SURGICAL TREATMENT OF CHRONIC INFECTIVE LESIONS OF THE SPINE

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Evaluations of the conservative treatment of spinal tuberculosis have shown how disappointing the results can be. The inefficiency of posterior spinal fusion is acknowledged and is accepted as a hindrance to anterior bony fusion. The exclusion of antibiotics from established tuberculous abscesses prevents their influence in such cases (Florey, 1954), and they are ineffective when their use is not supported by operation (Stevenson, 1954; Wilkinson, 1954).

Adoption of the direct surgical approach in chronic infective spinal disease has facilitated isolation of the organism and assessment of antibiotic sensitivities. Also the occurrence of staphylococcal and coliform spinal infection has become more apparent.

The results of surgical treatment of spinal tuberculosis in this hospital have been gratifying enough to merit a detailed consideration.

Material

Seventy-two patients who have had direct surgical evacuation of infective spinal lesions have been reviewed.

Aetiology.—Fifty-two (72%) of these lesions were proved to be tuberculous. Three (4%) were due to *Staphylococcus pyogenes* and four (5.5%) to *Escherichia coli* infection. One lesion was probably caused by *Brucella melitensis*. Twelve lesions were thought to be tuberculous, but attempts to isolate the organism failed.

Distribution (Fig. 1).—The distribution of lesions is similar to that in other reported series (Fraser, 1929). The age distribution differs from that of Hodgson and Stock's (1960) series in that the proportion of adults to children is higher. There were two double lesions—one

Fig. 1.—Distribution of chronic infective lesions of the vertebral column in 72 cases reviewed.

cervical and thoracic, and another thoracic and lumbar—a factor always to be considered in tuberculosis.

Diagnosis.—Clinical and radiological examinations were supported by Mantoux reaction, differential white-blood-cell count, and erythrocyte sedimentation rate. Staphylococcal antibody titre and antistreptolysin titre were also useful in diagnosis. Operation findings and the pathology of excised tissue have been examined.

Radiology.—Radiological findings were studied in all cases. Lateral tomograms were of great value, particularly in the thoracic region, in assessing the extent of cavities pre-operatively, and in deciding whether bony fusion had occurred afterwards. Post-operative x-ray films were taken, and repeated after two and four months and thereafter at six-month intervals until fusion occurred.

Treatment

The niceties of antibiotic therapy, such as duration and dosage, and the period of recumbency and ambulant spinal support were studied. Especial attention has been paid to the time between the operation and the patient's return to work.

The criteria of Swett, Bennett, and Street (1940) were accepted for "cure": true healing was diagnosed only when bony fusion could be demonstrated between the vertebral bodies.

Pre-operative Management

Operation is only an incident in the treatment of spinal caries. When the diagnosis of an infective lesion of the spine had been established, the patient was nursed in a plaster bed. A provisional pre-operative diagnosis of tuberculosis was made in all cases and appropriate doses of antibiotics given: streptomycin 1 g. daily; para-aminosalicylic acid (P.A.S.) 15 g. daily; isoniazid 300 mg. daily.

When reactions occurred to one drug another of similar action was substituted—for example, dihydrostreptomycin and calcium benzamidosalicylate. Antibiotics were given for eight months as a rule.

In several cases the disease had been treated at this or another hospital before operation was undertaken, and diagnosis had been confirmed for 10 years in one case.

Operation

Approach (Table I).—The two cervical lesions were approached anteriorly. Of 52 thoracic lesions 31 were treated by costotransversectomy and 21 by transthoracic route. Two patients treated by transthoracic route had

TABLE I.—Operative Approach in 72 Cases

Location of Lesion		Operation	
Cervical	2	Anterior approach	2
Thoracic	52	Transthoracic approach	21
		Costotransversectomy	31
Lumbar	18	Loin anterior approach	9
		Transversectomy	9

TABLE II.—Operative Findings

Age-group	Total Cases	Para-vertebral Abscess	Sequestrum	Granulations	Pus
0-9	6	5	4	4	5
10-19	13	10	3	6	5
20-29	16	14	7	7	9
30-39	13	15	8	8	5
40-49	13	9	6	5	6
50-59	6	4	2	2	2
60-69	5	5	3	3	1
Total	72	62	33	35	33

previously had costotransversectomies elsewhere, but the operation had not given sufficient exposure to eradicate the disease. In 18 patients with lumbar disease nine were treated by transversectomy and nine were exposed retroperitoneally. One patient treated by transversectomy was re-explored twice and sequestra were removed; the disease is now quiescent.

