grade III: Subsequent development of tractional retinal detachment occuring 4 months to 2 years from time of injury. Vitreous haemorrhage and vitreous incaceration in the wound was the important contributing factors in the development of vitreous traction. 17% had bad vision.

Grade IV: 60% had bad vision. Most of these had no visual potential for recovery and histological studies showed that massive choroidal haemorrhage had occured. Of those who started with visual potential for recovery, anterior segment organisation with involvement of the retina was the problem.

8.2 Visual outcome of Adhikary et al series (1976).

He reported results of 130 patients 63% regained good vision, 9.2% regained vision of 6/18 - 6/60 and 15.3% regained vision of less than 1/60.

8.3 Sympathetic ophthalmitis

Despite the fact that it is a rare problem, sympathetic ophthalmitis remains the most severe possible complication of ocular trauma. Roper Hall (1959) reported an incidence of about 6.3%. Eagling (1976) reported about 1% incidence, while adhikary et al (1976) reported none.

The reduced rate of enucleation of an eye after ocular trauma reflects good prognosis of retaining an injured eye (Eagling 1975, Neubauer 1975).

Roper Hall (1959) reported an excision rate fall from 50% to 15%. Neubauer (1975) reported an excision rate of 18.7% and Adhikary et al (1976) 9.2%

CHAPTER II

VITRECTOMY IN OCULAR TRAUMA

In the past 5 years much attention has been directed towards employing trans pars plana vitrectomy for the treatment of ocular trauma. Trauma now has become the second most frequent indication for pars plana vitrectomy.

1. Rationale of vitrectomy in ocular trauma.

Massive intraocular cellular proliferation is a serious complication of ocular trauma especially when the posterior segment is involved. This complication contributes much to the visual and cosmetic prognosis of these cases. The aim of vitrectomy in ocular trauma is therefore to prevent or treat this complication.

1.1 Vitrectomy as a measure to prevent intraocular proliferation

Prevention can be done in 2 ways:

(a) Removal of damaged tissue which acts as a stimulus to cellular proliferation. This prevents development of cellular proliferation if done before 3 days after injury.

(b) Removal of scaffold for cellular proliferation. This prevents progress of cellular proliferation.

1.2 Vitrectomy as a Treatment for Intraocular Proliferation

When massive intraocular fibrous proliferation is already established, removal of this tissue releases traction on the retina or/and the ciliary body giving them a chance to return to their normal Physiological functional state and prevent further damage.

2. Timing of vitrectomy

The histo-pathological knowledge of intraocular cellular proliferation indicate that vitrectomy should be done as soon as possible after trauma.

2.1 Rationale and advantages of early vitrectomy:

Machemer advises vitrectomy to be done within 7 days after injury; for the following reasons.

1. Prevention of Intraocular Proliferation:

Since cellular proliferation begins 3 - 7 days after injury, vitrectomy done before the third day would prevent the development of intraocular proliferation. However, clinical experience has shown that there are surgical disadvantages of vitrectomy done within 48 hours after trauma:

(a) In the Presence of vitreous haemorrhage, which is the case in most patients, it is not easy for the surgeon to differentiate between vitreous coagulum and retinal tissue. So that there is a high risk to damage the retina.

(b) The chances of further bleeding during surgery is very high in this period.

2. Early clearing of the ocular media:

This allows early assessment of the type and extent of tissue damage enabling:

(a) Early treatment of repairable injury like retinal tears and retinal detachment.

(b) Early decision to excise the eye, when the injury is irrepairable and this prevent sympathetic opthalmitis.

3. Early removal of opaque damaged tissue.

This is a preventive measure against development of amblyopia in children.

4. Early removal of possibly infected tissue.

Removal of damaged tissue and retained intraocular foreign bodies which might be infected, alters the course of endophthalmitis especially when combined with intracameral antibiotics.

The chances of further intraocular bleeding and damage to the retina as a result of vitrectomy performed before the 3rd day of injury are minimized by delaying the operation until 4 - 14 days after trauma.

2.2 Advantages of delaying vitrectomy until 4 - 14 days after trauma:

1. Better evaluation:

This period allows time for better evaluation of the anatomical and functional state of the injured eye. So that a good baseline is established to allow better assessment of the injury and prognosis. This may influence the decision to operate.

2. Surgical advantage:

(a) The risk of further bleeding during surgery is low in this period.

(b) Surgical ability to differentiate between vitreous coagulum and the retina is better.

It is known that spontaneous posterior vitreous detachment occurs about one week (1) after injury in cases of vitreous haemorrhage. This facilitates much better differentiation ability.

3. Prevention of Complications

(a) Sympathetic Ophthalmitis can still be prevented during this period.

(b) Although it is very likely that intraocular cellular proliferation would have started during this period; prevention of massive proliferation can still be achieved by removal of this tissue.

2.3 Patients Indicated for Early Vitrectomy:

Depending on the facilities available, some patients can be managed in the early phase (4 - 7 days after injury) for a combined surgical procedure after primary repair. Indicated for this procedure are patients with either vitreous haemorrhage plus retinal detachment, double perforating injury, retained reactive intraocular foreign body, or severe intraocular inflammation. The principle is to remove damaged lens material and vitreous/vitreous haemorrhage; and reattach the retina as soon as possible. (Ryan 1978).

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2.3 Retinal detachment: when there are retinal tears with vitreous behind the retina, and when the tears are more than 180°. Traction detachment is a late indication.

2.4 Removal of intraocular foregin bodies.
This is more indicated when the media are not clear and the foreign body is non-magnetic and toxic.

2.5 Posterior dislocation of the lens.

2.6 Treatment of endophthalmitis.
This is to be done before the retina is damaged.

3. Combined anterior and posterior vitrectomy

3.1 Where there is trauma involving both anterior and posterior segment especially when the lens is damaged.

3.2 Haemolytic glaucoma

3.3 Aphakic pupillary block.

4. Contraindications

4.1 Severe trauma with unrepairable damage.

4.2 Signs of blindness in the injured eye i.e. no perception of light.

(c) Cornea. Corneal clarity is essential for visualisation during pars plana vitrectomy. When the cornea is opaque, it can be removed and an artifial cornea used during vitrectomy.

