



Postoperative Morbidity After Iterative Ileocolonic Resection for Crohn's Disease: Should we be Worried? A Prospective Multicentric Cohort Study of the GETAID Chirurgie

Solafah Abdalla, Antoine Brouquet, Léon Maggiori, Philippe Zerbib, Quentin Denost, Adeline Germain, Eddy Cotte, Laura Beyer-Berjot, Nicolas Munoz-Bongrand, Véronique Desfourneaux, et al.

► To cite this version:

Solafah Abdalla, Antoine Brouquet, Léon Maggiori, Philippe Zerbib, Quentin Denost, et al.. Postoperative Morbidity After Iterative Ileocolonic Resection for Crohn's Disease: Should we be Worried? A Prospective Multicentric Cohort Study of the GETAID Chirurgie. *Journal of Crohn's and Colitis*, Elsevier - Oxford University Press, 2019, 13 (12), pp.1510-1517. 10.1093/ecco-jcc/jjz091 . hal-02362759

HAL Id: hal-02362759

<https://hal-normandie-univ.archives-ouvertes.fr/hal-02362759>

Submitted on 22 Jan 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Postoperative morbidity after iterative ileocolonic resection for Crohn's Disease: should we be worried? A prospective multicentric cohort study of the GETAID Chirurgie.

Journal:	<i>Journal of Crohn's and Colitis</i>
Manuscript ID	ECCO-JCC-2019-0123.R1
Manuscript Type:	Original Article
Date Submitted by the Author:	n/a
Complete List of Authors:	<p>Abdalla, Solafah; Hôpital Bicêtre, APHP, Department of Digestive and Oncologic Surgery Brouquet, Antoine; Hôpital du Kremlin-Bicêtre, Digestive surgery Maggiori, Léon; Beaujon Hospital, Colorectal Surgery Zerbib, philippe; Hôpital Claude Huriez, Université Lille 2, surgery Denost, Quentin; CHRU Bordeaux, Service de chirurgie Digestive Germain, Adeline; CHU Nancy, Digestive Surgery Cotte, Eddy; Lyon-Sud Hospital, Surgery Beyer-Berjot, Laura; Hôpital Nord, APHM, Aix-Marseille Univ, Digestie surgery Munoz Bongrand, Nicolas; Hôpital Saint-Louis, Université Diderot Paris 7, Digestive Surgery Unit Desfourneaux, Véronique; Hôpital Pontchaillou, Service de Chirurgie Viscérale Rahili, Amine; CHRU Nice, Service de chirurgie Digestive Duffas, Jean-Pierre; CHRU Toulouse, Service de chirurgie digestive Pautrat, Karine; CHU Lariboisière, Service de chirurgie digestive Denet, Christine; Institut Mutualiste Montsouris, Service de chirurgie digestive Bridoux, Valerie; Rouen University Hospital Charles Nicolle, Surgery Meurette, Guillaume; Inserm UMR 913, Institut des maladies de la ♦TMappareil digestif, CHU de Nantes, Université de Nantes, Service de chirurgie digestive Faucheron, Jean-Luc; CHRU Grenoble, Service de chirurgie digestive Loriau, Jérôme; Centre Hospitalier Regional Clinique Mons-Hainaut Site Saint-Joseph, Service de chirurgie digestive Guillon, Françoise ; Centre Hospitalier Regional Universitaire de Montpellier, Chirurgie Digestive vicaut, eric; Hopital Fernand-Widal, URC Benoist, Stephane; Hopital Bicetre, Service de chirurgie digestive Panis, Yves; Beaujon Hospital, Colorectal Surgery lefevre, jeremie; Hopital Saint-Antoine, General Surgery</p>

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Subject:	Clinical trials
Classifications:	Clinical trials



1
2
3 **Postoperative morbidity after iterative ileocolonic resection for Crohn's Disease: should**
4
5 **we be worried? A prospective multicentric cohort study of the GETAID Chirurgie.**
6
7
8
9

10 Solafah Abdalla¹, Antoine Brouquet², Léon Maggiori³, Philippe Zerbib⁴, Quentin Denost⁵,
11 Adeline Germain⁶, Eddy Cotte⁷, Laura Beyer-Berjot⁸, Nicolas Munoz-Bongrand⁹, Véronique
12 Desfourneaux¹⁰, Amine Rahili¹¹, Jean-Pierre Duffas¹², Karine Pautrat¹³, Christine Denet¹⁴,
13 Valérie Bridoux¹⁵, Guillaume Meurette¹⁶, Jean-Luc Faucheron¹⁷, Jérôme Loriau¹⁸, Françoise
14 Guillon¹⁹, Eric Vicaut²⁰, Stéphane Benoist², Yves Panis³, Jérémie H. Lefevre¹ on behalf of the
15 GETAID chirurgie group.
16
17
18
19

20
21
22
23 1 Sorbonne Université, Department of Digestive Surgery, AP-HP, Hôpital Saint Antoine, F-
24 75012, Paris, France; Saint-Antoine IBD Network.

25 2 Service de Chirurgie Digestive, Hôpital Bicêtre, APHP, Université Paris-Sud, 94275 Le
26 Kremlin-Bicêtre, France

27 3 Service de Chirurgie Colorectale, Hôpital Beaujon, APHP, Université Paris VII, 92118
28 Clichy, France

29 4 Service de Chirurgie Digestive, CHRU Lille, Lille, France

30 5 Service de Chirurgie Digestive, CHRU Bordeaux, 33000 Bordeaux, France

31 6 Service de Chirurgie Digestive, CHRU Nancy, 54000 Nancy, France

32 7 Service de Chirurgie Digestive, CHRU Lyon-Sud, 69230 Pierre-Bénite, France

33 8 Service de Chirurgie Digestive, CHRU Marseille-Nord, 13015 Marseille, France

34 9 Service de Chirurgie Digestive, Hôpital Saint-Louis, APHP, Université Paris VII, 75010
35 Paris, France

36 10 Service de Chirurgie Digestive, CHRU Rennes, 35000 Rennes, France

37 11 Service de Chirurgie Digestive, CHRU Nice, 06200 Nice, France

38 12 Service de Chirurgie Digestive, CHRU Toulouse-Rangueil, 31059 Toulouse, France

