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COMMUNICATIONS

A STATISTICAL ENQUIRY INTO 1000 CASES OF EYE INJURIES

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AT the request of the Committee on the Causes and Prevention of Blindness appointed by the Ministry of Health I made an enquiry into all cases of eye injury admitted as indoor patients to the Ophthalmic Department of the Glasgow Royal Infirmary during the five years 1909-1913 inclusive. The cases numbered 927. For the purpose of this paper I extended the enquiry back to June, 1908, so as to have a total of 1000 cases. The above years were chosen as "normal" years unaffected by the war.

Dr. Maitland Ramsay was ophthalmic surgeon to the hospital during the period in which the cases were admitted, and I desire to express my thanks to him for permission to use the hospital journals, and my indebtedness to the house surgeons who kept the records.

It is not my intention to make any reference to the methods of treatment employed in these cases nor to the results of the treatment. I give simply a statistical account of the cases arranged in such a way as to indicate the relative frequency of the different kinds of eye injuries, the relative frequency of these injuries in the various classes of the community, the nature of the injury to which each class is most liable, as well as other points which seem to be of interest.

Briefly summarized, some of these points are :—

1. 70.7 per cent. of these eye injuries were occupational in origin, and 29.3 per cent. were non-occupational.
2. Of the 70.7 cases in the occupational groups 516 occurred in three classes of workers :—
 - (a) Engineering workers liable to injury with cold metal, 260.
 - (b) Coal miners, 173
 - (c) Metal workers liable to injury with hot metal, 83.
3. Among the non-occupational groups there is a relatively high incidence of injuries to children. 17.7 per cent. of the population of the area were under 15 years of age, leaving 82.3 per cent. as the proportion over that age, yet each group was represented to an almost equal degree in the list of injuries (148 cases over 15, and 145 cases under 15).
4. The enucleation percentage rate was 21.8 in the case of non-occupational injuries and only 12.02 in the case of the occupational.

The difference in these rates is not altogether due to inclusion in the occupational group of the coal miners and the workers in hot metal, in whom the enucleation rate was low, for, excluding these, the enucleation rate in the remaining occupational injuries was 15.07 per cent. as compared with 21.8 per cent. in the case of the non-occupational injuries.

5. The higher enucleation rate in the case of the non-occupational injuries was due to the preponderance of severe contusion injuries, the results of violence amongst the adults and to the severity of eye injuries in children.

6. The injuries with a low enucleation rate were the infected corneal abrasions, burns and corneal wounds; and those with a high rate were corneo-sclerotic wounds, lacerated sclerotic wounds and cases admitted already suffering from cyclitis.

7. The enucleation rate of any class was, therefore, high or low, according to the number of these injuries incurred by the members of the group. This is shown by comparing Table II, which gives the enucleation rate of each type of injury, with Table VI, which gives the prevalent injury and the enucleation rate of each class.

8. An analysis of the non-occupational groups shows that the incidence of penetrating wounds in the case of children was almost twice that of the adults (73 children and 38 adults); while severe contusion injuries were four times more frequent in the adults than in the children (46 adults and 13 children).

Table I has been arranged to show the relative frequency of eye injuries amongst the various classes of the community. In order that one may have a more true indication of the comparative liability to eye injuries of each of these classes the figures in the first column have been included to show the percentage which each class

forms of the total population. The figures necessary for the working out of these percentages were collected from the 1911 census returns of Glasgow and the neighbouring counties, which is the area from which the patients came. The total population of this area was 2,330,782. The statistics do not indicate the *total* incidence of eye injuries among that number of people during a period of 5½ years, because the area is served by several eye hospitals. They do show, however, the relative frequency of the different eye injuries and their distribution amongst the various classes of workers.

TABLE I.

Showing the relative frequency of eye injuries amongst the various classes of the community.

