

# Multimodal approach in colorectal surgery without mechanical bowel cleansing

## *Abordagem multimodal em cirurgia colorretal sem preparo mecânico de cólon*

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### A B S T R A C T

**Objective:** To evaluate the outcomes after the implementation of a multimodal protocol (ACERTO protocol) with patients undergoing colorectal operations. **Methods:** Fifty-three patients (37 M and 16 F; 57 [18-82] years old) submitted to various colorectal operations were prospectively studied in two different periods of time: from January 2004 through July 2005 (n=25, conventional group) and from August 2005 through June 2008 (n=28; ACERTO group). The patients received either the traditional perioperative management (including mechanical bowel cleansing) or a multidisciplinary protocol of perioperative care (without mechanical bowel cleansing) established by the ACERTO protocol. We looked at morbidity and mortality rates and length of hospital stay for comparisons between the groups. **Results:** Mortality was 3.8% (2 patients) without difference between groups. Preoperative fasting and postoperative feeding were shortened and intravenous fluids were diminished in patients operated under the ACERTO protocol (p<0.05). Postoperative morbidity (36% vs. 28.6%; p=0.56) and the incidence of anastomotic leak (12 vs. 10.7%; p=1.00) were similar. The number of complications per patient with any complication was lower in the ACERTO group (p=0.01). Changing protocols reduced the length of hospital stay by 4.5 days (12 [4-43] vs. 7.5 [3-47] days, p= 0.04). **Conclusion:** The multidisciplinary routines of the ACERTO protocol are safe and enhanced recovery in colorectal surgery by reducing both hospitalization and the severity of postoperative morbidity.

**Key words:** Nutritional therapy. Colorectal surgery. Preoperative care. Postoperative care. Postoperative complications.

### INTRODUCTION

The postoperative recovery of patients who underwent operations involving the colon and rectum is still a great challenge for the surgeon. Postoperative infection rates, especially surgical wound and intraabdominal infections, are statistically considerable in those operations<sup>1</sup>. In spite of technical advances in coloproctology, such as laparoscopic access and the use of staplers, some routines concerning perioperative care have hardly changed over time<sup>2</sup>. Recent studies have attempted to revise those concepts and routines, confronting empirically established principles with the weight of evidence. Regarding colorectal surgery, the main points addressed in those studies are related to the nutritional approach (perioperative nutritional support, reduction in the preoperative fasting period and early resumption of feeding in the postoperative period), restriction in the use of drains and nasogastric tubes; shorter perioperative intravenous fluid therapy, and systematic use of preoperative mechanical bowel cleansing in colorectal surgery. Emphasis has also been placed on the rational use of antibiotics, pain management, postoperative nausea and

vomiting, emotional preparation of patients, and on a physiotherapeutic approach providing ultra-early mobilization and early return to the activities of daily living<sup>2-5</sup>.

Results produced by the European multicenter project named ERAS (Enhanced Recovery After Surgery) point to new prospects for perioperative management with a view to reducing surgical complications and accelerating patient recovery<sup>3,4</sup>. This new multimodal approach is based on a broad range of randomized studies consistently demonstrating that the adoption of *fast track* programs supported by the practice of evidence-based medicine can provide for early return of bowel function and improve patients' physiological functions, leading to a reduction in hospital stay and operative morbidity<sup>5-12</sup>.

Based on the above, we developed a project at the Department of Clinics and Surgery of the Faculdade de Ciências Médicas at the Universidade Federal do Mato Grosso, throughout the year of 2005, with the purpose of accelerating the postoperative recovery of patients submitted to abdominal surgery. The project came to be known as ACERTO PÓS-OPERATORIO (*Aceleração da Recuperação Total Pós-Operatória* – Total Postoperative

Study conducted at the Department of Clinics and Surgery of the FCM/UFMT, MT, Brazil.

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Recovery Acceleration) or simply ACERTO protocol. This is a multidisciplinary program (involving the services of general surgery, anesthesia, nutrition, nursing and physical therapy) founded on evidence-based practice and establishing a set of perioperative care measures with the aim of expediting the surgical patient's recovery. The initial outcomes of the ACERTO protocol have been published and showed that the institution of these new routines brought about a decrease in postoperative morbidity and hospital stay for patients undergoing various medium-complexity and major operations of the gastrointestinal tract and abdominal wall<sup>13-14</sup>. The aim of the present study was to evaluate the immediate postoperative outcomes following the institution of the ACERTO protocol – therefore, without mechanical bowel cleansing – in patients who underwent colorectal operations.

