TUBERCULOSIS SPONDYLITIS

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The most frequent site for extra pulmonary involvement of tuberculosis infection is the vertebral column. Percival Pott described tuberculosis of the vertebral column in 1877 as a kyphotic deformity of the spine associated with paraplegia[36]. Menard in 1894 described a series of patients with Pott's paraplegia successfully treated with decompression via costatransversectomy[26, 36]. Pott's disease is now infrequent in developed countries, but still constitutes a public health problem in underdeveloped countries.[2, 5-6, 9, 18, 43]

Prior to the era of antibiotics and improvements in general health, multisegmental involvement was thought to be the norm, usually diagnosed at the autopsies, but today involvement of more than one noncontiquous region of the spine is very rare[36]. The true incidence of primary posterior involvement is virtually unknown; however, the introduction of computerized tomography (CT) and magnetic extensive disease [3, 37].

Chemotherapy appears to be the mainstay in the treatment of tuberculosis. Only by the introduction of effective chemotherapy regimens could the mortality associated with the disease be controlled, and morbidity has been substantially decreased. Surgery in tuberculosis spondylitis is generally considered to be an adjuvant of effective chemotherapy. Indications for surgical treatment include 1) neurological involvement, 2) deformity and/or impending increase in deformity, and 3) the presence of large tuberculosis abscess and/or abundant necrotic tissue [28, 36].

Drainage and debridement of cold abscess has become popular after Hodgson and Stock since 1960[12]. The gold standard in practice today is probably radical debridement with anterior approach and anterior fusion with anterior strut grafts[36]. As spinal cord compression is usually located anteriorly, anterior approach and decompression is the preferred route for neural decompression[15, 36]. Satisfactory fusion rates have been reported with only posterior or anterior approaches[11-12, 16, 36, 42]. However, albeit in low rates, graft resorption can be seen in patients who had anterior or posterior fusion only, and kyphotic deformity due to asymmetric growth is probable in children[11, 29, 30, 32, 35]. Recently, posterolateral or transpedicular drainage without anterior drainage or posterior instrumentation following anterior drainage in the same session is offered as an alternative in attempts to avoid kyphotic deformity[11-12, 20, 32, 33]. Posterior instrumentation in addition to anterior fusion, sequential or staged is associated with increased morbidiy [24, 35]. Use of anterior instrumentation has been reported on a limited number of series. Oga and coworkers evaluated the

adherence capacity of mycobacterium tuberculosis to stainless steel and demonstrated that adherence was negligible, and the use of implants in regions with active tuberculosis infection may be safe[31]. Kostuik reported his experience on cases with healed or inactive disease[19]. Anterior plate fixation along with debridement and fusion of the active disease has been reported for a limited number of patients with active disease by the present author[5, 6].

Our prospective series of 63 patients with tuberculosis spondylitis were treated with anterior instrumentation along with anterior debridement and fusion was reported in 2002[7]. Analysis of the clinical and radiological results of these patients revealed that this procedure was associated with a very satisfactory rate of deformity correction as well as the maintenance of correction (Table-1). A very high rate of fusion could be achieved, with a negligible number of complications.

Anterior instrumentation in active tuberculosis infection is a relatively new concept, and the results of this study should probably be compared to those achieved with other modalities of surgical treatment as well as other reports on anterior instrumentation.

Indications for surgery in spinal tuberculosis are reported to include the presence of a large paraspinal abscess, the presence of severe bone destruction and kyphotic deformity, reurologic deficit with spinal cord compression, and lack of response to conservative treatment[33]. Posterior fusion had been the standard surgical procedure for the limited correction and prevention of progression of deformity in many centers before the safe and liberal use of anterior spinal surgery became feasible. However, posterior fusion does not appear to alter the naturel course of the disease process, pseudoarthrosis and bending of the fusion mass very frequently leads to substantial increase of the kyphotic deformity[2, 11, 40].

