threads which had resisted proteolysis better than the spongy iris tissue, each contained a blood vessel whose lumen was filled with red blood corpuscles.

Summary

A further case of iridoschisis is described. Pathological investigation of the iris has added nothing to our previous knowledge.

It is suggested that a blunt trauma forced the aqueous into the spongy iris tissue where the contained proteolytic enzymes destroyed the stroma. The pigment thus liberated blocked the drainage channels with production of secondary glaucoma.

A CROSS-SECTIONAL VIEW OF INJURIES IN AN OPHTHALMIC PRACTICE IN EIRE*

BY

EUPHAN MAXWELL

DUBLIN

THE injuries recorded in this paper were serious in themselves or in their sequelae. In order to emphasise certain aspects of the subject as a whole, a few trivial injuries have been included, but apart from this, as the title serves to explain, there has been no selection of cases.

The records in the Royal Victoria Eye and Ear Hospital, Dublin, have been preserved since 1904, the year in which the Hospital commenced to function. It is from such of these as deal with the patients treated in that department with which I have been connected directly or indirectly, and during certain years chosen at random, that my data have been collected. The years in question were 1904-5; 1914-15; 1924-25; and 1939-45; all inclusive. I have also included case histories from my private records together with such as were still available from those of my father.

As many of the injuries antedated the case-histories by intervals of time varying from days to years, the period under review has been found to extend over three-quarters of a century.

1.—Causation

The injuries, 796 in number, have been arranged in this section in age-groups. Percentages noted here as elsewhere must be

* Received for publication, October 20, 1947.

accepted as merely approximate. Causation introduces the subject of prevention but I have confined my attention in this respect to such problems as seemed to me, while analysing the cases, peculiarly relevant to the age-group under consideration.

Birth injuries.—Only 4 cases, all of them associated with forceps delivery, were recorded. Doubtless other conditions, examined during the period, due to birth trauma were missed, histories being seldom obtainable unless cases are seen shortly after the event. A discussion on preventive measures here would be outside the scope of the paper.

Up to 4 years of age.—Injuries amounted in this group to 4 per cent. of the whole, 66 per cent. being males and 34 per cent. females. Sharp objects especially with a glitter such as scissors, and falls in the vicinity of the domestic fire accounted for the majority. Organised preventive measures can hardly be expected to improve upon the maternal protective instinct but the "crèche" has justified its existence as an auxiliary in crowded areas where parents happen to find themselves in financial difficulties.

4-6 years of age.—Injuries amounted in this group to 5 per cent. of the whole, 65 per cent. being males and 35 per cent. females. Missiles such as sticks, stones, pieces of broken glass, etc., accounted for the majority. Children of this age delight in being allowed to join in the play of others older, stronger and I may add rougher than themselves—this often to their own hurt, to which the case histories bear ample testimony. To put too strong a curb on what is essentially a healthy instinct would be both unwise and difficult. Where supervision is unobtrusive the "playground centre" of the town and city has proved a valuable preventive measure in this direction.

7-16 years of age.—Injuries amounted in this group to 21 per cent. of the whole, 83 per cent. being males and 17 per cent. females. Games, organised and unorganised, many of the latter being more aptly termed hooliganism, accounted for nearly half the number.

A series of 27 cases (including some of the younger members of the next age-group) injured whilst playing games such as hockey, football, cricket, etc., has a local interest. Hurley as the national game can claim the largest proportion of casualties without prejudice, but 10 in the series seems unduly high. Moreover the aftermath makes grim reading—4 eyes had to be enucleated; 4 others suffered a total visual loss. The stick is the main danger, there being no rule, as in hockey, limiting the height to which it may be raised. If further evidence in this connection were forthcoming, the Gaelic Athletic Association

might consider it advisable to exercise stricter supervision over the small local games.

A series of 54 cases (including some of the older members of the preceding age-group) were injured in association with unorganised games. I use the word association advisedly as many of them were merely onlookers, with the end-result that they saw rather less than more of the game. Two small sub-groups deserve special mention. One consisted of twelve cases injured by air-gun pellets: three of the eyes had to be enucleated. I submit that, as in the case of fire-arms, air-guns should be licensed. The second consisted of eight cases injured by lime, mainly in the form of quick-lime mixed with sand, which had been thrown around in irresponsible fashion. It should be regarded as a criminal offence to leave dangerous materials unguarded in the public streets or builders' yards.

It is generally conceded that the closure of the so-called "dangerous gap" between the school-leaving age (14 in this country), and the entrance into industry would serve indirectly as a preventive measure in regard to injuries in this age-group.

17-45 years of age.—Injuries amounted in this group to 46 per cent. of the whole, 90 per cent. being males and 10 per cent. females. Causes in this age-group reflect the industrial life of this country, where the main industry is agriculture. Metal splinters from farm implements, broken wire, nails, etc.—flying particles of stone in quarrying, road-making and repairing—thorns and branches in ditching and hedging accounted for the majority.

Nothing approaching the ideal protective device for the eyes for general purposes in industry has yet evolved, but the rapid development in "plastics" augurs well for the future.

