Acta Orthop. Belg., 2011, **77**, 93-96

ORIGINAL STUDY

Long-term outcome after surgical treatment of thoracolumbar fractures versus a control group of healthy volunteers

Osman YARAY, Burak AKESEN, Ufuk AYDINLI

From the Department of Orthopaedics and Traumatology, University of Uludag, Bursa, Turkey

The authors conducted a retrospective study on the long term outcome (+/-9 years) after instrumentation for thoracolumbar fractures. This study is probably unique in that it compares the surgical group with a control group of healthy volunteers, rather than with a group of conservatively treated patients. All classical outcome measures were used : ODI, RMDQ, VASSS, VAS, Denis Pain scale, SF-36 Bodily Pain, SF-12 Bodily Pain, the remaining SF-36 and SF-12 scores, and the Denis Work Scale. As expected, the large majority of the scores was better in the healthy group. The difference was significant, except as far as the SF-tests were concerned.

Keywords : thoracolumbar fractures ; outcome measures ; healthy control group.

INTRODUCTION

Although spinal fractures represent only 6% of all traumatic injuries (*4*,*11*), their impact is tremendous. More and more authors realize that measurement of outcome from the patient's perspectives (*3*) is more important than outcome in terms of radiographic correction.

MATERIALS AND METHODS

The main purpose of this study was to compare the long term outcome of patients with surgically treated thoracolumbar fractures with the condition of healthy volunteers of the same age. The inclusion criteria for the surgical group were : 1. a single thoracolumbar fracture treated between May 1994 and January 2005 ; 2. absence of neurological complications ; 3. absence of concomitant neoplasia, infection or other illness ; 4. familiarity with the Turkish language.

Fourty-three patients constituted the "surgical group" : 28 males and 15 females. Their average age at the time of injury was 39 ± 13.85 years (range : 17-71), and at the time of follow-up 48 ± 14.25 years (range : 23-77). The mean follow-up period was thus 9 ± 3.09 years (range : 4-15). According to the Magerl classification (*19*) there were 28 or 65% type A fractures, 11 or 26% type B fractures, and 4 or 9% type C fractures. Level : T12-L2 in 32 patients (74%), L3-L5 in 9 patients (21%), T1-T11 in 2 (5%). Technique : posterior instrumentation and fusion in 18 (43%), anterior-posterior surgery in 14 (32%), anterior decompression and fusion in 11 (25%). Ten complications occurred in 9 patients. Three had implant related pain which was treated by implant removal ; 5 had implant failure ; one had an incisional hernia at the lumbotomy site and anterior cage

■ Osman Yaray, MD, Orthopaedic Resident
■ Burak Akesen, MD, Orthopaedic Spine Surgeon
■ Ufuk Aydinli, MD, Professor of Orthopaedic Surgery , Spine Surgeon
Department of Orthopaedics and Traumatology, University of Uludag, Bursa, Turkey.
Correspondence : Burak Akesen, MD, Dept of Orthopaedics, University of Uludag, Görükle, Bursa, Turkey, 16059. E-mail : akesenb@msn.com
© 2011, Acta Orthopædica Belgica.