Anterior debridement without fusion in the treatment of spinal tuberculosis has been evaluated in MRC studies performed in Hong Kong and Bulawayo, demonstrating that the magnitude and the rate of progression of the kyphotic deformity was similar in patients who had no surgery, and were significantly inferior compared to anterior debridement and fusion[21]. Longitudinal follow-up of the same group of patients revealed that bony fusion occurred later in those who had anterior grafting compared to only debridement, but the rates of fusion were similar at five years[22]. Over ten years, debridement group exhibited mean increases in kyphosis of 9.8 degrees for thoracic and thoracolumbar lesions and 7.6 degrees for lumbar lesions, compared to minor changes in the fusion group[23]. Upadhyay and

Table-1. The average preoperative (PR) and postererative (PO) local kyphosis (LK), loss of correction values (CL) and postoperative (CP) and final correction percentages (FP) of the patients according to vertebral regions. (n: number of patient)

	PRLK	CPLK(%)	t	P	FPLK(%)	CLLK
Thoracic (n:25)	22.6°±7.5°	75.1°±	13.5	<0.05	69.8±25.6	1.2°±1.8°
Thoracolumbar (n:	24.0°±	65.38°±	7.8	<81.2±24.7	0.9°±1.5°	
Lumbar (n:17)	23.5°±6.6°	78.9°±	19.3	<0.05	72.4±16.3	1.4°±1.9°
Total (n:63)	23.4°±	79.7°±	18	<0.05	74.2±	1.1°±1.7°

coworkers reported the latest follow-up of the same group of patients, concluding that the debridement group demonstrated increases in kyphotic deformity for up to six months. Therefore, adult patients demonstrated an arrest in progression, while some spontaneous correction of the deformity occurred in the pediatric patients[38-41]. Aksoy et al. reported a series of 100 patients either with posterior or anterior fusion only and demonstrated that kyphotic deformitiy developed less frequently after anterior fusion[2]. Rajasekaren and Soundarapendian reported 59% kyphotic deformity with anterior fusion[32].

With anterior debridement and fusion, the MRC trials demonstrated that an increase in kyphotic deformity occurred in only 17% of patients compared to 39% of patients treated with chemotherapy. In contrast to patients treated with only anterior debridement, the progression of the kyphotic deformity was considerably less, especially during the first six months of the treatment[21-24]. Kyphotic deformity did not significantly increase in these patients after six monts regardless of the treatment method. In another study 59% of patients had favorable results (excellent or good), 19% were rated as fair, and 22% as poor[32].

The necessity of prolonged immobilization following anterior procedures, and the relatively high rates of progression of kyphosis frequently related to the problems with strut grafts prompted the idea that tuberculosis spondylitis may be stabilized by posterior instrumentation[11, 36]. Oga and coworkers obtained good clinical results but the instrumentation was extended to an alarming average of 8.5 levels, in spite of the fact that 3.5 levels on average were involved by the disease[31]. Moon et al reported very good rates of correction and good maintenance of correction for both children and adults, fusion occurred in four months in single level spondylodesis cases and in six months in two-level[27].

Several studies have demonstrated satisfactory results using posterior instrumentation along with anterior debridement and fusion[24, 28, 31, 37]. Güven et al. reported a series of 10 cases with posterior instrumentation, in which there was a 3.4° loss in the correction of local kyphosis[10]. Domaniç et al. reported that in their series with anterior debridement, correction of the kyphosis was more successful in-patients who had additional posterior CD instrumentation[9]. Yau et al. reported higher success rates with anterior fusion and posterior instrumentation in the same session[42]. In our recent series, 72 adult patients with different surgical procedures were assessed. Eight patients had only anterior debridement and fusion, with 8.6% correction rate and average 23.6° correction loss during follow-up, compared to 76.8% average correction and 2.5° correction loss in 11 patients who had posterior instrumentation following anterior radical surgery[6].

Kostuik reported a series of 79 patients with anterior decompression and anterior internal fixation in 1983, among whom 51 had reurologic deficits. He reported two patients developing deformity because of spinal tuberculosis[19]. There has been very limited experience with anterior instrumentation following anterior radical debridement and fusion, especially on the early cases with active disease[4]. This reluctance so far probably arises from the presumption that placing the instrumentation in an area with active infection would be prone to complications like disease reactivation or secondary infection[17]. The results of our last study demonstrated that, anterior instrumentation in the presence of active infection does not cause any major complications, probably because of the poor adherence capacity of the tuberculosis bacilli to metals.

