

Myogenic events in muscle massive crushing

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Abstract

The events of muscle degeneration and regeneration were studied in an experimental model of mechanical and myotoxic injury in rats. Rectangular patches of rat rectus abdominis muscle were processed by mechanical crushing and injection of marcaine. Three days after the operation a second injection of marcaine was performed. The patches, with a small amount of surrounding abdominal wall, were harvested respectively at 11 and 24 days from the operation. In a second group of animals, 3 days after the crushing-marcaine operation, the patch was used as a muscle autograft, and harvests were performed at 24 days. Sections of the biopsies harvested at 11 days showed wide destruction of muscle tissue, infiltration by inflammatory cells, and wide presence of small regenerating myofibers positive to an anti-embryonic myosin monoclonal antibody (anti MHC-emb). On the other hand, sections of the 24 days harvests showed an almost complete reconstruction of the muscle tissue in the patch, with well packed large myofibers negative to anti MHC-emb, but distinct ATPase staining (fasts and slow regenerated and reinnervated myofibers). Sections of the autografted muscle harvested at 24 days showed a dominant fibrotic component, with a few regenerating myofibers still positive to anti MHC-emb. The results suggest that even after massive mechanical-myotoxic damage, conservation of some continuity of the vascular network and of the connective tissue architecture with the surrounding tissue maintain the potential of muscle tissue to regenerate and be reinnervated. Conversely when total interruption of the vascular and nervous network is performed, regenerative events are confined to the rim and the autograft results in a scar.

Key Words: guided healing, massive crushing, rat muscle, rectus abdominis, regeneration of ablated muscle.

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The events of muscle degeneration and regeneration were studied in an experimental model of mechanical and myotoxic injury in rats. Rectangular patches, 24mm long and 8mm wide, of rat rectus abdominis muscle were processed by mechanical crushing and injection of marcaine (fig.1A, 1B).

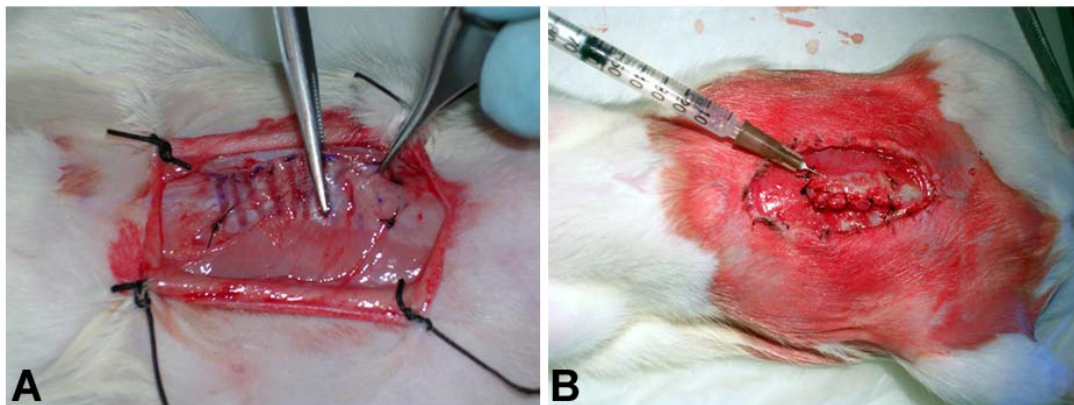
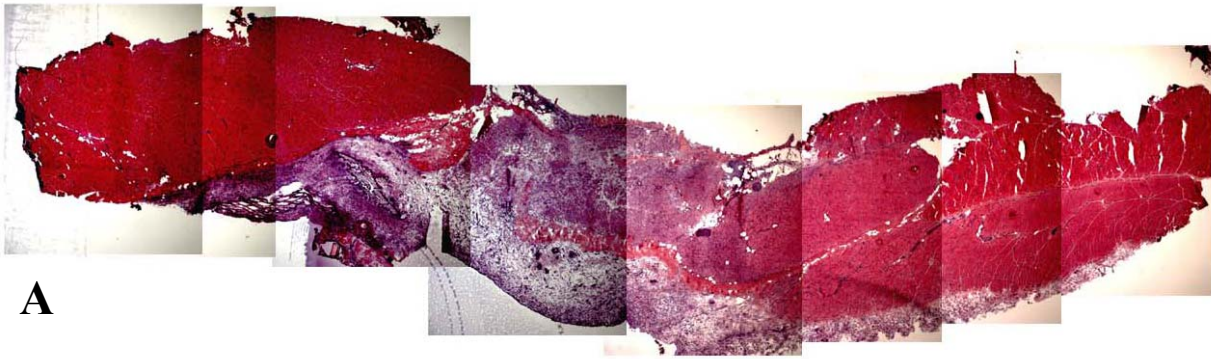
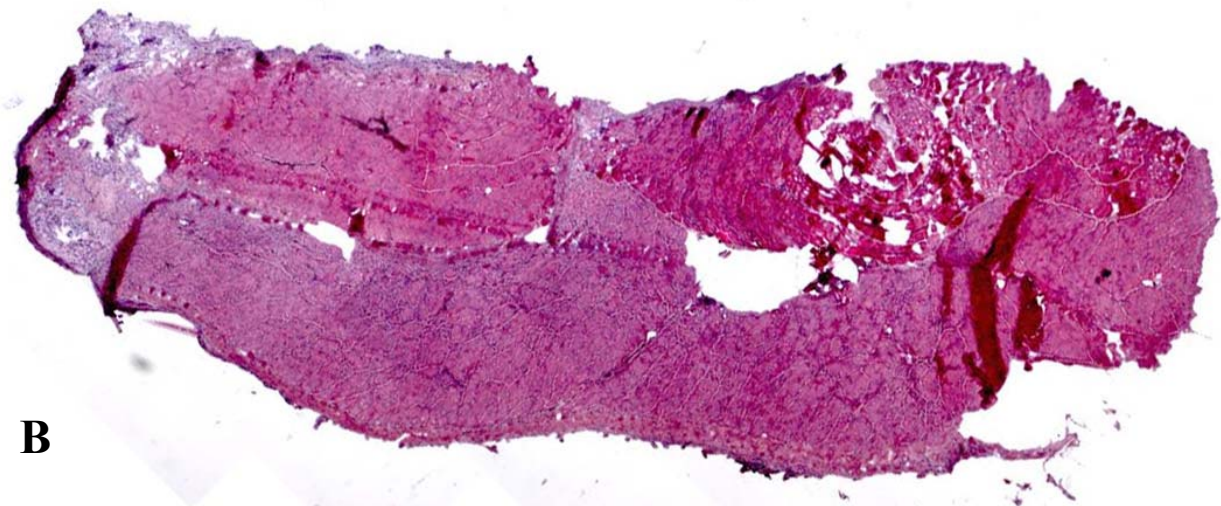


