



# Attitudes toward Surgical Management of Acute Diverticulitis: Results from an Online Experts' Survey in Lombardia Region – Italy

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## Abstract

**Aim:** To assess the current trends of surgical treatment for both uncomplicated and complicated acute diverticulitis through an online survey in Lombardia, the biggest region for healthcare in Italy.

**Methods:** An online survey relating to the surgical treatment of acute diverticulitis and covering 13 separate multiple-choice questions was set up by the authors following an analysis of the current literature, and then online launched starting from October 9<sup>th</sup>, 2017 for two weeks inviting to reply 90 chief surgeons' members of the Lombardia Surgical community. Questions were referred to both Low- (L-RP) and Increased-Risk (I-RP) Patients, considering the latter when showing at least one feature between age >80 years old, ASA score  $\geq 3$ , BMI >30 kg/m<sup>2</sup>, any Child-Pugh score.

**Results:** The full reply rate was 57.7% (52/90). Indication to elective surgery in L-RP was considered after 2, 3, more than 3 episodes and never in 33%, 17%, 31% and 27% respectively, while in I-RP the most chosen answer was never in 48% of cases. The most performed elective procedure was laparoscopic left sigmoidectomy with 63.5% in L-RP group and 65.4% in I-RP group. Low-tie represented the preferred vascular approach in 67% of responses. Conservative treatment is the preferred for complicated Hinchey 1 diverticulitis in both L-RP and I-RP with 75% and 63% of answers respectively. For Hinchey 2 diverticulitis laparoscopic lavage and drainage seemed to be the most chosen option in L-RP (42%) while it was the percutaneous drainage (50%) in I-RP. Attitudes toward Hinchey 3 class were quite heterogeneous. Hartmann's procedure, both open and laparoscopically, was surely the most indicated option for the treatment of complicated Hinchey 4 diverticulitis.

**Conclusion:** Uncomplicated and complicated diverticulitis highlighted different strategies of surgical treatment, even in a high-level surgical community. Further evidences and guidelines will be desirable.

**Keywords:** L-RP; I-RP; Diverticular disease; HL; IMA

## Introduction

Diverticular disease is a growing problem in western countries, with proportional impact on society and health spending. Epidemiological data suggested that over half of the American population over 60 has colonic diverticulosis, with an age-related prevalence, but even under 50-years-of-age there has been an increase of 132% in the last 10 years [1,2]. Natural history of the disease predicts that about 80% to 85% of patients with colonic diverticulosis will remain asymptomatic, while 10% to 15% will develop symptoms, up to about 5% who will suffer from acute diverticulitis with its complications [3]. Acute diverticulitis represents for various reasons pathology of surgical interest, which has aroused much interest and a big amount of literature over the years. However, some aspects concerning diverticulitis still lack of high evidence and different topics about the role of surgery in both uncomplicated and complicated diverticulitis have long been under debate. Regarding acute uncomplicated diverticulitis, the timing of elective surgery, some surgical steps and the technologies used are under the headlights. With reference to complicated diverticulitis and the treatment of its different stages according to Hinchey classification, there is still poor consensus, also due the controversial results from recent randomized trials in this field [4]. Starting from these considerations, we aimed to conduct a survey among the chiefs of surgery in Lombardia, the biggest Italian region for health system, with a over 10 million population in

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**Table 1:** Survey questions and multiple-choice answers regarding elective surgery.

1. After how many episodes of uncomplicated acute diverticulitis in normal risk patients do you suggest elective surgery?	A. 1 Episode
	B. 2 Episodes
	C. 3 Episodes
	D. More than 3 episodes
	E. Never
2. After how many episodes of uncomplicated acute diverticulitis in increased risk patients do you suggest elective surgery?	A. 1 Episode
	B. 2 Episodes
	C. 3 Episodes
	D. More than 3 episodes
	E. Never
3. Which elective surgical procedure do you choose in normal risk patients?	A. Open left colectomy
	B. Laparoscopic left colectomy
	C. Open sigmoidectomy
	D. Laparoscopic sigmoidectomy
4. Which elective surgical procedure do you choose in increased risk patients?	A. Open left colectomy
	B. Laparoscopic left colectomy
	C. Open sigmoidectomy
	D. Laparoscopic sigmoidectomy
5. Which vascular approach do you prefer?	A. High-tie
	B. Low-tie
	C. Other

