

Total Proctocolectomy in Ulcerative Colitis: Laparotomy versus Laparoscopy – A Systematic Review

Proctocolectomia total na Colite Ulcerosa: Laparotomia versus Laparoscopia – Uma Revisão Sistemática

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ABSTRACT

Introduction: Ulcerative Colitis is a chronic inflammatory bowel disease affecting the rectum and extending proximally. Some patients remain asymptomatic, while others require surgical intervention. Currently, total proctocolectomy with an ileal pouch-anal anastomosis is accepted as the gold standard for elective surgical treatment. Open or laparoscopic approach is still remaining controversial.

Aim: The aim of this systematic review is to determine whether the outcomes following laparoscopic approach are superior to the open approach in Ulcerative Colitis' patients.

Methods: This systematic review was carried out between August and September 2021, on Pubmed and Scopus, using the query "total proctocolectomy" AND "ulcerative colitis" AND (laparoscop* or (laparotom* or open)).

Results: Fifteen articles were included in this review. There was no significant difference between groups concerning amount of blood loss, small bowel obstruction, anastomotic leakage, wound disruption and infection, pouchitis, systemic sepsis, fecal incontinence and recovery of bowel movement. Laparoscopy was superior regarding number of blood transfusions, intestinal perforation and length of hospital stay. Concerning operative time, open approach showed a better outcome.

Conclusion: Laparoscopic approach is a safe treatment for these patients. Multicenter and prospective studies comparing both approaches are needed to clarify controversial outcomes.

Keywords: Ulcerative Colitis; Total Proctocolectomy; Laparotomy; Laparoscopy.

RESUMO

Introdução: A Colite Ulcerosa é uma doença inflamatória intestinal crónica que afeta o reto, estendendo-se proximalmente. Alguns doentes permanecem assintomáticos, outros necessitam de intervenção cirúrgica, sendo a proctocolectomia total com anastomose ileo-anal em bolsa, atualmente aceite como gold standard em contexto de cirurgia electiva. A abordagem por laparotomia ou laparoscopia é uma escolha controversa.

Objetivo: O objetivo desta revisão sistemática é determinar se os resultados cirúrgicos na laparoscopia são superiores à laparotomia em doentes com Colite Ulcerosa.

Métodos: Esta revisão sistemática foi realizada na Pubmed e Scopus entre agosto e setembro de 2021, usando os termos "total proctocolectomy" AND "ulcerative colitis" AND (laparoscop* or (laparotom* or open)).

Resultados: Foram incluídos quinze artigos. Não houve diferença significativa entre os grupos relativamente à quantidade de sangue perdida, obstrução do intestino delgado, deiscência da anastomose, infeção e rutura da ferida cirúrgica, infeção da bolsa, sépsis, incontinência fecal e recuperação do movimento intestinal. A laparoscopia foi superior no número de transfusões sanguíneas, perfuração intestinal e tempo de internamento. Em relação ao tempo cirúrgico, a laparotomia apresentou um melhor resultado.

Conclusão: A laparoscopia é uma opção segura para estes doentes. São necessários novos estudos multicêntricos e prospetivos comparando ambas as abordagens, de forma a esclarecer resultados ainda controversos.

Palavras-chave: Colite Ulcerativa; Proctocolectomia Total; Laparotomia; Laparoscopia.

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INTRODUCTION

Ulcerative Colitis (UC) is a chronic inflammatory bowel disease affecting the rectum and extending proximally to the colon to a varying degree^{1,2}, with a wide spectrum of disease severity.³ The precise aetiology is unknown, but it is thought to arise from an interaction of genetic and environmental factors.⁴ The natural course of UC varies depending on the site, the extent of bowel inflammation⁵ and its severity, which are taken into account in the Montreal classification.⁶

Ulcerative Colitis affects millions of adults and children worldwide⁷ and has a peak of incidence during early adult life.⁸ The epidemiological data reveals that the incidence of UC is constantly rising, primarily as a consequence of the spreading of the “western” lifestyle and urbanization.⁹

While some patients remain relatively asymptomatic, others present with disease manifestations requiring surgical intervention.⁵ When UC is not effectively controlled with pharmacological therapy, patients may be candidates for elective surgery. Under conditions of massive bleeding, perforation, dysplasia or toxic megacolon¹, patients are selected for urgent surgery. Despite the progress of medical management, surgery is still required in 15-35% of UC patients^{10,11}, being the only curative option for this disease.

