DIPLOPIA*†

BY

JOHN NOLAN

University Department of Ophthalmology, Royal Infirmary, Edinburgh 3

DIPLOPIA is one of the common complaints in the Eye Out-patient Department, but surprisingly little has been published concerning the incidence of the various causes of the condition or of the prospects for recovering binocular single vision. The only recent work on the subject appeared in papers by Hugonnier and Magnard (1960), who discussed 501 cases of diplopia due to ocular palsy, and by Mann, Collier, and Canaga (1962), who discussed diplopia due to general medical causes, of which they found the commonest to be diabetes mellitus, increased intra-cranial tension, cerebro-vascular insufficiency, cerebral aneurysm, multiple sclerosis, and myasthenia gravis. Each of these papers, however, set out to assess the problem only from one particular aspect.

In view of this, 226 consecutive patients complaining of diplopia who had been investigated in this department were reviewed. The terms "cured" and "recovered", as used in this paper, mean that the patient can maintain binocular single vision in the primary position and on looking down, without adopting an abnormal head posture.

Findings

The diagnoses and results are shown in Table I (opposite), and further details of each diagnostic group are given below.

No Definite Diagnosis (63)

All systemic investigations gave normal results. These included haemoglobin estimation, full blood count, erythrocyte sedimentation rate, Wassermann reaction and Kahn test, blood pressure, urine analysis and x rays of the skull and chest, together with a neurological examination.

The age incidence is shown in Table II (opposite). It is reasonable to postulate a small vascular lesion in the brain stem due to arteriosclerosis as the basic factor in the more elderly of these patients, since they all showed arterio-sclerotic fundus changes to some degree.

Two patients, both in the 40 to 49-year age group, complained of intermittent vertical diplopia and were referred for neurological investigation. Diagnoses of basilar insufficiency were made, but these were tentative and the cases were therefore included in the undiagnosed group.

Eighteen cases showed IIIrd nerve involvement (Table III, overleaf), as against fourteen cases of IVth and seventeen of VIth nerve palsy. Since these three nerves were almost equally affected it would seem that the lesion is more often in the nucleus than in the nerve itself, for in the latter event a greater proportion of VIth and IVth nerve palsies would be expected owing to the greater lengths and therefore greater vulnerability of these nerves. The fourteen cases under the heading "not known" in Table III gave histories of diplopia which sounded typical of a muscle palsy, but their symptoms and any signs had cleared up before they were seen in the Out-patient Department.

* Received for publication December 9, 1966.

† Address for reprints: as above.

TABLE I
AETIOLOGY AND OUTCOME OF 226 CASES OF DIPLOPIA IN ORDER OF INCIDENCE

Aetiology	Total		Outcome					
	No.	Per cent.	Recovered without Treatment	Recovered with Treatment	Require further Treatment	Still Improving	No Change	Not Traced
No definite diagnosis	63	28	43	4	3	6	6	1
Traumatic nerve palsy	40	18	16	8		3	7	6
Decompensating heterophoria	28	12		10	18			
Proptosis (not thyroid)	12	5	3	4	1		4	
Thyroid disease	11	5		1	5		4	1
Hypertension	9	4	6	1		1		1
Traumatic muscle haemorrhage	9	4	9					
Intra-cranial space-occupying lesion	9	4		3			6	
Unilateral diplopia	8	4	7				1	
Multiple sclerosis	7	3	7					
Congenital/long-standing lesions	6	3					6	
Alteration in angle of squint	4	2		2			2	
Myasthenia gravis	4	2		4				
Cerebrovascular accident	3	1	1				2	
Migraine	2	1	2					
Metastatic nerve palsy	2	1					2	
Diabetic nerve palsy	2	1	1			1		
Fractured orbit	2	1		2				
Physiological	2	1						
Accommodative spasm	1	<1		1				
Viral nerve palsy	1	<1	1					
Ocular myositis	1	<1	1					

TABLE II
AGE AT ONSET OF DIPLOPIA IN 63 CASES IN THE "NO DEFINITE DIAGNOSIS" GROUP

Age Group (yrs)	Total	Outcome					Span of Time for Spontaneous Cure	Not Traced	Per cent. of N.Y.D. group
		Recovered Spontaneously	Recovered with Treatment	Possibly Improvable with Further Treatment	Still Improving Spontaneously	No Change			
Under 40	15	7	1	1	3	2	Hours-3/12 Hours-3/12 1-6/52 1/52-5/12	1	25
40-49	11	8		1	1	1			17
50-59	7	5	1		1				10
Over 60	30	19	2	1	2	4		2	48
Total	63	39	4	3	7	7		3	

It is worth noting from Table I that over two-thirds of these cases have so far resolved spontaneously. The six cases showing no improvement have diplopia on version only, and are otherwise comfortable, so that no further treatment is indicated. The remaining cases are either improving spontaneously or are expected to improve with further treatment, and the prognosis for regaining binocular single vision in this group is therefore excellent.