39 13 Service de Chirurgie Digestive, Hôpital Lariboisière, APHP, Université Paris VII, 75010
40 Paris, France

41 14 Service de Chirurgie Digestive, Institut Mutualiste Montsouris, 75014 Paris, France

42 15 Service de Chirurgie Digestive, CHRU Rouen, 76031 Rouen, France

43 16 Service de Chirurgie Digestive, CHU Nantes, France

44 17 Service de Chirurgie Digestive, CHRU Grenoble, 38700 La Tronche, France

45 18 Service de Chirurgie Digestive, Hôpital Saint Joseph, 75015 Paris, France

46 19 Service de Chirurgie Digestive, CHRU Montpellier, 34090 Montpellier, France

47 20 Unité de recherche clinique, Hôpital Fernand Widal, APHP, Université Paris VII, 75010
48 Paris, France
49
50
51
52
53
54
55
56
57
58

59 **Short title:** Iterative ileocolonic resection for Crohn
60

Original article**Correspondance and reprint requests:**

Pr Jérémie H. Lefèvre, Department of Digestive Surgery, Hôpital Saint-Antoine, Assistance
Publique Hôpitaux de Paris, Sorbonne Université, 184 rue du Faubourg Saint-Antoine, 75012,
Paris, France

Tel: 0033 1 49 28 25 47, Fax: 0033 1 49 28 25 48

e-mail: jeremie.lefevre@aphp.fr

Conflict of Interest:

- SA: no conflict of interest to report
- AB: no conflict of interest to report
- LM: no conflict of interest to report
- PZ: no conflict of interest to report
- QD: no conflict of interest to report
- AG: no conflict of interest to report
- EC: no conflict of interest to report
- LBB: no conflict of interest to report
- NMB: no conflict of interest to report
- VD: no conflict of interest to report
- AR: Takeda
- JPD: no conflict of interest to report
- KP: no conflict of interest to report
- CD: no conflict of interest to report
- VB: Takeda, Shire
- GM: no conflict of interest to report
- JLF: no conflict of interest to report
- JL: no conflict of interest to report
- FG: no conflict of interest to report
- EV: Astra Zeneca, Bayer Health Care, Bristol-Myers Squibb, Daiichi-Sankyo, Pfizer
- SB: Takeda.
- YP: no conflict of interest to report
- JHL: Takeda, Biomup, Safeheal

Author contribution:

All author have read and corrected the final version of the article.

- SA: data analysis, writing up of the first draft of the paper
- AB: Study design, patient recruitment, data collection, writing up of the first draft of the paper
- LM: Study design, patient recruitment, data collection, writing up of the first draft of the paper
- PZ: patient recruitment, data collection
- QD: patient recruitment, data collection
- AG: patient recruitment, data collection
- EC: patient recruitment, data collection

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
 - 57
 - 58
 - 59
 - 60
- LBB: patient recruitment, data collection
 - NMB: patient recruitment, data collection
 - VD: patient recruitment, data collection
 - AR: patient recruitment, data collection
 - JPD: patient recruitment, data collection
 - KP: patient recruitment, data collection
 - CD: patient recruitment, data collection
 - VB: patient recruitment, data collection
 - GM: patient recruitment, data collection
 - JLF: patient recruitment, data collection
 - JL: patient recruitment, data collection
 - FG: patient recruitment, data collection
 - EV: patient recruitment, data collection
 - SB: Study design, patient recruitment, data collection, writing up of the first draft of the paper
 - YP: Study design, patient recruitment, data collection, writing up of the first draft of the paper
 - JHL: Study design, data analysis, patient recruitment, data collection, writing up of the first draft of the paper

ABSTRACT

Background and Aims

To compare perioperative characteristics and outcomes between primary ileocolonic resection (PICR) and **iterative** ileocolonic resection (IICR) for Crohn's disease.

Methods

From 2013 to 2015, 567 patients undergoing ileocolonic resection were prospectively included in 19 centers of the GETAID chirurgie group. Perioperative characteristics and postoperative results of both groups (431 PICR, 136 IICR) were compared. Uni- and multivariate analyses of the risk factors of overall 30-days postoperative morbidity was carried out in the IICR group.

Results

IICR patients were less likely to be malnourished (27.2% vs 39.9%, $p=0.007$), had more stricturing forms (69.1% vs 54.3% $p=0.002$) and less perforating disease (19.9% vs 39.2%, $p<0.001$). Laparoscopy was less commonly used in IICR (45.6% vs 84.5%, $p<0.01$) and associated with increased conversion rates (27.4% vs 14.6%, $p=0.012$). Overall postoperative morbidity was 36.8% in the IICR group and 26.7% in the PICR ($p=0.024$). There was no significant difference between IICR and PICR regarding septic intraabdominal complications, anastomotic leakage (8.8% vs 8.4%) and temporary stoma requirement. IICR patients more likely presented with non-infectious complications and ileus (11.8% vs 3.7%, $p<0.001$). Uni- and multivariate analyses did not identify specific risk factors of overall postoperative morbidity in the IICR group.

Conclusions

Surgery for recurrent CD is associated with a slight increase of non-infectious morbidity (postoperative ileus) that mainly reflects the technical difficulties of these procedures. However, **iterative** ileocolonic resection remains a safe therapeutic option in patient with

1
2
3 recurrent Crohn disease since severe morbidity including anastomotic complications is similar
4
5 to patients undergoing primary resection.
6

7
8 **Keywords:** Crohn's disease; recurrent disease; ileo-colic resection; morbidity
9

10 **No Funding to declare**

11
12 **Words:** 2894
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For Review Only