2017, 37,000 beds in hospitals and over €18 billion of Euros per year in health spending [5]. It should be considered that analyzing data from the 2018 Italian National Outcomes Program (PNE) referring to the performances in the year 2017, it emerged how more than 25% of all the procedures for colorectal cancer registered in Italy were performed in Lombardia, therefore, even in absence of reliable data, it is likely to expect that this proportion will also be confirmed for the surgical treatment of diverticulitis [6]. Our aim was to analyze the attitudes on acute diverticulitis inside a high-level surgical community.

## Methods

An online survey was administered to 90 chiefs of general surgery departments with a surgical volume referred to diverticulitis over than 20 cases per year in Lombardia region – Italy, starting from October 9<sup>th</sup>, 2017 for two weeks. Survey reminders were sent by email bi-weekly. The survey was designed to require less than 10 min to be completed and included questions regarding surgical choices in case of both uncomplicated and complicated diverticulitis. Complicated diverticulitis was defined as that condition covering one of the four severity classes according to Hinchey classification [4]. The survey questions, variables and answers are collected in Table 1 and Table 2 regarding elective and emergency surgery respectively. All the questions involved a multiple-choice answer. All the main questions were Related to Both Low- (L-RP) and Increased-Risk Patients (I-RP). A patient was defined at increased-risk when showing at least one feature between age >80-years-old, ASA score ≥ 3, BMI>30 kg/m<sup>2</sup>, any child class. Left colectomy was meant as resection of the left and sigmoid colon with mobilization of the splenic flexure. Sigmoidectomy was defined as resection of sigmoid colon with or without mobilizing the splenic flexure. Hartmann's procedure was classically defined as resection of the pathological sigmoid colon,

closure of the rectal stump and formation of an end colostomy. High- and low-tie were intended as arterial ligation at the origin of the inferior mesenteric artery and ligation of the first sigmoid artery with sparing of the left colic artery, respectively. At the end of the survey, a 0 rating to 10 rating visual satisfaction questionnaire and a space for free comments were proposed to respondents.

## Results

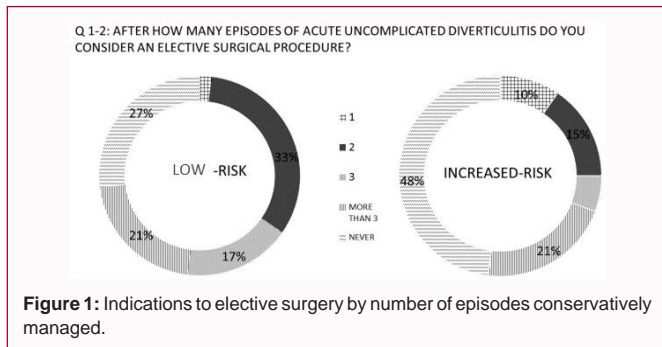
We collected 52 full responses with a reply rate of 57.7%. As shown in Figure 1, 33% of responders indicated an elective surgery in L-RP after 2 episodes of acute uncomplicated diverticulitis, 17% after 3 episodes, 31% after more than 3 episodes and 27% ever. Instead in I-RP, surgical indication was never placed in 48%, over 3 episodes in 31% and 2 episodes in 15%. Figure 2 and 3 show the intentions about the elective surgical treatment. The most performed elective procedure was laparoscopic left sigmoidectomy with 63.5% in L-RP group and 65.4% in I-RP group. Low-tie was indicated as the preferred vascular approach in 67% of responses. Figure 4 to 7 highlight the attitudes in case of complicated diverticulitis stratified by Hinchey classes. Conservative treatment is the preferred for complicated Hinchey 1 diverticulitis in both L-RP and I-RP with 75% and 63% of answers respectively. For Hinchey 2 diverticulitis laparoscopic lavage and drainage seemed to be the most chosen option in L-RP (42%) while it was the percutaneous drainage (50%) in I-RP. Attitudes toward Hinchey 3 class were quite heterogeneous. Both open and laparoscopic Hartmann's procedures were surely the most indicated options for the treatment of complicated Hinchey 4 diverticulitis. The final satisfaction questionnaire provided a mean score of 7.5/10 ± 4.5.

