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FRACTURE OF THE SPINE

Follow-up on a Material Treated by Early Mobilization

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A fracture of a vertebral body occurs partly by pure compression, as when falling on the feet, but as a rule the compression is associated with hyperflexion, more rarely lateral movement or hypertension of the spine. Depending upon the severity of the trauma, there may be involvement of the disc, posterior and anterior longitudinal ligaments, the interspinal ligaments, the articular processes, and the arch—and this is where the risk of displacement of the fracture and cord lesion comes in.

Unstable fractures are most often encountered in the cervical spine. In *Koskinin & Nieminin's* (1967) material of 159 patients with fracture of the cervical spine, 55 had neurological signs, two-thirds of whom had cord lesions.

In the dorsolumbar spine unstable fractures and cord lesions are rare, as may be seen also from our series. But in *Griffith's* (1966) material of numerous severe traffic accidents cord lesions were present in almost 10 per cent.

The stable fractures of the vertebral bodies in the dorsolumbar spine have been treated according to changing principles. In the 20's and 30's the principles of Watson Jones, Davis, and Böhler predominated. These principles were reduction with fixation of the spine in plaster in a hyperextended position for 2 or 3 months. Early mobilization was used. The plaster jacket was followed by a canvas back support for yet another 2 or 3 months.

Gradually, however, there has been a modification of and a change in the attitude to the treatment, as it was realized *firstly* that the reduction does not hold, X-ray follow-up after some years showing renewed collapse (94 per cent recurrences in *Baab's* (1966) material

and in 21 out of *Savastona's* (1960) 25 patients), *secondly* that the results in the fractures affecting the dorsal spine, which are very difficult to reduce, are just as good as those in reduced case, and *thirdly* that the late sequelae, in the form of pain, are not due to the compressed vertebra. This change in the attitude is due partly to Magnus, who already in the 30's advocated bed rest, never using reduction or canvas back support, and later to Nicoll who in the 40's recommended functional treatment consisting of bed rest for 2–3 weeks, support under the back, and simultaneous physical training in the form of extension exercises of the long back muscles. He used this treatment in mild, stable compression fractures, without any attempt at reduction.

Most subsequent authors have adopted Nicoll's principles, but in many places hyperextension jackets, or merely canvas back supports, are still in use (*Baab* 1966, *Howorth* 1956, *Savastona & Pierik* 1960), although they delay rehabilitation of the back muscles and thus increase the duration of disability, as also pointed out by *Nicoll* (1948).

Our series was treated exclusively by the principles of Nicoll, and in the follow-up study we tried to assess the primary results as well as the results at longer sight.

THERAPEUTIC REGIME

In uncomplicated cases of spinal fracture we put the patient to bed with a veneer sheet beneath the mattress and administer analgesics of the acetylsalicylic acid group combined with codeine or caffeine.

If there is no suspicion of cord lesion, if we have the impression that the fracture is stable, and if the posterior margin of the vertebral body is radiologically intact, we start training of the back on the second day and, soon after, rolling in bed. The physiotherapy follows the principle that the back should be kept extended during all movements and exercises. Gradually as the exercises no longer cause pain, they are rapidly replaced by new ones, until complete mobilization.

At discharge the patients are advised to continue doing the exercises at home or on an out-patient basis in a physical medicine clinic until no pain remains. The radiological findings were not routinely checked during the stay in hospital.

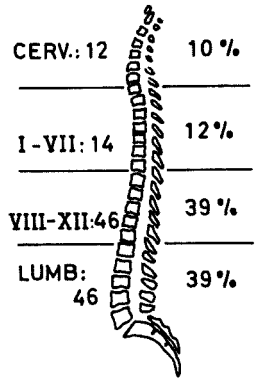

Figure 1. Distribution by site of 118 fractures in 104 patients.

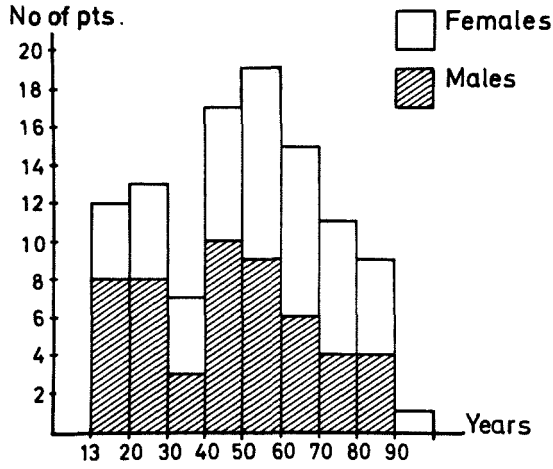

Figure 2. Age distribution curve.