Employers and employees will presumably agree in respect of certain essentials, viz., that the devices be comfortable and the material transparent, strong and not readily scratched or dimmed: that the shape be considered having regard to the occupation, the visor for example being the form of choice where danger is anticipated from above or from the side rather than from the front: that supplies should be plentiful and prices cheap.

It is unfortunate that few employers and employees recognise a joint responsibility in regard to maintenance: the one to renew stocks, the other to report defects. Several instances of faulty devices having not only failed to protect but actually having augmented injuries appeared in the case-histories. Such happenings naturally encourage the unreasoning prejudice against artificial protection which is still unfortunately very prevalent.

The recent establishment of a department of industrial ophthalmology in the Royal Eye Hospital, London, under the guidance

of Mr. Joseph Minton constitutes a major advance in these islands in regard to prevention in this age-group.

46-65 years of age.—Injuries amounted in this group to 20 per cent of the whole, 83 per cent. being males and 17 per cent. females.

Similar causes to those in the last age-group accounted for the majority, though the relative incidence in regard to metal splinters was found to be much lower.

Presbyopia introduces a further problem in prevention. Hypermetropes should be encouraged to wear their "middle distance" correction while at work.

Over 65 years of age.—Injuries amounted in this group to 45 per cent. of the whole, 85 per cent. being males and 15 per cent. females. Misadventures whilst gathering and chopping sticks, and amongst the older people various stresses and strains accounted for the majority. Prevention here is largely a matter for the individual. He must accept the physical limitations imposed by advancing years and learn to adapt himself.

However neutrally inclined, no country escaped the repercussions of the second world war. Despite the small numbers involved, it was interesting to note how the result of analyses of the 526 cases recorded prior to 1940 and the 270 during 1940—45 fitted into the local picture which the general situation had rendered inevitable:—

An increase in the number of injuries associated with hooliganism.

A decline in the number of industrial injuries in the 17-45 age-group, with a corresponding increase amongst the older men and women together with boys between 14 and 16 years of age, as the result of emigration of young adults towards the war zone.

A sharp decline in the number of injuries associated with motor, and a rise in those associated with bicycle accidents, as a result of the shortage in petrol.

An increase in the number of injuries incurred whilst felling trees and cutting wood as a result of lack of domestic coal.

An increase in the number of injuries due to blunt or otherwise defective tools as a result of new stocks being unobtainable.

2.—Types of injury

Findings suitable for analysis in this section have been arranged in groups in order of their frequency.

(a) *Penetrating wounds of the globe*, omitting such as were caused by the entry of foreign bodies, accounted for 36 per cent., the majority being corneal or corneo-scleral. They were mainly

in the lower segment in accordance with the upward protective reflex of the eye: uveal involvement was noted in 55 per cent. and associated cataract in 50.5 per cent. of the cases. The few wounds of the sclera recorded were found in the main in association with wounds of the lids.

(b) *Contusions of the globe* accounted for 22.25 per cent., multiple effects in the same eye being frequently observed.

Under this heading affections of the *lens* accounted for 30.5 per cent., dislocations being slightly more numerous than opacities.

Affections of the *iris* accounted for 19.25 per cent.

Affections of the *retina* accounted for 18.25 per cent., vascular disturbances predominating. Amongst these latter were two cases seen years after the injury, one with a hole at the macula, the other with the anterior chamber full of cholesterol crystals. A few instances of detachment, "immediate" and "remote" were also recorded.

Affections of the *cornea* accounted for 10.5 per cent., the majority being instances of superficial oedema with subsequent development of sepsis, together with a few instances of recurrent erosion. A group of four cases with interstitial oedema, three the result of explosions and one of an air-gun pellet deserves special mention. While rupture of Descemet's membrane was only confirmed on the slit-lamp in one instance, the cases would appear to have conformed with the clinical entity described by Major Dansey-Browning as "traumatic keratitis" in his papers on "battle casualties." (The Value of Ophthalmic Treatment in the Field. British Journal of Ophthalmology, 1944. Idem 1946.) In accordance with this author's experience the opacities took from two to three months to resolve.

Ruptures of the sclera accounted for 9.75 per cent. and of the *choroid* 8.25 per cent. One of the latter situated below the disc may be specially noted in that the retina was also ruptured resulting in an upper hemianopsia with sparing of fixation.

"*Contusions*" of the *optic nerve* accounted for 3.5 per cent., the term contusions being employed here in a wide sense to include defects secondary to trauma affecting the neighbourhood of the optic foramen.

(c) *Superficial wounds* accounted for 17 per cent., including a few instances where the lids alone were involved. As was to be expected the majority were corneal and were not seen until sepsis had developed. There were also a small number due to deeply imbedded foreign bodies, the most dramatic being a fish-hook which, blown backwards by the wind, buried itself, barb included,

in the cornea of a boy aged 15. Within three hours of the incident the hook was cut out, leaving a horizontal wound above the optical centre—two years later the vision with correction equalled 6/6 and J.1.

(d) *Burns* accounted for 8 per cent., of which 60 per cent. were due to lime compounds.

(e) *Foreign bodies which had passed into or through the globe* accounted for 5.75 per cent.

In 25 of the 42 cases recorded the foreign bodies had penetrated into the posterior part of the globe, the entrance wounds being in the main in the sclera. The lens was injured in at least 50 per cent. of the cases.

