



## Review Article

## Is patient factor more important than surgeon-related factor in sepsis prevention in colorectal surgery?

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## ABSTRACT

**Background:** Postoperative infection is an important complication of colorectal surgery and continued efforts are needed to minimize the risk of surgical site infection (SSI). Sepsis prevention in colorectal surgery depends upon the degree of contamination of the peritoneal cavity (*disease factor*), the preoperative status of the patient (*patient factor*) and surgical technique (*surgeon factor*). Immune response and metabolic regulation are highly integrated as minor operations may stimulate the immune response while the effect of major surgery is immunosuppression. The article debates the relative contributions and impact of patient and surgeon-related factors on sepsis prevention in colorectal surgery.

**Methods:** A retrospective literature review of published studies on sepsis prevention in colorectal surgery, bacteria-host interactions and the effects of immune deficiency, life-style (smoking, alcohol abuse) and non-steroidal anti-inflammatory drugs on the outcome of colorectal surgery.

**Results:** The most important factor in determining postoperative sepsis is the presence of viable organisms in the surgical field prior to wound closure. Inter-individual variation in the pattern of mediator release and of end-organ responsiveness may play a significant role in determining the initial physiological response to major sepsis and this in turn may be a key determinant of outcome. Sepsis source control failure in colorectal surgery are more likely in patients with delayed (>24 h) procedural intervention (*Patient/surgeon factor*), higher severity of illness - the Acute Physiology, Age and Chronic Health Care Evaluation score (APACHE >15 (*patient/disease factor*), advanced age- >70yrs (*patient factor*), comorbidity (*patient factor*), poor nutritional status (*patient factor*) and a higher degree of peritoneal involvement – Mannheim peritonitis index (MPI) score (*disease factor*). It would be heralded by persistent or recurrent intra-abdominal infection, anastomotic failure or fistula formation.

**Conclusions:** The most important prognostic factors in emergency colorectal surgery are the preoperative status, age and faecal peritonitis. Thus, peritoneal sepsis is seldom the sole cause of death, but compounds coincidental cardiovascular, respiratory or renal pathology. The empiric choice of the surgical technique/procedure is predominantly determined by the patient status and the disease. The patient factor is thus more important than the surgeon factor in the prognosis of sepsis in emergency colorectal surgery but surgeon-related factors can influence the morbidity and mortality from sepsis in both elective and emergency colorectal surgery.

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## 1. Introduction

Intra-abdominal sepsis is one of the most challenging situations in surgery [1]. Colorectal surgery is associated with a high sepsis rate which may lead to serious complications including death. According to the Centre for Disease Control (CDC), the National nosocomial infection surveillance (NNIS) indicates that

colon surgery carries the highest risk of surgical site infection (SSI). This is followed by vascular surgery, cholecystectomy and organ transplantation [2]. The risk index was based on the application of a range of points from 0 to 3 for the absence or presence of the following three composite variables: *1point* - the patient that has an operation classified as either contaminated or dirty; *1point* – the American Society of Anaesthesiologists (ASA) pre-operative assessment score of 3, 4, 5 and *1point* - the duration of operation exceeds the 75th percentile of operation time) Postoperative infection is an important complication of colorectal surgery and continued efforts are needed to minimize the risk of

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surgical site infection (SSI). SSI may be superficial incisional infection involving the subcutaneous tissue, deep incisional infection involving the deep soft tissue or organ/space surgical site infection. Dirty/contaminated surgery would render a SSI risk of >50% [4]. SSIs results in 10 billion dollars in cost/year in USA [3]. The patient with an SSI stays hospitalized 7 days longer, is 60% more likely to spend time in the ICU, is 5 times more likely to be readmitted within 30 days of discharge and is twice as likely to die [5]. Despite the major impact of prophylactic antibiotics, the overall incidence of sepsis after elective surgery remains static (5–10%) [1]. Though technical factors may play a part this residual sepsis may be a reflection of perturbation of the immune system due to surgical stress [6].

**Methods:** A retrospective literature review of published studies on sepsis prevention in colorectal surgery, bacteria-host interactions and the effects of immune deficiency, life-style (smoking, alcohol abuse) and non-steroidal anti-inflammatory drugs on the outcome of colorectal surgery. Electronic searches of the Medline (PubMed) database, Cochrane library, and science citation index were performed to identify original published studies on intra-abdominal sepsis and colorectal surgery. Relevant articles were searched from relevant chapters in specialized texts and all included.