PRESENT INVESTIGATION

During the period 1, January 1960 to 1, November 1967, a total of 113 patients with fracture of the spine were admitted to Surgical Department R of the Gentofte Hospital, Copenhagen. Primarily, we excluded 9 diagnosed as sequelae to spinal fracture or suspicion of spinal fracture. The former group had primarily been treated elsewhere, often by other principles. In all cases diagnosed as only suspicion of spinal fracture it was not possible to confirm the diagnosis at follow-up.

Figure 1 lists the localization of the fractures in the remaining 104 patients. The dorsal spine is divided into an upper segment from the 1st–7th and a lower segment from the 8th–12th dorsal vertebra. In the upper part there is great stability because of the thoracic cage (*Koskinen & Nieminen* 1967), and it is difficult to reduce these fractures. The 104 patients had a total of 118 fractures. 92, or 78 per cent, affected the lower dorsal and lumbar spine, with a distinct maximum at the 1st lumbar vertebra. The cervical and upper dorsal spine were affected in 10 and 12 per cent respectively.

The age distribution is presented in Figure 2. Fracture of the spine is a fairly common occurrence in elderly and aged persons due to senile osteoporosis (*Nicoll* 1948). In our series the sex ratio is equal.

Table 1. 104 patients with following types of fracture.

Compression fractures of vertebral body	91
Fracture of vertebral body with avulsion	25
Isolated fracture of the transverse or spinous process	9
Fracture of arch	5
Dislocation	8

Table 1 gives the distribution by type of fracture. It is apparent that by far the greater part of the fractures were compression fractures of the vertebral bodies. In 23 out of 25 fractures of vertebral bodies with avulsion there was also compression fracture.

Table 2. Cause of accident (104 patients).

	No. of pts	%
Traffic accident	29	27
Fall from heights	37	36
Sporting accident	8	8
Diving in shallow water	1	1
Miscellanous	29	28

In Table 2 the causes of the injuries are listed. Falls from heights, the largest group of 37 patients, or 36 per cent, is a motley group comprising severe working accidents with falls from great heights as, for instance, from a scaffold, a pylon, or the like as well as typical home accidents with falls from kitchen table, stool, or down a staircase. Traffic accidents were responsible in approximately one-quarter of the cases. Sporting accidents, especially riding, were to blame in

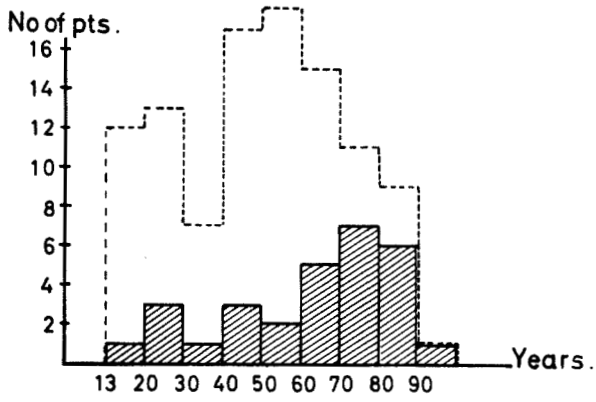

Figure 3. Age distribution for patients without adequate trauma (total of 29 patients).

8 per cent. In 29 cases (28 per cent) there had been no adequate trauma. In two cases these fractures occurred in patients on steroid medication, and a young man of 23 had a spontaneous fracture of the spine. Subsequent medical investigation, however, has given rise to a suspicion of hypercalciuria. In the great majority of cases, however, the spinal fractures with a non-adequate trauma were observed in elderly and aged subjects. The role of senile osteoporosis is apparent from the age distribution curve on Figure 3 which shows a marked preponderance of aged persons as compared with the age distribution curve for the material as a whole (top of the Figure).

Table 3. Number of concomitant lesions (104 patients).

Craniocerebral injury	22
Chest injury	6
Abdominal injury	4
Renal injury	8
Injury to limbs	12

In 67 cases the spinal fracture was an isolated injury. Table 3 lists the number and nature of complicating injuries. Craniocerebral trauma predominates. Renal injury was recorded in the presence of gross or microscopic haematuria. Seven patients showed, on the first days after the accident, a state of subileus of a paralytic type.

Among patients with fractures of the cervical spine there were 4 cases of permanent and 2 cases of transient pareses. Paraesthesiae

and sensibility disturbances were permanent in 4 cases and transient in 2. Sphincter disturbances were not observed in patients with fractures of the cervical spine.

Out of the 46 patients with fractures of the dorsal spine one patient had transient and one a permanent paralysis. Two had transient and one permanent sphincter disturbances.

Of the 46 patients with fractures of the lumbar spine two had transient and none permanent paralysis. Two had transient and three permanent paraesthesia, and one patient had transient and one permanent sphincter disturbances.

Out of the 104 patients 13 had died at the time of follow-up, including two who succumbed to their spinal fracture. The histories of these two patients will be briefly summarized below.

