

PAPERS AND ORIGINALS

Abdominal wound healing: a prospective clinical study

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British Medical Journal, 1977, 2, 351-352**Summary**

The incidence of wound dehiscence and incisional hernia after two methods of abdominal wound closure (layered closure with retention sutures and single-layer "mass closure") was studied in a randomised prospective clinical trial in a consecutive series of 200 patients. Dehiscence occurred in 1% of patients and herniation in 4.7%; the incidence of these complications was similar with both methods of closure. Seven of the 11 cases of dehiscence or herniation occurred in infected wounds, and wound infection was associated with a tenfold increase in the incidence of these complications.

The prevention of wound infection would reduce substantially the incidence of dehiscence and herniation in abdominal wounds.

Introduction

Recent reports have suggested that the use of certain techniques of abdominal wound closure may largely prevent the problems of postoperative wound dehiscence and incisional hernia.¹⁻³ The precise merits of these techniques are, however, difficult to assess since they have not been examined in prospective controlled trials, and some reports are based on the use of these methods by trained senior surgeons.³⁻⁴ The practical value of any method of abdominal wound closure can be judged only when it is used in unselected patients by all surgeons who close abdominal wounds, irrespective of their degree of training.

We report here the results of a controlled clinical trial of two currently recommended methods of abdominal wound closure.¹

Patients and methods

The two methods of wound closure were randomly allocated in a consecutive series of 200 patients undergoing exploratory laparotomy through vertical median or paramedian wounds in the professorial surgical unit at Sheffield Royal Infirmary. All the senior and junior members of the surgical team (two consultants and three registrars) participated in the trial. In method 1 (100 patients) a layered closure with non-absorbable monofilament suture material was performed using two layers of continuous 3 metric gauge polypropylene (Prolene, Ethicon Ltd) supported by interrupted braided polyester retention sutures (Ethiflex, Ethicon Ltd) inserted through all layers of the abdominal wall. In method 2 (100 patients) a single-layer "mass closure" was performed using interrupted figure-of-eight sutures of 3 metric gauge monofilament stainless steel wire inserted through all layers of the abdominal wall except skin. The wire sutures were knotted, and the cut ends were carefully buried beneath the abdominal fascia. In both methods the skin was closed with interrupted silk sutures.

The wound closure techniques were randomly allocated by drawing a trial card at the end of the abdominal procedure, and the method of randomisation took account of the type of surgery performed to ensure that the closure techniques were compared in similar groups of patients.⁵

The incidences of wound disruption, wound infection, sinus formation, and incisional hernia were recorded and the patients were followed up for six months after surgery.

The χ^2 test (with Yates's correction) was used in the statistical analysis of the results.

Results

Cases excluded from study—Nine patients (five who had method 1 closures and four who had method 2 closures) were excluded from the study: six died before a reasonable assessment of wound healing could be made, and three required a further laparotomy soon after operation.

Comparison of two groups—The groups of patients treated by the two wound closure methods were well matched for age and sex, the type of surgery performed, the incidence of palliative and emergency operations, the types of wounds, and the surgeons closing the wounds (see table).

Wound dehiscence and incisional hernia—One case of wound dehiscence occurred after each method of closure. With method 1 dehiscence occurred in a grossly infected wound after an emergency sigmoid resection for perforated diverticulitis. The wound completely separated to expose the small intestine, and the patient

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Type of surgery, type of wounds, and type of surgeons closing the wound in both groups of patients. Results are numbers of patients

	No of patients	Type of surgery				Emergency operations	Palliative operations	Wounds		Surgeon closing wound	
		Biliary	Peptic ulcer	Intestinal	Other			Median	Paramedian	Consultant	Registrar
Method 1	95	26	29	24	16	12	41	54	38	57	
Method 2	96	34	24	20	14	10	39	57	42	54	

subsequently died. With method 2 dehiscence occurred in one patient on the seventh day after an emergency laparotomy for a tubo-ovarian abscess. The wound was resutured and the patient recovered uneventfully. Four incisional hernias occurred after method 1 closure and five after method 2 closure. An incisional hernia was recorded when a palpable defect in the abdominal fascia was detected during voluntary straining of the abdominal muscles. The total incidence of failed wound healing (dehiscence plus hernia) after the two methods of closure was not significantly different (5.3% after method 1 and 6.3% after method 2).

Wound infection—Wound infection was diagnosed only when pus discharged from the wound. Infection occurred in 15 patients treated by method 1 (15.8%) and 13 treated by method 2 (13.5%). One persistent sinus occurred with method 1, which resulted in further surgery and removal of the polypropylene suture material.

Variables affecting wound healing—Wound dehiscence and herniation were not significantly related to the type of surgery performed, emergency operations, the type of wound (median or paramedian), or the surgeon performing the wound closure. Wound infection, however, seemed to be a highly significant factor in the pathogenesis of these complications. Dehiscence or herniation occurred in four (2.5%) out of 163 clean wounds and in seven (25%) out of 28 infected wounds ($\chi^2 = 18.43$; $P < 0.001$). Various other factors such as obesity, uraemia, jaundice, and malignant disease may affect abdominal wound healing.^{6,7} There were too few cases of dehiscence and herniation in this study to permit a statistical evaluation of these factors, but incisional hernias and wound infections were encountered rather more often in obese patients and in patients with malignant disease. Eight jaundiced patients were included in the study and one developed an incisional hernia.

Discussion

The two methods of wound closure examined in this trial were selected on the basis of highly favourable reports of their use in earlier studies. Only one case of dehiscence was reported among 1129 vertical laparotomy wounds that had been closed with non-absorbable sutures and retention sutures,⁴ and very few or no disruptions have been reported in a total of several thousand abdominal wound closures using wire, nylon, or polypropylene sutures and a single-layer mass closure technique.^{2,3,8-10} None of these studies was, however, conducted as a controlled clinical trial, and the precise significance of these reports has remained uncertain. Some reports have been limited to studies of the wound closure techniques in the hands of selected surgeons or selected patients,^{3,4,10} and the criteria used

to determine the incidence of postoperative wound dehiscence or herniation have seldom been clearly defined.

In our study the two closure techniques were compared in a randomised prospective clinical trial in 200 consecutive cases. The trial included emergency and elective operations, and all the surgeons working in one general surgical unit of a busy NHS teaching hospital took part. The overall incidence of wound dehiscence was 1.0%, and incisional hernias occurred in 4.7% of cases. Similar results were obtained with the mass closure technique and with the layered closure supported by retention sutures.

Complete prevention of abdominal wound dehiscence and incisional hernia may be an unattainable goal, but our findings have suggested that the incidence of these complications would be reduced by preventing abdominal wound sepsis. Seven of the 11 cases of dehiscence and herniation in this study occurred in infected wounds, and wound infection was associated with a tenfold increase in the incidence of these complications. The incidence of postoperative abdominal wound infection may be significantly reduced by the prophylactic use of topical or systemic antimicrobial agents,¹¹⁻¹⁴ and we would suggest that future studies of abdominal wound healing should include a careful evaluation of the techniques that have been recommended for the prophylaxis of wound infection.

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