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A thermoplastic vest to prevent self mutilation in experimental flap surgery in rats

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Introduction

Rats are frequently utilized for both research and training related to reconstructive head and neck surgery. The femoral neurovascular complex represents a useful model for microvascular anastomosis, both for the purposes of testing adjuncts designed to improve anastomotic patency rates, as well as for residents and students to gain experience in microvascular surgery outside the operating room. Additionally, the rat proves useful in investigations examining the survivability of both random and axial pattern skin flaps.

One of the difficulties in performing a study requiring survival surgery in the rat is auto-cannibalization. The rat chews on and scratches at any suture material used for wound closure, as well as the skin flap itself, which may be denervated from flap elevation. Damage to the surgical site may result in wound dehiscence or artifactual injury and necrosis of associated flaps, thereby compromising experimental data. Auto-cannibalization is a particular concern when the abdominal region is utilized for surgery, as the rat has ample access to this area with its teeth when unimpeded.

A protective vest can be fitted to the animal, which limits access to the surgical site by either directly covering the wound, or by restricting the animal's movements so that it cannot access the incision. Here we describe a novel protective rat vest, constructed from thermoplastic splinting material that is easily constructed as well as removed, and is non-traumatic for the animals.

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Methods

Twenty male Sprague-Dawley rats (avg. 450 g) underwent surgery to create a rectangular skin flap (3 x 9 cm) based off of the inferior epigastric artery. The flap was sutured in place with buried interrupted 3-0 Vicryl sutures and a running 3-0 nylon (Figure 1).

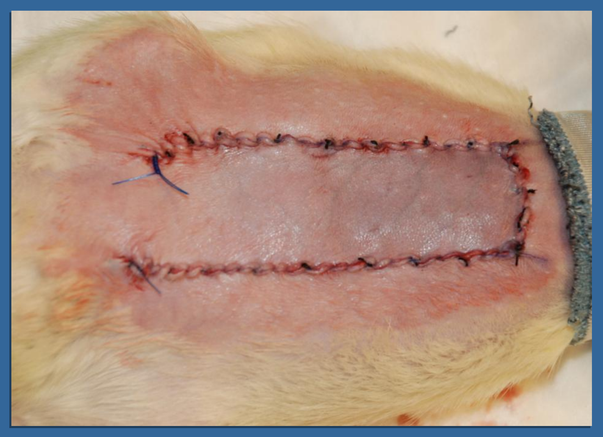

Figure 1: Abdominal skin flap

The protective rat vest was constructed from a surgical towel, cut to approximately 15 cm by 6 cm. Two arm holes were cut in the towel, about 5 cm apart. A piece of thermoplastic splinting material, measuring about 5 cm by 3 cm, was molded to the curvature of the rat's chest and sutured to the towel with 3-0 silk (Figure 2).

A 2-0 nylon suture is placed in the superior aspect of the dorsal portion of the vest to secure the collar. It is necessary to ensure a tight fit at the collar so that the rat cannot pull its head into the vest and chew on it (Figure 3).

After this, three pieces of silk tape are applied to the vest for further reinforcement, crossing the chest obliquely and circumferentially. One 2-0 nylon suture is placed through the dorsal aspect of the cloth and all tape edges to ensure security (Figure 4).

