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ORIGINAL ARTICLE

COMPARISON BETWEEN MODIFIED HONG KONG AND MODIFIED KALAFONG OPERATIONS IN TB SPINE PATIENTS- A CROSS SECTIONAL STUDY IN CMH RAWALPINDI

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ABSTRACT

Background: Spine tuberculosis is common in Pakistan and this needs expert treatment to decrease morbidity. The objective of this study was to compare Modified Kalafong (MKF) and Modified Hong Kong (MHK) operations for spinal TB patients regarding neurological recovery and deformity correction.

Material and Methods: This cross sectional study was conducted at Combined Military Hospital (CMH), Rawalpindi, Pakistan, on data from February 2012 to November 2020. According to the selection criteria and availability of data, 70 patients out of 90 consecutive patients handled surgically by MKF or MHK Operations were chosen for this research. Frankel grade system, Cobb's technique and Bridwell's criteria were used for assessment of results.

Results: There were thirty-one cases of MHK and thirty-nine cases of MKF patients. Age, Neurological recovery, and Numbers of Vertebrae involved with TB were comparable across the two groups. In the MHK, the mean operating time was 6.12 hours, whereas in the MKF, it was 5.37 hours. When compared to the MKF, where the mean blood loss was 0.921 L, the MHK had a greater mean blood loss of 1.139 L. Deformity correction with MHK was 79.467 % against 58.40% via MKF, which was statistically significant (P 0.001). The MHK group had a much shorter mean time to fusion (4.56 months) than the MKF group (6.74 months), which is significant (P 0.05) statistically.

Conclusion: Our study revealed significant differences between MHK and MKF spinal tuberculosis surgeries in terms of fusion time, blood loss and deformity correction.

KEY WORDS: Spine; Surgery; Tuberculosis; Neurology; Blood; curettage; debridement.

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INTRODUCTION

Pakistan is one of the five nations in the world with the highest prevalence of tuberculosis (TB), with the rate of 223 patients out of 100,000 individuals each year. The illness is responsible for 48,000 fatalities yearly and a 35 percent increase in multidrug-resistant tuberculosis (MDR TB) infections.[1] Three percent of all cases of tuberculosis involve bone and among that half are spine cases, which accounts for 1.5 percent of all TB cases.[2,3] The majority of instances of spinal tuberculosis are cured with chemotherapy over time, but some individuals may develop catastrophic complications such as spine deformity and paraplegia.[4] The global incidence of tuberculosis was declining, but it has lately risen.[5] This is likely attributable to treatment resistance, the rise of HIV/AIDS, and economic immigration.[6-9] On the top of priority in controlling this horrible illness is early diagnosis and timely treatment with medicines and surgery. Classical Hong Kong operation has been the gold standard since Hodgson's groundbreaking discovery.[9-12] The surgery consists of anterior corpectomy, thorough debridement of involved vertebrae, and replacement with strut graft. The titanium mesh cage filled with morselized graft is used for anterior reconstruction

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and kyphosis correction.[13-15] Classical Hong Kong operation (CHK) was changed later with the inclusion of instrumentation on neighboring vertebrae to sustain the spine until solid union was achieved. Pedicular screws and rods were utilized to support the spine, often on two levels above and below.[16-19] Comparative studies evaluating the two methods looked at a variety of outcomes such as operative time, blood loss and neurological recovery, as well as pre- and post-surgery deformity correction and fusion time, as well as any complication.

Spinal tuberculosis has been a global concern for centuries, and a lot of studies have been conducted and continues to be conducted. There are some research publications that have altered the direction of management. Oga et al.'s[20] research demonstrating the safety of implants in places with active TB, has vastly improved the treatment of spinal TB. Hodgson popularized Hong Kong in 1960[21], and it has been widely utilized for anterior vertebral body reconstruction in TB. Hodgson and Stock endorsed anterior arthrodesis as the preferred therapy for spinal tuberculosis. In addition, they advised posterior instrumentation for the correction of unfixed kyphus after anterior release. The procedure was clearly advantageous due to the direct access to the pathology and the ability to extensively debride the damaged vertebra and put a big strut graft.

Researchers like Rajasekaran and Soundarapandian[22] found that there was a significant association between the first loss of the vertebral body and gibbus. They proposed the formula $Y = a + bx$, which, when calculated, implies that a loss of every complete vertebra results of $30° \pm 3.58°$ of deformity. Louw[23] recommended the "Kalafong method" for treating spinal tuberculosis with neurological disability, which includes anterior debridement, cord decompression, grafting and posterior instrumentation through posterior approach. This enabled them to attain favorable outcomes.

