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DIAGNOSTIC DIFFICULTIES IN LOWER CERVICAL SPINE DISLOCATIONS

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INTRODUCTION

The object of this paper is to point out the risk of overlooking fractures and dislocations in the lower part of the cervical spine and to describe a reliable diagnostic technique.

Ebbehøj, in 1942, said that "there are mainly three reasons why fractures of the spine are overlooked: (1) The trauma has not been considered sufficient to cause a fracture of the spine. (2) The primary symptoms have not been so violent as to suggest to the doctor a possibility of fracture. (3) The X-rays taken have been insufficient, not visualizing the injury. This third reason may be avoided when bearing in mind that: A positive X-ray finding means much, at times everything, in the diagnosis; a negative finding means something; but a negative finding in a poor X-ray exposure means nothing at all".

Others (*Braakman & Vinken* 1967, *Norton* 1962) have pointed out that in an X-ray examination of the cervical spine it must be secured that all the vertebrae are visualized, since not uncommonly a dislocation of C 6 on C 7 or of C 7 on T 1 will be overlooked, because this region is superimposed by the shoulders in the lateral view.

It must be admitted that by the current standard exposures of the cervical spine in patients with acute injuries it is not always possible to reveal dislocations between the lower cervical vertebrae. These diagnostic difficulties are illustrated by the following two case histories.

CASE REPORTS

(B 142,621). A man, aged 50, was admitted to a surgical department after having fallen 5 metres from a roof, hitting the back of his neck against the ground. He was complaining of severe pain at the back of the neck. X-rays of the cervical spine

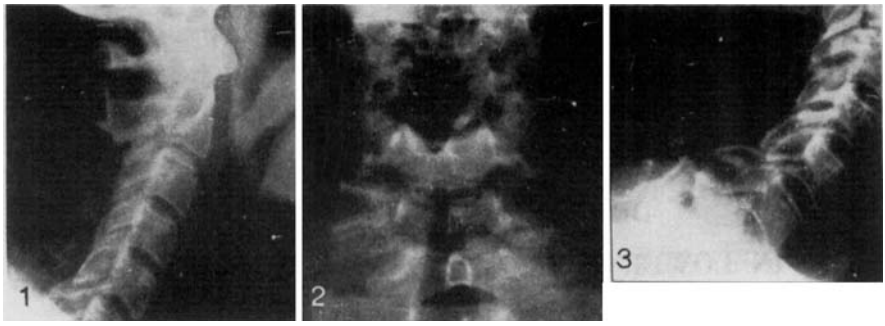

Figure 1. Lateral view taken in the recumbent position at the primary examination of Case 1.

Figure 2. Anteroposterior view taken in the recumbent position at the primary examination of Case 1.

Figure 3. Lateral view taken of Case 1 in the erect position 11 weeks later.

revealed a fracture of the spinous process of C 2. Objective examination of the limbs did not show any neurological abnormalities. After 11 days in hospital he had out-patient massage treatment of the back of the neck, but as this aggravated the pain he stopped attending. Owing to persistent pain, and to the appearance of paraesthesiae and a feeling of weakness in the right hand, he was referred to the Orthopaedic Hospital—6 weeks after the accident. Here the findings were a severe restriction of movement in the cervical spine and hypalgesia radially on the right hand, but no other neurological abnormalities. New X-rays of the cervical spine in 4 projections, and special views of the uppermost vertebrae again showed normal appearances apart from a blurred fracture of the spinous process of C 2. The lateral view, as in the primary exposures, showed the appearances only down to C 6 because of the superimposed shoulder (Figure 1). In the anteroposterior and oblique views the structures of the lowermost cervical vertebrae were somewhat blurred, but this was interpreted as spondylotic changes. To immobilize the neck a plastic collar was fitted. At follow-up, 11 weeks after the accident, the pain has disappeared. Objective examination still showed mild hypalgesia dorsally at the root of the right index finger, and now a striking prominence of the spinous process of C 7 was noted. Therefore, further X-rays were obtained. In the lateral view it was now possible to visualize also C 7, and this disclosed total dislocation between C 6 and C 7 with displacement which measured four-fifths of the width of the vertebral body and an angulation of 40° (Figure 3). The patient was now admitted and treated with Crutchfield skull traction for 2 months. Thereby the angulation was abolished, and gradually the two vertebrae fused anteriorly. After-treatment by plaster collar and later by plastic collar. 9 months after the accident the site was stable; there was restricted mobility in the neck, but no neurological abnormality, and the patient went back to work as a butcher.

