Posterior Fusion in Pott's Disease of Children

Şükrü Bayındır, M.D.*/ Gürbüz Baytok, M.D./Nejat Tokgözoğlu M.D.***/ Talat Göğüş, M.D.******

Tuberculosis, which still affects a large number of people, is a serious health problem in developing countries. In spite of steps that have been taken to fight it in recent years, all types of tuberculosis are still seen, including bone and joint tuberculosis, of which Pott's disease is the most common form in Turkey. Between 1961 and 1967 Pott's disease was diagnosed in 255 patients at Hacettepe Medical Faculty Orthopedics Department by clinical and radiological examination.

Chronic cases could not be detained at the hospital for long-term treatment, and only three or four beds were available for patients with skeletal tuberculosis. Since Hacettepe was originally established as a children's hospital, most of the cases diagnosed as Pott's disease seen here were in children, in whom the disease develops very rapidly especially during the early years, causing more severe deformities than in adults (Figure 1a and b) we were therefore forced to find some method of controlling the disease without keeping patients in hospital for long periods of time, in order to take full advantage of the small number of beds.

Generally, conservative methods of treatment to control Pott's disease were found insufficient, and long-term anti-tuberculosis medicines produced drug-resistant bacteria, [1-4] (Figure 2) we therefore found it necessary to resort to surgical methods to achieve our aim.

One such method of treatment, posterior fusion, combined with antibacterial drugs, was reported to give successful results. [1-5] On the other hand, it has been observed that when the lesion is attacked di-

---

From The Department of Orthopedics, Hacettepe University Faculty of Medicine, Ankara.

* Associate Professor and Chairman of the Department

** Specialist in Orthopedics

*** Associate Professor of Orthopedics

**** Specialist in Orthopedics

Figure 1 a: H.E., a 12-year-old girl. History of Pott's disease at least 8 years. Antero-posterior roentgenogram of vertebral column showing severe chest deformity.

rectly (i.e. by drainage of the abcess, curretage, debridement, sequestrectomy or any of these together with anterior fusion) better results may be obtained. [6-10]

In our opinion, instead of establishing the use of one routine method of treatment, it appears more reasonable to treat each individual patient by the method best suited to his case.

Bearing all this in mind, we used surgical methods of treatment, selecting posterior fusion in most cases, the results of which are discussed below.

Materials and Methods

Our series consisted of 255 patients with spinal tubercolusis studied during the years 1961-1967. We were able to accept only 112 of the 185

Figure 1 b: Lateral roentgenogram of same patient as in Figure la. Many vertebrae are involved causing severe kyphosis.

patients who could have been treated; the remaining 73 either could not be accommodated because of the shortage of beds, or else they refused treatment. Out of the 112 who were treated, 71 were children and 41 were adults. In this study we are concerned only with the 71 children between the ages of 0 and 16.

TABLE I

SEX OF PATIENT

Sex	Number of Patients	Percentage
Boys	35	49.3 %
Girls	36	50.7 %
Total	71	100 %

Figure 2: M.B., a 38-year-old male. Symptoms started 35 years previously at the age of 3. In spite of repeated prolonged rest in plaster bed and anti-tuberculosis drug treatment, severe dorsal kyphosis is present.

All the diagnoses were made by clinical and radiological examination. Sex incidence is shown in Table I, and age incidence in Table II.

TABLE II

AGE OF PATIENTS

Age	Number of patients	Age	Number of patients
0	1	9	2
1	4	10	2
2	18	11	1
3	11	12	–
4	9	13	2
5	3	14	1
6	5	15	1
7	5	16	–
8	6		
		Total	71

The 71 patients who were hospitalized were mostly kept on bed-rest for three to four weeks, and to enforce this, small children were placed in leg or cervical traction. Following strict bed-rest, five of the 55 patients who showed no evidence of paraplegia were treated by conservative methods, one by abcess drainage, and 49 by posterior fusion. Of the latter 49, one patient also had abcess drainage and of the remaining 16 patients, all of whom had thorough paraplegia, three were treated by anterior decompression, and one of these by posterior fusion at a later stage; two had abcess drainage followed by posterior fusion, and 11 were treated by posterior fusion alone, bringing the total number of posterior fusions in paraplegic patients to 14. The various methods used are shown in Table III.