INTRODUCTION

Despite increased use of immunosuppressive and anti-tumour necrosis factor (anti-TNF) treatments, approximately half of the patients presenting with Crohn's Disease (CD) will require surgery within 10 years after diagnosis.¹ The main location of CD is terminal ileum with or without involvement of the proximal colon. Thus, up to 75% of patients requiring abdominal surgery for CD will have ileal or ileocolic resection (ICR), among which 20 to 40% are performed within the first year after the diagnosis.^{2,3} Operative indications include failed medical therapy, complicated CD (perforation, obstruction, hemorrhage) and neoplasia, as expressed in the 2018 ECCO-ESCP guidelines.⁴ In some specific indications, surgical resection has been proved to be an effective alternative to medical treatment. Indeed, Ponsioen et al. showed that laparoscopic resection in patients with limited (< 40 cm), non-stricturing ileocecal CD is a reasonable alternative to infliximab therapy in terms of health-related quality of life.⁵ However, surgical resection of the diseased bowel is not curative and postoperative recurrence remains a significant problem.⁶ After ileocolic resection, endoscopic recurrence of CD arises in the neoterminal ileum in 30% of patients after 3 months and in up to 80% of patients after 1 year. Clinical recurrence has been reported to be as high as 20-30% at 1 year with a 10% increase in each of the subsequent years.⁷ **The probability of a second resection for recurrent disease is 7-25% at 5 years and 19-35% at 10 years.**^{8,9} Data of the literature are scarce concerning surgery for recurrent CD after previous intestinal resection and are mainly based on retrospective data. In a comparative study, surgery for recurrent CD showed higher morbidity rate, greater risk of postoperative intra-abdominal abscess and longer postoperative hospital stay.¹⁰ Comparing to primary ileocolic resections for CD, laparoscopy for **iterative** ileocolic resection has also been proved to be a safe and feasible approach without differences in stoma creation, early postoperative morbidity and mortality, reoperation rates and in-hospital stay.¹¹⁻
¹⁴ However, no multicentric prospective study designed to specifically compare operative and

1
2
3 postoperative outcome between primary and **iterative** ileocolic resection for CD is currently
4
5 available.

6
7 Thus, the aim of our study was to compare perioperative characteristics and outcomes between
8
9 primary and **iterative** ileocolic resection in patients operated for ileocolic CD.
10
11
12
13
14

15 **METHODS**

16 *Patients and data collection*

17
18 This study was based on the previously published data of the GETAID chirurgie group cohort.
19
20 ¹⁵ Briefly, all patients undergoing surgery for ileocolic CD at 19 French academic centers were
21
22 prospectively included from September 2013, to September 2015. To summarize, the inclusion
23
24 criteria were: age >18 years, ileocolic CD and elective or emergency intestinal resection. The
25
26 patients who had surgery for CD limited to a perianal or a colonic location were excluded. For
27
28 the present work, we also excluded patients who underwent **isolated** stricturoplasty or small
29
30 bowel resections. Variables including demographics, disease type and severity, previous
31
32 treatment of CD, number and type of previous resections for CD, intraoperative findings and
33
34 surgical procedures were prospectively collected. This study was conducted according to the
35
36 ethical standards of the institutional committee on human experimentation and reported
37
38 according to the Strengthening the Reporting of Observational Studies in Epidemiology
39
40 (STROBE) guidelines. ¹⁶
41
42
43
44
45
46
47
48
49

50 *Surgical procedure and postoperative outcome*

51
52 The description of surgical procedures has been given in the previously published paper. ¹⁵
53
54 Briefly, a laparoscopic approach was proposed as the favored option whenever possible at all
55
56 participating centers. The bowel planned for resection was extracted through a 5 to 6 cm
57
58 incision in a right lower quadrant or midline incision. Conversion to open surgery was defined
59
60

1
2
3 as any unplanned incision or a planned incision that was made longer than necessary to extract
4 the resected specimen and fashion of the anastomosis. The decision to fashion primary
5 anastomosis or temporary ileocolostomy was made on a per-patient basis and left to the
6 discretion of the surgeon, according to the preoperative clinical data and intraoperative findings.
7
8 The in-hospital or 30-day postoperative morbidity and mortality were recorded prospectively
9 starting from the date of the surgery. Postoperative morbidity was defined as any deviation from
10 the normal postoperative course, graded according to the Dindo-Clavien classification.¹⁷
11
12 Intraabdominal septic morbidity included anastomotic leakage with or without peritonitis,
13 intraabdominal abscess and postoperative peritonitis. Moreover, the reoperation rate, length of
14 hospital stay, and readmission rate were prospectively recorded.
15
16
17
18
19
20
21
22
23
24
25
26
27
28

29 *Statistical analysis*

30 Patients were divided into two groups, namely “primary ileocolic resection” (PICR) and
31 “iterative ileocolic resection” (IICR). The quantitative and qualitative variables were expressed
32 as the mean \pm the standard deviation (SD), median (interquartile range), and frequency. For
33 univariate comparisons between the PICR and IICR groups, the chi-squared test was used for
34 categorical variables, while the Mann–Whitney U test was applied for continuous variables.
35
36 The primary endpoint was the overall 30-day postoperative morbidity. To identify the risk
37 factors of the overall postoperative morbidity, univariate and multivariate analyses were used
38 to examine the relationship between the occurrence of postoperative morbidity and 49 variables
39 related to the patient characteristics and comorbidities, the type and severity of the CD,
40 preoperative treatment targeting CD, preoperative biological parameters, and intraoperative
41 findings and surgical procedures. Denutrition was defined as BMI <18 kg/m², and/or weight
42 loss > 10% of the body weight within 6 months before surgery and/or preoperative serum
43 albumin <30 g/dL. The association of baseline parameters with postoperative morbidity was
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 first assessed using univariable Cox analyses, and then parameters with P values of less than
4
5 0.1 or clinically relevant variables known for their impact of postoperative morbidity were
6
7 entered into a final multivariable Cox regression model.
8
9

10
11 A P value <0.05 was considered statistically significant. Statistics were performed using SPSS
12
13 (Statistical Package for Social Science, IBM SPSS Statistics, Version 23 for Macintosh; IBM
14
15 Corp., Armonk, NY, USA).
16
17