(d) Intraocular pressure:

i. Exclude glaucoma otherwise an additional trabeculectomy may be necessary.

ii. Hypotomy is a sign of retinal detachment. It is an indication for vitrectomy when associated with retinal detachment.

Hypotomy of short duration is a very good indication for vitrectomy if the cause of hypotomy is a cyclitic membrane pulling on the ciliary body epithelium and may save the eye from pthisis. Longstanding hypotomy and atrophy of an eye are contraindications for vitrectomy.

(e) Iris and pupil

If the pupil is distorted or displaced a plan to reconstruct it during the operation is anticipated.
Size of the pupil should be measured after full dilation.
there is always the possibility of surgical enlargement of the pupil for better visualisation.

(f) Lens.

i. Position - if the lens is subluxated it has to be removed as there will not be vitreous to support it after vitrectomy

ii. Opaque lens - this has to be removed before vitrectomy for good visualisation.

The degree of nuclear sclerosis should be assessed as it determines the method of lens removal. When the nucleus is hard ultrasound fragmentation is not indicated.

(g) Vitreous and retina

If the media are clear - locate the extent of retinal detachment, retinal defects, vitreous strands and membrane. Sometimes it is possible to locate retained intraocular foreign bodies by opthalmoscopy.
The appearance of the retina is important: White thickened detached retina means poor prognosis.

(ii) Unclear media

When lens opacities, hyphaema, pupillary membranes, vitreous haemorrhage or membranes are obstructing the view, specialised investigative methods are indicated to asses the site and extent of damage and locate retained intraocular foreign bodies.

X-ray examination of both orbits should be done in all perforating trauma to exlude retained intraocular bodies and locate them if they are present.

Ultrasonography

This is very useful when the media are unclear and the decision to operate may be influenced by Ultrasonography results. It helps to plan operative procedures as it is capable of demonstrating and locating the tissue damage.
In vitreous haemorrhage the extent and density of the opacities can be demonstrated, the detection of retinal detachment as well as location of its extent is possible and the quality of a detached retina can also be estimated i.e floating retina means good prognosis,

Stiff retina or triangular retinal detachment means presence of massive fibrous proliferation and therefore poor prognosis. Retinal defects, however, cannot be located by ultrasonography. Both the A and Bscan give useful information. Detection and localisation of foreign bodies is also possible with ultrasonography.

Electrophysiological tests.

Electroretinogram (ERG)

This is more important in proliferating conditions (Machemer). Year. However there may be a correlation between preoperative ERG and postoperative visual results (Jones et al 1977), Vitreous opacities can absorb a lot of light, therefore bright flash is more useful than ordinary light stimulation ERG (Machemer and Fuller 1975) Bright flash ERG may be helpful in the detection of retinal toxicity eg. siderosis bulbi. (Sanders et al 1975).

Visual Evoked Response (VER)

There is also a correlation between preoperative VER with post operative visual acuity. (Jones et al 1977). Rarely vitreous opacities are too dense to record a bright flash VER.

Electro oculogram (EOG)

This is not very useful in general in trauma. However it is useful to detect signs of toxicity in retained toxic intraocular foreign bodies. Sometimes it is done instead of ERG in children who cannot tolerate contact lens insertion when skin electrodes are not used.

PROCEDURE AND INSTRUMENTATION FOR (TPPV)

Procedure

Pars plana vitrectomy in ocular trauma is carried out similarly in principle as for other indications of vitrectomy. It is a closed system approach of eye surgery. The vitreons is removed through a posterior approach leaving the anterior segment intact.

The instrument for vitrectomy is introduced into the eye through sclerotomies at the pars plana - about 4mm posterior to the limbus to avoid lens damage. In aphakic eyes a more anterior sclerotomy position (3mm from the limbus) is preferred.

Intraocular manipulation is visually controlled through a dilated pupil under magnification and stereopsis with an upright image using an operating microscope. A comeal contact lens is used for posterior segment visualisation.

Instrument.

Vitrectomy instrument is capable of cutting, aspiration, replacing the removed vitreous and provides internal illumination. There is so far no ideal or standard instrument for vitrectomy, although many have been described and are available on the market. Deutman (1979) reported his experience with 6 types of instruments and concluded that rotating instruments, even when oscillating are not the safest for vitrectomy. He prefers using the O'Malley Ocutome.

The O'Malley Ocutome

This instrument is portable, easily dismantled and sterilised.

1. Hand piece characteristics

This is light (17 gr.), small in size and well balanced. It is comfortable for long period holding. It has an external tubing system for aspiration.

2. Degree of Control over surgical parameters

The surgeon controls the instrument's functions which is displayed by sound. Cutting and aspiration is activated separately with 2 foot switches. This is useful during lens removal and lavage of the vitreous although has a high chance of traction on tissues.

3. Infusion system

This is separate from the handpiece. The canula (20 gauge) is introduced in the eye through a separate pars plana sclerotomy. This enables great flexibility, more surgical capabilities and stable intraocular pressure even during scleral buckling or identation. The position of the canula in the eye must be checked as improper placement may cause choroidal or retinal detachment. The rate of infusion is controlled by gravity allowing a small total volume of exchange even in prolonged operations. When working close to the retina the infusion bottle should be hung low.

4. Illumination

There is also a separate fibreoptic 20 gauge (0.9 mm) probe to provide intraocular illumination. A third pars plana vitrectomy is therefore necessary.
This source of light sometimes cause unwanted light reflexes to shine on the cutting tip, and casting shadows making membrane peeling difficult.

5. Intraocular tip characteristics

This is made of stainless steel. It is 25 mm. long and 0.93 in diameter. Its small diameter allows easier insertion into the eye through a small sclerotomy. The tip is round and has a 2 tube system. The cutting port is on the side of the tip (0.5 mm from the tip). This may cause difficulties in reaching membranes especially when near the retina. The cutting port diameter is 1.0 x 0.65 mm, this being continously variable in size when in action, and is always open at the end of each cycle to avoid traction on uncut tissue.

