Adjusted enhanced recovery after surgery (ERAS) protocol in colorectal surgery at dr. Cipto Mangunkusumo General Hospital, Jakarta

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ABSTRACT

Background: The Enhanced Recovery After Surgery (ERAS) strategy has been proven to be successful in lowering hospital perioperative problem rates and postoperative length of stay (LOS) in colorectal surgery. The inability of dr. Cipto Mangunkusumo General Hospital to implement all of the components of the ERAS protocol was attributed to three major factors: patient-related (compliance), physician-related (silo mentality), and hospital-related (long waiting lists and inability to provide required facilities). This study aims to determine how well the ERAS procedure can be partially implemented to achieve the ERAS objective.

Methods: This study is a cross-sectional study involving sixty-three colorectal patients who underwent surgical procedures between 2015 and 2017 were evaluated retrospectively for complete ERAS protocol implementation. The complete implementation is the ability to accomplish all 15 ERAS components. Demographic, clinical, and total LOS data were also collected from medical records. These samples were analyzed using univariate analysis and Pearson correlation tests to determine the relationship between the number of ERAS components that accomplish per subject and the LOS of the patient.

Results: Eleven out of 15 ERAS components were implemented on 63 patients. The majority of the cohort were female (male-to-female ratio of 1:1.2) with an average age of 53 years, 0% mortality, 7.9% morbidity (1.6%, 1.6%, and 4.8% due to surgical site infection, pneumonia, and urinary retention, respectively), and underwent conventional rather than laparoscopic surgery (84.1% vs. 15.9%). The most common location of tumors and procedures were sigmoid (47.6%) and colostomy closure (25.4%). None of the patients was able to comply with all components of the ERAS protocol; however, the results from 6 patients who implemented ten or more components of the ERAS protocol showed a higher reduction rate of the total LOS from 8–12 days to only five days (a reduction rate of 62.5%) compared to patients who completed less than 10 components (p<0.01, r=−0.568).

Conclusion: Implementing at least 10 ERAS components may have a similar impact to fully implementing the ERAS protocol regarding how patients who have colorectal surgery are managed. These ten components are subsequently called the adjusted ERAS protocol for colorectal surgery.

Keywords: Adjusted, Colorectal, Enhanced Recovery after Surgery, Protocol.

INTRODUCTION

The Enhanced Recovery After Surgery (ERAS) protocol, also called a fast-track surgery, is a collection of evidence-based perioperative strategies that work synergistically to improve postoperative recovery among patients undergoing surgery. The ERAS protocol for colorectal surgery has been proven to shorten the recovery time and reduce the length of stay (LOS) following surgery. The first concept of ERAS was introduced by Henrik Kehlet, a professor in digestive surgery at the University of Copenhagen, who combined various interventions to reduce surgical stress. In 2001, the ERAS protocol was introduced by a group of surgeons in London. In 2005, the ERAS Guideline was established for colorectal procedures and has been expanding until now. According to the ERAS protocol published in 2014, there are 15 ERAS components to be implemented perioperatively in patients undergoing colorectal surgery. In 2019, the Department of Surgery at dr. Cipto Mangunkusumo General Hospital conducted a study assessing the use of the ERAS protocol in colorectal cases and concluded that implementing all 15 ERAS components was unsuccessful. This was attributed to three major factors: patient-related (compliance), physician-related (silo mentality), and hospital-related (long waiting list and inability to provide required facilities). For these reasons, the authors realized that adjusting the existing ERAS protocol might be necessary to increase compliance while aiming to...
achieve its goal of reducing the LOS, which is less than six days of hospitalization. This study aims to assess the effectiveness of a partial implementation of the ERAS protocol in achieving the ERAS goal.

**METHOD**

We conducted a cross-sectional study and collected relevant data from the medical records to establish the adjusted ERAS protocol for colorectal surgery. Subjects comprised patients who underwent colorectal surgery between 2015 and 2017 at dr. Cipto Mangunkusumo General Hospital. The following criteria were used to include the potential subjects: 1) patients aged ≥18 years, 2) patients who underwent elective colorectal surgery, and 3) patients with complete data recorded in their medical records. Meanwhile, the exclusion criteria included the following: 1) patients with stage 4 colorectal cancer; 2) patients who underwent multiorgan resection; 3) patients who underwent emergency surgery; and 4) patients with ASA class 4. We used the total sampling method in determining the sample that will take part in this study and then match it with the eligibility criteria that we have determined. The data were retrospectively evaluated for successful implementation of the ERAS protocol. LOS of the patient started to count from the day of operation to discharge. Data processing was performed using the SPSS version 25.0 to help with statistical calculations. The collected data were further analyzed using statistical univariate analysis and Pearson correlation tests to determine the relationship between the number of ERAS components that accomplish per subject and the LOS of the patient. Components implemented in patients hospitalized for five days or less were recorded as the reference to establishing the adjusted ERAS protocol for colorectal surgery.

