Back to basics – cutting the cord on umbilical infections

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ABSTRACT

INTRODUCTION Surgical site infections (SSIs) are a significant cause of postoperative morbidity with laparoscopic surgery associated with lower SSI rates. However, a departmental change in our unit to increased laparoscopic colorectal surgery resulted in increased wound infection rates at umbilical specimen extraction sites, the cause of which we attempted to elucidate.

SUBJECTS AND METHODS Prospectively collected data over an 18-month period (April 2008 to September 2009) for laparoscopic colorectal operations in a busy teaching hospital were retrospectively analysed, focusing on operation performed, whether pre-operative skin cleansing was employed, nature of specimen extraction excision, and rate of umbilical wound infection. Comparison was made with open colorectal procedures performed in the preceding year.

RESULTS In total, 275 laparoscopic colorectal operations were performed. Over the first 8 months there was a significant increase in infection rates when compared with open procedures over a similar time period (23.5% vs 8.0%; $P = 0.0001$). Changing practice to use pre-operative skin cleansing and an incision that skirted around, as opposed to traversing, the umbilicus reduced umbilical infection rates significantly from 23.5% to 11.6% ($P = 0.01$). Patients undergoing right hemicolectomy benefitted more (reduction of 30.0% to 6.9%; $P = 0.04$) than those undergoing anterior resection (26.8% vs 15.6%, $P = 0.13$).

CONCLUSIONS Umbilical incisions, when extended for specimen extraction, are particularly prone to infection following colorectal surgery but rates can be reduced by simple measures such as pre-operative umbilical cleansing and avoidance of the umbilicus in the incision, without the need for drastic and costly changes in technique or antibiotic prophylaxis.

KEYWORDS

Surgical wound infection – Laparoscopic surgery – Colorectal surgery

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Surgical site infections (SSIs) are infections that occur at the site of a surgical incision, or other invasive procedure. It is estimated that 5% of surgical procedures are complicated by a surgical site infection¹ and they are the third most frequent hospital-acquired infection.² SSI rates for colorectal surgery have been estimated at up to 23%.³ They represent a significant cause of morbidity and mortality, being associated with a doubling of mortality rates and increased length of hospital stay.^{4,5} Patients with SSIs are approximately five times more likely to be re-admitted⁴ and each SSI is estimated to cost an additional £814 to £6626 depending on the site and severity of the infection.⁶

Laparoscopic colorectal surgery is associated with a lower SSI rate than open surgery.^{7,8} We report on our experience switching from a policy of highly selective laparoscopic to unselected laparoscopic approach for elective colorectal surgery and note its effect on SSI rates.

Subjects and Methods

Data were prospectively collected from consecutive patients undergoing elective laparoscopic colorectal surgery at a large teaching hospital over an 18-month period from 1 April 2008 until 30 September 2009. Data collected included patient demographics, operation details and details of any postoperative surgical site infections. Data were also collected retrospectively on all open colorectal operations performed in the 12-month period prior to 1 April 2008 to allow for direct comparison with the laparoscopic data.

Evidence of SSI noted prior to discharge was recorded. Patients were routinely reviewed by a consultant nurse specialist 2 weeks after discharge, at which point a further wound inspection allowed evidence of SSI to be recorded. Wounds were analysed using the UK Surgical Site Infection Surveillance Service criteria (SSISS).

Table 1 Demographic data

Operation	Apr 2008–Jan 2009	Feb 2009–Sep 2009	Total
Median age years (range)	66 (14–89)	67 (15–91)	67 (14–91)
Male	59 (57.8%)	98 (56.6%)	157 (57.1%)
Female	43 (42.2%)	75 (43.4%)	118 (42.9%)
Mean operative time (SD)	178 (70.03)	178 (74.08)	178

Table 2 Breakdown of operations performed

Operation	Apr 2008– Jan 2009	Feb 2009– Sep 2009	Total
Anterior resection	49	77	126
Right hemicolectomy	31	29	60
Sigmoid colectomy	4	20	24
APR	4	11	15
Ileal pouch–anal anastomosis	1	9	10
Reversal of Hartmann's procedure	1	7	8
Panproctocolectomy	2	5	7
Hartmann's procedure	4	3	7
Subtotal colectomy	2	4	6
Ventral rectopexy	0	4	4
Other	4	4	8

The study was performed during a period of significant change within the colorectal department. The appointment of a fourth colorectal consultant who had recently completed a laparoscopic fellowship resulted in a drastic rise in the proportion of procedures performed laparoscopically, increasing from 18.5% in the previous year to 92.6% cases attempted by the laparoscopic approach.

