

Evidence-Based Medicine

骨科 R1 蔡沅欣

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Clinical Scenario

- 82 y/o male
- Fell down about 3 months ago, no significant discomfort, except mild back pain
- In recent 2 months, back pain progressed, bilateral lower leg weakness and numbness noted
- urine and stool incontinence (+)
- MRI showed L1 burst fracture with spinal cord compression
- OP:
 - L1 laminectomy and decompression
 - T11-12, L2-3 posterior instrumented fusion
 - L1 vertebroplasty

Image study



MRI



Post operation



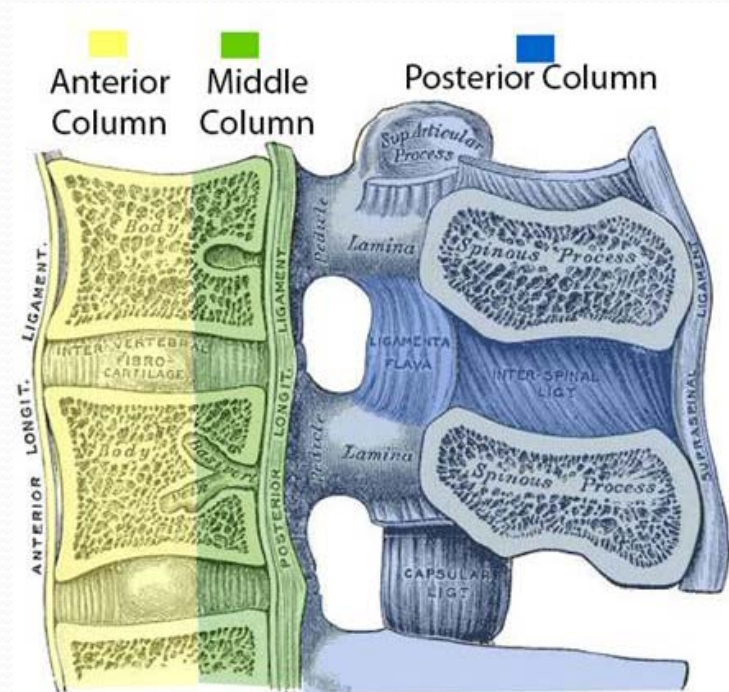
Background knowledge

- Denis three column system

- anterior column
- middle column
- posterior column

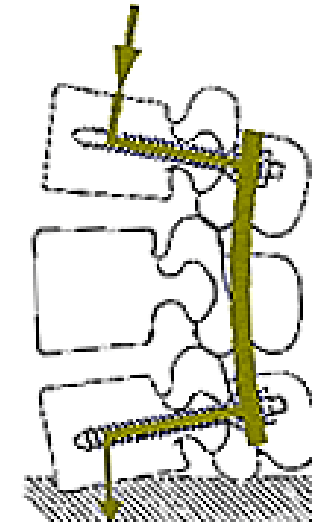
- Burst Fractures

- vertebral fracture with compromise of the anterior and middle column



- Management of burst fracture
 - Nonoperative
 - **bracing with a thoracolumbosacral orthosis**
 - neurologically intact, mechanically stable
 - retropulsed fragments resorb and usually do not cause neurologic deterioration
 - Operative
 - Indication of surgical treatment
 - neurologic deficits with radiographic evidence of cord/thecal sac compression
 - unstable fracture

- Treatment of spine burst fracture
 - Operation
 - **Neural decompression**
 - direct: remove retropulsed bone
 - indirect: restore spine alignment by posterior instrumentation
 - **spinal stabilization**
 - instrumentation



Foreground question

- Whether vertebroplasty or kyphoplasty needed for burst fracture?



提出可回答的臨床問題(Asking)

PICO

- Focus question for **therapy**

PICO

- P: patient with burst fracture
- I: vertebroplasty with surgical decompression and spinal stabilization
- C: surgical decompression & spinal stabilization
- O: spinal stability



搜尋最有用的資料(Acquire)

搜尋資料庫	Uptodate→ ACP journal → Cochrane → Pubmed
最初使用關鍵字	burst fracture, vertebroplasty
初步搜尋後修正 關鍵字(Key word)	由PubMed MeSH database的MeSH search找出同義字或關鍵字上游較廣義的字彙
	Burst fracture, Spinal Fractures [etiology;*surgery], Vertebroplasty [contraindications;*methods],
搜尋設限(Limits)	Clinical Trial, randomized control trial, review

