

# Anterior Corpectomy with Expandable Titanium Cages for Thoraco-Lumbar Fractures

Audrey Paulzak, MD

Pat O'Brien, BS

W. George Rusyniak, MD

Anthony Martino, MD

*University of South Alabama, Department of Neurological Surgery*





# Disclosure

The authors report no conflict of interest concerning materials or methods used in this study or specified in this presentation.

# Presentation Overview

- Study questions
- Background on surgical correction for traumatic burst fracture
- Methods and outcomes
- Exemplar cases
- Summary and discussion

# Study Questions

- Can anterior corpectomy with titanium cage placement be performed early (within 3 days) in the course of management of traumatic thoraco-lumbar burst fracture?
  - Is both early or late (>3 days) surgery tolerated by patients?
- Does anterior corpectomy with titanium cage placement improve neurologic outcomes of patients?
- Does having an access surgeon increase the complication rate for patients undergoing anterior corpectomies?
- Do titanium cages have significant complications during follow-up?

# Approaches to Traumatic Burst Fracture

- Two predominant approaches to managing traumatic burst fracture:
  - Posterior instrumentation and decompression.
  - Anterior corpectomy with cage and autograft and/or allograft bone.
- Limitations of common approaches:
  - Posterior approach: decompression may depend on extent of ligamentotaxis.
  - Anterior approach: PEEK cages may have issues with torsional stability.
  - Both approaches: autograft bone can be associated with complications at the harvest site.
- Anterior corpectomy with expandable titanium cages is less commonly described in the literature.
  - Technique is similar to PEEK cage/allograft with the presumed benefit of restoring anatomy at the time of surgery.

# Describing Degree of Neurologic Injury

- There are multiple systems for classification of spinal cord injury (ASIA, Frankel grading, etc.).
  - Anterior and posterior approaches for burst fractures typically uses Frankel grading.
- The Frankel grading system for spinal injury is a **5-point scale** describing the degree of neurologic dysfunction in spinal cord injury:
  - **Grade A** - Complete paralysis
  - **Grade B** - Sensory function only below the level of injury
  - **Grade C** - Incomplete motor function below the level of injury
  - **Grade D** - Fair to good motor function below the level of injury
  - **Grade E** - Normal function

# Study Methods

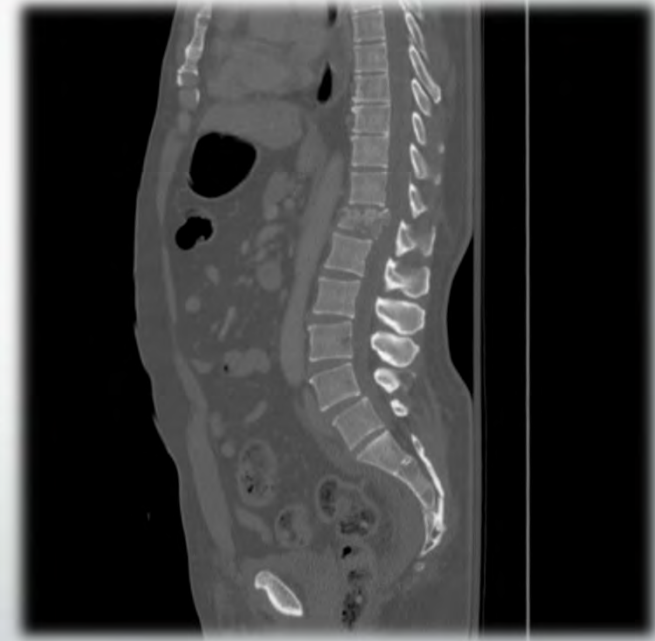
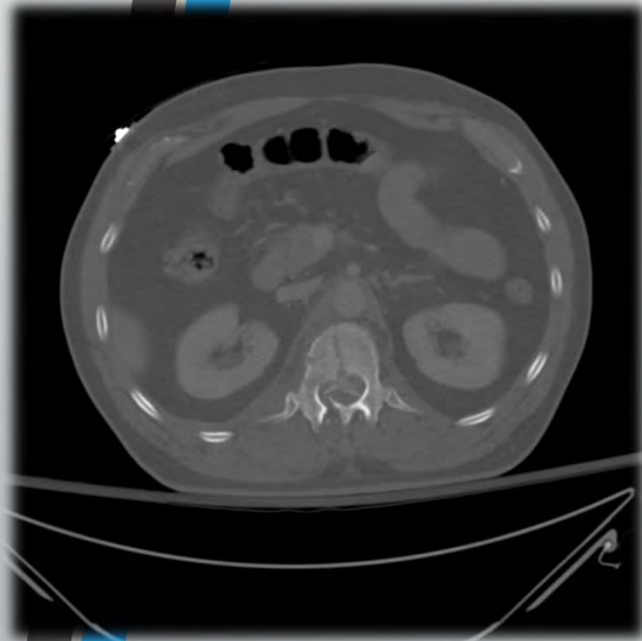
- **58 patients** with traumatic burst fracture were treated at USAMC over a 10-year period via anterior approach with expandable titanium cage.
  - Autologous bone graft from resected rib or vertebral body used.
  - Left lateral fixation one level above and below corpectomy.
  - One of two neurosurgeons performed each procedure.
  - Access surgeon provided exposure via retroperitoneal approach.
- Retrospective chart and radiologic review performed with follow-up and outcomes reported.
- Canal compromise, Cobb angle, Frankel Grade, surgical timing, and length of stay were the primary variables of interest.



