Closure of laparotomy wounds: skin staples versus sutures

To investigate the routine use of a skin stapling device for the closure of midline abdominal wounds, 48 patients were randomized to receive skin staples or subcuticular polydioxanone sutures. The mean (range) time for closure with staples was 8.0 (3.4-14.8) s cm⁻¹ while subcuticular closure took 12.7 (9.6-28.0) s cm⁻¹. The mean time saved per patient with skin staples was 77 s. Wound pain and requirements for analgesia were significantly lower in the sutured group. The mean cost per patient was £1.41 for subcuticular closure and £7.72 for stapling; the latter also incurred an additional cost of £6.27 for staple removal. No clear benefit derives from the use of staples in the closure of abdominal wounds.

Results

Twenty-two patients received stapled skin closure and 26 subcuticular PDS. No significant difference existed between the two groups for age, sex, body mass index, length of wound, or duration of type of operation (Table 1).

Wound closure

The groups were evenly matched for wound length (z = 0.11, P > 0.9). The mean closure time for the stapled group was 147 s; it was 224 s for those receiving PDS sutures. A mean of 25 (range 13-46) staples were needed to close each wound with up to 15 (mean 6) being wasted in each case.

The rate of wound closure was calculated for each patient from the wound length and the total closure time. For the stapled group the mean (range) rate was 8.0 (3.4-14.8) s cm⁻¹ and in the subcuticular group 12.7 (9.6-28.0) s cm⁻¹. Four stapled wounds required two staplers; the closure rate for these patients was between 8.3 and 9.6 s cm⁻¹. The difference in closure rate between the two groups was highly significant (z = 3.75, P < 0.0001).

Postoperative pain and wounds

For those patients in whom PDS was used the median pain score was 16 mm. Patients whose wounds were closed with staples had a median score of 28 mm. The difference in postoperative discomfort measured at 5 days (Table 2) was significant (z = 2.22, P = 0.03). The group receiving PDS closure needed significantly less opiate and non-opiate analgesia than those undergoing stapling (Table 2).

One wound infection with the discharge of pus occurred in each group. Objective assessment of the wounds at 1 month revealed no significant difference in assessment by the independent observer or patient (Table 2). No late hypertrophic reaction has been observed after 1 year in either group.

Table 1 Comparison of patient groups

<table>
<thead>
<tr>
<th></th>
<th>Staples (n=22)</th>
<th>Polydioxanone (n=26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)*</td>
<td>66 (38-89)</td>
<td>64 (27-80)</td>
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<tr>
<td>Sex ratio (M:F)</td>
<td>10:12</td>
<td>12:14</td>
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<tr>
<td>Body mass index (kg m⁻²)*</td>
<td>52 (37.3-70.6)</td>
<td>50.9 (41.2-78.6)</td>
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<tr>
<td>Wound length (cm)*</td>
<td>18.4 (13-27)</td>
<td>18.5 (10-28)</td>
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<tr>
<td>Operation time (min)*</td>
<td>88 (12-210)</td>
<td>91 (20-190)</td>
</tr>
<tr>
<td>Operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper abdomen</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Lower abdomen</td>
<td>12</td>
<td>16</td>
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</tbody>
</table>

* Values are mean (range). Differences between groups were not significant.

Any method of skin closure should provide adequate approximation of the tissues to allow wound healing with minimal risk of infection and should produce an acceptable cosmetic result. The method should be simple and quick to use, and should be economical.

Automatic skin staplers were first introduced in 1972 as a development from early Russian tissue-stapling devices. They are said to save considerable amounts of operating time. This has led to a steady growth in use of such staplers, their sizeable cost being justified by the resources saved.

Subcuticular skin closure is an acceptable method for skin approximation in most types of surgery and can be quickly performed. Clinical experience has suggested that time saving using staples is not significant and their use associated with more discomfort.

A prospective randomized trial was therefore undertaken to compare continuous subcuticular sutures with stapled skin closure.

