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# Open Right-sided Colonic Fast-track Surgery is Associated with Shorter Hospital Stay but more Re-admissions

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## Abstract

**Background:** Fast-track (FT) surgery programs – based on recognized clinical guidelines including opioid and fluid restriction, epidural analgesia, and early mobilization – have been introduced to optimize patient recovery after various surgical procedures. This study was designed to evaluate – with respect to hospital stay, complications, and re-admission rate – a local FT program for patients undergoing open right-sided hemi colectomy at a large urban university hospital in southern Sweden.

**Methods:** We compared retrospectively 86 study patients subjected to open right-sided hemi colectomy after implementation of the FT program (January 2006 – December 2007) with 86 control patients, matched for gender and age, before implementation (January 2000 – February 2005). Patient records were used as the primary source of data. Total hospital stay was the primary endpoint. Secondary endpoints were re-admission, reoperation, complication, and mortality rates.

**Results:** Median total hospital stay was shorter in study compared with control patients (7 *vs.* 9 days; P<0.001), but more study than control patients were re-admitted within 30 days (9.3% *vs.* 2.3%; P=0.046). The patient groups did not differ in reoperation, complication, or mortality rates.

**Conclusion:** This study has shown that clinical implementation of an FT program was associated with shorter hospital stay after open right-sided hemi colectomy, however at the price of more patient re-admissions. Fast-track programs should be evaluated with particular emphasis on hospital re-admissions, and specific measures be taken to identify high-risk patients not to discharge them too early.

**Keywords:** Epidural analgesia; Fast-track surgery programs; Right-sided hemi colectomy

## Introduction

Open right-sided hemi colectomy, a standard procedure for colonic cancer, may be associated with postoperative morbidity induced by abdominal pain, fatigue, muscle catabolism, infection, and venous thromboembolism, all of which may worsen clinical outcome and delay postoperative recovery [1]. Hypothermia also increases risks of bleeding, infection and delayed recovery [2].

Peri-operative neuronal axial block of afferent signals from the field of surgery, mainly by spinal or epidural analgesia (EDA), has been shown to reduce postoperative morbidity [1], surgical blood loss [3], and systemic inflammation [4]. The postoperative course has been proposed to be promoted by fast-track (FT) or enhanced-recovery-after-surgery (ERAS) programs, mainly based on neuronal axial block, titrated infusion of fluid, early oral nutrition, and rapid mobilization [1,5-10]. The ERAS concept, introduced in Northern Europe in 2001 and continuously updated since, is commonly used for colorectal surgery [7,9]. Programs for FT surgery have been reported to be associated with shorter hospital stay lower cost similar re-admission rate and better pain control [11-19].

A peri-operative FT program for colorectal surgery was clinically implemented in Malmö between 1st October and 31st December 2005. This retrospective clinical study has been designed to evaluate this program in patients undergoing right-sided hemi colectomy with respect to postoperative recovery, total hospital stay, postoperative complications, re-admission rate and patient mortality.

## Methods

### Study design

The study was approved by the regional Human Research Ethical Review Board at Lund University, Lund, Sweden (Reference No. 2015/638). Study patients, subjected to right-sided open hemi colectomy for colonic cancer at Skåne University Hospital in Malmö during an initial two-year period after implementation of the program (from 1st January 2006 until 31st December 2007), were compared with control patients, matched for gender and age, and subjected to the same surgical procedure, during a five-year period before implementation of the program (from 1st January 2000 until 28th February 2005).

In total, 142 patients were eligible for inclusion after, and 222 patients before, implementation of the FT program. Patients with non-elective admission, or subjected to non-elective (or other major)

surgery, were not included (Figure 1). The study comprised 86 study patients, and 86 control patients..

### Collection of data

Patient data was obtained from the regional electronic operation planning system, electronic patient journals, and a local EDA database.

### Variables

Data obtained was categorized to reflect background, process, and outcome variables. The primary outcome variable was total hospital stay, calculated as days from admission to discharge. Complications were recorded independently.

### Statistical methods

Statistical data was analyzed with the Statistical Package for the Social Sciences (SPSS) version 23 (IBM Inc., Armonk, New York, USA) software.

