Orthopaedics & Traumatology: Surgery & Research 100 (2014) 455–460

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Original article

Posterior percutaneous reduction and fixation of thoraco-lumbar burst fractures

L. Proietti[a,*], L. Scaramuzzo[b], G.R. Schirò[a], S. Sessa[a], G. D'Aurizio[a], F.C. Tamburrelli[a]

[a] Department of Orthopedic Science and Traumatology, Spine Surgery Division, Catholic University Rome, Largo A. Gemelli 1, 00168 Roma, Italy
[b] Spine Surgery Division 1, IRCCS Istituto Ortopedico Galeazzi Spa, via Riccardo Galeazzi, 4, 20161 Milano, Italy

ARTICLE INFO

Article history:
Accepted 13 June 2014

Keywords:
Percutaneous fixation
Thoraco-lumbar/lumbar fractures
Sagittal index
Thoraco-lumbar spine fractures

ABSTRACT

Background: Treatment of A3 thoraco-lumbar and lumbar spinal fractures nowadays remains a controversial issue. Percutaneous techniques are becoming very popular in the last few years to reduce the approach-related morbidity associated with conventional techniques.
Hypothesis: Purpose of the study was to analyze the clinical and radiological outcome of patients who underwent percutaneous posterior fixation without fusion for the treatment of thoraco-lumbar and lumbar A3 fractures.
Materials and methods: Sixty-three patients, having sustained a single-level thoraco-lumbar fracture, underwent short segment percutaneous instrumentation and were retrospectively analyzed. sagittal index (SI) was calculated in all patients. Clinical and functional outcome were evaluated by Visual Analog Scale (VAS), Oswestry Disability Index (ODI) and Short Form General Health Status (SF-36).
Results: Average operative blood loss was 82 mL (50–320). Mean pre-operative SI in the thoraco-lumbar segment was 13.3° decreased to 5.8° in the immediate postoperative with a mean deformity correction of 7.5. Mean pre-operative SI in the lumbar segment was 16.5° decreased to 11.3° in the immediate postoperative with a mean deformity correction of 5.2. Not statistically significant correction loss was registered at 1-year minimum follow-up. Constant clinical conditions improvement in the examined patients was observed.
Conclusion: Percutaneous pedicle screw fixation for A3 thoraco-lumbar and lumbar spinal fractures is a reliable and safe procedure.
Level of evidence: Level IV. Retrospective study.

1. Introduction

Treatment of thoraco-lumbar and lumbar burst or A3 fractures according to Magerl Classification [1], without neurologic injury, is, nowadays, a controversial issue. Evidence-based guidelines for the treatment of traumatic fractures of the thoracic and lumbar spine are lacking and the scientific evidence is largely based on retrospective case-series [2]. Wood et al. demonstrated that treatment of patients with a stable thoraco-lumbar fracture and normal findings on the neurological examination provided no major long-term advantage compared with non-operative treatment. Disadvantages of non-operative management are related to early or late complications as residual kyphosis, pressure sores, prolonged recumbence, deep vein thrombosis [3]. Today, there is a growing consensus that post-traumatic kyphotic deformity or vertebral fracture's non-union are responsible for persistent back pain and inability to return to normal daily activity [4,5]. Theoretical rationale for operative management is to obtain an immediate mechanical stability, a reduction of deformity and to restore good sagittal alignment of the spine [6]. The advantages of surgical versus conservative treatment are a better clinical outcome, reduction of deformity and earlier patient mobilization [3]. Open posterior short segment pedicle instrumentation is largely accepted for the treatment of thoraco-lumbar and lumbar fractures [5,6]. Nevertheless, disadvantages of extensive exposure typical of conventional surgery are largely recognized. Minimally invasive vertebral cement augmentation techniques such as vertebroplasty or kyphoplasty offer the patient the alternative treatment to prolonged bed rest or major spine surgery with relatively low risk and reportedly high clinical success rates [7]. In addition to vertebral augmentation performed with bone cement alone, the past

* Corresponding author. Tel.: +39 06 30 15 43 46; fax: +39 06 51 161.
E-mail addresses: proiettil@yahoo.it (L. Proietti), scaramuzzolaura@gmail.com (L. Scaramuzzo), giusepper.schiro@gmail.com (G.R. Schirò), sergiosessa84@yahoo.it (S. Sessa), perlalucente@hotmail.it (G. D'Aurizio), f.tamburrelli@tiscali.it (F.C. Tamburrelli).

http://dx.doi.org/10.1016/j.otsr.2014.06.003
1877-0568/

decade has also seen the development of other percutaneous systems using supplemental intracorporeal devices. One of the first systems described in this category was the vertebral body stent (VBS) introduced in the year 2002 [8]. In the last few years, few studies [9–11] on the safeness and validity of the percutaneous pedicle screw instrumentation for thoraco-lumbar fractures have been published [2,12]. Purpose of our study was to analyse the clinical and radiological outcome of patients who underwent percutaneous posterior fixation without fusion for the treatment of thoraco-lumbar and lumbar A3 fractures [8]. In the last few years, few studies [9–11] on the safeness and validity of the percutaneous pedicle screw instrumentation for thoraco-lumbar fractures have been published [2,12]. Purpose of our study was to analyse the clinical and radiological outcome of patients who underwent percutaneous posterior fixation without fusion for the treatment of thoraco-lumbar and lumbar A3 fractures.