CLASS.	Percentage of each class in relation to the total population in the area.	Number of eye injuries in each class.
Workers liable to injury with cold metal	5.9	260
Coal miners	3.3	173
General community over 15 years of age (accident non-occupational)	82.3	148
Children under 15 years of age	17.7	145
Workers with molten metal	1.2	83
Agriculturists, gardeners, gamekeepers, etc. ...	1.1	42
Masons, bricklayers, etc.	0.5	25
Housewives	—	21
Quarriers, paviors, roadmen, etc.	0.2	15
Glass workers	0.07	14
Plasterers and slaters... ..	0.2	13
Workers in wood	0.9	13
Plumbers	0.2	7
Chemical workers	—	4
Various occupations (<i>i.e.</i> , not enough in any one of these to justify separate classification) ...	—	37
	—	1000

In the 145 children and the 148 of the general community over 15 years of age the injury had no reference to the occupation. In other words, the eye injury was occupational in origin in 70.7 per cent. of the cases and non-occupational in 29.3 per cent. These figures correspond closely to those quoted by Praun¹. Ottinger found that of 1000 cases of eye injuries 71.3 per cent. were trade accidents and 28.7 per cent. non-occupational; while Hoppe, dealing with a total of 282 injuries, found that 75.9 per cent. were occupational and 24.1 per cent. non-occupational, but one must note that Hoppe includes in the latter group injuries sustained at work outside the injured person's particular trade.

Non-occupational Injuries

Of the 1000 cases under review the injury was not incurred at work in 293 cases. 148 of these patients were adults and 145 were children.

(a) *Adults (148 cases)*:—An analysis of the nature of the non-occupational accidents producing eye injury amongst the adult members of the community shows it to have been by some blunt form of instrument in 115 cases (or 77.7 per cent.); 35 of these occurred during fights and assaults from blows from the fist, kicks, etc.; in 17 the injury was caused by striking the eye against some object in falling; in 11 cases the eye was injured while chopping wood; in 7 cases at various forms of sport; in 23 cases by various forms of blunt instrument; while in 22 of the contusion injuries the nature of the weapon was not recorded.

These types of accident account for the fact that adult non-occupational injuries are to be found heading the list of the following: lid and conjunctival wounds, lacerated wound of the sclerotic, intra-ocular haemorrhage, dislocated lens, and detachment of the retina.

In addition to the causes of non-occupational injuries amongst adults referred to above, 10 were caused by glass and earthenware; 10 by sharp instruments such as a knife, a hat pin, a needle, a tack, a fork, a nail, etc.; 7 by firearms; 4 by burns; 1 by dust; and in 1 case a recurrent conjunctivitis with raised yellow nodules on the conjunctiva resulted from accidental vaccination of the conjunctival sac. 34 eyes were enucleated on account of the following injuries:—rupture of the sclera in 19 cases, cyclitis in 7, corneal wound with prolapse of iris in 3, destruction of the eye by burns in 2, dislocated lens in 2, and infected traumatic cataract in one case; the injury in these cases was caused by blunt instruments in 22 cases, by glass or earthenware in 4, by striking the eye against objects in 4, by burns in 2, by firearms in 1, and by a sharp instrument in 1.

(b) *Children (145 cases)*:—Reference to Table I., shows that children under 15 years of age constituted 17.7 per cent. of the population of the area from which the patients came, and that they were sufferers from eye injuries in 14.5 per cent. of the 1000 cases under consideration.

Siedelman² in a series of 223 cases found children under 15 years of age in the proportion of 21.5 per cent., while Landesberg³ found them in the proportion of 23.7 per cent. in 118 cases.

The severity of eye injuries in children is exemplified by the fact that 20.6 per cent. of the injured eyes were enucleated.

The injuries necessitating enucleation were as follows:—corneo-sclerotic wounds, 8; sclerotic wounds, 8; cyclitis, 10; staphyloma, 3; unrecorded, 1; while the nature of the accident was: penetration by a sharp instrument, viz., file point, scissors,

sharp stick, knife, pitch fork, arrow, pen point, wire, 9; penetration by blunt instrument, viz.: piece of iron, piece of wood, umbrella, 3; blow from coal, toy, horse kick, fall, 6; penetration by broken glass and earthenware, 7; not recorded, 4; birth injury, 1.