## Discussion

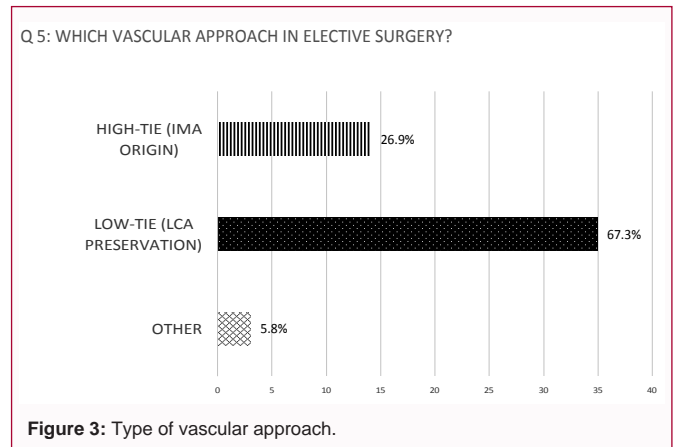
Diverticular disease means an all-encompassing definition, including all symptoms and complications due to diverticulosis of

**Table 2:** Survey questions, variables and multiple-choice answers regarding emergency surgery.

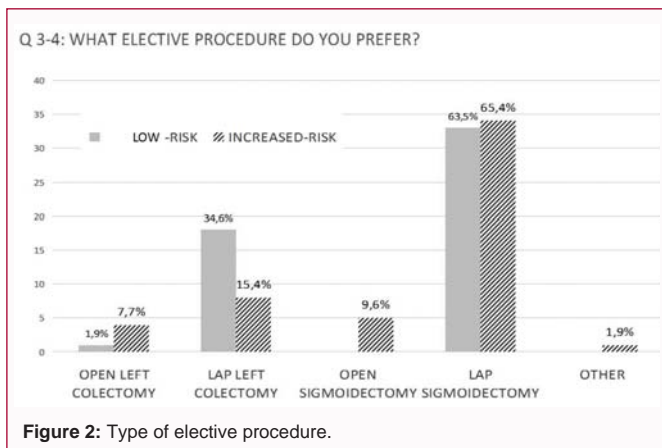
Questions	Variables	Answers
6-7. What is your choice in case of Hinchey 1 complicated diverticulitis?	Low-risk patient (L-RP)	A. Conservative treatment
8-9. What is your choice in case of Hinchey 2 complicated diverticulitis?	Increased-risk patient (I-RP)	B. Percutaneous drainage US- or CT-guided
10-11. What is your choice in case of Hinchey 3 complicated diverticulitis?		C. Exploratory laparotomy, lavage and drainage
12-13. What is your choice in case of Hinchey 4 complicated diverticulitis?		D. Exploratory laparoscopy, lavage and drainage
		E. Open left colectomy
		F. Laparoscopic left colectomy
		G. Open left colectomy + loop ileostomy
		H. Laparoscopic left colectomy + loop ileostomy
		I. Open sigmoidectomy
		L. Laparoscopic sigmoidectomy
		M. Open sigmoidectomy + loop ileostomy
		N. Laparoscopic sigmoidectomy + loop ileostomy
		O. Open Hartmann's procedure
		P. Laparoscopic Hartmann's procedure
		Q. Other