We have reported our first nine cases in 1996[5]. Yılmaz and coworkers reported on 22 patients with single or double level and 16 with multilevel involvement, treated with anterior instrumentation. Their rates of correction were 64% and 81% for short and long fusion respectively, an overall average of 3° of correction loss was encountered and there were no major complication[43]. In another study analyzing the results of comparison of 45 anterior radical debridement and anterior instrumentation cases with cases of posterior instrumentation, we have reported that with anterior instrumentation, statistically similar correction rates can be obtained, but this procedure required fewer mobile segments to be instrumented. Also in this study, we suggested that posterior instrumentation could be preferred if there were various regions of involvement, more than 2 vertebrae were involved and if involvement was at the lumbosacral junction[6]. In our last study, the results of 63 patients with 50.9 months of follow-up were evaluated and our correction rates in local kyphosis angle (79.7±20.2%), our correction loss at the last control visit (1.1°±1.7°) and our final correction rate (74.3±23.3%) were compatible with the results reported in the literature[7]. Evaluation of the effect on sagittal global contours showed a statistically significant correction rate in thoracic, thoracolumbar and lumbar regions and also correction loss rates at the last control visit were very low. The normal physiological sagittal contours were maintained in the thoracic and thoracolumbar regions in 88% and 71.4% of the patients respectively, but physiological normal lumbar lordosis was restored in five patients. It is noted that application of a distraction for correction of the local kyphosis deformity in thoracic region resulted in a decrease in the global kyphosis angle but though this effect neither hypokyphosis nor lordosis was noted in the thoracic region. It played a positive role in the lumbar region by increasing lordosis. Implant failure and pseudoarthrosis were not noted and a solid fusion mass was obtained in all patients. Tuberculosis reactivation was not noted.

Therefore, based on our results and those reported with the use of posterior instrumentation, it can be stated that instrumentation in active tuberculosis spondylitis can be performed safely with few complications, and is effective in obtaining and maintaining the correction of the deformity as well as obviating the need for external support. The two major advantages of anterior instrumentation over posterior are the ability to perform the operation with a single approach, and to prevent the inclusion of unnecessarily large number of levels into fusion.

It should be noted that all patients included in this study have undergone a very aggressive alternating three drug antibiotic regimen for twelve months, which has been the standard protocol in our center over the years, contrary to recent reports suggesting that shorter and less aggressive chemotherapy may be as effective. Fourteenth report of the MRC demonstrated that the clinical results at three years were excellent in patient groups receiving INH and R for six months, the same drugs for 9 months, but only in those receiving INH and PAS or EMB for 18 months[25]. In 1998, Medical Research Council Working Party on Tuberculosis of the Spine, reported in the series with 15 years follow-up that when ambulatory chemotherapy were compared with nonambulatory chemotherapy, with debridement and chemotherapy with Hong-Kong procedure, anterior radical debridement and anterior strut grafting is the most successful procedure for reurologic recovery, fusion and preventing kyphotic deformity[24]. Likewise, Upadhyay and coworkers have found that a

regimen consisting of INH, R and streptomycin given for as short as 6 months yielded comparable results with a regimen of INH, PAS and streptomycin, in a group of patients who underwent surgical debridement and grafting[41]. The use of a more aggressive regimen for longer periods might have been effective for a better control of the disease in our series, eventually leading to uneventful healing. Shorter and less aggressive regimens in the presence of anterior internal fixation material needs to be further tested.

Finally, it may be argued that in those patients with suspected Tuberculosis spondylitis, the diagnosis, as well as the absence of secondary non-specific infection needs to be confirmed before the process of surgical decision making. However, in areas where tuberculosis is an endemic problem, the rate of correct preoperative diagnosis may be very high.