As in the case of the non-occupational injuries of adults, blunt instruments were the most common cause of the accident in children. The causes in the order of frequency were: blunt instruments, 55; sharp instruments, 31; glass or earthenware, 23; burns, 8; air gun, 8; explosions, 3; birth injury, 1; while in 16 cases the nature of the accident was not recorded.

The numbers of each type of injury in these 145 children will be found in column 5 of Table VI.

The only fatal case in the whole series was a child who developed meningitis after a penetrating wound of the lower eyelid and orbit.

The frequency of rupture of the sclera and the extensive nature of the penetrating wounds resulting from violence amongst the adults, combined with the severity of eye injuries in children account for the high incidence of enucleation in non-occupational injuries. Although these injuries formed only 29.3 per cent. of the total series they were responsible for 42.9 per cent. of all the enucleations.

Occupational Injuries

(a) *Workers liable to injury with cold metal (260 cases)* :— This group includes the workers engaged in the engineering, shipbuilding, steel and iron trades, and those most commonly injured are the steel and iron dressers and turners, platers and riveters and blacksmiths.

In estimating the proportion which this class of worker forms of the total population of the Glasgow area, I have included the numbers given in the table of occupation of the census returns under the following heads—“engineering and machine making,” “shipbuilding (platers, riveters and other workers in iron),” and “vehicle makers.” These workers form 5.9 per cent. of the population and constitute the largest group of this series, viz.: 260 out of the 1,000 cases.

Small chips of metal were the most frequent cause of the injury as well as the most harmful in effect. In 191 cases the injury was caused by a chip of metal, and in 30 of these the eye was enucleated; whereas large pieces of metal caused the injury in only 41 cases with only 4 enucleations.

The small chips of metal caused infected corneal abrasions in 68 cases, and penetrating wounds of the eyeball in 123, whereas the large pieces of metal caused contusion injuries, viz.: intra-ocular haemorrhage, dislocated lens, cataract, and lid and conjunctival wounds.

Reference to Table VI shows that this class of worker was the

chief sufferer, as would be expected from the nature of the occupation, from corneal wounds with prolapse of iris, corneosclerotic wounds, incised sclerotic wounds, and simple corneal wounds, but it is rather striking to find that children occupy the second place in the case of the first three of these injuries (see Table VI).

It is doubtless owing to modern methods of ophthalmic surgery, that the enucleation rate in this class of worker is 14.6 per cent. which must be considered to be low, having regard to the type of injury.

(b) *Coal Miners (173 cases)*:—In 123 cases the cause of the injury was a small chip of coal or “a spark off the pick” as the miner usually expresses it, and the result an infected corneal ulcer, often of a very virulent type.

The high incidence of this injury, which has the low enucleation rate of 3.3 per cent, accounts for the fact that coal miners comparatively seldom lose the eye by enucleation after accident.

Table V shows that the enucleation rate for coal miners is 5.7 per cent. and that this is lower than that of any of the other classes. If it were not for the destructive effects upon the eye of explosion injuries the rate would be even lower. Eleven coal miners had their eyes injured by explosions and in 5 of the cases the eye was enucleated, the total number of enucleations from all causes in coal miners having been 10.

Blows from large pieces of coal caused various contusion injuries in 13 cases (detachment of the retina 3, cataract 4, irido-cyclitis 5, and irido-dialysis 1) and lid wounds in 2 cases.

There were only 15 cases of penetrating wounds of the eye in coal miners. In 3 of them it was caused by tools or apparatus, in 11 by coal, while in the other case the cause was not recorded.

The other 4 cases amongst coal miners were seen some time after the accident, 2 suffering from traumatic cataract and 2 from cyclitis.

(c) *Workers liable to injury with molten lead*:—In estimating the proportion that these workers form of the total population I have included the numbers given under the heading “manufacture of iron, steel and other metals” in the Table of Occupations in the Census Returns, and I found that they formed 1.2 per cent. of the total population.

During the $5\frac{1}{2}$ years under consideration 83 of these workers were admitted: 79 suffered from burns, 1 from cataract and 3 from iritis.