18 19 20 **RESULTS**

21 22 *Preoperative characteristics and previous medical treatment (Table 1).*

23
24 From September 1, 2013 to September 1, 2015, 567 patients underwent ICR. Four hundred and
25
26 thirty-one underwent PICR (76%) and 136 (24%) underwent IICR. Denutrition was more
27
28 frequent in the PICR group than in the IICR group (39.9% vs. 27.2%, p=0.007). Thus, the
29
30 proportion of patients receiving preoperative nutritional support was higher in the PICR group
31
32 compared to the IICR patients (36.0% vs 25.7% respectively, p=0.028). The phenotype of CD
33
34 according to Montreal/Vienna classification significantly differed between both groups
35
36 (p<0.001). Indeed, perforating CD was more frequent in the PICR group (39.2% vs 19.9%)
37
38 whereas **stricturing** CD was more frequent in the IICR group (69.1% vs 54.3%). Previous
39
40 medical exposure within 6 and 3 months were similar in both groups.
41
42
43
44
45
46
47

48 49 *Surgical procedures and intraoperative findings (Table 2).*

50
51 Laparoscopic approach was less frequently used in the IICR group (45.6% vs 84.5, p<0.01) and
52
53 the conversion rate was significantly higher (27.4% vs. 14.6%, p=0.012). As expected, internal
54
55 fistula (25% vs. 37.6%, p=0.007) and abscesses (11% vs. 20.2%, p=0.013) were less frequent
56
57 in the IICR group. Primary anastomosis was performed in 449 patients (79.2%) with a majority
58
59 of stapled ileocolic anastomosis (59.2%, n=266), without statistical difference between both
60

1
2
3 groups. Mean operative time was statistically longer in the IICR group (155.9 ± 53.3 min vs.
4
5 138.9 ± 49.9 min, $p=0.002$).
6
7
8
9

10 *Postoperative outcome* (Table 2).

11
12 Overall postoperative morbidity (36.8% vs. 26.7% , $p=0.024$), non-infectious morbidity (20.6%
13
14 vs 13.7% , $p=0.052$) and ileus (11.8% vs. 3.7% , $p<0.001$) were significantly higher in the IICR
15
16 group. However, postoperative length of stay was similar between both groups (10.2 ± 23.0 in
17
18 the PICR vs. 9.3 ± 6.9 days in the IICR, $p=0.499$). There were no significant differences between
19
20 intraabdominal septic complications, anastomotic leakage rate, severe postoperative
21
22 complications and reoperation with or without stoma confection between both groups (table 2).
23
24
25 Four hundred and forty-nine patients underwent IICR with primary anastomosis.

26
27 We then compared postoperative outcomes in the subgroup with primary anastomosis between
28
29 PICR ($n=337$, 75.1%) and IICR ($n=112$, 24.9%). Overall postoperative morbidity (38.4% vs.
30
31 25.8% , $p = 0.011$) and non-infectious morbidity (21.4% vs. 11.9% , $p=0.012$) were significantly
32
33 higher in the IICR group. There were no significant differences in infectious morbidity, surgical
34
35 site infections, intraabdominal septic complications, anastomotic leakage, severe postoperative
36
37 complications and reoperation rate for complications between both groups.
38
39
40

41
42 We also conducted a subgroup analysis on patients with elective procedures (PICR $n=385$ &
43
44 IICR $n=130$). We found the same differences in patients' characteristics. Laparoscopic
45
46 approach was less frequently used for IICR (46.9% vs. 90.4% , $p<0.001$) with more conversions
47
48 (27.9% vs. 13.8% , $p=0.006$). Again, overall morbidity was significantly increased in the IICR
49
50 group (37.7% vs. 17.4% , $p=0.015$) but only the postoperative ileus was significantly increased
51
52 in the IICR (11.5% vs. 2.4% , $p<0.001$).
53
54
55
56
57

58 *Patients undergoing multiple IICR* (Table 3).
59
60

1
2
3 Primary anastomosis was performed in the vast majority of the patients (82.4%) and its rate
4 was not correlated with the number of **previous** resections ($p=0.578$). Concerning the
5
6
7
8 postoperative outcome, there was a tendency for more frequent intraabdominal septic
9
10
11
12 complications in patients undergoing a third ICR or more (6.2% vs. 15.4%, $p=0.087$). Overall
13
14
15 postoperative morbidity, severe complications, reoperation rate for complications and length of
16
17
18 stay were not different depending on the number of **previous** ICR.

19
20
21 *Impact of case-volume on operative and postoperative outcomes (Table 4)*

22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
Mean ICR per center per year was 15.9 (± 12.9), with 11.9 (± 9.3) PICR per center per year and
4.0 (± 4.1) IICR per center per year. There were no significant differences in terms of
laparoscopic approach ($p=0.282$), overall postoperative morbidity ($p=0.829$) and length of
hospital stay ($p=0.297$) according to the yearly case-volume of the centers (Table 4). However,
there was a trend toward a lower conversion rate in high volume centers (22.0% vs. 46.2%,
 $p=0.080$).

Analyses of the risk factors of overall postoperative morbidity (Table 5)

The results of the univariate and multivariate analyses of the risk factors for overall
postoperative morbidity in 136 patients undergoing iterative ileocolic resection for ileocolic CD
are reported in Table 5. In the univariate analysis, previous ICR ($p=0.041$) and intraoperative
bowel injury ($p=0.062$) were associated with a higher risk of overall postoperative morbidity.
However, none of these parameters were statistically significant in the multivariate analysis
($p=0.138$ and $p=0.999$ respectively).

DISCUSSION

1
2
3 Our results confirm that surgery for recurrent CD slightly increases the risk of overall
4 postoperative morbidity. This is explained by a more technically difficult procedure that usually
5 lasts longer than primary surgery. This translates into a higher risk of non-infectious
6 complications, especially ileus, whereas the risk of infectious complications and major
7 morbidity is equivalent to primary surgery. Consequently, iterative ileocolonic resection
8 remains a safe therapeutic option in patient with recurrent Crohn disease. However, although
9 laparoscopy was feasible in 50% of the cases, IICR was technically more difficult. In this series,
10 overall postoperative morbidity was increased in the IICR group but linked only to the
11 postoperative ileus explained by the necessity of longer dissections and longer intraoperative
12 durations. Indeed, the rate of AL and duration of hospitalization stay were similar in both
13 groups.
14
15
16
17
18
19
20
21
22
23
24
25
26
27