In addition to classical radiograms and laboratory tests, MRI is the most important method in diagnosing tuberculosis[36]. Radionuclide imaging is not very hempful in these cases. There are high false-negative rates with technetium (33%) and gallium (70%) scans. CT imaging reveals the extent of bony destruction better than MRI[36]. An and coworkers have reported a diagnostic accuracy of 97% with MRI in a series of patients with spinal tumors or infectious diseases.[1]. In his series of 24 patients, Desai reported that diagnosis of the disease was possible in the very early stages with MRI[8]. Hoffmann et al. reported that MRI was necessary and very useful for surgical planning and diagnosing the canal compromise[13]. In the present study, our pre-operative rate of diagnosis was 96.8% (61 out of 63 patients) when a combination of MRI, CT and laboratory studies were used. The 2 patients diagnosed with having solid tumors preoperatively constitute the false negative cases

of this series. It should be noted however, that these figures might be misleading. The probable false positive cases who turned out not to be cases of tuberculosis spondylitis at surgery were not included in this database, hence; it can not be claimed that the diagnostic accuracy of these methods combined is as high as 96.8%. Schmitz and coworkers have demonstrated that Fluorine-18 flouro-2 - deoxy - D -glucose positron emission tomography is more sensitive and accurate in the diagnosis of tuberculosis spondylitis compared to MRI especially in the presence of metallic implants[34]. This technique may be used so as to achieve a higher rate of diagnostic accuracy in the future.

In patients without vertebral instability and deformity we prefer conservative management, and in those who have abscess formation in addition, we use invasive radiological techniques in addition to abscess drainage and chemotherapy. It is our contention that, in patients with vertebral destruction and collapse, moderate - severe kyphotic deformity and large abscess formation, vertebral instability and neurological deficits and instability, anterior radical debridement, anterior strut grafting and anterior instrumentation is an optimal method. In patients with involvement in different vertebral regions and multiple levels and in those global sagittal contours are markedly deformed owing to local kyphosis, and in patients who have difficulty in undergoing anterior instrumentation due to lumbosacral junction involvement, posterior instrumentation may be preferred, after anterior radical debridement and anterior strut grafting at the same session or subsequent one.

In conclusion, based on the results of our last study on the treatment of active Tuberculosis spondylitis with anterior instrumentation along with anterior debridement and fusion, it can be stated that, this procedure provides a
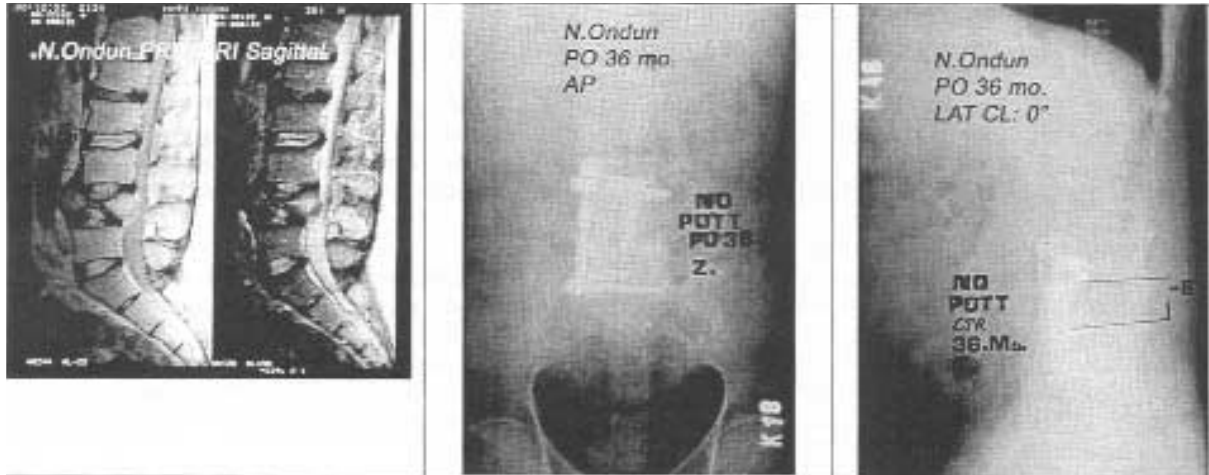
LEGEND:

