Turkish Neurosurgery 2010, Vol: 20, No: 3, 373-381

Thoracoscopic Surgical Approaches for Treating Various Thoracic Spinal Region Diseases

Çeşitli Torakal Omurga Hastalıklarına Torakoskopik Cerrahi Yaklaşımlar

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ABSTRACT

AIM: Minimally invasive surgery is currently a goal for surgical intervention in the spine. The effectiveness of endoscopic thoracic spine surgery and technological improvements are two factors that are always under consideration in the practice of spinal surgery.

MATERIAL and METHODS: We present twenty-five patients whose thoracoscopic spinal surgeries were performed between 2002 and 2008 for the treatment of various spinal diseases. Eleven patients with thoracic disc herniation, five patients with traumatic thoracic spinal compressive fracture, six patients with metastatic thoracic spinal tumors and three patients with tubercular spondylitis underwent thoracoscopic spine surgery. Clinical evaluations were performed at 3, 6,12 and 24 months post-surgery. The Oswestry disability questionnaire and linear visual analog scale (VAS) were used for the evaluation of pain.

RESULTS: Postoperatively, two patients had lung contusions, one patient had pneumonia and one patient had instability. There were significant initial improvements in both the Oswestry score and the VAS pain score up to 6 months ($p<0.05$). The average relative difference in pain scores in all groups was not significant at 12 and 24 months ($p>0.05$).

CONCLUSION: The favorable results of thoracoscopic spinal surgery encourage its application to situations in which a conventional thoracic approach is indicated. Thoracoscopic spine surgery is applicable to all patients with various spinal diseases

KEYWORDS: Minimal invasive surgery, Thoracal spine disease, Thoracoscopic spine surgery

ÖZ

AMAÇ: Son zamanlarda omurga cerrahi girişimlerinde az invaziv cerrahi hedef haline gelmiştir. Omurga cerrahisinde endoskopinin etkin olması ve teknolojinin ilerlemesi nedenleri ile omurga cerrahi pratiğinde rutin uygulanmaktadır.

YÖNTEM ve GEREÇ: Çeşitli torakal omurga hastalıkları nedeni ile 25 hastaya 2002-2008 tarihleri arasında torakoskopik cerrahi uygulanmıştır. Torakal disk herniasyonu olan 11 hastaya, travmatik torakal omurga kompresyon kırığı olan 5 hastaya, metastatik omurga tümörü nedeniyle 6 hastaya ve tüberküloz spondilitisi olan 3 hastaya torakoskopik cerrahi uygulanmıştır. Hastaların klinik değerlendirmeleri 3,6,12 ve 24. aylarda yapılmıştır. Ameliyat sonrası ağrının şiddet derecesi Oswestry ve görsel ağrı skalası (VAS) kullanılarak değerlendirilmiştir.

BULGULAR: Ameliyat sonrası 2 hastada akciğer kontüzyon, bir hastada pnömoni ve bir hastada instabilite gelişti. İlk 6 aya kadar Oswestry ve VAS ağrı skalalarında iyileşme derecesi anlamlı bulunmuştur ($p<0.05$). Tüm hastalarda 12. ve 24. aylarda ağrı skor ortalamasında göreceli değişiklik anlamlı bulunmamıştır ($p>0.05$).

SONUÇ: Torakoskopik omurga cerrahisinin, konvansiyonel torakal cerrahi yaklaşımlara göre olumlu sonuçları bu yöntemin uygulanması konusunda cesaret vermektedir. Çeşitli omurga hastalıkları olan hastalara torakoskopik cerrahi uygulanabilir.

ANAHTAR SÖZCÜKLER: Minimal invaziv cerrahi, Torakal omurga hastalığı, Torakoskopik omurga cerrahisi

Received : 09.02.2010
Accepted : 06.04.2010

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INTRODUCTION

Minimally invasive surgery is a current goal for surgical intervention. The advantages of endoscopic techniques include small incisions, a reduction in forced lung vital capacity, decreased pain and early mobilization. In particular, endoscopic techniques can be applied to a wide variety of thoracic spinal disorders (5,19]. The effectiveness of endoscopic thoracic spine surgery and technological improvement are two important factors that are always under consideration in practice of spinal surgery. Beginning in the early 1900s, a thoracoscopic approach was used as a diagnostic tool to evaluate pleural disease. The first report of a thoracoscopic approach was published by Jacobaeus in 1910 (8,9,10]. It was not until the late 1980s that the technology of endoscopic surgery was dramatically improved, with numerous studies applying thoracoscopy to lyse tuberculous lung adhesions. In 1993, Mack published the first study of endoscopic approaches to spinal disorders, reporting ten patients with various thoracic spinal pathologies that were effectively operated on endoscopically (12]. Regan (16] and Rosenthal (18] independently developed the technique of endoscopic thoracic spinal intervention. The viable options for a wide variety of thoracic spinal disorders include paravertebral abscess drainage, anterior thoracic discectomy for central thoracic disc herniation, anterior spinal cord decompression and fusion for spinal deformity, stabilization and fusion of thoracic vertebrae fracture, corpectomy for vertebral tumors and tissue biopsies (3,13].