Case record 1085/60. A 21-year-old man admitted after having dived into shallow water. Immediately after the accident he had felt remote and had experienced respiratory distress. After admission he complained of weakness and paraesthesia in both arms. X-rays of the cervical spine showed compression fracture of the bodies of the 5th and 6th cervical vertebrae. The posterior margins formed a posteriorly sharp angle on each other, projecting into the cervical canal. The patient was transferred to a neurosurgical department where he was treated by extension on the skull. During his stay there he died of large emboli in the main branches of the pulmonary artery.

Case record 1997/65. An 80-year-old man was admitted after having fallen (3 m) from a pear tree. On admission there was amnesia for the accident. Flaccid pareses of both legs and a loose spinal fracture at the 12th dorsal vertebra. X-rays revealed a compression fracture of the 12th dorsal vertebra with slight lateral displacement and some diastasis between the spinous processes. He was transferred to a neurosurgical department and later to the Physical Medicine Hospital at Hornbæk. He remained a wheelchair patient and was incontinent for urine until he died of decubitus and septicaemia 6 months after the accident.

Sixteen patients could not be traced. Thus, the follow-up comprised 75 patients. The follow-up periods are listed in Table 4.

Table 4. Follow-up period.

5 mths	1
6–12 mths	9
1–2 yrs	10
2–4 yrs	27
4–8 yrs	28

The follow-up study aimed at elucidating the results of individualized, early mobilization in the treatment of fractures affecting the vertebral bodies of the dorsal and lumbar spine. This applied to a total of 86 patients, only 2 of whom had isolated avulsion at the anterior margin of the vertebral body.

Table 5. Fractures of the vertebral body of the dorsolumbar spine. Primary results (86 cases).

Bed rest		Physiotherapy		Period off work	
<1 wk	12	<2 wks	21	<1 mth	15
1–2 wks	39	2–4 wks	30	1–2 mths	32
2–4 wks	30	4–8 wks	16	2–3 mths	9
>4 wks	4	>8 wks	12	>3 mths	10

Primary results (Table 5): The figure gives the number of weeks in bed, the duration of the physiotherapy, and the period of work in cases where these factors are known. 59 per cent had been immobilized for less than 2 weeks. Among 66 patients with compression fracture of the dorsolumbar spine included in the follow-up, 15 had returned to work in less than one month and a total of 47 patients (71 per cent) in less than 2 months. Many patients had no physiotherapy after discharge, but 16 continued for up to 8 weeks and 12 for more than 8 weeks after the accident. The symptoms and signs at follow-up in 66 patients with compression fracture of the dorso-lumbar spine were backache, episodes of sciatica, and back fatigue, tenderness of back muscles, restricted mobility, and a positive Lasegue (Table 6), back fatigue and backache being the predominant symptoms in half and one-third respectively. The total assessment of subjective complaints and working ability is given in the same Table. At the time of follow-up 36 patients were entirely symptom-free and 19 had slight complaints. These 19 patients had a normal working ability, but had intermittent vertebral symptoms, especially in the form of fatigue. It was a characteristic finding that these symptoms would occur after strain beyond the daily routine. In view of their working ability and general condition in daily life, they must be considered as cured, although the ability of the back to tolerate strain is reduced. Nine patients had more severe complaints. These patients had almost daily symptoms in the form of backache or back fatigue. Some of them, but far from all, have had intermittent, but invariably short periods

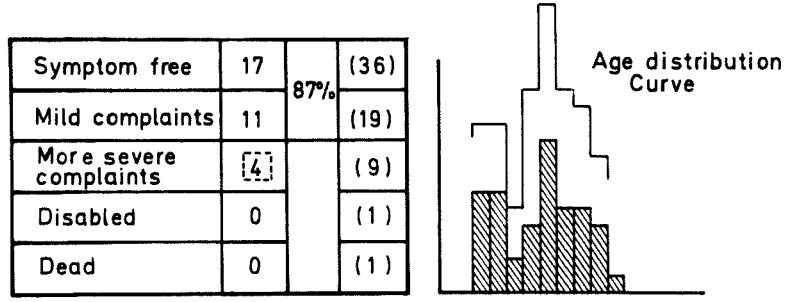

Figure 4. Fractures of the vertebral body of the dorso-lumbar spine immobilized for less than 2 weeks. Late results, 32 (42) cases.

of illness. A few have undergone rehabilitation, changing from heavy to lighter work. A few female patients had given up their employment. One patient is disabled and one (Case record 1997/65) has died.

Table 6. Fractures of the vertebral body of the dorsolumbar spine. Late results 66 (86) cases.

