

A randomised comparison of polydioxanone (PDS[®]) and polypropylene (Prolene[®]) for abdominal wound closure

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Summary

Two hundred and eighty four patients undergoing laparotomy by vertical incision were randomly allocated to closure with interrupted mass sutures of No. 1 polydioxanone (PDS[®]) or No. 1 polypropylene (Prolene[®]). Dehiscence occurred in 0.7% of the PDS group but in 6.4% of the Prolene group ($P=0.018$). Wound infection occurred in 8.6% of the PDS group and 15.4% of the Prolene group ($P=0.1$).

One hundred and ninety patients attended for review at a minimum of one year. Incisional herniation, usually asymptomatic, was present in 11% of each group. Knots were palpable in 2% of the PDS patients but in 12% of the Prolene; wound pain occurred in 12% of the PDS group but in 23% of the Prolene group ($P=0.06$).

These results suggest that PDS may be useful for abdominal closure.

Introduction

Both the techniques of abdominal closure, and the materials to be used, continue to excite debate. Like many others we employ interrupted mass closure, but the best suture material to use is debatable. Materials such as polyglycolic acid may be associated with a higher rate of late wound failure than non-absorbable materials such as Nylon, but the latter may cause wound pain and sinuses. Polydioxanone (PDS) is a synthetic monofilament which retains its strength for a considerable time but is eventually absorbed. This combination of properties might be of value for laparotomy closure and we have therefore compared PDS with polypropylene (Prolene) in a randomized trial.

Materials and methods

During a 10 month period 301 patients under the care of all three consultants at this hospital, undergoing laparotomy by vertical abdominal incision were entered into the trial. Patients who were being reoperated upon through the same incision were not included but the series was otherwise continuous. At the end of the operation the circulating nurse drew a sealed envelope and informed the surgeon of the suture to be used. No. 1 (BPC) gauge polydioxanone (PDS) or No. 1 polypropylene (Prolene) were mounted on $\frac{5}{8}$ circle hand-held Moynihan needles. Each was inserted as an interrupted mass figure-of-eight suture beginning and ending beneath the rectus sheath to bury the knots. The skin was closed with clips or nylon; wound drains were not employed. Most patients received subcutaneous heparin; bowel preparation and antibiotic prophylaxis were given according to the surgeon's usual routine.

Postoperatively the wounds were inspected by the house-surgeons. Wound infection was defined as discharge of pus, and any such discharge up to one month of follow-up is included as a postoperative infection. The house-surgeons also subjectively assessed the presence of postoperative abdominal distension or of chest infection.

Late assessment of the wounds was carried out at a minimum of 12 months postoperatively. The vast majority were assessed by one observer (CJP). This assessment was 'double-blind' as neither the examiner nor the patient knew which suture had been used. The wound was examined for palpable knots, and for incisional hernia, which was recorded whether or not the patient had noticed it, and the patient was asked if the wound was painful.

All analyses were by the Fisher exact probability test.

Results

Of the 301 patients, 17 were withdrawn from the study because of death or reoperation within 14 days (2 further patients were reoperated upon in the early postoperative period but at operation were found to have suffered a deep dehiscence: these are included in the results). There were thus 143 closed with PDS and 141 closed with Prolene. The comparability of the two groups is shown in Table I. There was a slight excess of colonic surgery in the Prolene group but other parameters were well-matched.