In this study, we present twenty-five patients in four designated spinal pathology groups who were operated on using endoscopic approaches with favorable outcomes. Preoperative and postoperative data were gathered and compared, and postoperative pain after thoracoscopic surgery was evaluated across the four different groups.

MATERIAL and METHODS

Between 2002 and 2008, twenty-five patients underwent endoscopic thoracic spine surgery for different spine diseases. There were 14 female and 11 male patients. The ages of the patients were 32-85 (mean 48.3). In total, 25 patients who were followed up for a minimum of 24 months were included in the study. All patients had back pain, and five patients had neurological deficits (paraplegia/paraparesis). The patients were divided into four groups according to primary thoracic disease: A) thoracic disc; B) traumatic thoracic spinal fracture; C) metastatic thoracic spinal tumor; and D) tubercular spondylitis (Table I).

Patients who had obvious general medical problems, previous thoracic surgery that may have caused pleural adhesions, posterior localization of pathology, or an inability to tolerate single lung

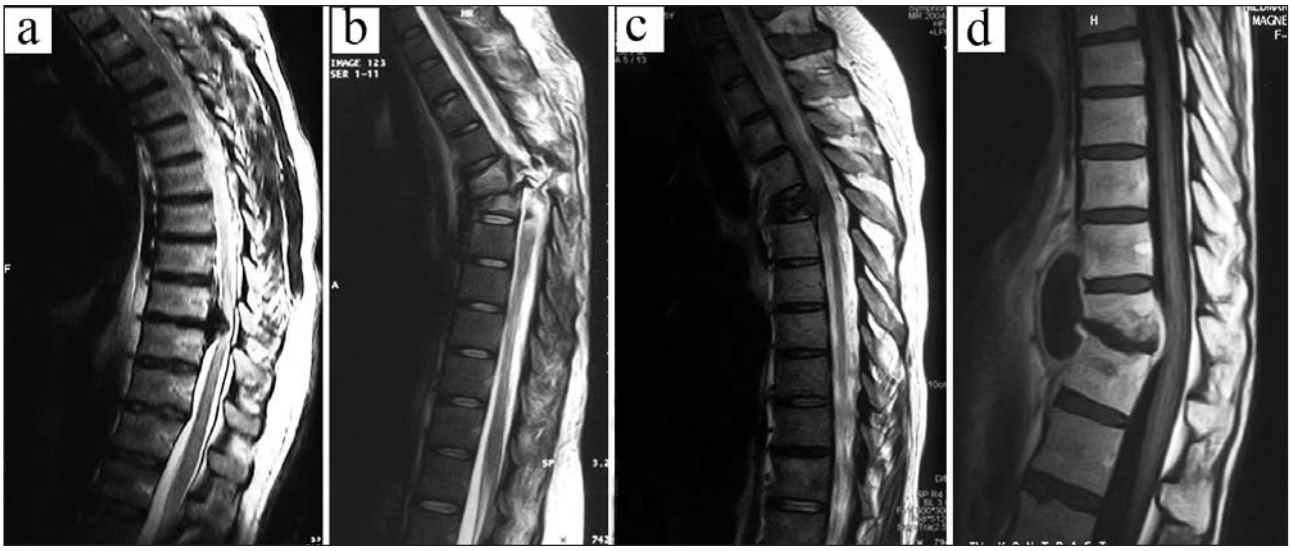

Figure 1: *Preoperative T2 weighted sagittal planes show:* ***A)*** *central localization of T9-10 disc herniation that has compressed the spinal cord;* ***B)*** *traumatic compression fracture of T5 spine;* ***C)*** *T5 metastatic breast carcinoma;* ***D)*** *tubercular spondylitis of T11-12 spines. (Postoperzti ve plain X-Ray and CT were shown in figure-7)*

Table I: Presentation of Twenty-Five Patients in Four Groups and the Obtained Results