**Results:** The most important factor in determining post-operative sepsis is the presence of viable organisms in the surgical field prior to wound closure. Inter-individual variation in the pattern of mediator release and of end-organ responsiveness may play a significant role in determining the initial physiological response to major sepsis and this in turn may be a key determinant of outcome. Sepsis source control failure in colorectal surgery are more likely in patients with delayed (>24 h) procedural intervention (*Patient/surgeon factor*), higher severity of illness – the Acute Physiology, Age and Chronic Health Care Evaluation score (APACHE >15 (*patient/disease factor*), advanced age- >70yrs (*patient factor*), co-morbidity (*patient factor*), poor nutritional status (*patient/disease factor*) and a higher degree of peritoneal involvement – Mannheim peritonitis index (MPI) score (*disease factor*). It would be heralded by persistent or recurrent intra-abdominal infection, anastomotic failure or fistula formation.

## 2. Discussion

Intra-abdominal sepsis in colorectal surgery may be spontaneous (at the time of the colorectal catastrophe) or postoperative. The former may be due to colonic or rectal perforation with a wide aetiology. The latter may be due to an anastomotic leak, inadequate elimination of sepsis, an unrecognised perforation or an infected haematoma. Sepsis prevention in colorectal surgery depends upon (1) the degree of contamination of the peritoneal cavity (*disease factor*), (2) the preoperative status of the patient (*patient factor*) and (3) surgical technique (*surgeon factor*) [7,8]. Thus, the complex interactions between the surgeon, patient and disease (Fig. 1). A reported 12-fold variation in the 30-day mortality rate following emergency abdominal surgery in 21st century Britain ranged from 3.6% in the best performing hospital to 41.7% in the worst [9]. This would be alarming in the developing world where a <17% mortality was reported in Kigali, Rwanda where emergency abdominal surgery was performed in <24 h of admission, guided by the Mannheim peritonitis index score [10]. This shows that surgical outcome depends on a complex interaction of many factors (surgeon, anaesthetist, patient, disease, demography) and success is obtained with the early onset of specific therapeutic procedures in the best hospitals [11].

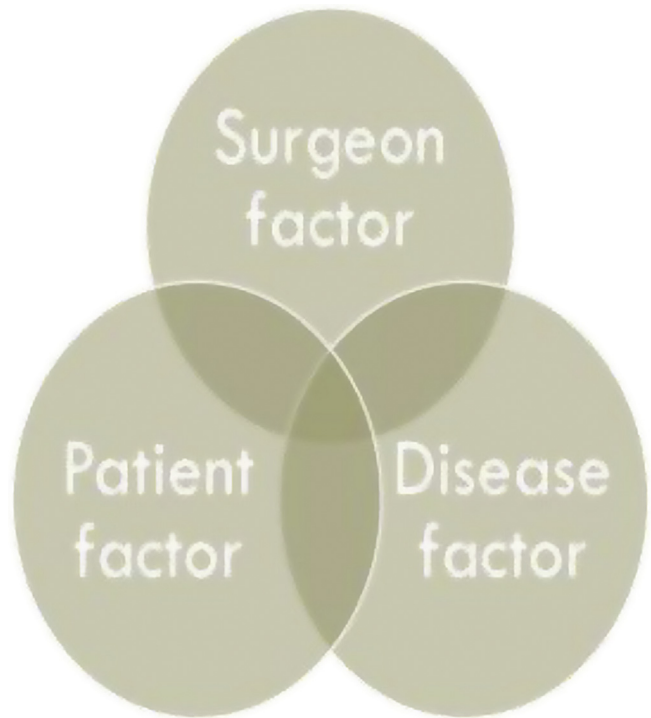


Fig. 1. Schematic diagram of the interaction between surgeon, patient and disease factors.

## 3. Surgeon factor

The most important factor in determining postoperative sepsis is the presence of viable organisms in the surgical field prior to wound closure. Despite antibiotic prophylaxis and therapy surgeon factor (decision-making and surgical technique) remain the single most important factor that can influence the morbidity and mortality from sepsis in colorectal surgery.

### 3.1. Decision-making in emergency colorectal surgery

Decisions about surgery in the emergency setting is made on an individual basis. This include damage-control surgery approach for intra-abdominal sepsis-acute resection of sepsis, drainage, and delayed reconstruction at re-look laparotomy at 48 h after correction of physiology [11], avoiding anastomosis after resection by exteriorising the bowel ends as stomas, or a primary resection of the left-sided colonic/rectal lesion in the form of a Hartmann's procedure where the proximal colon is brought out as an end colostomy and the distal segment either closed off or brought out as a mucous fistula. A laparostomy may be required if there is risk of developing abdominal compartment syndrome from severe sepsis and septic shock [12]. Intraoperative irrigation of the colon is most appropriate for obstructing rectal lesions amenable to primary resection where reservation of colon above a low anastomosis is desirable [13]. The empiric choice on the surgical technique thus seems predominantly driven by patient and disease characteristics. The short term prognosis of the emergency patients is mainly determined by deranged pre-operative physiology and co-morbidities. This is corroborated by a study which demonstrated that post-operative mortality in the emergency setting was not always the direct result of the surgical procedure but very often was the direct result of pre-existing co-morbidity [14].

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