Symptom-free	36	83 %	Backache	21
Mild complaints	19		Episodes of sciatica	10
More severe complaints	9		Back fatique	31
Disabled	1		Tenderness of back muscles	12
Dead	1		Restricted mobility	11
			Positive lasegue	4

Thirty-two patients of the follow-up material who had been immobilized for less than 2 weeks and who had no history of other spinal disorders were considered separately (Figure 4). Out of these patients 87 per cent were symptom-free or had mild complaints, although 4 had more severe complaints. This is somewhat better than for the group as a whole (Table 6). The age distribution curve shows that the patients were immobilized without regard to age. Out of the 4 patients with more severe complaints, 3 had been followed for less than a year. By way of comparison, it may be mentioned that out of 8 patients followed for less than a year, 3 had severe complaints as compared with 6 out of 46 followed for more than 2 years. One of the 3 patients, moreover, has a postulated compensation case which clearly influences the complaints. The fourth patient has been followed for 18 months. This patient, a young man who plays football without complaints, changed his occupation from T.V. mechanic to precision mechanic because of his back. In retrospect, on the basis of our

criteria, there does not seem to have been, in any of these 4 cases, a reason for longer-lasting immobilization. Among the remaining 5 patients of the total group with more severe complaints, 3 have had neurological signs. The disabled patient had a severe fracture of the dorsal spine with a gibbus. He had pre-existing abnormal kyphosis and spondylotic changes.

Table 7. Fractures of the vertebral bodies of the dorsolumbar spine. Radiological sequelae (53 X-rayed pts).

Kyphosis	Gibbus	Scoliosis	Block-vertebral	Second narrow of disc.	Second spondyl.	Visible seq.
18	6	9	2	12	25	53
Fractures of the bodies of the dorsolumbar spine immobilized for less than 2 weeks (26 X-rayed pts).						
10	2	3		6	7	26

At follow-up, X-rays of the spine were obtained in 53 of the patients with fracture of a vertebral body. The films showed in all cases radiological sequelae of the fracture. Indeed, this was to be expected, as no form of reduction had been performed. In addition, there was in some cases abnormal kyphosis, gibbus, and scoliosis, block vertebrae, secondary narrowing of the disc, and secondary spondylosis (Table 7). Gibbus, scoliosis, and secondary spondylosis were rare among patients immobilized for less than two weeks. The late results in patients with radiological sequelae, when disregarding gibbus and scoliosis, do not appear to be poorer than in the total series.

Moreover, it was found that patients with fairly heavy work (a total of 23) have a somewhat poorer prognosis, 80 per cent being symptom-free or having mild complaints as compared with 92 per cent of 40 patients with lighter work. Patients with a heavier type of work have been off work longer, 50 per cent having returned to work within 2 months as compared with 86 per cent of the patients with lighter manual work.

Patients in the age group 40–59 years (20 patients) were off work longer than those of the age group 13–30 (17 patients), 5 of the former group being off work for more than 3 months as compared with one patient of the young group. Four patients of the older group had severe complaints and one was disabled, as compared with 2 patients with severe complaints in the age group 13–30 years.

DISCUSSION

Our results, i.e. an average cure rate of 83 per cent, must be considered satisfactory and corresponds to the results obtained by others (*Hansen & Villumsen* 1959, *Savastona & Pierik* 1960). No better results can be obtained by temporary application of a hyperextension jacket (*Baab* 1966) or by surgical spinal fusion (*Howorth* 1956). The final result cannot be assessed until 2 years have elapsed (*Savastona & Pierik* 1960), as is also apparent from our series. Rather than advising a canvas back support or belittling the patient's complaints, one should refer them for physiotherapy, possibly preceded by massage and heating, as emphasized, *inter alios*, by *Nicoll* 1948.

Traffic accidents will go on making up an ever-increasing part of the causes, in our series 25 per cent, but in *Griffith et al.'s* (1966) almost 50 per cent. Their material was from an area with heavy and fast traffic. *Griffith et al.* found the most common site of the fracture to be the 6th dorsal vertebra, and this applied especially to young patients who often had severe concomitant injuries.

The radiological changes of secondary spondylosis, disc degeneration, and kyphosis found at follow-up did not entail poorer results, but scoliosis and gibbus formation showed perhaps somewhat poorer results than the average. However, the numbers involved are too small for statistical analysis.

From our material it is clearly apparent that frequently the duration of bed rest may be restricted to less than 2 weeks without compromising the late result. From talks with the patients at follow-up, it seems beyond doubt that the quality of the physiotherapy and in particular the patients' understanding of its importance and of observing it daily through many months is the alpha and omega of the treatment, as is also emphasized by Nicoll and by Watson Jones.

SUMMARY

A material of 104 patients with fracture of the spine is submitted. Out of these patients, 86 had fractures localized to the bodies of the dorso-lumbar spine. The treatment was individualized early mobilization and physiotherapy. The primary results as well as the late results on the basis of a follow-up study are reported.

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