TABLE I Patient characteristics and type of surgery

	PDS n=143	Prolene n=141
<i>Patients</i>		
Age	61.6±15.2	60.2±17.0
Sex ratio F:M	1.20	1.27
Obesity	Fat	24%
	Average	44%
	Thin	32%
Jaundiced	5	5
Steroids	3	2
<i>Surgery</i>		
Incision PM:ML	80:63	94:47
Emergency	28	28
Clean	114	109
Clean/contaminated	9	13
Dirty	20	19
Senior:Junior	75:67	79:57
<i>Procedure</i>		
Gastric	33	25
Biliary	47	42
Colonic	30	41
'Other'	33	33

EARLY RESULTS (TABLE II)

Ten patients (3.5%) suffered a burst abdomen. One occurred with PDS (0.7%) and nine with Prolene (6.4%); this difference is significant ($P=0.018$). Eight of these 10 dehiscences followed colonic surgery, one followed a nephrectomy and one followed vagotomy for a perforated ulcer. Six of the 10 had a wound infection prior to the dehiscence. Chest infection was commoner in the PDS group than the Prolene, but distension was commoner with Prolene. Overall, wound infection occurred in 12 patients closed with PDS (8.6%) and in 21 closed with Prolene (15.5%); this difference was not significant. Again, when the incisions were classified into clean or contaminated there was no difference in the wound infection rates for the two sutures.

LATE RESULTS (TABLE III)

One hundred and ninety patients attended for review at a minimum of 12 months (mean 14.7 months). Twenty one patients (11%) had an incisional hernia; these were generally asymptomatic and were evenly distributed in the two groups. One patient in the Prolene group had a wound sinus. The PDS group had a lower incidence of wound pain and palpable knots.

TABLE II Early results

	PDS n=143	Prolene n=141	P*
Distension	14	25	0.06
Chest infection	30	22	0.33
Dehiscence	1	9	0.018
Wound infection	12	21	0.11

*Significance assessed by Fisher's exact test

TABLE III Late results

	PDS n=100	Prolene n=90	P*
Hernia	10	11	0.8
Knots	2	11	0.011
Wound pain	12	21	0.06
Sinus	0	1	0.9

*Significance assessed by Fisher's exact test

Discussion

It is disturbing to report that we had one dehiscence in every 28 laparotomies (3.5% overall). This rate is much higher than in a previous trial from this hospital where the dehiscence rate was 0.6% (1). The high failure rate with Prolene may be related to the excess of colonic surgery in this group, 8 of the 10 dehiscences followed such operations, or to the characteristics of the suture material. There is a tendency to knot slippage with Prolene (2) and also the suture may occasionally fracture. We chose Prolene for historical reasons but it might have been preferable to employ Nylon as it is more widely used and is known to give acceptable results.

PDS was easy to handle, and gave satisfactory early results, which agrees with other studies.

Taylor (2) found that PDS was better than Nylon for a two layer continuous closure of midline wounds. In a small series Leese and Ellis (3) had no dehiscence with either PDS or Nylon. Similarly, Leaper *et al.* (4) reported no significant differences in the dehiscence rate when PDS or Nylon was used for continuous mass closure of midline and transverse incisions, but they did record more wound infections with PDS. Our overall rate of infection was 11% which is similar to that in Leaper's study, but we found less infection with PDS than Prolene.

Although some incisional hernias do occur for up to 5 years postoperatively (5), most will be apparent at 12 months. Our 'blind' assessment at 14 months postoperatively found that 11% of the patients had a hernia. This figure may seem high, but is comparable to that reported in other larger studies (6). We found no difference between PDS and Prolene, which supports the findings of the Manchester study (2). However, Leese and Ellis (3) reported 8.5% hernias with Nylon but 20% with PDS, although this failed to reach significance. The follow-up period of 6 months in the Bristol study (4) is too short for adequate assessment.

Patients occasionally complain of wound pain, but few studies have investigated this aspect of healing. We found that wounds closed with PDS were more comfortable—many fewer knots were palpable and fewer patients experienced wound pain (this just failed to reach statistical significance). Only one patient in the Prolene group developed a sinus, but more may do so in time. Certainly an absorbable suture such as PDS would theoretically avoid this problem. Therefore, in the long term, PDS may have advantages over Prolene, although the true incidence of incisional herniation will require longer follow-up.

The ideal suture sought by Moynihan (1920) was to (1) be sufficient to hold the parts together, (2) be absorbed as soon as its work was finished, (3) be free from infection and (4) be non-irritant. Our study suggests that PDS may be a step towards these aims and is an alternative to a non-absorbable suture for laparotomy closure.