Groups	Patient	Gender	Age	Clinical Presentation	Diagnosis	Intervention	Duration (Min)	Blood Loss	Stay in ICU (days)	Duration of hospitalization (days)
A	1	F	42	Back Pain	T11-12 disc herniation	Right 4 Port, T11-12 Discectomy	180	250	1	3
	2	M	39	Back Pain	T10-11 disc herniation	Left 3 Port T 10-11 Discectomy	180	300	2	4
	3	F	28	Back Pain	T11-12 disc herniation	Left 3 Port T 11-12 Discectomy	120	200	1	3
	4	F	45	Back Pain	T9-10 disc herniation	Left 3 Port T9-10 Discectomy.	120	200	2	2
	5	F	38	Back Pain	T8-9 disc herniation	Left, 3 Port T8-9 Discectomy	150	450	2	3
	6	M	35	Back Pain	T8-9 disc herniation	Right 4 Port T8-9 Discectomy	150	300	1	4
	7	M	47	Back pain – paresthesia	T9-10 disc herniation	Right 4 port, T9-10 Discectomy	180	350	1	4
	8	M	32	Back pain	T5-6 disc herniation	Left 3 port, T5-6 Discectomy	140	300	2	7
	9	F	42	Back pain – paresthesia	T9-10 disc herniation	Left 4 port, T9-10 Discectomy	150	250	1	3
	10	F	63	Back pain – paresthesia	T6-7 disc herniation	Left 4 port, T6-7 Discectomy	200	500	2	5
	11	M	55	Back pain	T7-8 disc herniation	Right 3 port, T7-8 Discectomy	180	300	2	5
B	12	M	47	Fall Down, Paraparesia	T9-10 Compression fracture	Right 4 Port T9-10 Endoscopic anterior discectomy + bone graft	180	350	1	4
	13	F	33	Fall Down, Paraparesia	T5-6 Fracture	Left 3 Port, T6 corpectomy + bone graft	140	300	3*	7
	14	F	42	Fall Down, Paraparesia	T10 Compression fracture	Left 4 Port T10 corpectomy + fix cage	150	250	1	3
	15	F	73	Back Pain for 2 months	T7 Osteoporotic compression fracture	Left 4 Port T7 corpectomy + fix cage	200	500	2	5
	16	F	75	Back Pain for 3 months	T8 Osteoporotic compression fracture	Right 3 Port corpectomy+ fibula bone graft	180	300	2	5
C	17	M	83	Operated colon ca, back pain for 3 months	T11 Metastatic tumor (colon ca)	Right 4 Port subtotal corpectomy and tumor excision(biopsy)+ PMMA*** injection	180	200	3	6
	18	F	36	Operated breast ca, radiation and chemotherapy Applied back pain for 2 month	T5 Metastatic tumor (breast ca)	Right 3 Port corpectomy+ expandable cage	150	250	1	4
	19	M	80	Metastatic prostate ca to colon	T8 metastatic compression fracture	Right 3 Port, corpectomy +fibula bone graft	180	200	1	3
	20	M	58	Bladder incontinence Back Pain, Paraparesia	T8-9 Metastatic multiple myeloma	Left 4 Port T8-9 vertebrectomy +PMMA*** +anterior plate fixation	360-Case 1st	1000	14**	20
	21	M	61	Back Pain, Gate disturbance	T6 Metastatic adenocarcinoma	Right 4 Port T6 corpectomy +Expandable cage	240	200	1	3
	22	M	31	Back Pain, Paraparesia, Bladder incontinence	T8 Metastatic adenocarcinoma	Right 4 Port T8 corpectomy+ Medullar bone graft +Anterior instrumentation	200	150	1	3
D	23	F	38	Back Pain, Did not receive anti-TBC drugs	T11-12 Vertebral TBC	Left 4 Port T11-12 vertebrectomy+ Iliac bone graft + anterior instrumentation	240	300	1	4
	24	M	42	Back Pain received anti-TBC drugs	T8-9 Vertebral TBC	Left 3 Port T8-9 vertebrectomy+ Iliac bone graft + instrumentation	180	200	1	5
	25	F	40	Back Pain received anti-TBC drugs	T8-9 Vertebral TBC	Left 3 Port T8-9 vertebrectomy +Iliac bone graft+ anterior instrumentation	200	200	1	5

** Postoperative second day chest CT showed left lung contusion; ** Re-intubated on sixth postoperative day for pneumonia; *** Polymethyl Methacrylate*

ventilation did not undergo the thoracoscopic approach.

Preoperative workup included a physical examination, neurological assessment, and laboratory blood examination. Radiological investigations included plain radiographs, thoracic computerized tomography (CT), and thoracic magnetic resonance imaging (MRI) (Figure 1A,B,C,D).

The surgical procedure was described in detail to patients. Patients were also informed of possible complications and that conventional thoracotomy could be performed. All data on the patients were collected at each visit before and after surgery. Clinical evaluations were conducted during follow-up visits at 3, 6, 12 and 24 months by a physical therapeutic physician and included the Oswestry Disability Questionnaire and a linear visual analog scale (VAS) for the evaluation of pain.

