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Anesthesiology 2004; 101:1063-5

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Severing the Link between Acute and Chronic Pain

The Anesthesiologist's Role in Preventive Medicine

FROM the new "prehabilitation" movement for preventing injuries in athletes to workplace injury-reduction strategies and the precautionary security efforts against terrorist attacks that have become a national priority, the age-old adage of "prevention over cure" is clearly paramount in most facets of our lives today. In medicine, disease prevention is currently recognized as beneficial from both health and economic perspectives. As the safety of the immediate perioperative period continues to improve,¹ anesthesiologists have begun to incorporate this prevention-focused perspective into decisions that they make on the operative day. There is a growing recognition that these decisions can have consequences extending well beyond the safe conduct of patients through the perioperative period.² One long-term consequence of the pain and tissue trauma that accompanies surgical procedures may be pain that persists after tissue healing appears to be complete.³ The article by Reuben in this issue of *ANESTHESIOLOGY* reviews the development of Complex Regional Pain Syndrome (CRPS) after orthopedic surgery and perioperative interventions that may prevent the CRPS associated with such procedures.⁴

Approximately 20% of the patients who present to chronic pain clinics with the diagnosis of CRPS have a history of prior surgical procedures, primarily orthopedic, in the affected region.^{5,6} Despite the limited data and associated methodologic limitations identified by Reuben, the prevalence of CRPS after some common orthopedic procedures has been estimated. Data on the number of procedures performed annually in the United States (table 1) provide an appreciation for the number

of cases of CRPS that may follow specific types of surgery. The figures in table 1 are only examples of the 7.4 million surgical procedures performed in 1996 on the musculoskeletal system and the 643,000 performed on the cranial and peripheral nerves.⁷ Given that the incidence of CRPS⁸ is conservatively⁹ estimated to be 6.28/100,000 for a combination of CRPS I and CRPS II, the number of new cases among a U.S. population of 289 million should be 18,149 per year, of which it could be estimated that 20% (3,630) are associated with prior orthopedic surgery.^{5,6} This figure is considerably less than the estimates provided at the bottom of table 1. When these estimates are coupled with data on the economic and psychosocial costs of chronic pain states to individuals and society,^{10,11} the burden of CRPS that accompanies acute surgical procedures appears substantial.

Preventive strategies include interventions to prevent a disease from occurring—*primary prevention*—and measures aimed at early detection or prevention of recurrence and treatment of presymptomatic and symptomatic individuals with an established disease to reduce morbidity—*secondary prevention*. Successful preventive medicine strategies are often based on an understanding of the epidemiology, pathophysiology, and the population at risk. Unfortunately, our knowledge of these aspects of CRPS is deficient. Apart from the type of surgery after which CRPS may develop, it would be desirable to know if other subgroups, in addition to those with a prior history of CRPS, are at risk of developing the disease as a consequence of surgical procedures. For example, CRPS is diagnosed at a much greater frequency in women, with a female to male preponderance greater than 2:1,^{6,12} and evidence suggests that women report greater levels of pain after acute surgical procedures.¹³ Furthermore, a comparison of patients who had a single episode of CRPS *versus* those who had recurrence indicated that the primary difference was that the latter group was younger.¹⁴

This Editorial View accompanies the following article: Reuben SS: Preventing the development of complex regional pain syndrome after surgery. *ANESTHESIOLOGY* 2004; 101:1215-24.

Accepted for publication August 24, 2004. Funded in part by National Institutes of Health Grant NS-26363, Bethesda, Maryland.

Table 1. Numbers of Procedures for Specific International Disease Classification (ICD-9) Procedure Codes, Rate of Complex Regional Pain Syndrome (CRPS) for Specific Procedures, and Corresponding Numbers of Cases of CRPS Associated with Common Orthopedic Surgical Procedures

Procedure (ICD-9 Code)	N† (in thousands/yr)	Rate‡ (%)	CRPS (in thousands/yr)
Arthroscopic knee surgery (80.26)	657	2.3–4.0	15.1–26.3
Carpal tunnel surgery (04.43)	366	2.1–5.0	7.7–18.3
Ankle fractures (79.*6 and 79.*7)	257	13.6	35.0
Total knee arthroplasty (81.54)	247	0.8–13.0	2.0–32.1
Wrist fractures (79.*2 and 79.*3)	194	7.0–37.0	13.6–71.8
Fasciectomy for Dupuytren's Contracture (82.35)	20	4.5–40	0.9–8.0
Total	1741	4.3–11.0	74.3–191.5

* Refers to any number 0–9. † See reference 7. ‡ See reference 4.