## Case #1 - TF:

52 y/o male patient with a traumatic burst fracture of T12 secondary to a fall.

On presentation, he had a Frankel grade of E. His canal compromise approached 60% and there was a Cobb angle of  $15^{\circ}$ .

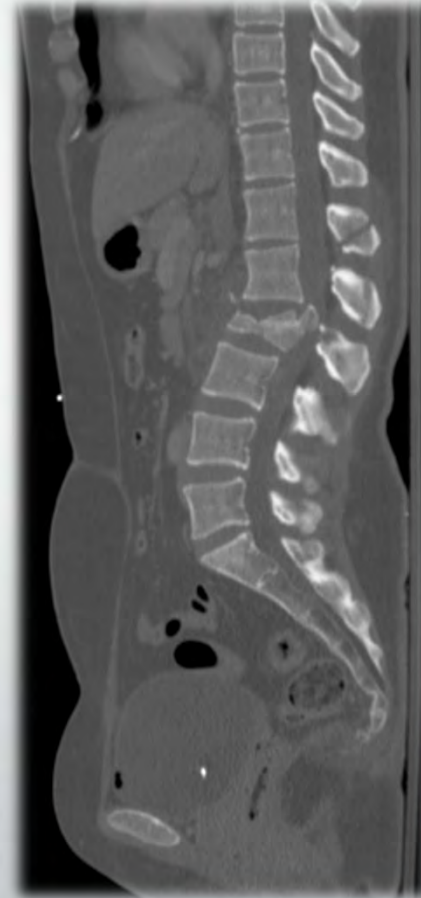




## Case #2 - AW:

31 y/o female patient with a traumatic burst fracture of L2 secondary to an MVC.

On presentation, she had a Frankel grade of A. The canal compromise approached 90%, and there was a Cobb angle of  $24^{\circ}$ .



# Patient Demographics

- **Average age at operation: 36 yrs.**
  - Age range: 15-67 yrs.
- **Males : Females: 46 : 16**
- **Average hospital stay: 17.6 days**
  - Range: 4-189 days
  - Length of hospital stay was variable and depended on comorbid conditions/injuries.

# Surgical Timing

- Surgical timing was divided into **2 groups**:
  - **Early surgery** ( $\leq 3$  days from injury to operation): 37 patients
  - **Late surgery** ( $> 3$  days from injury to operation): 21 patients
- **Average timing of surgery**: 7.8 days (Median: 3 days)
  - Range: 0-129 days

# Patient Demographics (cont.)

## Levels of injury undergoing anterior surgery

Spinal Level	Number of Patients
T6	1
T7	1
T8	1
T9	1
T12	10
L1	19
L2	16
L3	5
L4	4

4 patients underwent additional posterior fixation in addition to anterior surgery .  
In these cases, posterior fixation was used to address concomitant vertebral fractures at other levels.

## Patient Demographics (cont.)

### Frankel grade pre-op; **Thoracic**

Frankel Grade	Number of Patients
A	6
B	1
C	0
D	2
E	5

### Frankel grade pre-op; **Lumbar**

Frankel Grade	Number of Patients
A	4
B	0
C	3
D	4
E	31

## Patient Demographics (cont.)

### Mechanism of injury

Mechanism of Injury	Number of Patients
MVC	32
Fall	19
Motorcycle Accident	1
Other Trauma	11

## Case #1 - TF: Post-op

This patient remained Frankel Grade E.  
His Cobb angle improved to 8° (a  
difference of 7°).







## Case #2 - AW: Post-op

This patient improved from Frankel Grade A to Frankel Grade B. Her Cobb angle improved to  $13^{\circ}$  (a difference of  $11^{\circ}$ ).