Operative technique: The operating room setup and surgical instruments were similar for all patients (Figure 5A, B). The procedure was performed under general anesthesia on a radiolucent operating table. Endotracheal intubation with a double-lumen tube was used in all patients. Initial preparations included the placement of and arterial line, a central nervous system catheter, pneumatic compression stockings and a urinary catheter. Patients were also prepared so that conventional thoracotomy could be performed if complications occurred during thoracoscopic surgery. Patients were generally turned and placed in a right- or left-up lateral decubitus position, with the side to be operated on

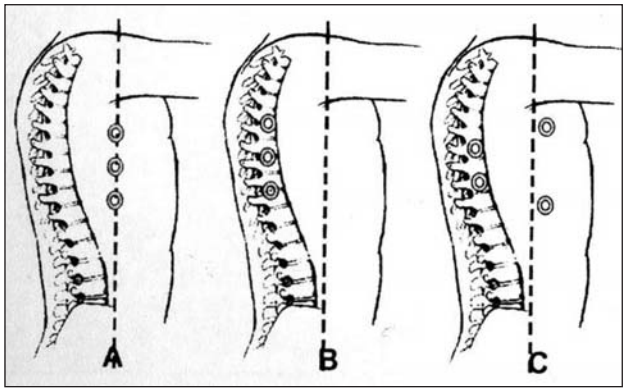

Figure 2: *Schematic of trocar locations. Three to four portal trocars were used, depending on localization of the target.*

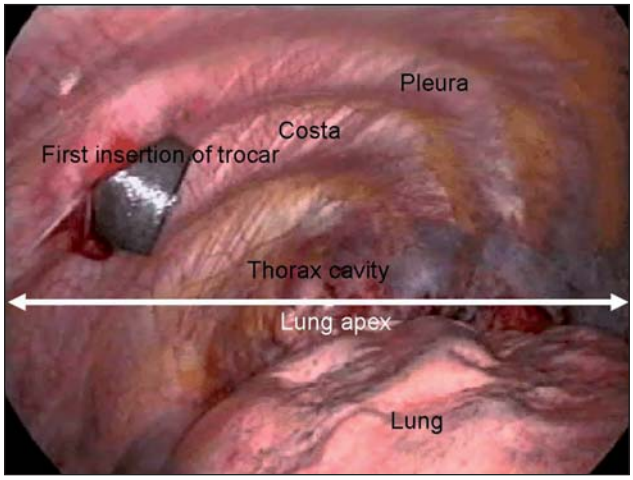

Figure 3: *The exploration of the thoracic cavity by optic camera for surgical anatomical orientation.*

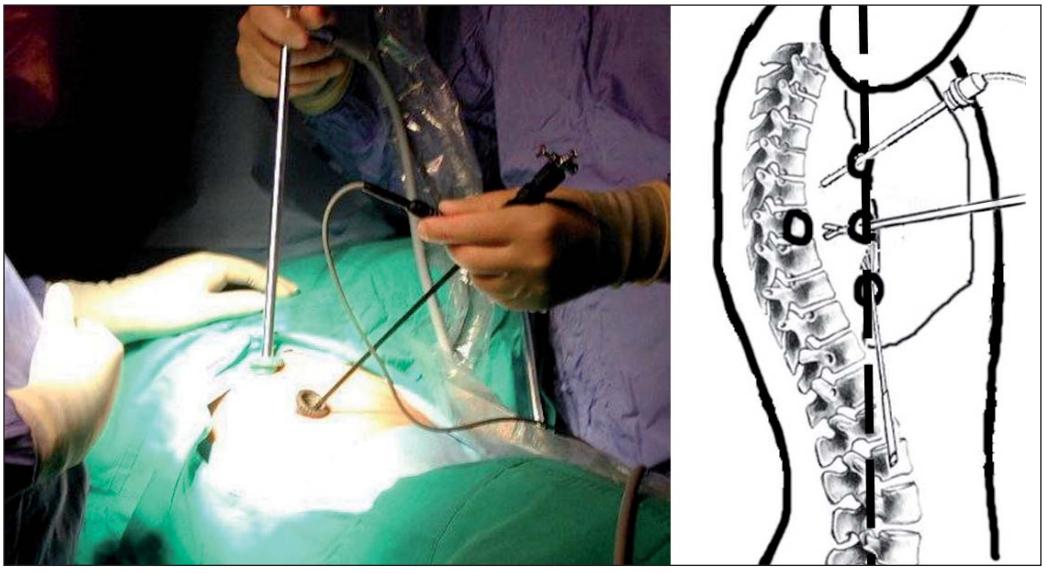

Figure 4: *One portal was inserted over the target on the posterior axillary line, and the second portal was on the cross point of the anterior axillary line and transverse line that passed the first portal.*

facing up. Accordingly, 11 patients underwent the thoracoscopy procedure from the right side, and 14 patients underwent the procedure from the left side. Fluoroscopy (c-arm) was positioned to verify the disease level prior to incision and to obtain lateral and anterior-posterior intraoperative images.

