



sevc
SOUTHERN EUROPEAN VETERINARY CONFERENCE
CONGRESO NACIONAL AVEPA

SEVILLA, 23-25 Octubre 2025

PANCARPIAN ARTHRODESIS: NEW APPROACHES, NEW FRONTIERS

Dr José Luis Fontalba Navas, Veterinary Surgeon, PhD, Dipl ECVS

AniCura VETSIA Veterinary Hospital

Surgery and Traumatology Department

Calle Galileo 3, nave 43, 28914 Leganés, Madrid

Spain

INTRODUCTION

Pancarpal arthrodesis is an established surgical technique for treating complex carpal injuries in dogs and cats, especially when joint stability is irreversibly compromised. These pathologies include irreducible dislocations, comminuted intra-articular fractures, severe degenerative diseases that cannot be treated conservatively, or previous surgical failures. In these scenarios, complete surgical fusion of the joint represents the best therapeutic option for preserving a functional and pain-free limb.

Traditionally, the standard approach to this surgery has been to place a rigid dorsal or craniodorsal plate fixed to the third metacarpal, distal radius, and carpal bones. This arrangement allows for proper functional alignment of the limb and has been shown to be effective in multiple studies. In some cases, it has been supplemented with cross pins or additional screws to increase stability, especially in larger animals or those with structurally compromised bones. However, this configuration has certain biomechanical limitations, such as the tendency to concentrate stress on the single fixed metacarpal, which can lead to complications such as implant fractures, screw loosening, osseointegration failure, or the need for surgical revision.

In addition, the carpus, due to its complex anatomy and exposure to weight during walking, requires a stabilisation system that can withstand loads in multiple planes. The exclusive use of a plate may be insufficient for certain patients, especially those with high physical activity or unfavourable anatomical conditions. These clinical challenges have driven the evolution of more robust surgical techniques adapted to the individual characteristics of each patient.

In this context, and with the aim of overcoming the aforementioned limitations, an innovative approach is presented: fixation using parallel plates anchored in the third and fourth metacarpals. This technique, currently under development at the AniCura VETSIA Veterinary Hospital, seeks to distribute the biomechanical loads more evenly between two metacarpal columns, increasing the structural rigidity of the system without compromising vascularisation or generating significant mechanical interference.



The placement of two parallel plates, usually dorsal or cranial-lateral, allows for greater rotational stability and reduces the risk of micro-movements at the fusion site, promoting bone healing. In addition, this technique maintains a respectful approach to the surrounding soft tissues, which is essential in cats, where the available anatomical space is limited and the tissue is particularly delicate. The first cases treated with this technique at VETSIA have shown promising clinical results, with good functional evolution, adequate consolidation and no major complications in the short term.

Although further prospective studies and longer follow-up are required to conclusively establish its efficacy and reproducibility, this technique represents a step forward in the evolution of pancarpal arthrodesis. The experience gained in its development will allow us to refine selection criteria, optimise the implants used and perfect the surgical technique to achieve increasingly predictable results.

ANATOMICAL FEATURES AND CHALLENGES IN PANCARPIAN ARTHRODESIS

The carpus is a complex anatomical structure that includes multiple joints and particularly demanding biomechanics. This region must withstand variable loads during locomotion, with multidirectional movements that require firm and stable surgical fixation to achieve effective bone consolidation in cases of pancarpal arthrodesis. Traditionally, fixation was performed by placing a single rigid plate over the third metacarpal, anchored to the distal radius and carpal bones. Although this technique has proven effective, it is not without limitations, mainly due to the asymmetrical distribution of loads and stresses, which can lead to implant failure or delays in bone union.

In response to these difficulties, the development of locked plates specifically for pancarpal arthrodesis has been a significant advance in veterinary orthopaedic surgery. These plates are designed to anatomically adapt to the shape of the carpus in dogs and cats, allowing for a firmer and more secure fixation. Unlike conventional plates, locked plates incorporate screws that are rigidly anchored to the plate by means of an internal thread mechanism, making the assembly stable and resistant to bending, torsion and axial forces. This feature allows the fixation to act as a stable support system, even in bones with reduced bone quality or in situations of significant bone loss.

In addition, locked plates allow for minimal reduction of the periosteum and less need for direct compression of the implant against the bone, which favours the preservation of bone vascularisation and adjacent soft tissues. This aspect is critical in the carpus, as vascularisation plays a fundamental role in consolidation and in the prevention of complications such as osteomyelitis or bone necrosis.

