CRANIAL SYMPTOMS AFTER CERVICAL INJURY

AETIOLOGY AND TREATMENT OF THE BARRÉ-LIEOU SYNDROME

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Neck injury of the whiplash type may lead to the cranial symptoms of the Barré-Lieou syndrome. Forty patients with this syndrome and 40 without it were investigated by a variety of imaging techniques.

There was a clear correlation between root sleeve defects at C3/4 shown by special oblique myelographic views and cranial symptoms. Good results were obtained by anterior cervical discectomy and fusion at C3/4 in 21 cases. It is suggested that the syndrome may result from irritation of the sympathetic nervous supply at this level.

Barré-Lieou syndrome, which includes a group of symptoms such as headache, vertigo, tinnitus and ocular problems, was initially described in 1926. Since then similar symptoms have been observed in patients injured in traffic accidents and attention has been focused on this relationship (Gay and Abbott 1953; Cammack 1957; Seletz 1958). One difficulty in assessing this syndrome is that the cranial symptoms are related to excessive movement of the neck. Research has led to a variety of opinions on the cause. These include: occlusion of the vertebral artery (Williams and Wilson 1962; Smith, Vanderark and Kempé 1971; Limousin 1980), involvement of the cervical sympathetic system (Barré 1926) and interference with the neck reflexes (Ryan and Cope 1955). The aetiology, diagnosis and management are still controversial, mainly because no characteristic radiographic findings have been reported.

An attempt has been made to determine the optimum oblique vertical angle at which cervical metrizamide myelography would satisfactorily demonstrate the fine anatomical details of the cervical nerve root sleeves. Views were taken at different angles, and it was shown that the best images of the cervical nerve root sleeves were seen at 40° from the vertical plane, using metrizamide of 280 mgI/ml (Tamura 1985).

To investigate the cause of Barré-Lieou syndrome,

cervical metrizamide myelography was performed in patients with and without the syndrome, and the results compared.

PATIENTS

A retrospective study was made of patients seen from 1983 to 1987 at Josai Hospital. Seventy-nine patients were investigated for Barré-Lieou syndrome, cervical neurological deficits or both, one patient being re-investigated after a second accident. Of these, 74 had had a cervical injury or injuries and five had developed the syndrome with no history of such injury.

Barré-Lieou syndrome group. Forty patients were diagnosed as cases of Barré-Lieou syndrome because of persistence of three or more of the main symptoms: headache, vertigo, tinnitus and ocular problems. Of these, 35 (16 female and 19 male) had developed the symptoms after cervical trauma. Their mean age was 42.2 years (range 14 to 67). Their neck injuries resulted from rear-end collision in 19 cases, head-on collision in two, side collision in four and from other accidents in 10.

Of all the patients seen at our hospital with whiplash injury after a rear-end collision Barré-Lieou syndrome occurred in 9%. About 40% of the whole series were referred after unsuccessful treatment at other hospitals. The five patients with no history of trauma were four women and one man. Their mean age was 47 years (range 31 to 68).

Plain radiography showed no abnormalities in 18 cases (43%); in eight cases there was degenerative change in the middle or lower cervical spine. Only two cases showed abnormalities in the upper cervical spine: a tear drop fracture at C2 in one, and ossification of the

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Case 1. A 25-year-old man with Barré-Lieou syndrome and cervicobrachialgia on the left after a head-on collision. Figures 1 and 2 – Anteroposterior and lateral myelograms, showing minimal abnormalities. Figures 3 and 4 – Oblique views, showing on the left, a significant defect of the fourth cervical nerve root sleeve at the C3/4 disc space. On the right all the root sleeves are clearly visible. Figure 5 – Discogram showing a posterior disc protrusion at C3/4.

posterior longitudinal ligament at C2 and C3 in the other.

Non-Barré-Lieou group. Forty patients had cervical trauma but not the Barré-Lieou syndrome. This group included 10 females and 30 males; their mean age was 39.6 years (range 14 to 71). The diagnoses were radiculomyelopathy in seven, neck pain and radiculopathy in 27, acute central spinal cord injury in four, and brachial plexus paralysis in two. The cervical injuries resulted from rear-end collision in 14, head-on collision in seven, side collision in three cases and other accidents in 16. In 24 cases (60%) plain radiographs showed no abnormalities, but in eight, degenerative changes were

seen in the middle or lower cervical spine, and in four there was narrowing of the intervertebral space at C5/6, C6/7 or both.