TABLE III

METHODS OF TREATMENT

Method of Treatment	Number of Patients
Conservative.....	5
Posterior fusion	59
Abcess drainage	1
Abcess drainage+Posterior fusion	3
Anterior decompression	2
Ant. decomp.+Post. fusion ..	1
Total	71

Conservative Methods: Following two to three weeks' bed-rest, patients were discharged from the hospital in plaster casts with prescriptions for anti-bacterial drugs. Three to four months later x-rays were taken to observe their progress; immobilization and anti-tuberculous treatment were continued for one year.

Abcess Drainage: For abcess drainage the method of Seddon was used. [9-11]

Posterior Fusion: After two or three weeks of bed-rest and anti-tuberculous treatment, marker x-rays were taken prior to surgery. Using these x-rays, the fusion area was considered to extend from one vertebra above to one vertebra below the diseased bones. For each vertebra, 150 cc of blood was prepared for transfusion at the time of the operation. To prepare the fusion area, the patient was given general anesthesia with endotracheal tubes, and placed in a prone position; the incision was then made over the affected area.

The soft tissues were dissected to expose the spinous processes and lamina, and fusion was done by a modified form of the Hibbs' technique,[1 11] using iliac bone grafts. The difference between this and the usual Hibbs' technique was that we left the spinous processes in place and decortication was done through these and the lamina. Ten to 12 days after the operation, the skin sutures were removed. In the case of cervical or upper-dorsal lesions the patient was placed in Minerva-type plaster cast immobilization. For dorsal lesions, body casts were used, and for lower thoracic and lumbar lesions hip spica casts. Anti-bacterial drugs were also prescribed for use after discharge from the hospital.

Antero-Lateral Decompression: The Capener technique [11 12] was used.

Whether the patients were treated by conservative or surgical methods, they were all given anti-bacterial drugs. These were: streptomycin 50 mg/Kg in daily doses for the first two weeks after admission, and twice weekly for four to six months thereafter. PAS 0.3 gr/Kg and INH 20 mg/Kg were also administered in three or four equal doses for at least a year.

Findings

The symptoms according to the family histories of the 71 patients studied in our series are shown in Table IV, and their symptoms between the time of onset and admission to the hospital are given in Table V.

TABLE IV

SYMPTOMS ACCORDING TO FAMILY HISTORIES

Age	Number of Patients	Age	Number of Patients
0	13	7	2
1	13	8	1
2	18	9	1
3	11	10	1
4	3	14	1
5	5		
6	2	Average Age	2.66

TABLE V

SYMPTOMS FROM TIME OF ONSET TO HOSPITAL ADMISSION

	No. of Patients	No. of Vertebral Affected
Disease began less than 1 year before admission	42	2.8
Disease began 1–3 years before admission	16	3.7
Disease began more than 3 years before admission	13	5

The involved area on the basis of radiological examination is shown in Table VI, the number of vertebrae in Table VII, and the angular deformity of the 54 patients showing gibbosity in Table VIII.

TABLE VI

AREA OF VERTEBRAL COLUMN INVOLVED

Area	No. of Patients	Percentage
Cervical	4	5.5
Cervico-dorsal	2	2.7
Dorsal	40	55.8
Dorso-lumbal	9	12.5
Lumbal	15	20.8
Lumbo-sacral	2	2.7
Total	72 *	100

TABLE VII

NUMBER OF VERTEBRAE AFFECTED

No. of Patients	No. of vertebrae affected	No. of Patients	(No. of vertebrae affected)
1	1	1	7
29	2	2	8
14	3	2	9
10	4	2	10
8	5		
2	6	Approx. % of vertebrae affected:	3.6

* One patient had two separate lesion areas.

