Factors affecting the healing of the perineum following surgery

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ABSTRACT

INTRODUCTION The aim of this study was to establish patient and procedural factors associated with the development of an unhealed perineum in patients undergoing a proctectomy or excision of an ileoanal pouch.

METHODS A review of 194 case notes for procedures performed between 1997 and 2009 was carried out. All patients had at least 12 months' follow-up. Univariate and multivariate analyses were performed in 16 parameters. For those patients who developed an unhealed perineum, Cox regression analysis was performed to establish healing over a 12-month period.

RESULTS Two hundred patients were included in the study, of which six had unknown wound status and were subsequently excluded. This left 194 study patients. Of these, 86 (44%) achieved primary wound healing with a fully healed perineum and 108 (56%) experienced primary wound failure. With reference to the latter, 63 (58%) healed by 12 months. Comparing patients with an initially intact perineum with those with initial wound failure showed pre-existing sepsis was highly relevant (odds ratio: 4.32, 95% confidence interval [CI]: 2.16–8.62, $p < 0.001$). In patients who had an unhealed perineum initially, perineal sepsis and surgical treatment were both significantly associated with time to healing (hazard ratio [HR]: 0.54, 95% CI: 0.31–0.93, $p = 0.03$; and HR: 0.42, 95% CI: 0.21–0.84, $p = 0.01$).

CONCLUSIONS The presence of pre-existing perineal sepsis is associated with an unhealed perineum following proctectomy in inflammatory bowel disease (IBD) and non-IBD surgery. Further studies are indicated to establish perineal sepsis as a causative factor.

KEYWORDS

Perineum – Wound – Healing – Proctectomy – Sepsis – Ileoanal Pouch – Inflammatory Bowel Disease

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Poor perineal wound healing affects a significant proportion of patients undergoing proctectomy or pouch excision for benign and malignant anorectal diseases. This causes significant physical and psychological morbidities to patients. There are also cost implications to healthcare systems as such patients require long-term follow-up.

Historically, the term 'persistent perineal sinus' (PPS) has been defined as a perineal wound that remains unhealed more than six months after surgery.¹ The incidence of PPS in patients undergoing surgery for inflammatory bowel disease (IBD) ranges from 3% to 70% at 6 months.^{2–4} The wound remains unhealed in up to 33% of patients at 12 months.^{5,6} PPS is reported more frequently after surgery for Crohn's disease than after surgery for ulcerative colitis or anorectal cancer.^{5,7,8} The incidence of PPS after abdominoperineal resection for low rectal cancer may be as high as 29%, especially in patients who have received preoperative radiotherapy.^{9–11} The rate of PPS for patients who underwent pouch excision has been reported as 40% at 6 months and 10% at 12 months.¹²

Despite recent advances in surgical techniques and perineal wound management, there has not been significant im-

provement in perineal wound healing.⁴ The aims of this study were to provide contemporary data on patient and procedural factors associated with the development of the unhealed perineum and subsequent perineal wound healing following surgery, and to determine the healing rate of patients with an unhealed perineum up to 12 months postoperatively.

Methods

Patients aged 16 years or over who underwent proctectomy, proctocolectomy or excision of an ileoanal pouch were included in the study. All indications were considered. All patients underwent primary closure of the perineal wound. Operative records between 1 September 1997 and 1 September 2009 were obtained. Case notes were reviewed and data entered into a standardised spreadsheet. All patients underwent at least 12 months of follow-up. Data on patient, disease and procedural factors were collected.

In general, patients underwent intersphincteric resections unless there was clinical indication to suggest otherwise. The perineum was closed in two layers of Vicryl® (Ethicon, Somerville, NJ, US) to approximate deep fascia,

followed by interrupted Vicryl® to the skin. None of the patients had mesh inserted.

Primary wound healing was defined as a perineal wound that remained intact from the outset. Initial wound failure was defined as a perineal wound that opened in the first postoperative week, with or without clinical evidence of infection. An unhealed perineum was one that had not healed by one year following the initial operation. The words 'open', 'unhealed' and 'sinus' in clinical records were used to define an unhealed perineum. The first stage of the analysis compared those patients who had primary wound healing with the rest. The second stage of the analysis compared those with an initial wound failure that healed subsequently by 12 months with those whose wound had not healed.