No benefits or funds were received in support of this study

Table I. — Outcome measures

	Surgical group 1 (N = 43)	Control group 2 (N = 44)
Functional disability		
ODI	19.10 ± 18.63 (0-70)	6.83 ± 9.26 (0-40) *
RMDQ	6.70 ± 6.42 (0-23)	3.50 ± 5.27 (0-22) *
VASSS	72.99 ± 20.45 (15-100)	85.65 ± 17.95 (26-100) *
Pain		
VAS	2.8 ± 1.9 (0-8.2)	1.7 ± 1.9 (0-7.5) *
Denis Pain Scale	2.37 ± 0.87 (1-5)	1.65 ± 0.48 (1-4) *
SF-36 BP (Bodily Pain)	70.29 ± 24.25 (20-100)	77.14 ± 23.01 (13-100) **
SF-12 BP (Bodily Pain)	72.67 ± 28.25 (0-100)	83.33 ± 20.84 (25-100) **
General health		
SF-36 PF (Phys.Funct.)	74.77 ± 25.23 (5-100)	80.73 ± 19.43 (20-100) **
SF-36 RP (Role Physical)	63.76 ± 37.87 (0-100)	76.73 ± 31.70 (0-100) **
SF-36 GH (Gen. Health)	65.66 ± 18.20 (25-100)	68.97 ± 17.13 (29-100) **
SF-36 V (Vitality)	70.93 ± 21.85 (0-100)	71.15 ± 23.23 (15-100) **
SF-36 SF (Soc. Function)	75.00 ± 21.65 (13-100)	76.28 ± 21.34 (37-100) **
SF-36 RE (Role Emot.)	77.49 ± 32.31 (0-100)	72.69 ± 38.76 (0-100) **
SF-36 MH (Ment. Health)	69.19 ± 19.92 (16-96)	69.04 ± 20.50 (16-100) **
SF-36 Phys. component	68.62 ± 20.92 (16-100)	75.89 ± 19.20 (34-100) **
SF-36 Emotional comp.	73.15 ± 17.53 (26-99)	72.28 ± 20.26 (29-100) **
SF-12 PF (Phys. Funct.)	74.42 ± 29.11 (0-100)	82.81 ± 25.34 (25-100) **
SF-12 RP (Role Physical)	67.44 ± 38.27 (0-100)	73.96 ± 41.24 (0-100) **
SF-12 GH (Gen. Health)	53.49 ± 27.75 (0-100)	65.63 ± 20.38 (25-100) **
SF-12 V (Vitality)	66.74 ± 21.35 (0-100)	70.00 ± 23.42 (20-100) **
SF-12 Phys. Comp.	67.00 ± 25.52 (0-100)	75.78 ± 22.50 (25-100) **
SF-12 Emotional Comp.	72.03 ± 21.03 (6-100)	68.43 ± 22.88 (22-100) **

* = significant / ** = not significant
Denis work scale : see Results.

dislodgement. No neurological impairment was present at follow-up. All patients filled in the outcome questionnaires mentioned in table I.

Fourty-four healthy volunteers (the "control group") were ready to fill in the same questionnaires. Their average age was 48 ± 8.25 years (range : 34-65), comparable to the age of the surgically treated patients at follow-up.

Four kinds of outcome scores were used (Table I). The lowest outcomes were the most favourable, except for the VASSS and SF tests, where 100 was optimal. *Functional disability scores* included the Oswestry Dısability Index (ODI) (*7,26*), the Roland-Morris Disability Questionnaire (RMDQ) (*17,21*), and the Visual Analogue Scale Spine Score (VASSS) (*13*). The *pain scores* were the Visual Analogue Scale (VAS) (*2,8*), the Denis pain scale (*6*) (the stages 1 to 5 were arbitrarily considered as analog values), the SF-36 BP (Bodily Pain) and the SF-12 BP (Bodily Pain). The *general health scores* included the remaining SF-36 and SF-12 scores. The *Denis work scale* (*6*) was used to evaluate the ability to work.

Statistical analysis

The Shapiro-Wilk and the Kolmogorov-Smirnov test were used for normal distributions. The Mann-Whitney U test and the Kruskal-Wallis test were used for comparisons between groups. The Wilcoxon matched-pairs signed-ranks test was used for intra-group variables. Categorical variables were analyzed using the Pearson Chi-square test. A probability $p < 0.05$ was considered statistically significant. The Denis work scale was not evaluated statistically.

RESULTS

As expected, the healthy control group scored better in most items, and the difference was

significant (Table I), except for the SF-36 and SF-12 tests. The ODI, RMDQ and VASSS scores respectively led to a probability of < 0.0001, < 0.0001, and < 0.003 while the VAS and the Denis pain scale yielded a probability of < 0.004 and < 0.02.

