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THE LATE RESULTS OF REMOVAL OF INTRA-OCULAR FOREIGN BODIES WITH THE MAGNET*

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THERE have been few recent publications of the late results of the removal of magnetic intra-ocular foreign bodies, so that a follow-up of the cases treated at Moorfields during the first 4 years of the war may be of general interest.

Of the 154 cases in which a magnetic foreign body was successfully removed from the eye during that period, the posterior route was used only twice, and of these, one eye became shrunken and siderotic, and the other required enucleation early from sepsis. Removal through the scleral wound of entry was effected in 2 further cases, the resultant vision being reduced to 6/18 from a localised cataract and 6/60 from macular striae respectively.

In the remaining 150 cases, the anterior route was employed. In about 15 per cent. of these the foreign body lay in the anterior chamber, and in the remainder it was drawn thither by the Haab magnet (or in 3 cases only by the Mellinger), final removal being effected with the hand magnet through a keratome section. The vision was estimated when the eye condition could be considered static 6 months to 3 years later, except in the very few cases in which the patient was out of reach, when an earlier record had to be accepted.

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RESULTANT VISION

	No. of cases	6/5-6/6	6/9	6/12	6/18	6/24-6/60	C.F.	H.M.	P.L.	No P.L.	Excision
Anterior route extractions											
1. With lens undamaged	48	17	14	3	3	4	3	2	2	0	0
2. With lens damaged:											
(a) cataract not removed ...	85	5	2	2	5	6	12	15	9	2	27
(b) cataract evacuated later ...	17	2	5	2	2	3	1	1	1	0	0
Total cases ...	150	24	21	7	10	13	16	18	12	2	27

This may be summarised as follows:—

RESULTANT VISION

	Good (6/5-6/9) per cent.	Moderate (6/12-6/60) per cent.	Bad ($<6/60$) per cent.	Excision per cent.
1. With lens undamaged	65	20	15	0
2. With lens damaged	13	20	40	27
Of total by anterior route	30	20	32	18

Factors Influencing the Resultant Vision

(1) *Damage to the lens* gravely affected the prognosis as is seen in the foregoing table, two-thirds of those with lens undamaged attaining good vision (6/9 or better), and two-thirds with lens damaged attaining bad vision only (less than 6/60).

(2) *The amount of uveal damage* was of considerable importance in determining the amount of permanent visual loss; in the following table those cases with holes and tears of the iris, traumatic hyphaema, iris or ciliary prolapse, hypopyon iritis or gross synechiae are arrayed against those with uveae intact and their resultant visions recorded:—

RESULTANT VISION

	Good (6/5-6/9)	Moderate (6/12-6/60)	Bad or Excision ($<6/60$)	Total
Without uveal damage	30	18	21	69
With uveal damage	8	11	49	68

(3) *The site of the entrance wound* has also some influence, those with the wound at the limbus having the worse prognosis, and those with scleral wounds (especially when within 5 mms. of the limbus) less favourable than those with corneal wounds.

RESULTANT VISION

	Good (6/5 - 6/9)	Moderate (6/12 - 6/60)	Bad or Excision ($<6/60$)	Total
Wound of entry in cornea ...	32	22	46	100
Wound of entry across limbus ...	2	1	8	11
Wound of entry in sclera ...	5	2	8	15

(4) *Delay in removal of intra-ocular foreign body* did not seem materially to prejudice the issue, although in two cases siderosis was evident which could have been averted. This is made clear by the following chart, in which the proportion of cases that attained good or moderate vision to those with bad vision remains constant irrespective of delay. Excisions were, in fact, relatively more frequent in those cases reaching hospital early; but this may be explained by the fact that the more severe injuries with the worse prognosis would demand hospital attention more urgently.

	Number obtaining	Good or moderate vision 6/5 - 6/60	Bad vision <6/60	Excision
Delay in attending hospital, 0 days	25	17	18	
Delay in attending hospital, over 1 day	20	13	5	
Delay in attending hospital, over 4 days	15	7	5	
Delay in attending hospital, over 14 days	11	4	1	
Delay in attending hospital, over 2 months	5	3	1	

Commentary

Lens damage was produced in two-thirds of the cases, although in 14 of the 102 the cataract remained localised enough to allow reading sight ($>6/18$). Of the remaining 88, excision of the eye was necessary in 27, representing 18 per cent. of the total cases, usually within a few days owing to suppuration, but in a minority, after a few weeks owing to the risk of sympathetic ophthalmia.