RESULTS

Imaging. The special oblique views showed bilateral or unilateral defects of the nerve root sleeves of C4 in all cases with Barré-Lieou syndrome (Table I), though the frontal and lateral views showed a normal or near-normal image (Figs. 1 to 9).

By contrast the group of patients without Barré-Lieou syndrome showed no defects in the C4 nerve root

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Case 2. A 34-year-old male taxi driver was injured in a rear-end collision. He was momentarily unconscious and then complained of severe neck pain, limitation of neck movement, and hypo-aesthesia of the face with a paraesthesia in both arms. He later developed the full Barré-Lieou syndrome. Figures 6 and 7 – Anteroposterior and lateral myelograms show no abnormal findings. Figures 8 and 9 – Oblique views demonstrate defects in the C4 and C5 nerve root sleeves at C3/4 and C4/5 disc levels.

sleeves, though there were defects in the root sleeves below C4 in all except five cases. In 16 cases in this group the defects in root sleeves below C4 were shown clearly only on the special oblique views (Table II). No defects in the root sleeves of C3 were seen in either group.

Discography was performed at C3/4 in 16 of the 40 patients with Barré-Lieou syndrome. These demonstrated a posterior disc protrusion in all cases (see Fig. 5). The symptoms of Barré-Lieou syndrome were not induced by this procedure. Metrizamide-enhanced CT scans were performed in 16 patients with Barré-Lieou

of symptoms to operation ranged from one to 69 months (average 14 months).

Anterior cervical discectomy and fusion at C3/4 was carried out in all 21 cases. Sixteen had operation at C3/4 level only. In five cases the clinical findings and myelograms indicated additional procedures at other levels: anterior discectomy and fusion was also performed at C4/5 in four cases and at C5/6 in one. The operative findings at C3/4 were disc extrusion in 12 cases, and disc protrusion in nine.

Fig. 10

Case 3. A 45-year-old man had a neck injury in a motor vehicle accident three years six months earlier, and was referred with Barré-Lieou syndrome. A defect in the C4 root sleeve was clearly shown on the left oblique view on myelography and the metrizamide CT scan demonstrates a lateral disc prolapse compressing the left cervical nerve root.

syndrome: in two cases only, it showed a lateral disc prolapse at C3/4, (Fig. 10). In the remaining 14 patients there were no definite findings.

Neurological deficits of C4. The patients with Barré-Lieou syndrome were examined for C4 deficits. In 30 cases (75%) there was impairment of sensation in C4 segmental distribution, especially in the suprascapular region. Of these 26 had disturbance of touch, pain and temperature sensations, the other four having disturbance of pain and temperature sensations but no loss of touch. Muscle testing was performed in 32 cases, of which 29 showed some weakness of combined shoulder and scapular movement: this was of MRC Grade 3 in 15 and Grade 4 in 14.

Operative treatment. Twenty-one patients (six female and 15 male) of the 40 with Barré-Lieou syndrome were treated by surgery; the age at operation ranged from 18 to 64 years (average 40.7 years). The interval from the onset

Table I. Levels of defects in cervical root sleeves on the special oblique projections in 40 patients with Barré-Lieou syndrome

	C4	C5	C6	C7	Number of cases
Traumatic origin (n = 35)	Bilateral				7
	Left				6
	Right				7
	Bilateral	Bilateral			1
	Bilateral	Right			1
	Left	Left			2
	Right	Right			2
	Right	Bilateral			1
	Bilateral		Bilateral	Bilateral	1
	Bilateral		Right		1
	Bilateral		Left	Left	1
	Bilateral	Bilateral	Bilateral		1
	Left	Bilateral	Bilateral		1
	Left		Bilateral		1
No history of trauma (n = 5)	Left				3
	Bilateral			Left	1
	Left		Bilateral		1

Review. Twenty patients were reviewed from 13 to 45 months after operation (average 30 months). Excluding tinnitus, symptoms had settled after an average of 3.7 months (range one to seven months). Tinnitus had also settled in all patients under 50 years of age at the time of the operation, while in three of the seven patients over 50 tinnitus had decreased gradually, but not as rapidly as the other symptoms. In 19 patients at final follow-up, all of the symptoms of Barré-Lieou syndrome had disappeared, but one patient aged 54 years still had slight tinnitus.

