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EX VIVO MODEL FOR PERCUTANEOUS VERTEBROPLASTY

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Abstract. The testing of novel biomaterials for percutaneous vertebroplasty depends on suitable animal models. The aim of this study was to develop *ex vivo* a reproducible and feasible model of percutaneous vertebroplasty for ulterior application *in vivo*. A large animal model was used (Merino sheep) due to its translational properties. Vertebroplasty was performed under tactile and fluoroscopic control through a bilateral modified parapedicular access in lumbar vertebrae. Care was taken in order to avoid disruption of the vertebral foramen. The average defect volume was 1234±240 mm^3 which ensures practical defects to test novel injectable biomaterials. Six vertebrae were injected with a commercial cement (Cerament®, Bone Support, Sweden) and adequate defect filling was observed in all vertebrae. All vertebrae were assessed by microCT, prior to and post defect creation, and after biomaterial injection. All vertebrae were mechanical tested and no mechanical failure was observed under loads higher than the physiological ones. Ultimately, this model is considered suitable for pre-clinical *in vivo* studies, mimicking clinical application.

Introduction. Percutaneous vertebroplasty (PVP) and kyphoplasty (KP) are minimally invasive techniques used for effective vertebral augmentation in humans when conservative treatment for vertebral compression fractures is not possible and/ or sufficient. Their purpose is to augment and stabilize the defective vertebral body by injecting percutaneously a material that will fill the bone defect. This will allow to achieve immediate pain relief and function [1–3]. In PVP small entry points for needle placement are made through the soft tissues (skin and muscles) to access the vertebrae, under fluoroscopic guidance, as an alternative to the conventional "open" approach techniques wherein an incision along the soft tissues is made.
To test biomaterials for PVP, the availability of a feasible animal model close to the human conditions is vital. Sheep is considered a suitable model for biomedical research due to its availability, low animal cost, easy handling and housing, and good homogeneity, when selected for age, breed, and sex [4]. Moreover, due to its anatomical similarities when compared to human bones, regarding weight, size, bone structure, bone remodelling process and biomechanical behaviour [7–9], it is also considered a good model for orthopaedic research, as these enables the use of the same prosthetic devices [4,8].