ROENTGENOLOGICAL EXAMINATION OF THE FUNCTION OF THE LUMBAR SPINE

Summary of Thesis

By

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The purpose of this investigation was to elucidate the question whether radiologically demonstrable disturbances in the statics and dynamics of the lumbar spine are due to an affection of an intervertebral disc, when other morphological changes can be ruled out. This question is of particular interest in the presence of dysfunction of the mobile segments without radiographic signs of secondary disc reactions.

The literature on radiographic examination of the mobility of the lumbar spine in series of normal subjects and patients is reviewed, and the technique used in the present investigation is described. During the exposures the patient is placed in the sitting position, and is requested to perform active extreme flexions of the spine, both in the frontal and the sagittal plane. During these movements, the normal spine forms a smooth harmonic curve with acute angles between the vertebral bodies, whereas patients with the lumbago-sciatica syndrome reveal an irregular curve of the spine with characteristic abnormal intercorporal angles and instability of the spine. The sources of error to which the technique is subject are discussed.

For the purpose of comparison, the absolute mobility of the individual mobile segments of the total spine was measured, the flexibility being expressed by the size of the intercorporal angles. This evaluation was performed on subjects who had no symptoms from the low back or from the lower extremities, and who did not present any radiographic signs of patho-anatomical changes in the spine.

The segmental mobility and the total flexibility were determined in the frontal plane in 29 subjects and in the sagittal plane in 33 subjects; the average age of both groups was 34.8 years. The angles obtained were compared with the results reported by other authors in similar studies. It is seen that the absolute angles decrease in the supine position and increase in the standing position, whereas the relative values for the

mobility of the individual segments in the same lumbar spine are practically constant in spite of differences in the experimental conditions. This observation underlines the importance of the discs and the regional ligaments in the function of the spine.

The control group consisted of a total of 120 symptom-free subjects of an average age of 36.7 years; the ages of 71 of these subjects ranged from 30 to 49 years. Of all the 600 lumbar segments examined in the control series, 80 revealed abnormal conditions in the functional examination, including 48 which showed abnormal angulation, but were otherwise of normal appearance; 18 segments also showed decrease in the height of the disc and/or instability; 14 segments with marginal osteophytes showed normal function. With a few exceptions, abnormal mobility was demonstrated exclusively in the fourth and fifth lumbar segments.

Functional examination did not reveal abnormalities in 43 control subjects; 35 showed nothing definitely abnormal, while dysfunction and reactive disc changes were observed in 42.

The series with lumbago-sciatica comprised 120 patients of an average age of 40.8 years; the ages of 88 of these ranged from 30 to 49 years. Radiographic routine examination in the supine and lateral positions showed no abnormalities in 62 patients, whereas signs of secondary disc lesion were observed in 58 patients with involvement of 96 segments. The two caudal segments showed the highest incidence of involvement.

Functional examination revealed dysfunction in 316 of the 600 lumbar segments. Abnormal function was observed in 240 of about 500 segments of normal appearance and in 76 of 96 segments with reactive changes. Normal function was seen in 20 segments of the spondylitis deformans type. The number of radiographic signs of mobility disturbances and of abnormal segments increased caudally, where dysfunction was most frequently present both in the frontal and the sagittal plane. More than two thirds of the dysfunctional segments of normal appearance were fourth or fifth segments, and all caudal segments with secondary disc reactions were dysfunctional.

Of 65 discs with decrease in height, 25 were disclosed exclusively by the functional examination; this decrease in height was thus due to stress; 18 of these were localized to segments of normal appearance and 20 to the two caudal segments.

Of 31 unstable segments, 13 were of normal appearance, and 18 showed secondary changes; instability involved L4–5 and L5–S1 in 27 cases.

Of the 120 patients with lumbago-sciatica, 118 revealed abnormal segmental function, while two did not present any definite abnormalities.

Thus, in both series, the frequency of lumbar segments with abnormal mobility and of radiographic signs of segmental dysfunction increased caudally, where disc degeneration is known to be most frequent. This observation applies both to segments with reactive disc changes and to those of normal appearance. Moreover, lumbar dysfunction was significantly more frequent in patients with the lumbago-sciatica syndrome than in symptom-free subjects, and it was an almost constant finding in these patients. Disc degeneration occupies a central position in the pathogenesis of the lumbago-sciatica syndrome. It is therefore reasonable to assume that the discal component is also of importance in the dysfunction in these patients, especially when the discoligamental factor is also considered.

The mechanism of abnormal angulation is discussed; it is emphasized that the articular process is of importance for the pathological segmental function in the dorsoventral direction. Looseness, primarily arisen dorsally in the segment with secondary instability, will most frequently lead to forward displacement of the vertebral, i.e. anteposition, whereas a lesion ventrally will usually result in backward displacement, i.e. retroposition. The musculoligamentous system of the segment will promote or inhibit such displacements of the vertebra.

In order to throw further light on the numerical correlation between segmental dysfunction and lumbar disc degeneration, the results of the functional examination were compared with the findings in myelography and/or operation on patients with the lumbago-sciatica syndrome who were suspected of herniation of a lumbar disc.

A total of 96 myelograms from 88 patients showed herniation of 78 intervertebral discs in 69 patients. A total of 91 discs were explored in 58 patients; herniation was present in 66 segments. Both in myelography and at operation, two thirds of the herniations were found in segments of normal appearance; the remaining third also showed reactive disc changes. Normal function was observed only in 4 of the 78 segments with myelographic herniation and in only 5 of the 66 segments in which operation revealed herniation. Thus, dysfunction is often observed in segments with verified herniation, which is the sequela of disc degeneration.

The number of radiographic signs of disc degeneration in segments with herniation varies from one to five. Neither the number, nor the

combination, nor the lateralization of these signs makes it possible with certainty to locate the site of the herniation. In the presence of monotopical segmental changes, the functional examination may be of value in diagnosing the level of the herniation.

Thus, the results of the present investigation render it likely that the disturbances in the statics and dynamics of the lumbar segment which are demonstrated in patients with lumbago-sciatica are usually manifestations of a disc degeneration, also in cases in which the mobile segment is otherwise of normal appearance.

The indications and contra-indications for functional radiographic examination are discussed, and it is emphasized that this examination should always be initiated with anteroposterior and lateral exposures taken of the patient in the sitting position. This modified form of routine examination offers certain diagnostic and technical advantages and may, in certain cases, render the functional examination superfluous, since the latter is intended to supplement, but not to replace, the routine examination.

Functional examination performed secundum artem is a valuable diagnostic aid in the demonstration of degeneration of intervertebral discs of the lumbar spine.

REFERENCE

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