Findings (Table II).—A paravertebral mass was present in 62 patients, but only 33 (44%) contained pus.

FIG. 2.—Diagrammatic representation to show how pleural thickening may cast a soft-tissue shadow on an anterior radiograph.

In the remainder the mass consisted of granulation tissue or thickened connective tissue. The paravertebral shadow on x-ray examination gave no indication of the extent of the bony disease found at operation. In some cases the size and thickness of the mass did not explain the extent and density of the radiological shadow. Thickening of mediastinal pleura may account for radiological opacity (Fig. 2). In the cavity of the vertebral body itself a sequestrum was removed in 33 cases (44%).

Post-operative Care

Intercostal drainage was continued for several days after transthoracic operations. Patients were nursed in a plaster bed for an average period of four months post-operatively. If no further destruction had occurred a spinal support was provided for three months and the patient mobilized even before fusion and incorporation of grafts. The average time between operation and return to work was 11 months; the longest 22 months and the shortest seven months.

Results

Follow-up

Only one death was recorded, in a patient aged 22 months, one day after costotransversectomy for extensive tuberculosis involving the upper six thoracic vertebrae; this case is not included in the follow-up.

All patients were reviewed clinically and radiologically. The longest follow-up was 12 years and the shortest 12 months. The length of follow-up was longer after costotransversectomy or transversectomy than after anterior approaches owing to the novelty of the latter procedures.

The incidence of fusion between two or more vertebral bodies after evacuation of infective material and insertion of anterior spinal grafts was high and the rate of incorporation rapid. This was more apparent in the lumbar lesions, which had a longer follow-up.

Cervical Lesions.—One lesion fused without complications, the other was quiescent.

Thoracic Lesions (Transthoracic Approach) (Table III).—In all 21 patients the lesions were quiescent and 15 were healed. The average follow-up was 18 months; the longest 32 months, and the shortest 12 months, and both these cases had fused.

Thoracic Lesions (Costotransversectomy) (Table IV).—All 31 cases were quiescent and 20 had fused. Four showed further collapse after operation, but these had not fused.

Lumbar Lesions (Loin Approach) (Table V).—All nine were quiescent and seven were healed. One patient developed increasing deformity after operation, but there was no interbody fusion in this case.

Lumbar Lesions (Transversectomy) (Table VI).—All nine were quiescent and seven were healed. None showed further collapse after operation.

Complications of operation included sinus formation in eight cases after costotransversectomy, temporary pleural effusions in seven cases after costotransversectomy and transthoracic approach, wound infection in one case, and one haemothorax. No sinus persisted for longer than seven months and five were healed within three months. The pleural effusions responded to aspiration except in one case after transthoracic exploration, where it became infected in a patient with a positive Kahn reaction. A fibrous pleurisy resulted and pulmonary decortication was necessary.

TABLE III.—*Transthoracic Approach*

Age-group	No.	Quiescent	Fusion	Increased Deformity
0-9	1	1	1	0
10-19	4	4	2	1 not fused
20-29	1	1	0	0
30-39	5	5	2	0
40-49	5	5	5	0
50+	5	5	5	0
Total ..	21	21	15	1

TABLE IV.—*Costotransversectomy*

Age-group	No.	Quiescent	Fusion	Post-operative Collapse
0-9	3	3	1	1 not fused
10-19	5	5	3	0
20-29	9	9	6	1 not fused
30-39	5	5	3	" " "
40-49	5	5	3	" " "
50+	4	4	4	" " 0 "
Total	31	31	20	4

TABLE V.—*Lumbar—Anterior Approach*

Age-group	No.	Quiescent	Fusion	Increased Deformity
0-9	1	1	0	1
20-29	3	3	2	0
30-39	3	3	3	0
40-49	1	1	1	0
50+	1	1	1	0
Total ..	9	9	7	1

TABLE VI.—*Transversectomy*

Age-group	No.	Quiescent	Fusion	Post-operative Collapse
10-19	4	4	4	0
20-29	3	3	2	0
40-69	2	2	1	0
Total ..	9	9	7	0

TABLE VII

Approach	Grafted	Fused	Not Grafted	Fused
Cervical	1	1	1	0
Transthoracic .. .	21	15 (70%)	—	—
Costotransversectomy ..	8	6 (75%)	23	14 (60%)
Lumbar anterior approach	2	2 (100%)	7	5 (70%)
" transversectomy	4	4 (100%)	5	3 (60%)
Total	36	28 (77%)	36	22 (61%)

Bone Grafts (Table VII).—All the transthoracic cases had a rib-strut graft fashioned from the excised rib and 70% had fused. In the remaining thoracic and lumbar lesions autogenous bone chips from transverse process or iliac crest were used in 14 cases and 86% of these had fused, whereas only 61% of those not grafted showed interbody fusion. No cases of sinus formation or sequestration of the graft were seen.

