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POST-PNEUMONECTOMY SCOLIOSIS

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Thoracogenic scoliosis may be caused by changes in the thoracic wall proper or in the pleural cavity.

Orthopaedic surgeons have mainly focussed their interest on post-thoracoplasty scoliosis, whereas investigations of the spinal changes following pneumonectomy are curiously enough few in number (Groot 1971). This is presumably due to the fact that post-surgical examinations have centred primarily on the possible recurrence of the cancer, whereas the severe physiological and anatomical disturbances as a result of the pneumonectomy have been considered comparatively unimportant.

The object of the present study was to examine the degree and the frequency of one of the many post-surgical consequences of shrinkage etc. in the pneumonectomy cavity, viz. scoliosis of the thoracic spine.

MATERIAL AND METHODS

Thirty-four patients who had undergone pneumonectomy 2–8 years previously were examined. At the time of operation the patients were from 16 to 71 years old, with an average age of 55 years. There were 28 men and six women. One patient could not be examined because of severe lung insufficiency. The material thus comprises 33 patients.

Each patient was questioned about back troubles and was examined clinically and radiologically. Three X-ray photos were taken of the spine on a 90 × 30 cm film, one standing and two sitting, with right and left ischial tubercles elevated respectively. The maximum amount of scoliosis is indicated by its summit = apex, and its extent by the top and bottom vertebrae of the scoliosis.

The degree of the scoliosis was evaluated by measuring the angle of the curve a. m. Cobb (1948). The rotation of the scoliosis was likewise evaluated a. m. Cobb (1948), graded 0, +, ++, +++, depending upon the rotation of the spinous process from the centre line (Table 1).

Operative procedures

Twenty patients underwent a left-sided pneumonectomy and 14 a right-sided pneumonectomy. The operation was carried out through the 5th or 6th intercostal space without costal resection. With this entry the costo-transverse ligaments are often divided. After the operation the pleural cavity spontaneously fills itself during the first post-operative days with adjustment of possible pressure increase to avoid dislocation of the mediastinum.

Two patients had post-operative empyema, and one of these was later subjected to thoracoplasty.

RESULTS

Subjective complaints

Only three patients complained about pains in the muscles of the back. Five patients complained about pains in the shoulder spreading to the arm. Three patients, one man and two women, felt cosmetically inconvenienced by the development of scoliosis.

Only complaints attributable to the spine are reported here.

Objective findings

On ordinary clinical examination, 31 patients showed a mild to moderate degree of scoliosis. None had more severe scoliosis. The scoliosis was convex towards the unoperated side, except in two patients, in whom the curve was directed to the side operated. The shoulder had sunk by 1–4 cm on the side of the pneumonectomy in 26 patients. Nine patients had a slight rotation towards the side of the pneumonectomy on bending forward.

Radiological findings

Twenty-three patients had a scoliosis of a mild degree (5° to 20°) (Table 1). In 21 it was fixed. Usually it extended only 4 to 5 vertebrae. All of the patients had mobile compensatory secondary curves below and above the major curve. Twenty-one patients showed no rotation, whereas 10 patients demonstrated a rotation of degree + +.

No changes (congenital anomalies, metastases) were observed which could explain the development of the scoliosis, and no scoliosis was noted on the pre-operative chest X-ray. The significance of this must be taken with a certain reservation, as milder cases of scoliosis can escape notice on these films.

Three patients are not included in the tables. One patient with left-sided pneumonectomy had an S-shaped scoliosis, dextro-convex, of the

thoracic vertebrae 5–10. It was not possible to establish which of the curves was the primary one. Two patients showed a scoliosis which was convex towards the operated side. One of them had had a post-operative empyema and later underwent thoracoplasty. This patient had an angle of scoliosis of 5°. The other one underwent a left-sided pneumonectomy and developed a sinistro-convex scoliosis of 17°. It was not possible to find any explanation of this extraordinary observation.

Table 1. Distribution of patients according to severity of the thoracogenic scoliosis.

Number of patients	Angle of scoliosis
7	0°– 5°
9	5°–10°
10	10°–15°
4	15°–20°
Total 30	

Table 2. Distribution of patients according to apex of angle of scoliosis.

Number of patients	Apex of angle of scoliosis
2	C 7
0	Th 1
4	Th 2
5	Th 3
13	Th 4
4	Th 5
2	Th 6 and further down

DISCUSSION

Bisgard (1934) described two different types of scoliosis, those which develop in the thoracic wall proper and those which develop from changes in the thoracic cavity, the so-called pleural scoliosis.