Specimen extraction and, in the case of right hemicolectomy, anastomosis took place through a mini-midline incision. Following a review of wound infection rates in

January 2009, two changes were made to practice: (i) patient's umbilici were thoroughly cleaned pre-operatively with chlorhexidine solution on the ward; and (ii) incisions were made skirting around the umbilicus whereas previously they had gone through the umbilicus. All other pre-, intra- and postoperative factors remained constant, specifically prophylactic antibiotics and wound guards were used for all procedures.

Results

A total of 275 patients undergoing laparoscopic colorectal operations between 1 April 2008 and 30 September 2009 were included in the study. Median age of the population group was 67 years of which 57.1% were male and 42.9% female. There was no statistical difference between the ages or genders of patients before and after our change of practice was implemented (Table 1). Mean operative time was 178 min (SD 70.03) over the study time with no difference between the two patient groups. Table 2 shows a breakdown of the procedures performed. There was no significant difference in infection rates between the different surgeons (Table 3).

At the beginning of the study period, the proportion of procedures performed laparoscopically was 18.5%. By September 2009, this proportion had increased to 92.6%. Over the first 10 months, 29 of 102 (28.4%) laparoscopic patients developed a surgical site infection. This was significantly more than patients having open resections over the same period (17 of 212; 8.0%; $P < 0.0001$). Of the 29 patients suffering a SSI in the laparoscopic

Table 3 Breakdown of procedures and SSIs by operator

Consultant	Apr 2008– Jan 2009	SSI	<i>P</i> -value	Feb 2009– Sep 2009	SSI	<i>P</i> -value	Total	SSI	<i>P</i> -value
Fellow	15	3 (20.0%)	0.67	28	2 (7.1%)	0.67	43	5 (11.6%)	0.43
Preceptored	40	11 (27.5%)		35	4 (11.4%)		75	15 (20.0%)	
Trainee 1	18	2 (11.1%)		28	2 (7.1%)		46	4 (8.7%)	
Trainee 2	12	3 (25.0%)		34	6 (17.6%)		46	9 (19.6%)	
SpR	17	5 (29.4%)		48	6 (12.5%)		65	11 (16.9%)	

group, 24 (82.8%) involved the umbilical port site.

Following the introduction of pre-operative cleansing and a change in technique from transumbilical to circumumbilical incisions, 20 of 175 (11.6%) patients undergoing laparoscopic surgery developed a SSI at the umbilicus. This represented a significant fall in umbilical port site SSIs from 23.5% to 11.6% ($P = 0.01$). This SSI rate of 11.6% is similar to the 8.0% of SSI noted in the open group ($P = 0.2976$). Right hemicolectomy patients benefitted most significantly (30.0% vs 6.9%; $P = 0.04$). Anterior resection patients also demonstrated a trend toward reduced infection rates (26.8% vs 15.6%; $P = 0.15$).

Discussion

Our study highlights the effects of simple changes on SSI incidence. Following a departmental change from performing predominantly open colorectal surgery to performing unselected laparoscopic colorectal surgery, we audited our results and this highlighted a very high SSI rate (28.4%). The majority of these were umbilical infections. In total, 23.5% of patients had developed an umbilical SSI. Following implementation of changes to practice which involved pre-operative umbilical cleansing with chlorhexidine and the use of circumumbilical rather than transumbilical incisions, umbilical SSIs fell significantly to 11.6%.

The two patient groups were well matched for age and sex and there was no difference in mean operative times between the two groups.

A number of studies have suggested that SSI rates are generally lower amongst patients undergoing laparoscopic rather than open colorectal resections.⁷⁻⁹ In our series, laparoscopic SSI rates remain higher than SSI in our open series (11.6% vs 8.0%) although not significantly so. The reasons for this are not immediately clear; however, it should be noted that a SSI rate of 8.0% amongst open resections is lower than the rate usually quoted in the literature.^{7,9} In contrast, our laparoscopic SSI rate is similar to that of other studies.^{7,9}

The use of pre-operative skin preparation is common in many departments; however, its benefit is controversial. The aim of washing the area is to reduce the volume of resident bacteria and this has been demonstrated in trials.¹⁰ A number of studies have demonstrated that simple pre-operative skin preparation can help to reduce postoperative surgical site infections.¹¹⁻¹³ However, a Cochrane review performed in 2007 looking at data from over 10,000 patients over a 26-year period failed to find any clear evidence for the use of pre-operative washing with chlorhexidine.¹⁴ It is possible, however, that this review, concentrating on all surgical incision types, is not applicable to certain incisions made through intrinsically dirty areas of the body, such as the umbilicus, where the impact of pre-operative washing may be more greatly appreciated.