References

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Book Review

Pediatric Surgery edited by K J Welch, J G Randolph, M Ravitch, J A O'Neill Jr and M E Rowe. 4th edition. 2 volumes. 1547 pages, illustrated. Year Book Publishers, Chicago and London. £264.

It is some 25 years since the publication of the 1st edition of this standard reference book on paediatric surgery. The present 4th edition with 5 editors and 149 contributors maintains the high standard of previous editions. The first volume starts with a general section followed by other sections on trauma, malignant tumours, transplantation, head and neck and thorax. The second volume includes the abdomen, genito-urinary system, special areas including cardiac surgery, neurosurgery and orthopaedics and finally skin, soft tissues and blood vessels.

In this American textbook only 4 of the 149 contributors are from outside that continent. The production is of a high standard in keeping with the Year Book Publications. In this edition there are 33 new chapters and others particularly the section on cardiac surgery have been reduced in length. The large number of contributors and editors has resulted in a lack of uniformity and style which affects both the content and the illustrations and leads to some repetition of material.

This repetition of material is marked in the section on Meckel's diverticulum (p 859) and that on disorders of the umbilicus (p 731) especially with the illustrations Fig. 87.5 and Fig. 74.2 which are essentially the same. Similar repetition occurs when dealing with tumours of the testis. In some sections the illustrations are of high calibre and a model of clarity, e.g. in urinary undiversion by W Hardy Hendren and in bifid and double ureters, ureteroceles and fused kidneys by F Douglas Stephens. In others the reduction in size, e.g. Fig. 75.5 has resulted in a loss of clarity. The 4 plates of colour illustrations add little to these volumes and could either be omitted or be transposed into the appropriate position in the text.

Some of the controversial issues in paediatric surgery are well discussed. There is an excellent chapter on the management of the undescended testis (chapter 79 by E W Fonkalsrud). The management of intussusception (chapter 88 by M Ravitch) is similarly well discussed but contains conflicting advice such as 'in my opinion barium enema can and should be administered to every child with an intussusception regardless of the duration of the child's condition' but then quotes a series of 5 perforations out of 7 patients following barium enema examinations when the duration was longer than 72 hours. This again conflicts with a later statement "Today, there is essentially no mortality from intussusception treated in the best pediatric surgical centers except in children already irretrievably moribund on admission..."

Ethical considerations receive very little attention in these volumes. It is only considered in the section on conjoined twins. Whilst one realises that it is a difficult subject to state clearly in print it does affect the day to day work and decisions of a practising paediatric surgeon.

The results of surgery in the severely handicapped such as cloacal exstrophy are optimistic as stated (p 771). "There is little speculation, however that with an aggressive intelligent staged surgical approach, these unfortunate babies may be rehabilitated to happy contributing members of society, a little handicapped perhaps but otherwise 'normal'." However in the preceding paragraphs they mention control of urinary and faecal incontinence by either fashioning stomas or use of intermittent catheterisation. Also as many have lower limb problems related to myelodysplasia and anomalies of the genito-urinary system which are likely to affect their sexual function this conflicts with the author's concluding statements.

The description of operative details varies from chapter to chapter; in some it is full and detailed and in others rather sparse and questionable. For example on page 861 the description of a 2 layer closure for the resection of a Meckel's diverticulum is satisfactory in the older child but may be unsuitable in the neonatal period.

There is an extensive bibliography at the end of every chapter. These 2 volumes on paediatric surgery should be available in medical libraries and in paediatric surgical units throughout the world. The cost is high which means that purchases of copies by trainees and even practising paediatric surgeons will be limited. The time may have come to consider in the future the publication of this material in 4-5 volumes of relevant content and in a more convenient size. Such a change could lead to increased sales especially if the relevant volumes could be purchased separately at a more reasonable price.

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