The most studied scoliosis in the first group is the thoracoplastic type where the convexity is directed towards the operated side and which has a rotation directed towards the concavity (Dwork et al. 1951, James 1967, Loynes 1972, Stauffer & Mankin 1966). Bisgard in 1935 produced scoliosis in animals by thoracoplasty, and Langenskiöld & Michelsson (1962) brought about progressive scoliosis in animals by

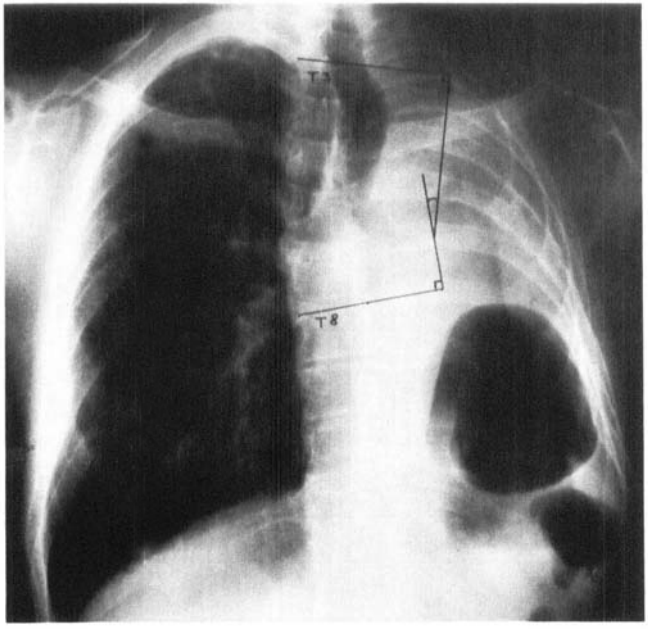

Figure 1. Typical X-ray of a patient who had undergone pneumonectomy on the left side. Severe changes as a result of shrinkage of the pneumonectomy cavity can be clearly seen. The angle of the scoliosis is superimposed.

removing the posterior part of some ribs. They stressed the significance of the costotransverse ligaments as important for the development of this type of scoliosis.

Pleural scoliosis is caused by the post-operative intrathoracic changes. After a pneumonectomy the cavity is filled with blood and exudate. This becomes connective tissue which subsequently shrinks and exerts traction on the surrounding organs and spine. The resulting scoliosis away from, and a mild rotation toward the operated side can be explained by the fact that the pulling forces mostly affect the weakest part of the thoracic spine. Thus the spine will curve over the operated hemithorax.

This is, however, not in accordance with Bisgard (1935) who thought that the effect on the spine is produced through the ribs which approximate laterally due to the pulling forces. This transfers a pressure on the spine to which the ribs are fixed.

The incidence of scoliosis in normal people over 50 years of age is 6 per cent (Vanderpool et al. 1969). All our post-pneumonectomy patients had scoliosis which must be ascribed to the operation. Only a

single previous investigation seems to have dealt with the occurrence of scoliosis following pneumonectomy (Groot 1971).

It is impossible to judge from the post-operative films how quickly the scoliosis develops and for how long it progresses. In the thoracoplasty scoliosis, it seems to appear a few days after the operation and to progress over several years (Bisgard 1934, Loynes 1972).

All of the scolioses examined by us are of the mildest degree according to the Scoliosis Research Society's classification (0°–20°) (Keim 1972).

Because of the slight difference in age of the patients nothing can be said about the influence of age on the scoliosis. In an examination of 67 pneumonectomy children under 18 years of age Groot (1971) found no scoliosis in 30 per cent. Forty per cent had an angle of scoliosis of less than 15°. Eighteen per cent had an angle of scoliosis between 15° and 30°, and 12 per cent had an angle of scoliosis of more than 30°. In children developing scoliosis the angle seems to be a little larger than the angle shown in our adult cases. In the thoracoplasty patients there does not seem to be any connection between age and degree of scoliosis (Dwork et al. 1951, Loynes 1972).

Our patient who had undergone thoracoplasty after pneumonectomy did not develop a pleural scoliosis, but a thoracoplasty scoliosis of 5°. Bisgard (1934) cites examples where pleural scoliosis can be corrected or possibly over-corrected by thoracoplasty.

In conclusion it may be said that pneumonectomy patients almost inevitably develop scoliosis high up in the thoracic spine with the convexity towards the unoperated side. The scoliosis appears as a link in the shrinking processes following a pneumonectomy. From a functional point of view the scoliosis does not seem to have caused problems for the patient.

SUMMARY

Thirty-four post-pneumonectomy patients have been examined from 2 to 8 years after operation. Ninety per cent of the patients showed a mild scoliosis high up in the thoracic spine with the convexity towards the unoperated side and with slight or no rotation.

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