搜尋歷程

Summaries: Uptodate→ 1 篇

Clinical manifestations and treatment of osteoporotic thoracolumbar vertebral compression fractures

Synopses: ACP journal→0 篇

Syntheses: Cochrane→ 2 篇

Studies: Pubmed→ 67 篇

Clinical manifestations and treatment of osteoporotic thoracolumbar vertebral compression fractures

TOPIC OUTLINE

SUMMARY & RECOMMENDATIONS

INTRODUCTION

CLINICAL MANIFESTATIONS

- Symptoms
- Height loss
- Kyphosis
- Clinical consequences

DIAGNOSIS

- Differential diagnosis

EVALUATION

MANAGEMENT

- Provide relief from pain
 - Oral analgesics
 - Calcitonin
 - Bisphosphonates
 - Parathyroid hormone
 - Muscle relaxants
 - Bracing
- Vertebroplasty and kyphoplasty
 - Efficacy of vertebroplasty
 - Efficacy of kyphoplasty
 - Adverse effects
- Exercise
- Treatment for osteoporosis
 - Lifestyle factors

INFORMATION FOR PATIENTS

SUMMARY AND RECOMMENDATIONS

Vertebroplasty and kyphoplasty — Vertebroplasty and kyphoplasty involve the percutaneous injection of bone cement under fluoroscopic guidance into a collapsed vertebra. Kyphoplasty also involves the introduction of inflatable bone tamps into the fractured vertebral body for elevation of the endplates prior to fixation of the fracture with bone cement [29]. These procedures are performed in an outpatient setting, although the optimal timing related to fracture acuity is unclear [30,31].

The potential short-term benefit for both procedures is improvement in pain, whereas potential long-term benefits include prevention of recurrent pain at the treated level(s), limitation or reversal of height loss and spinal deformity, and improved functional capability. Indirect comparisons based upon outcomes from case series indicate that both procedures provide equivalent pain relief, with more improvement in functionality and a suggestion of fewer adverse events (pulmonary emboli and neurologic sequelae) with balloon kyphoplasty [32,33]. In the only randomized trial comparing the two procedures, 100 patients with osteoporotic compression fracture were randomly assigned to vertebroplasty or kyphoplasty [34]. There was no difference in pain scores between the treatment groups at three days and six months [34]. The postoperative increase in vertebral body height (0.91 versus 0.31 cm) and the reduction in kyphotic wedge angle (8 versus 3 degrees) were significantly greater in the kyphoplasty group.

Short-term placebo-controlled (sham procedure) trials of vertebroplasty in patients with osteoporotic compression fractures have not shown a significant benefit in reducing pain [35,36]. In addition, a systematic review of eight trials comparing vertebral augmentation (seven trials vertebroplasty, one trial kyphoplasty) with placebo or standard medical care showed significant improvement in pain from baseline in both the treatment and control groups at 1, 3, and 12 months [37]. In the six trials that did not use a sham procedure (four of the six were funded by the device manufacturers), the reduction in pain at one month was better with vertebral augmentation than controls. However, the two sham-controlled trials, which provide the highest quality of evidence, did not show benefit of vertebroplasty over control. A subsequent meta-analysis of six trials (five vertebroplasty, one kyphoplasty) reported similar findings [38]. Although the mean difference in the pain visual analog scale was statistically significant favoring vertebral augmentation (mean difference 0.73, 95% CI 0.35-1.10, and 0.58, 95% CI 0.19-0.97 for early [<12 weeks] and late [6 to 12 months] time points, respectively), the sham-controlled trials did not show a significant benefit of vertebral augmentation over control [38]. These trials are discussed in more detail below. (See '[Efficacy of vertebroplasty](#)' below and '[Efficacy of kyphoplasty](#)' below.) Additional trials evaluating kyphoplasty, particularly compared with a sham procedure, are required.

There are no trials that address long-term (beyond two years) benefits. In an industry-sponsored review of a Medicare database with 858,978 patients who had vertebral fracture, operative management with vertebroplasty or kyphoplasty was associated with a 37 percent lower mortality than non-operative management [39]. However, this was not a randomized study, and there are likely unmeasured patient characteristics that account for the observed difference. In addition, patients who received operative management might have been cared for more aggressively than the non-operative group.