**Figure 1:** Indications to elective surgery by number of episodes conservatively managed.



**Figure 3:** Type of vascular approach.



**Figure 2:** Type of elective procedure.

the colon. It ranked 5<sup>th</sup> among the most costly gastroenterological diseases in the Western World [7]. Considering that its incidence increases with age, it is conceivable that both the health and social costs related to diverticular disease will be destined to grow together with the increase in the mean age of the population. Surgery can play a pivotal role in uncomplicated, smoldering and complicated acute diverticulitis [8]. Although several guidelines have been published in recent years, there is a low consensus regarding the surgical strategies of treatment for diverticulitis. Indications for elective surgery remain controversial regarding uncomplicated acute diverticulitis. In 2000,

recommendations from American Society of Colon and Rectal Surgeons (ASCRS) proposed an indication for elective sigmoidectomy after 2 episodes of uncomplicated diverticulitis, as well as after 1 episode of complicated diverticulitis conservatively managed [9]. Since then, many surgeons followed that recommended pathway, while many others criticized the indication by claiming that there was no evidence to support that an elective colectomy should follow always two attacks of diverticulitis. ASCRS revised these indications in 2014, suggesting a more cautious attitude and individualizing on a case-by-case basis the indication for elective sigmoidectomy after episodes of uncomplicated acute diverticulitis [10]. This was due to the fact that perforation generally characterizes the first acute episode and the number and severity of recurrences progressively decrease afterwards [11,12]. Many patients will have no other acute episodes after the first and the risk of complicated recurrence after an uncomplicated episode is between 3% and 5% [13,14]. Recurrent diverticulitis rate after segmental resection appears to be around 5%, while the rate of patients reporting residual symptoms after surgery despite the absence of diagnostic evidence of recurrent inflammation reaches up to 20% [15]. In addition, complication rate after elective surgery is described up to 15% [16].

Mäkelä et al. [17] in 2010 published the review of a large 20-year

series of patients hospitalized for acute diverticulitis concluding that 2 acute episodes would not justify an elective surgical treatment. But epidemiological analysis by Peppas et al. [18] about over than 30,000 cases estimated a hospital readmission rate of 18.6% in patients treated conservatively, as well as the presence of residual symptoms in 43% to 86% of the cases, compared with 6.1% of rehospitalizations in patients undergoing surgery and a big 4-years nationwide retrospective cohort study by Simianu et al. [19] concluded that 56.3% of elective procedures were performed before the third uncomplicated episode. Moreover, long-term results from direct randomized controlled trial, which compared sigmoidectomy after 3 or more uncomplicated episodes versus conservative management, showed better outcomes in terms of surgical outcomes, quality of life and economic benefits in favor of surgical treatment, despite a 15% anastomotic leakage rate [20,21]. Timing and indications for elective surgery are subject of a constantly evolving debate and the current trend, promoted by the major international guidelines, seems to prefer a tailored approach, assessing factors related to both the disease and the patient [10,22]. There is agreement that young patients are more likely to have an acute relapse due to a longer life expectancy, and that they are looking for an improvement in quality of life, that an elective surgical treatment, especially a minimally invasive one, could provide to them [23-25]. There is more debate about the attitude towards immunocompromised patients, considering that the risk of perforation during an acute episode is up to 5-times greater than in immunocompetents, however the post-operative morbidity and mortality rates are also greater [26,27]. Our survey showed discordant results, where in L-RP the indication to elective surgery after two acute uncomplicated episodes was quantitatively the highest (33%), although there was a big tendency to delay this indication. This trend was confirmed regarding I-RP, for whom 48% of respondents declared that they never put an indication for elective surgery, regardless of the number of previous acute episodes. However, the "mise à mort" of the elective surgery is not yet justifiable [28]. An excessive delay in surgical indication would be poorly preparatory to minimally invasive surgery as patients with less than 3 episodes of diverticulitis could benefit particularly from an elective laparoscopic procedure, considering that an increasing number of attacks over 3 affected conversion rate and perioperative complications in laparoscopic diverticulitis surgery [29,30]. Participants in our survey said they choose much more a laparoscopic approach compared to a traditional one in the case of elective surgery for acute diverticulitis, for both low- (63.5% for laparoscopic sigmoidectomy, 34.6% for laparoscopic left colectomy) and increased-risk (65.4% for laparoscopic sigmoidectomy, 15.4% for laparoscopic left colectomy) patients. Sigma trial showed that laparoscopic surgery, despite a 19.2% conversion rate, produced better results than conventional surgery in terms of morbidity, length of hospital stay and quality of life assessed by SF-36 questionnaire [31]. Quality of life and post-operative comfort have been evaluated, also by us, through Gastrointestinal Quality of Life Index (GIQLI) questionnaire, showing a statistically significant improvement in almost all the sample of patients undergoing elective laparoscopic surgery [32,33]. Despite this, the much of published literature is of low evidence, and meta-analysis by Abraha et al. [34] was not conclusive in defining whether laparoscopic surgery provides any advantage over conventional surgery in the elective management of acute diverticular disease. Regarding to the timing of surgery, a procedure performed more than 90 days after the last acute episode conservatively treated showed better results in terms of overall morbidity, length of hospital stay and percentage of residual inflammation compared to an early