6. Cutting mechanism

The cutting mechanism is guillotime type (axial, piston-like) with a precision-fit blade moving within the outer shell of the tip with a single stroke cutting mechanism.

Although the cutting mechanism is safe, especially when retina detachment is present, its cutting power is not enough for taut membranes. However, the 45 angled vitreous scissors (Medical workshop) can be used to cut these taut membranes.

The speed of cutting can be varied from 60 to 500 cuts per minute. Low speed is favourable when more safety precaution is indicated although it creates a longer suction time. High speed is preferred when more efficiency is required. High speed cutting, when uninterrupted, creates a suction effect which helps to hold the lens in place while being cut.

7. Aspiration of cut tissue

The O'Malley Ocutome has an automatic pump with a dial control on-console. It is controlled by the surgeon. This maintains intra-ocular pressure within narrow range. However, the small internal diameter of the tube system predisposes aspirated tissue to clog the system. Aspiration is usually done at the setting 2. When working close to the retina the setting zero is preferred.
When aspiration of tissue lying on the retina (e.g. haemorrhage, lost lens material), or drainage of subretinal fluid is required; the Charles needle becomes very useful for internal drainage.

Reflux function

This is not directly available but can be delivered or made.

8. Accessories

Although a vitrectomy instrument such as the O'Malley Ocutome, is the most important instrument, other accessory instruments are useful either before, during or after the pars plana vitrectomy procedure:

1. Retinal detachment set.

Retinal detachment is both an indication and complication of vitrectomy.

2. Ultrasonic fragmatome

This instrument is useful when the lens has to be removed at the same sitting as that for vitrectomy thus maintaining a closed system and using the same sclerotomies.

3. Lens aspiration set

Sometimes when the lens is swollen and soft, lens aspiration before vitrectomy may be indicated.

4. Cryocoagulation machine:

Cryocoagulation around sclerotomy incisiions after closure is a prophylactic measure. The frigitronics instrument is preferred.

5. Vitreous foreign body forceps (Grieshaber, Wilson, Neubauer)

For removal of anticipated foreign bodies.

6. Vitreous Scissors

For cutting tough taut membranes which cannot be handled by the ocutome cutting system.

7. Charles Needle (Flute needle)

For internal drainage and membrane peeling procedures.

8. Bipolar Dialthermy

For controlling intraocular haemorrhage during surgery when raising the intraocular pressure fails. This is indicated when bleeding originates from proliferating vessels in the vitreous.

9. Instruments for air or gas injection

When retinal detachment is present, air/gas injection in the posterior segment tamponades the retina after vitrectomy. This is very useful with retinal defects in the upper quadrant and the posterior pole. The air/gas mixture is usually inflated through the infusion canule. 20% S F 6 gas + 80% air is preferred as it is slowly absorbed and therefore stays much longer in the eye than ordinary air (42 days). SF 6 gas is capable of expanding, especially when injected alone, causing raised intraocular pressure. It has created absolute glaucoma with lost eyes in the past.

10. Silicone oil

This is the last attempt to keep a detached retina attached when other methods have failed. This is more likely to be the case in delayed vitrectomy cases where massive periretinal proliferation (MPP) has developed.

Complications

The following complications likely to arise either during surgery or post-operatively are to be remembered; and precautions taken to prevent at or aboid them.

(A) Complications - during surgery:

1. Traction on the vitreous base accurs when rotary cutters are used. This may cause periferal retinal tears. Since these instruments are no longer used, the complication is not expected.

2. Retinal Holes:
These are usually caused by direct trauma with the instrument and are usually posteriorly placed. The complication is likely to occur when the vitreous is opague, with retinal detachment behind it. It occurs two times more frequently during preretinal membrane peeling procedures.

3. Fresh Haemorrhages:
Fresh vitrous haemorrhage usually occurs when larger feeder or retinal vessels are injured during vitrectomy. Blood can pass through retinal defect into the subretinal space and vice versa.

4. Loss of lens material

4. Loss of lens material

During lens fragmentation, breaking of the posterior capsule can allow lens cortical material to escape into the vitreous or settle on the Retina

5. Incaceration of detached retina at sclerotomy site when the instrument tip is withdrawn from the eye. However, this is rare when the o'Malley Ocutome is used.

6. Damage to the comeal epithelium with the comeal contact lens.

B. Post-operative complications

1. Comeal oedema due to endothelial damage.

2. Endopthalmitis is rare but severe

3. Intraocular pressure

Rise of intraocular pressure when occurs

a) 6 - 24 hours after vitrectomy may be due to expansion of SF_6 gas, air block, uveal oedema or intraocular haemorrhage.

b) 2 - 4 days, means angle obstruction by blood cells and haemolytic products, fresh red blood cells and inflamatory cells, phakolytic material or uveal inflamation. Reduced outflow facility due to angle recession is another possibility

c) 2 - 3 weeks - Rubeosia is the commonest problem here

4. Retinal Detachment

Redetachment usually occurs 3 - 6 weeks after vitrectomy. Heavy vitreous flare is an early sign.

C. LONG TERM COMPLICATIONS

1. Raised intraocular pressure may be associated with post-operative retinal detachment or angle recession.

2. New massive fibrous proliferation causing tractional detachment of the retina.

3. Lens opacity

This may occur as a late presentation in association with touch of the lens by instrument during surgery; touch of the lens by air bubble or extensive irrigation.

4. Late endophthalmitis is a rare complication

5. Sympathetic ophthalmia

5 cases have been reported after vitrectomy in different conditions. But nothing has been reported in trauma cases.

RESULTS OF TPP VITRECTOMY

Success is assessed by amount of visual acuity. Good visual improvement when visual acuity is 0.5 or better. Poor vision if below 0.1.

The following are results of different authors.

1. Benson and Machemer (1976)

   41 cases - 32% visual improvement, poor results in cases of:

   a) double perforation

   b) failure to remove foreign bodies

   c) massive intraocular fibrous overgrowth.

