INJURIES OF THE ORBIT.

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The subject of Injuries of the Orbit will be divided up into the following sections:—

1. Eyelids.
2. Lacrymal apparatus.
3. Bones.
4. Eyeball—excluding perforating and non-perforating injuries.
5. Blood vessels.
6. Muscles and nerves.
7. Foreign bodies.
8. Infections.
9. Treatment other than that included in the above.

In the examination of a case of orbital wound particular attention should be paid to the following:—

1. History of the injury.
2. X-ray examination is useful for making a complete catalogue of damage to bones and as to the presence of opaque foreign bodies. This object, however, should not interfere with or delay other methods of examination and treatment.
3. The depth of an orbital wound should be carefully examined.
4. Small fragments of metal are often best left alone, especially if believed to have been hot at the time of the accident.
5. Fragments of wood should be removed as soon as possible (Colley).

I. Injuries to the Eyelids.

As the eyelids are the gateway to the orbit they are involved in a large proportion of orbital injuries. The careful examination of injuries of the eyelids is therefore essential for the determination of the extent of damage to the contents of the orbits and of its surroundings. For example, the presence of crepitation—surgical emphysema—imparted to the finger and thumb on palpation of the upper eyelid indicates the existence of a fracture of bone involving neighbouring air spaces, such as the ethmoid cells.

Slight contusions, abrasions, incised or lacerated wounds should be treated on general surgical lines. If such wounds are impregnated with dirt or other foreign matter such as gunpowder or the products of an explosion a general anæsthetic may be required in order that all macroscopic particles may be removed. While the wound is covered with sterile gauze the surrounding intact skin should be cleaned with a little spirit soap. The damaged area is then freed of foreign particles by means of forceps and swabbed with sterile lint or gauze damped with surgical spirit. Small portions or tags of dirty and badly damaged skin may be removed, but as conservatively as possible in order that scarring with ectropion may be avoided. Clean incised wounds, when careful examination has failed to reveal any foreign body, may be sutured with the finest silk-worm gut. Wounds that divide the lid margin should be sutured with the greatest care to produce exact apposition with the help of the finest silk-worm gut armed with eyeless needles of

smallest size. If loss of tissue is great so that marked deformity results, the services of a plastic surgeon may be enlisted.

Deep wounds due to penetration of the orbit by foreign bodies, of which examples are cited in a later section, should be examined as soon as possible while the patient is under the influence of an anæsthetic. Owing to orbital hæmorrhage and contusion of the eyelids inspection of the eye is often difficult and may require the use of a lid retractor.

2. Lacrymal Apparatus.

The lacrymal gland is so well protected by the upper temporal part of the orbital margin that it is rarely involved except in the most severe injuries. It is otherwise as regards the lacrymal punctum or canaliculus, especially of the lower eyelid. Trivial wounds of the nasal part of the lower eyelid are likely to result in scarring of these structures, with occlusion and resulting epiphora. In the event of division of the canaliculus between the punctum and the inner canthus the immediate and daily introduction of a bent silver probe into the sac for a few days, if this prove possible, may obviate the development of occlusion if combined with accurate suture of the skin.

Severe injuries to the bones of the face, as in motor accidents, are liable to be accompanied by damage to the lacrymal sac or nasal duct and to result in lacrymal obstruction from scarring. In similar injuries callus formation may produce the same complication. This is not usually discovered until a few weeks later when the patient becomes aware of the presence of mucopus in the eye from regurgitation from the lacrymal sac. The bony canal through which passes the nasal duct is so narrow that obstruction by fracture is most unlikely to be relieved by the attempt to pass a probe.

3. Injuries to Orbital Bones.

The use of forceps in the delivery of a child at birth is sometimes the cause of injury to the orbit as well as other parts of the skull. Some degree of facial asymmetry may persist throughout life.