TABLE VIII

DEGREE OF GIBBOSITY

No. of Patients	Degree of Gibbosity	Percentage
22	0° – 30°	41
18	30° – 60°	33
12	60° – 90°	22
2	90° – more than 90 %	4
54		

In 22 cases abcesses were revealed by x-ray examination, and six of these were also found by clinical examination. In 24 cases (33 per cent) lung lesions were found, 16 out of 71 (23.6 per cent) had paraplegia; and eight (9.4 per cent) were in the very early stages of paraplegia. None of our patients with neurological findings had any loss of sphincter function, nor did any patients have active fistulae.

Results

The average hospital stay for the patients treated was 62 days, the longest being 240 and the shortest four days. There were no postoperative deaths. To evaluate the results of long-term follow-up we invited our patients to return to the hospital at the beginning of 1967. Three of those who had been treated by conservative methods, 32 of the 63 who had had posterior fusion, and two of the three who had had anterior decompression, totalling 36 (50 per cent) responded to this call. The shortest follow-up was six months, and the longest six years, the average being 30 months. Follow-up time and results are shown in Table IX.

TABLE IX

FOLLOW-UP TIME AND RESULTS

Treatment	No. of Patients	Follow-up time	Results			
			Excellent	Good	Fair	Unsuccessful
Conservative	3	66 months	3	–	–	–
Post. fusion	28	29 "	25	1	2	–
Abcess drainage + Post. fusion	3	18 "	3	–		–
Ant. Decomp.	1	20 "	1	–	–	–
Ant. Decomp. + Post. fusion	1	18 "	1	–	–	–
Total	36	33	33	1	2	–

Subjective, clinical and radiological evaluations were made of all these cases, and the results were classified as excellent, good, fair and unsuccessful.

Excellent: No subjective complaints, no clinical findings with the exception of kyphosis, on radiological examination posterior fusion found to be complete, and the lesion to have healed.

Good: Some subjective complaints, but no clinical, laboratory or radiological evidence of activity.

Fair: Some subjective complaints, no clinical or radiological evidence of activity, but an increase in angular deformity of kyphosis of 10–15°.

Unsuccessful: Subjective complaints, clinical and radiological examinations revealing continued activity and an increase in the angular deformity of kyphosis.

Figures 3–4 show the x-ray films of some of the patients who were followed up.

The records of the 15 patients who did not respond to our invitation were also examined. Fourteen of these revealed that posterior fusion had been successful, and that all symptoms had disappeared. The remaining 21 (of whom 17 had had posterior fusion) did not return to the hospital for post-operative check-up.

Discussion

As we mentioned previously, tuberculosis is a public health problem in Turkey. In spite of the well-programmed BCG campaign that was launched in 1953, the statistics between 1960 and 1964 indicated that above the age of four years 2.5 per cent of the population had a prevalence for lung tuberculosis. Though this figure was reduced to one per cent by 1968,[13] it is still high, and in addition to these, cases of skeletal tuberculosis (which is a secondary infection) can be expected. It is also known that before the inoculation of infants post-primary type bone and joint tuberculosis can develop, and Pott's disease will therefore remain a serious problem in Turkey for years to come.

As shown in Table IV, the first years of life are clearly the most important in the development of Pott's disease, which indicates that in infants it is generally of the post-primary type. (Figure 5).

Figure 3a: a 2 ½-year old girl. Symptoms for at least 8 months, destroying L1-2.

Another important aspect of Pott's disease in children is the rapid destruction of the vertebral column in a short time, resulting in extreme deformities and neurological complications.[3 14] The reason for this is that the vertebral column is more cartilaginous in infants than in older children and adults. Diagnosis and treatment is very important to prevent such deformities and complications. (Figure 6). Table V shows that of the patients who came to the clinic within one year after the onset of the disease an average of 2.8 vertabrae were involved, of those who came within three years 3.7, and those who came after more than three years five vertebrae were affected. It was also found that the degree of kyphosis was related to the duration of the disease.

The localization of vertebral lesions in children was no different from that in adults. [2 15] (See Table VI).