2. Hutton et al (1976)

   28 cases - 64% visual improvement, correlation between time indication and visual results was reported.

   a) before 6 weeks - better prognosis

   b) 6 weeks to 3 months - worst prognosis

   c) after 3 months - good prognosis

3. Faulborn et al (1977)

   72 case (Primary vitrectomy)

   55% visual improvement.

4. Gerard & Hawkins (1976)

   29% visual improvement.

5. Okum - 15 cases - 40% useful vision

CHAPTER III

A STUDY OF 26 TPPV CASES

26 Trans pars plana vitrectomy cases were studied during the period 1979-1981 at Nijmegen University Hospital. Only cases which had TPPV following ocular trauma were selected. Both perforating and non-perforating ocular injuries were included in the study.

Most of these cases were referred by eye specialists from different parts of the country for secondary management or specifically for vitrectomy. However, some were emergency cases referred by neighbouring general practitioners for primary management.

Preoperative evaluation was carried out as described in chapter II. These cases were operated by Professor Deutman using the o'Malley ocutome in 24 cases, and the Kloti vitrectomy instrument in 2 cases.

Procedure and Instrumentation was carried out as described in chapter II.

The Zeiss OPM 1-6 microscope was used in all cases. A corneal contact lens held in position by the assistant, was employed for visualisation of the posterior segment. When the pupil was not wide enough for good visalisation adrenaline 1:1000 solution was irrigated in the anterior chamber to achieve a wider pupil or the pupil was enlarged by "eating" iris tissue with the ocutome. Hartmans solution was used for intraocular infusion during surgery. Combined procedures were carried out whenever indicated as discussed in chapter II.

Subconjunctival and parabulbar injection of Gentamycin and oradexon was administered after vitrectomy. Atropine 1% eye drops and sofradex eye ointment were instilled in the eye after surgery.

Post-operatively Atropine 1% eye drops twice a day and Chibrocadron eye drops four times a day were used in the operated eye.

Follow up time ranged from one month to 9 months.

1. Reference pattern

Time interval between date of injury and first attendance varied from 0 day to 6 months. 8 patients were emergency cases and they came on the same day of trauma. 18 patients were referred for secondary reconstruction, 8 of which came within 14 days of injury and 8 more than 28 days after injury.

Table 1 - To show when patients were refered after day of injury.

Ref. Days after Trauma	0	1-7	8-14	15-21	22-28	28
No. of cases	8	5	3	1	1	8

61.5% (16 cases) were referred within 14 days after trauma and 38.5% were referred after 14 days.

2. Age and sex

2:1 Sex - males - 23
female - 3
male: female ratio = 7.6:1

2:2 Age varied from 9 to 71 years.

Table 2 to show age distribution

Age	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
No of cases	1	5	10	6	1	2	0	1

84% of all cases are in the age group of 11-40 years with a peak at 21-30 years.
This agrees with reports of Roper Hall and Eagling (1976).

3. Aetiology

All aetiological factors in ocular trauma (chapter II) were presented.

Occupational - 9
Traffic accidents - 5
Domestic accidents - 5
Sport - 4
Assault - 3

Occupational trauma was the commonest cause.

4. Eye affected

22 cases (84%) sustained trauma to one eye only and 4 cases to both eyes. However, only one eye of each case with bilateral involvement had indications for TPPV. of the 22 cases with unilateral trauma, 15 was in the right eye and 11 in the left eye. Of the bilaterally affected, 50% needed TPPV in the right eye and 50% in the left eye.

5. Visual Acuity before TPPV

5.1 TPPV eye

This varied from light perception with false projection of light to 0.8 . 21 (84%) of all cases had vision below 0.1, 12 of which had good projection of o light and 9 false projection of light.

4 cases had good vision of 0.4 - 0.8

Table 3. Visual acuity before TPPV

Visual Acuity	0.1	0.1-0.3	0.4-0.8
No. of cases	21	1	4
Percentage	84	4.6	15.4

5:2 Second eye

a) Unilaterally affected - All these had vision of 1.0 or more in the second eye.

b) Bilaterally affected - 2 patients had vision below 0.1. The eye of one of these patients was enucleated.

- one patient had 0.3 vision and the 4th had 0.6 vision.

- Only one of the bilaterally affected patient had good vision in the second eye.

6. DAYS BEFORE Vitrectomy

This varied from same day of injury to 30 months after injury.

Table 4. No of patients operated in different periods after injury

Days	No. of Cases
0	1
1-7	3
8-14	5
15-21	4
22-28	2
> 28	11

1 patient was operated on the same day of trauma; 9 cases within 14 days and 11 cases after 28 days.

6. Type of Trauma

All 26 cases had trauma involving both the anterior and posterior segment. According to Eagling's classification (1976) this is the most severe type of ocular trauma i.e. Grade IV.
85% (22 cases) of all cases were perforating trauma and the rest non-perforating.

The vitreous was involved in all these cases presenting in 3 different states of clear vitreous, vitreous haemorrhage and massive fibrous proliferation. Other tissue damages were retinal detachment and lens damage. Intraocular foreign bodies also presented in these cases. There is therefore a common factor of vitreous damage with associated lens damage, retinal detachment and retained intraocular foreign bodies. An attempt to classify these factors is as follows: There are 3 major groups and 6 subgroups (see table 4)

Group I - clear vitreons
Group II - vitreous haemorrhage
Group III - massive proliferations
Sub group a - lens damage
b - retinal detachment
c - intraocular foreign body
ab - lens damage + retinal detachemnt
ac - lens damage + foreign body
bc - retinal detachment + foreign body

Table 4 Incidence of Tissue Damage

GROUP	alone	a lens damage	b retina detach-ment	c forei-gn body	ab lens + retina detach-ment	ac lens + fb	bc retina detach-ment + fb	Total
I clear vitreous	0	2	1	3	0	2	0	3
II vitreous haemorr-hage	1	12	9	5	6	2	4	17
III Massive Prolife-ration		2	4	2	1	1	1	6
Total	1	16	14	10	7	5	6	26

fb= Foreign Body.