Naturally enough a great variety of bone injuries occurs, depending upon the type of accident, the instrument causing the injury and whether the injury is direct, as upon the orbital margin, or indirect, as by extension from a fractured base. Local fractures of the orbital margin arise from blows by relatively small objects, as a hammer or some kind of weapon of offence, or from falls against such objects as a knob or bed-post or the corner of a stone step. The lateral part of the orbital margin is more frequently fractured than the mesial. The suture lines are often followed (Gill). Severe injuries as from motor car accidents are liable to cause multiple fractures which may include the base of the skull and extension into the optic canal with immediate or subsequent damage to the optic nerve. Blows from the hoof of a horse or other animal may produce local or very extensive fractures. Lutz reported the case of a cowboy who was kicked in the left cheek by a steer. The vault of the skull, the left orbital floor and the malar bone were fractured with palsy of the inferior oblique muscle. This had recovered in six months to the extent that diplopia only occurred on looking up to the extreme right.

Perforating injuries of the orbit of great variety have been described. A child aged 4 years fell upon a piece of a broken ruler which entered through a 1 cm.

wound of the upper lid, perforated the roof of the orbit and caused death from meningitis (Haase). Operations for curetting the ethmoid cavity have occasionally been accompanied by serious injuries (Roese). In one, perforation of the lamina papyracea caused an orbital hæmatoma, swelling of the lid, proptosis, and diplopia from damage to the internal rectus. In another, even more dire results followed the operation. Loss of sight in the eye from damage to the optic nerve, slight ptosis and palsy of the 3rd (oculomotor) nerve, loss of sensation in cornea and conjunctiva from injury to the 1st division of the 5th nerve were recognised on the following day. Bullet wounds commonly cause relatively little bony damage, while shell wounds may produce the most devastating lesions.

Treatment for fractures with deformity should be undertaken with the help of general anæsthesia as soon as possible after the infliction of injury. The free blood supply of the bones of the face encourages their early healing. Manipulation after examination by inspection and palpation is the sheet anchor, assisted occasionally by wiring (Gill). If immediate operation be undertaken for the repair of deformity, X-rays will prove of use to complete the evidence as to the extent of bony injury. For example, radiograms show a fracture line in the wall of the optic canal in all cases of traumatic disturbance of vision where the eye itself is intact (Hoffman & Loeff). Such a line could be detected, as also in all orbital fractures, after a long interval, even up to as much as 10 years.

4. Dislocation and Avulsion of the Eyeball.

Dislocation of the eyeball is a rare occurrence.

It is described by Henke and Lubarsch, and a case of particular interest came recently under the writer's care at Moorfields Eye Hospital.* A young man slipped and fell in the London Docks and struck his head against a crate. He was immediately admitted to the hospital and under an anæsthetic the eye which was displaced completely in front of the eyelids was with difficulty replaced within the orbital cavity. The vision, which was "counting fingers" at 1 metre without correction by lenses before the operation, gradually recovered and in a few days with - 0.25 sph., - 2.0 cyl. 175° was 6/6 to the intense surprise of all who saw him. Another case was seen by the author in 1920. It was under the care of Mr. C. Goulden at the London Hospital. The dislocation of the eye was the result of the intense venous engorgement of the orbital contents owing to an arterio-venous aneurysm. Reference will be made to it in a later section (Blood vessels).

Avulsion of the eyeball is probably as rare as dislocation. It is reported as a result of a motor accident (Benstein). It has occurred in a unique manner in an epileptic (Harbridge). The patient, a woman, 40 years of age, at the commencement of a seizure trod on a stick and then fell so as to strike one eye on it. The only external injury was a slight abrasion of the upper eyelid. The eyeball was hanging by a thin strand of inferior rectus and conjunctiva. The description of avulsion of both eyes, as a self-inflicted injury, is like a gruesome fairy story. A girl of 16 years, the subject of chronic encephalitis, removed—with her fingers—one eye after the other. The eyeballs were described as being like those removed at a surgical operation except that one optic nerve was 2 inches and the other 1 inch in length. The writers of the paper describing this case quote Axenfeld as having succeeded in dislocating an eye of a cadaver with his fingers in 1 minute. The optic nerve could only be severed by jerking it severely (Goodhart & Savitzky).

*A detailed report of the case by Zorab and Burns has been accepted for publication in the British Journal of Ophthalmology.