Patients and methods

A total of 48 patients (22 men, 26 women; age 27-89 (mean 65) years) undergoing laparotomy through a midline incision were randomized to skin closure using an automatic skin stapling device (Weck, Swindon, UK) or continuous subcuticular undyed 3/0 polydioxanone (PDS; Ethicon, Edinburgh, UK). All wounds were made and closed by a single operator with more than 1 year’s experience of both methods. O PDS was used for abdominal wall approximation using a standard mass closure technique. No fat stitch was used and all wounds were treated with dry povidone-iodine spray before skin closure. For stapled wounds the size of the stapler was chosen by the scrub nurse using judgement on the number of staples required to close the wound.

The time taken for skin approximation was measured by an independent observer from the time that the closure device was picked up to the time at which the wound was closed and the device put down. If a further stapler was required to complete wound closure, the additional time taken was included.

No knots were used for the subcuticular suture, the stitch being passed back and forth beneath the skin twice before and after wound suturing. The ends of the suture were trimmed flush with the skin after the wound had been cleaned and dried, the material being left to be absorbed. Both types of wound were covered with self-adhesive dressings.

The 100-mm visual analogue pain scale has been shown to give an accurate measure of pain that is both reliable and reproducible. For each patient at 5 days after operation, or at hospital discharge if sooner, a standard 100-mm analogue pain scale test was performed to assess discomfort from the wound. All patients received continuous intravenous infusion of opiate for the first 48h after surgery. The total number of additional opiate and non-opiate analgesic doses was recorded for the first 10 days (removal of clips). On the fifth day the lengths of the wounds were measured. At 1 month after surgery an experienced observer, unaware of the closure technique, graded wounds on a five-point scale for appearance. The patient’s opinion was also determined by the observer using the same scale.

Statistical analysis was carried out using the Mann-Whitney U test.
The mean estimated cost was £6.27 per patient.

**Discussion**

Subcuticular wound closure provides good skin approximation, with rates of infection no higher than those reported for interrupted sutures, even in contaminated wounds. PDS elicits a minimal tissue reaction, has a predictable reabsorption pattern, and, when used as a subcuticular closure material, is associated with a low rate of wound infection.

Skin staples are associated with low wound infection rates that are better than those of conventional percutaneous sutures. They are reported to save operating time, especially when compared with interrupted sutures, showing savings of up to 5 min 20 s per laparotomy wound. Smaller time savings occur when staples are compared with subcuticular closure. This study confirms these findings, although the mean saving with staples of only 77 s per wound is the smallest reported. The chance of including another case on the list because of time saved is unrealistic with such small differences, while the use of automatic skin staplers in moderate-sized wounds on the basis of time savings alone is hard to support.

Stapled wound closure costs £12.58 more per wound than closure by PDS. At the rate of stapler usage described, the 2504 staplers employed by East Dorset Health District during the year of the study would have been used to close 2053 wounds (18% per cent of wounds required more than one stapler). This represents an additional annual cost above subcuticular skin closure with PDS of over £25,000.

If stapled closure is associated with fewer wound complications than subcuticular PDS then an additional cost may justify other savings. No evidence for this effect exists.

No account has been taken within the calculations of the additional cost incurred from the higher analgesia requirements for patients with stapled wounds. The total number of analgesia doses required by a patient is a less effective means of comparison but in this study provided a guide to the additional resources required by the stapled group of patients. The finding of increased wound pain and analgesia requirements in this group is at variance with results of other workers. In these reports, however, the staples were compared with conventional interrupted sutures, which may explain the different findings.

Other types of skin stapler with different staple configurations may evoke less postoperative pain. No comparative study has addressed this issue.

Subcuticular PDS has been shown to give a better cosmetic result within the first 6 months than simple sutures or skin staples. Conventionally closed wounds are stronger than those closed with staples at 21 days, and are under less tension. In the context of skin flap procedures a much greater proportion of flap necrosis has been found with staples. The comparison of wound appearance in this study has not shown an early advantage over subcuticular closure. This study demonstrates no significant advantage in the use of staples over subcuticular PDS in the closure of midline laparotomy wounds.

**References**