Figure 3b: Same patient as in Figure 3a. Complete posterior fusion from D12--L3. Spontaneous anterior fusion has also taken place. This x-ray was taken 5 years after posterior fusion.

Before anti-bacterial drugs and surgical methods were developed for the treatment of Pott's disease, plaster bed immobilization was widely used for many years. After the discovery of anti-bacterial drugs it was thought that these, in combination with conservative methods, could control the disease and achieve more successful results; this method of treatment, especially in advanced cases, was still far from adequate, though, and a large number of our patients had already received this type of treatment before coming to our clinic. Early and selected cases, however, can be treated in this way.

If immobilization with drugs does not give successful results in a short time it should be discontinued, and one of the surgical methods should be used. If this is not done, anti-tuberculous drug resistant bacteria may

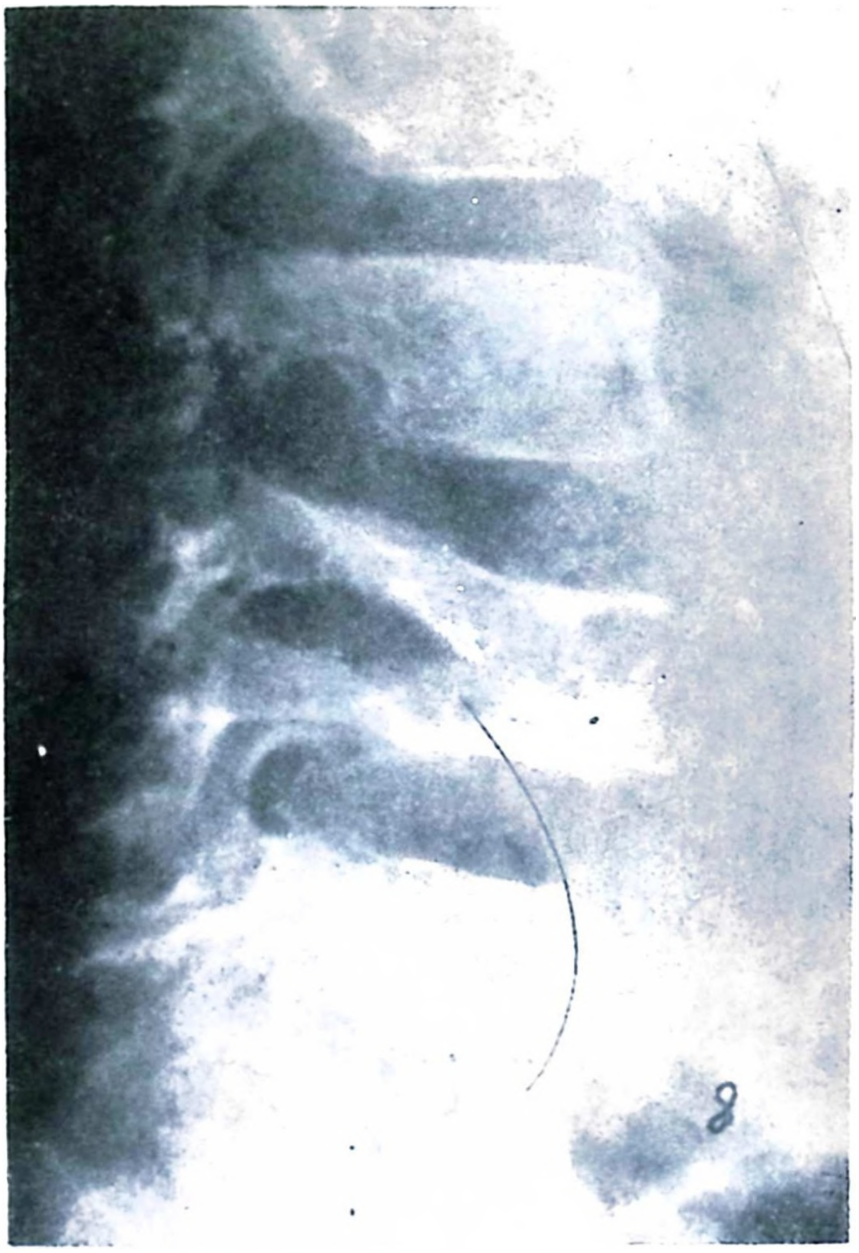

Figure 4a: SY., a 7-year-old boy. Symptoms for at least 3 ½ years destroying L3-4.