The purpose of the surgical intervention is to remove the affected bowel segment. Pancolitis is the most common disease distribution.⁶ Surgery can be performed with either open or laparoscopic techniques.⁹ The main goals of surgical treatment are to obtain good functional outcomes and improve quality of life.³ Currently, total proctocolectomy (TPC) with the creation of an ileal pouch-anal anastomosis (IPAA) is generally accepted as the gold standard for the surgical treatment of UC,^{9,12} being mostly performed in young adults.⁸ This procedure, first performed by Peters in 1992¹³, offers patients an unchanged body image with no stoma and preserved anal route of defecation.⁷ Many aspects of this treatment still remain controversial, including the type of approach (open or laparoscopic), number of stages of surgery, type of pouch and construction type. Few prospective, randomized studies have been designed and performed regarding those aspects.⁷

Laparoscopic approach has spread only relatively slowly due to its complicated technique, steep learning

curve¹⁴⁻¹⁶, and long operative times.¹⁷ Nevertheless, it has been shown to be both safe and feasible.¹⁸ A number of studies have shown that laparoscopic surgery has numerous short-term advantages, such as less postoperative pain, shorter hospital stay, less time required for recovery of the bowel function, better cosmetic appeal, less blood loss, lower incidence of incisional hernias, fewer operative adhesions (which are responsible for more than 75% of the small bowel obstructions following this technique¹) and less major wounds complications^{9,12,18-25}, compared with the open procedure. While there is adequate data on the long-term outcomes after conventional open TPC-IPAA, the same cannot be stated for the laparoscopic variant. Only a few small case series and prospective randomized trials^{24,26,27} have evaluated the laparoscopic approach.

Therefore, the aim of this systematic review is to compare and determine whether the intraoperative and postoperative outcomes of TPC-IPAA following laparoscopic approach are superior to the outcomes following an open approach, in the surgical management of patients diagnosed with UC.

METHODS

Search Strategy

The research question was developed according to PICO. We focused on patients with Ulcerative Colitis diagnosis and aimed to compare open total proctocolectomy and laparoscopic total proctocolectomy in terms of outcomes and assess whether there is superiority of one over the other.

This study started with research on two data bases, Medline (PubMed) and Scopus, using the query “total proctocolectomy” AND “ulcerative colitis” AND (laparoscop* or (laparotom* or open)). The search took place between August and September 2021.

The query resulted in 53 articles on the PubMed database and 65 articles on Scopus. Two additional studies were found after searching the references of previous review articles.

Inclusion Criteria

We searched for articles published between 2010 and 2020 that included patients with Ulcerative Colitis diagnosis and evaluate the outcomes of open proctocolectomy, laparoscopic proctocolectomy or both. The

search included randomized clinical trials, cohort studies, and case-control studies as well as cross sectional studies.

Exclusion Criteria

Case reports as well as articles written in languages other than English or Portuguese were excluded. Articles in which full text was not available were also ruled out.

Summary Measure

The main summary measure in the quantitative synthesis was the number of individuals in which a particular outcome was recorded, when undergoing surgery.

The number of participants in some studies was calculated from the published value corresponding to the percentage.

Quality Assessment of Studies and Data Extraction

Study quality and eligibility were individually assessed by two investigators, who assessed if all inclusion and exclusion criteria were met. Primarily, it was done through title and abstract analysis, and then, if abstracts were deemed acceptable, through full-text assessment. Data extraction (see Table I) was individually done from the data published in the articles, and then compared by the investigators. Different opinions regarding the relevance of articles were solved by consensus between the authors.

