



Original Article

# Long-term operative outcome of giant calcified thoracic disc herniation – A retrospective analysis of 24 patients

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Received : 31 August 2022

Accepted : 24 September 2022

Published : 11 November 2022

**DOI**

10.25259/SNI\_798\_2022

**Quick Response Code:**



## ABSTRACT

**Background:** Thoracic disc herniations (TDHs) are rare (0.15–4%) and often cause significant myelopathy (70–95%). They are defined as “Giant” if they occupy >40% of the spinal canal. Further, they are ossified/calcified in 42% of cases, with a 70% incidence of intradural extension. Here, we reviewed our experience resecting 24 giant thoracic discs utilizing a posterolateral surgical approach.

**Methods:** Over a 2-year period, we evaluated the outcomes for 24 patients averaging 40 years of age undergoing posterolateral resections of giant ossified/calcified TDH. We evaluated multiple clinical and radiographic parameters; demographics, Frankel grades, surgical time, perioperative complications, and number of levels involved. In addition, utilizing magnetic resonance/computed tomography studies, we documented that the most commonly involved level was T11–T12, and the average canal occupancy ratio (i.e., degree of canal encroachment) was  $58.2 \pm 7.72\%$ .

**Results:** Neurological improvement was seen in 22 of the 24 patients; none experienced neurological deterioration over the average 2-year post-operative period. Six complications occurred; three dural tears and three suture site infections.

**Conclusion:** The posterolateral approach proved to be safe and effectively for resecting 24 giant ossified/calcified TDH with minimum complications.

**Keywords:** Calcified disc, Giant thoracic disc herniations, Posterolateral approach

## INTRODUCTION

Thoracic disc herniations (TDHs) are rare and occur with a frequency of 1 in a million. They make up to 0.15–4% of all surgery for disc herniations and are symptomatic typically in the elderly patients. They are labeled as “giant” when they occupy more than 40% of the spinal canal on magnetic resonance or computed tomography studies; notably, 15–70% exhibit concomitant intradural extension. Surgery in myelopathic patients may be performed anteriorly, posteriorly, posterolaterally, laterally, or circumferentially. Here, we reviewed 24 patients with giant TDH who underwent successful posterolateral resections with limited morbidity.

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## MATERIALS AND METHODS

Over a 2-year period, 24 patients with giant ossified/calcified TDH underwent posterolateral surgery. Multiple clinical and radiographic parameters were followed at 1, 3, 6 months, and 1 at 1 and 2 years postoperatively [Table 1]. There were additional inclusion and exclusion criteria. The 18 males and 6 females, averaged 40 years of age, and 15 patients had single level disc involvement, while nine patients had multiple levels involved. The most commonly involved level was T11-12 exhibiting a mean canal occupancy of 58.2. Preoperatively, there were five patients with Frankel-A 8 with Frankel-B, 9 with Frankel-C, and 2 with Frankel-D grades.

### Surgical technique

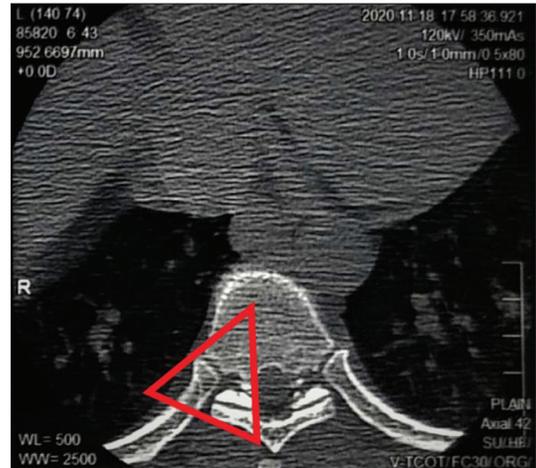
Through a standard mid-line posterior skin incision, posterolateral approaches (i.e., transfacetal, transpedicular, or costotransversectomy) [Table 2] allowed for anterior resection of the TDH utilizing high speed burrs, curettes, and Kerrison Rongeurs [Figure 1]. After the mid portion of these anterior discs was resected, the posterior portions were thinned out into an “eggshell configuration,” and removed. The dura was freed from the ossified/calcified disc using Penfield and Woodson dissectors. This then allowing the TDH to be punched anteriorly into the disc space and removed [Figures 2-6]. In a few cases where the dura was adherent to the ossified/calcified disc, a portion of the calcified TDH was left as a “floating mass,” and covered with a fat patch (i.e., without a cerebrospinal fluid [CSF] leak). In other cases, where dural tears occurred and could not be sutured, the fistulas were covered with collagen matrix and muscle patch grafts. This was followed by bilateral pedicle screw placement

