How to Harvest, Store, Apply, and Manage Split Thickness Meshed Grafts in Horses

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1. Introduction

Traumatic injuries resulting in large skin defects that are not able to be closed primarily due to size or contamination are common in horses. Often, these injuries occur at or below the carpus or hock. In these locations, due to lack of mobile skin and underlying soft tissue, the normal mechanisms of second intention healing, contraction, and epithelialization, may result in prolonged healing time and poor cosmetic results. Additionally, exuberant granulation tissue often forms preventing contraction and epithelialization. To facilitate wound healing in these cases, various grafting techniques have been used. The most common techniques used in horses are pinch or punch grafting. Pinch and punch grafts are easy to apply, cost-effective, and have a relatively high rate of survival between (50% to 90%). The cosmetic appearance, however, may be less than ideal because the final result is tufts of hair surrounded by hairless epithelium. An alternative to these grafts is a meshed, split-thickness sheet graft, which produces superior cosmetic results. Harvested sheets of skin are meshed by creating staggered rows of incisions, which allow expansion. Meshing the sheet grafts allows large defects to be covered with a smaller piece of donor skin. Meshed grafts survive better than non-meshed grafts because they allow drainage, conform well to the recipient bed, and can withstand some motion. An additional advantage is that they allow antimicrobial drugs to contact the wound. This article discusses how to harvest, store, apply, and manage split thickness mesh grafts in horses.

2. Materials and Methods

Graft Harvest, Meshing, and Storage

The grafts are harvested while the horse is anesthetized. Although we harvest grafts using gas anesthesia at Texas A&M University, the duration of the procedure permits the harvesting to be performed...
using intravenous anesthesia. Determining factors that may complicate wound healing, such as the presence of a sequestrum, is important so that the wound can be adequately treated at the time of surgery. The horses are positioned in lateral recumbency or in dorsal recumbency to allow access to the wound and the abdomen where the graft is harvested. The abdomen is clipped and prepared for aseptic surgery. The skin surrounding the wound is also clipped and prepared for surgery. A series of penetrating towel clamps are clamped on the skin on a line abaxial/lateral and on a line caudal to where the skin will be harvested from the abdomen. These are grasped by two assistants who place traction on the towel clamps stretching the skin tight in an abaxial and caudal direction from the harvest site. The hand held dermatome is positioned immediately cranial to the caudal row of towel clamps and axial to the lateral row of towel clamps with the knife directed cranially. With a significant amount of downward pressure placed on the dermatome, the graft is harvested using a slow back and forth sawing motion. Thumb forceps are used to grasp the leading edge of the cut graft and to pull it in a caudal direction during the initial cut. The skin is cut at widths varying between 4 and 8 cm and at a thickness of approximately 0.63 cm (Fig. 1).

The harvested tissue is then placed on a dermatome expander with the dermal side down. The graft is positioned to lie flat and unwrinkled on the dermatome. The skin flap is cut so as to fit within the boundaries of the dermatome expander. The roller is then used to press the graft into the staggered blades of the expander. The meshed graft is grasped with thumb forceps, peeled off the expander (Fig. 2), and placed dermal side up on a vaseline-impregnated gauze strip. The vaseline-impregnated gauze strip with graft is then rolled with the gauze to the outside of the roll and placed into a sterile plastic container in approximately 100 ml of cell culture medium containing 10% horse serum. We harvest at least twice the amount of tissue necessary to cover the wound bed so that, if necessary, we can replace failed grafts. The container is stored at 4°C until the bed is ready for grafting. We have successfully applied grafts that have been stored 4 weeks after harvesting. After the graft is harvested and stored, the wound that will receive the graft is surgically debrided and lavaged with a dilute solution of chlorhexidine (0.05%). The wound is covered with a sterile non-adherent dressing, sterilized gauze, and elastic tape. A thick cotton bandage is applied over the primary wrap.

