Alterations in neuromuscular function following thermal injury.

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Severe burn injury can result in dramatic changes in human physiology and biochemistry. Aberrant responses, hypersensitivity and potentially lethal hyperkalemia to depolarising [1,2] and hyposensitivity to non-depolarising [2,3] muscle relaxants have been noted in burn trauma. The molecular basis of these responses is currently thought to be due to an increase in nicotinic acetylcholine receptors in skeletal muscle [4,5].

Using a rat thermal injury model [4,5], we investigated the effect of three sizes of thermal injury, 20, 30 and 50% burn at 10, 14, 21 and 28 days post burn on:

1) the pharmacodynamics of d-tubocurarine in evoked twitch (tension) responses of the left gastrocnemius muscle mediated via the sciatic nerve [41

2) an alteration in receptor number reflected by changes in [125I] α-bungarotoxin binding to receptors from individual diaphragm and gastrocnemius muscles, extracted essentially as described [6] with filtration binding using the cationic polymer polyethylenimine [7].

Statistically significant decreased sensitivity to d-tubocurarine in evoked twitch responses compared to controls is not apparent in this study at the present time. This can, in part, be attributed to the size of the sample population, but it is also possible that it may reflect an alteration in the affinity state of the receptor for d-tubocurarine.

Binding of [125I]α-bungarotoxin to receptors from gastrocnemius muscle was increased in all thermally injured groups at day 14 with respect to control (p=0.05, one-way analysis of variance), after which time, receptor levels returned to near control (Fig. 1a). In contrast, binding to receptors extracted from the diaphragm was not significantly different from control values in any of the thermally injured groups at any post-burn period (Fig. 1b). This result differs from that previously noted [5] but could arise from some damage to underlying organ and tissue structures. Hypoactivity of the diaphragm was not investigated.

Results from this study are by no means conclusive. The observations in the gastrocnemius indicate an increase in acetylcholine receptors at a site distant from the area of trauma and that as the wound heals, receptor numbers return to normal. The mechanisms responsible for such changes are unknown, but alterations in affinity state and interaction of circulating mediating agents may be involved.