Journal of Hospital Infection 78 (2011) 297–301

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

A bundle of care to reduce colorectal surgical infections: an Australian experience

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ARTICLE INFO

Article history:
Received 9 September 2010
Accepted 21 March 2011
by S.J. Dancer
Available online 12 June 2011

Keywords:
Care bundle
Healthcare-associated infections
Postoperative complications
Quality of healthcare
Surgery
Surgical wound infection

SUMMARY

Use of 'bundles of care' to improve patient outcomes is becoming more widespread; however, their use is more common internationally than in Australia. The objective of this study was to assess the feasibility of implementing a bundle of care for patients undergoing colorectal surgery with the aim of reducing surgical site infections. Each component of the bundle was evidence based, focusing on normothermia, normoglycaemia, oxygen delivery and use of appropriate antibiotics. Implementation required extensive consultation and education, together with a checklist to accompany patients and record whether processes were followed and outcomes achieved. Difficulties were experienced with achieving compliance with processes, although some improvements were seen. There was a link between the use of warming devices and improved maintenance of normothermia. The infection rate fell from 15% [95% confidence interval (CI) 10.4–20.2] before the project to 7% (95% CI 3.4–12.6) 12 months after the project. While the small sample size does not allow definitive conclusions to be drawn, the results are promising. Potential reasons for low compliance with individual components of the bundle of care are discussed. In conclusion, introduction of a bundle of care for patients undergoing colorectal surgery into an Australian hospital was only modestly successful. Despite this, infection rates decreased over the 12 months following introduction of the bundle.

Introduction

The objective of this study was to assess the feasibility of implementing 'a bundle of care' for patients undergoing colorectal surgery with the aim of reducing surgical site infections (SSIs). The bundle of care incorporated maintenance of normothermia, oxygenation, blood pressure and blood sugar level; and administration of appropriate antibiotic prophylaxis.

The study involved collaboration between the Victorian Healthcare Associated Surveillance System Coordinating Centre, which is responsible for collation and reporting of statewide healthcare-associated infection data, and Southern Health, a multicentre health service in Melbourne, Victoria.

Infection rates following colorectal surgery are possibly the highest for any surgical group, with rates in excess of 30% reported for high-risk patients.[1–4] Colorectal surgery involves a contaminated surgical field, and patients often have comorbidities. SSIs after bowel surgery have been associated with significantly higher risk of in-hospital mortality in Victoria.[5]

Antibiotic prophylaxis is a modifiable risk factor for SSIs in patients undergoing colorectal surgery. A number of studies have shown that appropriate prophylaxis reduces the incidence of SSIs for colorectal surgery.[6]

For some time, the US Surgical Care Improvement Project (SCIP) has promoted correct use of antibiotics, normothermia for colorectal patients and strict glucose control for cardiac patients. More recently, maintenance of normothermia was introduced as a recommendation for all patients undergoing surgical procedures lasting 60 min or more under general or neuraxial anaesthesia, unless there is an explicit indication for hypothermia.[7]

Peri-operative glycaemic control is more controversial, particularly with respect to target populations and the aggressiveness of control measures. However, there is an emerging view that normoglycaemia can help to reduce the risk of infection among surgical patients.[8–11]

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0195-6701/$ – see front matter
doi:10.1016/j.jhin.2011.03.029

Methods

Study setting

The project was conducted in the Colorectal Surgical Unit at Dandenong Hospital, a 315-bed acute tertiary referral hospital within Southern Health. Approximately 300 major elective and emergency colorectal procedures are performed in this unit each year. The study period was divided into an implementation phase (1 January 2009–30 June 2009) and a sustainability phase (1 July 2009–31 December 2009).

Development of a bundle of care

Stakeholders delivering care to patients undergoing colorectal surgery were identified, including pre-admission, operating suite, anaesthetic care, post-anaesthetic care and surgical wards. A steering committee was established, headed by the Program Medical Director of Critical Care with representation from colorectal surgeons, the Infection Control Department, the Quality Unit, the Infectious Diseases Department and the Coordinating Centre. On the basis of published literature and consensus views on feasibility, a bundle of care was formulated for patients undergoing colorectal surgery (Table I). Regular focus groups were held to discuss progress. A checklist was developed to accompany each patient, allowing process compliance and some outcome measures to be recorded.

Antibiotic choice was assessed as optimal, adequate or inadequate. An optimal choice followed national guidelines exactly, while an adequate choice fell short of this but was considered, by a panel of infectious disease physicians, to cover the likely pathogens associated with surgery.[12] Recommended prophylactic antibiotics according to Australian guidelines are metronidazole plus either cephazolin or gentamicin; alternatively, cefoxitin may be used as a single agent.