develop, and the disease would continue its chronic course for many years (Figure 2). The aim of the plaster bed and other types of external support is to immobilize the diseased area of the vertebral column. In this way an opportunity is given for uninterrupted, natural repair of the affected area. If anti-bacterial drugs are administered in addition to this, the repair can take place more rapidly. In fact, such immobilization is quite impractical, and can only be obtained by arthrodesing the diseased area to the healthy portion of the vertebral column. Posterior fusion methods have therefore been used since 1911.

Although this is a surgical method, it actually has precisely the same effects as conservative methods. Surgery directed at the lesion appears

Figure 4b: Same patient as in Figure 4a 3 ½ years after posterior fusion. Fusion is complete and spontaneous anterior fusion is taking place.

to be more radical and successful, but it is, of course, more complicated technically than posterior fusion, and it does not prevent an increase in kyphosis in children. Besides this, the literature supporting anterior fusion in children is inadequate.

We observed that in 42 of the 59 cases which could be followed where only posterior fusion had been performed, the fusion was complete and the lesion healed. Only two patients showed an increase in angular deformity of more than 10–15°, and in the cases which were followed up for long enough, anterior fusion had taken place spontaneously after posterior fusion (Figures 3 and 4).

In our experience, bed-rest is necessary for at least one month for children with paraplegic Pott's disease. At the end of this period, if paraplegia has not disappeared, or at least decreased considerably, antero-