In 10 cases the foreign body came to rest in the anterior part of the globe.

The majority of the intra-ocular foreign bodies were magnetic.

In 7 cases the foreign bodies passed through the globe. These consisted of metal splinters, explosive materials and a rifle bullet. The routes were various. The globe was traversed in 4 instances in a fore and aft, in another in a lateral direction. The rifle bullet having penetrated the upper lid passed downwards through the globe ending half in and half out of the antrum of Highmore. Finally in the case of a man who had been stooping over a detonator which exploded, the foreign body entered the sclera below and, in emerging through it above wounded the inside of the upper lid, being then presumably washed away by the tears.

(f) *Injuries involving the orbit* accounted for 4.75 per cent. While the majority were haemorrhages or fractures, a small group of foreign bodies in the anterior part of the orbit, which caused little or no damage to the globe, have also been recorded. The fractures have been classified in accordance with the scheme outlined in the paper "Fractures of the orbit" by Major King and Lt.-Col. Samuel (*Trans. Ophthal. Soc. U.K., 1944*) with this result:—

Lateral wall and floor—8 cases, more than half being due to extensions from fractures of the maxilla and malar bones.

Medial wall—7 cases, 2 of which with an associated lacrimal fistula were the result of penetrating wounds.

Roof—5 cases, 3 of which were due to extensions from fracture of the base, one from fracture of the parietal bone, and the fifth from fracture of the upper orbital rim.

The diagnosis in these cases was based on clinical, and in so far as neighbouring bony structures were involved, radiological evidence. Unfortunately the average radiological reports on that

difficult region, the orbit itself, are seldom illuminating, and a further group of 8 cases with diplopia and in 3 instances proptosis, had to be accorded, in the absence of evidence to the contrary, a tentative diagnosis of haemorrhages in the orbit the result of contusion effects. To quote Lt.-Col. Samuel in the paper already referred to "the keystone of accurate diagnosis in these fractures lies in the use of a comprehensive radiological examination." As the majority of cases seen in an average civilian ophthalmic practice have sustained little structural damage, and treatment can be but conservative, it may be questioned, whether the expense of such an examination as a routine would be justifiable having regard to diagnosis only. On the other hand there can be no doubt that if prognosis is to be removed from the realm of speculation, knowledge of what has actually happened is essential.

(g) Injuries affecting the *cranium* with involvement of the visual apparatus accounted for 2 per cent., cases recorded in the series with merely post-traumatic neuroses not having been included. This low percentage would appear to be somewhat out of proportion but in Dublin, fortunate in its neuro-surgical unit under the leadership of Mr. Adams McConnell, such cases are referred for the most part to our colleague Mr. Alan Mooney, ophthalmic surgeon to the unit.

(h) Cases in which trauma, using the word in a broad sense, acted as a *precipitating* or *aggravating* agent accounted for 4.25 per cent. Unless the patient has been under previous observation the verdict where trauma is thus accused must be one of "non-proven." The doubtful standing of these cases in the survey has been acknowledged by placing the group last and out of the order of its frequency.

Precipitation.—Twelve instances of detachment of the retina in predisposed eyes and in which a history of preceding strain or comparatively trivial injury to the eye or its neighbourhood was obtained have been included under this heading. In 10 of these a medium or high myopia was present. The first of the two hypermetropes, a woman aged 56, having noticed a rapidly developing "blindness" of her right eye, recalled, after close questioning, that on the previous day she had received a knock on her right cheek. An examination of the eye revealed a detachment together with, in its neighbourhood but distinct from it, a peripheral area of retinal cystic degeneration. The second, a man aged 39, stated that his attention was directed to defective vision in his left eye by a blow on his head. Examination within a few days of the accident revealed an anterior dialysis in the

lower temporal quadrant, the detached retina showing a "moth-eaten" appearance.

A small group of cases which developed severe keratitis following trivial injury to the globe, and in which a diagnosis of syphilis or tuberculosis was subsequently established, was recorded.

Two further instances may be noted. In the first, a man aged 50, the right lens dislocated upwards under the conjunctiva, without any apparent cause—two years later, a slight blow on the left eye precipitated a similar catastrophe. The second, a girl aged 19, was frightened, if not actually struck, by a piece of plaster falling off the ceiling. Shortly afterwards she developed "hysterical" blindness. On admission to hospital three weeks later, there was no light perception. Five minutes after receiving 1 per cent. solution of zinc sulphate in both eyes, the vision became and remained normal.

Aggravation.—A group of 6 cases in which a more or less trivial injury to the globe resulted in an acute attack of glaucoma was recorded. In 3 of these the evidence was in favour of a prior chronic simple glaucoma; in the remainder a subsequent microscopical examination revealed the presence of intra-ocular tumour.

Two further examples were noted. The first was that of a young man who noticed visual defects in his right eye subsequent to a fall on the back of his head. The findings suggested an intra-cranial disturbance, confirmed later by an operation which revealed the presence of a hook-worm cyst in the left occipital lobe (this case was published in the Proceedings of the annual meeting of the British Medical Association in Dublin in 1933). The second was that of a boy who developed paralysis of the left 6th and 7th nerves following the blow of a cricket ball on his left cheek. Later his general condition began to show signs of deterioration and commencing bilateral papilloedema was observed. At the subsequent autopsy multiple intra-cranial tuberculomata were found.