The Denis Work Scale (*6*) was applied to the 35 out of 43 patients who were employed before their accident. Of these, 51.4% returned to their previous job (W1), 22.8% returned to their previous job with some restrictions (W2), 11.4% chose a new job (W3), 3% worked part-time (W4), while 11.4% were unemployed (W5). All healthy volunteers were employed (comparable with W1).

DISCUSSION

The authors used most of the classical outcome measures to evaluate the long term effect of surgery on vertebral fractures. Theoretically, they might have compared the "surgical group" with a "conservatively treated group". However, they preferred to use healthy volunteers of the same age as a control group, an approach which is unique, to their best knowledge.

Functional disability was significantly more pronounced in the surgical group than in the healthy control group, as expected. Other "surgical" series, however without a healthy control group, led to similar findings. Indeed, the mean scores obtained in the current study for functional disability were 19.10 (ODI) / 6.70 (RMDQ) / 72.99 (VASSS), which is comparable to those found in literature : Wood *et al* (*25*) noted 20.75 / 8.16 / -, Yi *et al* (*27*) found 20.8 / 8.2 / -, Leferink *et al* (*18*) reported 4.0 / 79.4. Fortunately, an average ODI score of 19.10 interferes only minimally with the activities of daily living, according to Fairbank *et al* (*7*).

Pain. The mean VAS and Denis *pain scores* were also significantly worse in the surgical group, as expected. But again they were comparable to the findings of other "purely surgical" series. Indeed, the average values obtained were 2.37 / 27.53, while Wood *et al* (*25*) reported 3.3 / -, Yi *et al* (*27*) 3.3 / -, Defino and Canto (*5*) 2.07 / -. The similarity of these findings was striking. The SF–36 BP (Bodily Pain) and the SF–12 BP (Bodily Pain) were also worse in the surgical group, but not significantly.

General Health : the remaining SF-36 and SF-12 results were mostly worse in the surgical group, but not significantly.

Denis Work scale : 11.4% of those who were employed before their accident had lost their job. This is comparable to the data from the literature : unemployment rates of 8 to 17% are customary (*1,5,20,27*). Of course, social and economic conditions vary among different countries. The Denis work scale was not evaluated statistically.

REFERENCES

1. **Andress HJ, Braun H, Helmberger T *et al.*** Long-term results after posterior fixation of thoraco-lumbar burst fractures. *Injury* 2002 ; 33 : 357-365.
2. **Ayerbe-Gracia J, Sousa-Casasnovas P.** [Outcome assessment in lumbar spine surgery : the patient's perspective.] (in Spanish). *Neurocirugia (Astur)* 2004 ; 15 : 447-457.
3. **Chapman RJ.** Directions of spine outcomes research. In : Chapman RJ, Hanson PH, Dettori JR, Norvell DC (eds). *Spine Outcomes Measures and Instruments*. Thieme, New York, 2007, pp 1-9.
4. **Cooper C, Atkinson EJ, O'Fallon WM, Melton LJ III.** Incidence of clinically diagnosed vertebral fractures : a population-based study in Rochester, Minnesota, 1985-1989. *J Bone Miner Res* 1992 ; 7 : 221-227.
5. **Defino HL, Canto FR.** Low thoracic and lumbar burst fractures : radiographic and functional outcomes. *Eur Spine J* 2007 ; 16 : 1934-1943.
6. **Denis F, Armstrong GW, Searls K, Matta L.** Acute thoracolumbar burst fractures in the absence of neurologic deficit. A comparison between operative and nonoperative treatment. *Clin Orthop Relat Res* 1984 ; 189 : 142-149.
7. **Fairbank JC, Couper J, Davies JB, O'Brien JP.** The Oswestry low back pain disability questionnaire. *Physiotherapy* 1980 ; 66 : 271-273.
8. **Freyd M.** The graphic rating scale. *J Educ Psychology* 1923 ; 14 : 83-102.
9. **Gertzbein SD.** Scoliosis Research Society. Multicenter spine fracture study. *Spine* 1992 ; 17 : 528-540.
10. **Hermsmeyer JT.** Outcomes measures and instruments. In : Chapman RJ, Hanson PH, Dettori JR, Norvell DC (eds). *Spine Outcomes Measures and Instruments*. Thieme, New York, 2007, pp 45-50.
11. **Hu R, Mustard CA, Burns C.** Epidemiology of incident spinal fracture in a complete population. *Spine* 1996 ; 21 : 492-499.
12. **Keller RB.** Outcome research in orthopaedics. *J Am Acad Orthop Surg* 1993 ; 1 : 122-129.
13. **Knop C, Fabian HF, Bastian L, Blauth M.** Late results of thoracolumbar fractures after posterior instrumentation and transpedicular bone grafting. *Spine* 2001 ; 26 : 88-99.