In the patients who had not had an operation, at an average follow-up of 24 months (range five months to eight years), the symptoms of this syndrome had continued.

DISCUSSION

The plain radiographs showed no significant difference, allowing for age and cervical injury, between the 40 cases with Barré-Lieou syndrome and the 40 without. Only the vertical oblique views in cervical myelograms were markedly different in the two groups as regards a defect in the image of C4 nerve root sleeve.

The findings at myelography and at operation were of lateral soft disc herniations at C3/4; these did not exert pressure directly on the spinal cord, but on the C4 nerve root and especially on its ventral root.

In the autonomic nervous system, C4 nerve root communicates with the superior cervical ganglion of the sympathetic chain through a communicating branch of postganglionic fibres (Pick 1970; Romanes 1972; Warwick and Williams 1973; Chusid 1985). It seems possible that irritation of the C4 nerve root by a soft disc herniation affects this communicating branch, resulting in symptoms related to the sympathetic nervous system.

The symptoms of Barré-Lieou syndrome could then be explained as follows:

1. Headache may result from spasm of the internal and external carotid vessels.
2. Vertigo may be caused by ischaemia of the brain produced by sympathetic vasoconstriction of the internal carotid artery and its intracerebral branches.
3. Tinnitus may be produced by sympathetic stimulation of the caroticotympanic nerve which derives from the internal carotid plexus.
4. Ocular symptoms could be explained either by the influence of the internal carotid plexus on the ciliary muscles, causing interference with their normal regulation, or by reduced blood flow in the ophthalmic artery.
5. Facial pain may be related to the fact that the superior carotid ganglion has communicating branches with the facial nerve and the trigeminal ganglion.

The bilateral nature of the symptoms could be explained by the transverse branches which connect the sympathetic trunk on one side to the other.

Patients with Barré-Lieou syndrome tend to develop secondary symptoms such as restlessness, irritability, and inability to concentrate. Such symptoms may become chronic; careful assessment of such patients is required before considering an operation.

Early improvement after operation is usually seen in facial appearance, with the disappearance of oedema and decrease of wrinkles. Restlessness and irritability improves gradually during the first postoperative month; some patience is required during this period, and recovery tends to be slower in patients with a long history. Patients with root symptoms at other than C4

may continue to complain of cervicobrachialgia after the Barré-Lieou syndrome has settled, but these symptoms usually improve with time.

The vertically oblique view, in metrizamide myelography is useful to help differentiate between Barré-Lieou syndrome and neurosis or malingering. Four patients with normal findings on myelography, who had

Table II. Levels of defects in cervical root sleeves on the special oblique projections in 40 patients with neck injury but no Barré-Lieou syndrome. No patient showed a defect at either C3 or C4

Diagnosis	C5	C6	C7	C8	Number of cases
Neck pain and radiculopathy* (n = 27)	Left				3
	Right				5
	Left	Bilateral	Bilateral	Right	1
	Left	Left			1
		Left			5
		Right			2
		Bilateral			1
		Bilateral	Left		1
			Bilateral		1
			Right		1
Radiculomyelopathy (n = 7)			Left		2
	Right				1
	Right	Left	Left		1
	Right	Bilateral			1
	Bilateral				1
	Bilateral	Left	Bilateral	Left	1
		Left			1
		Bilateral			1
Acute central spinal cord injury† (n = 4)	Left	Bilateral			1
		Bilateral	Right		1
		Bilateral	Bilateral		1
Brachial plexus injury (n = 2)			Right		1
				Right	1

* four patients showed no defect

† one patient showed no defect

had doubtful symptoms for a long time after a whiplash injury settled in the long term after the reassurance of normal findings.

The treatment of patients with Barré-Lieou syndrome has been difficult because of the lack of evidence for firm diagnosis. Our results, especially in terms of the

gratitude of the patients, indicate that careful investigation and treatment can be rewarding.

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