## METHOD

Patients who underwent large bowel surgery with at least one anastomosis at the General Surgery Service of the Hospital Universitário Júlio Müller between January 2004 and June 2008 were studied prospectively (N=53). The project was submitted to, and approved by, the Ethics Committee of the Hospital.

The observation was conducted in two phases. The first (from January 2004 through June 2005, conventional group), before the institution of the ACERTO project – thus, under the conventional protocol including mechanical bowel cleansing. The second (August 2005 through June 2008, ACERTO group), with patients receiving perioperative care according to the ACERTO protocol and, therefore, without bowel cleansing. Table 1 shows the operations performed and the patients' demographics for each phase.

The collection of data was carried out daily in both phases by medical students doing undergraduate research. Table 2 shows the set of measures established by the ACERTO project and the conventional routines that were being followed before its implementation.

The study variables were: (1) institution of preoperative nutritional support, (2) length of preoperative fasting, (3) volume of postoperative intravenous fluid therapy; (4) starting day of postoperative oral or enteral feeding. In order to assess the impact of such procedures, the two groups were evaluated for mortality, morbidity (with an emphasis on surgical site infection and anastomotic fistulae) and length of postoperative hospitalization. Surgical site infection was defined according to the criteria proposed by Mangram *et al.*<sup>15</sup>. All patients received antibiotic prophylaxis for 24 hours and a prokinetic agent (metoclopramide, 10 mg IV 6-hourly). The intravenous antimicrobial regimen consisted of metronidazole (500 mg 8-hourly) associated with amikacin (500 mg 12-hourly) or cefoxitin (1 g 8-hourly). Whenever a technical error occurred in surgery or the patient was immunocompromised or if there were clinical or laboratory indications of infection, antibiotics were prescribed therapeutically. All patients in the conventional group underwent preoperative mechanical cleansing with mannitol.

Statistical analysis of the data was carried out using the statistical software SPSS 8.0. The variables length of preoperative fasting, length of hospital stay, postoperative day (POD) for resumption of oral feeding, and volume of intravenous fluid infused postoperatively were assessed for normality, and subsequently for homogeneity of variances through Levene test. For parametric data, Student's t-test was used (data expressed as means and standard deviations), and for the comparison between non-parametric data, Mann-Whitney test was used (data expressed as medians and variations). Categorical variables were analyzed by the chi-square or Fisher's exact test, as required. The value of  $p < 0.05$  was considered to be statistically significant.

## RESULTS

Throughout the study period, 53 patients underwent elective colon and rectum operations involving at least one anastomosis. In the conventional group, 25

**Table 1 -** Clinical and epidemiological characterization of the groups of patients operated on under the conventional and ACERTO protocols.

	Conventional (n=25)	ACERTO (n=28)	p
Sex (M/F)	19/6	18/10	0,38
Age (years)	56 (18-81)	58 (18-82)	0,52
Malignant neoplasia	16 (64)	18 (64,3)	p=0,85
Malnutrition	13 (52%)	10 (35,7%)	p=0,27
Operative time (hours)	4,5 ± 1,8	3,8 ± 1,8	p=0,16
Bowel cleansing	25 (100%)	0 (0%)	<0,001
Type of operation			
Partial colectomy	13 (52)	11 (39,1)	0,40
Closure colostomy	6 (24)	9 (32,1)	
Retosigmoidectomy	3 (12)	7 (25)	
Miscellaneous	3 (12)	1 (3,6)	

**Table 2 -** Management in surgery colorectal applied in the general surgery infirmary of the HJUM before and after the implementation of the ACERTO PÓS-OPERATÓRIO project.**Conventional management**

- Preoperative nutritional support for 5-10 days for malnourished patients.
- Minimum preoperative fasting of 8 h (since the night before surgery).
- Institution of postoperative diet after passing of flatus or evacuation (end of ileus).
- Postoperative intravenous hydration at 40ml/kg until resumption of feeding.
- Systematic mechanical bowel cleansing with mannitol for colorectal surgery.
- Use of drains, tubes and antibiotics at the surgeon's discretion.
- Early postoperative mobilization.