(B 148,871). A man, aged 36, was admitted to a surgical department with symptoms and signs of mild concussion after a motor accident. On the third day he complained

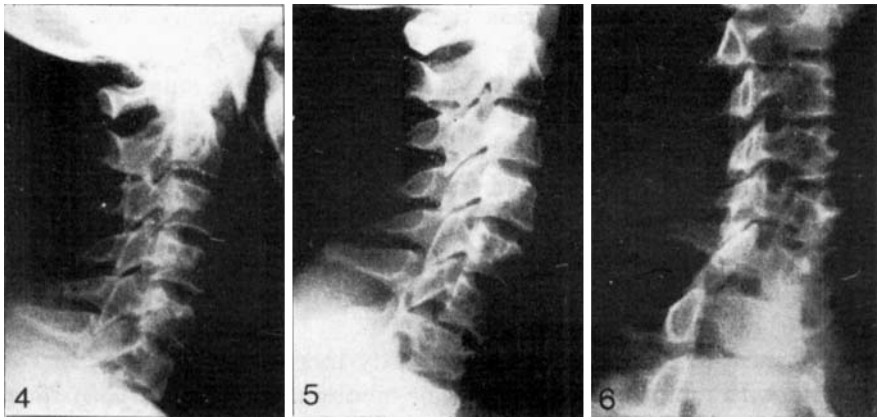

Figure 4. Lateral view taken in the recumbent position at the primary examination of Case 2.

Figure 5. Lateral view taken 4 months later of Case 2 in the erect position.

Figure 6. Oblique view taken 4 months later of Case 2 in the erect position.

of pain at the back of the neck and in the right shoulder, so that the cervical spine was X-rayed. The films showed no abnormalities (Figure 4). He was discharged on the 15th day. The pain persisted, and the patient developed paraesthesiae of the right index and long fingers and a feeling of weakness in the right arm. As these symptoms continued, he was referred to the Orthopaedic Hospital 4 months after the accident. No neurological abnormalities were found, but there was considerable limitation of movement in the cervical spine and a striking prominence of the spinous process of C 7. Renewed X-ray examination now gave a good survey, also in the lateral projection, revealing a dislocation between C 6 and C 7 with displacement of almost half the width of the vertebral body and an angulation of 25° (Figure 5). Oblique views showed that the dislocation was only left-sided (Figure 6). The vertebrae had already fused by a bony bridge anteriorly, and the site was stable, so treatment was not felt to be indicated. However, the patient was kept off work for another few months.

DISCUSSION

These two case histories constitute an alarming memento that even severe injuries to the cervical spine may be overlooked because of lacking perspicuity in the current X-ray views. As it is important to treat dislocations of the cervical spine, attempts must be made to diagnose them during the acute phase. For this reason, the value of the X-ray examinations will be discussed. First, mention will be made of the incidence, causes, and lesion mechanism in dislocations and fractures

of the cervical spine, whereas the therapeutic problems will not be discussed.

Injuries to the spine are very common, but only a small percentage affect the cervical part. From 1947–1951 *Trojaborg & Bryndum* (1959) found that among 1035 spinal injuries only 7 per cent were cervical. 2½ per cent of the injuries were pure dislocations, and these occurred only in the cervical spine. Cervical spine lesions are most commonly localized in the area between C 4 and C 7. In a study of 77 forward dislocations in the area C 3–T 1 *Ramadier & Bombart* (1967) found 36 to be localized between C 6, C 7, and T 1.

