

# The Management of Traumatic Glaucoma\*

NEVILLE WELSH, D.O., R.C.P.(LOND.), R.C.S.(ENG.), F.R.C.S.(EDIN.), F.R.C.S.(ENG.), *Department of Ophthalmology, University of Natal and King Edward VIII Hospital, Durban*

## SUMMARY

The causes of traumatic secondary glaucoma should be assessed on the gonioscopic findings, and treatment instituted accordingly. A dislocated lens should not be removed as a routine, and specific indications for removal are discussed. Pupil block and peripheral anterior synechiae are surgical emergencies, whereas angle recession may be treated medically initially. More than one cause of traumatic glaucoma can occur simultaneously. One must be particularly careful after contusion injuries, especially after hyphaemata, since the onset of secondary traumatic glaucoma can be delayed.

*S. Afr. Med. J.*, 45, 1250 (1971).

Glaucoma is probably the commonest subject dealt with in various ophthalmological publications. However, traumatic glaucoma, which is a frequent clinical problem, is largely ignored. Traumatic glaucoma has different mechanisms of pathogenesis, and only by understanding these mechanisms can one hope to improve on the present poor prognosis. This article is confined to observations on the Bantu because I have most experience with this group. Trauma to the eye in the Bantu is one of the commonest lesions dealt with at the King Edward Hospital in Durban. Of these, contusion injuries with secondary glaucoma provide us with one of the most difficult problems in management. Perforating injuries with secondary glaucoma are not discussed in this article.

## AETIOLOGY

On gonioscopic evidence, contusion injuries with secondary glaucoma can be caused by:

1. Blockage of the angle by haemorrhage, vitreous, iris, free lens matter or macrophages from phacolytic glaucoma.
2. Disturbances of the lens with subluxation or dislocation causing pupil block or angle block.
3. Intrinsic damage to the trabecular meshwork and iris root causing either recession of the angle or oedema of the iris root with formation of peripheral synechiae.

Blockage of the angle is mentioned in passing because management entails treating the underlying cause, e.g. anterior chamber washout for hyphaema or aspiration of lens matter. Details of technique vary from clinic to clinic and the only comment to be made is that operative intervention should be early and should be repeated if necessary.

\*Paper presented at the Congress of the Cape Western Branch of the Ophthalmological Society of South Africa (M.A.S.A.), held in Hermanus on 11-14 March 1971.

## MANAGEMENT

### Dislocated Lens

In the management of groups 2 and 3 (above), every effort must be made to see the angle of the anterior chamber. If corneal oedema is present, glycerine will temporarily clear the cornea and glycerine can be placed on the gonioscope. The main problem is the decision required if dislocation of the lens is present. Dislocation must be very carefully assessed because more often than not the dislocated lens indicates the severity of the contusion and is not in itself causing the rise in intra-ocular pressure. This is the basic point in dealing with these cases. Too often in the past removal of a dislocated lens with loss of vitreous has not resulted in the hoped-for drop in intra-ocular pressure.

Chandler<sup>1</sup> stated that the removal of the traumatically dislocated lenses should be considered a hazardous procedure. McDonald and Purnell<sup>2</sup> in a series of operations on dislocated lenses lost vitreous in all cases. Rosenbaum and Podos<sup>3</sup> lost vitreous in 11 out of 13 cases. McDonald and Purnell<sup>2</sup> enucleated 3 eyes: a further 3 had persistent tension, and 6 others developed retinal detachments after lens extraction.

Jarrett<sup>4</sup> in 24 operations for traumatic dislocation, lost 8 eyes after lens removal. In only 6 cases was tension controlled by lens extraction.

### Indications for Lens Removal

Basically, to stabilize the contused eye, we are concerned directly with lowering the intra-ocular tension. Visual acuity requirements are not of immediate concern. Therefore the only indications for removing a dislocated lens to lower the tension would be:

1. Complete anterior dislocation of the lens. There would probably be pupil block from the vitreous or from the posterior lens surface and if anterior synechiae were to develop, they would not be visualized, so the lens should come out.

2. When the lens is causing phacolytic glaucoma. Smith and Zimmerman<sup>5</sup> have found that phacolytic glaucoma can be caused by trauma and it can be recognized by a deep anterior chamber, traumatic cataract with a flare and cells.

In other cases a dislocated lens should be left alone until gonioscopy showed one of the following: (i) pupil block, (ii) recession of the iris, and (iii) peripheral anterior synechiae.

**Pupil block** will be caused either by vitreous in the pupil or by a dislocated lens. Mydriasis may relieve the



pupil block and failing this, immediate peripheral iridectomy is indicated. This is urgent otherwise peripheral anterior synechiae will also occur. Note that the lens does not now have to be removed in this acute stage.

If there is no pupil block, the cause of the glaucoma must be looked for in the angle and two situations may arise.

**Angle recession.** Recession of the iris with a deep anterior chamber or contusion angle deformity was described by Wolf and Zimmerman,<sup>6</sup> in 1962. A tear occurs between the longitudinal and circular muscles of the ciliary body. The longitudinal muscle remains attached to the scleral spur, and the circular muscle with the iris root is displaced posteriorly. Even without this gross damage, contusion could cause microscopic changes to the trabecular meshwork. Rodman,<sup>7</sup> in 31 posterior dislocations, found that 97% had recession of the iris and in 34 anterior dislocations, 74% developed recession.