In the 79 cases of burns the distribution of the burn was as follows:—lids and conjunctiva in 19 cases, lids and conjunctiva with corneal haziness in 15 cases, lids and conjunctiva with erosion of the cornea in 28, the sclerotic was eroded in 11 cases and there was total destruction of the cornea in 6. The latter 6 eyes were

enucleated, as well as 1 eye in which there was erosion of the sclera, so that in this class of worker the enucleation rate was only 8.4 per cent. of the number injured.

In Sheffield, Snell⁴ found that out of a total of 359 consecutive cases of eye injuries 43 or 11.9 per cent. were caused by hot metal and 173 or 48.1 per cent. by iron or steel splinters. The percentages in this series of 1,000 cases were 8.3 per cent. injuries by hot metal and 26 per cent. by cold metal. Snell's list includes only 3.06 coal miners, while in this series that class of worker formed 17.3 per cent. of the total.

(d) *Agriculturists, Gardeners, Game-keepers, Fishermen, etc. (42 cases)*:—These form 1.1 per cent. of the total population and are represented in this series of accidents to the extent of 4.2 per cent.

The causes of the injuries were as follows:—Sharp instruments such as thorn, piece of glass, straw in 22 cases; blunt instruments such as wood, stone, spade handle, horse's hoof in 11 cases; gun accident in 1 case; dust in 3 cases; lime wash in 2 cases; acid in 1 case; while in 2 cases the cause was not recorded.

The distribution of the varieties of injuries in this group of workers is set out in Table VI.

(e) *Masons and Bricklayers (25 cases)*:—Chips of stone caused infected corneal abrasions in 18 cases; a chip of steel from a tool caused a penetrating injury in 3 cases, with traumatic cataract in 2 of them, and irido-cyclitis in 1; lime caused burns in 2 cases; glass caused a superficial corneal wound in 1 case; while in the remaining case (leucoma adherens) the cause was not recorded.

(f) *Housewives (21 cases)*:—21 women were injured in the course of performing their household duties.

The following is a *résumé* of the causes and results of the injuries:—dust caused infected corneal abrasion in 4 cases; a fragment of coal caused a similar condition in 3 cases; 6 eyes were injured in chopping sticks with the following results—infected corneal abrasion 1 case, detachment of the retina 1 case, cyclitis necessitating enucleation 1 case, traumatic cataract 1 case, corneo-sclerotic wound 1 case, dislocation of the lens 1 case; 1 eye was burnt with ammonia with resultant conjunctivitis and keratitis; a projecting nail caused a penetrating wound in 2 cases; a blow from a broom handle broke a spectacle glass which caused a corneal wound with prolapse of the iris in 1 case; while in 4 cases the cause of the injury was not specifically stated.

As will be seen from the above this class provides a case of injury from a broken spectacle glass, but the injury is apparently very much less frequent than the occurrence of 1 case in 1,000 accidents would indicate, for Sydney Stephenson⁵ in recording a case states that he had seen only 3 cases in 25 years, and quotes Lauber's finding of only 5 cases out of a total of 150,000 accidents to the

eye. The case in this series was similar to Stephenson's, namely, a perforating corneal wound with prolapse of the iris.

(g) *Quarrymen (15 cases)*:—The injury was caused by a piece of stone in 10 cases, by a chip of metal from a tool in 2 cases, and by an explosion in 3 cases. The injuries caused by stone were—infected corneal abrasion 3; simple corneal wound 2; corneal wound with prolapse of iris 1; sclerotic wound and cataract 2; cataract 1; detachment of the retina 1; 1 case injured by a tool was admitted with a shrinking eye, and one with an infected wound on account of which the eye was enucleated. The explosion injuries were—rupture of the sclerotic in 2 cases, and irido-dialysis with corneal abrasion in 1 case.

(h) *Glass Workers (14 cases)*:—A bursting bottle caused the injury in 6 cases, a chip of glass (origin not specifically stated) in 4, a blow from a cork in 2, a spark of molten glass in 1 case, and a chip of steel from a tool in 1 case. The varieties of injuries so produced are set forth in Table VI.