Another key advance in the development and application of these specific plates has been the improvement in the materials used. Titanium and high-strength stainless steel alloys are frequently used, providing biocompatibility, corrosion resistance, and mechanical properties suitable for withstanding the biomechanical demands of arthrodesis. In addition, the surface of the plates can be treated to improve integration with the bone and reduce soft tissue irritation.



Imaging techniques play a key role in ensuring the accuracy of implant placement and surgical planning. Orthogonal radiography remains the basic method for assessing the alignment and position of implants, but computed tomography (CT) offers a much higher level of detail, allowing accurate visualisation of bone structures and the relationship between them. This information is essential for adapting the design of the locked plates to the patient, selecting the most appropriate size and type of screws, and anticipating possible technical difficulties.

In addition, intraoperative fluoroscopy has gained prominence as a tool for guiding implant insertion in real time, preventing iatrogenic damage and optimising fixation accuracy. This technology makes it possible to perform minimally invasive surgery, with reduced approaches and minimal tissue manipulation, which in turn reduces the risk of infection and accelerates the patient's functional recovery.

Overall, the development of specific locked plates for pancarpian arthrodesis, supported by high-quality materials and advanced imaging techniques, represents a fundamental advance in improving efficacy, safety, and functional outcomes in canine and feline patients. These innovations help overcome the challenges inherent in carpal surgery, providing surgeons with more precise, versatile tools tailored to the individual needs of each patient.

NEW APPROACH: PARALLEL PLATES ANCHORED IN METACARPALS 3 AND 4

The technique we are developing uses parallel plates fixed to metacarpals 3 and 4, allowing for a more even distribution of loads and improving the overall stability of the system.

This configuration allows for:

- Reduction of asymmetric load on a single metacarpal.
- Greater bone contact surface for implant anchoring.
- The possibility of using longer screws with better biomechanical orientation.
- A decrease in the need for supplementary fixations, such as cross pins.

To date, preliminary evaluation based on clinical and radiographic follow-up shows good progress in consolidation and a reduced complication rate, although a prospective and more extensive study is required to validate these results.

We believe that by distributing the forces between two parallel metacarpals, a more natural biomechanical balance is achieved, avoiding focal stress points that can weaken the bone or the fixation system. In addition, the use of parallel plates provides a larger bone contact surface for implant anchoring, allowing for the placement of a greater number of screws and, crucially, longer screws with a direction that optimises the mechanical strength of the system. This improves fixation and reduces the possibility of unwanted movements that could compromise healing.

Another obvious benefit is the reduced need for supplementary fixations, such as cross pins, which are commonly used to reinforce stability but complicate surgery and may increase damage to surrounding soft tissues.



Subjectively, the author has noticed that this technique causes fewer problems related to the skin and soft tissues than when orthogonal plates are used. Less manipulation and tension on the skin appears to reduce postoperative complications such as irritation, wounds, or infections, improving patient comfort and facilitating postoperative care. It is also important to mention that, from a functional point of view, fixation at metacarpals 3 and 4 is better suited to the dog's natural biomechanics, as these are the main toes on which the animal supports its weight when walking.

This means that the load transmitted through the implant is more physiological, which can help the dog recover function more quickly and normally, walking more naturally and without overloading other structures.

SURGICAL STRATEGIES AND POSTOPERATIVE CARE

The surgical technique maintains the importance of precise anatomical reduction and careful management of soft tissues. The use of appropriate instruments for meticulous plates, screws and compression fixation is recommended, seeking to maximise bone contact.

Postoperative care includes:

- Multimodal analgesia.
- Restriction of movement using cages or controlled spaces for 4 to 6 weeks.
- Periodic radiographic follow-up to evaluate consolidation.
- Supervised physiotherapy to restore function.

COMPLICATIONS AND MANAGEMENT

The most common complications include superficial or deep infections, implant failure, and delayed healing. In the literature, the complication rate can be as high as 20% with traditional techniques (Cook et al., 2001; Manley & Marcellin-Little, 2009; Lewis et al., 2007).

Experience with the parallel plate technique suggests a tendency to reduce these complications, especially those related to mechanical instability.