6:1 Vitreous damage

This was a common factor in all patients, more cases (65.4%) presenting with vitreous haemorrhage.

6:2 Other tissue damage

Vitreous damage was associated with lens damage in 16 cases (61.5%), and retinal detachment in 14 cases (54.4%). More cases of these tissue damages however, were associated with vitreous haemorrhage (Table 4)

6:3 Intraocular foreign bodies

A total of 10 cases (30.5%) had retained intraocular foreign bodies. 5 cases (50%) out of these were associated with vitreous haemorrhage and 3 cases (30%) with clear vitreous. Here again more cases were associated with vitreous haemorrhage.

6:4 Combinations of different tissue damages with/and foreign body (see table 4)

ab - 7 cases

ac - 5 cases

bc - 6 cases

All 3 combinations occurred. More cases of ab and bc occurred in association with vitreous haemorrhage; while an equal number of foreign body cases occurred in association with either vitreous haemorrhage or clear vitreous.

6:5 Vitreous damage alone

This occurred only in 1 patient who had vitreous haemorrhage due to concussion injury (non-perforating).

6:6 Correlation of vitreous damage to other tissue damage and foreign body. (table 4)

More patients of these Grade IV type of trauma presented with vitreous haemorrhage which was further associated with most cases of other types and combinations of tissue damage

Massive intraocular fibrous proliferation was the next vitreous damage presentation and was associated with more retinal detachment cases.

Clear vitreous damage was the least of all types of vitreous damage and when it occurred, it was associated with more cases of retained intraocular foreign bodies.

Vitreous damage without associated retinal detachment, lens damage or foreign body was seen only in one case.

6:7 Site and Type of Intraocular Foreign Bodies

10 patients presented with retained intraocular bodies. 90% of these were metallic and reactive.
More (60%) foreign bodies lodged in/on the retina than in the vitreous (30%).

6:8 Removal of retained intraocular foreign bodies

Table 5: Site and Type of Foreign Bodies

	Retina	Vitreous	Other
No. of Cases	7	2	1
Iron	5	-	1
Copper	-	2	-
Lead		1	
Tile	1		

Table 6: Method of Removal of Foreign Bodies

	Forceps	Magnet	Not removed
Iron	3	2	1
Copper	2		
Lead	1		
Tile			1
Total	6	2	2

80% were successfully removed. 60% removed with vitreous foreign body forceps.

7. Complications

7:1 During Surgery

a) Haemorrhage - This was seen in 3 patients (No. 20 and 9) case No. 20 was operated on the 26th day after injury but had possibly a posterior rupture of the globe causing choroidal rupture and total retinal detachment. After cleaning the damaged lens, the retina presented in the anterior segment of the eye and more haemorrhage caused difficulties in continuing surgery.

Case No. 9 was operated on the 9th day after trauma. He had retinal detachment with subretinal haemorrhage.
Case No. 21 - Had double perforating with bullet in the orbit. Fresh blood continously oozed into the vitreous during surgery. He was operated 7 days after trauma.

b) Retinal defects. Removal of foreign bodies lodged on/in retina left retinal defects at site of foreign body in all 3 patients (No. 19, 26, 5). 2 of these were small and successfully treated by gas insufflation after vitrectomy. Patient No. 5 was left with a big defect which was unsuccessfully treated with gas unsufflation + scleral identation. The foreign body of this patient was removed 7 weeks after trauma. EOG showed toxic changes (Paradox) before TPPV. A peripheral retinal tear occurred in patient No. 13 who had a foreign body removed with a magnet, combined with TPPV.. Traction on the vitreous base could have accurred in this young patient. One patient (No. 4) developed a posterior defect due to damage of the retina by the ocutome tip. This was a case of massive intraocular fibrous organisation with a long standing retained iron foreign body.

c) Loss of lens material

Some lens material sank into the vitreous and onto the retina at the posterior pole during lens fragmentation in patient No. 26.

These were successively removed with the Charles needle after vitrectomy.

7:2 Post operative complications

a) Vitreons haemorrhage - occurred 6 days after surgery in case No. 3. The indication for TPPV was massive intra-ocular proliferation with subtotal retinal detachment.

b) Comeal oedema occurred in 1 case

c) Raised intraocular pressure occurred 6 months after TPPV in one patient.

This patient presented with an intraocular pressure of about 44mm Hg before TPPV. The pressure was controlled by Timoptol eye drops.

d) Massive intraocular fibrous proliferation

A total of 4 patients developed this complication after vitrectomy. 2 of these (17 & 20) came with combined tissue damage (IIab) after concussion trauma (non-perforating). The retinal detachment in these patients could not be repaired successfully. The other 2 cases (5 & 14) had retained intraocular foreign bodies, removal of which failed in one case; and late presentation with removal of the foreign body seven weeks after trauma was the case in the second one. Iron was the nature of these 2 foreign bodies.

8. VISUAL RESULTS

8.1 Visual improvement.

16 cases achieved visual improvement after TPPV. This is an overall visual improvement of 61.5%.

Table 7. Cases with Visual improvement: Type of Damage, Visual Acuity, and Days before TPPV against Visual outcome.

Case No	Type of damage	Days before TPPV	V.A. before TPPV	P.L. before TPPV	V.A. after TPPV	P.L. after TPPV
10	Ia	9	L.P	+	0.6	+
2	Iac	1	5/60	+	1.0	+
6	IIIb	12/12	1/60	+	5/60	+
7	IIIb	30/12	1/300	-	0.1	+
8	Ia	20	L.P	+	0.6	+
11	Iab	42	L.P	-	0.26	+
12	Iab	20	L.P	-	0.5	+
15	IIIab	8/12	0.16	+	0.25	+
16	Ibc	0	1/60	+	0.8	+
19	IIbc	5/12	0.8	+	1.0	+
22	Iab	22	L.P	+	0.3	+
21	Ib	7	0.08	+	0.5	+
24	I	3/12	0.25/300	+	0.6	+
25	IIIbc	6/12	0.4	+	0.5	+
26	IIbc	8	L.P	+	0.5	+
23	Ia	15	L.P	+	0.5	+

1/12 = 1 month

VA = Visual Acuity

PL = Projection of Light

8.2 Projection of light before TPPV & Visual outcome

91.25% of the 16 cases with visual improvement had good projection of light before TPPV. Among the 11 cases which achieved good vision, 91% had good projection before TPPV.

