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Contemporary concepts in hernia prevention: Selected proceedings from the 2017 International Symposium on Prevention of Incisional Hernias

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ABSTRACT

Incisional hernia is a frequent complication of midline laparotomy and enterostomal creation and is associated with high morbidity, decreased quality of life, and high costs. The International Symposium on Incisional Hernia Prevention was held October 19–20, 2017, at the InterContinental Hotel in San Francisco, CA, hosted by the Department of Surgery, University of California, San Francisco. One hundred and three attendees included general and plastic surgeons from 9 countries, including principal participants for several of the seminal studies in the field. Over the course of the 2-day meeting, there were 38 oral presentations, 3 keynote lectures, and 2 panel discussions. The Symposium was a combination of new information but also a comprehensive review of the existing data so as to assess the current state of the

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field and to set the stage for future research. Further, the Symposium sought to increase awareness and thus emphasize the importance of preventing the formation of incisional and enterostomal hernias.

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Epidemiology, pathogenesis & economics of incisional hernias

Although the overall epidemiology of incisional hernias has been well delineated, the fundamental pathogenesis of this post-operative complication and how to identify patients at increased risk remain topics of active interest and research. Furthermore, the substantial economic impact of the condition, estimated to be >\$3 billion annually in the US, is garnering more attention.

A systematic review of factors affecting midline incisional hernia rates

A comprehensive review of the literature, including the largest meta-regression analysis published to date on the subject, identified several factors that independently increased the risk of midline incisional hernia. The factors included increasing age, obesity (or upper midline incision alone), abdominal aortic aneurysm surgery, previous laparotomy, and previous incisional hernia repair.¹ Notably, there was no evidence that suture type (absorbable vs nonabsorbable) affects the rate of hernia formation. The overall pooled incidence of incisional hernias of midline wounds at 2 years was 12.8% with a wide range (0%–36%).

Incisional hernias represent a failure of early wound healing

Whereas most incisional hernias are not clinically apparent for 12–18 months after abdominal surgery, compelling evidence from a few studies indicates that the hernias develop within a few weeks after surgery due to a failure of early wound healing. Normal wound healing involves an orderly sequence of well-coordinated interactions between various forms of cells in the inflammatory response and the extracellular matrix consisting of 4 phases: coagulation, inflammation, proliferation, and remodeling. Collagen deposition and maturation occurs during the proliferation and remodeling phases, respectively, with a progressive increase in the ratio of collagen type 1:type 3 signifying a more organized extracellular matrix. In most causes of deficient early wound healing, such as seen in diabetic patients, recent evidence implicates altered inflammation due to the decreased recruitment of bone-marrow-derived circulating cells.² Clinical evidence that failed early wound healing causes incisional hernias includes studies wherein metallic clips placed as markers of the opposed fascial edges were shown to have separated >1 cm within 30 days after operation in patients who went on to develop incisional hernias.³ The radiographic detection of separation of these metal clips in the early phase of wound healing after operation was both sensitive and specific for the eventual formation of an incisional hernia. A close association of fascial separation detected by computed tomography (CT) within 1 month after laparotomy with later formation of ventral hernias provided further evidence that incisional hernia formation represents a failure of early wound healing.⁴ The forces on the abdominal wall are greater than the sum of the strength of biologic healing and the physical construct of the repair, leading frequently to failure at the suture-tissue interface with suture pull-through. Therefore, the prevention of incisional hernias should target methods that support the early inflammatory phase of wound healing.

Economic perspectives on incisional hernia prevention

Hernia prevention can come in many forms, including decreased infection, less open surgery, patient “prehabilitation,” optimal suture technique, and mesh-reinforced closures. Prehabilitation relevant to preventing incisional hernias would include steps taken to optimize a patient’s wound healing, including control of diabetes, smoking cessation, weight loss, and good overall nutritional status. Several key stakeholders have been identified, including patients, hospitals, payers, industry, and providers. Analysis of the nationwide inpatient sample demonstrates that approximately 1.9 million patients underwent open surgery in 2013, and this population exhibited a relevant and substantial comorbidity burden as evidenced by the high prevalence of obesity, pulmonary disease, and diabetes. Based on a simple calculation, approximately 600,000 patients per year undergoing open surgery are at a markedly increased risk for developing an incisional hernia. Recent work has demonstrated the cost utility of the mesh-reinforced closure, establishing that adding mesh to abdominal wound closure to prevent hernia could add benefit to society and decrease overall costs.⁵ This work has also been validated as it relates to the payers’ perspective. From the hospitals’ perspective, strong consideration is paid toward the cost of an effective preventative technique and its impact on Medicare Severity Diagnosis Related Group payments. Currently, there is a category III CPT code (0437T) available for use, with current efforts under way to convert this research code to a reimbursable, category I code in the near future.

Suture closure of the abdomen

Nonclinical data published in 2001⁶ heralded the increased bursting strength of an abdominal incision when small (3–6 mm) bites of the fascia were taken as compared to 1-cm bites. Over 15 years later, the body of clinical data demonstrating a decrease in rate of incisional hernia formation when laparotomies are closed using the small bites technique continues to grow. Yet, widespread adoption remains a challenge. In addition, other suturing methods and suture types are under investigation.

Small bites versus large bites: The STITCH Trial

In 1993, Israelsson and Jonsson published a landmark, prospective clinical study introducing the importance of a suture length to wound length ratio of >4 in preventing incisional hernias after midline laparotomy.⁷ Subsequent studies have corroborated this seminal observation. Most recently, a prospective, multicenter, double-blind, randomized controlled trial (RCT) was conducted in surgical and gynecologic departments in 10 hospitals located throughout the Netherlands comparing the traditional, large bites suture technique with the small bites technique for fascial closure of midline laparotomy incisions.⁸ Adult patients were equally assigned to closure of the incision using large bites (1-cm bites every 1 cm) versus small bites (5-mm bites every 5 mm). The primary outcome was the occurrence of incisional hernia; the hypothesis was that the incidence would be less in the small bites group. Over approximately 29 months, 560 patients were randomized to the large bites group ($n=284$) or the small bites group ($n=276$). Patients in the small bites group had fascial closures sutured with

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