The glass industry employs only 0.07 per cent of the population in the Glasgow area so that the presence of these workers to the extent of 1.4 per cent. of the series shows a relatively high incidence.

Reference to Table V shows that the enucleation rate amongst glass workers is the highest recorded in the series, 35.7 per cent., but the total number of these workers dealt with was so small that it is perhaps not justifiable to assume that the rate would be so high over a great number of accidents amongst them. That injuries produced by glass or earthenware are, on the whole, dangerous is evidenced by the fact that glass or earthenware was the cause of the injury in 12.3 per cent. of all the enucleation cases, irrespective of occupation, ranking in this respect practically equal to sharp instruments and blunt instruments, each of which were responsible for the injury in 13.8 per cent. of the enucleations.

(i) *Plasterers and Slaters (13 cases)*:—Lime was the cause of the injury in 8 cases, causing conjunctivitis in 2, a burn with resultant symblepharon in 2, and infected corneal abrasion in 4.

A chip of stone caused an infected corneal abrasion in 2 cases. In 1 case a thorn caused a penetrating wound with resultant cyclitis, which necessitated removal of the eye. In 2 cases the cause of the injury was not recorded.

(j) *Workers in Wood (13 cases)*:—4 were injured by a tool; 2 by a piece of wood; 2 by a nail; 1 by a tack; 1 by a piece of wire; and 3 by a chip of iron and the injuries so caused are set forth in Table VI.

(k) *Plumbers (7 cases)*:—In 1 case a burn was caused by spirits of salt; molten metal caused burns in 2 cases; a tool was responsible for a contusion in 1 case; a large piece of metal caused a lacerated

sclerotic wound in one case, while chips of metal caused penetrating wounds in 2 cases.

(l) *Chemical workers (4 cases)* :—2 were injured by an alkali and 2 by an acid. In each group the burn was confined to the lids and conjunctiva in one of the cases, while in the other the cornea was also involved.

(m) *Various occupations (37 cases)* :—The 37 cases included in this group were drawn from many classes of workers, with, on an average, one or two representatives from each class.

Table II has been arranged to show the comparative frequency of the different kinds of eye injuries and the second column has been added to show the enucleation rate in the case of each.

TABLE II.

Showing the comparative frequency of the different kinds of eye injuries in 1000 cases.

NATURE OF THE INJURY.	Number of Cases.	Percentage requiring enucleation.
Infected corneal abrasion	300	3.3
Corneal wounds with prolapse of the iris	141	9.9
Burns	110	9.09
Corneo-sclerotic wounds	59	54.2
Cyclitis	50	58.0
Lid and conjunctival wounds	36	—
Simple corneal wounds	37	10.8
Sclerotic wounds (incised)	35	14.2
Sclerotic wounds (lacerated)... ..	35	82.8
Traumatic cataract	31	—
Intraocular haemorrhage	24	—
Contusions	23	—
Dislocated lens	14	—
Detachment of the retina	13	—
Injury to the lacrymal apparatus	8	—
Iritis	7	—
Conjunctivitis	5	—
Secondary glaucoma	4	—
Particles embedded on the eyeball	4	—
Anterior staphyloma	3	—
Iridodialysis	3	—
Conjunctivitis and keratitis	3	—
Kerato-iritis	2	—
Abrasion of the cornea	2	—
Conjunctivitis and iritis	2	—
Corneal ulcer due to exposure in traumatic facial paralysis	1	—
Conjunctivitis and irido-choroiditis	1	—
Rupture of the choroid	1	—
Fracture of the malar bone	1	—
Proptosis, retinal oedema and subsequent optic atrophy	1	—
Penetration of the orbit, meningitis, death... ..	1	—
Buphthalmos	1	—
Periostitis of the supraorbital ridge... ..	1	—
Fracture of base of skull, proptosis, optic atrophy	1	—
Accidental vaccination	1	—
Insufficiently recorded	38	—
	1000	—

Some explanation of the methods employed in compiling this table is required.

When an eye was the seat of multiple injuries the most serious of these was chosen to determine the group in which the case is entered.

