Original Article

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MODIFIED VERSUS CLASSICAL HONG KONG OPERATION FOR SPINAL TUBERCULOSIS

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ABSTRACT

Objective: To compare Classical Hong Kong (CHK) and Modified Hong Kong (MHK) operations as treatment options for spinal tuberculosis.

Study Design: Retrospective analytical study

Place and Duration of Study: Combined Military Hospital (CMH), Rawalpindi, Pakistan, from Jan 2002 till Dec 2007.

Patients and Methods: Out of 100 consecutive patients managed surgically by Classical or Modified Hong Kong Operations, 60 patients were selected for this study depending upon the selection criteria.

Results: Twenty patients were in CHK group and forty patients were in MKH group. Both of these groups matched for age, gender and involvement of spinal levels with tuberculosis. Neurological recovery in CHK group was 31.8% while in MHK group it was 40.0 %. Correction of deformity was 25.0% in CHK while 30.3% in MHK.

Conclusion: There was no statistical difference between CHK and MHK operations for spinal tuberculosis considering neurological improvement and correction of deformity in our study.

Keywords: Anterior instrumentation, Spinal Surgery, Spinal tuberculosis.

INTRODUCTION

Pakistan is one of the five countries in the world worst affected by tuberculosis (TB), with prevalence of 365,000 cases per year (incidence of 223 cases/100,000 population/ year). The disease causes 48,000 deaths annually and increasing number of multi drug resistance tuberculosis (MDR TB) cases i.e. 35%[1]. Bones are involved in 3% of all cases with TB. Spine is involved in almost 50% cases involving bones. It makes it 1.5% of all the cases suffering from TB[2,3]. Most of the cases of spinal TB heal with chemotherapy in due course of time but some patients might land up with catastrophic sequel such as spinal deformities and paraplegia[4].

Worldwide TB was showing downward trend but recently it has shown resurgence[5]. This is probably due to drug resistance, increase in immune deficiency disease i.e. AIDS and economic immigration[6,7,8]. In order to control this dreadful disease early diagnosis and prompt treatment by drugs and surgery is the fore most step. Since Hodgson's revolutionary revelations Hong Kong operation has become the gold standard[9,10,11,12]. The original procedure of anterior corpectomy, debridement of involved vertebrae and replacement with strut graft of bone-Classical Hong Kong operation (CHK) was modified with addition of instrumentation on adjacent vertebrae– Modified Hong Kong operation (MHK) at a later stage. MHK was evolved to give support to the graft until it formed stable union with healthy vertebrae.

The objective of this study was to find out the effect of CHK as compared to MHK operation in cases of thoracolumbar spinal tuberculosis.

MATERIAL AND METHODS

This was a quasi experimental study that was conducted at Spine Unit, Orthopaedic Department of Combined Military Hospital (CMH) Rawalpindi, a tertiary care hospital for Armed Forces of Pakistan and civilian private patients, the duration of the study was from Jan 2002 to Dec 2007.

Out of 100 operated patients, 60 consecutive patients suffering from spinal tuberculosis of thoracic and lumbosacral spine and operated at Spinal Surgery Unit of CMH,

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Rawalpindi, whose medical records were complete, were included in this study. Those with incomplete records or operated with some other procedure were excluded. All patients with multi-organ involvement were also excluded as this may have untoward effects on the results.

TB spine was diagnosed on basis of clinical, radiological and histopathological criteria. Only patients who grew TB bacilli on culture or showed granulomatous inflammation of biopsy material taken during operation were included.

This study includes comparsion of only two operative procedures i.e Classical Hong Kong and Modified Hong Kong operation.