Three to four portal trocars were used, depending on the location of the target (Figure 2). In all cases, the first 10 mm portal was placed directly over the target spine or disc segment posterolaterally, between the posterior axillary and the midline. The thorax cavity was explored with an optic camera for anatomical orientation (Figure 3). One portal was inserted over the target on the posterior axillary line. The second portal was on the cross point of the anterior axillary line and the transverse line that passed the first portal (Figure 4). This method permitted us compatible manipulation during the procedure and the use of 0 and 30° angled optics during the operation in all varieties of spinal disorders.

A 32-Fr chest tube was inserted before lung expansion and wound closure. The chest tubes were placed at 20 cm H_2O of suction. All patients were kept in the postoperative ward and monitored closely for heart rate, arterial pressure, respiratory rate, oxygen saturation and respiratory complications. Patients were examined by plain chest X-ray for adequate lung inflation, and chest CTs were obtained in 6 patients to determine any lung complications. Different procedures were

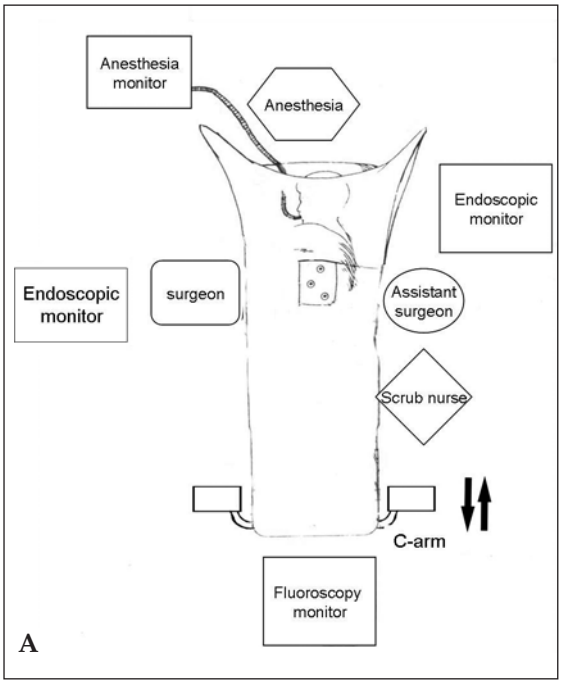

Figure 5: A) *operating room setup*
B) *thoracoscopic spinal surgery instruments*

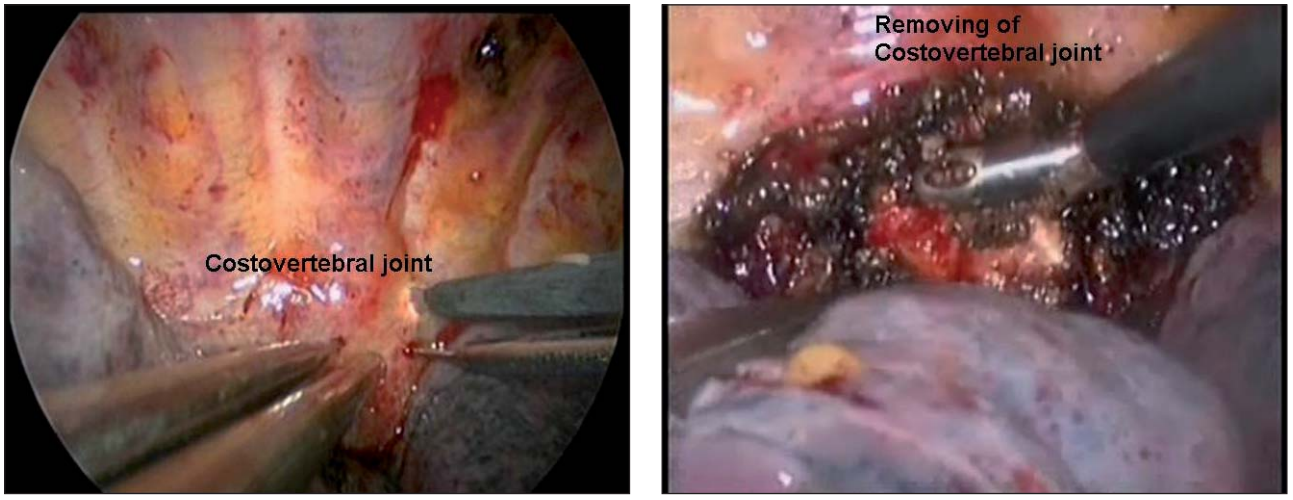

Figure 6: *Removal of costovertebral joint to visualize dura meter and access to epidural space.*

performed to treat various spinal disorders by thoracoscopic spinal surgery:

Group A (Thoracic disc herniation): The procedure was performed in 7 patients from the left side and 4 patients from the right side. The procedure was started with a 0 degree angled rigid endoscope. A 30º angled rigid endoscope was used where required based on the patient's pathology. A three or four portal trocar strategy was used as explained above. One portal was inserted over the disc space on the posterior axillary line. An adequate level was identified by radiography. The spinal canal was visualized by removing the superior portion of the pedicle. The tracing of the superior edge of the pedicle to the vertebral body, and the disc space led to the exploration of the disc herniation after removal of costovertebral joint (Figure 6). The interbody fusion procedure was not performed after the discectomy (Figure 7A).

