



Balloon kyphoplasty : scintigraphy as the ultimate decision maker ?

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Balloon kyphoplasty is still controversial as a treatment for vertebral compression fractures (VCFs) due to osteoporosis. Nevertheless, the authors conducted a prospective study in 60 patients about the effectiveness of scintigraphy, after the conventional roentgenographic examination, as an ultimate decision maker for the identification of the levels to be treated. Seventy-one levels were radiographically and scintigraphically positive, were seen as active, and thus treated. Thirty-seven levels were radiographically negative but positive scintigraphically, were considered as imminent fractures, and thus treated. Ten levels were positive radiographically, but negative scintigraphically, and were not treated as they were considered as healed. The Oswestry Disability Score (100% = worst possible condition) improved from 38.8% ± 39.5% at baseline, to 2.38% ± 3.99% on the first postoperative day ($p < 0.001$), to 2.00% ± 3.40% at 1 month ($p < 0.001$) and to 1.93% ± 3.33% at 6 months ($p < 0.001$). This preliminary study gives a hint that scintigraphy might work as the ultimate decision maker, even when plain radiographs are negative. Further studies will be needed to compare patients with VCFs positive radiographically and scintigraphically, and other patients with VCFs negative radiographically, but positive scintigraphically.

Keywords : spine ; balloon kyphoplasty ; scintigraphy ; vertebral compression fracture ; osteoporosis.

INTRODUCTION

Osteoporosis is considered an epidemic of the modern world. It affects approximately 28 million Americans, and this number is expected to increase in the near future. The prevalence of osteoporosis will probably rise within the European Union from 23.7 million in 2000 to 37.3 million in 2050, which means an increase of 57% (3). The most frequent complication of osteoporosis is vertebral compression fracture (VCF). Approximately 700 000 VCFs

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occur in the United States each year, and approximately one third of them are causing chronic pain (3). Balloon kyphoplasty is now a well-known treatment (1,2,4,5,6,7,8,10,15,16,18,19), but is still controversial (1,8,10). Many diagnostic tools for evaluation of VCFs are available without standardized international guidelines for preoperative work up. The objective of the present study was to evaluate the value of bone scintigraphy, after initial roentgenographic examination, for the identification of the levels to be treated. Indeed, scintigraphy detects osteoblastic activity (13), so allowing to distinguish between healed and active VCFs, even when plain radiographs are normal.

MATERIALS AND METHODS

Between 2003 and 2005, 60 consecutive patients with 108 vertebral compression fractures (VCFs), were prospectively enrolled (Table I). All patients signed an informed consent, and the study was performed in a HIPAA (Health Insurance Portability and Accountability Act) compliant manner. The protocol was approved by the Institutional Review Board. There were 49 women and 11 men ; their average age was 68 +/- 14 years (range : 34-84). Twenty-six patients were treated at one level, 17 at 2 levels, 10 at 3 levels, and 7 at 4 levels. The vertebrae treated ranged from T6 to L5, but most of them were located at the levels T11 to L3. Seventy-one (28 + 43) (Table I) of the 108 VCFs were positive radiographically and scintigraphically, and were treated, while 37 (15 + 22) of the 108 VCFs were radiographically negative but scintigraphically positive, and were also treated. The rationale was that only the scintigram could detect active levels. Ten (7 + 3) VCFs were positive radiographically but negative scintigraphically, and were not treated as they were considered as healed.

Balloon kyphoplasty was performed according to the standard fashion (14).

Bone Scintigraphy

The patients received 925–1110 MBq of technetium 99m–methylene diphosphonate intravenously. Whole-body anterior and posterior images were obtained with a table motion speed of 12 cm/min, 3 hours after injection. The images were interpreted independently by two physicians who were blinded to the clinical and roentgenographic findings. Any tracer uptake higher than the uptake in the normal vertebrae and with the typical distribution of a compression fracture (horizontally increased uptake extending from one side of the vertebra to the other) was considered positive. In 3 cases of disagreement, a third physician was asked to interpret the images, and the final interpretation was reached in consensus.

Single photon emission computed tomography (SPECT) was not used ; the authors felt that it would be too sensitive and might result in unnecessary treatment.

Clinical outcome

All patients completed the Oswestry Disability Index questionnaire, translated by the authors : immediately before kyphoplasty, on the first postoperative day and after one and 6 months. One hundred percent was the worst possible outcome.

Statistical analysis

Intergroup comparisons were performed with Student's t test for continuous variables. Continuous variables were expressed as mean ± SD. A value of $p < 0.05$ was considered significant.