The subject of injuries to the eyeball is considered by other writers in different numbers of this Journal. It seems desirable to make some reference to methods of filling the socket at the operation of enucleation of the eyeball for severe injuries thereto. For many years ophthalmic surgeons have, particularly in young and healthy patients, inserted into Tenon's capsule a hollow glass sphere, and imprisoned it by means of two layers of sutures—in Tenon's capsule and in the conjunctiva. Cross describes the case of a woman aged 54 whose eye had been removed 34 years previously. In the course of an operation for enlarging the socket which had become much contracted a glass ball was found and removed. It was partly filled with cloudy blood-stained fluid which had entered it through a small perforation. The hole had no doubt arisen as the result of gradual erosion of the glass. The writer has seen such a glass sphere which had been removed in a fragmented state from the socket of a pensioner of the war of 1914—18 some 20 years after its insertion. The glass had become fenestrated and very thin. It has been suggested that, in order to avoid this unpleasant late effect of glass erosion a golden hollow sphere, 18 millimetres in diameter, grooved on four sides for the rectus muscles should be inserted into Tenon's capsule (Wheeler). It is certain that the gold would not be eroded during a lifetime. Alternatively, a fat graft taken from the inner side of the thigh may be implanted in a similar manner.

5. Blood Vessels.

Proptosis occurs when hæmorrhage takes place in the orbit from contusion or penetrating wounds, and occasionally from a puncture of a vein when a retro-ocular injection of novocaine is administered before an operation upon the eye. This is liable to arise when the eye is congested as in acute or subacute glaucoma. This accident may be avoided in such cases by introducing the local anæsthetic into Tenon's capsule, with 3 minims of 1/1,000 adrenalin solution, instead of by puncture through an eyelid. The solution is introduced more effectively if a long curved needle is used so that the point of the latter lies near the posterior pole of the eye. The anæsthetic by the latter method naturally fails to put the extrinsic muscles out of action, but from the point of view of anæsthesia is usually quite effective.

The presence of orbital hæmorrhage is readily diagnosed in severe cases by the rapidity of development of marked proptosis and by the severe pain with which this is accompanied. A pressure bandage, an injection of morphia and rest in bed with the head slightly raised form the appropriate treatment. The pressure of the eyeball upon the retained blood is generally sufficient to compress the orbital vessel or vessels damaged.

The subject of arterio-venous aneurysm of the common carotid artery and the cavernous sinus, although strictly posterior to the orbit, is included here since its physical signs are essentially orbital. It occurs in severe injuries such as motor accidents associated with fracture of the base of the skull (Arganāraz & Seña); in gunshot wounds, and in a variety of strange accidents such as that reported by Dunphy. In the latter a farmer aged 35 years while looking up at a hay-rick was injured by one tine of a hay-fork which entered at the outer canthus and penetrated deeply. There was severe hæmorrhage and the man fainted. Proptosis was marked at the end of 24 hours. In 7 days the patient heard a blowing noise in his ears when recumbent. The pupil of the affected side was dilated and fixed and the eye was blind. The optic disc was blurred in outline and "dirty white"

in colour, and a corneal ulcer was present from exposure. A bruit was audible all over the head. The eyeball was excised and the brisk resulting hæmorrhage was controlled by pressure and packing. An attempt had been made at ligation of the internal carotid, but was not pursued owing to the patient's serious general condition. No further attempt was made at ligation as pressure over the carotid caused numbness of the hands and fainting.

In a case of Mr. C. B. Goulden's which was under the author's observation (see Fig. 1) the patient had received an accidental wound from a revolver bullet in the left cheek some five years previously. At that time the left carotid artery

FIG. 1.—Arteriovenous aneurysm of carotid artery and cavernous sinus ; result of a revolver bullet wound.