**Management as prescribed by the ACERTO PÓS-OPERATÓRIO project**

- Preoperative nutritional support for 7-10 days for malnourished patients.
- Prolonged preoperative fasting not allowed. Fasting of 8 h for solids. Fluid diet reinforced with carbohydrates 6 and 2 h before surgery. Exception: morbidly obese patients, severe GER and impaired gastric emptying.
- Reintroduction of feeding in the immediate PO or 1st POD (fluids).
- Intravenous hydration at no more than 30 ml/Kg/day until POD 1. At the doctor's discretion, extend beyond POD 1 and increase volume.
- No preoperative bowel cleansing.
- No routine drains or tubes. Rational and standardized use of antibiotics\*.
- Inform the patient before the operation the details of the procedure to be performed, encouraging him/her to deambulate and resume feeding early in the PO.
- Ultra-early mobilization: have the patient deambulate or sit up on the same day of the operation for at least 2 h. Over the following days the patient should be encouraged to stay out of bed for 6h.

patients were operated on, and 28 in the ACERTO group. Two deaths occurred in the postoperative period (overall mortality rate of 3.8%), one in each study phase ( $p > 0.05$ ).

**Preoperative nutritional support therapy**

Twenty-three patients (43.4%) were considered to be malnourished: 13 (52%) in the conventional group and 10 (35.7%) in the ACERTO group ( $p = 0.27$ ). No difference existed between the groups as shown in table 1. The malnourished patients in the ACERTO group were given significantly more preoperative nutritional support than in the previous phase (70%; 7/10 vs. 23.1%; 3/13;  $p = 0.039$ ).

**Preoperative fasting**

The length of preoperative fasting was twice as long as the prescribed length for the patients of both groups (table 3). A statistically significant ( $p < 0.0001$ ) decrease occurred in preoperative fasting duration between the conventional group ( $20 \pm 6$  hours) and the ACERTO group ( $4.5 \pm 3$  hours).

**Resumption of feeding in the postoperative period**

The following results are shown in table 3. The patients in the ACERTO group resumed feeding one day sooner than those in the conventional group (1st POD [immediate PO–6th POD] versus 2nd POD [1st POD–5th POD];  $p = 0.01$ ). Eighteen patients (64.3%) in the ACERTO group were given diet no later than the first POD. In contrast, only 3 (12%) patients in the conventional group resumed feeding until the first POD.

**Perioperative hydration**

The volume of crystalloid fluids administered to the patients in the two groups is shown in table 3. The conventional group received 50% more intravenous crystalloid fluids than the ACERTO group ( $p = 0.03$ ). The volume of crystalloid infusion per day of postoperative hospital stay was twice as high in the conventional group ( $2.1 \pm 0.4$  vs.  $1.3 \pm 0.4$  L;  $p < 0.001$ ).

**Length of postoperative hospital stay**

The length of postoperative hospital stay was significantly reduced by 4.5 days on average in the period

**Table 3 -** Outcomes of the perioperative management with fasting and postoperative intravenous fluid replacement in the two types of protocol.

	Conventional	ACERTO	p
Duration of preoperative fasting (hours)	20 $\pm$ 6	4,5 $\pm$ 3	<0,01
Postoperative day of diet resumption	2° [1°-5°]	1° [0-6°]	0,01
Volume of intravenous hydration postoperatively (liters)	26 [9-70]	17 [2-120]	0,03

following the institution of the ACERTO protocol (12 [4-43] days vs. 7.5 [3-47] days,  $p=0.04$ ). This result is shown in figure 1.

### Postoperative morbidity

There was no statistical difference for overall morbidity rate, surgical site infection and anastomotic fistulae. However, the number of complications per patient with some form of morbidity was twice as high in the conventional group ( $p=0.01$ ). These data are shown in table 4.

## DISCUSSION

The results of this study showed that with the new protocol it was possible to shorten the time of perioperative fasting and to reduce intravenous fluid replacement. It was also possible to perform colorectal anastomoses with no mechanical bowel cleansing without negative effects on surgical outcomes. Quite the contrary, a reduction was observed in the duration of postoperative hospital stay and a lower degree of infectious morbidity in terms of number of complications per patient presenting some form of morbidity. Therefore, adopting a multidisciplinary program with scientifically founded measures represented a substantial improvement in outcomes.

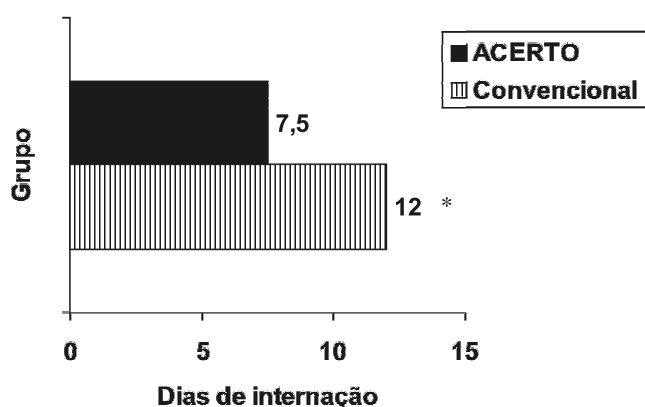


Figure 1 - Days of hospital stay (median) of the patients who underwent colorectal surgery under the conventional and the ACERTO protocol.