Classical Hong Kong Operation (CHK) this procedure was performed under general anaesthesia in lateral position with either a thoracotomy / thoracoabdominal or lumbar retroperitoneal approach. Major vessels were mobilized away from the operative field after division of intercostal or lumbar vessels. Vertebral column was cleared on both sides of the vertebral bodies. All dead and necrotic material with adjacent discs were removed till healthy end plates of adjacent vertebral bodies. If the patient had a neurological deficit, posterior longitudinal ligament was divided, pseudomembrane compressing dura was removed and cord/ cauda equina was adequately decompressed. If there was no deficit posterior longitudnal ligament was left intact. Graft was harvested from either 2-3 pieces of ribs tied together with suture or tricortical iliac crest bone graft. Recipient site was further opened up by manual pressure on the posterior elements and kidney bridge was raised to open it up even more and the graft was inserted in between healthy end plates. Posterior pressure was relieved and kidney bridge lowered to tightly fix the graft in place. Pleura was closed over the operated level. Drain (chest tube or retroperitoneal drain) was placed and wound closed in layers. (Fig. 1)

Modified Hong Kong Operation (MHK) this operation was exactly similar to above operation with solitary inclusion of instrumentation. We used lateral single body screws fixed with a rod or 4.5mm AO titanium broad DCP and 6.5 mm AO screws. (Fig. 2)

Anti Tuberculosis drug Treatment (ATT) the patients were given four drug first line antituberclousis therapy (ATT) (Rifampicin, Isoniazid, Ethambutol, Pyrazinamide) +/- Levofloxacin and Amikacin, for initial two months. Then the patients were continued with three drug regimen for another ten months. During this period regular ESR levels and serum ALT levels were monitored.

Post operatively the patients were mobilized out of bed by trained physiotherapists. They were started with breathing exercises. Rehabilitation was done at Armed Forces Institute of Rehabilitation Medicine, Rawalpindi for a minimum period of 2 weeks. Before they could walk Boston brace or hyperextension brace was advised. This was discarded after having clinical and radiological evidence of union.

The patients were advised monthly follow-up for first 3 months. After this they were advised 2 monthly visits, till completion of ATT. There after they visited outpatient department at 6 monthly interval.

Improvement was assessed by radiology and clinical examination. X-rays of the spine were carried out on each visit. Kyphosis angles were measured on lateral view of concerned vertebrae by Cobb's method. The readings were corrected taking into account physiological lordosis at lumbar level and kyphosis at thoracic level. Dynamic lateral flexion/ extension X-Rays were taken to see for union at 6 and 9 months post operatively. Improvement in sensory and motor power was seen by American Spinal Injury Association (ASIA) score. AISA-A being complete paralysis, with no sensory and motor power and ASIA-E with no neurological deficit. Pain was assessed by graphic rating scale (GRS) with added descriptive terms, grading it into nil, mild, moderate, severe and excruciating categories of pain (five grades). Patient satisfaction was graded from fully satisfied, partially satisfied to not satisfied (three grades).

Statistical analysis was done using SPSS version 12. Chi square test was used to determine the significance of results of patients of pain relief, patient satisfaction, employment status and neurological recovery. Student Independent t test was used to determine the significance of amount of correction obtained. A *p* value of < 0.05 was taken as significant.

RESULTS

Out of 100 patients of spinal TB operated in our centre, 60 patients satisfied the selection criteria. CHK included 20 patients. There were 9 (45%) males and 11 (55%) females in this group. The ratio of male to female was 1:1.2. The average age of this group was 38.65 years (SD±20.6 with age range between 2.5±73.5 years).

Table-1: Demographic data

		Classical Hong Kong n= 20	Modified Hong Kong n=40	p Value CHK vs MHK
1	Age	Average : 38.65 yrs Range : 2.5 -73.5 yrs SD : 21.66 yrs	Average : 40.12 yrs Range : 16.0 – 70.0 yrs SD :16.45 yrs	0.742
2	Gender	Male : 09(45%) Female : 11(55%) M:F : 1:1.2	Male : 16(40%) Female: 24(60%) M:F : 1:1.5	0.067
3	No of Vertebrae involvement	Average: 2.5 SD : 0.645 Range: 1-5	Average: 2.9 SD : 0.480 Range : 1-7	0.379
4	Regional Involvement Thoracic Thoracolumbar Lumbar Lumbosacral Sacral	 11 (55%) 03 (5%) 04 (30%) 01 (5%) 01 (5%)	 25 (60%) 07 (10%) 06 (27.5%) 02 (2.5%) 00 (0.0 %)	 0.603

Second group (MHK) consisted of 40 patients of which 16 (40%) were males and 24 (60%) females. The ratio of male to female was 1:1.5. The average age of this group was 40.12 yrs (SD ± 7.45 years, range was between 16.0 ± 70 years (Table 1).