Table I. — Number of levels treated or not treated with balloon kyphoplasty, based on findings in plain radiographs and bone scintigrams (60 patients)

		Positive scintigram	Negative scintigram
Positive radiograph	Thoracic	28 treated	7 not treated
	Lumbar	+ 43 treated = 71 treated	+ 3 not treated = 10 not treated
Negative radiograph	Thoracic	15 treated	Not applicable
	Lumbar	+ 22 treated = 37 treated	Not applicable
		108 treated	

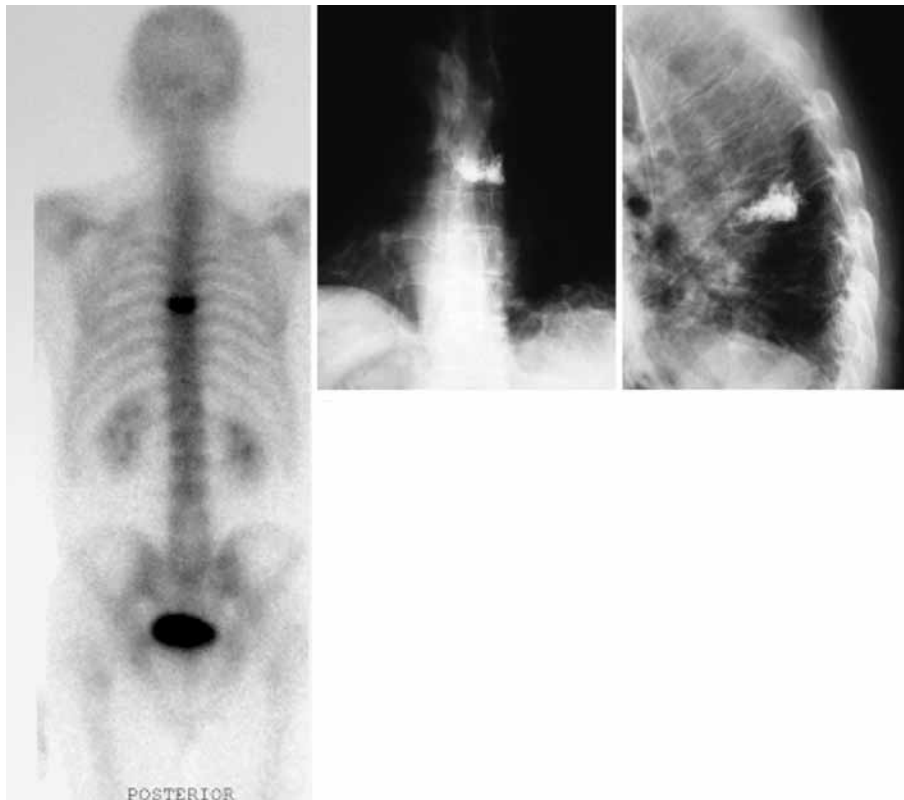


Fig. 1. — Scintigram showing increased uptake at level T7, subsequently treated with balloon kyphoplasty

RESULTS

A total of 108 kyphoplasties (Table I) were performed in 60 patients, or ± 1.8 per patient. The Oswestry score improved from $38.8\% \pm 39.5\%$ at baseline, to $2.38\% \pm 3.99\%$ at 1 day postoperatively ($p < 0.001$), to $2.00\% \pm 3.40\%$ at 1 month ($p < 0.001$) and to $1.93\% \pm 3.33\%$ at 6 months ($p < 0.001$).

DISCUSSION

Minimally invasive methods for the treatment of VCFs have attracted the attention and interest of both physicians and patients over the past two decades (1,2,4-8,10,15,16,18,19). Although their effectiveness is still under discussion (1,8,10), they occupy a significant part in the management of such fractures.

Radioisotope bone scanning provides useful information about bone turnover and thereby identifies active processes. Bone scanning has been used before for the identification of facet joints responsible for back pain, with excellent results (13). In addition, it has been used in retrospective studies for the identification of VCFs suitable for balloon kyphoplasty (9,11,12,16); the current study is the first prospective study. The excellent results give a hint that bone scanning might be useful as an ultimate decision maker after initial roentgenographic examination: it is noteworthy that there were 37 levels which were only detected scintigraphically. The authors feel that, although plain radiographs are very useful as a first step, they cannot be relied upon for the selection of the levels for kyphoplasty, due to their low sensitivity and their low specificity, since they may be positive in old but inactive VCFs. It should be emphasized that bone scintigraphy is

performed as whole body imaging and therefore can identify compression fractures throughout the spine, often missed by other techniques which are often limited to a part of the spine. Of course, treated patients may develop new symptoms in the future, due to “new” compression fractures, but the fact that the patients in the current study remained symptom-free at 6 months might be attributed to earlier recognition of compression fractures which otherwise would have been considered as “new”, a few months later. Finally, scintigraphy is a widely available imaging technique with low cost and practically no side effects.

The current study had several limitations. In the first place it did not involve a control group. Ideally, a first group should have consisted of patients with only VCFs positive radiographically and scintigraphically, while a second group should have consisted of patients with only VCFs negative radiographically but positive scintigraphically. The second group should then have a result at least as good as the first group. A second limitation was the fact that bone scanning was not compared to MRI.

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