2. Materials and methods

Since May 2005 to March 2009, 63 patients have undergone short posterior percutaneous instrumented fixation for single level traumatic type A3 fracture of thoraco-lumbar/lumbar spine, at our institution. Three patients were lost to follow-up and were excluded from the study. Sixty patients, 38 males and 22 females, with an average age of 51.2 (range 20–65) were analysed in a retrospective way. In all cases, Pathfinder system (Zimmer-Abbot Spine Austin Texas) was implanted using 4 pedicle screws, one level above and one below the fractured vertebra (Fig. 1a, b). Inclusion criteria were: single-level A3 fracture, age ranged between 18 and 65 years, no neurological involvement and fracture level between T11 and L5 (Table 1). Exclusion criteria were: pathological or osteoporotic fracture, multilevel fracture, previous surgery at site of fracture. Instrumented levels ranged from T10 to S1.

Patients were in prone position on a radiolucent operating table. First step is to localize the entry points into the pedicles on a two-dimensional plane. A series of 4 sequential dilators are then used to dilate and expand the musculature and fascia. After the largest dilator is in place, the 3 inner dilators are removed, leaving the outer largest dilator along with the guide wire in place. At this point, the constructed extender sleeve attached to the canulated polyaxial screw is inserted as a single construct using the fitted canulated screwdriver. Then, a titanium rod was inserted through the caudal skin incision, was bluntly advanced through the muscle and was engaged to the poliaxial canulated screws. In some cases, correction on the sagittal plane in distraction or compression way were performed.

Table 1
Table showing the demographic data of the study's population.

Demographic data	
Sex	
Male	38
Female	22
Mechanism of injury	
Fall from height	22
Car injury	21
Motor vehicle accident	17
Politrauma	15
BMI (kg/m^2)	
16–18.50	2
18.51–24.99	27
25–29.99	25
30–34.99	6
Type of fracture	
A3.1	28
A3.2	8
A3.3	24
Level of fracture	
T11	5
T12	17
L1	17
L2	8
L3	9
L4	3
L5	1

Thirty-five of sixty patients underwent two second surgery in order to remove the instrumentation percutaneously after fracture healing while the other twenty-five patients refused a second surgical procedure. Of the 35 patients who accepted hardware, removal underwent thin-cut CT scans (2.5 mm contiguous, non-overlapping images, reconstructed at 2 mm intervals in order to obtain sagittal and coronal reformats) of the pertinent spinal levels to evaluate screw positioning and fracture healing. Radiological follow-up of the other 25 patients was performed with only plane X-ray exams avoiding unnecessary or excessive radiation dose exposure correlated to computed tomography, therefore pedicles screw positioning was not analyzed.

Image interpretation was performed by three independent observers (two senior spinal surgeons and a senior radiologist). Evaluation of screw placement was performed according to Youkilis' criteria: grade 1, screws were not counted as violations, because they replaced the pedicular cortex without extending beyond it. Grade 2 violations were defined as screws that extended less than 2 mm beyond the pedicular cortex, whereas grade 3 violations were defined as screws found to be more than 2 mm outside of the cortical margin [13]. Sagittal index (SI) in accordance to Farcy' s criteria [14] was calculated in all 60 patients, with a dedicated software (Kodak DirectView Picture Archiving and Communication System), in the pre-operative and postoperative time.

Clinical and functional outcome were evaluated, in all patients, by Visual Analog Scale (VAS), Oswestry Disability Index (ODI) and Short Form General Health Status (SF-36) at regular intervals (pre-operative, 15 days, 1 month, 3 months, 6 months, 12 months and every year postoperative). Patients were divided in two groups respect to the pre-operative SI value: a group A with a SI value between $10^\circ \leq 15^\circ$, patients of this group were carefully selected patients in which surgical treatment was presented as an alternative to best rest and cast immobilization considering their high functional daily-life request and a group B with a SI value $> 15^\circ$. Clinical outcome and kyphosis correction of the 2 groups was compared at a one-year minimum follow-up. The data of all consecutive patients treated since May 2005 to March 2009 were included in this study and analyzed in a retrospective fashion.

3. Statistics

Statistical analysis was conducted using paired *t* test for continuous variables as SI value and Chi^2 test verified with Fisher's exact test for non-parametric data as Oswestry Disability Index and SF-36 data and Visual Analog Scale. Significance was established for $P < 0.05$. The tests were carried out with SPSS software (SPSS Inc, Chicago, IL).

4. Results

Among the screws, 240 were implanted in 60 consecutive patients. Average surgical time was 67 minutes (range, 50–96 min). Average intra-operative blood loss was 82 mL (range 50–320 mL). The median length of hospital stay after surgery was 4.9 days (range 3–7). All patients were successfully mobilized at first postoperative day. Placement of the 140 pedicle screws was analyzed in 35 patients who underwent second surgery. Screw placement was