In CHK group on the average 2.55 vertebrae were involved, range was between 1 to 5 vertebrae. In MHK group on the average 2.99 vertebrae were involved, range was between 1 to 7 vertebrae.

The average level of involvement was two contiguous vertebrae mostly in thoracic spine however it ranged from single vertebrae to five. Involvement of noncontiguous vertebrae was seen in 3.7% of cases in our study. The results as far as neurological recovery and correction of deformity are concerned are summarized in table-2. Overall improvement of the patients was 67.5% in CHK group and 57.5% in MHK (*p*-value 0.015); job status was improved by 61.5% in CHK and 56.25% in MHK (*p*-value 0.165). Mobility was improved by 70% in CHK and 64.25% in MHK (*p*-value 0.701). Patient satisfaction with operation was 61.6% in CHK and 58.33% in MHK (p value 0.286)). Back pain was improved by 67.5% in CHK and 61.75% in MHK (*p*-value 0.535).

The most common complication was feeling of stiffness in three cases in group A and one in group B. Two implant failures were seen in the form of broken pedicle screws in MHK.

Follow up period on average in CHK was 1 years and 11 months minimum was 1 year 1 month and maximum was 5 years. In MHK the average period was 2 years and 5 months, minimum was 2 years and maximum was 5 years.

DISCUSSION

Surgery is augmentation of chemotherapeutic treatment. Indications of surgery were neurological deficit. Deformity or impending increase in deformity and large abscess/necrotic tissue not responding to drugs[4].