3.—Observations on treatment and long-term histories

Prompt antiseptic treatment, general and local, is obviously the primary consideration in eye injuries. It is gratifying to note the gradual rise throughout the period under review of the efficacy of the antiseptics in use, a rise which mounted rapidly towards the close with the advent of the sulphur compounds and penicillin. Unfortunately there has been no marked reduction in the dangerous time-lag between the injury and initial medical treatment, in so far as at all events as the rural community is concerned.

It must be admitted that difficulties of transport, accentuated during the second World War, have been a contributory factor, but the case histories have indicated time and again that the negative attitude of mind of the patient himself has been in the main responsible. Any attempt to combat this attitude must focus on two factors which tend to engender a false sense of security—lack in general of severe pain in wounds of the eye-ball unless and until sepsis supervene, and failure to appreciate the significance, or even become aware of defective vision in the injured eye in the presence of good vision in the sound one.

While the potential value of non-specific protein shock therapy had long been appreciated, it was not until about 1938 that, in the form of intravenous injections of T.A.B. vaccine, it began to be extensively used, and with increasing enthusiasm, by Dublin ophthalmologists. Its place, more especially in conditions tending to chronicity, is now assured. Obviously such a vigorous form of treatment is contraindicated in debilitated states, nor is it surprising that even in healthy persons it may produce considerable general, though temporary, discomfort. At the time of writing I have, however, only met with one instance of ocular complication, viz., herpes of the cornea followed by an obstinate dendritic ulcer in the uninjured eye of a boy aged 9.

The period has also witnessed that extraordinary advance in local and general anaesthesia which has rendered possible a precision in operative technique hitherto unobtainable.

On analysis the following cases and groups of cases emerged as suitable for comment in some detail:—

Anterior synechia.—From 144 cases of iris prolapse reported during the period a group of 30 in which no attempt at division of synechiae had been made, were observed over periods averaging 22 years. Twenty of these were noted to have suffered no discomfort though in two instances where the wounds had occurred at the limbus small implantation cysts had developed. In 16 cases where the synechiae were situated more or less peripherally vision was unaffected: in the other 4 where they were more or less central there was inevitably some reduction.

In the 10 remaining cases the vision was very reduced and some of the eyes had to be subsequently enucleated on account of painful scars or secondary glaucoma. Two children, both aged 3 at the time of the injury, developed buphthalmos, with marked rise of tension, after an interval of one and three years respectively.

In connection with rise of tension the following case seen in the early years of the period may be cited. A boy aged 9 developed a cataract as the result of a blow from a bush, no wound being

noted. A linear extraction resulted in good vision with correction. When seen 4 years later he had an enlarged and hazy cornea and a tension of 58 mm. Hg. No suggestions as to the cause of this development were recorded and there was unfortunately no "follow-up." While the wounds in this group were on the whole more extensive than in the former, it is of interest to note that it contained a higher proportion of young children.

Operation for the division of anterior synechiae may prove difficult, it can be still more difficult to decide whether an operation should be attempted at all. While the cases in which the synechiae were divided proved too few in number to permit of comparison, this "follow-up" may be said to favour conservatism. On the other hand it serves as far as it goes to emphasise the potential danger of gradual deformation of the globe in young eyes. It is unfortunate that in just such cases the whole problem is aggravated by the natural reluctance of parents to consent to operation on an eye which would appear to have survived the injury, for the sake of a problematic disaster in the future.

Lental affections.—In an analysis of 88 cases of cataract in which the eyes were either enucleated, or, where saved, kept under observation for periods averaging 7 years, 2 groups emerged of interest in connection with the time element in operative interference on the lens. In the first where no operation was performed, nearly half the eyes were subsequently enucleated. In the second where operation was performed within a few days of the injury the proportion of enucleations was still higher. In the absence of an analysis of all the factors involved it would be absurd to attempt more than a suggestion that at least some of these operations were of the nature of what is rather brutally described as "meddlesome" surgery. The results where every effort was made to combat rise of tension and iritic irritability by a vigorous use of therapeutics, and operation was deferred until a later date, were much more satisfactory.

Several instances of that disappointing though fortunately infrequent sequel, a tough thick capsule were noted, including cases of rethickening after division. To obtain an adequate opening may not only prove difficult, but be followed by undesirable reaction. Early and, where necessary, repeated division is the obvious course, but co-operation is not always forthcoming. For some time I have been considering the question whether an operation a few days after an X-Ray "contact" exposure, when the capsular tissue would probably be in a preliminary stage of softening, might present less difficulty. Recently with the kind co-operation of Dr. Sholto Douglas (Assist. Radiologist St.

Anne's City Hospital) I operated on a capsule, the toughness of which had already been demonstrated, a week after such an exposure, and with an encouraging result.

A series of 31 cases of *dislocation* were recorded but it is probable that minor instances of this condition passed undetected or were not entered in the case-sheets. Only 17 were examined in the initial stage, on an average, 14 days after the injury. In 3 of these cases the lens was successfully extracted, but in a fourth the attempt was followed by copious loss of vitreous and the eye became a total loss. One of the eyes which developed secondary glaucoma was trephined but while this operation succeeded in reducing tension the lens eventually fell back into the vitreous chamber, a general deterioration continued, and 5 years later phthisis bulbi was noted.

