

# Does the Size of the Stitch Length Affect Surgical Site Infection?

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The term *evidence-based medicine* was first coined by Sackett and colleagues<sup>1</sup> as “the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients.” The key to practicing evidence-based medicine is applying the best current knowledge to decisions in individual patients. Medical knowledge is continually and rapidly expanding, and it is impossible for an individual clinician to read all the medical literature. For clinicians to practice evidence-based medicine, they must have the skills to read and interpret the medical literature so that they can determine the validity, reliability, credibility, and utility of individual articles. These skills are known as critical appraisal skills. Generally, critical appraisal requires that the clinician have some knowledge of biostatistics, clinical epidemiology, decision analysis, and economics as well as clinical knowledge.

The Canadian Association of General Surgeons (CAGS) and the American College of Surgeons (ACS) jointly sponsor a program titled “Evidence-Based Reviews in Surgery” (EBRS), supported by an educational grant from Ethicon Inc and Ethicon Endo Surgery Inc. The primary objective of this initiative is to help practicing surgeons improve their critical appraisal skills. During the academic year, 8 clinical articles are chosen for review and discussion. They are selected not only for their clinical relevance to general surgeons, but also because they cover a spectrum of issues important to surgeons; for example, causation or risk factors for disease, natural

history or prognosis of disease, how to quantify disease (measurement issues), diagnostic tests and the diagnosis of disease, and the effectiveness of treatment. Both methodologic and clinical reviews of the article are performed by experts in the relevant areas and posted on the EBRS Website. A listserv discussion is held where participants can discuss the monthly article. Fellows and candidates of the College can access Evidence-Based Reviews in Surgery through the American College of Surgeons website ([www.facs.org](http://www.facs.org)). All journal articles and reviews are available electronically through the Website. Currently we have a library of 50 articles and reviews, which can be accessed at any time. Each October, a new set of articles will be available each month until May. Surgeons who participate in the current (modules) packages can receive CME credits by completing a series of multiple choice questions. Additional information about EBRS is on the ACS Website or by email to the administrator, Marg McKenzie at [mmckenzie@mtsinai.on.ca](mailto:mmckenzie@mtsinai.on.ca).

In addition to making the reviews available through the ACS and CAGS Websites, 4 of the reviews are published in condensed versions in the *Canadian Journal of Surgery*, 4 in the *Journal of the American College of Surgeons*, and 4 in *Diseases of Colon and Rectum* each year.

## REFERENCE

1. Evidence-Based Medicine Working Group. Evidence-based medicine. *JAMA* 1992;268:2420–2425.

## SELECTED ARTICLE

### Effect of stitch length on wound complications after closure of midline incisions: a randomized controlled trial

Millbourn D, Cengiz Y, Israelsson LA. *Arch Surg* 2009;144:1056–1059.

**Question:** Does the size of the stitch length affect surgical site infection and incisional hernia in closed midline incisions?

**Design:** Randomized controlled trial.

**Settings:** Department of Surgery, Sundsvall Hospital, Sweden.

**Patients:** Seven hundred thirty-seven patients who had an elective or emergent operation through a midline incision.

**Allocation:** Pseudorandomization.

**Intervention:** Wound closure with a short stitch length (ie, placing stitches 5 to 8 mm from the wound edge using 2-0 suture) or a long stitch length (ie, placing stitches more than 10 mm from the wound edge using 1-0 suture).

**Main Outcomes Measures:** Wound dehiscence, surgical site infection (SSI), and incisional hernia.

**Results:** Surgical site infection occurred in 35 of 343 patients (10.2%) in the long stitch group and in 17 of 326 (5.2%) in the short stitch group ( $p = 0.02$ ). Incisional hernia was present in 49 of 272 patients (18.0%) in the long stitch group and in 14 of 250 (5.6%) in the short stitch group ( $p < 0.001$ ). One patient whose wound was closed with a long stitch had a wound dehiscence.

**Conclusions:** In midline incisions closed with a running suture and having a suture length-to-wound length ratio of at least 4, current recommendations of placing stitches at least 10 mm from the wound edge should be changed to avoid the patient suffering wound complications.

**Commentary:** Midline incisions are used for access to the abdominal cavity in the majority of open operations. Complications such as infection, dehiscence, and hernia formation, are significant causes of morbidity to the patient and represent a significant burden on the health care system. Clearly, optimizing care, with resultant reduction in abdominal wall complications, would be of great benefit to the patient and to society. Most surgeons today have been taught and currently perform a running suture closure with suture bites at least 1 cm from the midline fascial edge that encompass peritoneum, fascial layers, and muscle, and are placed about 1 cm apart, even though this dogma is based on marginal science.<sup>1-3</sup> The study by Millbourn and colleagues<sup>4</sup> challenged this dogma and suggested that we should be closing with bites that are only 5 to 8 mm from the fascial edge. The proposed rationale for this is that with smaller amounts of tissue in the closure, there is less ischemia and trauma to the rectus muscle, therefore leading to a lower rate of wound infection and hernia formation.

The objective of this randomized controlled trial was to compare outcomes after closure of midline laparotomy incisions using short or long stitches (small or large bites of tissue). Patients undergoing their first midline laparotomy were randomized to have either running abdominal wall closure with mass closure stitches that exceeded

10 mm from the wound edge or bites of 5 to 8 mm that only incorporated the aponeurosis (ie, linea alba fascia). One additional difference between study groups was in the size of the suture used to close the midline fascia: in the long stitch group, #1 PDS was used while 2-0 PDS was used in the short stitch group. Surgical site infection (SSI), wound dehiscence, and incisional hernia were the primary outcomes; SSI and wound dehiscence were recorded 4 weeks after surgery and wound dehiscence was defined as a complete wound disruption that needed emergent reoperation. Surgical site infection was defined according to CDC criteria.<sup>5</sup> At 12-month follow-up, the wound was examined and an incisional hernia was defined as any palpable defect in the aponeurosis or protrusion beyond the level of the aponeurosis. All assessments were made by the principal investigator. Both he and the patients were blinded to the treatment allocation.