Many of the commonly performed surgical procedures on extremities may be necessary in patients with preexisting CRPS, who are presumably at greater risk for recurrence or exacerbation of their disease. In patients without a prior history of CRPS, data presented by Reuben suggests that a multimodal approach may limit the development of CRPS, at least for anterior cruciate ligament reconstruction. Although it is reasonable to speculate whether the benefits of such an intervention are worth the costs and the risks, it must be recognized that the proposed multimodal approach makes good sense with respect to perioperative pain management. The question of how long to wait, if at all, before performing surgery on patients with a prior history of CRPS remains an open one.

The interventions reviewed by Reuben are built around some combination of regional anesthesia, sympathectomy, and manipulation of inflammatory mediators. The importance of the sympathectomy that accompanies brachial plexus or epidural blockade was emphasized by successful interventions with stellate ganglion blocks or intravenous sympathectomy with clonidine. Spinal blockade was not mentioned. Although it blocks noxious stimuli sufficiently for surgery to be performed and it produces a sympathectomy, the effects of a single intrathecal dose of local anesthetic may be too short-lived to be useful for preventing CRPS. The success of multimodal therapy, which combines acetaminophen, nonsteroidal antiinflammatory drugs, femoral nerve block, and intraarticular administration of local anesthetic, clonidine, and morphine sulfate for arthroscopic knee surgery, emphasizes the potential of more than a single analgesic modality for preventing CRPS. Less familiar pharmacologic tools include the free radical scavengers, particularly vitamin C, which decreased the incidence of CRPS when administered for a period of almost 2 months. The serotonin type 2 receptor antagonist ketanserin may also be an effective component of a multimodal therapy designed to prevent CRPS if administered for several days starting before surgery. One nonpharmacologic intervention that may be beneficial is physical therapy, which is most effective when acute pain is managed optimally.¹⁵ Clearly, maximal multimodal therapy requires

a concerted team approach. Importantly, most of the interventions described as beneficial for reducing CRPS also make sense for reducing acute pain.

The CRPS that can accompany orthopedic procedures is not an isolated phenomenon and is another manifestation of the long-term pain that is not an uncommon sequela of certain surgical procedures. The best known of these is the phantom and stump pain that is present in 70% of patients 1 yr after amputation of an extremity.¹⁶ Approximately 50% of patients report some type of pain 1 yr after thoracotomy¹⁷ or breast surgery.^{18,19} Some level of residual pain is reported for up to several months after the procedure in about half of patients undergoing lower abdominal surgery.^{20–22} Approximately 25% of patients report pain 1 yr after sternotomy^{19,23} or herniorrhaphy.^{19,24} What may be even more significant is the fact that even relatively low levels of residual pain appear to significantly affect social and physical function and overall perception of health.^{20,21,24} The ability to prevent the long-term residual pain that accompanies these procedures and the means of prevention continue to be controversial.²⁵ However, several studies suggest that it is possible,^{20,22,26} even if modest interventions are generally unsuccessful at limiting short-term pain and analgesic use.²⁷ By marshaling the evidence for prevention of CRPS after orthopedic procedures, Reuben continues to demonstrate that the choice of perioperative analgesic regimen may have important long-term consequences, the economic and psychosocial impacts of which have yet to be measured.

Overall, Reuben has challenged us as physicians and scientists to do better. The data he summarizes are provocative because they raise the possibility that interventions routinely used to reduce the acute pain that accompanies orthopedic surgery may also be effective at reducing CRPS, which is an all-too-frequent consequence of such surgery. As specialists whose role continues to be questioned and for whom reimbursement is often limited for procedures used to treat acute pain, anesthesiologists cannot afford to ignore the opportunities and challenges that such observations present to play a role in preventive medicine.

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