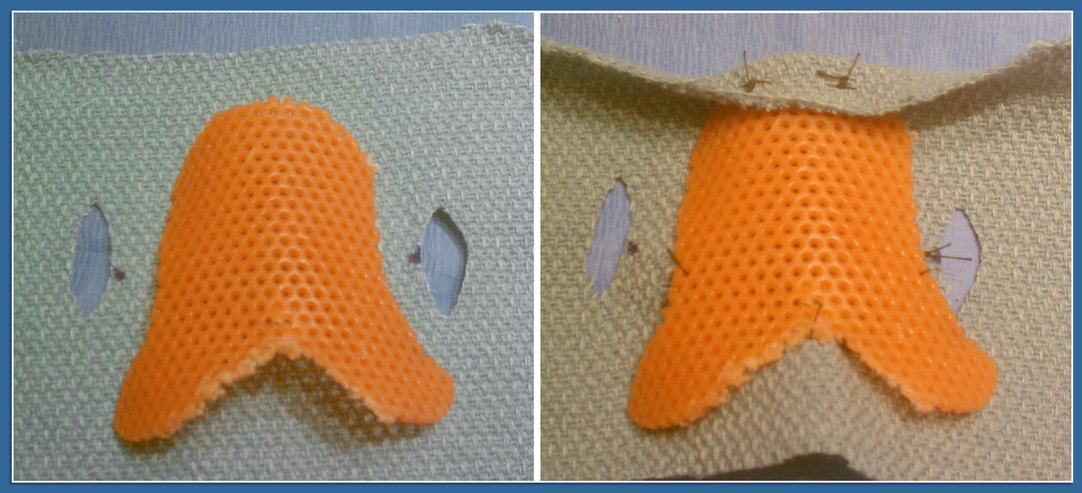

Figure 2: Thermoplastic splint is fixed to surgical towel with suture. Arm holes have been cut.

Results

All 20 rats were maintained in their vests for 7 days. One vest was removed on post-operative day 1 because of respiratory distress, attributed to pneumonia by the veterinary staff. The vest was re-fitted after 24 hours. During this time, the rat did chew through a portion of the nylon suture, but the underlying Vicryl was intact.

All animals demonstrated good mobility, feeding and breathing, without significant restriction. All surgical wounds were intact after the seven day period. No injury resulted from the vest.

Discussion

Other methods to limit self mutilation include gluing a splint directly to the rat's chest,[1] covering the incisions with a cloth vest,[2, 3] creating a splint out of x-ray film and tape,[4,5] and using a cone shaped collar.[6] These can be difficult to remove, cause irritation to the animal or entrap limbs within the construction, and offer decreased ability to monitor the surgical site, while deteriorating and malfunctioning with use.

Commercially produced protective rat vests do not necessarily conform to the specifications needed for the surgical site, and are expensive ($40 a vest). One sheet of thermoplastic material, provides sufficient material for over 40 animals, and can be purchased for less than $100. We found that each vest requires about 10 minutes to construct and to apply to each animal.

Figure 3: A suture sixes the vest collar

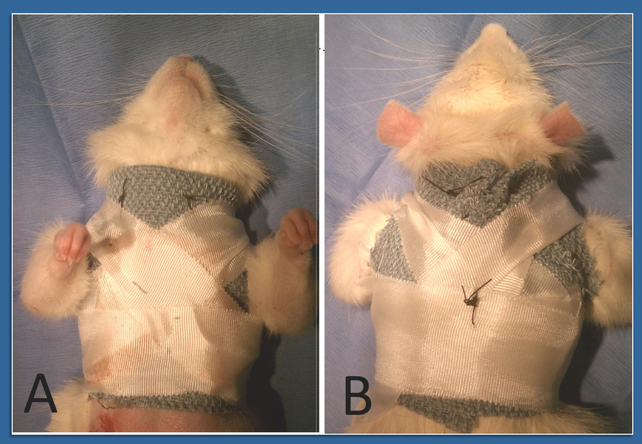

Figure 4: Tape, secured with a suture, reinforces the construction

Our design presents several advantages over the others mentioned. The materials are sturdy, and the vest remains intact for at least a week, obviating the need to clip nails or teeth. The vest is reasonably comfortable for the animals, and they appear to adjust to its presence quickly. It also affords adequate mobility to the animal, which is able to move about the cage easily, but is restricted only in its ability to flex at the waist.
While quickly removed and adjusted, this vest is highly successful in preventing the rat from accessing the incision with its teeth. Additionally, the vest does not obscure the surgical site, allowing investigators and animal caretakers to easily inspect all incisions.

CONCLUSIONS

A protective rat vest constructed from surgical towels and thermoplstic splinting material represents a cost effective and successful method to prevent auto-cannibalization of surgical sites located on the rat's abdomen. It is well tolerated by the animals, it is sturdy, and it is applied with relative speed and ease, while allowing unimpaired monitoring of surgical incisions.

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