Spaeth and Levy<sup>8</sup> found that 60% of cases with hyphaema also had angle recession and Smith and Zimmerman<sup>5</sup> found that 25% of phacolytic glaucoma cases had angle recession.

When this postcontusion deformity is found, treatment should be conservative and if medical methods of lowering the tension are unsuccessful, which we invariably find, then a drainage operation or a cyclodialysis is advisable.

**Peripheral anterior synechiae** may arise in 3 ways:

1. *Neglected pupil block.* Rodman<sup>7</sup> examining 120 enucleated specimens of traumatic glaucoma with dislocated lenses found peripheral anterior synechiae in 91% of his cases of anterior dislocated lenses. He attributed this to pupil block. More than half the eyes in this group were enucleated within the first 6 months of trauma. Therefore immediate diagnosis in this group followed by mydriasis and peripheral iridectomy is the procedure as outlined by Chandler.<sup>1</sup> If the lens presents in the anterior chamber, it may be aspirated via a small *ab externo* incision.

2. *Forward pressure of a partially dislocated lens* may cause peripheral anterior synechiae and a peripheral or sector iridectomy should be done. If this is not sufficient, aspiration of the lens is the best manoeuvre, and if the pressure is high, a posterior sclerotomy is most helpful.

3. *Primary iris root oedema due to contusion* may result in peripheral anterior synechiae, particularly in Bantu patients in whom the normal angle may be considered open. I recall only 2 cases of classical narrow-angle glaucoma with attacks of closure in over 500 primary glaucoma cases. However, a chronic state of closure can occur without symptoms in narrow-angles, the so-called creeping closure as defined by Alper.<sup>9</sup> In wide open-angles with contusion of the eyeball, iris root oedema occurs, and even though there is no flattening of the anterior chamber with no pupil block and no lens involvement, the thickened, oedematous iris root readily forms anterior synechiae. These are usually diffuse, involving the circumference of the angle. The appearance is similar to that of a carpet that is too big for a room and the carpet is

pushed up at the edge of the wall—what I would therefore call a 'creeping carpet' appearance.

Diffuse peripheral anterior synechiae develop very easily in the Bantu eye and they can also be expected following post-traumatic uveitis. The effect then is to close the angle which leaves a complicated situation where a drainage operation is required, which is to be avoided if possible because the results are poor.

The treatment in acute cases of iris oedema that may go on to peripheral anterior synechiae is medical in the first place. Glycerol 1 g/kg body weight as a 50% solution is given orally. This amounts to approximately 50 ml. This is given daily. An immediate subconjunctival injection of cortisone, usually 1 ml of Depo-Medrol is given and this is followed up by cortisone drops. We have found this to be extremely useful. My preference is also for miotics to prevent angle closure. Repeated gonioscopy is mandatory, and if peripheral anterior synechiae show signs of developing, an immediate large sector iridectomy is performed.

## Summary of Management

To summarize the management of traumatic secondary glaucoma, one relies on the following:

1. Pupil block to be urgently treated by mydriasis and medical therapy including subconjunctival cortisone and oral glycerol. Failure of improvement within 12 hours requires immediate peripheral iridectomy.
2. Contusion injury to the angle with iris recession has already converted the glaucoma into a chronic phase and medical treatment may be continued as long as possible since the only alternative is a drainage procedure or cyclodialysis which is not urgent.
3. In the absence of these two factors, oedema of the root of the iris with primary peripheral anterior synechiae formation must be suspected, and medical treatment is continued with careful gonioscopy follow-up. The first sign of peripheral anterior synechiae formation requires immediate large-sector iridectomy and if this fails, a drainage procedure.
4. Removal of the lens is necessary if phacolytic glaucoma is developing or if there is complete anterior dislocation.
5. If there is partial dislocation of the lens and it presses forward forming potential peripheral anterior synechiae, then I think this is a strong indication for sector iridectomy and lens aspiration.
6. Blockage of the angle by lens matter, etc. requires anterior chamber washout, etc.

It is as well to remember that all mechanisms can occur in one eye, i.e. a traumatic dislocated lens can give rise to phacolytic glaucoma causing pupil block with anterior and posterior synechiae with angle recession. Although one is dealing with an eye that was healthy till the time of the injury, the violence of the contusion can cause irreversible damage and particularly those eyes that show widely dilated pupils with inversion of the iris carry a de-



pressing prognosis. On the other hand, the prognosis is more favourable for iridodialysis, because the angle is then open.

## CASE REPORTS

The following unselected cases illustrate some main points.

### Case 1.

A 19-year-old Bantu man was injured by a stick of sugar cane 3 weeks before admission to hospital. A traumatic cataract developed immediately. The ocular tension was normal and gonioscopy showed an open angle. Three weeks later, the intra-ocular pressure was 59 mmHg (Schiotz), the pupil was miotic and the lens was causing pupil block. Gonioscopy showed an open angle with scattered peripheral anterior synechiae. A broad iridectomy was performed and lens matter was aspirated as the capsule had ruptured.