On the other hand 40% of the 10 cases which did not achieve visual improvement had good projection of light.
All cases which had visual deterioration however, had good projection of light before TPPV. They lost it after TPPV.

Conclusion

Projection of light is a clinical sign, for assessing the potential for visual improvement before TPPV.

8.3 Relationship between visual improvement and time interval before TPPV

Table 11: Visual improvement. TPPV cases operated in different periods up to 28 days.

Period	Cases
0	1
1-7	2
8-15	3
16-21	2
22-28	1
Total	9

Comment on Table 11

Although a total of 9 cases had TPPV within 28 days after injury, 7 of them had TPPV in the period 1-21 days.

Table 12: Visual Improvement: TPPV cases operated in different 2 week periods up to more than 28 days.

PERIOD	CASES	PERCENT
0-14	5	31.25
15-28	4	25
>28	7	43.75
Total	16	

Comment on Table 12.

Total cases of visual improvement - 16 (61.5%). some patients showed gain of vision after TPPV in all groups.

8.4 Relationship between good visual Improvement and time interval before TPPV.

Table 13. Good visual improvement cases in different periods up to more than 28 days.

PERIOD	CASES	PERCENT
0	1	
1-7	2	
8-14	2	
15-21	3	
22-28	0	
>28	3	
Total	11	

Comment on Table 13

Total - 11 cases

8 cases (72.7%) had TPPV within 21 days.

No case had TPPV 22-28 days

3 cases (27.2%) had TPPV more than 28 days

Conclusion

72.7% of patients who gained good vision after TPPV, were operated within 21 days after trauma.

8.5 No Visual Improvement - Table 14

			BEFORE		AFTER	
Case	Damage	Days bef. TPPV	V.A.	Projection	V.A	Projection
1	Iab	2/12	L.P	-	2/300	-
3	IIIb	2/12	1/60	+	1/60	+
4	IIIac	3/12	L.P	-	L.P	-
5	Ic	7/52	0.6	+	L.P	-
9	Ib	10	L.P	-	L.P	-
13	IIac	16	0.5	+	0.4^{+}	+
14	Iac	10	0.5/300	-	0.5/300	-
17	Iab	3	L.P	+	L.P	-
18	Ic	10	L.P	-	2/300	-
20	Iab	26	L.P	-	L.P	-

- 10 cases out of a total 26 had no visual improvement.

*NB: - 1/12 = 1 month

1/52 = 1 week

8.6 Relationship of No. visual improvement with time interval before TPPV

Table 15: No visual improvement

Cases operated in different periods up to more than 28 days.

Period	Cases	Percent
3 0	-	-
1-7	1	10%
8-14	3	30%
15-21	21	10%
22-28	1	10%
28	4	40%
Total	10	

Comment

Total 10 cases - 38.5%

6 cases (60%) had TPPV within 28 days

5 cases (50%) had TPPV in 1-21 days

Table 16: No visual improvement

Cases operated in different periods of 2 weeks up to more than 28 days

Period	Cases	Percent
0-14	4	40%
15-28	2	20%
28	4	40%

Comment

Some patients showed no visual improvement in all 3 groups

8.7 Relationship between Visual Deterioration and Time interval before TPPV

Table 17: Visual deterioration cases in different periods

Period	Cases
0	-
1-7	1
8-14	-
15-21	-
21-22	-
22-28	-
> 28	1
Total	2

Comment

A total of 2 cases had visual deterioration. One of them was operated within 7 days and the other after 28 days.

Table 18: To compare percentage of good vision and visual deterioration cases in different periods

Period	Good vision	Visual deterioration
0-7	27.3%	50%
8-14	18.2%	-
15-21	27.3%	-
22-28	-	-
> 28	27.3%	50%

Comment

Good visual improvement did not occur in period 22-28 days. Visual deterioration occured in the time periods within 7 days and after 28 days.

8.8 CASES OPERATED AFTER 28 DAYS

Table 19: Visual outcome of Patients operated after 28 days

Case No	Period	Improved	Improved Not	Good	Same	Deterio.
6	2/12	+				
7	30/12	+				
15	8/12	+				
19	5/12	+		+		
24	3/12	+		+		
11	6/52	+				
25	6/12	+		+		
1	2/12		+		+	
3	2/12		+		+	
4	3/12		+		+	
5	7/52		+			+

Table 19 & 20

Total number of patients - 11 (42.2%)

a) 7 cases (63%) had visual improvement. 2 out of these gained good visual improvement.

b) 4 cases (36%) had no visual improvement. Of these, 1 had visual deterioration and 3 remained with the same vision.

Table 20: Visual outcome of patients in Table 19 grouped in different periods

Period	Improved	Good	Not Improved	Same	Deterioration
29 days - 6/52	0	0	0	0	0
6/52-3/12	3	1	4	3	1
After 3/12	3	1	0	0	0

9. Visual Results in Relation to Period Interval Before Trans Pars Plana Vitrectomy After Trauma

A total of 26 cases were studied. These cases were operated in different periods varying from the same day of injury to 30 months after injury.

Table 4 shows that more patients (15) were operated within 28 days than after 28 days (11). Among those operated within 28 days, 9 were operated in period 8-~~12~~ 21 days. Fewer cases were operated in period 0-7 and 22-28 days.

9.1 Visual Improvement

An over all 61.5% (16) visual improvement was achieved. The distribution of these cases in different periods before TPPV showed that more cases (9) were operated in period 0-28 than after 28 days. Among the 9 cases operated within 28 days, 77.8% were operated between 1-21 days.

Conclusion

Visual improvement was observed in some patients in all the time periods studied. Although more patients achieved visual improvement when operated within 28 days, even more had visual improvement when operated in period 1-21 days after injury.