The cases entered in the "cyclitis" group were admitted some time after the accident, when cyclitis had already developed, and in these the original wound was either not sufficiently apparent, or inadequately described at the date of admission. The group does not include any of the cases in the other groups in which cyclitis developed after the first admission.

No case, therefore, has been entered in more than one group.

So far as this series goes, the analysis of the cases given in Tables II and VI shows that the most common eye injuries in order of frequency are, penetrating wounds of the eyeball (32.2 per cent.) infected corneal abrasions (30.0 per cent.), burns (11.0 per cent.), and severe contusion injuries of the eyeball (9.1 per cent.).

The incidence of penetrating wounds of the eyeball and of infected corneal abrasions is, therefore, almost equal, and together they form almost 2/3rds of the whole series.

In the case of the infected corneal abrasions there is a pronounced occupational factor which would determine their number in any set of statistics. In Glasgow the Coal Mining Industry is responsible for 125 cases out of a total of 301, and the Coal Mining and Engineering Industries together for 199.

The number of burns of the eye met with is to an even greater extent influenced by the occupational factor, for 79 cases occurred in the group of workers employed in the manufacture of metal, while the remaining 31 cases are found distributed amongst 10 of the other groups.

In the case of penetrating wounds and of severe contusion injuries there is a more general distribution amongst all classes. These forms of injury differ, however, in so far as the penetrating wounds are mainly occupational (in 65.5 per cent.), and the severe contusion injuries are mainly non-occupational (in 64.8 per cent.).

It is surprising that in an industrial area, such as Glasgow is, there should be such a high percentage as 34.5 of non-occupational penetrating wounds. A very regrettable feature of this high incidence is that children contribute almost twice as many cases as adults (73 children and 38 adults).

The severe contusion injuries, on the other hand, occur almost four times more frequently in adults than in children (46 adults and

13 children) owing to the fact that they are mainly the result of violence, which also accounts for the fact that 64.8 per cent. of these injuries are non-occupational.

Reference to Table VI shows that while the incidence of dislocated lens and detachment of the retina was practically equal, 10 of the 14 cases of dislocated lens were non-occupational in origin, and only 5 of the 13 cases of detachment of the retina.

There was only one case of rupture of the choroid in the series. The rarity of traumatic rupture of the choroid in civil life is thus in striking contrast to the frequency with which it occurs as a result of war injuries.

Four cases were admitted suffering from glaucoma secondary to the effects of trauma.

Enucleation :—In this series enucleation was performed in 149 cases, i.e. in 14.9 per cent. The statistics quoted by Praun⁶ refer to the work of nearly 30 years ago and these show enucleation percentages ranging from 45 to 73.3 per cent. The following three tables have been arranged to show (1) the nature of the accident (Table III) ; (2) the nature of the injury (Table IV) ; and (3) the occupation of the patient (Table V) in the enucleation cases.

TABLE III.

Causes of the accident in the cases requiring enucleation.

CAUSE OF THE ACCIDENT.	Number of Cases.	Percentage of each cause.
Chips of metal... ..	38	29.2
Sharp instruments	18	13.8
Blunt instruments	18	13.8
Glass or earthenware... ..	16	12.3
Explosions	10	7.6
Molten metal	7	5.3
Chips of coal	4	3.0
Striking eye against objects	4	3.0
Chopping wood	3	2.3
Blows from fist	3	2.3
Kicks	3	2.3
Firearms	2	1.5
Burns from fire	2	1.5
Birth injury	1	0.7
Chip of stone	1	0.7
	130	—

NOTE.—In calculating the percentages in this table the 19 cases in which the cause of the accident was not specifically recorded were excluded.

TABLE IV.

The nature of the injury in the cases requiring enucleation.