Two of the treated cases were rendered comfortable in the primary position by the inclusion of prisms in their spectacles, and the other two cases were cured by surgery.

The time taken for spontaneous recovery in this group varied from a few hours to 5 months.

Traumatic Nerve Palsy (40)

The nerves involved are shown in Table III. The three "not known" gave histories of diplopia for some days after a head injury, but in two of them the symptoms and signs had completely resolved by the time they attended the Out-patient Department; the third showed a post-traumatic convergency insufficiency in which it was felt that "compensation neurosis" played a large part.

Seven of the eight treated patients (see Table I) achieved binocular single vision in the primary and depressed positions after muscle surgery, and the eighth was made comfortable with prisms.

Two of the patients listed as unchanged ceased to complain of diplopia because they developed constant suppression. The time taken for spontaneous recovery in this group varied between 4 days and 6 months.

TABLE III
INCIDENCE OF CRANIAL NERVE INVOLVEMENT IN THE MAJOR DIAGNOSTIC GROUPS

Nerves Involved	III	IV	VI	Multiple	Not Known	Supra-Nuclear	Total
No definite diagnosis	18	14	17	—	14		63
Traumatic palsies	13	12	8	4	3		40
Hypertension	2	—	5	—	2		9
Multiple sclerosis	2	1	1	—	3		7
Overall involvement including all groups in Table I	47	27	38	9	20	1	142
Percentage of 226 cases	21	12	17	4	9		

Decompensating Heterophorias (28)

Although this condition is not uncommon in young children, such patients do not usually complain of diplopia because they rapidly suppress; it is not therefore surprising that the youngest patient in this group was nearly 9 years old. The age incidence is thereafter fairly uniformly spread over the decades, the oldest patient being aged 76 years (Table IV).

TABLE IV
AGE OF 28 CASES OF DECOMPENSATING HETEROPHORIA

Age Group (yrs)	Under 10	10-19	20-29	30-39	40-49	50-59	60-69	Over 70	Total
No. of Cases	2	3	4	4	3	2	7	3	28

Eighteen of these patients have only occasional diplopia and are under orthoptic supervision; of the remainder, five with convergence insufficiency were cured by orthoptic treatment, three were cured by operation, and two were rendered comfortable with prisms.

TABLE V
CAUSES OF PROPTOSIS OTHER THAN THYROID DISEASE IN 12 PATIENTS

Cause	No. of Cases
Spontaneous haemorrhage	1
Traumatic	1
Lymphosarcoma	2
Not known	3
Mucocele	3
Neoplasm of antrum	1
Orbital metastasis	1

Proptosis, excluding Cases of Thyroid Exophthalmos (12). (Table V).

The cases of spontaneous haemorrhage and traumatic proptosis resolved without treatment in less than one week.

The two patients with lymphosarcoma responded to local irradiation and the proptosis disappeared completely in both cases. One of them, however, developed a perforating corneal ulcer and panophthalmitis during treatment, with resulting loss of vision in the affected eye. The other patient sees 6/6 in each eye and now has no diplopia whatsoever.

Of the three undiagnosed cases, one had an erythrocyte sedimentation rate of 112 mm./hr and recovered spontaneously in a week. The other two remain unchanged after 3 years, every test including biopsy having been negative.

Two of the patients with mucocele had complete resolution of proptosis and diplopia after anastomosis operations; the third is still under the care of the Ear, Nose and Throat Department.

Thyroid Disease (11)

This group comprises eight cases of thyrotrophic exophthalmos and three of thyrotoxicosis, and all eleven have maximum diplopia on elevation. One of the thyrotoxic patients was cured of diplopia when the disease was controlled by Carbimazole.

Hypertension (9)

In these cases the diastolic blood pressure was over 110 mm. Hg. All other investigations were normal and it was therefore assumed that hypertension was the basic pathological entity. The cranial nerves affected are shown in Table III. Of the two "not known", one had two transient attacks of diplopia, and the other gave a history of diplopia for a month; neither had any symptoms or signs other than hypertension by the time he attended the Out-patient Department.

The treated case, who had had diplopia for 10 years, was made comfortable with prisms.

Traumatic Muscle Haemorrhage (9)

These patients each had a haemorrhage in one of the extra-ocular muscles. The diplopia resolved spontaneously within a week in eight, but the ninth took five months to recover.

Space-Occupying Lesions (9)

These cases comprised six aneurysms, one brain-stem tumour, and two acoustic neuromata. One presented with a partial IIIrd nerve palsy, the others all presented with multiple cranial nerve involvement. All were operated on by the neurosurgeons. Treatment for the residual ocular muscle defects has been carried out so far on three patients, one being cured by operation and two by prisms. The others are still under observation.

