Abdominal incisions—vertical or transverse?

HAROLD ELLIS
D.M., M.Ch., F.R.C.S.

PHILIP D. COLERIDGE-SMITH
F.R.C.S.

ADRIAN D. JOYCE
F.R.C.S.

Surgical Unit, Westminster Hospital, London SW1

Summary

Two-hundred and nine patients were entered into a prospective, randomized trial in order to determine whether a vertical or transverse abdominal incision is the more satisfactory in producing sound wounds. Ninety-six patients were randomized between paramedian and transverse incisions, and followed up for at least 1 year. No significant difference in the incidence of wound failure could be shown between 46 paramedian and 50 transverse incisions. Those patients who were considered to require a vertical incision were randomized between median and paramedian incisions. No significant difference in wound failure rates between 39 median and 40 paramedian incisions could be demonstrated. No advantage or disadvantage of a transverse over a vertical abdominal incision or of a paramedian over a median incision could be shown in this study.

KEY WORDS: wound healing, laparotomy, surgical wound dehiscence, surgical wound infection, abdominal wall.

Introduction

Many factors influence the surgeon's choice when making an abdominal incision. Some will be overriding, such as inadequate access through alternative incisions, or previous surgery which makes it illogical to open the abdomen via an entirely separate incision.

However, there are many occasions when either a vertical or transverse incision would be appropriate and only personal preference or convention selects the route of final choice. There have been few prospective, randomized trials objectively comparing the healing and complications of these options.

In this study we have set out to determine whether, in the absence of other indications, horizontal or vertical incisions are the most satisfactory with regard to healing. In addition we have assessed the complication rates associated with median and paramedian

incisions in those patients for whom a vertical incision was considered mandatory.

Patients and methods

In 1981 all patients admitted under the care of the Professorial Surgical Unit at the Westminster Hospital for laparotomy were entered into the trial.

Patients whose surgery could be performed through either a vertical or transverse incision and in whom neither type of incision was contra-indicated by previous surgery, were allocated to Group A. These patients were randomly allocated to either a transverse or paramedian incision.

The remaining patients, all of whom were considered to need a vertical incision, formed Group B and were randomly allocated to a median or paramedian incision.

All incisions were closed by a standard technique with monofilament loop nylon (gauge No. 1), on a 5/8 circle curved hand needle.

A 'mass closure' technique was used, as described previously (Bucknall and Ellis, 1981) taking all layers of the abdominal wall, excluding skin and subcutaneous fat, in one layer. The skin was closed with interrupted 2/0 nylon sutures.

Deep tension sutures were not employed and all drains were brought out through separate stab incisions.

Patients undergoing large bowel surgery received a standard preparation regime. For 5 days before surgery they were given oral fluids only. Magnesium sulphate 10 ml 2-hourly was given on the third day, until diarrhoea was produced. Neomycin 500 mg qds and metronidazole 400 mg tds were given orally on the last 2 days. On the day of surgery a rectal washout was given, and gentamicin 80 mg intramuscularly and metronidazole 1 g rectally administered with the premedication 1 hr before operation. These antibiotics were continued for 48 hr post-operatively. Sys-

temic prophylactic antibiotics were not given for routine non-infected procedures.

Data relating to the patient, including age, weight, situation and type of incision, pre- and post-operative complications, wound bacteriology if appropriate and the status of the surgeon performing the operation, were entered on standardized forms. The patients were re-examined at 1, 3, 6 and 12 months following operation and the presence of any infection, discharging sinus or wound herniation noted.

Wound sepsis was defined as the discharge of pus and incisional hernia as a palpable defect, no matter how small, after contraction of the anterior abdominal wall muscles. Data was recorded on a CBM PET 2000 series microcomputer using a floppy disc storage system. Various programmes enabled patients' follow-up information to be displayed, additional data to be entered and the results analyzed. Statistical analysis was performed using Fisher's exact test of χ^2 , whichever was the more appropriate.

Results

The total number of patients entered was 209, of whom 34 died during the first year following operation, leaving 175 available for analysis. The age distribution is shown in Fig. 1. This high incidence of post-operative mortality is explained by the fact that many of the laparotomies were 'second-look' procedures for recurrent carcinoma, and not unexpectedly several of these patients succumbed to their disease within the first year. The operative procedures were divided as follows: biliary/pancreatic (43%), intestinal/colonic (26%), oesophageal/gastric/duodenal (15%). The remainder were divided between various urological and vascular procedures. Overall 27% of patients were operated on for malignant disease.

There were 96 patients in Group A (paramedian/transverse) of whom 8/46 (17%) in the paramedian group and 7/50 (14%) in the transverse group developed hernias (Table 1). This difference was not statistically significant.

TABLE 1. Incidence of wound failure in Group A

	Paramedian	Transverse
Intact	38	43
Hernia	8*	7*
Total	46	50

*Not significant— χ^2 test.

In Group B 9/39 (23%) median incisions and 7/40 (18%) paramedian incisions developed hernias (Table 2), again the difference was not statistically significant.

TABLE 2. Incidence of wound failure in Group B

	Midline	Paramedian
Intact	30	33
Hernia	9*	7*
Total	39	40

*Not significant— χ^2 test.

There was one total wound disruption of a paramedian incision in Group A, which was resutured but subsequently developed an incisional hernia. No other total bursts occurred.