**RESULT**

We collected the data from 146 patients who underwent colorectal surgery at dr. Cipto Mangunkusumo General Hospital between January 2015 and December 2017, of whom only 63 met the inclusion criteria. The mean age was 53 years old. The cohort was mostly female, with a male-to-female percentage ratio of 46% to 54%. Around 84.1% of patients underwent surgery with a conventional approach, while only 15.9% underwent laparoscopic surgery. The most common location of tumors and procedures were sigmoid (47.6%) and colostomy closure (25.4%). The patients’ morbidity was attributed to surgical site infection (1.6%), pneumonia (1.6%), and urinary retention (4.8%). Table 2 shows postoperative morbidity and mortality.

Table 2. Postoperative morbidity and mortality.

<table>
<thead>
<tr>
<th>COMPLICATION (n=63)</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>TOTAL</th>
<th>Percentage(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Morbidity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Urinary retention</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4.8</td>
</tr>
<tr>
<td>Ileus</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Deep vein thrombosis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Abdominal abscess</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Bleeding</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Heart problem</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Leakage anastomosis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 1. Patient characteristics, types of operations, tumor location, and surgical procedures.

<table>
<thead>
<tr>
<th>VARIABLES (n=63)</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>TOTAL (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients (n)</td>
<td>24</td>
<td>17</td>
<td>22</td>
<td>63</td>
</tr>
<tr>
<td>Age (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–65 years old</td>
<td>91.7</td>
<td>76.5</td>
<td>86.3</td>
<td>85.7</td>
</tr>
<tr>
<td>&gt;65 years old</td>
<td>8.3</td>
<td>23.5</td>
<td>13.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>37.5</td>
<td>53.0</td>
<td>54.5</td>
<td>46.0</td>
</tr>
<tr>
<td>Female</td>
<td>62.5</td>
<td>47.0</td>
<td>45.5</td>
<td>54.0</td>
</tr>
<tr>
<td>Surgical approach (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laparoscopic</td>
<td>8.3</td>
<td>17.6</td>
<td>22.7</td>
<td>15.9</td>
</tr>
<tr>
<td>Open/Conventional</td>
<td>91.7</td>
<td>82.4</td>
<td>77.3</td>
<td>84.1</td>
</tr>
<tr>
<td>Location (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ascending colon</td>
<td>16.7</td>
<td>23.5</td>
<td>22.7</td>
<td>20.6</td>
</tr>
<tr>
<td>Tranverse colon</td>
<td>0.0</td>
<td>11.8</td>
<td>9.1</td>
<td>6.3</td>
</tr>
<tr>
<td>Descending colon</td>
<td>12.5</td>
<td>11.8</td>
<td>4.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Sigmoid colon</td>
<td>54.2</td>
<td>35.3</td>
<td>50.0</td>
<td>47.6</td>
</tr>
<tr>
<td>Rectum</td>
<td>16.7</td>
<td>17.6</td>
<td>13.6</td>
<td>15.9</td>
</tr>
<tr>
<td>Surgical procedures (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right hemicolectomy</td>
<td>12.5</td>
<td>23.5</td>
<td>18.1</td>
<td>19.0</td>
</tr>
<tr>
<td>Left hemicolectomy</td>
<td>0.0</td>
<td>5.9</td>
<td>9.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Colostomy closure</td>
<td>37.5</td>
<td>17.6</td>
<td>13.6</td>
<td>25.4</td>
</tr>
<tr>
<td>Anterior resection</td>
<td>8.3</td>
<td>5.9</td>
<td>13.6</td>
<td>9.5</td>
</tr>
<tr>
<td>Low anterior resection</td>
<td>8.3</td>
<td>11.8</td>
<td>9.0</td>
<td>9.5</td>
</tr>
<tr>
<td>Hartmann’s procedure</td>
<td>12.5</td>
<td>5.9</td>
<td>4.5</td>
<td>6.3</td>
</tr>
<tr>
<td>Hartmann’s procedure reversal</td>
<td>4.2</td>
<td>11.8</td>
<td>27.3</td>
<td>14.3</td>
</tr>
<tr>
<td>Abdominoperineal resection</td>
<td>16.6</td>
<td>17.6</td>
<td>4.5</td>
<td>12.7</td>
</tr>
</tbody>
</table>

We found that up to 11 of the 15 ERAS components could be implemented for 63 patients. Eleven ERAS components were successfully implemented in one subject and 10 in 5 subjects, while the other subjects could only comply with less than 10 ERAS components. From the statistical
analysis, there was a significant correlation between the number of ERAS components implemented per subject and the length of stay; the greater the number of ERAS components per subject, the lower the total length of hospital stay. By applying at least 10 of the ERAS components to one subject, the LOS could be reduced to five days.

