Spinal Instability Predicting Score (SIPS) for Subsequent Fractures after Vertebroplasty in Patients with Osteoporotic Vertebral Compression Fractures

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Introduction: Augmentation procedures, such as vertebroplasty (VP) and kyphoplasty (KP), have emerged as the standard treatments for Osteoporotic vertebral compression fractures (VCFs) patients not responding to conservative treatment. However, these procedures have problems with subsequent fractures (SFs). The purpose of this study was to evaluate the spinal instability factors related to SFs after vertebral augmentation procedures.

Methods: We retrospectively reviewed patients who underwent augmentation procedures for osteoporotic VCFs. Between May 2003 and November 2007, 659 patients underwent vertebral augmentation procedures. Among those patients, 285 patients (Vertebroplasty (VP), n=231; Kyphoplasty (KP), n=54) with X-ray follow-up > 6 months were enrolled.

SFs were classified were classified into following 4 groups: 1) no SFs (NSFs; no subsequent fractures), 2) neo-fractures (NFs; new vertebral fractures involving another vertebrae after a new history of trauma), 3) HF (new vertebral fractures involving another vertebrae without a definitive history of trauma), and 4) kyphotic compression fractures (KCFs; progressive collapse and kyphotic changes of augmented vertebrae in the same vertebrae). We treated the patients with additional augmentation procedures for HF and NF, and conservative management for NSF and KCF. We analyzed SF patterns of patients who underwent VPs. Each occurrence rate was studied for factors that may induce SFs due to instability; scoring was performed related to the HF occurrence rate only. By summation of those scores, we obtained corrected SIPS for SFs. The items of the SIPS included fracture site [score, 2~5], vertebral augmentation level [2~6], bone mineral density [1~5], vertebral height [1.5~10], vertebral kyphotic angle [1.5~6], spinal column kyphotic angle [1~6]. After correcting the SIPS by factors which possible preventing HF [0 ~ (-8)], based on the corrected SIPS in VPs, the SFs risk group were classified into the following four groups: group A, no risk group (~11.5); group B, low risk group (12~13.5); group C, moderate risk group (14~18.5); and group D, high risk group (19~).

Results: The SFs types for VPs were as follows: NSFs, 112 cases (48.28%); HF, 65 cases (28.02%); NF, 35 cases (15.09%); and KCF, 19 cases (8.19%). The pre-operative VAS scores for VP were as follows: NSFs, 8.46; HF, 8.58; NF, 8.51; and KCF, 8.47. The final follow-up scores were as follows: NSFs, 2.37; HF, 3.72; NF, 3.03; and KCF, 3.26. In the SFs risk group, the possible percentage of HF according to the corrected SIPS were as follows: { NFs } / { total FFs = possible percentage of HF } [HF, NF, and KCF] - group A: { 84.06% } / [ 0% ] [ 0%, 10.14%, 5.80% ], group B: { 60.61% } / { 39.39% } [ 6.06%, 21.21%, 12.12% ], group C: { 41.54% } / { 58.46% } [ 24.62%; 16.92%; 16.92% ], and group D: { 6.24% } / { 93.76% } [ 73.44%, 15.63%, 4.69% ].

Conclusions: According to the SIPS, group D had a high predicting score. We can calculate predicting scores and can predict SFs using the SIPS. If the SIPS is high, the patients have a greater chance for SF and the HF rate is correspondingly higher. Therefore, such patients must give more attention after vertebroplasty and use more aggressive treatment modalities during the first treatment.