was ligatured in order to check the hæmorrhage. The condition shown in the illustration was present five years later. The vision of the proptosed eye was perception of shadows. Arterial pulsation was transmitted through the eyeball and a murmur was audible. To relieve the ocular discomfort evisceration of the eyeball was performed as being considered a much safer proceeding than enucleation. The writer has seen recently for the Ministry of Pensions a man who was wounded by a bullet in the war of 1914-18. The bullet entered by the left cheek and was retained. He underwent ligature operations on the neck, at first the left side and later the right, in August, 1918, February, 1919, and October, 1919. Twenty-one years later marked proptosis of the left eye was present, but no trace of pulsation was to be felt on or around the eyeball. The man complained of noises in his head with the pulse-beat, but otherwise seemed comfortable. The affected eye was blind, but the right eye with a glass had 6/9 vision. The left eye remained congested, and had the scar of corneal ulceration, but was covered by the drooping upper eyelid when the right eye was closed naturally.

The treatment recommended is at first periodic compression of the carotid artery in the neck, and intragluteal injection of gelatin (Arganāraz & Seña).

6. Muscles and Nerves.

Ocular palsy takes place as a result of contusion, hæmorrhage or direct damage to nerves or muscles in the orbit by penetrating objects. A blow by a very heavy chisel which produced failure of action of the superior oblique muscle was believed to have effected this by injuring the muscle directly or its pulley (Crisp). Similarly the inferior oblique may suffer transient loss of function from separation at its origin (Bonnet). A fall into a thorny hedge was followed by proptosis with resistance to backward pressure of the eye and almost complete external and internal ophthalmoplegia. The optic disc was paler than normal and vision reduced to 6/60. In two months movement and function of the eye were almost restored to normal (Colley). These transient disturbances could be explained by an excessive retro-ocular hæmorrhage. The writer had under his care a typical case of external rectus palsy in a schoolboy who had been pushed by the schoolmaster so that the eye was struck against the corner of a desk. Slow but steady improvement took place over a period of several months. This must have been the result of hæmorrhage into the sheath of the muscle.

In addition to the two cases mentioned above of displacement of the pulley of the superior oblique and detachment of the origin of the inferior oblique, others have shown limitation of movement as the result of gunshot wounds of the orbit. In the latter a muscle belly is divided wholly or in part but by its involvement in scar tissue rarely behaves like palsy of a single muscle. In the same way penetrating wounds of the orbit by such objects as sharp fragments of wood are likely to be complicated by scar-tissue formation, the result of inflammation. The writer has under observation a man upon whom treatment by diathermy for retinal detachment resulted in a restoration of vision 6/18 with lens, but whose eye behaved like a partial superior rectus palsy. This is believed to be due to excessive scarring between the eyeball and the inferior rectus muscle. Diathermy was applied far back and deep to this muscle, which had been relaxed by novocaine injection.

Naturally palsies of great variety are described as the result of penetrating wounds of the orbit, such as gunshot wounds, the variation depending upon the site and direction of the wound (Duggan, Lutz). Reference has already been made to palsy of the 2nd, 3rd and 5th cranial nerves from operations upon the ethmoid cells (Roese). When the 1st or 2nd divisions of the 5th cranial nerve have been damaged by bony fragments, paræsthesia or anæsthesia may persist for months after an operation at which all bony pressure has been removed (Gill).

At the apex of the orbit sensory or motor palsy may result from a hæmatoma in the sphenoidal fissure, and the optic nerve may be involved in fracture in the optic foramen. The sphenoidal fissure syndrome includes total ophthalmoplegia, motor and sensory, or a partial affection of these nerves. Prognosis is good if some remnant of sensation or movement or reflex are present at an early period after the time of injury. The syndrome of the orbital apex includes palsy of the optic nerve—or blindness—with the above. In general the following conclusions may be adopted:—

1. *Immediate palsies* (a) from damage by bony spicules, are permanent; (b) are occasionally encountered from shock and are transient.
2. *Palsies whose onset is delayed a few hours* are the result of hæmorrhage, and generally recover (Bonnet, Venco).