The overall wound infection rate was 17.7% of which coliforms accounted for over 65%, the remainder being Gram-positive or anaerobic organisms. As in previous studies from this unit, a strong association between wound infection, either in the early post-operative phase or as a persistent sinus, and failure of wound healing has been found; 20/31 (65%) wounds which subsequently developed a hernia had suffered a post-operative wound infection, compared with 37/143 (26%) of intact wounds (Table 3, $P < 0.05$, χ^2 test). Taking all patients into consideration 22/30 (73%) wounds which developed a sinus had been infected compared with 33/145 (23%) non-infected wounds ($P < 0.01$, χ^2).

TABLE 3. A comparison of the incidence of wound sepsis

	Group A	Group B	Total
Intact	20/80 (25%)	17/63 (27%)	37/143 (26%)*
Hernia	9/15 (60%)	11/16 (68%)	20/31 (65%)*

* $P < 0.01$, χ^2 test.

One-hundred and twenty-nine patients had upper abdominal incisions, 39 lower and seven full length. Twelve per cent of the upper abdominal incisions and 10% of the lower, developed incisional hernias. There was no statistically significant difference between these groups. Only one patient in the full length group developed a hernia.

In those patients who had had previous abdominal incisions re-opened 6/26 (23%) developed incisional hernias. This was not significantly different from the overall rate of wound herniation in the remaining patients. The re-incisions were divided equally between median and paramedian: 13 in each group. Four median and two paramedian incisions developed hernias, a non-significant difference ($P = 0.64$, Fisher's exact test).

There was no correlation between status of the surgeon performing the operation and incidence of incisional hernia, neither was there any correlation between wound failure and advancing age.

FIG. 1. Age and sex distribution of all patients. (■) males; (▨) females

Discussion

Previous authors have demonstrated theoretical advantages of transverse over vertical laparotomy incisions. Tera and Aberg (1976) have shown that in the cadaveric abdominal wall transverse incisions have 40–60% greater strength than vertical incisions. Leaper (1983), examining the radiological vasculature of the abdominal wall, has demonstrated that there may be an advantage of a transverse incision. This has less tendency to interfere with the vascular anatomy of the healing wound in the first 4 weeks after abdominal incision in rats.

In clinical trials, Halasz (1964) was able to show that transverse incisions were less painful in the immediate post-operative period and were associated with a lower incidence of pulmonary complications. However, Greenall, Evans and Pollock (1980) were unable to show any overall difference between the long-term failure rate of transverse and midline incisions. This may have been due to a higher incidence of wound infection in the transverse group, although in selecting any incision all complicating factors must be catered for, including wound infection.

This study has shown that there is no advantage related to wound healing in selecting either a vertical or transverse abdominal incision when either would be appropriate. This agrees with the findings of Greenall *et al.* (1980). In addition, the same criteria cannot demonstrate any difference between median and paramedian incisions, when a vertical abdominal incision is necessary. The incidence of incisional hernia was 16% for paramedian incisions in both

group A and B, indicating that there is no increased risk of wound failure when the choice of incision is restricted. Factors contributing to failure of wound healing are principally wound infection with some contribution from post-operative chest infection.

There is no difference in the incidence of hernias from upper and lower abdominal incisions, as might be expected from the varying types of surgery associated with these. Another slightly unexpected finding is that advancing age does not appear to contribute to the risk of hernia formation.

It appears that, using the standard means of wound closure employed here, incisions in any part of the abdomen will heal with the same incidence of hernia and dehiscence irrespective of the incision being vertical or horizontal.

The close association between sepsis and wound break-down means that future attempts to reduce the complications associated with making an abdominal incision must be directed towards reducing this factor, or overcoming its influence. It may be possible to modify the technique of abdominal incision with this in mind, and suture materials which have less tendency to sinus formation are desirable. A review of prophylactic antibiotic measures may also be indicated and indeed our incidence of wound infection has now been reduced with the use of cefuroxime in place of gentamicin in our prophylactic regime.

An objective comparison is currently being undertaken in this unit between the wide paramedian incision of Guillou *et al.* (1980) and more traditional incisions by means of a prospective randomized trial.

References

- BUCKNALL, T.E. & ELLIS, H. (1981) Abdominal wound closure—A comparison of monofilament nylon and polyglycolic acid. *Surgery*, **89**, 672.
- GREENALL, M.J., EVANS, M. & POLLOCK, A.V. (1980) Midline or transverse laparotomy? A random controlled trial. *British Journal of Surgery*, **67**, 188.
- GUILLOU, P.J., HALL, T.J., DONALDSON, D.R., BROUGHTON, A.C. & BRENNEN, T.G. (1980) Vertical abdominal incisions—a choice? *British Journal of Surgery*, **67**, 395.

- HALASZ, N.A. (1964) Vertical vs horizontal laparotomies. *Archives of Surgery*, **88**, 911.
- LEAPER, D.J. (1983) Angiology as an index of the healing of abdominal wounds and colic anastomoses. *Annals of the Royal College of Surgeons, England*, **65**, 20.
- TERA, H. & ABERG, C. (1976) Tissue strength of structures involved in musculo-aponeurotic layer sutures in laparotomy incisions. *Acta Chiropratica Scandinavica*, **142**, 349.

(Accepted 27 October 1983)