28 In this prospective multicentric study, we included 136 IICR to 431 PICR within 3 years,
29 which is, to our knowledge, the largest series in the literature. Only few previous studies focused
30 on specific comparison between IICR and PICR. There were all retrospectives, unicentric with
31 less than 80 patients undergoing iterative resections^{13,18,19} In their meta-analysis, Shigeta et al.
32 evaluated the perioperative results of laparoscopy in 413 primary CD vs. 214 recurrent CD.¹¹
33 More specifically, this last study involved 350 PICR and 164 IICR, mostly included
34 retrospectively, in monocentric studies, over a period of 19 years, meanwhile our patients were
35 prospectively included in a shorter range of time which limited more efficiently several biases.
36
37
38
39
40
41
42
43
44
45
46

47 The patients of the IICR group were less frequently malnourished, necessitated less
48 preoperative nutritional support but had more favorable preoperative biological parameters
49 (CRP<10 g/L). This better preoperative nutritional status may reflect a less aggressive behavior
50 of the CD. Indeed, the patients of the IICR group presented more frequently a stricturing
51 behavior of CD, whereas the patients of the PICR group presented with penetrating CD.
52
53
54
55
56
57
58
59
60

1
2
3 to ours. Indeed, except for Manser et al.¹⁹ stricturing behavior of CD was more frequent in
4 recurrent CD and obstructive bowel syndrome was the main indication for surgery in this group.
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

14,18,20,21 Stricturing behavior of CD has also been identified as an independent risk factor of surgical recurrence.⁴ These differences reflect a better selection of patients before surgical resection and may explain the favorable results observed in this series.

The patients of the IICR group were older, with more patients > 65 years old. As in other studies, this difference is explained by a younger age at the diagnosis and a longer duration of the CD.^{19,22}

As expert centers, the participating centers of this study performed laparoscopy as often as possible, according to the 2018 ECCO-ESCP recommendations.⁴ In this study, laparoscopy was feasible in 45.6% of the IICR, which is comparable with the data of the literature.¹⁰ However, laparoscopy in IICR was technically more difficult than in PICR, as evidenced by the higher conversion rate and the prolonged operative duration than in the PICR group. Moreover, we showed that feasibility of a laparoscopic approach was also hampered with the number of previous resections. Other studies showed similar results, as Goyer et al. who showed that laparoscopy for complex and recurrent CD was associated with longer operative time and increased risk of conversion.¹⁴ We did not have the data concerning the surgical approach of the first resection and therefore it was impossible to identify the probability of being operated through a laparoscopic approach after an open surgery.

Overall morbidity was significantly higher in the IICR group (36.8% vs. 26.7%, p=0.024). Studies comparing IICR vs. PICR showed similar results.¹⁸ This higher morbidity rate was explained by a higher rate of postoperative ileus related to intraoperative adhesions, longer dissections and thus longer operative duration and conversion rate. Our 3.7% rate of postoperative ileus in the PICR group was similar in the LIRIC trial (4%).⁵ On the other hand, if the overall morbidity was increased in the IICR group due to ileus, it can be noted that specific

1
2
3 surgical morbidity and anastomotic leakage were not different in both groups, and this also in
4
5 the subgroup of primary anastomoses. This increased postoperative ileus is of importance in
6
7 the current management of such patients in whom the enhanced recovery programs will fail
8
9 more frequently.
10

11
12 Enhanced recovery for colorectal surgery (ERAS) programs is associated with shorter
13
14 time to restoration of bowel movement and shorter length of hospital stay (LHS) in patients
15
16 undergoing ICR for CD. ^{23,24} In our study, mean LHS was relatively long (9-10 days) but
17
18 median was 7 days, similar in both group (PICR: 7 days (IQR=6-9), IICR : 7 days (IQR=6-10).
19
20 Indeed, the 19 participating centers had diverse ERAS protocols with different inclusion
21
22 criteria. However, data in the literature is in accordance with our findings. In a RCT, Zhou and
23
24 al. compared 16 laparoscopic PICR for CD with ERAS vs 16 PICR with conventional
25
26 management for CD: mean postoperative DHS was 9.94 +/-3.3 days. ²⁴ Brouquet and al.
27
28 compared 57 PICR (52.6% through laparoscopic approach) with 54 IICR (48% through
29
30 laparoscopic approach). ¹⁸ The median LHS was 7 days (4-18) versus 9 days (6-63) in the PICR
31
32 and IICR group respectively. In the TRUE trial comparing single port versus conventional
33
34 multiport conventional laparoscopy for colonic resection, including 47 (75%) conventional
35
36 laparoscopic right colectomies for cancer, and 53 (42%) PICR for CD, the mean LHS was 6
37
38 +/-2 days in the conventional laparoscopic group. ²⁵ Finally, in a randomized controlled trial,
39
40 Maggiori and al. evaluated full vs limited ERAS programs in colorectal resections for cancer.
41
42 ²⁶ Mean DHS was 9.4 +/-3.3 days (range, 6-24) in the limited fast track program vs 8.6 +/- 3.5
43
44 days in the full fast track program. Only Spinelli and al., who evaluated ERAS programs in
45
46 primary ileocolonic resections for CD found a shorter DHS of 6.8 +/-3.1 days in the patients
47
48 undergoing laparoscopic primary ICR without ERAS. ²³
49
50
51
52
53
54
55

56 In this series, we could not identify risk factors of postoperative overall morbidity in the
57
58 IICR group and we did not demonstrate a negative impact of preoperative treatment targeting
59
60

1
2
3 CD as recently reported.¹⁵ This could be related to a lack of statistical power. Indeed, only 29
4 patients were treated previously with anti-TNF alpha in the IICR group which is insufficient to
5 individualize an independent effect. Of this parameter, preoperative hemoglobin < 10g/dL was
6 also not identified as a predictive factor of overall morbidity in our study. Indeed, patients in
7 the IICR group were in a better general and nutritional condition, with a less inflammatory type
8 of CD, which explains the low prevalence of anemia in this group. Operative duration > 180
9 min was not individualized as a risk factor of postoperative morbidity. Indeed, the IICR group
10 was characterized by longer operative duration.
11
12
13
14
15
16
17
18
19
20