7. Foreign Body in the Orbit.

The type of foreign body found in the orbit is almost infinitely variable—a broken knife blade plunged in above the eye by a drunken room-mate; a piece of broken anilene pencil, in a man aged 31; this is particularly venomous on account of the severe inflammation that it induces (Carson, Abdoolaeve); a bunch of spicules of hard wood from an aeroplane stay removed by the author from near the inner canthus of a German airman in the 1914–18 war; a fragment of a ruler which penetrated the brain (Haase); a crochet hook driven into her right temple behind both eyes by an insane woman—it was removed from the left temple and left no loss of vision or mobility (Benedict); pellets from shot-gun, slugs from air-gun, bullets from rifle and revolver and fragments of shell (McCannel, Pavia, Rodin, Savin, Bonnet, Duggan).

A few of the cases are of sufficient interest to record in more detail. A man was attacked by a drunken room-mate and stabbed with a knife. There was a 2 centimetre wound about 1 cm. above the left eyebrow. Œdema of the lid, chemosis of the conjunctiva were present, proptosis and limitation of movement of the eye which was displaced downwards. The eye itself had escaped injury. Operation was postponed one month owing to the presence of hæmaturia and lung rales. A radiogram revealed a large shadow in the outer part of the orbit. Eventually under general anæsthesia and through a 2.5 centimetre incision in the upper eyelid a piece of knife-blade, 47×12 millimetres, was removed with difficulty. Its point had been impacted in the outer wall of the orbit. The position and mobility of the eye were practically normal in two weeks, but slight ptosis remained (Carron).

McCannel's case was of interest for the course taken by the .22 bore rifle bullet. This was fired by a suitor at 6 ft. distance at a woman aged 21 years. The bullet penetrated slightly below and lateral to the external canthus. It traversed the orbit, ethmoid and lower part of the sphenoid into the nasopharynx. It was swallowed and its presence in the abdomen was proved by radiogram. It was recovered 5 days later. The eye suffered contusion injuries and permanent serious impairment of vision.

A man aged 48 years was wounded by a revolver bullet which entered the right temple and made its exit in the left temple. The right eye was proptosed and displaced upwards. The inferior rectus muscle was inactive. The pupil was half dilated and sluggish in its reaction to light. The optic disc was pale and some pigment spots were visible on the fundus oculi in the periphery of the inferior temporal region. The vision of this eye was 6/36. The left eye was the subject of a choroidal rupture on the temporal side and its vision was 6/9. This is an example of the relatively moderate degree of damage that may result from an injury which is usually fatal (Duggan). The writer examined during the last war two cases of self-inflicted wounds made with a service revolver, in each of which the wound of entry was the right temple. Both were rapidly fatal.

8. Infections complicating Orbital Wounds.

In addition to the common organisms, staphylococci and streptococci, as causes of inflammation in wounds, *B.tetani*, and the gas-producing *B.sporogenes*, *B.perfringens*, *Cl.Welchii* and *Cl.septique* should be remembered. These will be considered further in the section on treatment. The types of inflammation that affect the orbit are tenonitis, periostitis, cellulitis, orbital abscess, cavernous sinus thrombosis. The following table helps to simplify the diagnosis:—