Results are reported as median with interquartile range in parenthesis and compared between study and control patients with the Mann-Whitney U-test. A multivariate logistic regression analysis was done to identify potential confounders.

P-values < 0.05 were considered statistically significant.

## Results

There was no difference in background variables between study and control patients (Table 1), and they were not associated with the duration of hospital admission.

| | Before fast-track program (n=86) | After fast-track program (n=86) | P value |
|---|---|---|---|
| Age[1] (years) | 77 (71-81) | 78 (69-82) | >0.300 |
| Female gender (%) | 51 | 51 | >0.300 |
| ASA2 classification (%) | | | >0.300 |
| 1 | 16 | 13 | |
| 2 | 59 | 65 | |
| 3 | 24 | 21 | |
| 4 | 1 | 1 | |
| Body mass index[1] (kg/m$^2$) | 25 (23-28) | 25 (21-26) | 0.279 |
| Hypertension (%) | 39 | 28 | 0.146 |
| Cardiovascular disease (%) | 38 | 45 | 0.257 |
| Diabetes mellitus (%) | 10 | 15 | >0.300 |
| Chronic obstructive pulmonary disease (%) | 11 | 8 | >0.300 |

**Table 1:** Background variables in patients subjected to open right-sided hemi colectomy before and after clinical implementation of a peri-operative fast-track program at a large urban university hospital in southern Sweden; Median (interquartile range); American Society of Anesthesiologists.

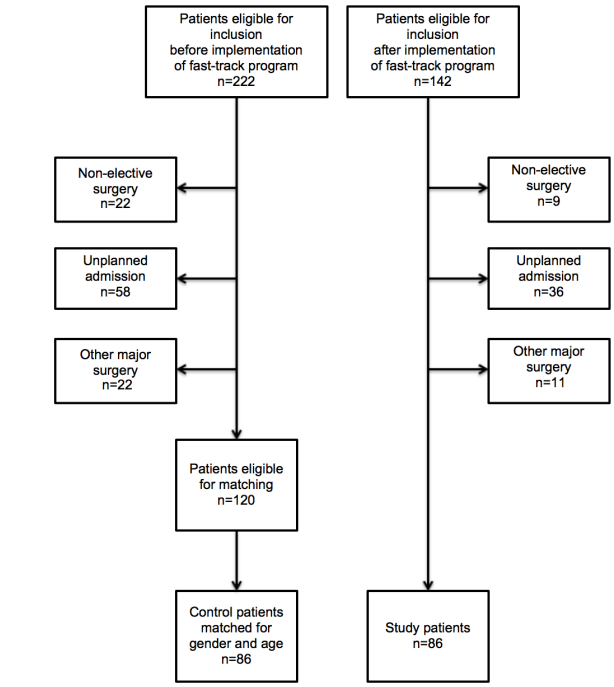


**Figure 1:** Flowchart of patients subjected to open right-sided hemi colectomy before (control patients) and after (study patients) clinical implementation of a peri-operative fast-track program at a large urban university hospital in southern Sweden.

There was no difference in process variables between study and control patients. Epidural anesthesia was used more after the FT program had been implemented (Table 2).

| | Before fast-track program (n=86) | After fast-track program (n=86) | P value |
|---|---|---|---|
| Duration of anesthesia[1] (h) | 3.8 (3.2-4.3) | 3.5 (3.0-4.0) | 0.123 |
| Duration of surgery[1] (h) | 2.7(2.0-3.2) | 2.4 (2.0-2.8) | 0.149 |
| Perioperative bleeding[1] (l) | 0.2 (0.2-0.3) | 0.2 (0.1-0.3) | 0.176 |
| Epidural analgesia (%) | 9.1 | 72 | <0.001 |

**Table 2:** Process variables in patients subjected to open right-sided hemi colectomy before and after clinical implementation of a peri-operative fast-track program at a large urban university hospital in southern Sweden; Median (interquartile range) (1).