RESULTS

Our search identified 119 studies. After reviewing the titles and abstracts, as well as subsequently excluding repeated articles, 44 articles were included for review of the full text. 29 articles were excluded, since they did not provide enough data to evaluate the outcomes of either open or laparoscopic technique, did not separate Ulcerative Colitis from other Inflammatory Bowel Diseases or did not include total proctocolectomy (TPC) with the creation of an ileal pouch-anal anastomosis (IPAA) as the surgical technique. 15 articles were left and included in the final systematic review. A flowchart depicting the literature search method, as well as the resulting number of articles selected is displayed in Figure 1.

The pooled analysis included a total of 1771 patients diagnosed with Ulcerative Colitis, of which 752 patients

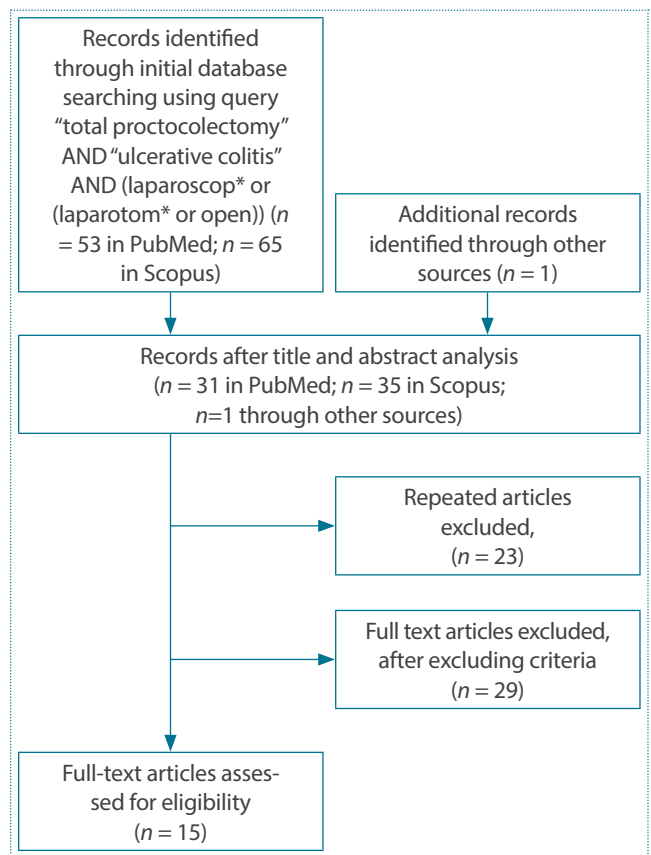


FIGURE 1 Flowchart showing the literature search method. Legend: *n* = number

underwent laparoscopic TPC-IPAA and 1019 patients underwent open TPC-IPAA. Out of the 15 articles, 13 were retrospective studies and 2 were prospective. Table I presents the main characteristics of the different studies, as well as the number of patients who underwent both surgical techniques.

The present systematic review evaluated a few intraoperative outcomes, namely the amount of blood loss, number of blood transfusions needed and operative time, as well as some postoperative outcomes: small bowel obstruction, anastomotic leakage, wound infection and disruption, pouchitis, intestinal perforation, and the length of hospital stay.

Intraoperative Outcomes

Amount of Blood Loss

Amount of blood loss was compared between both techniques in two studies and measured by median.

TABLE 1 Overview of the selected studies.

	Year	Country	Study Design	Nr. of Laparoscopic Surgery	Nr. of Open Surgery
Mizushima <i>et al.</i>	2017	Japan	Retrospective	169	316
Khazraei <i>et al.</i>	2018	Iran	Retrospective	68	7
Kawamura <i>et al.</i>	2013	Japan	Retrospective	31	3
Inada <i>et al.</i>	2015	Japan	Retrospective	12	12
Jani <i>et al.</i>	2015	India	Prospective	28	-
Linden <i>et al.</i>	2013	USA	Retrospective	68	39
Shimada <i>et al.</i>	2016	Japan	Retrospective	-	24
Linden <i>et al.</i>	2012	USA	Retrospective	68	-
Ateş <i>et al.</i>	2017	Turkey	Retrospective	6	-
Bismar <i>et al.</i>	2018	USA	Retrospective	27	-
Dolejs <i>et al.</i>	2011	USA	Retrospective	100	290
Geisler <i>et al.</i>	2011	USA	Prospective	4	-
Huntington <i>et al.</i>	2016	USA	Retrospective	-	8
Causey <i>et al.</i>	2012	USA	Prospective	148	298
Tajti Jr <i>et al.</i>	2015	Hungary	Retrospective	23	22