Group B (Traumatic thoracic spinal compressive fracture): Exposure for thoracic corpectomy was similar to other dorsal spinal disorders. The locations of the portals were checked by c-arm endoscopy. The segmental vessels were mobilized and occluded with hemoclips before corpectomy to prevent bleeding. Free fragment bony vertebrae were removed by puncture, and the remainder removed by high-speed drill. Following the corpectomy procedure, a bone graft was applied with or without an anterior interbody cage and autogenous bone (crista iliaca bone). If the patient required posterior column stabilization, posterior instrumentation was applied in the same session (Figure 7B).

Group C (Metastatic thoracic spinal tumor): The initial thoracoscopic approach was performed as described for traumatic thoracic spinal fracture. In such cases, the involved body of vertebrae was usually soft, so corpectomy could be easily done by curettage. In metastatic cases, polymethyl methacrylate bone cement was preferred as a supporting material instead of bone graft (Figure 7C).

Group D (Tubercular spondylitis): After the performance of the initial procedure described in the previous cases, the correct level of tubercular spondylitis was marked by preoperative fluoroscopy and confirmed by counting vertebrae. The skin incision and working trocar were arranged just above the spine surgery zone. A soft tissue abscess in the involved area also aided confirmation of the true level. A small incision was performed over the abscess by long no. 15 scalpel, and the purulent material was drained. An aspiration system was made available before incising the abscess to avoid contamination.

Specimens were obtained according to microbiology lab protocols for tuberculosis and pyogenic organisms. The pleura over abscesses were enlarged by electrocautery. The intercostal vessels were ligated with hemoclips. Granulation tissue and vertebral bones were removed by curettage and high-speed drill. Infected granulation tissue, bony sequestrate and necrosed discs were totally resected to avoid infection recurrence, and the graft surface was prepared up and down with the removal of cartilage endplates. Anterior autogenous bone (crista iliaca) insertion and anterior instrumentation was performed (Figure 7D).

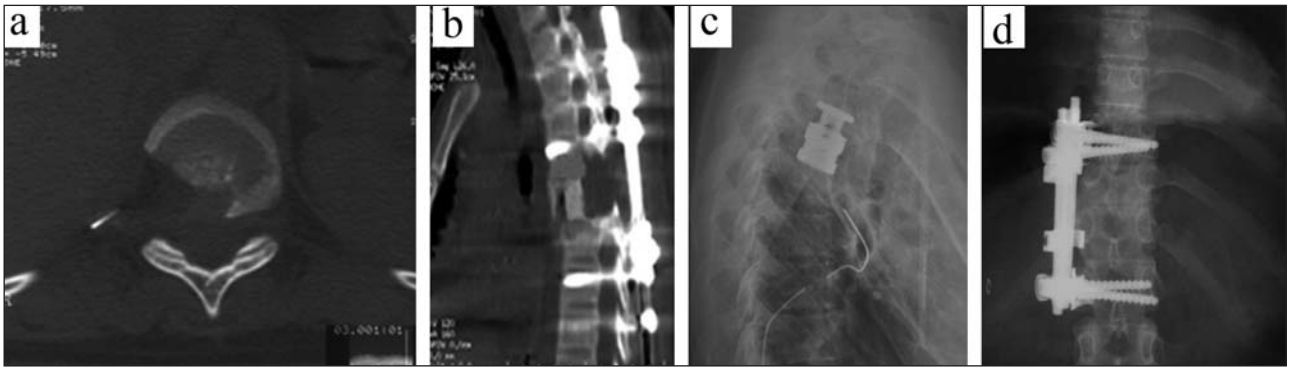

Figure 7: *Postoperative plain X-Ray and CT graphics.* ***A)*** *Bone window CT scans show resection of T9 right pedicle and part of the spine body;* ***B)*** *Sagittal reconstruction of CT shows T5 corpectomy, replacement of autogenous bone graft (crista iliaca bone) and associated posterior transpedicle instrumentation;* ***C)*** *Lateral plain X-ray shows T5 corpectomy and expandable cage;* ***D)*** *Anterior-posterior plain X-ray shows thorzcic spinal instrumenlation and fusion after thorzcoscopic surgery for tubercular spondylitis.*

RESULTS

In all twenty-five patients, the thoracoscopic approach was performed with technical satisfaction. One patient with a T5-6 traumatic compression fracture showed lung contusion on the left side in the postoperative second day chest CT. Blood gases were at physiological levels. One patient with metastatic breast carcinoma at T5 was re-intubated on the sixth postoperative day, and a chest CT scan revealed pneumonia. There was no pseudoarthrosis in patients who underwent the fusion procedure. One patient with T8 corpectomy was treated for T8 adenocarcinoma; there was a recurrence on upper vertebrae that caused instability after 12 months. Three patients with primary neoplasm died after the 12-month follow-up.

