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## Succinylcholine Hyperkalemia after Burns

*To the Editor:*—The appropriate review, "Anesthesia for Major Thermal Injury," overstates the contraindication to succinylcholine on pages 754 ("... succinylcholine ... >24 h after burn injury is unsafe") and 755 ("... safe only within 24 h of a burn").<sup>1</sup> The safe period for burn patients is 6–7 days after a burn injury, whereas that for denervation is 4 days.

Studies beginning 6 days after burn injury demonstrated safety for 2 weeks,<sup>2</sup> whereas others detected abnormality by 9 days after burn injury.<sup>3</sup> These studies perhaps did not test enough patients within 6 days after their burn injury. However, in a study of denervation, denervation being the most severe lesion associated with hyperkalemia after succinylcholine, increases were not detected until 4 days.<sup>4</sup>

The development of additional skeletal muscle nicotinic acetylcholine receptors (upregulation) is not rapid enough to result in hyperkalemia within 24 or 48 h.<sup>5</sup> The parallel upregulatory resistance to nondepolarizing relaxants (parallel to the sensitivity of succinylcholine) develops sooner than the sensitivity of succinylcholine because it depends on receptors in the vicinity of the endplate, all of which participate in the blocking effect to acetylcholine released at the junction. This response is not detectable in dogs until 4 days of disuse atrophy.<sup>6</sup> Sensitivity to succinylcholine depends on depolarization of all acetylcholine receptors and the summated flux of potassium. Thus the exaggerated response involves receptors spread far beyond the endplate. It takes time for this response to develop, and the burn response is less rapidly achieved than that after denervation.<sup>4,5</sup>

Burn patient recovery to normal after succinylcholine administration is achieved when there is healing and weight gain, generally 2 months after the burn.<sup>2,3</sup> With recovery after stroke or cord section, the permanence of the lesion suggests that the exaggerated succinylcholine response may be prolonged; it is not likely to wane until after resistance to nondepolarizing relaxants has reverted to normal.<sup>5</sup>

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*In Reply:*—The debate as to when it is safe or unsafe to administer succinylcholine to a patient with burns has existed since the problem with hyperkalemia was first identified. There is a paucity of data derived from studies on patients, and it is always dangerous to make broad clinical recommendations based on data from animal studies.

We appreciate Dr. Gronert's letter, which challenges our conservative admonition that succinylcholine is only safe within 24 h after a burn injury. He states that succinylcholine is safe for up to 6 days after a burn injury. Dr. Gronert is an expert in muscle relaxants and his opinions must be respected.

However, experts often differ in their opinions. Perhaps that is true in this circumstance. Until more definitive information becomes avail-

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### References

1. MacLennan N, Heimbach DM, Cullen BF: Anesthesia for major thermal injury. *ANESTHESIOLOGY* 1998; 89:49–70
2. Schaner PJ, Brown RL, Kirksey TD, Gunther RC, Ritchey CR, Gronert GA, Dotin LN, Mason AD Jr: Succinylcholine-induced hyperkalemia in burned patients: I, II. *Anesth Analg* 1969; 48:764–70, 958–62
3. Viby-Mogensen J, Hanel HK, Hansen E, Graae J: Serum cholinesterase activity in burned patients: II. Anaesthesia, suxamethonium and hyperkalaemia. *Acta Anaesthesiol Scand* 1975; 19:169–79
4. John DA, Tobey RE, Homer LD, Rice CL: Onset of succinylcholine-induced hyperkalemia following denervation. *ANESTHESIOLOGY* 1976; 45:294–9
5. Martyn JAJ, White DA, Gronert GA, Jaffe RS, Ward JM: Up-and-down regulation of skeletal muscle acetylcholine receptors: Effects of neuromuscular blockers. *ANESTHESIOLOGY* 1992; 76:822–43
6. Fung DL, White DA, Gronert GA, Disbrow E: The changing pharmacodynamics of metocurine identify the onset and offset of canine gastrocnemius disuse atrophy. *ANESTHESIOLOGY* 1995; 83:134–40

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able, we will likely continue the more conservative approach in our practice.

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