Inada's study¹⁴ described less amount of blood in the laparoscopic TPC-IPAA group compared to the open group. Nevertheless, Dolejs *et al.*¹ did not report any difference between the groups. Shimada *et al.*¹⁷ described a mean of 512mL of blood loss in a group of 24 patients who underwent open TPC-IPAA. Another article²¹ reported a median estimated blood loss of 100mL a in a group of 8 patients, who underwent the laparoscopic technique.

Number of Blood Transfusions

In addition, three articles^{1,14,28} examined the number of blood transfusions, all showing patients undergoing open TPC-IPAA required significantly more transfusion than those who underwent laparoscopy.

Operative Time

Operative time was shown to be significantly longer in the laparoscopic group than in the open TPC-IPAA group, as reported in three studies.^{1,14,29} Jani *et al.*²⁷ reported a mean operative time of 375 minutes in a group of 28 patients who underwent laparoscopic TPC-IPAA, while

Geisler *et al.*²¹ showed a median operative time of 153 minutes when performing the same technique. In terms of open TPC-IPAA, one article¹⁷ reported a mean operative time of 375 minutes in a total of 24 patients diagnosed with UC. Huntington *et al.*² described 296 minutes as the median length of open surgery, in a total of 8 patients.

Postoperative Outcomes

Small Bowel Obstruction

Small bowel obstruction was defined as a disruption of the normal propulsive ability of the gastrointestinal tract, requiring fasting.³⁰ Data from two studies^{9,29} showed significantly higher incidence of small bowel obstruction in patients undergoing open surgery technique, compared to those undergoing laparoscopy, while one study made by Mizushima³⁰ showed the opposite. Dolejs *et al.*¹ reported no significantly difference between open and laparoscopic TPC-IPAA. One study¹⁷ reported 4 cases of small bowel obstruction in a total of 24 patients

undergoing open TPC-IPAA. Another report² showed only one small bowel obstruction among a group of 8 patients who underwent the same technique. On the other hand, according to Kawamura *et al.*⁵ the present findings indicate that small bowel obstruction remains one of the most common complications after laparoscopic TPC-IPAA. Linden *et al.*³¹ reported one small bowel obstruction in a laparoscopic group of 68 patients diagnosed with UC, which was classified as a major complication of the surgery.

Anastomotic Leakage

Five studies reported data concerning anastomotic leakage. Regarding open TPC-IPAA, Inada *et al.*¹⁴ showed only one anastomotic breakdown, in a total of 12 patients diagnosed with UC. Another article¹⁷ also studied a group of 24 patients who underwent open surgery, reporting 2 cases of anastomotic leakage, while the laparoscopic group of 12 patients did not report any case of such event. In terms of laparoscopic TPC, one article³ reported 9 anastomotic leakage in a group of 68 patients, while Kawamura *et al.*⁵ showed only one episode in a total of 31 patients, in a patient with severe UC. Linden *et al.*³¹ did not report any case of the outcome concerned.

Wound Disruption

Only Causey *et al.*²⁸ reported wound disruption cases, showing no significant difference between both surgical approaches.

Wound Infection

Wound infection was mentioned in eight studies. According to Inada *et al.*¹⁴ wound infection was less frequent in the laparoscopic TPC-IPAA group when compared to the open group. In addition, Causey *et al.*²⁸ also reported that laparoscopy was associated with lower number of wound infections. In Linden's study²⁹ and according to Tajti Jr *et al.*⁹, the wound infections accounted were similar between both techniques. The same results were described by Causey *et al.*²⁸ who showed no statistically significant difference between both groups. One article regarding open TPC-IPAA (2) reported only one case of wound infection in a group of 8 patients diagnosed with UC. Also, Shimada *et al.*¹⁷ showed that in a total of 12 patients undergoing open surgery, 3 had wound infections, while in the laparoscopic group of 12 patients, none developed surgical site

infection. Regarding laparoscopic TPC-IPAA, Kawamura *et al.*⁵ reported 5 cases of wound infections in 31 patients diagnosed with UC, while Linden *et al.*³¹ reported none.