In 17 cases the cataract was subsequently removed, and ten of these failed to regain good vision owing to iritis of varying intensity.

Of the 48 cases in which no lens damage was caused, in 16 the vision was impaired, the following factors being responsible:—

Vitreous haze or haemorrhage ...	6
Retinal commotio ...	5
Retinal detachment ...	1
Pigment on antr. lens capsule ...	1
Ciliary prolapse with subsequent glaucoma	1
Corneal scar ...	1
Previous amblyopia (F.B. present 35 years although no evident siderosis) ...	1

In comparing these figures with others previously published it is noted that Anderson in 1936 found excision required in 33 per cent. of anterior route extractions and 50 per cent. of posterior route extractions and in the remainder the various degrees of impairment that he found were in proportions corresponding to those recorded above.

He also observed that although the large majority reached hospital within a day of the accident a delay did not appear to have much ill effect on the ultimate vision; this is confirmed by the cases treated at Moorfields, where of the 150 cases in which the time lag was recorded, 60 reached hospital the same day and 28 the following day.

A survey of the magnetic intra-ocular foreign-body extractions performed at Moorfields was published in the Moorfields Hospital Reports of 1897 by Mr. Mackenzie, and again in 1907 by Mr. Goulden, and provide an interesting comparison with the present day figures. During the 6 years (1890 to 1896) 50 foreign bodies were removed; in 10 cases the foreign body did not penetrate beyond the iris and good vision resulted; of the remaining 40, 20 lost the eye, and among the remainder on their discharge, a third allowed good, a third moderate, and a third bad vision (using the standards previously mentioned).

The Mellinger magnet has fallen largely into disuse at Moorfields, as it is usually considered more dangerous and cumbrous to apply, and in addition considerably weaker than the Haab.

It has been argued that by using the anterior route there is a risk of damaging a previously undamaged lens; in 4 cases only of the 150 has subsequent lens opacity been noted in a case in which the lens was apparently clear on admission, in two of these the cataract remained small and peripheral and in a third siderotic lens changes ensued; having regard to the frequent difficulty in observing a very early peripheral cataract in a grossly damaged eye this argument does not seem very important.

The relative strengths of the various standard magnet terminals have been assayed for us by Mr. K. J. R. Cocke, Home Appliance Engineer of the British Thomson-Houston Co. Ltd., and he has kindly given me permission to publish his results. Readings of mean magnetic flux density were made by means of a 1 sq. cm. search coil and Cambridge fluxmeter. The search coil in each case was placed at an average distance of 7 mm. from the tip of the pole piece.

From the measurements thus made the relative pull of the various magnets has been calculated, that of the Haab magnet with the rounded polepiece being taken as 100 per cent.

The results show that even using the 1 inch core the Mellinger magnet has a pull of less than half that of the Haab with the rounded pole piece.

HAAB MAGNET

Polepiece	Rheostat position	Relative pull
1. D	out	100
2.	out	80
3.	out	52
4.	out	10
2.	in	12

MELLINGER MAGNET

Core	Rheostat position	Relative pull
1 inch	out	41
7/8 inch	out	31
11/16 inch	out	18
7/16 inch.	out	13
3/16 inch	out	5
1 inch	in	3

HAND MAGNET

Pole piece	Relative pull
Blunt	1.0
Thin flat	0.2
Curved flat	0.1

Summary

The late results of 150 recent cases of removal of magnetic intra-ocular foreign bodies have been analysed and the factors affecting the prognosis assayed. Uveal and lens damage are both of great importance in reducing the ultimate vision. The site of entry wound is of moderate significance, those at the limbus and ciliary region having the worst outlook. Delay in dealing with the foreign body is not of much consequence.

The lens was injured in two-thirds of the cases; of these a quarter lost the eye, but in a further 14 per cent. the cataract remained localised enough to allow reading vision (6/18 or better). Where the lens was uninjured the prognosis was fair, two-thirds of these cases retaining good vision.

The posterior route and the Mellinger magnet have been very rarely used; reasons for this are offered.

The strengths of the magnetic fields from the various pole-pieces have been estimated.

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