In respect to the aetiology, the greatly increasing incidence in connection with motor accidents must be mentioned. *Brooks* (1933) found that 12 per cent were due to motor accidents and 50 per cent to falls. For the period 1946–1955 *Durbin* (1957) found traffic accidents to be responsible in almost 30 per cent, falls in roughly 30 per cent, and diving into shallow water in 20 per cent. During the period 1950–1959 *Norton* (1962) found 70 per cent to be due motor accidents, only 15 per cent to falls, and 10 per cent to diving into shallow water.

As patients involved in traffic accidents often have multiple injuries, several of which cause more striking symptoms than does a mild affection of the cervical roots, a cervical injury is particularly apt to be overlooked in these cases unless the patient is examined for this very purpose.

In an analysis of the detailed mechanism of lesion to the cervical spine *Holdsworth* (1963) found that a pure flexion trauma most often results in a wedge-shaped fracture of the vertebral body without an attendant injury to the interspinous and supraspinous ligaments and that, accordingly, these fractures usually do not cause instability. Flexion-rotation traumas cause primary rupture of the posterior ligaments and secondarily perhaps dislocation, occasionally complicated by fracture. When the posterior ligaments have ruptured, the site is unstable. *Holdsworth*, therefore, pointed out the importance of a clinical examination for injury to the posterior ligaments and comparison with good X-rays. *Durbin* (1957) too mentioned the importance of the posterior ligaments to the stability. In order to demonstrate injuries to these ligaments, he recommended lateral X-rays in flexion, with caution and with the assistance of a doctor.

In experiments on cadavers *Beatson* (1963) found that—to produce dislocation of both articular facets—the interspinous ligament, both joint capsules, the posterior longitudinal ligament, as well as the an-

nulus fibrosus had to be destroyed. He also found that displacement of less than half the width of the vertebral body was invariably connected with unilateral dislocation and that a displacement of more than half the width of the vertebral body was tantamount to bilateral dislocation. From his study it may be deduced that from the lateral X-ray views alone it can be decided whether a unilateral or bilateral dislocation is present, while oblique views are required to disclose which side is dislocated in unilateral cases.

It is extremely important to differentiate between these two degrees of dislocation as soon as possible, as the risk of a severe, perhaps irreversible, cord or root damage is far greater in bilateral than in unilateral cases (*Braakman & Vinken* 1967). It is by no means an invariable rule for a cervical spine injury to cause neurological symptoms; this occurs in only about half the cases. Therefore, the remaining, large percentage will risk neurological damage, if the spinal lesion is not diagnosed and treated.

The ordinary X-ray examination of the cervical spine includes only anteroposterior and lateral views. In a cooperative patient in the erect position all the cervical vertebrae may be visualized in these views. If the patient is X-rayed in the recumbent position, it is considerably more difficult to prevent superimposition by the shoulders upon the lower cervical vertebrae in the lateral exposure (Figure 7). If the patient is the victim of an accident or in pain the difficulty is increased. If, furthermore, there is damage to the cervical spine, the patient will inevitably keep the muscles of the region so fixed that the shoulders become superimposed upon the area distal to C 6 (Figures 1 and 4). This has also been demonstrated by *Towne* (1933) in a patient with an overlooked dislocation of C 6 on C 7. The AP view is of no particular value in disclosing a possible dislocation. It is true that in the case of unilateral dislocation there may be a usually very slight lateral displacement of the shadow of the spinous process of the forward dislocated vertebra, but this does not apply in the case of bilateral dislocation (Figure 2). Oblique views may be of value in revealing a dislocation, but it is rather difficult to assess the lower vertebrae in this projection, and the exposures require quite some manipulation with the patient.