Pouchitis

Diagnosis of pouchitis was made upon review of the biopsy material by a pathologist³², or confirmed by endoscopy.⁹ Only one article compared pouchitis incidence in open and laparoscopic surgery⁹, reporting no significant difference between both techniques. Huntington *et al.*² described a group of 8 patients diagnosed with UC undergoing open TPC-IPAA, where half of the patients developed inflammation of the pouch. In terms of laparoscopic surgery, pouchitis was mentioned in 3 studies. According to Khazraei *et al.*³, 13 cases of pouchitis occurred in a group of 68 patients. In addition, Kawamura *et al.*⁵ reported 5 cases, in a total of 31 UC patients, while other report³² mentioned 9 events of pouchitis in a group of 27 patients.

Intestinal Perforation

Inada *et al.*¹⁴ reported significantly less frequent intestinal perforation in the laparoscopic group in comparison to the open group. Among a group of 13 patients who underwent laparoscopic TPC-IPAA, perforation occurred in one patient - just proximal to the ileostomy site - according to Kawamura *et al.*⁵ Likewise, Jani *et al.*²⁷ reported one proximal jejunal perforation, in a total of 28 patients undergoing laparoscopic surgery.

Systemic Sepsis

No significant difference was reported by Causey *et al.*²⁸ between laparoscopic and open TPC-IPAA. No other article mentioned this parameter.

Length of Hospital Stay

Hospital discharge can be influenced by many factors, namely normal diet tolerance, acceptable stool frequency, improved complications and controlled pain by oral drugs.¹⁴ Eight articles described results concerning the length of hospital stay. Inada *et al.* reported the median length hospital stay among patients undergoing the laparoscopic approach was significantly shorter than in those undergoing open TPC-IPAA group. In addition, Dolejs *et al.*¹ also described the shorter length of hospital stay of the laparoscopic group as one of the benefits of that technique, in comparison with the open technique. Nevertheless, two other studies^{9,29} did not find significant

difference between both groups. In a group of 28 patients, the mean hospital stay for the laparoscopic surgery was 7,4 days.²⁷ Another article³¹ reported a mean of 6 days, in a group of 68 patients who underwent laparoscopy, while Huntington *et al.*² showed a mean hospital stay of 8,9 days, in a group of 8 patients undergoing the same technique. Meanwhile, Shimada *et al.*¹⁷ reported a mean hospital stay of 18 days in a group of 24 patients who underwent the open TPC-IPAA.

Recovery of Bowel Function

Only one study⁹ evaluated the recovery of bowel function time, showing no significant difference between the groups.

Fecal Incontinence

Scores were calculated with the Wexner/Cleveland Clinical Fecal Incontinence Symptom Severity Scoring System.³³ Fecal incontinence was only reported in articles regarding laparoscopic TPC-IPAA. Khazraei *et al.*³ studied a group of 68 patients diagnosed with UC, where only 6 patients developed fecal incontinence after the laparoscopic surgery. In addition, Ates *et al.*³³ reported 2 cases of fecal incontinence in a group of 6 patients.

DISCUSSION

In the present report, a systematic review was performed to assess the current state-of-art concerning intraoperative and postoperative outcomes of the open TPC-IPAA, as well as the laparoscopic TPC-IPAA. Laparoscopic surgery provides a good field of view of the abdominal cavity and is known for smaller skin incisions and consequently a better cosmetic outcome. Due to progress in medical therapies for UC³⁴⁻³⁶, the use of laparoscopic TPC-IPAA for UC has gradually increased. Yet its use in UC's patients remains relatively infrequent (28). In fact, in comparison to the open approach, the laparoscopic technique is a more complex surgery and difficult to handle without causing injury, especially in inflamed bowels.¹⁷

It was thought that using a less invasive approach would possibly reduce the chances of less desired outcomes and increase the most advantageous. However, this paper found modest evidence comparing both surgical procedures and its outcomes simultaneously, in patients diagnosed with Ulcerative Colitis alone.