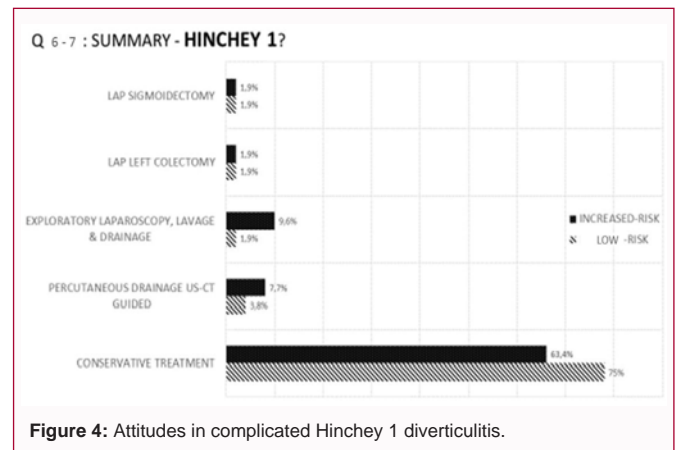


Figure 4: Attitudes in complicated Hinchey 1 diverticulitis.

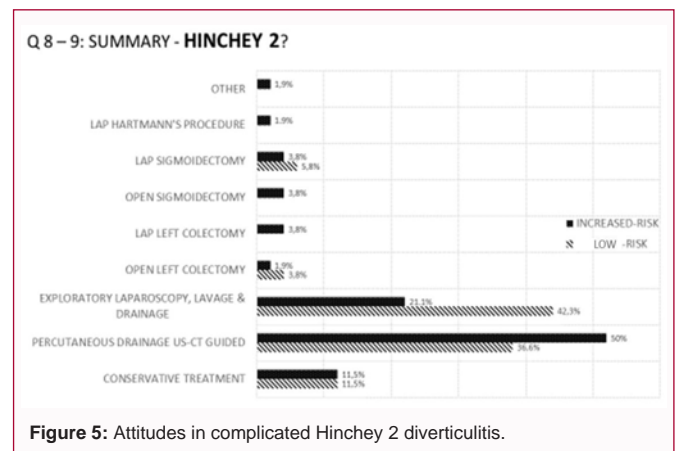


Figure 5: Attitudes in complicated Hinchey 2 diverticulitis.

surgery within 90 days [35]. Recently, the Low-Ligation (LL) of Inferior Mesenteric Artery (IMA), meaning a preservation of left colonic artery, has been compared with the standard High-Ligation (HL) at aortic origin level. The rationale was in the attempt to improve anastomotic perfusion and minimize nerves damages. For the treatment of colorectal cancer, the oncological and functional outcomes of LL were similar if not better than HL [36,37]. Although regarding to laparoscopic diverticulitis surgery the type of IMA ligation does not seem to impact on leakage rate, survey participants definitively preferred LL over HL (67.3% vs. 26.9% to other 5.8%) [38].