Case No	Sex	Age	Actiology	Referal Period	Perf.	Nature of F.B	V.A.	P.L	Tissue Damage	V.A. 2nd Eye	Period before TPPV	Final V.A.	Follow up Period
1	M	36	Traffic	2/12	+	--	L.P.	-	IIab	0.6	2/12	2/300	24/12
2	M	18	Occupati-on	0	+	Copper	5/60	+	IIabc	1.25	1	1.0	6/12
3	M	30	Assault	2/12	+	--	1/60	+	IIIb	1.0	2/12	1/60	6/12
4	M	26	Occupati-on	3/12	+	Iron	L.P.	-	IIIac	1.0	3/12	L.P.	6/12
5	M	21	Occupati-on	6/52	+	Iron	0.6	+	IIc	1.0	7/52	L.P.	2/12
6	M	19	Sport	6/12	-	--	1/60	+	IIIb	1.0	12/12	5/60	6/12
7	M	23	Assault	7	+	--	1/300	-	IIIb	1.0	20/12	0.1	1/12
8	M	71	Domestic	14	+	--	L.P.	+	IIa	1.0	20	0.6	7/12
9	M	12	Domestic	1	+	--	L.P	-	IIb	1.0	10	L.P.	7/12
10	F	26	Traffic	0	+	--	L.P.	+	IIa	1.0	9	0.6	9/12
11	M	35	Traffic	24	+	--	L.P.	-	IIab	1/300	42	0.25	7/12
12	M	30	Traffic	17	+	--	L.P.	-	IIab	1.0	20	0.5	8/12
13	M	15	Occupati-on	14	+	Iron	0.5	+	Iac	1.25	16	0.4	3/12
14	M	29	Occupati-on	0	+	Iron	0.5/300	-	IIac	1.25	10	0.5/300	4/12

9.2 Good Visual Improvement

An overall 42.3% good vision was achieved, which is 68.75% of all visual improvement cases. 72.7% of these cases were operated wighin 28 days. It is interesting to abserve that none had good visual improvement when operated in period 22-28 days. See table 13

Conclusion - More patient had good visual improvement when operated in the period within 21 days, after trauma.

9.3 No Visual improvement (Table 15 and 16)

No visual improvement was observed in 10 patients (38.5%).
The vision of 8 of them remained almost the same and deteriorated in the remaining 2 patients.
Among all the 10 patients, 5 were operated within 21 days and 5 after after 21 days. However, of the 5 operated after 21 days, 4 were operated after 28 days.

Conclusion

Although failure of visual improvement occured in some patients, more had poor visual results when operated after 28 days.

9.4 Visual deterioration (Table 17)

2 patients (7.7%) had visual deterioration. One of them was operated within 7 days and the other after 28 days. Visual deterioration was not observed in patients operated in the period 8-28 days.

Conclusion

Deterioration of vision occured only among patients who were operated in period 0-7 and the period after 28 days.

9.5 Comparison of Cases which achieved good vision and those which had visual deterioration (Table 18)

Good visual improvement occured in all periods except in the 22-28 days period.

Visual deterioration was observed when TPPV was done too early (before 7 days) or too late (after 28 days).

9.6 Period after 28 days (Table 19 & 20)

A total of 11 cases were operated from the 29th day up to 30 months after Trauma. When divided in groups of 3 periods described by Hutton et al (1976 b), the folowing observation were made.

a) 29 days - 6 weeks

No case was operated during this period

b) 6 weeks to 3 months

A total of 7 cases (63%) had TPPV during this period.

Visual improvement occurred in 3 patients and one of these gained good vision.

4 cases did not improve vision and one of them had visual deterioration.

c) After 3 months

A total of 4 cases (36%) were operated. All of these had visual improvement and one gained good vision.

Comment

Although visual improvement could be achieved in this period, there was only a 14.2% of good visual improvement. In the period of 6 weeks to 3 months the percentage of good visual improvement is the same as that of visual deterioration.

10. Discussion

26 cases had Trans pars plana vitrectomy after trauma, 61% of which were referred within 2 wekks and 30.8% after 28 days.

Possible reasons for late reference

1. 62.5% (5 cases) of those referred later than 28 days had trauma in the year 1978/79 when vitrectomy was probably not recognised by many doctors to be a treatment of ocular trauma.

2. Patient No. 24 was referred about 2 months after non-perforating trauma with non resolving vitreous haemorrhage. Ignorance of TPPV indication in non-perforating trauma could have been the contributing factor.

3. 2 cases which were referred late were cases of retained intraocular bodies which could not be removed. These cases were referred when they developed retinal detachments. Ignorance of removal of foreign bodies in combination with TPPV could have been another contributing factor.

Ignorance of TPPV in cases of ocular trauma in the year 1977 was well illustrated by a patient who had perforating trauma in 1977 and was referred to this hospital for secondary management 7 days after trauma. This patient did not have vitrectomy until 30 months later when he developed tractional retinal detachment.

With the exception of one patient who was 71 years old and presenting with high blood pressure, all these patients were healthy and young. 84% fell in the range of 11-40 years with a peak at 21-30 years.

This agrees with the findings of Roper Hall and Eagling in general ocular trauma.

No patient below the age of 9 years were seen in this study. Probably ocular trauma below that age is mostly not severe enough to indicate TPPV. Because of this we do not expect to meet a problem of amblyopia in this study.

98.5% of all cases were males. This is a male; female ratio of 7.6:1. This ratio is much higher than that found by Eagling (1976) in general ocular trauma which is 3.5:1. Therefore although general ocular trauma is common in males than females, severe ocular trauma needing vitrectomy is even much more common in males than females.

Occupational trauma was the commonest actiological factor. 42% of all cases had occupational injuries. Then followed traffic accident and domestic accident injuries with equal numbers of cases in each group. Although the incidence of occupational injuries has fallen (Eagling, Johnston), this actiological factor remains the commonest cause of severe ocular trauma.

Unilaterality remains a common factor in TPPV cases as it is common in ocular trauma. Of the 4 cases which had bilateral trauma, only one eye had indications for TPPV in each case. There does not seem to be a preference to either the right or left eye in these cases of severe ocular trauma as it is also in general ocular trauma.