In terms of intraoperative outcomes, these are intrinsically related to the surgical work and may be an indirect measure of surgical complexity. Comparisons of both open and laparoscopic groups showed a reduced number of blood transfusions in patients undergoing laparoscopic TPC-IPAA and confirmed it as one of the advantages of that technique. Nevertheless, the length of operation was confirmed to be longer in the laparoscopic group, which showed superiority for the open approach in this aspect. This may be related to the longer learning curve that underlies minimally invasive techniques, such as laparoscopic TPC-IPAA. In terms of amount of blood loss, given the lack of articles with statistically significant data, it was not possible to draw conclusions of superiority of one approach towards the other.

Regarding post-operative outcomes, these mainly assess the patient physical status. Small bowel obstruction was one of the most frequent complications reported in both open and laparoscopic surgery. It is associated with impaired quality of life, prolonged length of hospital stay and surgery need, unless it responds to fasting and tube decompression.³⁰ There was no significant difference between both groups. In addition, due to lack of homogeneity between articles, when comparing open and laparoscopic approaches, no differences were reported concerning anastomotic leakage. Wound disruption and systemic sepsis were only reported in one prospective article, showing no difference between both groups, not allowing to conclude any superiority of one approach towards the other. Despite being reported in 8 articles, it is not possible to draw conclusions regarding wound infection due to high heterogeneity between data concerning open and laparoscopic approach. Pouchitis was a frequent complication of both open and laparoscopic TPC-IPAA. Nevertheless, data taken from the reviewed articles addressing this outcome, did not allow any clear conclusion regarding comparison of both techniques. Intestinal perforation was proven to be less frequent in the laparoscopic surgical technique. Length of hospital stay was shorter in patients undergoing laparoscopic, which favors the superiority of laparoscopy over the open approach. Regarding fecal incontinence, there is no terms of comparison between both surgical techniques, leading

to no conclusions concerning this outcome. In spite of the reduced sample size of patients undergoing open or laparoscopic surgery, both groups were homogeneous and the results shown in this study allow us to conclude that there is no superiority of one technique towards the other, regarding recovery of bowel function.

There are several limitations which should be acknowledged when interpreting the present data. Firstly, the heterogeneous nature of the current data as well as the potential for confounding factors (namely age, sex, Ulcerative Colitis' severity, use of preoperative immunosuppressive therapies, underlying pathological issues or previous surgeries) should be considered. Also, most of the articles covered in the present review included very few UC patients either in laparoscopic surgery or in open surgery^{2,3,5,9,14,17,21,27,29,31-33}) which made data extrapolation difficult. Therefore, there are no appropriate large scale studies of laparoscopic TPC-IPAA for UC. Also, surgical methods in each review were not selected in accordance with any definitive criteria, but rather by surgeons' preference, which could introduce some element of bias. Nevertheless, 12 of the 15 articles included in this review were retrospective studies and, therefore, selection bias always remains. For this reason, it may be difficult to make reliable conclusions with the number of predictor variables examined.

Longer term evaluation and larger trials are of utmost importance in order to validate our findings and define the parameters that are still incongruous, achieving an adequate statistical power.

CONCLUSION

In conclusion, laparoscopic surgery is a safe and feasible treatment for patients diagnosed with UC who are candidates for elective surgery. It is associated with a lower incidence of intestinal perforation, fewer number of blood transfusions and shorter length of hospital stay, despite longer operative time in comparison with the open approach.

Further studies are needed to compare the open TPC-IPAA to laparoscopic TPC-IPAA with respect the controversies regarding the amount of blood loss, small bowel obstruction, anastomotic leakage, wound disruption and

infection, pouchitis, systemic sepsis, fecal incontinence and recovery to bowel function. We underline the need to test these results preferably on multicenter, prospective trials comparing open and laparoscopic approaches in the surgical treatment of UC.

In addition, we emphasize the interest to evaluate long term outcomes, namely 5-10 year survival rate. It is also crucial to perform cost-effectiveness and cost-benefit analysis regarding investment in laparoscopic surgery and its widespread impact in healthcare systems. ■■■

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The authors have no supportive foundations to declare.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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