

## The Effect of Pulsed Jet Lavage in Vertebroplasty on Injection Forces of PMMA Bone Cement, Material Distribution and Potential Fat Embolism; a Cadaver Study

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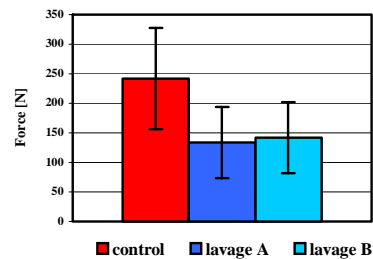
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**INTRODUCTION:** Percutaneous vertebroplasty is an established procedure for the treatment of osteoporotic vertebral fractures. The technique is highly effective in pain reduction and prophylaxis of further fractures but contains the risks of cement leakage or fat embolism, which limits the volume of injected cement to 30 cc or 6 levels at one session.<sup>1,2</sup> In this study, a lavage technique was developed to investigate its effect in vertebroplasty on injection forces, cement distribution and fat wash out.

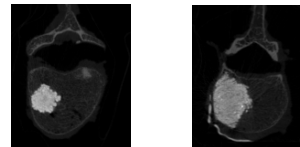
**METHODS:** 24 vertebral bodies (Th8 – L04) from 5 osteoporotic cadaver spines were grouped in triplets of similar bone mineral density. Previous to PMMA vertebroplasty (Vertecem, Synthes Inc., CH), a pulsatile jet lavage was performed in two groups with 8 specimens each, using a special adaptor for radial irrigation in one group. 100 cc of Ringer solution were injected through one pedicle and regained by low vacuum via the contralateral side. Eight untreated vertebral bodies were used as controls. All vertebrae underwent transpedicular PMMA cement augmentation under standardized conditions injecting 20% of the vertebral volume at constant speed. Injection forces were measured on an Instron universal testing machine, cement distribution was assessed with digital x-rays and CT (Xtreme CT, Scanco Medial, CH). Fat content of the retrieved lavage solution was analysed biochemically.

**RESULTS:** The lavage technique showed to be feasible and reproducible – in all samples the full lavage solution injected could be regained through the contralateral transpedicular access. To date the analysis of the fat content is not complete yet. Injection forces were significantly reduced in both lavage groups compared to controls (*Figure 1*). System failure due to dilatation of the syringe occurred at forces above 300 N in 6 of 8 untreated vertebrae compared to 2 of 16 lavaged specimens. Extravasation of PMMA through a segmental vein was found in digital x-rays in 2 of 8 controls and 2 of 16 lavaged specimens. Distribution analysis by

CT is still ongoing, preliminary data show a more homogenous cement distribution with less extravasation (*Figure 2*).



*Fig. 1: Maximal Injection forces [ $\pm 1$  SD, n=8 for each group] at vertebroplasty in untreated (red) and lavaged (blue) vertebrae.*



*Fig. 2: CT Sections of a lavaged (left) and an untreated (right) vertebral body.*

**DISCUSSION & CONCLUSIONS:** The data available to date clearly demonstrate a reduced injection force at vertebroplasty after lavage compared to the untreated group. Although we have no complete data yet, the tendency for a more homogenous cement distribution with less extravasation after lavage becomes apparent. The technique of the lavage has shown to be reproducible in intact vertebrae and an easy-to-apply technique. Theoretically the wash out of bone marrow should reduce potential fat embolism at prophylactic cement augmentation of intact osteoporotic vertebrae – clinical trials will be needed.

**REFERENCES:** <sup>1</sup> N. Aebli et al (2002) *Spine* 27:460-6. <sup>2</sup> P. Heini et al (2004) *Orthopaede* 33:22-30.

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