using a free hand technique followed by the application of rods. Negative suction drains were placed and removed on the third postoperative day in patients without CSF leaks, but left in longer for those with CSF fistulas.

## RESULTS

### Postoperative neurological Frankel grades

No patient exhibited immediate postoperative neurological deterioration, nor was there worsening in their Frankel Grades over 2 postoperative years. Their postoperative Frankel Grades included: 1 with Frankel-A, 1 with Frankel-B, 8 with Frankel-C, 6 with Frankel-D, and 8 with Frankel-E [Table 3]. Two patients showed no neurological improvement postoperatively. Further, the immediate postoperative bladder incontinence observed in 12 patients, gradually improved in 10; two showed no improvement.



**Figure 1:** Posterolateral approach, entering from the side of maximum compression as shown by marked area.



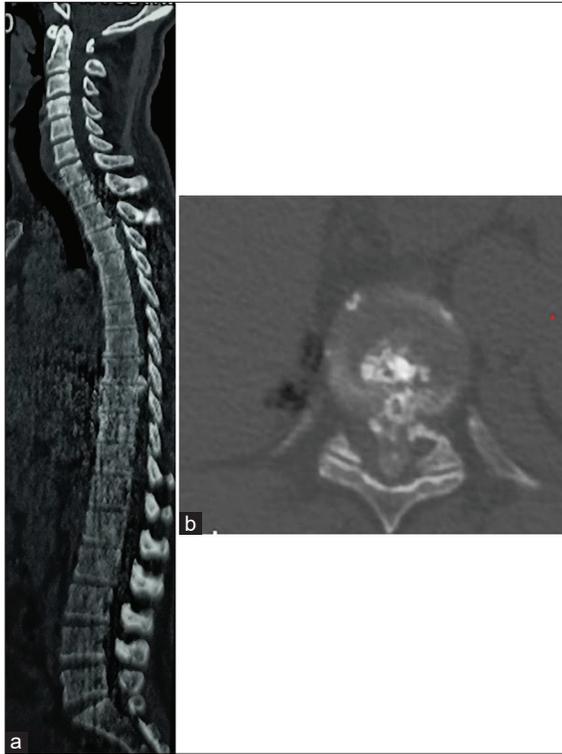
**Figure 2:** Sagittal image depicting the approach to calcified disc as shown by arrows.

**Table 1:** Clinicoradiological parameters.

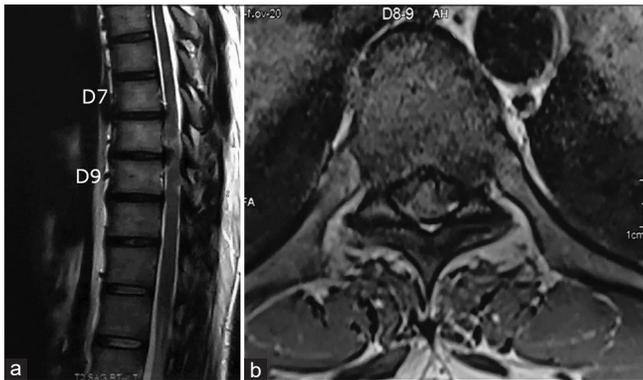
Clinical Parameters	Radiological parameters
Demography	X-rays pre and postoperative
Neurological assessment-Frankel Grading	CT scan
Surgical approach used	MRI scan
Surgical time and blood loss	Number of levels affected
Time to mobilization	Canal occupancy
Complications	