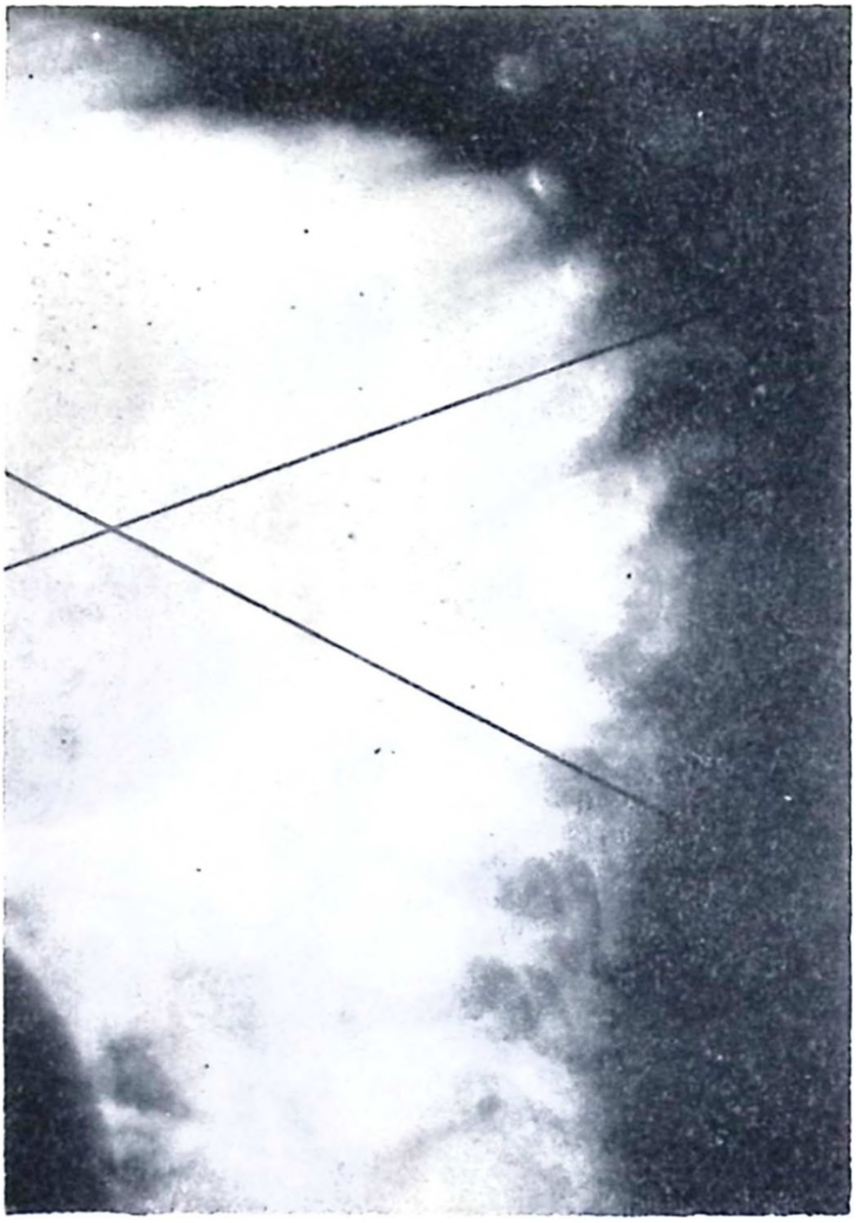

Figure 5: S.L., a 9-month-old girl. Symptoms for 4 months. Destructive lesion on 3 vertebrae (D11-12L1) seen in lateral roentgenogram.

TABLE X

THE RESULTS OF THE 16 CASES CURED OF PARAPLEGIC COMPLICATIONS

Treatment	No. of patients	excellent	good	fair	unsuccessful
Fusion corrected by bed-rest	11	11	–	–	–
" not corrected by bed-rest					
Ant. decomp.	2	1	–	–	1
Abcess drainage + fusion	2	2	–	–	–
Ant. decomp. + fusion	1	1	–	–	–
Total	16	15	–	–	1

Figure 6a: M.D., a 1 ½-year-old boy. Symptoms for at least 4 months. Pott's disease in the upper cervical region. Retropharangeal abscess and atlanto-axial subluxation are present.

lateral decompression should be performed. As we observed above, neurological findings returned to normal on bed-rest alone in 11 out of 16 cases. The other five patients required further treatment for paraplegia (three had antero-lateral decompression, and two had abcess drainage), and posterior fusion was performed on 14 out of the 16 at a later stage.

The necessity for antero-lateral decompression, abcess drainage and anterior fusion has been strongly supported by several authors, [6-10] but reviewing our results we found that this was not usually needed. Instead of going through complicated operations, bed-rest should be tried long enough to see whether any improvement occurs. If not, decompression operations can be performed on patients who have not lost their sphincter control at the time of admission. If paraplegia improves after bed-rest, posterior fusion should be performed in order to prevent the recurrence of paraplegia. During antero-lateral decompression, if stability is present with spontaneous anterior fusion, posterior fusion is, of course, unnecessary.

We wish to mention a few details regarding the posterior fusion technique we used. If the number of vertebrae affected was too great in child-

Figure 6b: The same patient as in Figure 6a. Lateral x-ray 3 ½ months after posterior fusion. Complete fusion and decrease in detropharangeal abscess is observed. Atlanto-axial subluxation was partially corrected during the operation.

ren under two years of age we found that the crista iliaca was not sufficient, and a bone graft was therefore taken from the tibial cortex. We also found that a modified form of Hibbs' posterior fusion technique was more successful. The aim of this modification was to increase the surface of the host area leaving the spinous processes intact, and decorticating these and the laminae. In this way, the grafts were placed in closer contact with the fusion area, so that a more complete fusion could take place in a shorter time.

It has been suggested that posterior fusion of the vertebrae may limit the movement of the spine and also effect its growth. It has been stated, however, that this suggestion has no practical value.[17]

We found that if a suitable method of treatment is chosen, Pott's disease in children can be controlled, and hospitalization can be curtailed. We would add that posterior fusion together with anti-bacterial drugs in both paraplegic and non-paraplegic patients proved to be a successful method of treatment.