Eleven other cases in the series were examined at intervals, averaging 5 years after the injury. In this group 7 eyes were found at the final examination to have completely deteriorated. Two of the remaining 4, which can be said to have held their own, may be noted in some detail. The first was that of a man aged 41 who stated that 4 years previously his right eye had been injured by a stick. The findings consisted of a lens dislocated towards the nasal side, together with strands of suspensory ligament with zonular lamella attachments descending from behind the iris on the temporal side swaying to and fro in the anterior chamber. The vitreous face was unbroken. The vision with the pupil dilated and aphakic correction was normal. The second was that of a woman aged 55 whose right eye was struck by a piece of wood while chopping. An examination within a few hours of the incident revealed a lens dislocated towards the temporal side with vitreous in the anterior chamber. When examined 5 years later the lens, anchored by the inferior suspensory ligament, was seen to be lying in a horizontal backward position, presenting the appearance of an opened trap-door. Her vision, with aphakic correction, was still normal.

Penetrating foreign bodies.—An analysis of the 42 cases recorded showed that in the group of 7 in which the foreign body had passed through the globe 3 eyes had to be enucleated, 3, observed over an average period of 9 years, had very reduced vision but "quiet" eyes, while the seventh, in which the foreign body had passed out of the palpebral fissure (as noted in section 2), had practically normal vision when examined 5 years later.

In the group of 10 cases in which the foreign body had lodged in the anterior segment, it was extracted by the magnet or a forceps with satisfactory results in 8 cases. In 1 of the 2 failures the immediate result following extraction by the magnet was good

but a recurrent iritis associated with chronic colitis developed and the eye examined 27 years later was found to be blind and glaucomatous. The second failure was due to the patient's refusal to have the foreign body which had lodged in the anterior part of the lens, extracted. A few weeks later it had shifted to a position behind the iris whereupon the eye became painful. Magnet extraction failed to relieve the general condition of the eye and it had to be removed.

The record of the 25 cases in which the foreign body had lodged in the posterior segment is a sorry one, the ultimate condition in 16 eyes necessitating enucleation. In 6 of these 16 cases, the foreign body was non-magnetic and the state of the eye too dangerous to consider any attempt at extraction: in the remainder, although the foreign bodies were successfully extracted sepsis developed subsequently. It is interesting to note that in some of these cases, with the hope of minimising the danger of sepsis by reducing the time-lag, the magnet was used almost immediately on admission to hospital without awaiting an X-Ray examination. Modern therapeutics leave no excuse for such injudicious haste. All the magnetic extractions noted were by the anterior route. I have only recently adopted the posterior route and my practical experience is therefore limited. As far as it goes, however, it has strengthened my conviction previously based on theoretical considerations, that the posterior is the route of choice.

Two cases have an interest of their own. One, the only instance recorded in the series of extraction of a non-magnetic foreign body from the posterior segment, was that of a girl aged 14, whose left eye was struck by a piece of brass which came to rest in the vitreous in the neighbourhood of the pars plana of the ciliary body. It was removed by a cross action forceps through a scleral incision, and apart from incipient senile cataract, the eye when seen 47 years later, was normal with 6/9 and with correction J. 2. In the second, an example of disintegration of metal splinters, the initial X-Ray revealed an intra-orbital and intra-ocular foreign body. Two years after the injury siderosis was recorded and, 2 years later again, its disappearance. A slight attack of iritis in the eye 14 years after the injury brought the patient to the hospital and thus afforded an opportunity for a second X-Ray. This revealed complete disappearance of the intra-ocular and a definite reduction in the size of the intra-orbital foreign body. *Retinal detachment.*—The number of "traumatic" cases noted under "contusion effects" (section 2) was 11, just under 1.5 per cent. of all the injuries recorded in the series. This percentage seems low but it must be admitted that my interpretation of what

constitutes traumatic detachment is somewhat rigid and open to criticism. Two of these cases may be specially noted, the first being that of a boy aged 15 whose left eye was struck by a stone. He was seen 6 years later with partial spontaneous reattachment of the retina. This case has been recorded in detail in the Transactions of the Ophthalmological Society, 1945. The second, despite a time-lag, afforded what would appear to be satisfactory evidence as to cause. A child, aged 8 years, in falling off a hay-rick, struck her right eye on a binder. She was not seen until 4 months later when, in view of gross dislocation of the lens and bad light projection, it was decided to remove the eye. Microscopical examination revealed total retinal detachment together with definite traces of previous massive choroidal haemorrhages.

In view of the dramatic change in outlook which occurred during the period it is but fitting that some reference be made to surgical results. Unfortunately, for various reasons, the main one being that half of the patients were seen before the days of operation, only 4 cases from amongst those noted as due to, or precipitated by, trauma, had surgical treatment, obviously too small a number for any detailed comment. Suffice it to say that one of the eyes subsequently degenerated, possibly aggravated by too extensive scarring, while the other three, observed over periods ranging from 2 to 6 years, showed that a successful result had been maintained.