	PERIOSTITIS, EXCLUDING CHRONIC FORMS.	CELLULITIS.	CAVERNOUS SINUS THROMBOSIS.	TENONITIS.	NEOPLASMS, OSTEOMA, CAVERNOUS ANGIOOMA, LACRYMAL GLAND TUMOUR, SARCOMA.
History of onset ...	Sudden ...	Sudden ...	Sudden ...	Sudden ...	Gradual.
General condition {	Malaise ... Pyrexia ...	Malaise ... Pyrexia ...	Extreme malaise ... Pyrexia ...	Slight malaise ...	Normal, apart from cachexia from large malignant growths.
Appearance of patient.	Ill ...	Ill ...	Seriously ill ...	Well ...	
Diplopia ...	Present if eye is in a position of deviation.	Present if eye is in a position of deviation.	Vision impaired early (extreme orbital oedema).	On attempting to turn eyes.	Present if eye is in a position of deviation.
Pain ...	Severe ...	Severe ...	Throbbing ...	Pain on trying to turn eyes.	Usually absent except from pressure of bony growths on sensory nerves.
Tenderness ...	Localised to site of bone lesion if at the orbital margin.	No localised tenderness.	No localised tenderness.	None, except on backward pressure of the eyeball.	Absent.
Eyelids ...	Red and swollen ...	Red and swollen ...	Extreme dusky redness and swelling.	Moderate or slight swelling.	No swelling apart from extension of growth. (N.B. — Neurofibromatosis usually involves upper eyelid.)
Conjunctival chemosis	Marked ...	Marked ...	Marked ...	Well marked ...	Usually absent.
Proptosis ...	Present in deep or posterior orbital periostitis; slight in periostitis of the orbital margin.	Present ...	Extreme ...	Slight ...	Present.
Proptosis direction	Varies with site of origin of periostitis.	Mainly directly forwards.	Mainly directly forwards.	Mainly directly forwards.	Directly forwards in tumours of the optic nerve. Lateral displacement according to site of origin of other tumours.
Unilateral or bilateral	Unilateral ...	Unilateral ...	Often bilateral in later stage.	Unilateral ...	Unilateral.
Movement of eyeball	Varying with degree of proptosis.	Varying with degree of proptosis.	Varying with degree of proptosis.	Marked limitation in comparison with slight degree of proptosis.	Usually fair; limitation late.
Palpable localised swelling.	In periostitis of orbit margin, or pointing abscess.	—	—	—	In various tumours.
Pulsating exophthalmos and bruit.	—	—	—	—	In arterio-venous aneurysm, in aneurysm of the carotid or of the ophthalmic artery, and in some vascular tumours.
Mastoid oedema ...	—	—	Sometimes present (thrombosed petrosal sinus).	—	—
Cerebral symptoms	—	If meningitis supervenes.	Develop quickly. ...	—	—
Vision ...	—	Impaired if nerve also inflamed.	Found impaired if able to be tested.	—	Gradual loss in some cases.
Fundus ...	Normal ...	Optic neuritis if anterior end of nerve involved.	Distension of retinal veins; sometimes papillo-oedema.	—	Generally normal.
X-ray ...	—	—	—	—	Shadow with bony tumour.
Prognosis ...	Fair in anterior periostitis, grave in posterior.	Grave. Risk of meningitis.	Fatal ...	Good ...	Good except in large osteoma, or carcinoma or sarcoma.

Extension of inflammation is liable to take place through fractures of the cribriform plate of the ethmoid and to produce meningitis. The latter may also arise from a perforating wound by a foreign body into the cranial cavity through the roof of the orbit as in Haase's case. In this a piece of a ruler pierced the upper eyelid and the roof of the orbit and caused death from meningitis.

9. Treatment.

Prophylaxis. Prevention of damage in industry to the orbital contents applies more particularly to the eyeballs in which the results of industrial accidents are more incapacitating than in other structures. Of a large series of accidents it has been stated that 98 per cent. were preventable and of these 88 per cent. could be prevented by proper supervision and administration. This includes the use of mechanical devices and training of workers, supervisors and managers (Carris).

Treatment. 1. First-aid treatment for hæmorrhage consists in the application of a graduated dressing and a pressure bandage. If the coats of the eyeball are perforated pressure should be avoided unless it is essential in order to check bleeding. If this is intense a hypodermic injection of morphia should be given and an intramuscular injection of saline gelatin, and the patient kept in a reclining position with the head slightly raised.

2. In wounds other than superficial or when the presence of a foreign body is suspected a general anæsthetic should be given and careful exploration made with enlargement of the wound if necessary. If suitable retractors are not available an assistant may help to expose the depth of the wound by means of the handles of two teaspoons. Considerable difficulty may arise in this owing to the protrusion of orbital fat. Any large metal foreign body must be removed and any fragments of wood, but small metal bodies—especially if suspected of being hot on entry—are best left alone (Colley). Some form of aspirator is useful when hæmorrhage is troublesome. Care should be taken to provide drainage for a deep wound in a dependent position or to place the patient after operation so that gravity may assist drainage.

3. If the eyeball is badly lacerated or lens or vitreous humour are presenting in a wound of the eyeball immediate enucleation is preferable. This also facilitates examination for a foreign body in the orbit. If sepsis is already established within the orbit as indicated by pain, fever and proptosis, evisceration of the eyeball with removal of most of the sclerotic—except for a collar around the optic nerve—is a safeguard against infection of the subdural space and the development of meningitis.