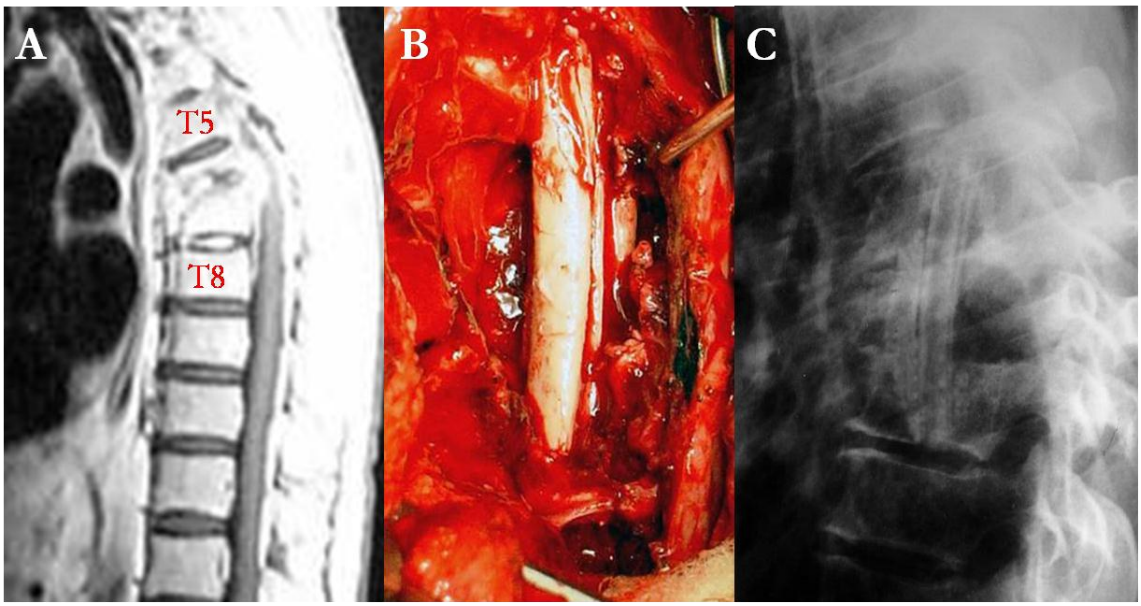

Fig.1: Classical Hong Kong operation

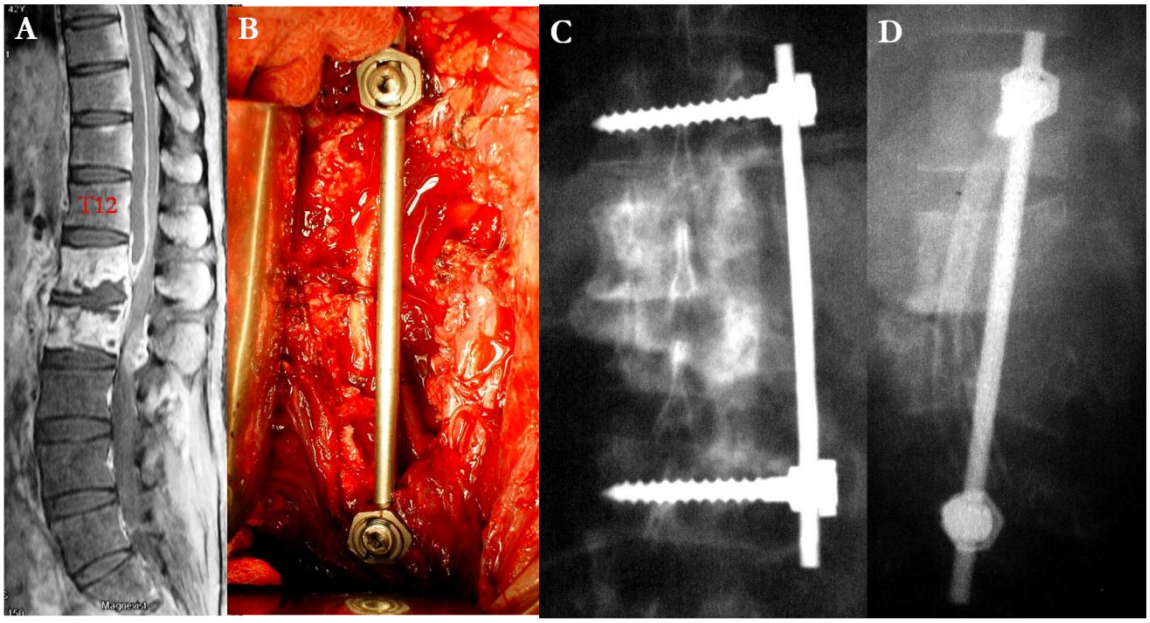

Fig.2: Modified Hong Kong operation

Surgery in the form of debridement of dead tissue, drainage and replacement by bone graft is the standard treatment[9,10,11].This was confirmed by the Medical Research Council (MRC) trials. They showed that the kyphotic deformity tends to increase in due course if no surgery is undertaken or only debridement is done. The rates of fusion are delayed in cases of grafting in early post op period where as they are same in five years time. In ten years time kyphosis angles increase to 9.8 in thoracic and 7.6 in lumbar spine in cases where only debridement is undertaken as compared to grafting group where insignificant changes take place[10].

This may improve in cases where the patients are young and have growing capacity[14,15]. The first six months of treatment

are critical as maximum kyphosis occurs during this period whatever the mode of treatment is

2 deoxy–D–glucose positron emission tomography has been recommended as it is more sensitive and accurate in tuberculosis

Table-2: Comparison of outcomes / results of Classical Hong Kong and Modified Hong Kong operations with their statistical analysis.

Sr. No.	Parameter	Classical Hong Kong n=20	Modified Hong Kong n= 40	p Value CHK vs MHK	P value Within CHK and MHK
1	Neurological status (ASIA) Pre Op				
	A	4 (20%)	11 (27.5%)	0.58	CHK
	B	2 (10%)	4 (10%)		Pre op
	C	8 (40%)	15 (37.5%)		Vs
	D	3 (15%)	8 (20.5%)		Post op
	E	3 (15%)	2 (5.0%)		< 0.001
	Post Op				
	A	0 (0%)	0 (0%)	0.82	MHK
	B	1 (5%)	1 (2.5%)		Pre op
	C	2 (10%)	4 (10%)		Vs
	D	3 (15%)	5 (12.5%)		Post op
	E	14 (70%)	30 (75%)		< 0.001
2.	Correction of deformity	Percentage correction 25.0%	Percentage correction 30.3%	0.983	

adopted[10,11].