14. **Knop C, Oeser M, Lange U, Zdichavsky M, Blauth M.** [Development and validation of the Visual Analogue Scale (VAS) Spine Score.] (in German). *Unfallchirurg* 2001 ; 104 : 488-497.
15. **Kocyigit H, Aydemir O, Olmez N *et al*.** Reliability and validity of the Turkish version of Short-Form-36 (SF-36). *Turk J Drugs Therapeutics* 1999 ; 12 : 102-106.
16. **Kraemer WJ, Schemitsch EH, Lever J *et al*.** Functional outcome of thoracolumbar burst fractures without neurological deficit. *J Orthop Trauma* 1996 ; 10 : 541-544.
17. **Küçükdeveci AA, Tennant A, Elhan AH, Niyazoglu H.** Validation of the Turkish version of the Roland-Morris Disability Questionnaire for use in low back pain. *Spine* 2001 ; 26 : 2738-2743.
18. **Leferink VJ, Keizer HJ, Oosterhuis JK, van der Sluis CK, ten Duis HJ.** Functional outcome in patients with thoracolumbar burst fractures treated with dorsal instrumentation and transpedicular cancellous bone grafting. *Eur Spine J* 2003 ; 12 : 261-267.
19. **Magerl F, Aebi M, Gertzbein SD, Harms J, Nazarian S.** A comprehensive classification of thoracic and lumbar injuries. *Eur Spine J* 1994 ; 3 : 184-201.
20. **McLain RF.** Functional outcomes after surgery for spinal fracture : return to work and activity. *Spine* 2004 ; 29 : 470-477.
21. **Roland M, Morris R.** A study of natural history of back pain. Part I : development of a reliable and sensitive measure of disability in low-back pain. *Spine* 1983 ; 8 : 141-144.
22. **Siebenga J, Leferink VJ, Segers MJ *et al*.** A prospective cohort study comparing the VAS spine score and Roland-Morris disability questionnaire in patients with a type A traumatic thoracolumbar spinal fracture. *Eur Spine J* 2008 ; 17 : 1096-1100.
23. **Ware J Jr, Kosinski M, Keller SD.** A 12-Item Short-Form Health Survey : construction of scales and preliminary tests of reliability and validity. *Med Care* 1996 ; 34 : 220-233.
24. **Ware JE Jr, Sherbourne CD.** The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care* 1992 ; 30 : 473-483.
25. **Wood K, Butterman G, Mehbod A *et al*.** Operative compared with nonoperative treatment of thoracolumbar burst fracture without neurological deficit. *J Bone Joint Surg* 2003 ; 85-A : 773-781.
26. **Yakut E, Düger T, Oksüz C *et al*.** Validation of the Turkish version of the Oswestry Disability Index for patients with low back pain. *Spine* 2004 ; 29 : 581-585.
27. **Yi L, Jingping B, Gele J, Baoleri X, Taixiang W.** Operative versus non-operative treatment for thoracolumbar burst fractures without neurological deficit. *Cochrane Database Syst Rev* 2006 ; 4 : CD005079.