Not included in these groups were three instances of retinal detachment which had developed at the site of penetrating scleral wounds at intervals varying from 4 months to several years after the injury. No attempt at suturing these wounds had been made and these cases may be cited as evidence in favour of this procedure whenever possible.

Sympathetic ophthalmia.—Seven instances were recorded representing about 2 per cent. of the penetrating wounds and ruptures of the globe in the series. It must be acknowledged, however, that in only 2 cases was the clinical diagnosis confirmed by microscopical evidence.

The youngest patient was 9, the oldest 71, while the average age of the remainder equalled 34 years.

The average time of development after the injury was 7 weeks. To this time-group may be added 2 cases which did not develop the condition but in which microscopical evidence of incipient sympathetic ophthalmia in the enucleated eyes was found. In 1, a man aged 51, the eye was removed 3 weeks and in the other, a man aged 21, 3 months after the injury.

Three cases were recorded in which the condition was not observed until several days had elapsed after enucleation, 2 of

these presenting further points of interest. In 1 the wound was superficial, but an ulcer had developed which perforated, the final result being panophthalmitis subsequent to which the eye was removed. The other a boy aged 9, was struck in the left eye with a knife by his sister. The parents had to be threatened with the attentions of the N.S.P.C.C. before permission for enucleation could be obtained. Nine days after, k.p. and papilloedema were observed in the right eye. This boy, unfortunate in his family, was fortunate in the conclusion. Two months later the eye was normal with vision 6/6.

The final visual results in the sympathizing eyes were varied: only 2 instances of total blindness were recorded.

In regard to treatment, therapeutics varied with a tendency in favour of the arsenical compounds, especially as a preventive measure in the case of "dangerous" eyes. In 1 case a cataract was subsequently successfully extracted from the sympathizing eye by Dr. Anderson, of Belfast, who is publishing a detailed account in the Transactions of the Ophthalmological Society, 1947.

Two further cases relative to the subject may be noted. One a boy aged 13 developed circumcorneal injection and photophobia in the right, 2 months after an injury which had resulted in a scleral rupture near the limbus in the left eye. A tentative diagnosis of iritis, possibly sympathetic in character, in the right eye was made and as the wound in the left was found to have become markedly contracted, that eye was removed. Periodic attacks continued, however, for about another 2 months when they finally ceased, leaving a healthy eye with no trace of any previous iritis. That was in 1915. At a later date the slit-lamp would have enabled the obvious diagnosis of "sympathetic irritation" to have been arrived at sooner. The second case was that of a man aged 55 who developed a mild irido-cyclitis in the right some 14 months after a penetrating corneal injury had been caused by a twig in the left eye. As this latter was tending to phthisis bulbi it was removed though, in view of the patient's general condition affording ample cause for the irido-cyclitis, the possibility of sympathetic ophthalmia was not seriously considered. This clinical view-point was subsequently confirmed by the microscopical findings in the injured eye of a cellular infiltration of the choroid, confined entirely to the inner layers.

Burns.—Two case-histories with special points of interest are worth noting. The first, 1 of 2 instances of "eclipse blindness" recorded, revealed an almost incredible ignorance when it is realised that the eclipse in question occurred as recently as 1942. A school boy, aged 11 years, was permitted, if not actively encouraged, to watch the eclipse "through his fingers" for the

space of an hour, with the result that the vision in the right eye was permanently reduced to 6/24. The second provided an example of the destructive action of cresol. A man aged 40, developed recurrent ulceration of the left cornea following a splash of tar while engaged on road repairs. When seen at the hospital 6 weeks after the injury the entire corneal epithelium was found to be loose. Various treatments, including an effort to protect the cornea with a contact lens, proved unavailing, an intractable iritis developed, and eventually at the patient's own wish, the eye was removed.

An increase in a more general appreciation of the preventive possibilities of early grafting in the treatment of caustic burns was already apparent before the close of the period. The introduction of the use of "amnio-plastin" in this connection has proved a notable advance. At the time of writing my experience with this membrane while limited, has been most encouraging.

Injuries secondary to orbital disturbances.—An analysis of the 9 cases of *optic nerve* involvement recorded showed marked reduction of vision in 6 instances. In 5 where the ultimate result was blindness or merely appreciation of hand movements in the eye, the defect had been noted by the patient in the early stages: in the sixth where the vision equalled 6/36, when examined a year later, the defect had not been noted until 6 weeks had elapsed since the injury. The initial violence was in the region of the temple in 4 cases, and in the other 2 of the zygomatic arch and of the forehead respectively. Apart from severe destruction of the lateral wall involving the external rectus in 1 case, there were no associated neuro-muscular disturbances in this group. Three cases with field defects were recorded. The first, a man aged 28, in falling off a motor bicycle, struck the left side of his head against the ground. The following day a left 3rd nerve paralysis and an inferior hemianopsia were noted—central vision was not affected. Four months later the 3rd nerve had recovered, the field defect was unchanged.

The second, a boy aged 16, sustained a palpable fracture of the left upper orbital rim. An examination of the left eye in connection with diplopia in the direction of the fracture was made a year later when an inferior sector defect was discovered. Central vision was not affected. A year later again all that remained of the sector defect was a small relative scotoma to 1/1000, and this too had disappeared at a final examination some months afterwards.