Therefore, the lateral view is decisive in the acute situation, but it has its weakness in respect to the lowermost vertebrae. Only *Braakman & Vinken* (1967) have mentioned tomography as the last resort in making a diagnosis of unilateral dislocation of C 7 on T 1. However, as

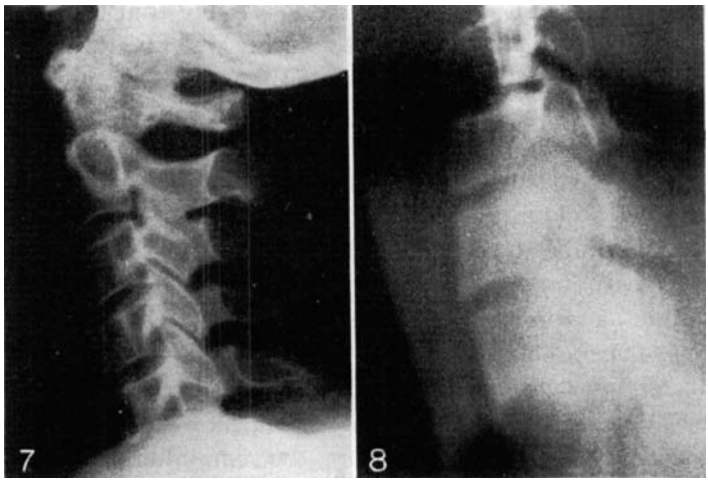

Figure 7. Lateral view taken in the neutral recumbent position of a healthy man with hefty shoulders. Nota that only the 5 uppermost cervical vertebrae are visible.

Figure 8. Example of lateral tomography of C 5, C 6, C 7, and T 1. Same person as shown in Figure 7.

it is important not to move an injured patient more than absolutely necessary, it seems to the present author more advisable to supplement the examination immediately by a couple of tomographic views of the lowermost cervical vertebrae in the sagittal plane, if the conventional laterals are not sufficiently informative (Figure 8).

CONCLUSIONS

(1) Dislocations and fractures of the cervical spine are increasing in frequency with the increasing number of traffic accidents.
(2) The symptoms and signs of these injuries are often slight in relation to those of other injuries that may co-exist, and there need not primarily be neurological signs.
(3) Even total dislocations between the lowermost cervical vertebrae may be overlooked because of the difficulties of radiological survey in this region in the sagittal plane.
(4) Therefore, the current projections must be supplemented by a couple of lateral tomographic exposure, in the event of lacking perspicuity.
(5) Lateral views during flexion must be obtained, if there is a sus-

picion of injury to the posterior ligaments, as such a lesion causes instability between the vertebrae concerned.

SUMMARY

On the basis of two cases in which dislocations of C 6 on C 7 had been overlooked during the first stay in hospital, the author reviews the incidence, causes, and mechanism of injuries to the cervical spine. The radiographic possibilities of diagnosing dislocations between the lowermost cervical vertebrae are discussed, considering that the shoulders are superimposed upon this region in ordinary laterals taken in the recumbent position, especially of an injured patient who fixes the muscles in the region of the neck. It is recommended to use tomographic lateral views to secure the diagnosis immediately at the first examination.

RESUME

Sur la base de deux observations où une dislocation entre les vertèbres cervicales 6 et 7 avait passé inaperçue lors de la première hospitalisation, il est étudié la fréquence, les causes et le mécanisme des lésions de la colonne cervicale. Il est discuté des possibilités radiologiques pour poser le diagnostic de la luxation entre les vertèbres cervicales inférieures, reconnaissant le fait que les épaules jettent une ombre sur cette région sur les radiographies latérales ordinaires prises chez un malade accidenté couché dont les épaules et la partie du cou sont fixés. Il est recommandé d'utiliser des prises latérales tomographiques afin de s'assurer que le diagnostic puisse être posé dès le premier examen.

ZUSAMMENFASSUNG

Auf Grundlage von zwei mitgeteilten Krankengeschichten, wo eine Verrenkung zwischen C 6 und C 7 bei der ersten Krankenhausaufnahme übersehen worden war, sieht man die Häufigkeit, Ursachen und Mechanismen von Bescadigung der Halswirbelsäule durch. Die röntgenologischen Möglichkeiten einer Diagnose der Luxation zwischen den untersten Halswirbeln wird in der Erkenntnis, dass die Schultern diese Region auf gewöhnlichen Seitenaufnahmen in liegender Stellung, besonders bei dem beschädigten Patienten mit fixierter Schulter-Halsregion verdunkeln. Man empfiehlt tomographische Seitenaufnahmen zu machen, um die Diagnose gleich bei der ersten Untersuchung zu sichern.

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