Group A (Thoracic disc herniation): This group contained 11 patients who had symptomatic central disc herniation at T5-6 (n=1), T6-7 (n=1), T7-8 (n=1), T8-9(n=2), T9-10 (n=3), T10-11 (n=1), and T11-12 (n=2). The average operative time was 159 minutes (range 120-200 minutes), and the mean blood loss was 309 ml (range 250-500 ml). The chest tube was removed when the drainage was less than 100 ml over 24 hours. In ten patients, it was removed the next day, and in one patient, it was removed on the 3rd postoperative day. The mean stay in the ICU after surgery was 1.5 days (range 1-2 days), and the mean duration of hospitalization was 3.9 days (range 2-7 days). There was significant improvement for up to one year.

Group B (Traumatic thoracic spinal compressive fracture): Five patients underwent thoracoscopic spinal surgery for traumatic compressive fracture. Three patients had symptomatic thoracic spinal fracture at one level (T7, T8, T10) and two patients at two levels (T5-6, T9-10). Two patients had T7 and T8 osteoporotic fracture. In this group, the average operative time was 170 minutes (range 140-200 minutes), and the mean blood loss was 280 ml (range 200-500 ml). The mean stay in the ICU and duration of hospitalization was 1.8 days (range 1-3 days) and 4.8 days (range 3-7 days), respectively.

Group C (Metastatic thoracic spinal tumor): Six patients underwent a thoracoscopic approach for tumor excision from thoracic vertebrae. Two metastatic colon carcinoma patients had tumors at T8 and T11, one metastatic breast cancer patient at T5, two adenocarcinoma patients at T6 and T8 and one multiple myeloma patient at two levels, T8-T9. In this group, the average operative time was 185 minutes (range 150-360 minutes), the mean blood loss 333 ml (range 150-1000 ml), the stay in the ICU was 3.5 days (range 1-14 days), and the duration of hospitalization was 6.5 days (3-20 days).

Group D (Tubercular spondylitis): Three patients were treated for tubercular spondylitis. All of these patients had vertebral abscesses at T8-9 (n=2) and T11-12 (n=1). The average surgery time was 207 minutes (range 180-240 minutes), mean blood loss was 233 ml (range 200-300 ml), the mean stay in the ICU was 1 day and the mean duration of hospital stay was 4.6 days (range 4-5 days).

Outcome data, including Oswestry disability score and VAS back pain score, were collected for 25 patients up to 24 months postoperatively. The scores of patients in each group is depicted in Table II. The average percent improvement in Oswestry scores was greatest in group A (preoperative: 88.33, postoperative mean: 32.17), followed by group B (preoperative: 63.73, postoperative mean: 32.41), group C (preoperative: 85.20, postoperative mean: 38.40) and group D (preoperative: 53.33, postoperative mean: 35.39).

The average percent change in VAS pain score was greatest in group A (preoperative: 8.7, postoperative mean: 2.8), followed by group B (preoperative: 8.0, postoperative mean: 3.05), group C (preoperative: 7.6, postoperative mean: 2.60) and group D (preoperative: 6.6, postoperative mean: 2.62). For all twenty-five patients, the preoperative mean Oswestry score was 72.63, and the postoperative mean was 34.06; the preoperative VAS mean was 7.72, and the postoperative mean was 2.76.

There was significant initial improvement in both Oswestry scores and VAS pain score up to 9 months ($p<0.05$). The average relative differences in the Oswestry score and VAS pain score for all groups were not significant at 12 and 24 months.

DISCUSSION

Thoracoscopic spinal surgery (TSS) is a minimally invasive technique used for accessing and treating spinal disorders. Due to the excellent results obtained, the continued use of TSS is encouraged in situations in which a conventional approach would normally be used (2). Thoracoscopy can be used to