To our knowledge, only one study in 1987, looking at open procedures, has previously investigated the difference between circumumbilical versus transumbilical incisions.¹⁵ It failed to

show any benefit, in terms of infectious complications, from avoiding the umbilicus in the incision. The paucity of studies is perhaps surprising considering the frequency with which incisions around the umbilicus are performed. In laparoscopic procedures, it is desirable to minimise the cosmetic effects of the incision, potentially by hiding it within the umbilicus if this does not put patients at increased risk of SSI. However, our results would suggest this to be inadvisable.

Conclusions

These results are complicated by the fact that we changed two factors simultaneously, making it difficult to differentiate between the individual effectiveness of each intervention. However, this study does demonstrate the impact that simple measures, such as pre-operative skin preparation and incision type, can have on surgical site infection rate. Further studies into the use of pre-operative skin cleansing and incision sites, with respect to their effect on SSI, are warranted within the new laparoscopic era.

References

1. Smyth ET, McIlvenny G, Enstone JE, Emmerson AM, Humphreys H, Fitzpatrick F *et al*. Four Country Healthcare Associated Infection Prevalence Survey 2006: overview of the results. *J Hosp Infect* 2008; **69**: 230–48.
2. Smyth ET, Emmerson AM. Surgical site infection surveillance. *J Hosp Infect* 2000; **45**: 173–84.
3. Howard DD, White CQ, Harden TR, Ellis CN. Incidence of surgical site infections post colorectal resections without preoperative mechanical or antibiotic bowel preparation. *Am Surg* 2009; **75**: 659–63.
4. Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalisation and extra costs. *Infect Control Hosp Epidemiol* 1999; **20**: 725–30.
5. Kaye KS, Anderson DJ, Sloane R, Chen LF, Choi Y, Link K *et al*. The impact of surgical site infection on older operative patients. *J Am Geriatr Soc* 2009; **57**: 46–54.
6. National Institute for Health and Clinical Excellence (NICE). *Surgical site infection: prevention and treatment of surgical site infection*. London: RCOG Press, 2008.
7. Howard DPJ, Datta G, Cunliffe G, Gaten C, Huang A. Surgical site infection rate is lower in laparoscopic than open colorectal surgery. *Colorectal Dis* 2010; **12**: 423–7.
8. Poon JT, Law WL, Wong IW, Ching PT, Wong LM, Fan JK *et al*. Impact of laparoscopic colorectal resection on surgical site infection. *Surgery* 2009; **249**: 77–81.
9. Kiran RP, El-Gazzaz GH, Vogel JD, Remzi FH. Laparoscopic approach significantly reduces surgical site infections after colorectal surgery: data from national surgical quality improvement program. *J Am Coll Surg* 2010; **211**: 232–8.
10. Byrne DJ, Napier A, Phillips G, Cuschieri A. Effects of whole body disinfection on skin flora in patients undergoing elective surgery. *J Hosp Infect* 1991; **17**: 217–21.
11. Bienkowski M, Gospodarek E, Olejarski A, Deptula A. The evaluation of skin disinfection efficacy and its influence on prevalence of surgical site infections in patients subjected to laparoscopic cholecystectomy. *Med Dosw Mikrobiol* 2007; **59**: 183–91.
12. Dizer B, Hatipoglu S, Kaymakcioglu N, Tufan T, Yava A, Iyigun E *et al*. The effect of nurse-performed preoperative skin preparation on postoperative surgical site infections in abdominal surgery. *J Clin Nurs* 2009; **18**: 3325–32.
13. Cruse PJ, Foord R. The epidemiology of wound infection. A 10-year prospective study of 62,939 wounds. *Surg Clin North Am* 1980; **60**: 27–40.
14. Webster J, Osborne S. Preoperative bathing or showering with skin antiseptics to prevent surgical site infection. *Cochrane Database Syst Rev* 2007; (2): CD004985.
15. Paes TR, Stoker DL, Ng T, Morecroft J. Circumumbilical versus transumbilical abdominal incision. *Br J Surg* 1987; **74**: 822–4.