Statistical analysis

As the outcome (wound healing) was measured on a binary scale, all analysis was performed using logistic regression. Initially, the individual effect of each factor on the outcome was assessed in a series of univariates. Parametric and non-parametric tests were used for normal distribution and non-normal distribution continuous variables respectively. Chi-squared tests were used for categorical variables. Variables showing some evidence of an association with poor healing in the univariate analysis ($p < 0.2$) were considered for multivariate analysis. A backwards selection procedure was used to retain only the statistically significant variables in the final model. A Cox regression method was used to analyse healing rates for those who developed an unhealed perineum. A Kaplan–Meier plot was generated by plotting the proportion of patients whose wound had healed against time.

Results

Two hundred patients were included in the study. Six patients had unknown wound status and were subsequently excluded, leaving 194 study patients (Table 1). Of these, 86 (44%) achieved primary wound healing (a fully healed perineum at the outset) and 108 (56%) experienced initial wound failure. With reference to the latter, 63 (58%) had healed by 12 months (Fig 1).

Comparing those patients with primary wound healing and those with initial wound failure showed that pre-existing perineal sepsis (61/194, 31%) was significantly associated with failure to heal primarily (odds ratio: 4.32, 95% confidence interval [CI]: 2.16–8.62, $p < 0.001$) (Table 2). Only 14/61 patients (23%) with pre-existing perineal sepsis achieved primary wound healing compared with 72/133 (54%) who did not have pre-existing sepsis.

A comparison was made between those who developed initial wound failure but had healed by 12 months ($n=63$, 58%) and those who remained unhealed at one year ($n=45$, 42%). Of the 41 patients with pre-existing perineal sepsis who also had initial wound failure, 22 (54%) achieved healing at 12 months compared with 35/44 (78%) who did not have pre-existing perineal sepsis but still suffered initial wound failure (hazard ratio [HR]: 0.54, 95% CI: 0.31–0.93, $p=0.03$) (Table 3). Overall, of the initial 61 patients with pre-

Table 1 Patient demographics

Variable	Category	Summaries for all patients ($n=194$)
Mean age	–	50.1 (SD: 16.2)
Sex	Female	86 (44%)
	Male	106 (56%)
Mean body mass index	–	24.4kg/m ² (SD: 5.1kg/m ²)
Smoking	Non-smoker	114 (60%)
	Ex-smoker	39 (21%)
	Smoker	37 (19%)
Diabetes	No	185 (96%)
	Yes	7 (4%)
Disease process	Cancer	63 (32%)
	Crohn's disease	46 (24%)
	Ulcerative colitis	53 (27%)
	Other	32 (16%)
Procedure	APR/proctectomy	114 (60%)
	Proctocolectomy	48 (25%)
	Excision of pouch	29 (15%)
Chemoradiotherapy	None	25 (13%)
	<6 weeks	9 (5%)
	>6 weeks	40 (21%)
	Not cancer	120 (62%)
Infliximab	No	140 (87%)
	Yes	21 (13%)
Laparoscopic	No	162 (84%)
	Yes	32 (16%)

SD = standard deviation; APR = abdominoperineal resection

Figure 1 Flowchart of study

existing sepsis, 19 (31%) were still unhealed at one year compared with 9/133 (7%) of those without pre-existing sepsis.

