



Preserving the Inferior Mesenteric Artery during Elective Laparoscopic Sigmoidectomy for Diverticulitis

Danilo Coco^{1*}, MD;  Silvana Leanza², MD

¹Department of General Surgery, Ospedali Riuniti Marche Nord, Pesaro, Italy

²Department of General Surgery, Carlo Urbani Hospital, Jesi (Ancona), Italy

*Corresponding authors:

Danilo Coco,
Ospedali Riuniti Marche Nord, Pesaro, Italy
Email: webcostruction@msn.com

Received: 16-02-2022

Revised: 11-04-2022

Accepted: 11-04-2022

Abstract

Context: During a Laparoscopic Sigmoid Resection (LSR) for patients with diverticulitis, the inferior mesenteric artery may or may not be preserved depending on the surgical technique. We aimed to evaluate results after LSR with Inferior Mesenteric Artery Preservation (IMAP) and Superior Rectal Artery Preservation (SRAP) in terms of anastomotic leakages and denervation of the hypogastric nerves with consequent genitourinary and defecation alterations.

Evidence Acquisition: A retrospective PubMed research of manuscripts published from January 2000 to January 2020 was conducted, enrolling studies about patients with symptomatic diverticular disease who underwent surgery.

Results: A total of 1685 patients with IMAP and SRAP were included in the study.

Conclusion: This retrospective review showed that patients with IMAP-SRAP demonstrated an equal or lower leakage rate with reduced incidence of stoma, lower incidence of defecation disorders, and similar or improved quality of life compared with laparoscopic left colectomy with no IMAP.

Keywords: Diverticular disease, Diverticulitis, Inferior mesenteric artery preservation (IMAP), Superior rectal artery preservation (SRAP), High tie, Low tie, Laparoscopic left colectomy

Please cite this paper as:

Coco D, Leanza S. Preserving the Inferior Mesenteric Artery during Elective Laparoscopic Sigmoidectomy for Diverticulitis. *Iran J Colorectal Res.* 2022;10(1):5-8. doi: 10.30476/ACRR.2022.94652.1138.

Introduction

Diverticular disease is a common cause of morbidity and mortality. It occurs in about 60% of people in Western countries, primarily those aged from 50 to 70 (1). Among patients with diverticular disease who experience the first attack of acute diverticulitis, as many as one third suffer a relapse, another third of whom experience a subsequent relapse. Nearly 30% of patients recover entirely following a sigmoid resection in the first attack (2, 3).

It has recently become standard to offer a Laparoscopic Sigmoid Resection (LSR) to patients with diverticulitis. During this procedure, the inferior mesenteric artery (IMA) may or may not be preserved depending on the surgical technique. LSR with Inferior Mesenteric Artery Preservation (IMAP) avoids mobilization of the rectum and ligation at the origin of the IMA, which minimizes anastomotic dehiscences due to preserved vascularization. More importantly, a better postoperative course is experienced in terms of the patient's defecatory and

genitourinary capacity since the hypogastric nerves are also spared (4-7). LSR with IMAP and Superior Rectal Artery Preservation (SRAP), by sectioning the sigmoid arteries one by one, seems to expose the patient to fewer morbidities (8). In this study, we aimed to evaluate results after LSR with IMAP/SRAP in terms of the incidence of anastomotic leakages and denervation of the hypogastric nerves with consequent genitourinary and defecation alterations.

Materials and Methods

We searched the PubMed database and evaluated 23 investigations conducted from 2000 to 2020. The inclusion criteria included English language, complete treatment of the disease, and the following keywords: “diverticular disease, diverticulitis, inferior mesenteric artery preservation, superior rectal artery preservation, high tie, low tie, and/or laparoscopic left colectomy.” We excluded case reports, fragmented conversations on pathology, and inferior mesenteric artery preservation due to cancer. Following these rules, only nine manuscripts were deemed eligible. Two researchers (DC and SL) revised the manuscripts and extracted the relevant data.

Results

Masoni et al. (1) compared the results of 54 IMAP procedures against 53 IMA resection (IMAR) cases. For the patients in the IMAP group, the study demonstrated decreased frequency and intensity of gas incontinence, less soiling, and better QoL compared with the IMAR group. Mean surgery durations were 138 ± 45 min for IMAP and 124 ± 51 min for IMAR ($P=0.611$). The authors concluded that IMAP might spare the autonomic innervations of the colon and rectum, which seems to reduce soiling, urgency, and fragmented evacuation. This is while in the IMAR group, high ligation of the IMA may lead to denervation of the colonic stump. The quality of life evaluation was better in the IMAP group. The rate of anastomotic leakage was not mentioned.

A prospective study by Jolivet et al. (9) about the high tie of the IMA for diverticular disease on twenty-five consecutive patients evaluating preoperative and six-months-postoperative bowel symptomatology (Jorge–Wexner Incontinence Score and KESS score), urinary function (IPSS), sexual function (IIEF), morbidity, and quality of life (SF-36) concluded that laparoscopic sigmoidectomy with a high tie of the IMA for diverticular disease did not induce functional disorders at six months after surgery and demonstrated an improvement in quality of life. The morbidity (leakage) rate declared was 12%. No operative time comparisons were made.