CONCLUSIONS

Pancarpal arthrodesis remains a fundamental procedure in veterinary orthopaedic traumatology for the treatment of complex carpal injuries that compromise joint stability.

The traditional technique, which consists of placing a fixed plate on the third metacarpal and sometimes reinforcing it with crossed pins to increase stability, has proven effective over the years. However, this technique has significant biomechanical limitations, such as the asymmetrical concentration of loads on a single metacarpal, which can predispose to implant failure and delays in bone healing, as well as some complications related to the surrounding soft tissues.

In response to these challenges, the development and application of parallel plate fixation anchored to metacarpals 3 and 4 represents a new frontier in veterinary orthopaedic surgery. This innovative approach allows for a more homogeneous distribution of loads throughout the bone structure and improves the overall stability of the system, which could significantly reduce the rate of postoperative complications.

Initial experience with this technique at our centre is encouraging, showing promising results in terms of both bone healing and postoperative functionality in patients. This opens the door to future prospective and expanded studies that will be necessary to conclusively validate its clinical validity and establish standardised surgical protocols.

BIBLIOGRAPHICAL REFERENCES

1. Tuan J, Comas N, Solano M. Clinical outcomes and complications of pancarpal arthrodesis stabilised with 3.5 mm/2.7 mm locking compression plates with internal additional fixation in 12 dogs. *N Z Vet J*. 2019 Sep;67(5):270-276. doi: 10.1080/00480169.2019.1636417. Epub 2019 Jul 7. PMID: 31234729.
2. Ramirez JM, Macias C. Pancarpal Arthrodesis Without Rigid Coaptation Using the Hybrid Dynamic Compression Plate in Dogs. *Vet Surg*. 2016 Apr;45(3):303-8. doi: 10.1111/vsu.12458. Epub 2016 Mar 23. PMID: 27007492.
3. Bristow PC, Meeson RL, Thorne RM, Butterworth SJ, Rutherford S, Renwick AI, Wustefeld-Janssens B, Witte PG, Woods S, Parsons KJ, Keeley BJ, Owen MR, Li A, Arthurs GI. Clinical comparison of the hybrid dynamic compression plate and the castless plate for pancarpal arthrodesis in 219 dogs. *Vet Surg*. 2015 Jan;44(1):70-7. doi: 10.1111/j.1532-950X.2014.12183.x. Epub 2014 Apr 7. PMID: 24708556.
4. Rial García A, Brincin C, Craig A. Outcome, complications, and follow-up in dogs treated with pancarpal arthrodesis stabilised with orthogonal plates. *J Am Anim Hosp Assoc*. 2024 Nov 1;60(6):252-264. doi: 10.5326/JAAHA-MS-7421.
5. Zderic I, Varga P, Styger U, Drenchev L, Gueorguiev B, Asimus E, Saunders WB, Kowaleski M, Boudrieau RJ, Déjardin LM. Mechanical assessment of two hybrid plate designs for pancarpal canine arthrodesis under cyclic loading. *Front Bioeng Biotechnol*. 30 March 2023;11:1170977. doi: 10.3389/fbioe.2023.1170977. PMID: 37064234; PMCID: PMC10098118.
6. Basa RM, Johnson KA. Management of feline carpal injuries: What are the options and when is arthrodesis indicated? *J Feline Med Surg*. 2019 Sep;21(9):809-823. doi: 10.1177/1098612X19870388. PMID: 31446862; PMCID: PMC10814143.
7. Chong WL, Eckart LH, Sul R, Jermyn K, Michelsen J. Retrospective Comparison of Titanium Hybrid Locking Plate with Stainless Steel Hybrid Dynamic Compression Plate for Pancarpal Arthrodesis: 23 Dogs. *Vet Comp Orthop Traumatol*. 2022 Jul;35(4):270-278. doi: 10.1055/s-0042-1748198. Epub 24 May 2022. PMID: 35609872.
8. Higgins J, Hayes G. Owner satisfaction and prognosis for return to work after pancarpal arthrodesis in working dogs in the United Kingdom: a retrospective study (2011-2020).



sevc
SOUTHERN EUROPEAN VETERINARY CONFERENCE
CONGRESO NACIONAL AVEPA

SEVILLA, 23-25 Octubre 2025

Acta Vet Scand. 2024 Sep 12;66(1):49. doi: 10.1186/s13028-024-00759-5. PMID: 39267066; PMCID: PMC11391598.