NATURE OF THE INJURY.	Number of Cases.	Percentage of each injury as a cause for enucleation.
Corneo-sclerotic wounds with prolapse of iris ...	32	23.02
Lacerated wounds of the sclerotic	29	20.8
Cyclitis	29	20.8
Penetrating corneal wounds with prolapse of iris...	14	10.07
Deep infection from traumatic corneal ulcers ...	10	7.1
Burns	10	7.1
Incised wounds of the sclerotic	5	3.5
Simple penetrating corneal wounds	4	2.8
Anterior staphyloma	3	2.1
Dislocated cataractous lens	2	1.4
Suppurative cyclitis	1	0.7
	139	—

NOTE.—In calculating the percentages in the above table the 10 cases in which the nature of the injury was not sufficiently recorded were excluded from the total.

TABLE V.

Cases of enucleation arranged according to occupation.

CLASS.	Number of Eye Injuries.	Number requiring enucleation.	Percentage requiring enucleation.
Workers liable to injury with cold metal ...	260	38	14.6
General community (over 15 years of age), <i>i.e.</i> , non-occupational injuries	148	34	22.9
Children under 15 years of age	145	30	20.6
Coal miners	173	10	5.7
Workers with molten metal	83	7	8.4
Various occupations	37	7	18.9
Agriculturists, gardeners, gamekeepers, etc....	42	6	14.2
Glass workers	14	5	35.7
Housewives	21	3	14.2
Quarrymen, paviors, etc.	15	3	20.0
Masons and bricklayers	25	2	8.0
Workers in wood	13	2	15.3
Plasterers and slaters	13	1	7.6
Plumbers... ..	7	1	14.2
Chemical workers	4	0	0.0
	1000	149	—

(1) *The nature of the accident*:—Penetration of the eye by a chip of metal accounted for the injury in almost one-third of the cases.

Sharp instruments, blunt instruments, and glass or earthenware are found to have been responsible for the injury in practically equal degree.

The other less frequent causes will be found in Table III.

(2) *The nature of the injury*:—Corneo-sclerotic wounds with prolapse of the uvea, lacerated sclerotic wounds, and cyclitis, in practically equal degree, are shown to be the injuries mainly responsible for the loss of an eye by enucleation.

The enucleation incidence of the different forms of eye injury has already been shown in Table II. The effect of an injury to the danger zone is well demonstrated in that table. Corneo-sclerotic wounds have an enucleation percentage rate of 54.2, while that of simple corneal wounds is only 10.8, that of corneal wound with prolapse of the iris 9.9 and that of incised sclerotic wound 14.2.

The majority of the wounds which produced the cyclitis from which the patient was already suffering at the time of his first admission were doubtless corneo-sclerotic; and the enucleation percentage rate of that group is also high, viz., 58.

(3) *The nature of the occupation*:—From an examination of Table V it will be seen that certain occupations show a high enucleation rate, e.g., glass workers 35.7 per cent.; quarrymen 20 per cent.; workers in wood 15.3 per cent.; and plumbers 14.2 per cent., but in each of these classes the total numbers admitted were so small that it may be unwise to conclude that these classes would show such high rates over greater numbers.

From the investigation, however, of the four classes in which the numbers were enough to justify one in forming conclusions there emerges a striking fact, namely, that the enucleation incidence was greater in the non-occupational injuries than in the occupational.

Some explanation of this is to be found in Table II, from which it appears that the injuries with the highest enucleation rates are the corneo-sclerotic wounds, the lacerated sclerotic wounds and cyclitis; and these types of injury are found to be relatively more frequent amongst those admitted for accidents not connected with their work (see Table VI).

For instance, amongst non-occupational injuries 23 cases of lacerated sclerotic wounds occurred, while 2 is the greatest number of this injury in any of the occupational groups.

Compare also, in the matter of enucleation, the children with workers whose occupation exposed them to that fruitful source of injury resulting in the loss of the eye by enucleation, namely, penetration by a chip of metal. In the engineer and shipbuilder class the enucleation rate was 14.6 per cent., while in the case of the children it was 20.6 per cent.