Table 3. Correlation between the number of ERAS components fulfilled and length of hospital stay.

<table>
<thead>
<tr>
<th>Sum Number of ERAS Components Per Subject</th>
<th>Number of Samples (Person)</th>
<th>Average Length of Stay (LOS)</th>
<th>p-value</th>
<th>Correlation Coefficient (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 4</td>
<td>0</td>
<td>-</td>
<td>&lt;0.01</td>
<td>-0.568</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>9 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>10 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>21</td>
<td>9 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>8 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>12</td>
<td>6 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>5 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>4 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 to 15</td>
<td>0</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DISCUSSION**

The ERAS protocol, which consists of 15 components, should be fulfilled to achieve the desired goals. However, those components cannot always be implemented completely, especially at dr. Cipto Mangunkusumo General Hospital. The current study showed that no patient could comply with all the ERAS protocol components, with only six subjects successfully complying with 10 or more ERAS components, while the remaining subjects could not even comply with 10 ERAS components. Failure to fully implement ERAS is typically linked to three major factors: patient, physician, and hospital. Regarding the patient factor, their compliance becomes the major problem in implementing the ERAS protocol. For example, not all Indonesian people are accustomed to chewing gum, and doing so subjects the patients to an increased risk of aspiration and choking. Regarding the physician factor, the treating surgeons still struggle with a silo mentality. The operation team members who contribute to the ERAS implementation include surgeons, anesthesiologists, paramedics, and clinical nutritionists, most of whom still engage in performing conservative treatments for perioperative care in patients undergoing colorectal surgery, such as six hours of preoperative fasting, a low carbohydrate preoperative diet, non-routine use of anti-thrombotic medication, routine use of postoperative drainage or a nasogastric tube, long-term use of urine catheters, and postponing the postoperative diet. Regarding the hospital factor, the main issue is related to the long queue for getting listed for a surgical procedure as well as the inability to provide required facilities such as routine use of anti-thrombotic medication (due to government policy for the list of drugs used in colorectal surgery), chewable gum, and a high carbohydrate diet. Because such treatment is not covered by national health insurance, it can place a significant financial burden on patients. The components that contribute the most to the reduction of LOS are the accelerated removal of surgical drains, nasogastric tubes, and urine catheters.

The non-implemented ERAS components at our institution included a high-carbohydrate preoperative diet, shortening of fasting, anti-thrombotic medication, and chewable gum. Despite being unable to administer such an intervention, implementing only 10 ERAS components on one patient has
already suggested a significant reduction
in the LOS from 8–12 days to five days (a
reduction rate of 62.5%). Related
to the presented results, it is possible
and acceptable only to implement most,
but not all, components of the 2014
ERAS protocol. We called this 10 ERAS
cOMPONENT-based protocol an adjusted
ERAS protocol.

The limitation of this study includes
a small number of samples obtained and
incomplete data because this study used
medical records designed for service, not
peculiarly for research purposes. Larger
scale studies will be required to evaluate
the efficacy of implementing the ERAS
protocol in Indonesia.

CONCLUSION
The 10 ERAS component-based protocol
implemented at Dr. Cipto Mangunkusumo
General Hospital are later called the
adjusted ERAS protocol for colorectal
surgery, adapted from the ERAS protocol
published in 2014. Applying the adjusted
ERAS protocol in colorectal cases can
reduce the LOS to five days and ultimately
improve the quality of service in colorectal
surgery, especially in Indonesia.

ETHICS CONSIDERATION
The Committee of Ethics Faculty of
Medicine Universitas Indonesia approved
the study (No 1200/UN2.F1/ETIK/2018).

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AUTHOR CONTRIBUTION
All authors have contributed to all
processes in this research, including
preparation, data gathering, analysis,
drafting, and approval for publication of
this manuscript.

CONFLICT OF INTERESTS
The authors report no conflicts of interest
in this work.

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Jakarta.

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