**Table 2:** Approach based on location and number of levels.

Condition (GC-TDH)	Approach
Paracentral/foraminal-single level	Unilateral+Transfacetal/pedicular
Central-Single level	Bilateral+Transfacetal/pedicular
Multilevel	Costo-transverse/Multi-TP/TF



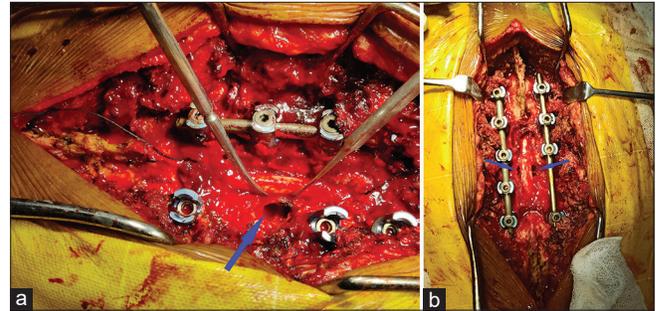
**Figure 3:** (a) Case of thoracic disc herniations in a 42 years male, sagittal computed tomography (CT) showing giant calcified herniated disc at D8-9 and D7-8 levels and (b) axial CT showing giant calcified herniated disc.



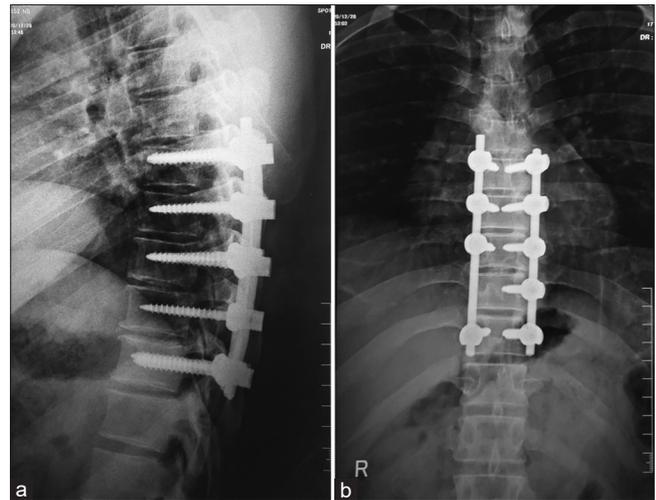
**Figure 4:** (a) Sagittal magnetic resonance imaging (MRI) showing herniated disc at D7-8, D8-9 levels and (b) axial MRI showing herniated disc at D7-8 and D8-9 levels.

### Extent of surgery

Patients underwent an average of 4.25 (range 2–6 levels) levels of instrumentation, with mean surgical times of  $222.5 \pm 41.4$  min; the average blood loss of  $1.17 \pm 0.17$  l. They were mobilized an average of 4.16 days postoperatively (ranging from 3 to 10 days).



**Figure 5:** (a) Unilateral posterolateral approach as shown by arrow for resection of foraminal/paracentral disc and (b) bilateral posterolateral approach preferred in a large central calcified disc.



**Figure 6:** (a) Postoperative X-ray and (b) postoperative X-ray.

### Complications

Six patients had postoperative complications. Three had dural tears managed by direct suturing using Prolene 5–0 and reinforced with fat patches (Note that we now realize that Prolene sutures typically unfurl and are NOT the best sutures to use in these cases). All three patients were managed with a postoperative dural leak protocol. Another three patients had suture site complications which were managed conservatively. No patient required revision surgery.

### DISCUSSION

#### Choice of operative approaches

There are multiple approaches to giant TDH documented in the literature. Although anterior approaches provide excellent view of the central herniated disc and allow for thorough decompression, there is a high morbidity rate and a steep learning curve for thoracotomy or thoracoscopy (i.e., complication rates 21–39%).<sup>[1]</sup> In addition, laminectomies for central TDH have resulted in high morbidity rates.<sup>[2,3]</sup> The

posterolateral approach (i.e., transfacetel/transpedicular/costotransversectomy) offers reduced morbidity (i.e.,

including reduced dural tears) with equally good if not better long-term outcomes. When Sivakumaran *et al.* used a posterolateral approach; their patients demonstrated good neurological recoveries without significant complications.<sup>[7]</sup>

**Table 3:** Table showing the location of TDH, neurological recovery, Mean levels of instrumentation, blood loss, duration of surgery, and mobilization time.