21 In conclusion, this large prospective multicentric study on IICR showed only an increase
22 of post-operative ileus. Major surgical morbidity is similar to primary ileo-colic resection and
23 iterative procedures should not push to creation of stoma and be performed in expert center
24 through laparoscopy. This therapeutic option could thus be discussed in patients with recurrent
25 disease and should not be denied on the basis of risk of increased morbidity.
26
27
28
29
30
31
32
33
34

35 REFERENCES

- 36 1. Peyrin-Biroulet L, Loftus EV, Jr., Colombel JF, Sandborn WJ. The natural history of
37 adult crohn's disease in population-based cohorts. *Am J Gastroenterol* 2010;**105**:289-
38 97.
39
- 40 2. Peyrin-Biroulet L, Harmsen WS, Tremaine WJ, *et al.* Surgery in a population-based
41 cohort of crohn's disease from olmsted county, minnesota (1970-2004). *Am J*
42 *Gastroenterol* 2012;**107**:1693-701.
43
- 44 3. Armuzzi A, Felice C, Papa A, *et al.* Prevention of postoperative recurrence with
45 azathioprine or infliximab in patients with crohn's disease: An open-label pilot study. *J*
46 *Crohns Colitis* 2013;**7**:e623-9.
47
- 48 4. Bemelman WA, Warusavitarne J, Sampietro GM, *et al.* Ecco-escp consensus on
49 surgery for crohn's disease. *J Crohns Colitis* 2017.
50
- 51 5. Ponsioen CY, de Groof EJ, Eshuis EJ, *et al.* Laparoscopic ileocaecal resection versus
52 infliximab for terminal ileitis in crohn's disease: A randomised controlled, open-label,
53 multicentre trial. *Lancet Gastroenterol Hepatol* 2017;**2**:785-92.
54
55
56
57
58
59
60

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
 - 57
 - 58
 - 59
 - 60
6. Buisson A, Chevaux JB, Allen PB, Bommelaer G, Peyrin-Biroulet L. Review article: The natural history of postoperative crohn's disease recurrence. *Aliment Pharmacol Ther* 2012;**35**:625-33.
7. Van Assche G, Rutgeerts P. Medical management of postoperative recurrence in crohn's disease. *Gastroenterol Clin North Am* 2004;**33**:347-60, x.
8. de Buck van Overstraeten A, Eshuis EJ, Vermeire S, *et al*. Short- and medium-term outcomes following primary ileocaecal resection for crohn's disease in two specialist centres. *Br J Surg* 2017;**104**:1713-22.
9. Frolkis AD, Lipton DS, Fiest KM, *et al*. Cumulative incidence of second intestinal resection in crohn's disease: A systematic review and meta-analysis of population-based studies. *Am J Gastroenterol* 2014;**109**:1739-48.
10. Brouquet A, Bretagnol F, Soprani A, *et al*. A laparoscopic approach to iterative ileocolonic resection for the recurrence of crohn's disease. *Surg Endosc* 2010;**24**:879-87.
11. Shigeta K, Okabayashi K, Hasegawa H, *et al*. Meta-analysis of laparoscopic surgery for recurrent crohn's disease. *Surg Today* 2016;**46**:970-8.
12. Pinto RA, Shawki S, Narita K, Weiss EG, Wexner SD. Laparoscopy for recurrent crohn's disease: How do the results compare with the results for primary crohn's disease? *Colorectal Dis* 2011;**13**:302-7.
13. Chaudhary B, Glancy D, Dixon AR. Laparoscopic surgery for recurrent ileocolic crohn's disease is as safe and effective as primary resection. *Colorectal Dis* 2011;**13**:1413-6.
14. Goyer P, Alves A, Bretagnol F, *et al*. Impact of complex crohn's disease on the outcome of laparoscopic ileocecal resection: A comparative clinical study in 124 patients. *Dis Colon Rectum* 2009;**52**:205-10.
15. Brouquet A, Maggiori L, Zerbib P, *et al*. Anti-tnf therapy is associated with an increased risk of postoperative morbidity after surgery for ileocolonic crohn disease: Results of a prospective nationwide cohort. *Ann Surg* 2018;**267**:221-8.
16. von Elm E, Altman DG, Egger M, *et al*. The strengthening the reporting of observational studies in epidemiology (strobe) statement: Guidelines for reporting observational studies. *Lancet* 2007;**370**:1453-7.
17. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: A new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg* 2004;**240**:205-13.

18. Brouquet A, Blanc B, Bretagnol F, *et al.* Surgery for intestinal crohn's disease recurrence. *Surgery* 2010;**148**:936-46.
19. Manser CN, Frei P, Grandinetti T, *et al.* Risk factors for repetitive ileocolic resection in patients with crohn's disease: Results of an observational cohort study. *Inflamm Bowel Dis* 2014;**20**:1548-54.
20. Bandyopadhyay D, Sagar PM, Mirnezami A, *et al.* Laparoscopic resection for recurrent crohn's disease: Safety, feasibility and short-term outcomes. *Colorectal Dis* 2011;**13**:161-5.
21. Nguyen SQ, Teitelbaum E, Sabnis AA, *et al.* Laparoscopic resection for crohn's disease: An experience with 335 cases. *Surg Endosc* 2009;**23**:2380-4.
22. Panteleimonitis S, Ahmed J, Parker T, Qureshi T, Parvaiz A. Laparoscopic resection for primary and recurrent crohn's disease: A case series of over 100 consecutive cases. *Int J Surg* 2017;**47**:69-76.
23. Spinelli A, Bazzi P, Sacchi M, *et al.* Short-term outcomes of laparoscopy combined with enhanced recovery pathway after ileocecal resection for crohn's disease: A case-matched analysis. *J Gastrointest Surg* 2013;**17**:126-32; discussion p 32.
24. Zhu Y, Xiang J, Liu W, Cao Q, Zhou W. Laparoscopy combined with enhanced recovery pathway in ileocecal resection for crohn's disease: A randomized study. *Gastroenterol Res Pract* 2018;**2018**:9648674.
25. Maggiori L, Tuech JJ, Cotte E, *et al.* Single-incision laparoscopy versus multiport laparoscopy for colonic surgery: A multicenter, double-blinded, randomized controlled trial. *Ann Surg* 2018;**268**:740-6.
26. Maggiori L, Rullier E, Lefevre JH, *et al.* Does a combination of laparoscopic approach and full fast track multimodal management decrease postoperative morbidity?: A multicenter randomized controlled trial. *Ann Surg* 2017;**266**:729-37.