Surveillance methods

Standardized surveillance methods and definitions from the National Health and Safety Network (NHSN) were used. All patients undergoing a colorectal procedure included in the NHSN colon or rectal procedure groups during the study period were included. Subsequent infections were classified as superficial, deep or organ space; no postdischarge surveillance was performed. A project officer was responsible for overseeing compliance with bundle components and education of clinical staff.

Table I
Bundle of care for patients undergoing colorectal surgery

Bundle component	Comments
Temperature maintained ≥36 °C peri-operatively and for 1 h postoperatively	Recommendations included documentation of temperature, use of warmed blankets pre- and postoperatively, use of Bair Huggers and warmed fluids intra-operatively
Fraction of inspired oxygen delivered maintained ≥0.8 intra-operatively; adequate oxygenation for 4 h postoperatively	Adequate postoperative oxygenation was defined initially as administration of at least 6 L oxygen/min and regular monitoring of oxygen saturation. Later in the project, this was changed to use of a high-flow non-rebreathing mask for 4 h postoperatively
Systolic blood pressure maintained ≥90 mmHg intra- and postoperatively	
Blood sugar level maintained ≤10 mmol pre- and intra-operatively	Documentation of pre- and intra-operative blood sugar level was requested from February 2009
Appropriate antibiotic prophylaxis given	Appropriate choice, timing and second dose for prolonged procedures (>3 h)

Statistical analysis

Crude infection rates were calculated, and proportional outcomes were used to assess compliance with individual components of the bundle of care. Standardized infection ratios were calculated as observed infection rates divided by expected infection rates, using NHSN data to calculate the denominator.

Results

One hundred and thirty-three patients and 142 patients underwent colorectal surgery at the study centre during the implementation phase and the sustainability phase, respectively. Most were admitted electively for planned surgery. The median age of patients was 66 years (range 18–90 years). There were 123 females and 152 males. Thirty-two patients were assigned an American Society of Anesthesiologists (ASA) score of 1, 126 patients were ASA 2, 93 patients were ASA 3, 21 patients were ASA 4 and three patients were ASA 5. The median duration of surgery was 190 min (range 15–494 min), and the median length of stay was nine days (range 1–71 days).

Twelve SSIs were identified during the implementation phase, with a crude infection rate of 9% [95% confidence interval (CI) 4.8–15.2]. Ten infections were identified during the sustainability phase, with a crude infection rate of 7% (95% CI 3.4–12.6). In the 12 months immediately before the project, the crude infection rate was 15% (95% CI 10.4–20.2). In the six months immediately before the project, the calculated standardized infection ratio was 2.1; this decreased to 1.6 and 1.3 in the implementation phase and sustainability phase, respectively.

Diabetic control

Fifty-three patients were diabetic. While the study recorded the monitoring of blood sugar level, no specific recommendations for action were made as the hospital has an existing procedure for managing diabetic patients undergoing procedures lasting more than 3 h. Over the entire 12-month period, blood sugar level was recorded pre-operatively for almost all patients with diabetes (96%), although intra-operative monitoring of blood sugar level was only recorded for 67%. The percentage of patients whose recorded blood sugar level was maintained at <10 mmol/L intra-operatively fell from 94% in the implementation phase to 56% in the sustainability phase, although this is based on very small numbers of patients.

Oxygen delivery

Compliance with recommendations for oxygen delivery is summarized in Table II. The highest compliance achieved was 67% intra-operatively and 42% postoperatively.

One hundred and forty-eight patients received a fraction of inspired oxygen (FiO_2) ≥0.8 intra-operatively, and the mean lowest recorded intra-operative oxygen saturation for these patients was

Table II
Compliance with recommended delivery of fraction of inspired oxygen (FiO_2) during study period

Period	No. of patients	Administered FiO_2 ≥0.8 intra-operatively *N* (%)	6 L/min or high-flow mask at 10–12 L/min for 4 h postoperatively *N* (%)
Jan–Feb	38	7 (18.4)	0 (0)
Mar–Apr	48	28 (58.3)	8 (16.7)
May–Jun	47	28 (59.6)	24 (51.1)
Jul–Aug	60	40 (66.7)	20 (33.3)
Sep–Oct	43	24 (55.8)	13 (30.2)
Nov–Dec	38	21 (55.3)	18 (47.4)