4. Particularly in war wounds, where streptococcal and gas gangrene infections are likely, prophylactic doses of sulphanilamide or sulphapyridine are worthy of consideration (B.M.J.). Dosage recommended is as follows:—*1st dose*, 1.5 grm. (3 tablets) of sulphanilamide in 100 c.c. of hot lemon. *2nd dose*, 2 hours later, 1 tablet partially crushed for slow absorption. Subsequently 1 tablet every 4 hours for 4 days. Total 13.5 grm. in 4 days.

A watch should be maintained for toxic effects—moderate rise of temperature, increasing prostration, perhaps headache, leucopenia. Against an established infection by Cl. Welchii or Cl. septicum a combined treatment of serum with sulphapyridine or sulphanilamide is recommended. This is fully justifiable where—as in the rare occurrence of gas gangrene in the orbit—amputation is not possible (B.M.J.).

5. An orbital abscess is most commonly found in the superior nasal part of the orbit because of the ethmoidal origin of the majority. If the presence of pus is suspected owing to the state of the temperature chart and localised tenderness and induration, a deep incision should be made as the signs indicate. Further assistance may be obtained from the position and direction of the wound. In incising through the upper or lower eyelid in the nasal part of the orbit, care should be taken to avoid damage to the pulley of the superior oblique muscle, and to the lacrymal sac respectively.

6. At one period much use was made of "Scarlet R" ointment in the healing of healthy granulating wounds. A reduction in time of healing of 30 per cent. is now claimed for a protein derivative of embryonic tissue in powder form called *epicutan* (Waugh). After a period of wound cleansing the powder is applied to the raw area and covered with sterile gauze. The dressing is changed every 5 days.

7. Space does not allow of detailed consideration of plastic surgery as employed in the region of the orbit. This includes the treatment of entropion, ectropion, the repair of defects in the eyelids with the removal of scar tissue, and the enlargement of a contracted socket (Wheeler).

REFERENCES.