The third, a woman aged 67, sustained a deep wound above and to the temporal side of the left eye-brow—an X-Ray of the skull was negative. She noticed defective vision in her left eye some

days later, but it was not until three months had elapsed that slight pallor of the disc was observed, when perimetry revealed with 3/330 a normal field except for a slight depression in the infero-nasal quadrant and with 3/1000 a sector defect in that area. A year later both isopters were involved in the defect. Although it did not extend to the fixation point there was some indeterminate disturbance of central vision. Movements of the globe were never affected.

A group of 12 cases in which *limitation of ocular movements* was recorded proved capable of analysis in respect of cause and subsequent history. In 4 instances a limitation, not restricted to any one muscle or group of muscles, would appear to have been the result of mechanical obstruction—in two, where movement was restored within a month, probably due to haemorrhage—in 2, where limitation was still present some years later, to cicatrized tissue. There were 4 instances of direct trauma to an individual muscle, in 2, where the superior oblique was involved, recovery took place within about six months—in 2, where the external rectus was involved, in about a year in 1 case, but in the other there was no recovery and the patient when seen 30 years later, was found to have developed marked over-action of the internal rectus.

There were 3 instances of paralysis of the 3rd nerve with loss of sensation along individual branches of the 5th, presumably the result of disturbances in the neighbourhood of the superior orbital fissure—there were unfortunately no references to the 4th nerve in the notes. In 1 of these cases complete recovery had taken place within two months—in the second, lateral movements were rapidly restored but the vertical not until 4 months had elapsed—in the third, lateral movements had recovered in about 5 months, but 4 years later there was still some limitation of the vertical. References as to the ultimate recovery of the 5th nerve branches were vague but return of sensation was obviously slow. The last case in this group has been included amongst orbital injuries as the X-Ray report was of a fracture of the right parietal bone extending into the orbital roof. The ocular findings, bilateral paralysis of the 6th nerve associated with mild papilloedema, were obviously, however, the result of posteriorly situated disturbances—7 weeks later all signs and symptoms had disappeared.

A case of emphysema in an amateur boxer, who had been struck in the right eye near the nose during a match was recorded. An X-Ray 3 weeks later, revealed the orbit clear of air but in the meantime the incident had decided the patient to adopt another hobby.

The period has witnessed the development of plastic surgery as a speciality and to-day problems of treatment include not only

the "how" but the "who." No more potent argument in favour of retaining this work for the ocular area in the hands of the eye surgeon could be advanced than the published results of Major Stallard and Mr. Foster (Discussion on Plastic Repair of the Lids, *Trans. Ophthalm. Soc. U.K.*, 1945). The position in Eire, whose people have not suffered the wounds of war, is different, however, from that which pertains in the rest of the British Isles. In a group of 40 cases in the series which included in addition to orbital injuries, isolated traumata of the lids, and contractions of the socket where due to penetrating wounds, only 6 required anything in the nature of what might be termed a major plastic operation. Even the inclusion of non-traumatic cases would not materially alter the fact that the demand is small, and, naturally where this is the case, individual experience must remain limited and hospital facilities somewhat inadequate. Mr. Foster has translated a passage from *De Medicina* thus: "If too much of the lid is lost nothing will restore it; if the loss is slight cure is possible." I confess my reaction to the problem is to operate on the case where "cure is possible," and leave "nothing" to the plastic surgeon.

Intracranial injuries involving the visual apparatus. It may be recalled here that the period has witnessed the development of yet another speciality, neuro-surgery. From the first, co-operation between the ophthalmologist and neuro-surgeon has been of the closest—a co-operation which has yielded rich dividends.

As already noted (Section 2) only a few cases have been recorded in the series. These included 3 instances of subdural haematoma, all of which were subsequently operated upon by Mr. Adams McConnell. The first that of a man aged 37, was hit on the back of his head by a plank. Some days later he developed severe headaches, and subsequently his sight began to fail. He was not examined, however, until 6 months had elapsed when he was found to have a mild bilateral papilloedema, no light perception in the right and a markedly reduced vision in the left eye. A subdural haematoma on the right side was evacuated, an exploratory puncture on the left proving negative—the operation was followed by complete cessation of headache. Five years later optic atrophy of the right eye, and in the left a tubular field with vision 6/12 and J.2, was recorded. The second case was that of a man aged 40, who, knocked off his bicycle, hit the left side of his head against a bush. Some weeks later he developed diplopia and a throbbing in his head. An examination 3 months after the injury revealed bilateral 6th nerve paresis and mild papilloedema: central and peripheral vision were normal. Some weeks after evacuation of bilateral haematomata all adverse signs and

symptoms had disappeared. The third case would appear to be an instance of "tentorial pressure cone." The patient aged 30, in lifting a heavy weight fell, striking the back of his head against the ground. About 3 weeks later he developed diplopia, loss of memory and lethargy. Examination of his right eye revealed a dilated pupil, which proved transitory, paralysis of the internal rectus and a haziness of the lower margin of the optic nerve. Vertical movements were absent in both eyes. Central and peripheral vision were normal. A clear subdural fluid evacuated on both sides was followed by a rapid improvement of his general condition. About 3 months later the right internal rectus was found to be normal, but it was not until nearly a year had elapsed since the operation, that the bilateral vertical movements were fully restored.