Seven hundred thirty-seven patients were randomized to 1 of 2 groups: short stitch (356) or long stitch (381). The 2 groups were similar with respect to age, sex, body mass index, and degree of wound contamination. Compared with the long stitch group, the short stitch group had a significantly lower rate of SSI (10.2% vs 5.2%, respectively) and incisional hernias (18.0% vs 5.6%, respectively). There was no significant difference in the wound dehiscence rate. Interestingly, although SSI overall was significantly reduced in the short stitch group compared with the long stitch group, this was mostly due to differences in deep SSI. This might be expected because deep SSI would be more likely to result from muscle/fascial ischemia/necrosis. Multivariate analysis showed that wound contamination, diabetes, and long stitch length predicted SSI, while male sex, high body mass index, longer operating room time, SSI, long stitch length, and SL/WL (suture length to wound length) ratio  $< 4$  independently predicted incisional hernias. The authors concluded that “in midline incisions closed with a running suture and having a suture length to wound length ratio of at least 4, current recommendations of placing stitches at least 10 mm from the wound edge should be changed to avoid patient suffering and costly wound complications.”

The authors should be congratulated on performing a trial to assess a fundamental intervention that is performed frequently and significantly affects the recovery of the surgical patient. Although the quality of the trial was good overall, there are a few methodologic concerns. First, the patients were not actually randomized to the 2 groups. Instead, “pseudorandomization” was used to allocate subjects to the 2 groups; that is, subjects were allocated to the long stitch or short stitch closure depending on the week they had surgery. So, in week 1, all subjects had a short stitch closure; week 2 subjects had long stitch closure, and

so forth. This method of allocation was used frequently in the past, but current trial methodology is more sophisticated and this allocation method is considered to be a major methodologic flaw in most scoring systems (such as the Jadad system<sup>6</sup>) for assessing the quality of clinical trials.

The major problem with this method is that randomization is not concealed. So the surgeons would know that on week “x,” short stitch would be used and on week “y” long stitch would be used. By not being blinded and knowing what treatment the patient would receive, the surgeon could decide whether or not he/she wanted the patient entered into the trial. For example, if a surgeon thought that long stitch would be better in obese patients; he/she might not enter the patient into the trial on “short stitch” weeks. This would mean that the 2 groups might be biased. Second, even if there was no intent to bias the groups, this could have occurred if certain types of cases or patients were included one week and not on the other or different surgeons operated on alternate weeks.

In this particular trial, it may not have been a major problem. The authors stated that there were 750 eligible patients and only 13 did not fit the protocol, suggesting that very few patients were not entered into the trial. Also, the 2 groups seemed to be similar.

The other problem for the reader is that the investigators reported only a paucity of information, which might have had a significant impact on outcome. For instance, stitch length, stitch interval, and SL/WL ratio are presented, but there are no details on how these were measured, who measured them, etc. These are issues of compliance with the intervention and should be provided in a study comparing surgical interventions. More details about the patients would also have been useful so the reader could be certain that the groups were similar and could also assess the generalizability of the results. For instance, the indications for surgery, types of procedures performed, proportion of patients having emergency or elective operations, proportion of patients having other comorbidities, and medication (such as immunosuppressive agents and steroids) might affect wound healing, but these data were not reported. Finally, there are a number of practices that have been shown to decrease the SSI rate, and information on the proportion of patients who received appropriate and timely antibiotics and thermoregulation were not reported.

Despite these concerns, the results of this study should challenge surgeons to rethink the best suture techniques to close the midline fascia. Simple technical maneuvers that may decrease infection, dehiscence, and hernia would be of great benefit to our patients because are all important adverse outcomes. Additional randomized controlled trials may be necessary to see if the results can be

replicated, but it would be wrong if we simply disregarded the results of this study.

With regard to the generalizability of these results, it is important to remember that this trial included patients having “first-time” midline laparotomies. It did not include patients having reoperations or hernia repair closures. In addition, the patients didn’t exactly fit a North American profile; they were a little too thin and had a low rate of diabetes mellitus. However, a recent report from the same group<sup>7</sup> showed the same benefits of the short stitch in obese and in diabetic patients. Together, these 2 articles are quite compelling in terms of suggesting an optimal approach to fascial closure.

Additional trials are required before this technique is adopted to repair ventral hernias because the quality of the midline fascia is variable, often quite poor, and may be difficult to differentiate from the hernia sac. Similarly, further studies are required before this technique is adopted in trauma patients, especially those managed temporarily with an open abdomen, have diffuse intra-abdominal infection, or have significant immunosuppression.

Finally, it is important to keep in mind that optimal outcomes in abdominal surgery require adherence to a number of best practices in addition to the technique of suture closure including:

- appropriate and timely antimicrobial prophylaxis,
- intraoperative normothermia,
- adequate muscle paralysis during fascial closure to achieve adequate tissue approximation,
- minimization of potential (dead) space in the subcutaneous tissues of the incision when possible, to limit any seroma fluid that may become infected,
- careful handling of tissues and minimization of the amount of tissue subject to cautery burn, to minimize necrotic tissue,
- meticulous hemostasis, debridement of nonviable tissue, and avoidance of foreign material,
- consideration of a staged skin closure in heavily contaminated wounds.

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