Figure - 1. Preoperative magnetic resonance imaging sagittal view (a) and postoperative 36th month control posteroanterior (b) and lateral (c) radiograms of 36 years old male (N.O.) with Pott's disease in the lumbar 4 vertebra. Two mobile segments were instrumented with anterior Z - plate and 100% correction rate was obtained after anterior radical debridement and strut grafting. There was 5° loss of correction and solid fusion mass was observed in the last visit.
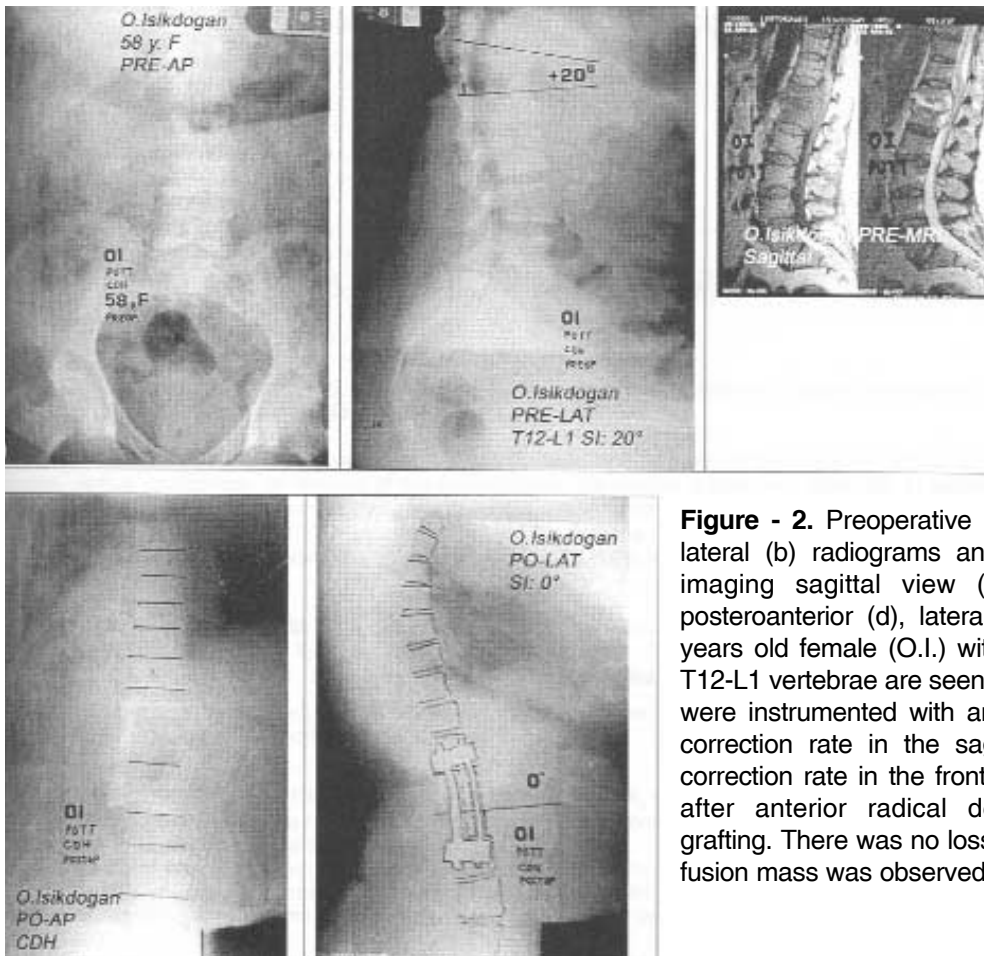

Figure - 2. Preoperative posteroanterior (a) and lateral (b) radiograms and magnetic resonance imaging sagittal view (c) and postoperative posteroanterior (d), lateral (e) radiograms of 58 years old female (O.I.) with Pott's disease in the T12-L1 vertebrae are seen. Three mobile segment were instrumented with anterior CDH and 100% correction rate in the sagittal plane and 100% correction rate in the frontal plane were obtained after anterior radical debridement and strut grafting. There was no loss of correction and solid fusion mass was observed in the last visit.

very high and effective rate of deformity correction and maintenance. Furthermore, as demonstrated by several other studies, the use of metallic implants in the presence of active tuberculosis infection appears to be a safe procedure associated with a very low rate of complications.

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