After one month, the eye had settled and the ocular pressure was 16 mmHg.

**Comment:** Sudden swelling of the lens occurred 3 weeks after discharge causing acute secondary glaucoma.

### Case 2.

A 29-year-old Bantu male was injured by a stick 1 day before admission. A total hyphaema was present but this cleared. Two weeks later a total secondary hyphaema developed and the ocular pressure was 49 mmHg. An anterior chamber washout was performed which reduced the pressure to 33 mmHg. Gonioscopy showed an open angle with excessive trabecular pigment and with some peripheral anterior synechiae. A sector iridectomy for the peripheral anterior synechiae was performed and the ocular pressure was lowered to 13 mmHg. Three weeks later the pressure increased to 30 mmHg and gonioscopy showed recession of the angle. A bleb trabeculectomy was eventually successful in controlling the ocular pressure.

**Comment:** After the first hyphaema, a gonioscopic examination should have been done. The secondary hyphaema occurred 2 weeks later and peripheral anterior synechiae masked the signs of recession of the angle which was present 3 months later.

### Case 3.

A 21-year-old Bantu male was assaulted and developed a total hyphaema. The hyphaema absorbed leaving a partially dislocated, cataractous lens lying posterior to the iris. Gonioscopy showed a wide open angle and the ocular pressure was normal. Fourteen days later the ocular pressure rose to 30 mmHg. Cells and flare were present, and peripheral anterior synechiae were now evident over more than two-thirds of the circumference of the angle. A posterior sclerectomy was performed and the eye settled with a pressure of 15 mmHg.

**Comment.** The secondary glaucoma was probably due to phacolysis of the lens and the lens should have been removed. Peripheral anterior synechiae complicated the picture and this case demonstrates the ease of their formation in an initial open angle.

### Case 4.

A 34-year-old Bantu male was assaulted with a stick in the right eye 6 months before admission. The ocular pressure at the first examination was 60 mmHg with corneal oedema, deep anterior chamber with a dislocated lens lying postero-superior. A posterior sclerotomy followed by a drainage procedure was unsuccessful and 2 weeks later a cyclodialysis was done. Five months later the ocular pressure was 15 mmHg, the dislocated

lens was still present and vision was 6/36 with aphakic correction.

**Comment.** The dislocated lens could be safely ignored.

### Case 5.

A 20-year-old Bantu male was punched in the right eye one week before admission. A total hyphaema was present with an ocular pressure of 25 mmHg. Following an anterior chamber washout, the pressure was 30 mmHg. Gonioscopy revealed a deep anterior chamber, cataract formation with iris recession. A drainage operation successfully controlled the pressure.

### Case 6.

A 26-year-old Bantu, was assaulted with a stick 2 days before admission. There was a total hyphaema present, and after absorption a traumatic cataract appeared with rupture of the iris sphincter. The ocular pressure was normal and the angle was open. One month later, the patient returned with a pressure of 60 mmHg and pupil-block glaucoma. The lens was aspirated and a sector iridectomy was done. The pressure remained at 38 mmHg and recession of the angle was noted. A cyclodialysis was repeated twice but the pressure is still raised and a drainage operation is now indicated.

**Comment.** Pupil block and recession of the angle both occurred as delayed causes of secondary glaucoma.

## CONCLUSIONS

From these cases the following conclusions can be drawn:

1. There is a high incidence of complications associated with the presence of hyphaemata.
2. A contused eye may settle and a delayed onset of secondary glaucoma can occur 1 month later.
3. One cause of secondary glaucoma may follow another.
4. One must be prepared to re-operate on each phase of glaucoma as it arises.
5. All contusion injuries to the eye must have repeated gonioscopic examinations in order to anticipate and recognize the causes of traumatic secondary glaucoma.

By following a regimen such as this, it is possible to save and restore the vision in many more cases in which formerly enucleation was considered the only treatment.

I wish to thank Dr H. R. J. Wannenburg, Superintendent of King Edward VIII Hospital, Durban for permission to publish the case reports.

## REFERENCES

1. Chandler, R. A. (1964): Arch. Ophthalm., **71**, 765.
2. McDonald, P. R. and Purnell, J. E. (1957): J. Amer. Med. Assoc., **145**, 220.
3. Rosenbaum, L. J. and Podos, S. M. (1967): Amer. J. Ophthalm., **64**, 1097.
4. Jarrett, W. H. (1967): Arch. Ophthalm., **78**, 289.
5. Smith, M. E. and Zimmerman, L. E. (1965): *Ibid.*, **74**, 799.
6. Wolf, S. M. and Zimmerman, L. E. (1962): Amer. J. Ophthalm., **54**, 547.
7. Rodman, H. I. (1963): Arch. Ophthalm., **69**, 445.
8. Spaeth, G. L. and Levy, P. M. (1966): Amer. J. Ophthalm., **62**, 1098.
9. Alper, M. G. and Laubach, J. L. (1968): Arch. Ophthalm., **79**, 663.