We do **not** recommend vertebroplasty or kyphoplasty for the acute management of pain due to osteoporotic compression fractures. In most patients with osteoporotic vertebral compression fracture, the acute pain resolves gradually over four to six weeks and completely resolves within three months [40]. In some patients, the pain may persist beyond three months (sometimes due to paraspinal spasm). These modalities have not been adequately evaluated for the treatment of chronic pain.



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- ☐ Technology Assessments (0)
- ☐ Economic Evaluations (0)
- ☐ Cochrane Groups (0)

- ☒ All
- ☐ Current Issue

Cochrane Central Register of Controlled Trials : Issue 2 of 12, February 2013

There are 2 results from 683114 records for your search on 'burst fracture, vertebroplasty in title abstract keywords in Trials'

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- ☐ Osteoporotic **burst fracture** with spinal canal compromise treated with percutaneous **vertebroplasty** .
Li CH , Chang MC , Liu CL and Chen TS
Clinical neurology and neurosurgery, 2010, 112(8), 678
- ☐ Suitability of a calcium phosphate cement in osteoporotic vertebral body **fracture** augmentation: a controlled, randomized, clinical trial of balloon kyphoplasty comparing calcium phosphate versus polymethylmethacrylate.
Blattert TR , Jestaedt L and Weckbach A
Spine, 2009, 34(2), 108

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- ☐ [Development of calcium phosphate cement for the augmentation of traumatically fractured porcine specimens using vertebroplasty.](#)

1. Tarsuslugil SM, O'Hara RM, Dunne NJ, Buchanan FJ, Orr JF, Barton DC, Wilcox RK.
J Biomech. 2013 Feb 22;46(4):711-5. doi: 10.1016/j.jbiomech.2012.11.036. Epub 2012 Dec 20.
PMID: 23261249 [PubMed - in process]

[Related citations](#)

- ☐ [Traumatic spinal fracture treated by vertebroplasty: a case report.](#)

2. Tender GC, Serban D.
J Med Case Rep. 2012 Nov 21;6(1):390. doi: 10.1186/1752-1947-6-390.

PMID: 23171525 [PubMed] [Free PMC Article](#)[Related citations](#)

- ☐ [\[Factors and revision strategy for failure of thoracolumbar spine internal fixation after burst fracture\].](#)

3. Wang X, Lu G, Li J, Wang B, Kang Y, Hu J, Deng Y.
Zhong Nan Da Xue Xue Bao Yi Xue Ban. 2012 Oct;37(10):1037-44. doi: 10.3969/j.issn.1672-7347.2012.10.012.
Chinese.

PMID: 23117457 [PubMed - in process] [Free Article](#)[Related citations](#)

- ☐ [Minimally Invasive Transpoas L2 Corpectomy and Percutaneous Pedicle Screw Fixation for Osteoporotic Burst Fracture in the Elderly: Technical Report.](#)

4. Tomycz L, Parker SL, McGirt MJ.
J Spinal Disord Tech. 2012 Jul 24. [Epub ahead of print]
PMID: 22832557 [PubMed - as supplied by publisher]

[Related citations](#)

Titles with your search terms

Thoracic ossified meningioma and osteoporotic burst fracture: treatment [J Neurosurg Spine. 2006]

[Percutaneous vertebroplasty for vertebral fractures caused by osteoporosis] [Ned Tijdschr Geneesk. 2008]

Burst fracture of the spine involving vertebrae presenting no other lesions: treatment [Clin Imaging. 2005]

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8 free full-text articles in PubMed Central

Traumatic spinal fracture treated by vertebroplasty: a case report [J Med Case Rep. 2012]

Vertebroplasty Using Calcium Phosphate Cement for Osteoporotic Vertebral Fractures [Asian Spine J. 2012]

[Review] Kyphoplasty in osteoporotic vertebral compression fractures [J Orthop Surg Res. 2011]

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Article acquired

Spine (Phila Pa 1976). 2008 Feb 15;33(4)

Direct reduction of thoracolumbar burst fractures by means of balloon kyphoplasty with calcium phosphate and stabilization with pedicle-screw instrumentation and fusion.

Korovessis P, Repantis T, Petsinis G, Iliopoulos P, Hadjipavlou A.

- **OBJECTIVE:**

To evaluate the outcomes of the treatment of acute thoracolumbar burst fractures by transpedicular balloon kyphoplasty with calcium phosphate cement and posterior instrumented fusion.