Location	Number of patients		
T7-8	3		
T8-9	7		
T9-10	7		
T10-11	10		
T11-12	12		
Frankel grading	Preoperative	6 weeks postoperative	2 years postoperative
A	5	1	1
B	8	5	1
C	9	8	8
D	2	8	6
E	0	2	8
P-value	>0.05	<0.01	<0.001
Mean level of instrumentation	4.25 (range 2–6 levels)		
Mean duration of surgery	222.5±41.4 min		
Mean blood loss	1.17±0.17 l		
Mean time for mobilization	4.16 days (day 3-day10)		

### Mean canal occupancy ratio of TDH and accompanying risks/complications

Thoracic canal compression beyond 40%, as with giant TDH, has typically results in significant myelopathy. Our mean canal occupancy ratio was  $58.2 \pm 7.72\%$  and indeed; our patients were myelopathic as indicated by their preoperative Frankel Grades [Table 3]. The mean canal encroachment in Quraishi *et al.*<sup>[4]</sup> was 62% (range 40–90%), and their patients demonstrated significant postoperative neurological improvement (i.e., without worsening) utilizing surgical various surgical techniques.

### Surgical times for posterolateral surgical approaches to giant TDH

The average surgical times for posterolateral resection of giant TDH are shorter than for other approaches;<sup>[8]</sup> our mean surgical duration was  $222.5 \pm 41.4$  min. For Sivakumaran *et al.*, the average surgical time for posterolateral giant TDH surgery was also low at 92 min.<sup>[7]</sup> However, the average

**Table 4:** Results of published studies of surgical treatment for giant calcified TDH.

Authors	Year	Patients	Approach	Follow-up	Outcome (Neurological)	complications
Sivakumaran <i>et al.</i>	2018	24	Posterolateral	6 months (2–36 months)	Improved/maintained in all 24	Two-dural tear
Hott <i>et al.</i>	2005	20	8-thoracoscopy 8-thoracotomy 4-posterolateral	2.6 years	53% improved 5% worsened, 42% status quo	1-paraparesis 4-chest complications 1-progressive kyphosis 2-intercostal neuralgia
Gille <i>et al.</i>	2006	18	Thoracoscopy	45 months	83% improved 5% worsening 12% delayed recovery	1-pleural effusion 39% (7) dural breaches 3-intercostal neuralgia
Russso <i>et al.</i>	2012	7	Mini-thoracotomy	23 months	Nurick grade improved from 3.5 to 1.28	42% complication rate 1-neurological worsening 1-Subdural hematoma
Zhao <i>et al.</i>	2013	15	Thoracotomy	45 months	12 cases improved 3-no change	26% complication rate
Yamasaki <i>et al.</i>	2013	11	Bilateral facetectomy	4.3 years	10 cases had a 1 Frankel grade improvement, 60% improvement	Dural tear
Quraishi <i>et al.</i>	2014	13	Thoracotomy	37 months	8 patients improved 1 Frankel grade (61%), 2 improved 2 grades (15%) and 3 were unchanged (23%)	31% complication rate, with 3 breaches
Roelz <i>et al.</i>	2016	17	Mini-thoracotomy	5.5 years	Postop JOA score 11.1/13 Two cases of transient postoperative deterioration	23% had reversible neurological worsening 11% rate of lung complications, 1 CSF pleural fistula

operative time of 344 min was observed with anterior surgery.<sup>[5,6,9]</sup> Other factors such as average blood loss and time to mobilization were reduced for posterolateral versus anterior surgery for giant TDH [Table 4].

## CONCLUSION

We successfully utilized posterolateral approaches to remove giant ossified/calcified TDH in 24 patients.

## Acknowledgment

No conflicts of interest from any of the authors.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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**How to cite this article:** Gaddikeri MB, Srivastava SK, Patil P, Naseem A, Agrawal H. Long-term operative outcome of giant calcified thoracic disc herniation – A retrospective analysis of 24 patients. *Surg Neurol Int* 2022;13:526.

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