Extraspincteric dissection was performed in 7 patients, all for benign diseases, with 6 (85%) failing to heal

Table 2 Univariate analysis on factors affecting initial wound healing

Variable	Category	Not healed	Odds ratio (95% CI)	p-value
Procedure	APR/proctectomy	54/112 (48%)	1	0.06
	Proctocolectomy	31/48 (65%)	1.96 (0.97–3.94)	
	Excision of pouch	19/28 (68%)	2.27 (0.94–5.44)	
Disease	Cancer/other	52/93 (56%)	1	0.80
Process	IBD	53/98 (54%)	0.93 (0.52–1.64)	
Body mass index*	–	–	0.94 (0.66–1.35)	0.74
Smoking	Non-smoker	62/113 (55%)	1	0.49
	Ex-smoker	18/38 (47%)	0.74 (0.35–1.55)	
	Current smoker	22/36 (61%)	1.29 (0.60–2.78)	
Diabetes	No	100/182 (55%)	1	0.91
	Yes	4/7 (57%)	1.09 (0.24–5.02)	
Chemoradiation**	None	12/24 (50%)	1	0.17
	<6 weeks	7/9 (78%)	3.50 (0.60–20.4)	
	>6 weeks	16/39 (41%)	0.70 (0.25–1.95)	
Steroids**	Stopped taking	9/23 (39%)	1	0.68
	Currently taking	13/29 (45%)	1.26 (0.42–3.84)	
Infliximab	No	76/140 (54%)	1	0.87
	Yes	11/21 (52%)	0.93 (0.37–2.32)	
Perineal sepsis	No	56/133 (42%)	1	<0.001
	Yes	47/61 (77%)	4.32 (2.16–8.62)	
Haemoglobin	<13g/dl	59/98 (60%)	1	0.10
	≥13g/dl	43/89 (48%)	0.62 (0.35–1.10)	
Albumin	≤30g/l	20/32 (63%)	1	0.36
	>30g/l	75/140 (54%)	0.69 (0.31–1.52)	
Laparoscopic	No	90/161 (56%)	1	0.55
	Yes	15/30 (50%)	0.79 (0.36–1.72)	
Suture used	Vicryl®	53/106 (50%)	1	0.61
	Other	24/44 (55%)	1.20 (0.59–2.43)	

CI = confidence interval; APR = abdominoperineal resection; IBD = inflammatory bowel disease

*Odds ratios reported for a 5-unit increase in explanatory variable

**Variable only applicable for a subgroup of patients

at 12 months. The remaining 187 patients underwent intersphincteric dissection.

In patients who had an unhealed perineum, perineal sepsis and surgical treatment were both significantly associated with time to healing (HR: 0.54, 95% CI: 0.31–0.93, $p=0.03$; and HR: 0.42, 95% CI: 0.21–0.84, $p=0.01$) (Table 3).

The results of the multivariate analysis suggested that only non-operative treatment (ie expectant treatment/simple dressings) was significantly associated with healing. After adjusting for the effects of this variable, there was no evidence of an effect of perineal sepsis or any other variables on the outcome. As there was only one variable in the

final model, the size of effect of this variable was equivalent to that seen in the univariate analyses.

The time to healing for patients with an open wound can be seen in the subsequent Kaplan–Meier plot (Fig 2). This plots the proportion of patients whose wound had healed against time.

Discussion

This large contemporaneous study of perineal wound healing has tried to evaluate causal factors as well as management. The follow-up period of 12 months was reasonable.

Table 3 Univariate analysis of factors associated with perineal wound healing at 12 months