Preparation of Recipient Bed and Graft Placement

In our hospital, meshed grafts are applied when the wound has formed a smooth healthy granulation tissue bed. One day prior to grafting, the wound bed is trimmed with a razor blade to the level of the skin surface. The wound is bandaged as described above. The following day the horse is sedated with...
xylazine (0.4 mg/kg, IV) followed by butorphanol tartrate (0.02 mg/kg IV). The wound is gently cleaned by spraying sterile saline over the wound bed. Using aseptic technique, the vaseline-impregnated gauze is unrolled, and the graft is separated from the gauze. The graft is positioned over the wound with the hair directed to match adjacent hair around the wound. The graft is expanded to fit the wound with the hair directed to match adjacent hair around the wound. The graft is expanded to fit the wound, and secured around the wound edge with tissue adhesive (Fig. 3). Surgical skin staples are used to attach the graft directly to the interior of the wound bed. The wound is bandaged, as discussed above, with the addition of antibiotics (ticarcillin sodium powder and amikacin) that are placed on the sterile non-adherent dressing. If the wound is over a joint, a splint is secured to decrease motion.

Management of Graft
To allow the graft to adequately attach to the wound bed so as not to dislodge it when the dressings are removed, we wait 3 days before changing the bandage after placing the graft. Before removing the nonadherent dressing in contact with the graft, the dressing is moistened with sterile saline to prevent it from sticking to the graft and mechanically disrupting the graft when it is removed. Keeping the wound clean during bandage changes is important. Consequently, we use sterile gloves when handling the dressings placed directly on the graft. Depending on the appearance of the graft, the site is re-bandaged as before without further treatment, or the graft is cleaned by spraying a dilute chlorhexidine (0.05%) over the surgical site. The bandage is then changed every 1 to 3 days depending on the amount of discharge seen at each bandage change. If sections of the graft appear to fail, they are excised. If the entire graft fails, the necrotic tissue is removed, and another graft placed on the bed when the bed appears healthy.

3. Results and Discussion
We apply split thickness skin grafts to approximately 8 to 10 horses a year at Texas A & M University. Our clinical impression is that 70% of grafted wounds have a significant portion of the graft that survives. However, some cases may require 2 or 3 applications of grafts before one will take. It is important to communicate to the owner that not all grafts survive so their expectations are realistic. It is also important to provide an accurate estimate of the cost of grafting and aftercare. The cost to treat an animal is approximately $2000 to $3000 for most wounds. This includes the expenses related to surgery as well as the board and bandage material in the postoperative period. A significant portion of this cost goes towards board. We are reluctant to send the horse home earlier than 2 weeks after grafting, because bandage changes performed incorrectly by an owner can easily harm the graft and destroy any progress achieved in wound healing. With appropriate training, however, we believe that a graft could be harvested at a private practice on an outpatient basis or even on the farm. Graft harvest can be performed with the horse placed under general anesthesia using short acting intravenous anesthesia. The graft could...
then be placed on the wound when the wound bed was healthy, wherever the horse was stabled as this is done with the horse standing under sedation. This would allow the horse to remain at the farm with bandage changes being performed every 2 to 3 days by the veterinary practitioner. This would in turn reduce the cost of grafting significantly, as well as allowing the practitioner the opportunity to provide another technique to treat wounds in horses.

References and Footnotes
4. Mesh Skin Graft Expander, Padgett Instruments, Kansas City, MO 64108.
5. Adaptic, Johnson and Johnson Products, Inc., Fort Dodge, IA 50501.
6. McCoy's 5A Medium, Sigma Chemical Co, St Louis, MO 63178.
7. GG-Free Horse Serum, Gibco Lab, Inc., Grand Island, NY 14072.
8. Nolvasan, Fort Dodge Laboratories, Inc., Fort Dodge, IA 50501.
13. Torbutrol, Fort Dodge Laboratories, Inc., Fort Dodge, IA 50501.
15. AutoSuture Royal 35W, United States Surgical Crop, Norwalk, CT 06956.
17. Amiglyde, Fort Dodge Animal Health, Fort Dodge, IA 50501.

Fig. 3. Photograph of graft being placed on horse. Tissue adhesive is being applied at the periphery of the wound to hold the graft in place. Surgical staples will be used to attach the interior of the graft and the excess graft tissue will be trimmed.