

## CORRESPONDENCE

surgery more effectively than by general anesthesia alone. Once more, everything old is new again.

**Barry G. Smiler, M.D.**  
Sarasota Memorial Hospital  
1700 South Tamiami Trail  
Sarasota, Florida 34239

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*In Reply:*—We would like to thank Smiler for drawing our attention to the truly remarkable, innovative, and creative work of Dr. George Washington Crile<sup>1</sup> (1864-1943), a prolific author of 24 books and more than 400 articles.<sup>2</sup> As a surgeon in the late 19th century and early 20th century, when radical surgery was a dominant force in America, Crile pioneered the study of surgical shock, combining laboratory investigations with his surgical practice and his astute clinical observations to improve the safety of surgical procedures.<sup>2</sup> His research spanned many fields, and in developing his various theories, he incorporated research findings and concepts from anesthesiology, biology, physiology, psychology, and surgery.

The idea of anoci-association developed out of Crile's work on shock and exhaustion (fig. 1). Crile believed that both intense fear and noxious stimulation produced shock. Moreover, he assumed that the effects of shock on the central nervous system were identical whether brought about by distressing emotional events or by noxious somatic stimuli. He proposed that shock and exhaustion could be prevented, and the patient's postoperative status improved, by blocking all noxious or harmful (anoci) stimuli (associations) from reaching the brain during the surgical operation. Accordingly, Crile recommended general anesthesia to prevent traumatic emotional experiences from reaching conscious awareness and preincisional plus intraoperative local anesthetic infiltrations to prevent noxious surgical inputs from reaching the brain. Together, the administration of these agents provided for what Crile termed the shockless operation through anoci-association.

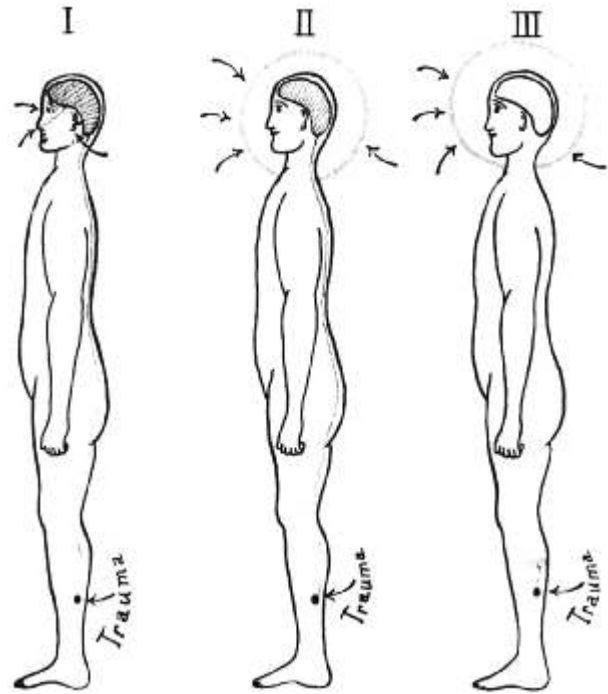
To achieve complete anoci-association, Crile advocated the use of multiple anesthetic agents and techniques before, during, and after surgery, heralding the current trends in preemptive analgesia<sup>3</sup> and multimodal, balanced analgesia.<sup>4,5</sup> In discussing the importance of complete blockade, Crile wrote "... There is no single agent that alone can produce anoci-association, which is the goal of operative surgery. We, therefore, do not advocate ether alone, nor chloroform alone, nor nitrous-oxid-oxygen alone; we do not advocate local anesthesia alone, nor morphin and scopolamin alone, nor spinal anesthesia alone, but through selection and combination of anesthetics we aim to attain the anesthesia that in the case in hand will exclude all stimuli from the brain, and thereby attain anoci-association" (page 109).<sup>1</sup>

Crile's technique for ensuring complete anoci-association included premedication with morphine plus scopolamine, general anesthesia

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**Fig. 1. Illustration of Crile's concept of anoci-association. (I) In the conscious patient, auditory, olfactory, and visual input from special sense organs, and noxious somatic impulses from peripheral nociceptors are transmitted to the brain, where they contribute to shock and exhaustion. (II) Under general anesthesia alone, noxious somatic impulses arising from trauma continue to reach the brain. (III) The shockless operation achieved by complete anoci-association. Transmission of noxious auditory, olfactory, and visual impulses are prevented from reaching the brain with use of general anesthesia, and noxious somatic impulses arising from the trauma are blocked by local anesthesia. (Reproduced from Crile and Lower.<sup>1</sup>)**

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with N<sub>2</sub>O/O<sub>2</sub> (plus ether if required), intraoperative morphine (if required), routine use of intradermal and subcutaneous procaine infiltrations before skin incision, successive procaine infiltrations of fascia, muscle, and other tissues before division, and postoperative injection of quinine and urea hydrochloride to protect the patient from nociceptive impulses arising from the wound.

Although anoci-association was developed to prevent surgical shock, Crile<sup>1</sup> did refer specifically to the benefits of anoci-association on acute postoperative pain. Moreover, there is even an indication that he believed the analgesic effect associated with anoci-association would long outlast the clinical duration of action of the analgesic agents<sup>6</sup>—a crucial feature of preemptive analgesia. In an address delivered at the Massachusetts General Hospital on the 64th anniversary of Ether Day in 1910, Crile<sup>7</sup> discussed the role of summation of repetitive noxious inputs in producing hyperalgesia, and although the example he described involved sensitization of peripheral nociceptors, the concept of summation clearly implied a central mechanism. What is most remarkable, however, is that Crile attributed the problem of painful scars to a change in central neural function and that he ascribed allodynia-like symptoms to a lowered threshold in the brain.

The lesion which produces a painful scar is in the brain, not at the site of the wound. It is explained by a fundamental principle of nerve conduction; that is, a strong traumatic or psychic stimulus produces some change in conductivity somewhere in its cerebral arc, the effect of which is to lower the threshold of that arc. . . . After the stimulus of physical trauma, . . . the arc . . . suffers a lowered threshold and hence from that time on mere trifles become adequate stimuli. Now if an operation be so performed that no strong stimulus reaches the brain, either during or after the operation, then the threshold of the cerebral arc from the wound will not be lowered. Since the threshold is not lowered, contact with the scar or any injury to that part will have little more effect than will contact with any other part of the body. Hence we see

how painful scars may be minimized or prevented by complete anoci-association" (pages 215–216).<sup>1</sup>

**Joel Katz, Ph.D.**

Department of Psychology  
The Toronto Hospital  
Toronto General Division  
200 Elizabeth Street, CW2-306  
Toronto, Ontario, Canada M5G 2C4

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