Regarding the assessment of attitudes in case of complicated acute diverticulitis, we proposed Hinchey classification-based questions, as this still represents the most used score in international guidelines [8]. More recent classification systems seemed to be better for a CT scan-based evaluation of complicated diverticulitis, categorizing common findings such as pericolic fat inflammation and the presence of pericolic air bubbles, cutting-off the size of abscesses, detecting the presence of free air at a distance from the inflammation site [39,40]. However, Hinchey classification was easily intelligible and allowed us to speak a common language that will be functional to data analysis. Low Hinchey scores found a certain uniformity in treatment from surgical societies guidelines, with 100% concordance that small abscesses may be treated by antibiotics solely while large abscesses, usually defined as more than 3 cm to 5 cm in diameter, can be interventionally drained in addition to antibiotic treatment [8]. Conservative treatment was the most chosen option also from our sample in case of Hinchey 1 diverticulitis for both low- and high-risk patients in 75% and 63% of responses respectively. However, an

Q 10 – 11: SUMMARY - HINCHEY 3?

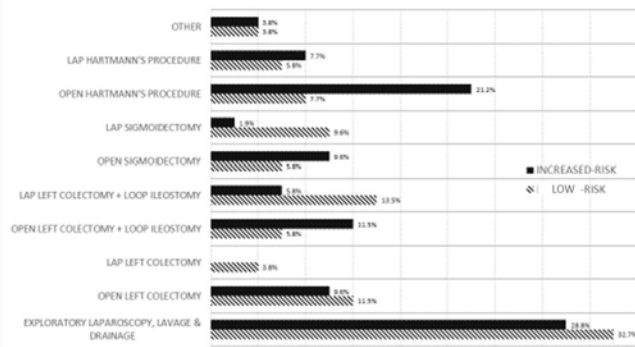


Figure 6: Attitudes in complicated Hinchey 3 diverticulitis.

Q 12 – 13: SUMMARY - HINCHEY 4

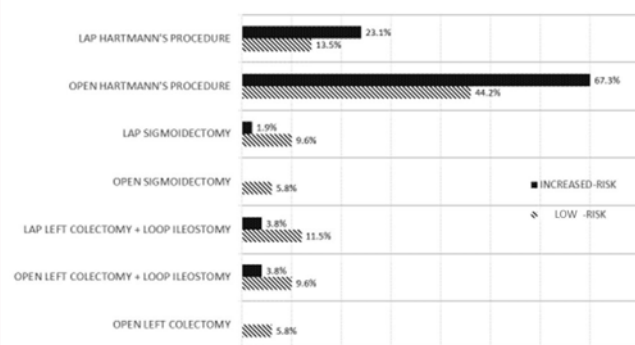


Figure 7: Attitudes in complicated Hinchey 4 diverticulitis.

increasing in the risk of the patient led some responders to consider percutaneous drainage and laparoscopic lavage options for this stage of disease. Both these two treatments were the most considered in case of complicated Hinchey 2 diverticulitis, although showing a contrasting trend. Regarding L-RP, exploratory laparoscopy, lavage and drainage represented the most chosen option with 42.3% of preferences in front of percutaneous US-CT guided drainage with 36.6%, while ratios inverted for I-RP with percutaneous drainage which has recorded 50% and laparoscopic lavage 21.1% of the responses. Laparoscopic lavage and drainage was firstly introduced by O'Sullivan in 1996 for the treatment of 8 patients with generalized purulent peritonitis secondary to perforated diverticulitis diagnosed laparoscopically, and since then some case-series have demonstrated its effectiveness while others criticized its safety stressing high recurrence and reoperation rates [41,42]. Multicenter retrospective LLO study collected 212 patients underwent laparoscopic lavage for Hinchey III diverticulitis showing a successful sepsis control associated with low rates of perioperative mortality and reoperation [43]. Randomized trials that compared laparoscopic lavage and drainage with other therapeutic options for different complicated stages have provided controversial results. Dilala trial compared laparoscopic peritoneal lavage vs. conventional Hartmann's procedures for Hinchey 3 diverticulitis, where laparoscopic lavage was performed by using 3 liters of saline, positioning of an abdominal drainage and a broad-spectrum antibiotic. The 2-years clinical and economic considerations seemed to favor laparoscopic lavage and drainage technique [44,45]. Scandiv randomized multicenter study that compared 150 patients treated by laparoscopic lavage vs. 150 patients undergoing resection with primary anastomosis in acute perforated diverticulitis concluded that