Variable	Category	Healed	Hazard ratio (95% CI)	p-value
Procedure	APR/proctectomy	32/43 (74%)	1	0.26
	Proctocolectomy	18/27 (67%)	0.74 (0.41–1.32)	
	Excision pouch	9/16 (56%)	0.56 (0.26–1.18)	
Disease	Cancer/other	32/41 (78%)	1	0.09
	IBD	27/46 (59%)	0.64 (0.38–1.08)	
Body mass index*	–	–	1.09 (0.83–1.43)	0.53
Smoking	Non-smoker	33/51 (65%)	1	0.50
	Ex-smoker	11 /14 (79%)	1.51 (0.76–3.00)	
	Current smoker	13/19 (68%)	1.11 (0.58–2.11)	
Diabetes	No	56/83 (67%)	1	0.85
	Yes	2/3 (67%)	1.15 (0.28–4.72)	
Chemo/radiotherapy**	No	8/10 (80%)	1	0.88
	Yes	13/15 (87%)	1.07 (0.44–2.58)	
Steroids**	Stopped taking	6/9 (67%)	1	0.89
	Currently taking	7/10 (70%)	1.08 (0.36–3.22)	
Infliximab	No	91/140 (65%)	1	0.22
	Yes	4/10 (40%)	0.52 (0.19–1.47)	
Perineal sepsis	No	35/44 (80%)	1	0.03
	Yes	22/41 (54%)	0.54 (0.31–0.93)	
Haemoglobin	<13g/dl	30/50 (60%)	1	0.28
	≥13g/dl	26/34 (76%)	1.34 (0.79–2.27)	
Albumin	≤30g/dl	7/13 (54%)	1	0.34
	>30g/dl	43/64 (67%)	1.47 (0.66–3.28)	
Suture used	Vicryl®	25/42 (60%)	1	0.08
	Other	19/21 (90%)	1.70 (0.94–3.10)	
Laparoscopic	No	48/75 (64%)	1	0.12
	Yes	11/12 (92%)	1.70 (0.88–3.27)	
Treatment	None/dressings	34/44 (77%)	1	0.01
	Surgery	11/26 (42%)	0.42 (0.21–0.84)	
Size of defect	<1cm	8/21 (38%)	1	0.17
	>1cm	17/28 (61%)	1.79 (0.77–4.17)	

CI = confidence interval; APR = abdominoperineal resection; IBD = inflammatory bowel disease

*Odds ratios reported for a 5-unit increase in explanatory variable

**Variable only applicable for a subgroup of patients

Figure 2 Healing time of patients with primary wound failure

Our overall rate of an unhealed perineum was 23%, which is in keeping with previous published studies. Our study showed that healing occurred after six months. It can therefore be argued that the term ‘persistent perineal sinus’ should be redefined.

Previous studies have found that preoperative radiation predisposes to poor wound healing.^{9,15,14} This finding is not consistent in the literature. One study suggests that there was no significant increase in the risk of major wound complications in rectal cancer patients undergoing preoperative radiation but that patients with anal cancer who had preop-

erative radiation may be at risk.¹⁵ A large population study concluded that neoadjuvant chemoradiation was not associated with an increased occurrence of perineal sinus, ulceration or hernia.¹⁶ Our study showed no association between chemoradiation within a six-week window of operation and poor healing. However, the small population of patients who underwent radiotherapy makes it difficult to form conclusions. It is important to note that the dose and duration of radiation differs.

One would not intuitively expect any advantage in perineal wound healing with a laparoscopic abdominal approach and this proved to be the case in our study.

The association of pre-existing perineal sepsis with poor wound healing was to be expected. The presence of a fistula (in the setting of Crohn's disease) and inflammation impede the normal processes of healing. In these patients, there is a strong argument for a staged examination under anaesthesia with control of sepsis, before proctectomy.

Most perineal wounds were packed in the 1970s.^{17–19} This was associated with prolonged healing time and PPS. Primary closure was accompanied by continuous postoperative irrigation of the wound through drains placed laterally to the midline perineal wound, not actually through the wound itself. This was found to be safe and provided satisfactory healing with primary healing in 75% of patients by three months after surgery.²⁰ Placement of the drains through the middle of the perineal incision, especially in men, resulted in a PPS in 40% or more of patients.²⁰

Our surgical treatment for an unhealed perineal wound in the study population consisted of examination under anaesthesia, curettage and irrigation. In the early postoperative period, its benefit may relate to drainage of sepsis. Other available treatment includes omentoplasty,²¹ gracilis muscle advancement,²² posterior thigh fasciocutaneous flaps,²³ gluteus maximus V-Y advancement flaps,²⁵ vacuum assisted closure^{24–26} and rectus abdominal myocutaneous flaps.²⁷ Sutured omentoplasty was reported to have a 100% wound healing rate at three months.²⁸ Our findings that examination under anaesthesia was associated with poor healing may be a reflection of preference of the surgeon to select those with high risk wounds.

Conclusions

The presence of pre-existing perineal sepsis is associated with an unhealed perineum following proctectomy in IBD and non-IBD surgery. Further studies are indicated to establish perineal sepsis as a causative factor.

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