- ARDOOLAEV, G. (1932-4), "Traumatism of the orbit with an anilin pencil." *Am. J. Oph.*, **17**, p. 675. (*Abstr.* from Soviet *Viest. Oph.* **1**, p. 492.)
- ARGANARAZ, R. & SENA, J., (1933-4), "Orbito-ocular lesions in fractures of the cranium." *Arch. de Optal. de Buenos Aires* **8**, p. 6. (*Abstr.* from *Arch. of Ophth.* **12**, p. 783.)
- BENEDICT, W. L. (1935), "Crochet hook through both orbits." *J. Amer. Med. Assoc.*, **104**, p. 395.
- BENSTEIN, I., (1934-5), "Avulsion of the globe and optic nerve." *Am. J. Oph.* **18**, p. 92. (*Abstr.* from Soviet *Viest. Oph.* **5**, p. 56.)
- BONNET, P. (1932), "Ocular paralyses in contusions of the skull and the face . . ." *Arch. d'Ophth.* **49**, p. 583.
- BONNET, P. (1934), "Sequelae of a transfixed wound of the orbit by a fragment of shell." *Bull. Soc. d'Oph. de Paris*, p. 347.
- BRILSFORD, J. F. (1940), "X-rays in diagnosis and treatment of gas gangrene." *B.M.J.* p. 247.
- B. M. J. (1940), "Chemotherapy and war wounds," p. 449.
- B. M. J. (1940), "Chemotherapy for gas gangrene," p. 491.
- CARRIS, L. H. (1931-2), "The prevention of industrial accidents to the eyes and orbits." *Arch. of Ophth.*, **7**, p. 476. (*Abstr.* from N.Y. academy of Medicine, Section Ophth., October 14th.)
- CARSON, W. E. (1930), "Knife blade in orbit." *Am. J. Oph.*, **13**, p. 717.
- COLLEY, H. T. (1934), "Penetrating wounds of orbit." *Brit. J. Ophth.*, **18**, p. 241.
- CRISP, W. H., (1939), "Superior oblique paralysis by contusion." *Am. J. Oph.*, **20**, p. 193. (*Abstr.* from Colorado Oph. Soc.)
- CROSS, G. H., (1931), "Glass sphere in orbit." *Arch. of Ophth.*, **6**, p. 132. (*Abstr.* from College of Physicians of Philadelphia, Ophth. section, January 15th.)
- DUGGAN, J. N., (1934), "Injury to both orbits with a revolver shot causing little damage." *Brit. J. Oph.*, **18**, p. 253.
- DUNPHY, E. B., (1934), "Arterio-venous aneurysm resulting from peculiar accident." *Am. J. Oph.*, **17**, p. 249.
- GILL, W. D. (1934), "Fractures of facial bones with special reference to involvement of . . . and orbits." *South. Med. Jour.*, p. 197.
- GILL, W. D. (1931), "Fractures involving the orbit and paranasal sinuses . . . diagnosis and treatment." *Texas State Jour. Med.*, **27**, p. 351.
- GOODHART, S. T. & SAVITSKY (1933), "Self mutilation in chronic encephalitis. Avulsion of both eyeballs and extraction of teeth." *Am. J. Med. Sci.*, **185**, p. 674.
- HAASE, A. (1929), "Injury of the brain through perforating wound of orbit." *Zeit. f. Augen.*, **69**, p. 230.
- HARBIDGE, D. F. (1931), "Eye injuries in epileptics." *Am. J. Oph.*, **14**, p. 22.
- HOFFMANN, W. & LOEFF, W. (1935), "The value of Roentgenologic examination in injuries of the orbit." *Arch. of Ophth.*, **134**, p. 84. (*Abstr.* from *Arch. of Ophth.*, **14**, p. 1032.)
- HOFFMANN & LOEFF (1935), "The value of X-ray examination in injuries of the orbit." *Am. J. of Oph.*, **18**,. (*Abstr.* from *Arch. f. Oph.* **134**, p. 82.)
- LUTZ, A. (1930), "The traumatic paralysis of the inferior oblique muscle." *Arch. f. Oph.*, **123**, p. 721.
- MCCANNELL, A. D. (1936), "Gunshot wound of orbit." *Am. J. Ophth.*, **19**, p. 1111. (*Abstr.* of Minnesota Acad. of Ophth. & Oto.)
- MEYER, M. F. & ROELING, J. C. (1935), "Orbital abscess (following foreign body of orbit) & meningitis with recovery." *Arch. of Ophth.*, **13**, p. 445.
- PAVIA, J. L. (1935), "Concerning projectiles lodged in neighbourhood of orbit." *Am. J. Ophth.*, **18**, p. 691. (*Abstr.* from *Rev. Oto. neuro. opt.* **9**, 1934.)
- RODIN, F. H. (1933), "Ocular injuries from airguns." *Am. J. Oph.*, **16**, p. 430.
- ROESE, H. F. (1934), "Lesions of the contents of the orbit during endonasal curetting of the ethmoid cavity. Report of 2 cases." *Arch. of Ophth.*, **12**, p. 263. (*Abstr.* from *Klin. Monats. f. Augen.*, **91**, 95, 1933.)
- SAVIN, L. H. (1936), *Proc. Roy. Soc. Med., Clinical*, Dec. 11th. (*Abstr.* *Arch. of Ophth.*, **36**, p. 743.)
- SPACKMAN, E. W. (1937), "Localisation of intra-orbital foreign bodies." *Arch. of Ophth.*, **18**, p. 204.
- VENCO, (1939), "Incomplete syndrome of the orbital apex on a traumatic basis." *Arch. of Ophth.*, **21**, p. 167. (*Abstr.* from *Riv. oto-neuro-opt.* **14**, 20, 1937.)
- WAUGH, W. G. (1940), "Experiments in the acceleration of wound healing." *B.M.J.*, p. 249.
- WHEELER, J. M. (1938), "Implantation of hollow grooved body into orbit for filling." *Arch. of Ophth.*, **20**, p. 707.