De Nardi et al. (10) retrospectively compared IMAP with IMAR in 219 elective sigmoidectomies for

diverticular disease using the primary endpoint of anastomotic leakage and the secondary endpoints of operative time, stoma formation, overall postoperative complications, restoration of bowel function, and length of postoperative hospital stay. Anastomotic leakage was 4.5% in IMAR and 3.9% in IMAP ($P>0.05$), while the operative time was 225 ± 43.4 min in IMAR vs. 191 ± 41.7 min in IMAP ($P=0.002$). No differences were observed in the rate of overall complications, stoma formation, restoration of bowel function, and postoperative hospital stay. The study stated that the preservation or ligation of the IMA did not affect leakage rate or morbidity, mortality, or operative time.

An important systematic review conducted by Cirocchi et al. (11) on whether preservation of the IMA reduces the risk of anastomotic leakage in 2,190 patients (IMA preservation 1,353, ligation 837) using eight studies demonstrated that the rate of anastomotic leakage was not significantly higher in the IMA ligation group (6%) than the IMAP group (2.4%). In this way, this systematic review failed to demonstrate a statistically significant difference in the anastomotic leakage rate when comparing IMAP with IMA ligation, even if it demonstrated that conversion to a laparotomy was significantly lower in the IMA ligation group (5.1%) than in the IMAP group (9%).

A retrospective review by Lehmann et al. (12) inspected IMAP and SRAP in terms of anastomotic leakage. There were no significant differences in leak rates when the IMA or superior rectal artery (SRA) was sacrificed (0% and 3.7%, respectively) or preserved (9.3% and 6.5%, respectively). The study concluded that preserving or sacrificing these arteries was not associated with an increased leak rate from colorectal anastomoses after sigmoidectomy for diverticular disease. No references were given about operative time, though the study stated that hand-sewn anastomoses were associated with a higher leak rate (33% vs. 2%; odds ratio, 3.44; 95% confidence interval, 1.514-7.817; $P<0.001$) than stapled anastomoses.

Tocchi et al. (13) performed a retrospective study on 163 patients after a sigmoid resection. The primary endpoint was anastomotic leakage. They noted that IMAP had less anastomotic leakage and a significantly lower number of staple-ring disruptions. The mean operating time was superior in the IMAP group.

Sohn et al. (14) performed a systematic review of three studies with a total of 564 patients, aiming to assess whether SRAP reduces anastomotic leakage. The SRA was preserved in 305 patients and sacrificed in 259. One study demonstrated a significant reduction in the anastomotic leak rate in the arterial preservation group, while another showed a non-significant reduction of anastomotic leakages. In the third study, preservation of the SRA was associated with a non-significant increase in leakages (Tables 1 and 2).

Table 1: A summary of the outcomes following laparoscopic sigmoidectomy for diverticulitis with inferior mesenteric artery preservation (IMAP).

Authors	Study	Date (No. of Pts.)	QoL	Intestinal function	Anastomotic leak
Masoni et al.	Randomized, single-blinded	Jan 2004 to Jan 2010 (53)	Good	Minor incontinence	No leak
Mari et al.	Retrospective	Jan 2015 to Mar 2016 (31)	Good postoperative quality of life	No differences in the genitourinary function	No leak
Jolivet et al.	Prospective	2020 (25)	Better general health	Good scores for bowel symptomatology and urinary and sexual function	No leak
De Nardi et al.	Retrospective	Jan 2006 to Dec 2012 (153)	Not calculated	Good restoration of bowel function	3.9%
Cirocchi et al.	Randomized and non-randomized clinical trials	2012 (400)	Not calculated	Not calculated	7.3%
Lehmann et al.	Retrospective	May 2011 (130)	Not calculated	Not calculated	9.3%
Posabella et al.	Prospectively collected database	Jan 2004- Dec 2014 (736)	Not calculated	Not calculated	1.2%
Sohn et al.	Retrospective multicenter analysis	2002-2015 (157)	Favorable outcome	Favorable outcome	1.9%
Tocchi et al.	Retrospective	2001 (163)	Not calculated	Not calculated	Inferior leakage in IMAP

Pts., Patients; QoL, Quality of Life; IMAP, Inferior Mesenteric Artery Preservation

Table 2: Operative time

Masoni et al.	138±45 min in IMAP vs. 124±51 min in IMAR (P=0.611)
De Nardi et al.	191 ±41.7 min in IMAP vs. 225±43.4 min in IMAR (P=0.002)
Tocchi et al.	Mean operating time was superior in the IMAP group

IMAP, Inferior Mesenteric Artery Preservation; IMAR, Inferior Mesenteric Artery Resection