TABLE VI.—A CLASSIFICATION

	Total of each kind of injury.	Workers liable to injury with cold metal.	Coal Miners.	General community (over 15 years of age).	Children under 15.	Workers liable to injury with molten metal.	Agricultural gangs, keepers, etc.
Infected corneal abrasion... ..	300	74	125	19	21	—	1
Corneal wound with prolapse of iris	141	53	9	21	35	—	—
Burns	110	—	6	5	6	79	—
Corneo-sclerotic wounds	59	21	2	3	17	1	—
Cyclitis	50	8	11	8	11	—	—
Lid and conjunctival wounds	36	4	2	17	9	—	—
Simple corneal wounds	37	22	—	3	1	—	—
Sclerotic wounds—incised	35	18	—	3	9	—	—
Sclerotic wounds—lacerated	35	—	1	19	4	—	—
Traumatic cataract	32	5	8	5	8	—	—
Intraocular haemorrhage... ..	24	3	—	12	6	—	—
Contusions	23	8	1	5	5	—	—
Dislocated lens	14	3	—	8	2	—	—
Detachment of the retina	13	2	3	5	—	—	—
Injury to the lacrymal apparatus	8	—	—	2	1	—	—
Iritis... ..	7	—	1	3	—	3	—
Conjunctivitis	5	—	1	1	—	—	—
Secondary glaucoma	4	2	—	2	—	—	—
Particles embedded in the eyeball	4	—	1	1	2	—	—
Anterior staphyloma	3	—	—	—	3	—	—
Irido-dialysis	3	—	1	1	—	—	—
Conjunctivitis and keratitis	3	—	—	—	—	—	—
Kerato-iritis... ..	2	—	—	—	1	—	—
Abrasion of the cornea	2	—	1	1	—	—	—
Conjunctivitis and iritis	2	2	—	—	—	—	—
Corneal ulcer due to traumatic facial palsy	1	1	—	—	—	—	—
Conjunctivitis and irido-choroiditis	1	1	—	—	—	—	—
Rupture of the choroid	1	—	—	1	—	—	—
Fracture of the malar bone	1	—	—	1	—	—	—
Proptosis and subsequent optic atrophy	1	—	—	—	1	—	—
Penetration of orbit, meningitis, death	1	—	—	—	1	—	—
Buphthalmos	1	—	—	—	1	—	—
Periostitis of supra-orbital ridge... ..	1	—	—	—	—	—	—
Fractured base of skull, proptosis, optic atrophy... ..	1	—	—	—	—	—	—
Accidental vaccination	1	—	—	1	—	—	—
Not sufficiently recorded	38	33	—	1	1	—	1
Total	1000	260	173	148	145	83	42
Percentage which each class forms of the total population of the area	—	5.9	3.3	82.3	17.7	1.2	1.1
Enucleation percentage rate of each class	—	14.6	5.7	22.9	20.6	8.4	14.2

The converse of this explains the low enucleation rate in two classes of workers, namely, the coal miners and the workers exposed to injury by hot metal.

In the case of the coal miners, in whom the enucleation rate was only 5.7 per cent., the principal injury was infected corneal abrasion, while in the case of the workers with hot metal, with an enucleation rate of 8.4 per cent., the principal injury was a burn, and in Table II it will be seen that both of these forms of injury have a low enucleation rate. Both groups, however, suffer badly in the matter of impairment of vision owing to the destruction of cornea which results from those injuries.

Table VI has been constructed in order to present, in an easily accessible form, some of the data, upon which this paper is based.

In the first column opposite each type of injury will be found the total number of cases of each injury and this number can easily be converted into a percentage rate seeing that the total number of injuries is 1000.

In the succeeding columns is to be found the distribution of each type of injury amongst the various classes of the community. The last column shows the enucleation percentage rate of each type of injury.

The third line from the bottom of the table gives the total number of each class of patient, and again this figure is easily convertible into percentage because the total number of patients dealt with is 1,000.

The line below this gives the percentage which each class forms of the total population, while in the last line the occupational enucleation percentage rate is given.

The non-occupational injuries are found in the 4th and 5th columns; all the others are occupational.

In only two cases in the series were both eyes injured by the same accident. An explosion in a coal mine was the cause of the one, and a gun accident that of the other.

Explosions and gun-shot accidents are probably the usual causes of simultaneous injury of both eyes, which, fortunately, is an uncommon event.

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