\* ;  $p = 0.05$  vs. ACERTO PÓS. group.

Multiple studies have underlined the importance of preoperative nutritional support for malnourished patients<sup>2</sup>. Nevertheless, the fact is that even with guidelines prescribing preoperative nutritional support for those patients, this was not happening in most cases. With the institution of the ACERTO project, this issue received more attention, and thus more patients were benefited. This fact, in conjunction with other measures, must have influenced the improved results observed in the second phase of the study.

Prolonged preoperative fasting, usually between six and eight hours, has been an accepted practice for many years. The rationale of this routine is to ensure gastric emptying and prevent bronchoaspiration on anesthetic induction. However, this rationale has been put in question, as there seems to be no evidence that shortened fasting times for fluids as compared with the conventional regimen increase the risk of pulmonary aspiration or morbidity<sup>16</sup>. This argument is reinforced by findings demonstrating that preoperative fasting, in addition to being very uncomfortable and unnecessary, can be detrimental as it potentiates or perpetuates the body's response to trauma<sup>17</sup>. Anesthesia societies now recommend more liberal guidelines with regard to fasting, allowing the use of clear fluids up to two hours before surgery. Recent studies suggest that giving patients a carbohydrate-rich beverage affords more fulfillment, less irritability, less vomiting, a rise in gastric pH and, especially, a milder metabolic response to surgical stress<sup>18</sup>. We have routinely given our patients a supplementation with a carbohydrate solution two to six hours prior to the operation<sup>13,14</sup>. For that reason, the patients in the ACERTO group spent half the time fasting in relation to the conventional group. It is noteworthy that delays do occur<sup>13</sup>, and neither group followed the established protocol to the letter. In this respect, the patients in the conventional group were certainly more at a disadvantage and had a much longer fasting period.

There are considerable advantages to early feeding in the postoperative period of elective operations<sup>19</sup>. However, many surgeons still only prescribe a diet in the postoperative period after peristalsis is resumed, which is clinically characterized by the resumption of bowel sounds and the passing of flatus. As a result of that, postoperative fasting tends to be extended for 2 to 5 days<sup>20</sup>. Evidently, although energy requirements are increased as a consequence of the surgical trauma, protein offer is zero and nitrogen balance is negative. Such medical practice, lacking scientific basis, draws on the assumption that intes-

Table 4 - Clinical outcomes of colorectal surgery with anastomosis, according to the protocol for perioperative care.

Complication	Group		
	Conventional (n=25)	ACERTO (n=24)	p
Overall morbidity	9 (36)	8 (28,6)	0,56
Surgical site infection	4 (16)	2 (7,1)	0,40
Anastomotic fistula	3 (12)	3 (10,7)	1,00
Number of complications/ patient with complication	2 (1-4)	1 (1-3)	0,01

tinal rest would be important to assure the healing of intestinal anastomoses at a lower risk<sup>20,21</sup>. Recent literature has debated and challenged this form of management. Early feeding following operations involving intestinal resections and anastomoses can be managed without risks and with potential benefits to patients, such as earlier discharge, lower incidence of infectious complications and cost reduction. In a previous study, Aguilar-Nascimento and Gloetzer<sup>21</sup> demonstrated the feasibility of early feeding after colonic anastomoses with potential benefits. In a meta-analysis, Lewis *et al.*<sup>20</sup> confirmed once more that the old concept on the "risks" of early postoperative feeding lacked evidence. In our study, resumption of feeding was successful on the first postoperative day in the second phase of the study. This procedure was not detrimental and, along with other measures adopted, in fact accounted for the better outcomes in the period following the implementation of the ACERTO protocol, in our opinion.