Concomitant squint as a sequel.—This development is not always recorded and only 24 cases in the series proved capable of analysis in regard to the association between position and the age of the patient when the eye was injured. The findings were found to conform more or less with those published in Worth's Squint—Chavasse.

Six eyes in persons under 3 years of age showed a divergence in 5, the 1 convergence being a late development.

Thirteen eyes in persons between 3 and 20 years of age showed a convergence in 8, 2 of which were aphakic with good corrected vision. Of the 5 divergent eyes, 2 were early and 3 late developments.

Five eyes in persons over twenty showed a convergence in one instance: of the four divergent eyes, two were early and two late developments.

4.—Medico-legal aspects

The period witnessed the passing of the Workmen's Compensation Act, a measure of social reform of major importance.

In most of our cases the employer's liability is covered by an insurance company, which, in accordance with local usage, appoints an ophthalmic specialist to furnish a medical report. A workman can of course lodge an appeal against the compensation suggested, whereupon his case is heard in court. I submit that, while this court provides the best machinery for a discussion on the case as a whole, it fails in regard to the sifting of purely medical findings.

I suggest that if the medical report in the first instance were to be based as a routine upon a consultation between the doctor appointed by the insurance company and the doctor who treated the injury, there would be fewer appeals. I suggest further that,

in the event of an appeal, such a report might form a basis for a preliminary discussion over which an ophthalmic specialist appointed by the court as medical referee, would preside. If the judge, at the subsequent hearing, should desire further information, he would naturally request the doctors in question to attend as witnesses.

The working of the Act has tended to focus attention on a variety of problems connected with industrial injuries.

It may happen, for example, that to award a man who claims inability to resume his occupation, a lump sum of money, has the unhappy result of encouraging him to join the ranks of the permanent unemployables. When the difficulties associated with rehabilitation have been overcome it will assuredly be recognised eventually as the most humane method of compensation.

Its authors can hardly have anticipated the degree to which malingering may discredit the Act. Several instances were noted in the series, the following serving as an example. A man aged 44, who had lost his right eye some years previously as the result of an accident, developed a small ulcer in the lower part of the left cornea following a slight injury from a chip of paint. The ulcer healed without incident, and he returned to work, the vision in the eye with correction being normal. Two years later he reported inability to continue work as his sight had deteriorated and put forward a claim for £1,000. Despite the fact that he was able to walk alone to my house for an examination, he entered the study with the eye closed, feeling along the wall with both hands. Subsequently in court he forgot to play the part and moved about freely. Nevertheless his claim was settled "out of court" for £150: the easy way out. I submit that where the evidence in favour of malingering has sufficient weight, it should be incorporated in the medical report, when, at the discretion of the judge, the offender could be charged with attempting to obtain money under false pretences.

The major problems centre naturally around the protection of the workmen. Where negligence on the part of employers in respect of blunt tools, inadequate lighting and so on, can be demonstrated, the facts should be incorporated in the medical reports for the consideration of the court.

An important aspect of protection in the absence of the use of devices with side pieces, is a realisation of possible danger zones frequently complicated by the presence of a tyro or "accident-prone" workman. With this aspect in view I analysed a group of 215 cases, though in the frequent absence of valuable data the results could only be registered as impressions.

A workman's stance would appear to be determined by right

or left handedness, ocular dominance being of secondary importance. A right handed man engaged in work such as chopping wood, would tend to bring his right eye automatically into the main danger zone, in so far as foreign bodies flying more or less upwards were concerned: the analysis showed for this type of work a definite preponderance of injured right eyes. On the other hand if he is using a hammer and chisel, he tends to stand on the left side of his work, twisting the right side of his body downwards and forwards, bringing the left eye into the main danger zone: the analysis showed for this type of work a definite preponderance of injured left eyes. Foreign bodies may naturally fly off at various angles, rendering the matter of danger zones of equal importance to assistants and neighbouring workmen: a number of injuries thus incurred, appeared in the group. In this connection I was interested on the occasion of a visit to one of the small granite quarries in the Dublin mountains, to note the "safety" positions, relative to one another, adopted by the workmen. The owner informed me that these positions were firmly established in accordance with long tradition.

In the course of investigations in respect of the protection of the workman I have learnt to appreciate the importance of the foreman. A good foreman is the best possible interpreter of safety measures to his own group of men.

In conclusion I wish to acknowledge my indebtedness to Mr. William McCrea for his invaluable pathological reports. I would have asked him to supplement this paper with a comprehensive statement were he not already contemplating publication in respect of his work in the laboratory as a whole. I wish also to acknowledge my indebtedness to Mr. Harris Tomkin, who works with me in the same hospital department, for his permission to include in the series such of his patients as were admitted for treatment during the period under review.

A NOTE ON INTRA-VITREOUS PENICILLIN*

BY

T. STUART-BLACK KELLY

MANCHESTER

SINCE clinical opportunities of administering penicillin by the intra-vitreous method are fortunately rare, these few cases may be of interest. The retinal changes described in experimental cases (Sorsby 1946, Mann 1946) and in some clinical cases (Rycroft 1945,

* Received for publication, December 30, 1947.