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## The "Intramuscular" Rectus Abdominis Pedicle

*Sir:*

The free rectus abdominis flap based on the deep inferior epigastric vessels is a well-established and reliable flap used for a variety of reconstructive indications. Here we describe our recent experience with a patient with an "intramuscular" variant of the deep inferior epigastric that resulted in a vascular pedicle that was exceedingly short.

A 47-year-old man presented with a right maxillary squamous cell carcinoma. He underwent wide excision and right radical neck dissection, followed by reconstruction with a free rectus muscle flap. As the rectus was lifted off the posterior rectus sheath in a cranial to caudal direction, an absence of the deep inferior epigastric vessels that normally run on its posterior surface caudally was noted. Also noted was the absence of intercostal vessels (minor pedicles), which normally pierce the rectus sheath to join the inferior pedicle. The pedicle of the inferior epigastric was noted to pierce the substance of the rectus muscle right after it emerged from the external iliac vessels above the inguinal ligament. The pedicle was only 1.5 cm long (Figs. 1 and 2). This unexpectedly short pedicle necessitated the use of vein grafts, which were harvested from his forearm before flap division. Anastomoses were performed uneventfully with two 7-cm vein grafts. He was well at 6-month follow-up.

While the branching pattern of the deep inferior epigastric varies,[1] the course and anatomy of its main trunk are fairly constant, with few variants described.[2] Godfrey et al. described two cases of "circummuscular" free transverse rectus abdominis musculocutaneous pedicle in which the pedicle ran along the posterior surface of the muscle, wrapped around the muscle on its medial edge, and continued on the anterior muscle surface before piercing the sub-
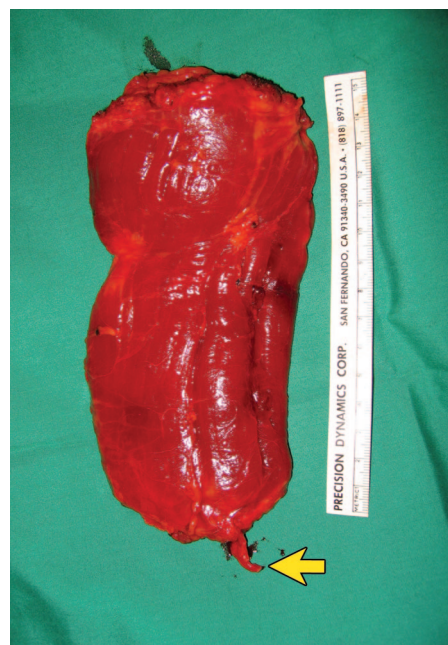


**Fig. 1.** The posterior surface of the rectus abdominis flap. Note the short deep inferior epigastric vessels, measuring only 1.5 cm (*arrow*). The pedicle plunged immediately into the substance of the muscle just above the insertion of the muscle at the pubic symphysis.

stance of the muscle.[3] This circummuscular inferior epigastric pedicle was also later reported by Yano et al.[4] Yano et al., however, noted that the pedicle wrapped around the lateral edge of the rectus muscle. The clinical significance of this circummuscular variant is that the anteriorly located pedicle is susceptible to damage when the rectus sheath is opened and may be mistaken for musculocutaneous perforators coming through the muscle and hence ligated during flap elevation.