Summary

An evaluation was made of 71 children between the ages of 0 and 16 with Pott's disease who visited Hacettepe Faculty of Medicine between 1961 and 1967. The location of the disease, the number of vertebrae affected and the ages of the patients are studied.

We found that Pott's disease develops extremely rapidly in the early years of childhood, with such complications as paraplegia and extreme deformity, and the importance of early diagnosis and treatment is emphasized.

The value of posterior fusion, which was performed on 63 of our patients, and its results are described. The value of conservative treatment by bed-rest in paraplegic cases is also shown. If, however, there is no improvement after one month, such surgical methods as antero-lateral decompression and abcess drainage were found to be necessary. It is also observed that when paraplegia disappeared after conservative and surgical treatment, its recurrence could be prevented by posterior fusion.

We suggest that if a modified form of Hibbs' technique is used, leaving the spinous processes in place and decorticating them with the laminae, posterior fusion is achieved more completely in a shorter time.

REFERENCES

1. Hibbs, R. A. and Risser, J. C.: Treatment of vertebral tuberculosis by the spine fusion operation. A report of 286 cases. A second series. Bone and Joint Surg. 10: 805, 1928.
2. Hallock, H. and Jones, J. B.: Tuberculosis of the spine, An end result study of the effects of the spine fusion operation in a large number of patients. Bone and Surg. 36-A: 219, 1954.
3. Cleveland, M., Bosworth, D. M., Fielding, J. W. and Smyrnis, P.: Fusion of the spine for tuberculosis in children. A long range follow-up study, Bone and Joint Surg. 40-A: 91, 1958.
4. Allen, A. R. and Stevenson, A. W.: The results of combined drug therapy and early fusion in bone tuberculosis, Bone and Joint Surg. 39-A: 32, 1957
5. Ege, R.: Vertebra tuberkulozu tedavisi ve tedavide fuzyon ameliyetinin değeri, Dirim 37: 399, 1962.
6. Ayral, F.: Spondilitis tuberkuloza tedavisinde ön yolla (debridment) ve fuzyonun değeri. Unpublished observation
7. Hodgson, A. R. and Stock, F. E.: Anterior spine fusion for the treatment of tuberculosis of the spine. The operative findings and results of treatment in the first one hundred cases, Bone Joint Surg. 42-A: 295, 1960.

8. Hodgson, A. R., Stock, R. E., Fang, H. S. Y. and Ong, G. B.: Anterior spinal fusion. The operative approach and pathological findings in 412 patients with Pott's disease of the spine, Brit. J. Surg. 48: 172, 1960.
9. Seddon, H. J.: Antero-lateral decompression for Pott's paraplegia, Bone and Joint Surg. 33-B: 461, 1951.
10. Seddon, H. J.: Pott's paraplegia and its operative treatment, Bone and Joint Surg., 35-B: 487, 1953.
11. Crenshaw, A. H. (Ed) Chapter 13 Vol. II, Campbell's Operative Orthopedics, 4th ed., C. V. Mosby Co. St. Louis, 1963, p. 942.
12. Capener, N.: The evolution of lateral rhachotomy, Bone and Joint Surg. 36-B: 173, 1954.
13. Başkök, C.: Türkiye'de tüberkülozun epidemiyolojik durumu ve dış ülkelerle kıyaslanma, Tüberküloz ve toraks mec. A. 15: 85, 1967.
14. Bosworth, D. M.: Treatment of bone and joint tuberculosis in children, Bone and Joint Surg. 41-A: 1255, 1959.
15. Ege, R.: Fuzyon ameliyatı yaparak tedavi ettiğimiz 74 vertebra tüberkülozuna ait özellikler, Tüberküloz ve toraks mec. 10: 19, 1962.
16. Albee, F. H.: Transplantation of a portion of the tibia into the spine for Pott's disease, J. A. M. A. 57: 885, 1911.
17. Hallock, H., Kermeth, C. F. and James, J.: Spine fusion in young children, Bone and Joint Surg. 36-A: 481, 1954.