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Improving the safety of spinal fracture fixation in dogs

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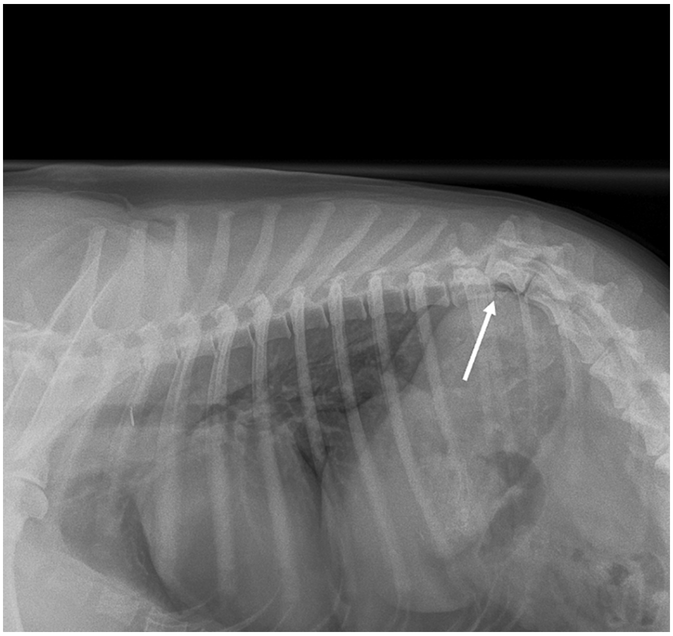
University College Dublin (UCD) is undertaking a comprehensive program to support research at all levels, with a particular focus on building sustainable infrastructure for clinical research within the UCD Veterinary Hospital. In this article, Head of Small Animal Surgery, Ronan Mullins, offers an insight into research involving the freehand probing technique for stabilization of vertebral fractures in dogs and techniques aimed at improving the safety of spinal fracture fixation.

Vertebral fractures are a major cause of spinal cord injury in dogs. Spinal stabilization is technically challenging, with a variety of treatment options available: application of plates and screws, pins or screws with bone cement or titanium rods, and external skeletal fixation. While the use of 3D-printed patient-specific drill guides has increased and is associated with a high rate of accuracy, the technology required to design and produce such guides is expensive and not universally available; this can result in treatment delays for patients.

Collaborating with colleagues at UCD, Iowa State University, Colorado State University, and University of Bern, Dr. Mullins is investigating a modification of the freehand technique, known as the pedicle-probing technique, for insertion of pins or screws into the canine spine. The traditional freehand technique relies on intraoperative identification of correct implant entry points and drilling of pilot holes using preoperatively calculated or published "safe" insertion angles. While a certain amount of tactile feedback is possible during drilling, inadvertent breach of the vertebral canal can have serious consequences for the patient. The pedicle-probing technique involves the creation of a cortical defect at the correct entry point, insertion of a blunt probe through this defect and into the underlying cancellous bone, establishment of a safe trajectory, and drilling of the definitive pilot hole. The principle of this technique is that the blunt probe follows the path of least resistance through the cancellous bone and is less inclined to breach the vertebral canal.

Dr. Mullins' initial research involved comparing the safety and accuracy of pin placement in the thoracolumbar spine of canine cadavers using this technique versus 3D-printed drill guides. Following CT, a total of 112 positive profile pins were placed in 4 cadavers from T7 through L7, 1 left and 1 right.



Significantly displaced T11-12 vertebral fracture in a Collie.

Postoperative CT was performed, and pin tracts were graded by 2 blinded observers using a modified Zdichavsky classification. While both techniques had a high degree of accuracy, pins were placed faster using 3D-printed drill guides.

Further aspects of this research include investigating intraoperative techniques to detect vertebral canal breach prior to implant placement. One such initiative investigates the reliability of a dedicated probe instrument and image-guided techniques to evaluate the integrity of pedicle drill tracts prior to implant placement. With nonimage or 3D-printed guided techniques, the ability to determine a vertebral canal breach prior to implant placement would be particularly advantageous, especially in cases where pins or screws are combined with bone cement. If found to be reliable, these techniques could translate into decreased patient morbidity, reduced surgical interventions, decreased hospitalization, and reduced costs for clients.