Figure 1. Rat rectus abdominis. A, crushing with a needle holder; B, injection of marcaine



A



B

Figure 2. Transverse section of rat rectus abdominis harvested 11 days (A) and 24 days (B) after the crushing-marcaïne injection

The patches, with a small amount of surrounding abdominal wall, were harvested respectively at 11 and 24 days from the operation. In a second group of animals, 3 days after the crushing-marcaïne operation the patch was used as a muscle autograft, and harvests were performed at 24 days from the first operation. Sections of the biopsies harvested at 11 days showed wide destruction of the muscle tissue, infiltration by inflammatory cells and wide presence of small regenerating myofibers positive to an anti-embryonic myosin monoclonal antibody (anti MHC-emb) (Fig. 2, A). On the other hand, sections of the 24 days harvests showed an almost complete reconstruction of the muscle tissue in the patch, with well packed large myofibers negative to anti MHC-emb, but distinct ATPase staining (fast and slow regenerated and reinnervated myofibers) (Fig. 2, B).

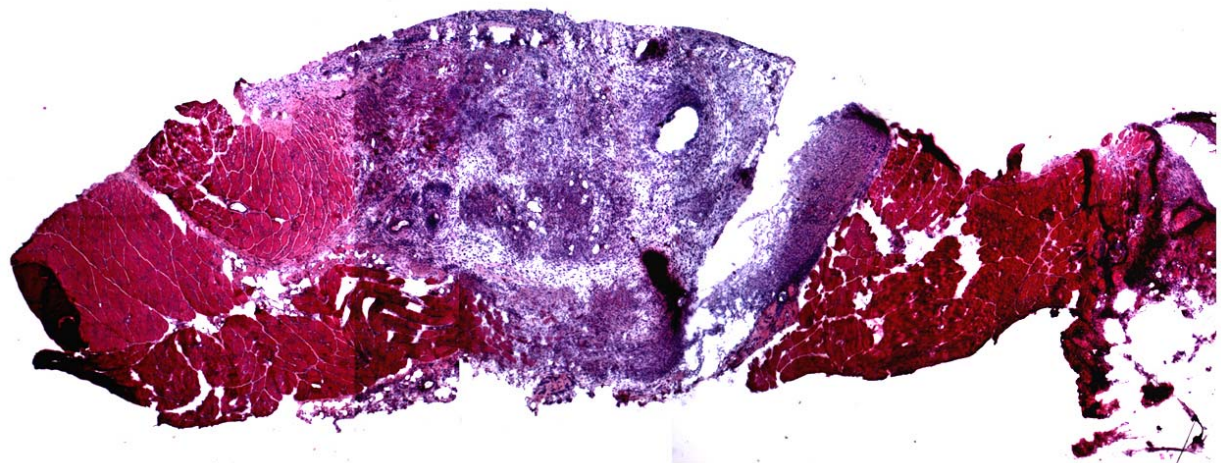


Figure 3. Transverse section of a rat rectus abdominis harvested 24 days after autografting.

The autografted muscle harvested 24 days after operation mainly showed fibrotic tissue (Fig. 3), with a small number of regenerating myofibers still positive to anti MHC-emb antibody (not shown)

The results suggest that even after a massive mechanical-myotoxic damage, conservation of the connective tissue architecture and of some continuity of the vascular network with the surrounding tissue maintains the potential of muscle tissue regeneration and reinnervation. Conversely, complete discontinuation of the vascular and nervous networks prevents regenerative events, that are confined to the muscle rim. The autografted muscle tissue disappears, substituted by a fibrous scar.

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