Discussion

Early diagnosis is essential to obtain good results in the treatment of infective lesions of the spine. The aim is to prevent deformity, to avoid abscess formation and paraplegia, and to promote healing. Even with antibiotics conservative treatment of tuberculosis of the vertebral column rarely achieves all these objectives.

Removal of diseased tissue by surgery facilitates a firm diagnosis and assessment of antibiotic sensitivities. It prevents or arrests deformity and enables the causes of cord compression and abscess tension to be removed. Healing may be promoted by insertion of grafts.

Indications for Operation

Disease of adjacent vertebrae causing damage to intervertebral disks and concomitant mechanical instability merits surgery. The inaccessibility of abscesses to antibiotics is an added indication for surgical evacuation. Operation in cervical and thoracic lesions is more urgent than in lumbar ones owing to their extensive nature and more serious consequences at those levels. In children the disease is so rapidly destructive that early operation is advised. Paraplegia is a definite indication for operation.

Patients not responding quickly to conservative treatment require surgery. It may be that the wrong antibiotic is being given, as exemplified in staphylococcal and coliform lesions. It is also noteworthy that a persistent sinus from a psoas abscess will not heal permanently until the primary source of infection is healed.

The shorter recumbency after surgery is advantageous in old people and children, and infirmity is no contra-indication to operative treatment.

Operation is performed as soon as the patient is accustomed to a plaster-bed after two or three weeks of antibiotics, except when a trial of conservative treatment is appropriate or in cases of proved staphylococcal origin.

Surgical Approach

Cervical Lesions.—Peremptory conclusions from two cases are unjustified, but anterior approaches to such lesions are favoured since the introduction of techniques for the less accessible levels (Hodgson and Stock, 1960).

Thoracic Lesions.—Transthoracic exploration gives an approach to the lower nine thoracic and first lumbar vertebrae, and better access is obtained than by a costo-transversectomy approach. Insertion of rib grafts is facilitated. Contraindications to the transthoracic approach include extreme kyphosis (vertebral bodies at its apex are inaccessible anteriorly) and severe fibro-caseous pulmonary tuberculosis. These are indications for either the "anterolateral" approach or costotransversectomy. A lesion healed by bone anteriorly but active in posterior parts of the vertebral body is more easily removed by costotransversectomy.

Lumbar Lesions.—The second, third, and fourth lumbar vertebrae are approached extraperitoneally through an oblique incision as for kidney operations. For disease of the fifth lumbar and first sacral vertebrae an approach like that to the ureter is suitable. Lumbo-sacral lesions may also be approached transperitoneally through a midline suprapubic incision. A psoas abscess is a useful guide to the level of disease, for a communication with the affected vertebral body may be found high up in its wall.

The Operation

Removal of all the affected vertebral body (Hodgson and Stock, 1960) may be too radical, and excision of all bone containing granulation tissue is unnecessary provided that necrotic and sequestered material is completely removed and antibiotics cure any remaining disease satisfactorily.

Autogenous bone inserted into the exposed cancellous bed promotes healing, and the results show a small but distinct advantage in favour of grafting.

Summary

Seventy-two patients have been studied in whom direct surgical attack on chronic infective spinal lesions has been performed. Fifty-two lesions were tuberculous, three staphylococcal, and four coliform infections; the remainder were unproved. The majority of lesions affected the thoraco-lumbar spine.

Clinical diagnosis was especially supported by radiology, and lateral tomograms were of particular value in the thoracic region to assess the extent of the disease.

The pre-operative care and dosage of antibiotics has been established. The operative findings and results are reported: of 62 paravertebral abscesses explored only 33 contained pus. The post-operative care is considered, and the short period (average 11 months) between operation and return to work is noteworthy. Thirty-five (67%) of 52 thoracic lesions and 14 (78%) of 18 lumbar lesions are fused. The results of bone-grafting favour this procedure.

The indications for operation and its extent and the advantages and disadvantages for the anterior and posterior approaches are discussed in detail.

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A revised edition of the Medical Research Council's Special Report No. 253, *Tables of Representative Values of Foods Commonly Used in Tropical Countries*, by B. S. Platt, has now been prepared. Renumbered No. 302, it is obtainable from H.M.S.O., price 7s. net.