In this study we saw that this disease involves relatively younger patients with almost equal involvement of both gender as was seen by our contemporaries[4,16].

The involvement of thoracic spine in majority of cases was seen in our study which was similar to what others have experienced[4, 16]. The increased risk of neurological symptoms seen in thoracic spine might be due to small diameter of spinal canal as compared to lumbar spine along with difference in the blood supply. The involvement of non contiguous vertebrae is seen in less than 1% in literature[17] but it was not economically feasible for us to do the whole spine MRI. However if patients claimed pain or were symptomatic we did it and found it to be 3.7%. MRI as investigative modality is the investigation of choice for early diagnosis as advised by Hoffman and Jain *et al*[18,19]. However CT imaging gives the picture of destroyed body better than MRI[18]. The use of fluorine-18 flouro-especially in the presence of of metallic implants[20].

Although anterior fixation, as done by us, is most commonly used[4,17,16], anterior debridement with posterior stabilization or posterior approach debridement with posterior stabilization is also recommended due to fear of scoliosis in the long run[4,19]. Although posterior stabilization by instrumentation seems to be logical as it avoids the infective field[19] but no aggravation of symptoms were seen post operatively in our study. Further posterior instrumentation takes longer operating time, addition of another approach and fixation of larger number of spinal units hence loss of more motion segments[21]. We have a followup of almost five years but we have not seen any case of significant kyphosis post operatively. This might be due to central fixation of bone graft and only supporting role of implants during early post op period until bone fusion occurs. However the use of CHK is getting out of favour in disease involving two or more than

two vertebrae, due to collapse or break of graft, increase in pseudoarthrosis and increasing kyphosis with delayed ambulation as seen by Rajasekran *et al* and Sundraraj *et al*[22,23].

Early intervention with stabilization was avoided in the past due to fear of secondary infection and putting implants in an infective field. It has been confirmed that mycobacteria adhere poorly to the metallic implants as compared to *staphyococcus. epidermidis* as described by Oga *et al*[24]. We have seen that titanium cages with grafts are being used successfully[12,25,26]. On the other hand sequestrum and abscess causes hindrance to antibiotics reaching optimum levels. The type of implants to be used are surgeons choice as variety of systems are in use[4,10,12] and are selected taking into consideration availability, training of the surgeon and economic factors. They help during the temporary phase of bone fusion which on the average lasts for four to six months.

Correction or retardation in the rate of development of kyphosis has been one of the advantages of operative treatment as seen by MRC at Hong Kong and Bulawayo trials[10,11]. Anterior instrumentation with debridement has been tried by many contemporaries[4,16,22] with good results as was seen in our study. The correction of in CHK 6.279 degrees (25%) and improvement in kyphosis angle in MHK 8.10 degrees (30.3%) was at par with these studies and there was no significant differences in both the methods. Use of rib graft is well documented[4,10,11,12] and we have used it successfully in almost all the cases. The fear of slipping and narrow surface area for union is genuine[16] but we did not encounter any difficulty. We normally use rib graft by tying 2-3 fragments together. Fusion does take place satisfactorily whether anterior or posterior fusion is undertaken[4, 12].

The patients had almost same results as far as mobility, job satisfaction, back pain and overall improvement is concerned however there was better correction of deformity and neurological recovery in MHK group. Conservative treatment still has got role in managing cases which are localized to single spinal unit without collapse, with no neurological deficit and having stable curvature of spine[27]. We understand that the sample size in our study was small. Further detailed studies are needed to study these two methods of management .

CONCLUSION

We can conclude that both CHK and MHK are good operative treatment options for active spinal tuberculosis in terms of correcting kyphotic deformity, neurological deficit and early return to normal life.

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