

How To Make, Place, and Remove Transphyseal Staples

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Introduction

Foals can have angular and flexural limb deformities with or without a rotational component^{1,2}. Most foals are born with at least some degree of limb deformity of either type, and carpal valgus is the most frequently encountered type.³ Methods employed to surgically correct angular limb deformities include hemicircumferential transection of periosteum and periosteal elevation (or periosteal stripping) and transphyseal bridging (or growth retardation). Transphyseal bridging is accomplished with screws and wires, staples, or with a lag screw across the physis.^{4,5} Combinations of stripping and growth retardation have also been used.¹ Corrective trimming of the hoof is almost always recommended, and owners are instructed to restrict exercise.

A popular method for transphyseal bridging is placement of two cortical screws and one or two figure-eight cerclage wires. This technique was compared to staple placement in a retrospective study published in 1978.⁴ From this study it was concluded that the overall success rate did not differ, but surgical complications were greater with staple application. The authors reported marked blemishes, wound dehiscence, staple spreading and staple extrusion requiring reinsertion. The staples used in that study were vitallium staples originally manufactured for use in humans. The complications described in the study have led to a negative view of using staples for transphyseal bridging. This technique has been seldom recommended, and is widely not considered as secure as screws and wire.

Our experience with staples has been to the contrary. In our hands, transphyseal bridging is easily accomplished using custom made staples. Surgery time is short using this method, and the cosmetic result is excellent in almost all cases. We experience few incisional complications, the staples stay in place and are easy to remove.

Materials and Methods

Transphyseal Staples: Steinmann pins of 7/64 inch are used to make staples. A 90-degree angle is bent in the end of the Steinmann pin with heavy pliers at approximately 1.25 inches from the end. An identical bend is placed approximately 1.25 inches from the first, and the pin is cut with sidecutters at approximately 1.25 inches from the second bend. The cut end is sharpened by grinding a single angle on the outside edge of the staple on a bench grinder. This yields a U-shaped staple approximately 1.25 inches on all three sides. The same procedure is repeated on the other end of the pin; two staples are made from one pin. The staples are sterilized individually or in pairs. Smaller staples can be made in the same manner with smaller Steinmann pins for distal metacarpal deformities or for miniature horses.

Case Management: Radiographs are performed on carpi before surgery to rule-out crushing of the cuboidal bones or any other structural abnormality that would alter prognosis. If the foal has carpal valgus, is young (less than 2 months) and the deformity is mild to moderate (less than approximately 15 degrees), the owners are encouraged to stall rest the foal for 30-60 days. We recommend this because many foals correct with no surgical intervention. If the foal does not correct, or if the abnormality is severe, transphyseal bridging by placement of the custom-made staples is recommended.

Surgery: Depending on the surgeon's preference, foals may be administered non-steroidal antiinflammatories and antibiotics. Foals are sedated with butorphanol and/or xylazine, nasotracheally intubated and induced with isoflurane. Foals are placed in lateral recumbency to allow access to the appropriate physis. Foals with bilateral deformities are turned to the opposite recumbency during surgery for completion of the other leg.

After draping, towel clamps are used to retract the skin dorsally. This prevents the skin incision from being directly over the staple. The incision is made with a #10 scalpel blade through the skin and subcutaneous tissues. The incision is centered over the widest part of the physeal area, and is approximately 4 cm in length. The physis is identified using a needle, the antebrachial carpal or fetlock joint identified via palpation. The staple is centered over the physis and inserted into the bone using a mallet. The proximal end is not driven down flush with bone, leaving it slightly "proud". This makes palpation and elevation of the proximal edge of the staple easier during removal. It is possible to take intraoperative radiographs or use fluoroscopy to verify placement of the staple at this point in the surgery, but with experience, this is not necessary. The skin is released and it is closed with 2-0 poliglecaprone 25 in a continuous horizontal mattress or subcuticular pattern. The leg is bandaged, and the feet are trimmed if necessary before moving to recovery.

Aftercare: Owners are instructed to keep the leg or legs bandaged for at least 2 weeks with a padded pressure bandage. Stall confinement is recommended to owners until the legs are 50% improved. After that, the foal is allowed small paddock turnout. Owners are cautioned to bring the foals back as soon as the legs appear straight to prevent overcorrection. If bilateral, they are instructed to return if one of the legs is straight, even if the other is not.

Staple Removal: Staple removal is accomplished under anesthesia or standing. If anesthetized, foals are induced as described above, and placed in the same recumbency. The leg is draped, and towel clamps are used as described above to move the skin dorsally over the staple. The staple is usually easily palpable under the skin. The skin incision is made on the scar from the previous surgery site through the skin, subcutaneous tissues, and down to the staple. A Langenbeck periosteal elevator is inserted under the proximal end of the staple, which should be slightly proud, and is used as a lever to loosen the staple. Sterile pliers are used to grasp and remove the staple. The skin is released and closed as described above.

Recently, we started removing staples in standing, sedated foals. The foals are sedated, and the staple is palpated under the skin. The area is anesthetized with local anesthetic, clipped and prepared routinely. The staple is then removed as described above. Surgical staples or sutures are used to close the skin, and the leg is bandaged.

Discussion

Transphyseal stapling is an effective method for growth retardation in foals with angular limb deformities. Staples can easily be made with equipment and supplies available to most practitioners. Insertion and removal of the staples is accomplished with little time and effort, and removal can even be done standing. Incisions to insert and remove the staples are small, and the appearance is cosmetic after healing. Using the custom made staples from Steinmann pins appears to reduce the risk of spreading or extrusion encountered with vitallium staples.

References

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