Discussion

Diverticular disease is a common cause of morbidity, hospitalization, and mortality, especially in Western countries, where it occurs in roughly 60% of people, mainly those aged 50 to 70. During the treatment of diverticulitis, surgeons prefer the laparoscopic approach, and two techniques can be performed with sparing and without sparing the IMA. In the literature, many studies debate if IMAP plus SRAP achieves better results than IMA ligation. We conducted a review to shed light on this issue. No differences with a P-value below 0.01 were observed between these two procedures in the rate of anastomotic leakage, overall complications, stoma formation, restoration of bowel function, and postoperative hospital stay. Many data were controversial and seemed to demonstrate higher conversion rates in IMAP, longer operative times in IMAR, and a moderate advantage in terms of anastomotic leakage

in IMAP. Preservation of genitourinary function and sexual activity seemed superior in IMAP, while QoL seemed to be similar between the IMAP and IMAR groups (1, 10-14)

Conclusion

Inferior mesenteric artery/superior rectal artery preservation during laparoscopic sigmoidectomy for diverticulitis leads to a similar anastomotic leakage rate as inferior mesenteric artery resection while offering equal or improved quality of life, bowel function, and genitourinary and sexual function.

Acknowledgments

Danilo Coco, the corresponding author of this article; Silvana Leanza MD, co-author.

Conflicts of interest: None declared.

References

1. Luigi Masoni, Francesco Saverio Mari, Giuseppe Nigri, Francesco Favi, Marcello Gasparrini, Anna Dall'Oglio, Fioralba Pindozi, Alessandra Pancaldi, Antonio Brescia, Preservation of the inferior mesenteric artery via laparoscopic sigmoid colectomy performed for diverticular disease: real benefit or technical challenge: a randomized controlled clinical trial, *Surg Endosc* DOI 10.1007/s00464-012-2420-3.
2. Parks TG (1969) Natural history of diverticular disease of the colon: a review of 521 cases. *Br Med J* 4:639–642 3.
3. Janes S, Meagher A, Frizelle FA (2005) Elective surgery after acute diverticulitis. *Br J Surg* 92:133–142.
4. Dobrowolski S, Hac' S, Kobiela J, Sledzin'ski Z (2009) Should we preserve the inferior mesenteric artery during sigmoid colectomy? *Neurogastroenterol Motil* 21:1288-e123.
5. Ho YH, Low D, Goh HS (1996) Bowel function survey after segmental colorectal resections. *Dis Colon Rectum* 39:307–310
6. Lee WY, Takahashi T, Pappas T, Mantyh CR, Ludwig KA (2008) Surgical autonomic denervation results in altered colonic motility: an explanation for low anterior resection syndrome? *Surgery* 143:778–783.
7. Horgan PG, O'Connell PR, Shinkwin CA, Kirwan WO (1989) Effect of anterior resection on anal sphincter function. *Br J Surg* 76:783–786.
8. Koda K, Saito N, Seike K, Shimizu K, Kosugi C, Miyazaki M (2005) Denervation of the neorectum as a potential cause of defecatory disorder following low anterior resection for rectal cancer. *Dis Colon Rectum* 48:210–217.
9. M. Jolivet, B. Trilling, P-Y. Sage, B. Boussat, E. Girard & J-L. Faucheron, Prospective evaluation of functional outcomes after laparoscopic sigmoidectomy with high tie of the inferior mesenteric artery for diverticular disease in consecutive male patients, *Techniques in Coloproctology* volume 24, pages33–40(2020).
10. Paola De Nardi Paolo Gazzetta Does inferior mesenteric artery ligation affect outcome in elective colonic resection for diverticular disease?, *ANZ Journal of Surgery*, Volume 88, Issue 11, November 2018, Pages E778-E781, <https://doi.org/10.1111/ans.14724>.
11. R. Cirocchi G. Popivanov G. A. Binda B. M. Henry K. A. Tomaszewski R. J. Davies S. Di Saverio, Sigmoid resection for diverticular disease – to ligate or to preserve the inferior mesenteric artery? Results of a systematic review and meta-analysis, *Colorectal disease*, Volume 21, Issue 6, June 2019, Pages 623-631, <https://doi.org/10.1111/codi.14547>.
12. Ryan K Lehmann 1, Lionel R Brounts, Eric K Johnson, Julie A Rizzo, Scott R Steele, Does sacrifice of the inferior mesenteric artery or superior rectal artery affect anastomotic leak following sigmoidectomy for diverticulitis? a retrospective review, *Am J Surg* 2011 May;201(5):623-7. doi: 10.1016/j.amjsurg.2011.01.011.
13. A Tocchi I, G Mazzoni, V Fornasari, M Miccini, G Daddi, S Tagliacozzo, Preservation of the inferior mesenteric artery in colorectal resection for complicated diverticular disease, *Am J Surg* 2001 Aug;182(2):162-7. doi: 10.1016/s0002-9610(01)00681-x.
14. M. Sohn M.D. & A. Agha M.D., Preservation of the superior rectal artery, *coloproctology* volume 40, pages42–46(2018).