- **SUMMARY OF BACKGROUND DATA:**

In the surgical treatment of thoracolumbar fractures, the major problem after posterior correction and transpedicular instrumentation is failure to support the anterior spinal column, leading to the loss of correction and instrumentation failure.

- **METHODS:**

Twenty-three consecutive patients with an average age of 48 years, who sustained thoracolumbar A3-type burst fracture with or without neurologic deficit were included in this prospective study. Twenty-one of 23 patients had single fractures and 2 had each one additional A1 compression contiguous fracture. On admission 5 (26%) of 23 patients had neurologic lesion (5 incomplete, 1 complete). Bilateral transpedicular balloon kyphoplasty was performed with quick hardening calcium phosphate cement to reduce segmental kyphosis and restore vertebral body height and supplementary pedicle-screw instrumentation [long including 4 vertebrae for T9-L1 fractures and short (3 vertebrae) for L2-L4 fractures]. Gardner kyphosis angle, anterior and posterior vertebral body height ratio, and spinal canal encroachment were calculated before to after surgery.



謹慎的文獻評讀 (Appraisal)

效度 Validity	
Randomization	NO
Blind	NO
Withdraw, incomplete or loss to follow up >20%	NO
Intention-to-treat analysis	NO
Enough participants (power calculation)	No, 23 patients were included
證據等級 Level of evidence	Case series, Level 4

效益Impact

Main result

All 23 patients were operated within 2 days after admission and were followed for at least 24 months after index surgery. Operating time and blood loss averaged 70 minutes and 250 cc, respectively. The 5 patients with incomplete neurologic lesions improved by at least 1 American Spine Injury Association grade, whereas **no neurologic deterioration** was observed in any case. Overall **sagittal alignment was improved** from an average preoperative 16 degrees to 1 degrees kyphosis at final follow-up observation. **The anterior vertebral body height ratio improved from 0.6 before surgery to 0.9 ($P < 0.001$) after surgery, whereas posterior vertebral body height was improved from 0.95 to 1 ($P < 0.01$).** Spinal canal encroachment was reduced from an average 32% before surgery to 20% after surgery. No differences in preoperative values and postoperative changes in radiographic parameters between short and long group were shown. Cement leakage was observed in 4 cases: 3 anterior to vertebral body and 1 into the disc without sequela. In the last computed tomography evaluation, there was shown a **continuity between calcium phosphate and cancellous vertebral body bone**. Posterolateral radiological fusion was achieved within 6 to 8 months after index operation. There was **no instrumentation failure** or measurable **loss of sagittal curve** and **vertebral height correction** in any group of patients.

Precise or results

P value /95% confidence interval: **as above**

Clinical
bottom-line

Balloon kyphoplasty with calcium phosphate cement secured with posterior long and short fixation in the thoracolumbar and lumbar spine, respectively, provided excellent immediate reduction of post-traumatic segmental kyphosis and significant spinal canal clearance and restored vertebral body height in the fracture level in an equal amount both in the short and the long instrumentation.

J Bone Joint Surg Am. 2009 Jan;91(1)

Thoracolumbar burst fractures treated with posterior decompression and pedicle screw instrumentation supplemented with balloon-assisted vertebroplasty and calcium phosphate reconstruction.

→ The present study demonstrates that **excellent reduction of unstable thoracolumbar burst fractures** with and without associated neurologic deficits can be maintained with use of short-segment instrumentation and a **transpedicular balloon-assisted reduction combined with anterior column reconstruction with calcium phosphate bone cement** performed through a single posterior incision. The resultant circumferential stabilization combined with a decompressive laminectomy led to maintained or improved neurologic function in all patients with neurologic deficits, with a low rate of instrumentation failure and loss of correction.



是否可應用到此臨床個案上
(Apply)

臨床應用	我們的病患其主要疾病中是屬<u>重症</u>患者，接受本案討論的處置可獲得的療效屬<u>高療效</u>；有副作用的可能為<u>低風險</u>族群：。 這項處置治療在本院做的可行性(feasibility): 可行; 部分健保給付是否有其他的選擇與相對成本利弊差異：有 好處是否多於壞處: 是 是否符合病人的期望(value): 是	
醫療建議	綜合上面討論，我們的臨床建議	我們建議給予病人脊椎固定與脊髓減壓手術外，合併vertebroplasty以提升脊椎穩定度與改善變型程度。
	這樣建議的建議強度	Medium



The End...

Thanks