With regard to intravenous fluid therapy in surgical patients undergoing elective operations, some studies have shown significantly better results with unrestricted replacement of intravenous fluids<sup>22,23</sup>. Brandstrup *et al.*<sup>23</sup>, in a multicenter study comparing two regimens of perioperative fluid replacement with 140 patients, concluded that restricted fluid replacement significantly reduced postoperative complications (33% vs. 51%); cardiopulmonary (7% vs. 24%) and those associated with wound healing (16% vs. 31%). Evidence indicate that, in elective contexts, positive water and sodium balance hampers the return of gastrointestinal function postoperatively, and affects the body as a whole, extending the period of ileus as well as increasing morbidity and mortality rates<sup>24,25</sup>. The present study supports the concept of effective restriction of the hydration volume administered in the postoperative period of colorectal operations. Patients in the ACERTO group were given a significantly lower volume of intravenous fluids and resumed feeding sooner. This must certainly have contributed to shortening the postoperative period.

Another point addressed in the context of the ACERTO protocol was the possibility of abandoning preoperative mechanical bowel cleansing for colorectal operations altogether. We believe, based on studies of the evidence-based era, that mechanical bowel cleansing is dispensable<sup>3,4,26</sup>. It does not seem that more complications, especially postoperative fistulae, result from the lack of colon preparation for patients<sup>26</sup>. Recent meta-analyses have also shown that mechanical bowel cleansing is even more associated with dehiscence and postoperative fistulae than is the lack of preparation<sup>27-29</sup>. Bucher *et al.*<sup>27</sup>, comparing 642 patients with cleansing and 655 without it, from seven randomized prospective studies in colorectal surgery, found twice as many anastomotic leaks in those patients who underwent cleansing (OR: 1.87;  $p=0.03$ ). Slim *et al.*<sup>29</sup>, in another meta-analysis with 11 studies, verified the greater likelihood of fistulae when cleansing is used. Accordingly, a recent multicenter randomized study with 1400 patients concluded that routine mechanical bowel cleansing can be safely forsaken<sup>30</sup>. Our results are too incipient to determine the influence of dispensing with bowel cleansing on surgical outcomes. Moreover, this is not a randomized study, and the conventional procedures differed from the ACERTO group in several routines. However, in the no-cleansing group with 28 patients, the number of cases of anastomotic dehiscence was not greater. On the contrary, morbidity and mortality rates were similar, while a higher number of complications in patients with some morbidity was found. In addition, hospitalization time was significantly shorter.

In Brazil, no reports exist of centers that have been adopting these multimodal practices as a whole. Evidence-based routines represent a new tendency that is gradually taking place. Because these routines are founded on randomized studies and meta-analyzed, they are sound and consistent<sup>2-4,13,14,26</sup>. In conclusion, the adoption of multidisciplinary perioperative care procedures such as those proposed by the ACERTO project is safe and improves outcomes in colorectal surgery as they reduce the severity of complications and the length of hospital stay.

## R E S U M O

**Objetivo:** Avaliar os resultados pós-operatórios de um protocolo multimodal de cuidados peri-operatórios sem preparo mecânico de cólon (protocolo ACERTO) em pacientes submetidos a operações colorretais. **Método:** Foram avaliados prospectivamente 53 pacientes (37 M e 16 F; 57 [18-82] anos) submetidos a diversas operações colorretais com pelo menos uma anastomose, divididos em dois grupos. O primeiro grupo ( $n=25$ ) foi operado entre janeiro de 2004 e julho de 2005 com protocolo convencional incluindo preparo mecânico de cólon. O segundo grupo ( $n=28$ ) foi operado entre agosto de 2005 e junho de 2008, após a implantação do protocolo ACERTO e sem preparo de cólon. Comparou-se estatisticamente a incidência de complicações, a duração da hospitalização e a mortalidade em ambos os grupos. **Resultados:** Dois (3,8%) pacientes faleceram no pós-operatório, um em cada grupo. Pacientes do grupo ACERTO tiveram jejum pré-operatório abreviado, receberam menos fluido intravenoso e re-alimentaram mais cedo que o grupo convencional ( $p<0.05$ ). Não houve diferença na morbidade pós-operatória (36% vs. 28,6%;  $p=0,56$ ) com incidência de fistula anastomótica semelhante (12 vs. 10,7%;  $p=1,00$ ). O número de complicações por paciente foi menor no grupo ACERTO ( $p=0,01$ ). O tempo de internação do grupo ACERTO, operado sem preparo de cólon foi abreviado em 4,5 dias (12 [4-43] dias vs 7,5 [3-47] dias,  $p= 0,04$ ). **Conclusão:** As rotinas do protocolo ACERTO são seguras e melhoram resultados em cirurgia colorretal por diminuir a gravidade de complicações e o tempo de internação.

**Descritores:** Terapia nutricional. Cirurgia colorretal. Cuidados pré-operatórios. Cuidados pós-operatórios. Complicações pós-operatórias.

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