Table 1. Preoperative characteristics and previous medical treatments of patients undergoing IICR and PICR

	Total n=567	IICR n=136	PICR n=431	p
Age > 65 years	33 (5.8)	15 (11.0)	18 (4.2)	0.030
Male gender	247 (43.6)	57 (41.9)	190 (44.1)	0.656
BMI <18	92 (16.2)	17 (12.5)	75 (17.4)	0.164
BMI > 30	27 (4.8)	8 (5.9)	19 (4.4)	0.495
Denutrition	209 (36.9)	37 (27.2)	172 (39.9)	0.007
Current smoker	161 (28.4)	37 (27.2)	124 (28.8)	0.777
ASA score > 2	29 (5.1)	13 (9.6)	16 (3.7)	0.011
Duration of CD > 2 years	435 (76.7)	132 (97.1)	303 (70.3)	<0.001
Previous acute episode > 3	80 (14.1)	28 (20.6)	52 (12.1)	0.013
Disease behavior				
Stricturing CD	328 (57.8)	94 (69.1)	234 (54.3)	<0.001
Inflammatory CD	43 (7.6)	15 (11.0)	28 (6.5)	
Perforating CD	196 (34.6)	27 (19.9)	169 (39.2)	
Multifocal intestinal CD	94 (16.6)	21 (15.4)	73 (16.9)	0.642
Associated colorectal CD	102 (18.0)	21 (15.4)	81 (18.8)	0.363
Associated perianal CD	82 (14.5)	24 (17.6)	58 (13.5)	0.221
Associated extradigestive CD	57 (10.1)	14 (10.3)	43 (10.0)	0.940
Previous isolated small bowel resection	127 (22.4)	103 (75.7)	24 (5.6)	<0.001
Previous colorectal resection	63 (11.1)	54 (39.7)	9 (2.1)	<0.001
Preoperative biologic parameters				
Hemoglobin level < 10 g/dl	18 (3.2)	3 (2.2)	15 (3.5)	0.448
Albumin serum level < 30 g/L	67 (15.5)	15 (11.0)	52 (12.1)	0.845
C reactive protein serum level > 10 mg/L	240 (42.3)	45 (33.1)	195 (45.2)	0.028
Preoperative nutritional support	190 (33.5)	35 (25.7)	155 (36.0)	0.028
Previous medical treatment exposure	436(76.9)	105 (77.2)	331 (76.8)	0.950
Steroids	59 (10.4)	12 (8.8)	47 (10.8)	0.488
Thiopurin and/or Methotrexate	53 (9.3)	13 (9.6)	40 (9.3)	0.923
All anti-TNF	146 (25.7)	31 (22.8)	115 (26.7)	0.411
Number of lines of medical treatment ≥ 2	190(33.5)	51 (37.5)	139 (32.3)	0.280
Medical treatment < 3 months before surgery	243 (42.9)	55 (40.4)	188 (43.6)	0.514
Steroids	45 (7.9)	10 (7.4)	35 (8.1)	0.773
Thiopurin and/or Methotrexate	47 (8.3)	10 (7.4)	37 (8.6)	0.650
All anti-TNF	133 (23.5)	29 (21.3)	104 (30.9)	0.554

ASA American Society of Anesthesiologists, BMI body mass index, CD Crohn's Disease,

IICR: iterative ileocolonic resection, PICR: primary ileocolonic resection

Table 2. Surgical procedures and postoperative outcome in patients undergoing IICR and PICR

Variables	Total n=567	IICR n=136	PICR n=431	p
Emergency surgery	52 (9.2)	6 (4.4)	46 (10.7)	0.027
Surgical approach				
Laparoscopy	426 (75.1)	62 (45.6)	364 (84.5)	<0.001
Conversion	70 (16.4)	17 (27.4)	53 (14.6)	0.012
Associated procedures				
Strictureplasty	13 (2.3)	3 (2.2)	10 (2.3)	0.938
Additional intestinal resection	40 (7.1)	9 (6.6)	31 (7.2)	0.819
Intraoperative findings				
Internal fistula	196 (34.6)	34 (25)	162 (37.6)	0.007
Abscess	102 (18.0)	15 (11.0)	87 (20.2)	0.013
Intraoperative CD length > 50 cm	61 (10.8)	5 (3.7)	56 (13.0)	0.002
Length of resected bowel > 50 cm	79 (13.9)	14 (10.3)	65 (15.1)	0.140
Intraoperative complication				
Bowel injury	2 (0.4)	2 (1.5)	0	-
Bleeding	2 (0.4)	0	2 (0.5)	-
Primary anastomosis	449 (79.2)	112 (82.4)	337 (78.2)	0.297
Type of anastomosis				
End to side	86(15.2)	19 (14.0)	67 (19.9)	
End to end	49(8.6)	13 (9.6)	6 (10.7)	0.457
Side to side	304(53.6)	77 (56.6)	227 (67.4)	
Hand-sewn/stapled	183 (40.8) /266 (59.2)	38(33.9)/74(66.1)	145 (43)/192 (57)	0.100
Operative time, min	143.1 (+/- 51.2)	155.9 (+/- 53.3)	138.9 (+/-49.9)	0.002
Operative time > 180 min	121 (21.3)	42 (30.9)	79 (18.3)	0.002
Postoperative mortality	0	0	0	-
Overall postoperative morbidity	165 (29.1)	50 (36.8)	115 (26.7)	0.024
Infectious morbidity	101 (17.8)	27 (19.9)	74 (17.2)	0.476
Non infectious morbidity	87 (15.3)	28 (20.6)	59 (13.7)	0.052
Morbidity surgical site infection	78 (13.8)	19 (14.0)	59 (13.7)	0.934
Intraabdominal septic complications	48 (8.5)	12 (8.8)	36 (8.4)	0.863
Anastomotic leakage with peritonitis	14/449 (3.1)	3/112 (2.7)	11/337 (3.3)	0.757
Anastomotic leakage without peritonitis	11/449 (2.4)	2/112 (1.8)	9/337 (2.7)	0.600
Intraabdominal abscess	23/567 (4.1)	7/136 (5.1)	16/436 (3.7)	0.460
Other complications				
Intraabdominal bleeding	12 (2.1)	1 (0.7)	11 (2.6)	0.199
Ileus	32 (5.6)	16 (11.8)	16 (3.7)	<0.001
Wound infection	22 (3.9)	8 (5.9)	14 (3.2)	0.165
Urinary tract infection	11 (1.9)	4 (2.9)	7 (1.6)	0.332
Pneumonia	2 (0.3)	0	2	-
Pulmonary embolism	1 (0.2)	0	1	-
Catheter infection	9 (1.6)	3 (2.2)	6 (1.4)	0.504
Urinary retention	4 (0.7)	1 (0.7)	3 (0.7)	0.962
Acute renal failure	6 (1.1)	0	6 (1.4)	-
Severe complications (Dindo-Clavien III,IV)	49 (8.6)	11 (8.1)	38 (8.8)	0.792
Reoperation for complications	24 (4.2)	4 (2.9)	20 (4.6)	0.391
Reoperation with stoma for complications	19 (3.4)	4 (2.9)	15 (3.5)	0.761
Drainage for complications	14 (2.5)	2 (1.5)	12 (2.9)	0.389