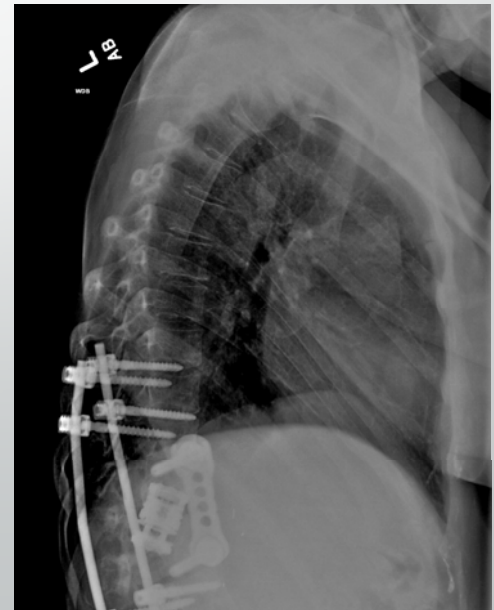
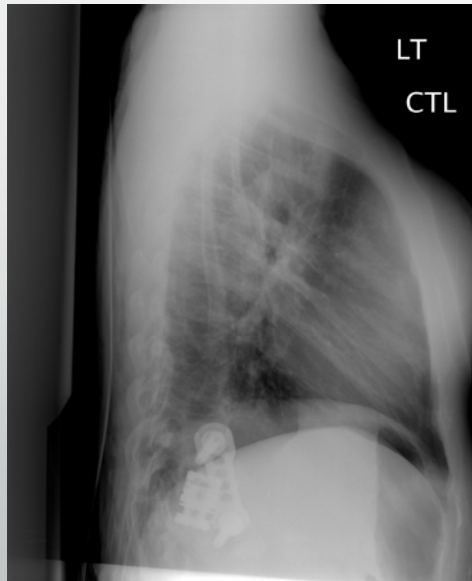
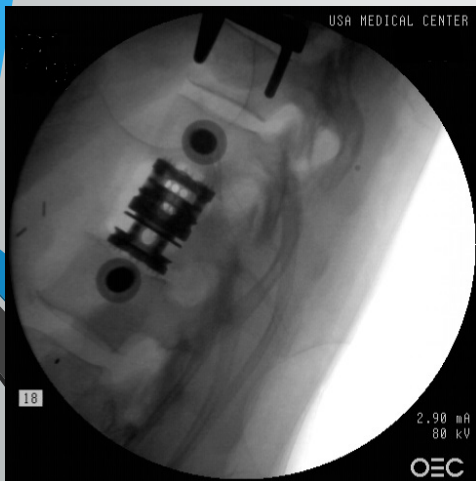


## Results: Approach Complications

- Retroperitoneal approach complications were minimal.
  - **One patient** had an iatrogenic renal vein injury which was repaired at the time of surgery.
  - No patient had significant vascular, lymphatic, or ureteral injuries.
- No surgical site infections.

# Results: Hardware Complications

- **Two patients:**
- **One cage displacement requiring no cage replacement.**
  - This patient had posterior displacement of the cage and required subsequent posterior fixation at 6 months post-op.



## Results: Hardware Complications

- **Two patients:**
- **One** had backing out of inferior screws at 1 month post-op, which remained stable over a 3-year follow-up



**No** hardware infections.

## Results: Additional Complications

- **One patient** died from MRSA pneumonia/sepsis 1 month after operation.
  - Presented with extensive polytrauma including hemopneumothorax and respiratory failure.

# Results: Neurologic Outcomes

## Frankel grade post-op; Thoracic

Frankel Grade	Number of Patients
A	5
B	0
C	0
D	0
E	7

Unchanged = 10; Improved = 2; Worsened = 0

## Frankel grade post-op; Lumbar

Frankel Grade	Number of Patients
A	3
B	1
C	1
D	5
E	32

Unchanged = 37; Improved = 5; Worsened = 0

**\*Note:** 4 patients were lost to follow-up and did not have available post-operative data for analysis

# Study Limitations

- Follow-up imaging consisted of x-ray data only.
  - While Cobb angles were able to be calculated between pre-op CT and post-op x-ray, we were unable to calculate residual canal compromise.
- There were 4 patients lost to follow-up.
- Length of follow-up was variable due to the nature of multi-system trauma from our Level I Trauma center.

# Future Directions

- How do anterior corpectomies with expandable titanium cages compare to posterior fixation at our institution?
  - With the addition of a new faculty member with extensive expertise in posterior fixation, a growing data set is now developing for comparison studies.
- Is there significant cranial or caudal settling of expandable titanium cages through the adjacent vertebral bodies over time, and if so, to what degree?
- What other outcome measures might be significantly impacted by anterior approach with titanium cage vs. other approaches (i.e. time to mobility, post-op pain, etc.) ?

# Summary

- Management of thoraco-lumbar burst fractures with expandable titanium cages was **tolerated in both early and late cases**.
- **>50%** of multi-trauma patients were able to undergo anterior corpectomy via retroperitoneal approach within 3 days of injury.
- There were **7 cases** of neurological improvement of at least 1 Frankel grade.
  - **Thoracic:** 2 cases
  - **Lumbar:** 5 cases
- Retroperitoneal approach with access surgeon was technically feasible and did not result in any significant complications.

The authors anecdotally reported that the anterior approach seemed more facile for achieving an adequate decompression of the spinal canal compared to their experiences with mesh cages or the posterior approach alone



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