The multivariate model showed that patients subjected to right-sided hemi colectomy after the FT program had been implemented had significantly shorter (approximately 2 days) hospital stay than patients operated before the program, whereas there was no difference

in clinical complications, reoperation or mortality rates. Total hospital stay did not differ between study patients with or without EDA (P=0.197). The number of surgical re-admissions within 30 days was, however, significantly higher after the program had been implemented (9.3% compared with 2.3%). Main reasons for re-admission were thrombosis in the superior mesenteric vein or cholecystitis before, and pain, ileus, melena, wound rupture, anastomotic insufficiency or abscess formation after, implementation of the FT program (Table 3).

| | Before fast-track program (n=86) | After fast-track program (n=86) | P value |
|---|---|---|---|
| Total hospital stay1 (days) | 9 (8-12) | 7 (6-9) | <0.001 |
| Re-admission within 30 days (%) | 2.3 | 9.3 | 0.046 |
| Complications | | | |
| Severe infection (%) | 9.1 | 4.7 | 0.256 |
| Moderate infection (%) | 8.0 | 1.2 | 0.064 |
| Anastomosis leakage (%) | 1.1 | 1.2 | >0.300 |
| Venous thromboembolism (%) | 0 | 0 | |
| Bleeding/haematoma (%) | 2,3 | 3.5 | >0.300 |
| Wound rupture (%) | 2.3 | 2.4 | >0.300 |
| Patient mortality (%) | 3.4 | 4.7 | >0.300 |
| Reoperation (%) | 5.7 | 9.3 | >0.300 |

**Table 3**: Outcome variables in patients subjected to open right-sided hemi colectomy before and after clinical implementation of a peri-operative fast-track program at a large urban university hospital in southern Sweden; Median (interquartile range)(1).

## Discussion

We have shown that implementation of an FT program for right-sided hemi colectomy was associated with shorter hospital stay, although at the price of more re-admissions. Despite our low total number of re-admissions it seems that many study patients were readmitted for problems associated with a normal postoperative course (e g., pain or ileus) after the program had been implemented. Although the optimal duration of hospital stay to minimize the re-admission rate is unknown, it seems important to identify, at an earlier stage, patients with higher risk for complications not to discharge them too early. Other studies have accordingly reported FT programs to be associated with shorter total hospital stay, however with no change in re-admission rate [11,13,14].

We found no change in patient mortality rate in agreement with findings by others [11,14-16].

In contrast to our findings, female gender (together with early postoperative mobilization and oral intake) has been reported to be associated with shorter hospital stay [17].

Previous studies of the FT concept have been based on various kinds of colorectal surgery [11-16]. To improve clinical evaluation of the FT program and minimize influence of confounding factors, we chose to evaluate this program during and after moderate and standardized abdominal surgery. We therefore compared control and study patients subjected to open right-sided hemi colectomy at a single surgical site.

The only process variable found to have been influenced by the program is the use of EDA. Although approximately one fourth of our study patients did not receive one, EDA per se was not found to influence total hospital stay in contrast to findings in a previous report [18]. Plausible reasons for no EDA might have been clinical contra-indications, patient unwillingness or low compliance to the program. Adherence of medical staff to FT programs has been reported as varying or even deficient [10].

Background data cannot explain differences in clinical outcome between our control and study patients. During the eight-year study period, new surgical and anesthesiology procedures and techniques, partly inspired by the FT concept, together with better bedside patient care, and more strained financial conditions might also have promoted earlier patient discharge. This makes it harder to conclude that the FT program alone accounts for the shorter hospital stay in our study patients. Nevertheless, it should be pointed out that this study reflects two periods of time immediately preceding and following local implementation of this program in clinical practice. Since its implementation was allowed to take almost a year, we still consider our findings to reflect actual influence of its major components on clinical outcome.

In conclusion, clinical implementation of an FT concept has been found to reduce hospital stay after open right-sided hemi colectomy, however at the price of more hospital re-admissions. We hence consider clinical measures to be taken to identify patients with higher risk for complications not to discharge them too early. Future studies should preferably be designed to evaluate FT programs with particular emphasis on hospital re-admissions, patient satisfaction, and long-term follow-up.

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