both 90-days and 1-year findings didn't support laparoscopic lavage for the treatment of perforated diverticulitis and that any potential advantages of laparoscopic lavage clashed against the risk of secondary surgery and the lack of assessment for malignancies although uncommon [46,47]. Dutch ladies trial consisted of two arms with different purposes. Lola arm aimed to compare laparoscopic lavage and drainage versus resection and primary anastomosis in Hinchey 3 complicated diverticulitis, but unfortunately this arm was suspended in March 2014 due to unacceptable results from the laparoscopic lavage cohort, with a 23% early and 17% delayed reoperation rate and a morbidity rate twice that of the controls [48]. Diva arm, comparing resection and Primary Anastomosis (PA) vs. Hartmann's Procedure (HP) in Hinchey 3 and 4 complicated diverticulitis concluded that in hemodynamically stable, immunocompetent patients younger than 85-years-old, PA seemed to be preferable to HP [49]. In our opinion, this appears to be the correct level of comparison in Hinchey's stages 3 and 4. If operative treatment is considered the standard for severe diverticulitis due to perforation and generalized peritonitis, the pathway of choice between PA and HP remains under debate. Recent meta-analysis from Cirocchi et al. [50] highlighted 3 randomized trials that compared PA vs. HP for perforated diverticulitis for a total of 254 patients, not reporting statistically significant differences in terms of leakage rate, overall morbidity and mortality between the two methods. However, studies with a high level of evidence were lacking and those available often showed bias especially in order to the allocation of patients in the treatment arms. The guidelines from World Society of Emergency Surgery (WSES) also suggested how PA was applicable in case of Hinchey 3 and 4 diverticulitis in selected patients [51]. The effectiveness of PA has been confirmed in a broad sense through a prospective analysis by the European Society of Colo Proctology (ESCP), which has shown a complication rate comparable to HP. In addition, ESCP suggested that a defunctioning stoma reduced not the rate of anastomotic leakage but the severity of leak-related complications [52]. Indications for diverting ileostomy in colorectal surgery remain low- and very-low anastomoses, presence of peritonitis and sepsis, high-risk patients, considering then that the reversal rate after diverting ileostomy reaches 90%, as opposed to the Hartmann's reversal rate which does not exceed 50%, also due to the complexity and risk of the procedure [53]. Furthermore, if the patient's hemodynamics is stable, laparoscopic surgery can amplify its vocation to minimize the proinflammatory response to surgical stress in the septic patient [54]. The analysis of a retrospective cohort parallel to the ladies trial indicated that laparoscopic sigmoidectomy for perforated Hinchey 3 diverticulitis was superior to open sigmoidectomy in terms of postoperative morbidity and hospital stay [55]. However, there are many factors of variability, related to the disease, the patient and the surgeon. This variability also emerged from the responses to our questionnaire, where for stage Hinchey 3 in the L-RP 33% indicated laparoscopic lavage and drainage as the preferential treatment, while the sum of the resective surgical options with PA was 44% and 13% chose HP. HP which rose to 28% in case of I-RP, while laparoscopic lavage and PA recorded 28% and 37% of responses respectively. Hinchey 4 diverticulitis represents a life-threatening condition that requires damage-control surgery. Here, both for L-RP and especially for I-RP, HP was the most pursued option by our sample, mainly with an open surgical approach.

**Conclusion**

Although some certainties emerge from our investigation within a high-level surgical community and are in line with the most current

trends in literature, we have highlighted some treatment steps still not well clarified for both uncomplicated and complicated diverticulitis. Future evidence and guidelines will be needed to better define these aspects.

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