As tuberculosis cases are on rise and are a huge public issue in our country, we searched literature for best surgical procedures, but couldn't found such comparable data. The purpose of this research was to assess the efficacy of MHK with MKF in patients of thoracolumbar spinal TB.

MATERIALS AND METHODS

A total of 70 cases with proven TB of the thoracic and lumbar spine who fulfilled the conditions for anterior and posterior vertebral body reconstruction and had fitness for surgery, either through a MHK or MKF were included in the study. Patients with well-kept records and consistent follow-up were chosen for the research. Cases are excluded with vertebral collapse owing to other reasons except TB, those without kept records, and those lost to follow-up. After receiving clearance from the institution's ethical committee, the aforesaid research was done.

The Frankel approach was used to verify the neurology of all of the considered cases before the surgery [Figure 1].Frankel grades A and B are candidates for urgent surgery, while grades C, D, and E are treated with bed rest and anti-tuberculosis treatment. If no progress is shown within 3 to 6 weeks, surgery is indicated. Thirty-one patients had surgery using the MHK technique, and 39 underwent surgery using the MKF technique. Immediate after surgery, all patients began anti-tuberculous treatment in accordance with conventional protocol, which was maintained for a duration determined by the organism's resistance. Trained physiotherapists helped the patients get out of bed after surgery. Breathing exercises were used to get them started. For a minimum of two weeks, rehabilitation was carried out at the Armed Forces Institute of Rehabilitation Medicine in Rawalpindi.

All patients were then examined postoperatively, every three months, and at one year after surgery.

Frankel Grade	Definition
Grade A	Absent motor and sensory function
Grade B	Absent motor function; sensation present
Grade C	Motor function present but not useful (2/5 or 3/5 power); sensation present
Grade D	Motor function present and useful (4/5 power); sensation present
Grade E	Normal motor and sensory function

Figure 1: Frankel grade System (Source Srivastava et al. (2021)

X-rays and MRI were done for radiological assessment before surgery. X-rays were performed postoperatively on each visit. In a few cases for which X-rays were unable to detect fusion, a CT scan was performed. Among the radiological data considered important, were vertebrae involvement, the amount of instrumentation, and correction of kyphosis. All this was assessed by Cobb's technique [Figure 2], and the fusion grade was based on Bridwell's criteria.

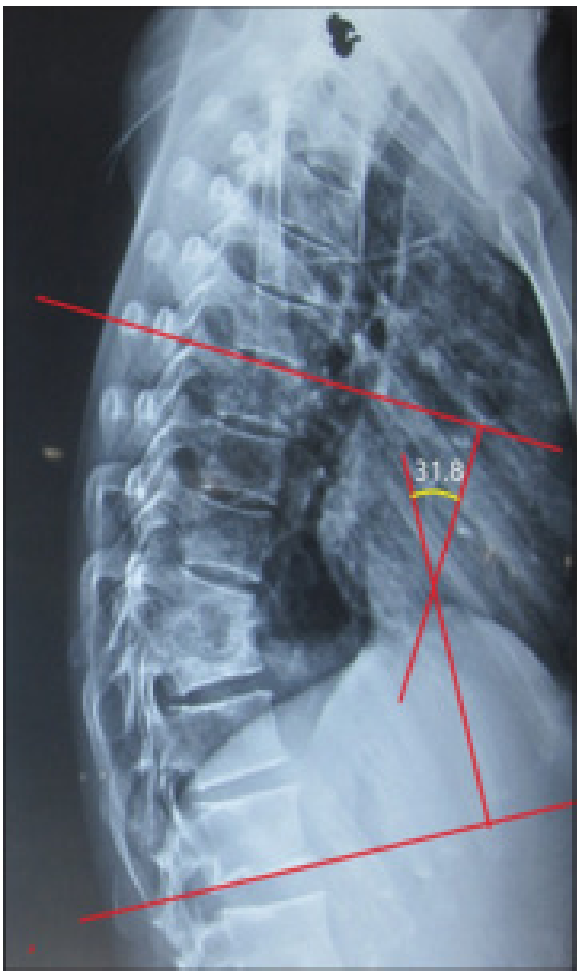


Figure 2: Cobb's kyphosis measuring technique

Bridwell measuring Grades:

Grade 1: Incorporated graft with remodeling and trabeculae

Grade 2: The graft is intact, not completely modified or integrated, and there are no lucencies.