Most cases (84%) had vision below 0.1 before TPPV. However 15.4% had good vision before TPPV. Among all 26 cases, 67.8% had good projection of light before TPPV.

83.2% of all cases therefore, had good potential for visual improvement before TPPV. Furthermore, of the cases with poor projection of light, 89% had retinal detachment; and all patients with good vision before TPPV had retained intraocular foreign bodies with relatively clear media.
Retinal detachment and unclear media therefore, contributed much to poor vision before TPPV. Considering the type and severity of ocular injuries in these patients, all had severe ocular trauma. Severe non perforating injury was also an indication for vitrectomy contributing to about 15% of all cases.

Although vitreous damage was a common factor in all these cases, vitreous haemorrhage was the commonest presentation, followed by massive proliferation and clear vitreous. Associated other tissue damage were more common in vitreous haemorrhage than in other presentations of vitreous damage. Massive intraocular proliferation was related to late reference in all cases, retinal detachment in some cases (66.6%) and failure to remove intraocular foreign bodies in a few cases (16.6%).clear vitreous damage was associated with foreign bodies in all cases.
Lens damage and retinal detachment had equal chances of occuring in these severe injuries. Vitreous damage with out lens or retinal damage occurred only in one patient (3.6%) who was a case of non perforating trauma.

Retained intraocular foreign bodies were present in 38.5% of all patients and 90% were reactive metals. Foreign body removal is an important indication for early vitrectomy.

The complications which occurred were due to the type of injury rather than to vitrectomy. Haemorrhage during surgery due to choroidal damage and subretinal haemorrhage; retinal defects at the site of foreign bodies after removal; development of intraocular proliferation due to failure to repair damaged retina and failure to remove foreign bodies was amongst these complications. However one retinal defects due to damage by the ocutome tip occurred.

Late presentation was another important contributing factor to complications. In-experience has been stressed as an important factor in these cases. There were 2 cases which had complications due to vitrectomy. The Kloti instrument was used in one of them.

The relationship between visual results and projection of light before vitrectomy has been discussed. This study has clearly shown that the presence of accurate projection of light is a reliable clinical sign for assessing the potential of visual outcome in these severe trauma cases most of which come with poor vision below 0.1. However there is a 9% chance of misinterpretation with this light projection test especially in the too early and too late period

Visual Results in Correlation with time Indication

The study has shown that there is hope for vision in cases with severe ocular trauma after being treated by TPPV. Generally speaking there is hope for improving vision as demonstrated by the visual improvement of some patients operated in the different time periods. However, there is better visual hope when patients are operated in periods 8-21 days, and after 3 months. Worse (deterioration) visual results are more likely to occur in period 0-7 and 7 weeks to 3 months.

Machemer and Ryan (1979) record that TPPV should be performed 7-14 days for better results. Although this agrees with our finding, we have shown an extension of this period by one week i.e. 7-21 days, Among the cases operated within 28 days, 77.8% of those who gained visual improvement were operated in period 1-21 days. However among patients who gained good visual improvement none was operated in period 22-28 days. On the other hand our figures show that cases with visual deterioration occurred in period 0-7 and more than 28 days after trauma.

As mentioned in previous chapters, clinical and histopathological correlation has been shown. Histopathological study favour TPPV before 3-7 days to prevent the beginning of cellular proliferation. Clinical experience show that 1-7 days is a period of more likely complications and therefore although preventing cellular proliferation could be achieved, surgical complication worsen the prognosis. Clinically therefore, this period is too early in general. Special indication for TPPV in this period have been mentioned in chapter II.

Period 8 - 21 days gives visual improvement of 77.8% and good visual improvement of 72.7%. When cases present early, it is the best period to operate. The principle here is to arrest the progress of cellular proliferation which has already strated by this time.

In period after 28 days the results favour period after 3 months where there is 100% rate of visual improvement compared to that of 43.2% in period 6 weeks to 3 months. Good visual improvement however is similar in both periods (14.2%). This figure is much lower than that achieved in period before 28 days (72.7%). The chance of gaining good visual improvement was similar to that of loosing vision (deterioration) in period 6 weeks to 3 months (14.2%).

These results are similar to those of Hutton et al (1976) who found better prognosis in period before 6 weeks and after 3 months; and poor prognosis in period 6 weeks to 3 months. Progress of intraocular massive fibrous overgrowth is the explanation for the poor results in period 6 weeks to 3 months as this is the case during this late period. Probably it is the most active stage or it might be due to fibrous contraction. It is known that massive fibrous overgrowth is a self limiting process. This could explain the good results of period after 3 months. Probably this is when progress either haults or regresses.

Conclusion from these results is that good visual prognosis is to be expected before 28 days period although it can also be achieved after 3 months if the eye is still grossly intact. Period 6 weeks to 3 months is the period of poor prognosis.

SUMMARY

26 young healthy patients, ranging between 9 to 71 years, 98.5% of whom were males, had transpars plana vitrectomy for treatment of severe ocular trauma. 15% of cases had non-perforating trauma. Occupational accidents was the commonest actiological factor.

Vitreous haemorrhage with associated lens or/and retinal damage was commonest indication. 38.5% had retained intraocular foreign bodies, 90% of which were metallic & reactive. 30% of these foreign body cases presented with clear vitreous. Massive intraocular fibrous proliferation was associated with late reference, retinal detachment and failure to remove foreign bodies.

Most patients presented with poor vision of below 0.1. This was much contirbuted by unclear media and retinal detachment. Accurate projection of light was found to be a good clinical sign for assessment of potential for visual improvement.

61.5% success (visual improvement) was achieved with an overal 42.3% good visual improvement. Poor results (visual deterioration) occurred in 7.7% of all cases.
Good visual results occurred when patients were operated in period before 28 days, more ideally between 1 and 3 weeks after trauma. Good results also occurred when TPPV was done in eyes which remained functionally and morphologically intact more than 3 months after trauma. The poorest visual results occurred in period 6 weeks to 3 months.

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