Unilateral Diplopia (8)

These cases are interesting since in six of them absolutely nothing could be found to account for their symptoms; one had macular changes and the last had lens opacities. They all recovered spontaneously except the patient with macular degeneration. Walsh (1957) pointed out that most cases of unilateral diplopia reveal no objective abnormality on clinical examination and clear up spontaneously.

Multiple Sclerosis (7)

The nerves involved are shown in Table III. The "not known" cases gave histories of diplopia which had resolved before they were seen in the Ophthalmological Out-patient Department.

Congenital or Long-standing Lesions (6)

Two patients have a superior oblique tendon sheath syndrome and one a unilateral VIth nerve palsy; all three have binocular single vision in the primary position, and no treatment has been undertaken. The other three patients have had divergent squints since early childhood, and have always complained of occasional diplopia; this is never troublesome, and is postulated as being due to occasional fixation with the usually non-fixing eye.

Alteration in Angle of Squint (4)

This was thought to be the explanation in four patients, who had all had a squint since childhood. Three showed consecutive divergence with diplopia, and one was thought to be aware of diplopia owing to a change in the angle of convergent deviation resulting the use of an unsuppressed area of retina in the squinting eye.

Myasthenia Gravis (4)

These patients' symptoms are controlled by anticholinesterase drugs.

Cerebrovascular Accident (3)

One patient had a partial IIIrd nerve palsy which resolved in 5 weeks, one has Parinaud's syndrome and left hypertropia, and the third has multiple cranial nerve involvement.

Migraine (2)

One patient has ophthalmoplegic migraine, and the other experiences diplopia during the "aura".

Metastatic Nerve Palsy (2)

These patients each had a unilateral VIth nerve palsy and generalized metastases from carcinoma of the breast. They were made comfortable by occluding one eye.

Diabetic Nerve Palsy (2)

These insulin-dependent patients both had unilateral VIth nerve palsy.

Fractured Orbit (2)

Both patients had fractured malar bones. After wiring, the diplopia gradually resolved in the course of a year in one case, but was cured immediately in the second case.

Accommodative Spasm (1)

This teenage girl was cured by a course of cycloplegic drugs.

Viral Nerve Palsy (1)

A right VIth palsy, which occurred during virus pneumonia in a 52-year-old woman, resolved spontaneously in 3 months.

Comment

Diagnosis.—The largest group of patients complaining of diplopia was that which defied definite diagnosis, and comprised 28 per cent. of the cases. It was felt that the most likely cause in the majority of these was arteriosclerosis. If this view is correct, then approximately one-third of the total number was due to vascular disease. Trauma and decompensating heterophorias came next in order of frequency, so that 58 per cent. of the diplopias seen were due to one of these three causes.

A nerve palsy was present in nearly two-thirds (63 per cent.) of the series (Table III). In the patients with thyroid disease, the defective elevation is probably due to a bound-down inferior rectus rather than to a palsied superior rectus (Miller, van Heuven, and Ward, 1965; Long, 1966).

Prognosis.—143 patients had binocular single vision in the primary and depressed positions when last seen, and are therefore listed as "cured". 97 of these had recovered spontaneously and 37 had responded to treatment. Nine cases have diplopia only on version, eleven are still improving spontaneously, and it is thought that a further 27 will be amenable to future treatment. Five patients have binocular single vision in the primary position with the help of prisms.

The prognosis is therefore good as regards the prospect of regaining a comfortable field of binocular single vision in most of the aetiological groups listed.

Summary

226 consecutive patients presenting with a complaint of diplopia were studied. The commonest causes were vascular disease (32 per cent.), trauma (22 per cent.), and decompensating heterophoria (12 per cent.). There was an ocular cranial nerve palsy in nearly two-thirds of the cases. Nearly half the patients recovered binocular single vision

in the primary and depressed positions spontaneously, and it is anticipated that two-thirds of the remainder will have recovered when treatment is complete.

REFERENCES

- HUGONNIER, R., and MAGNARD, P. (1960). *Bull. Soc. franç. Ophtal.*, **73**, 80.
LONG, J. C. (1966). *Arch. Ophthal. (Chicago)*, **75**, 634.
MANN, S. H., COLLIER, T. M., and CANAGA, B. L. (1962). *Amer. Practit. (Philad.)*, **13**, 68.
MILLER, J. E., VAN HEUVEN, W., and WARD, R. (1965). *Arch. Ophthal. (Chicago)*, **74**, 509.
WALSH, F. B. (1957). "Clinical Neuro-Ophthalmology", 2nd ed., p. 212. Williams and Wilkins, Baltimore.