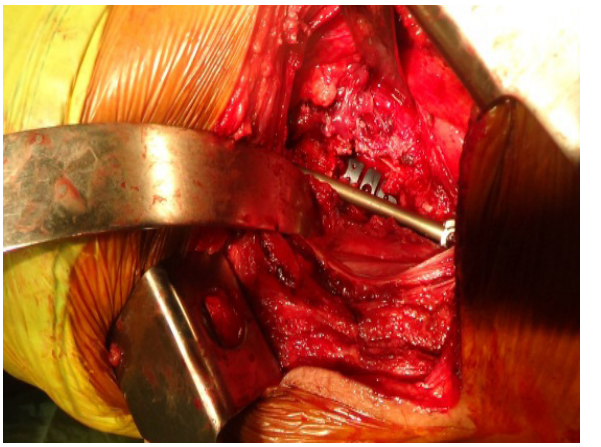
Grade 3: Graft is present, but there is lucency at the top or bottom.

Grade 4: Certainly not fused, with graft resorption and collapse.

Surgical Technique:

Modified Hong Kong:

Patients undergoing this method were positioned in the lateral decubitus position. The transthoracic intrapleural method used by Srivastava et al. [Figure 3] was a flexible strategy. Through debridement of necrotic and sequestrated tissue is done along with partial or complete removal of involved vertebrae until neural decompression was achieved. The titanium mesh cage filled with morselized graft was used for anterior reconstruction and kyphosis correction. [13-15]It is complemented with single lateral body screws in vertebrae above and below.



Modified Kalafong

Fig 3: Modified Hong Kong

Modified Kalafong:

Patients had surgery via a typical midline posterior incision. All the dead tissue and necrotic bone is cleared. Spinal cord is thoroughly decompressed and anterior vertebral column is supported with titanium mesh cage containing bone graft. Pedicular screws and rods were utilized to support the spine, often on two levels above and below.[16-19]

RESULTS

There were total 70 patients in the study, 31 patients were in Modified Hong Kong group while 39 patients were in Modified Kalafong group. The demographic characteristics are shown in Table: 1.

Neurological assessment and VAS score before and after surgery and Fusion time & Deformity correction at surgical site are shown in Table:2.

Table 1: Demographic statistics.

Variables	Modified Hong Kong (n=31)	Modified Kalafong (n=39)	P-value
Gender			
Male	11 (35.5%)	16 (41.0%)	0.042
Female	20 (64.5%)	23 (59.0%)	
Age	42.1	44.2	0.67
Numbers of Vertebrae involved	2.7 (range 1-7)	3.1 (range 1-7)	0.83
Lesion Location			
Thoracic	15 (48.39%)	21 (53.85%)	0.58
Thoracolumbar	9 (29.03%)	11 (28.21%)	
Lumbar	7 (22.58%)	7 (17.95%)	
Operative Time	6.12 (hours)	5.37 (hours)	0.74
Time of Mobilization	2.53 weeks	1.21 weeks	0.37
Complications	4 (12.9%) patients	9 (23.0%) patients	0.19
Blood Loss	1139.76 (ml)	921.26 (ml)	0.19

Table 2: Neurological assessment, Fusion time, VAS and Deformity correction.

S.No.	Parameter	Modified Hong Kong (n=31)	Modified Kala-fong (n=39)	P-value MHK vs MKF	P-value Within MHK and MKF
1	Neurological status (ASIA)				
	Pre-operative				
	A	8 (25.8%)	11 (28.2%)		
	B	3 (9.7%)	4 (10.3%)		
	C	14 (45.2%)	19 (48.7)	0.54	MHK pre-op Vs post-op < 0.001
	D	5 (16.1%)	4 (10.3%)		
	E	1 (3.2%)	1 (2.6%)		
	Post-operative				
	A	0 (0%)	1 (2.6%)		
	B	2 (6.5%)	3 (7.7%)		
	C	3 (9.7%)	4 (10.3%)	0.73	MKF pre-op Vs post-op < 0.001
	D	5 (16.1%)	6 (15.4%)		
	E	21 (67.7%)	25 (64.1%)		
2	Fusion Time (months)	4.56	6.74	0.03	
3	VAS Score				
	Pre-operative	6.36	5.76	0.01	0.53
	Post-operative	1.68	1.28	0.01	0.42
	Last follow-up	0.69	0.61	0.01	0.61
4	Pre op Cobb	41.13	35.75	0.444	
	Post op Cobb	8.27	12.57	4.709	
	Deformity Correction	79.72%	58.40%	0.01	

With the Frankel grading system, neurology was rated. At the conclusion of one year, a considerable improvement in neurology was seen in both groups and was almost same.