Table II: The Mean Operative and Follow-up Results in All Patients

All 20 cases	Operation Time (minutes)	Blood loss (ml)	Stay in ICU (day)	Duration of hospitalization (day)	Oswestry disability Score Average						VAS back pain score Average					
					Preop	Postop 3 months	Postop 6 months	Postop 12 months	Postop 24 months	Postoperative mean	Preop	Postop 3 months	Postop 6 months	Postop 12 months	Postop 24 months	Postoperative mean
Group A	159	309	1.5	3.9	88.3	40.1	37.8	26.3	24.5	32.17	8.7	4.7	2.8	1.8	1.9	2.8
Group B	170	280	1.4	4.2	63.73	45.70	31.10	29.26	23.60	32.41	8.0	4.8	2.8	2.4	2.2	3.05
Group C	185	333	1.8	4.8	85.20	46.82	35.82	32.56	*30.0	36.30	7.6	4.3	2.5	1.6	*2.0	2.6
Group D	207	233	1	4.6	53.33	41.52	34.53	33.52	32.00	35.39	6.6	3.6	2.6	2.3	2.0	2.62
Average	180.2	288.75	1.42	4.37	72.63	43.53	34.81	30.41	27.52	34.06	7.72	4.35	2.02	2.02	2.02	2.76

** Three patients died 12 months postoperatively. The averages were taken excluding the 3 patients.*

access or treat a variety of spine disorders. Thoracoscopic spinal surgery is more beneficial than open thoracotomy as it is less invasive. This observation is widely known and supported by relevant literature. In this study, operative and follow-up data were obtained and compared for different diagnosed cases treated by thoracoscopic surgery. We discussed previously the issues analyzed during our study of a consecutive series of 25 patients with different thoracic spinal disorders. The outcome is dependent on the primary disorders and surgical techniques.

Rosenthal and Dickman reported the results of 55 consecutive patients undergoing thoracoscopic microsurgical excision of herniated thoracic discs (17]. They found that 60% of myelopathic patients and 79% of radiculopathic patients improved. They compared open surgery results to their patients treated with thoracoscopic surgery and showed that thoracoscopic discectomy was associated with 50% less blood loss and an hour less operative time. Anand and Regan reported that thoracoscopic surgery for thoracic disc disease has an overall long-term satisfaction rate of 84% and a clinical success rate of 70% for refractory thoracic disc disease.

The other condition for which thoracoscopy is osteomyelitis. Three to 10% of these patients have involvement of the skeletal system. Vertebral tuberculosis constitutes 50% of all cases, 44% of which occur in the dorsal spine (11]. The use of thoracoscopy to obtain tissue confirmation for a faster and more reliable diagnosis has been reported (4]. We found it apparent that thoracoscopic surgery obtains radical debridement, leading to a direct visualization of the dural sac and kyphotic deformity correction with interbody cage and anterior screwing.

Huang et al. showed the reliability and effectiveness of thoracoscopy in the management of ten patients with dorsal tuberculous spondylitis (6]. There was no recurrence of infection at the 24-month follow-up examination, but there was increased kyphotic deformity in two patients secondary to rib graft subsidence. All three patients in our series were improved at the 24-month follow-up assessment. We did not encounter patients with kyphotic deformity. We believe that a rib graft cannot supply safe stabilization for the anterior part of vertebrae because the superior and inferior surfaces of the costa are small. We used an iliac crest bone graft that could carry more load with earlier stabilization of fusion.

The use of thoracoscopic spinal surgery for the management of traumatic and osteoporotic compressive fractures has been described in the literature. Dickman et al. compared outcomes of fracture management between open thoracotomy and thoracoscopic surgery groups (3]. A significant reduction in narcotic use and ICU and hospital stays in the thoracoscopic group was reported. The main problem encountered was pseudoarthrosis. There is a high incidence of pseudoarthrosis if an allograft is used (14,15]. As we have described previously, an autogenous bone graft, particularly iliac crest graft, is the current standard treatment of choice to avoid pseudoarthrosis. We used autogenous bone graft for fusion after thoracoscopic corpectomy and an associated expandable cage for probable reduction of pseudoarthrosis.

Thoracoscopic spinal surgery has been described as an alternative procedure to open thoracotomy in the management of primary and metastatic spinal tumors. The use of thoracoscopic spinal surgery for spinal tumors with infiltration to adjacent tissues is high risk and has to be exercised with caution. Huang et al. (7] reported that 5% of perioperative deaths were related to respiratory complications. The other problem of spinal tumors is instability, depending on the recurrence of tumors in the upper or lower vertebrae. In one patient with adenocarcinoma, instability occurred after tumor recurrence at the 12-month follow-up. In the current study, patients with severe disability, regardless of primary spinal disease (Oswestry score≥50, VAS>4), showed significantly greater improvement at the 12- and 24-month follow-ups (Oswestry score <50, VAS<4).

The complication rate in our study was 20%, which compares favorably with Anand and Regan (1] with a 21% rate, McAfee et al. with a 20.5% rate and Huang et al. (7] with a 24.4% rate.

In conclusion, thoracoscopic spinal surgery is applicable to all patients with various spinal diseases. There is no significant difference in the time of operation, blood loss, ICU stay or ward parameters between the different spinal diseases. The perioperative morbidity associated with the thoracoscopic approach is lower than that associated with thoracotomy.

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