The clinical implication of the "intramuscular" variant of the rectus flap is that the inferior epigastric is unexpectedly short. This necessitated the use of interpositional vein grafts to safely perform the microvascular anastomosis in a tension-free manner, which significantly prolonged and complicated the reconstruction. Another possible solution is to perform intramuscular dissection of the rectus muscle using perforator flap techniques. While this is technically possible, as elucidated by Moon and Taylor,[1] the intramuscular course of the epigastric vessels is highly variable, with extensive branching to supply the substance of the muscle. Intramuscular dissection may therefore be time consuming and potentially risk damage to the delicate pedicle.[5] In conclusion, more than anatomical curiosities, awareness of variants of the deep inferior epigastric pedicle is important to safely perform this workhorse flap.
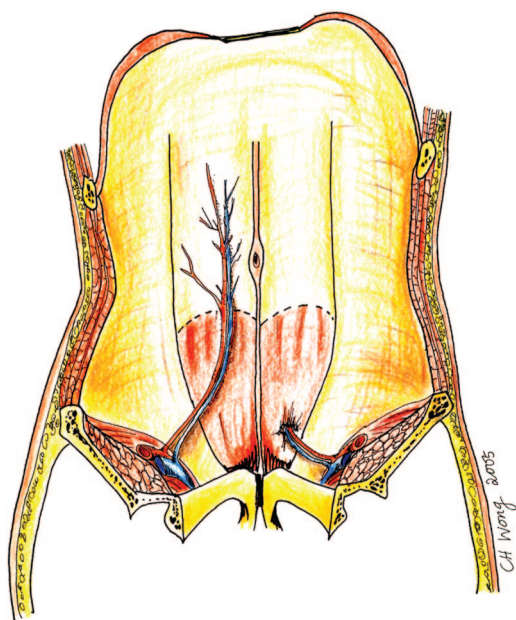
**Fig. 2.** The deep inferior epigastric vessels viewed from within the abdominal cavity. The *left* side of the diagram illustrates the typical course of the pedicle where the vessels reach the posterior surface of the rectus about 7 cm superior to the insertion of the rectus muscle and travel on its surface before piercing the substance of the muscle at its middle third. The *right* side of the diagram shows the "intramuscular" deep inferior epigastric pedicle where the pedicle plunges into the substance of the muscle just superior to the insertion of the muscle at the pubic symphysis, giving a very short pedicle.

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## Late Results of Burn Wound Scar after Cerium Nitrate–Silver Sulfadiazine and Compressive Therapy: Scanning Electron Microscopy Evaluation of a Keloid Scar

*Sir:*

Common local therapy for third-degree burns is based on silver sulfadiazine alone (Flammazine) or silver sulfadiazine and cerium (III) nitrate (Flammacerium)[1]; later, compression is applied by elastic silicone bandages.

Under the influence of cerium, deep second-degree and third-degree burn wound tissues transform into a pliable, leathery, yellow-green eschar, which acts as a mechanical barrier, thereby reducing the risk of infection. Immune suppression can also be prevented by cerium.[1–3] Prevention of the infection also means prevention of inflammation and, subsequently, prevention of hypertrophic or keloid scars.[4]

Early results of scarring after cerium nitrate–silver sulfadiazine and compression therapy in a deeply burned patient have previously been reported. The results showed the lack of detectable calcium in biopsy specimens from treated wounds.[3]

In this communication, we report the results of a long-term biopsy of a scar formed after cerium nitrate–silver sulfadiazine therapy applied to a 5-year-old child, who was burned in an explosion of a fondue set. She presented with a third-degree burn localized on the anterior part of her neck. She was treated with cerium nitrate–silver sulfadiazine antibiotic ointment, followed by tangential excision and coverage with a split-thickness skin graft. No complications, infections, or general problems occurred during hospitalization. A silicone compression garment was applied for 11 months.

After 1 year, the patient presented with a keloid scar. Biopsy specimens were taken and evaluated using scanning electron microscopy.

All specimens underwent the same preparation for scanning electron microscopy: fixation with buffered glutaraldehyde solution, washing in a cacodylate buffer solution, and then dehydration, drying, and coating with gold. Images were taken with a Philips XL 20 scanning electron microscope (magnification, $30\times$ to $4000\times$).

Figure 1 shows three very large collagen bands. Fibers are composed of numerous firmly packed fibrils (similar to keloid collagen fibers[5]). In Figures 2 and 3, fibers are randomly connected, with variable lengths (as in keloids) and parallel orientation to the surface of the skin (in some areas), as seen in normal skin as well as in some hypertrophic scars.[5,6] In particular, fibers in Figure 3 are beginning to separate and are not curled but allineated, as in normal mature scars.[5,6]