The median duration of fusion was four to eight months. The MHK group had a much shorter mean time to fusion than the MKF group, which is significant (P 0.05) statistically. Final follow up VAS scores were much lower than those of preoperative (P 0.05), although pre (P=0.53) and postoperative (P=0.42) VAS scores showed no difference between the two groups as well as at the last visit (P=0.61).

The pre-op Cobb and post-op Cobb angles between the two groups of MHK and MKF showed significant differences (p 0.05). This demonstrates that the MHK technique offers improved deformity correction, which is crucial for preserving spinal balance and reestablishing the anterior weight-bearing column.

DISCUSSION

In our study the average age of the MHK group is 42.1 years, while the average age of the MKF group is 44.2 years. This is because the MHK is somewhat more morbid than the MKF and is not recommended in the older age group due to comorbidities that prevent its usage.

In our study, deformity correction with MHK was 79.467 percent against 58.40 percent via MKF, which was statistically significant (P 0.001). This demonstrates that MHK allows for a more effective correction of kyphosis, which is crucial for maintaining spinal balance and restoring the anterior load-bearing column. In his research, Louw [23] observed a reduction in Cobb from 20.13 to 7.27 with MHK. In their research, Yilmaz et al. [24] observed a correction of 64 percent in kyphosis when MHK surgery was performed. There are relatively few studies that compare MHK and MKF for the treatment of kyphosis. Laheri et al. [25] observed a correction rate of 62.5% when using a posterolateral method. In their work, Jain et al. [26] demonstrated a correction from 49.08° to 25° when using an anterolateral method.

The average fusion time was between 4 and 7 months. The MHK group took 4.569 months on average to fuse, while the MKF group took 6.74 months. This difference is statistically significant (P 0.03). Compared to the MKF group, the MHK group fused more quickly. In their study, Ozdemir et al. [27] used a MHK to get a fusion rate of 96%. Ma et al. [28] found that MHK and MKF had fusion rates of 92.5 percent and 91 percent, respectively. According to Kemp et al. [29], iliac crest grafting had a 94.5 percent fusion rate. The MHK technique permits extensive debridement of necrotic tissue and the use of substantial iliac crest and rib strut grafts, which promotes high fusion rates. The patient's age as well as the fusion technique all affect how long it takes to fuse.

The Frankel grading system was used to assign grades in neurology. There were 39 patients who had MKF surgery, of whom 11 had Frankel A, 4 had Frankel B, 19 had Frankel C, 4 had Frankel D, and 1 had Frankel E. After surgery, the majority of the patients' neurology became better, and after a year, there was 1 patient with Frankel A, 3 patients with Frankel B, 4 patients with Frankel C, 6 patients with Frankel D, and 25 patients with Frankel E. There has been a substantial improvement in neurology. Three patients had postoperative neurologic deterioration, and towards the end of a year, a slow recovery had been seen. Neurological improvement was marginally greater in individuals who had the MHK procedure. In their research, Laheri et al. [25] saw a 91.3 percent neurological recovery after 15 months, with a 4.3 percent deterioration of neurology. Christodoulou et al. [11] saw comparable outcomes in their investigation of anterior stabilization in TB spine. Garg et al. [30] found that MHK and MKF elicited almost the same neurological improvement.

CONCLUSION

In these difficult instances, decompression and deformity correction are the sole means of preventing the advancement of neurological deficiency, kyphosis, and late-onset paraplegia. Single-stage anterior reconstruction stabilization by means of an anterior approach permits comprehensive debridement, neural decompression, and significantly superior anterior column reconstruction and deformity correction under direct vision. Both methods have their own pros and cons. The posterior technique is simple to learn and have almost comparable neurology improvement which is sole goal of surgery.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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None declared.

AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	MSK, WA
Acquisition, Analysis or Interpretation of Data:	MSK, WA, AQK, SI, AUM, MKS, MAQ
Manuscript Writing & Approval:	MSK, WA, AQK, SI, AUM, MKS, MAQ

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.