Length of stay mean±SD, median (IQR) 9.9±2.3; 7(6-9) 9.3±6.9; 7(6-10) 10.2±23.0; 7(6-9) 0.499

Table 3. Surgical procedures and post-operative outcomes in 136 patients undergoing iterative ileocolonic resection (ICR) depending on the number of **previous** ileocolonic resections

	Iterative ICR n = 136	2nd ICR n = 97	3rd ICR or more n = 39	p
Laparoscopy	62 (45.6)	48 (49.5)	14 (35.9)	0.150
Conversion	17 (27.4)	14 (14.4)	3 (7.7)	0.568
Primary anastomosis	112 (82.4)	81 (83.5)	31 (79.5)	0.578
Operative duration	155.9 (+/- 53.3)	153.2 (+/-52.4)	162.9 (+/-55.6)	0.747
Operative duration > 180 min	42 (30.9)	28 (28.9)	14 (35.9)	0.372
Overall postoperative morbidity	50 (36.8)	34 (35.1)	16 (41.0)	0.513
Intra-abdominal septic complications	12 (8.8)	6 (6.2)	6 (15.4)	0.087
Severe postoperative complications	11 (8.1)	7 (7.2)	4 (10.3)	0.557
Reoperation for complications	4 (2.9)	2 (2.1)	2 (5.1)	0.338
Length of stay mean±SD, median (IQR)	9.3±6.9; 7(6-10)	8.5±4.7; 7(6-9)	11.2±10.4; 7.5(6-13)	0.181

% are in parentheses

Table 4. Operative and postoperative outcome by yearly case volume in the IICR group.

	Volume ≤ 15 patients / year*	Volume > 15 patients / year	p
IICR/total	23/130 (17.7)	113/434 (26.0)	0.051
Laparoscopy	13/23 (56.5)	50/113 (44.2)	0.282
Conversion	6/13 (46.2)	11/50 (22.0)	0.080
Operative duration > 180 min	6/23 (26.1)	36/113 (31.9)	0.585
Overall postoperative morbidity	8/23 (34.8)	42/113 (37.2)	0.829
Length of stay mean±SD, median (IQR)	7.8±3.4; 7(4-8.5)	9.54±7.4; 7(6-10)	0.297

*One center of this group was excluded from this analysis because no IICR was performed

(n=3 patients, among which 3 PICR and 0 IICR)

% are in parentheses

Table 5. Univariate and multivariate analyses of risk factors of overall postoperative morbidity in 136 patients undergoing IICR.

	Univariate analysis	Multivariate analysis		
	p	p	OR	IC95%
Age > 65 years	0.770	0.848	0.926	0.229-3.747
Male gender	0.154	0.490	0.759	0.331-1.744
BMI <18	0.673	0.104	3.885	0.755-19.995
BMI > 30	0.955	-		
Denutrition	0.298	0.225	0.429	0.107-1.722
Current smoker	0.768	0.627	1.249	0.481-3.245
ASA status > 2	0.279	0.230	0.401	0.090-1.783
Duration of CD > 2 years	0.122	-		
Acute episode < 3 months	0.644	-		
Previous acute episode > 3	0.103	-		
Disease behavior				
Stricturing CD	0.347	-		
Inflammatory CD	0.770	-		
Perforating CD	0.680	0.547	0.718	0.257-2.009
Preoperative CD length > 50 cm	0.753	-		
Multifocal intestinal CD	0.653	-		
Associated colorectal CD	0.529	-		
Associated perianal CD	0.325	-		
Associated extra-digestive CD	0.209	-		
Prior isolated small bowel resection	0.320	-		
Prior colorectal resection	0.926	-		
Number of previous ICR				
Second ICR vs. 3 rd or more	0.513	0.470	1.254	0.493-3.191
Preoperative biologic parameters				
Hemoglobin level < 10 g/dL	0.247	-		
Albumin serum level < 30 g/L	0.168	-		
C reactive protein serum level > 10 mg/L	0.468	-		
Preoperative nutritional support	0.724	-		
Medical treatment < 3 months before surgery				
Steroids	0.127	0.999	-	-
Any anti-TNF	0.911	0.460	1.434	0.533-3.854
Intraoperative findings				
Internal fistula	0.347	-		
Abscess	0.752	-		
Intraoperative CD length > 50 cm	0.242	-		
Emergency surgery	0.296	-		
Surgical approach				
Laparoscopy vs Laparotomy	0.667	-		
Conversion	0.734	-		
Associated procedures				
Strictureplasty	0.901	-		
Additional intestinal resection	0.349	-		
Length of resected bowel > 50 cm	0.966	-		
Primary anastomosis	0.395	-		
Stapled vs handsewn anastomosis	0.678	-		

1
2
3 Operative time > 180 min

0.525

-

4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For Review Only