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## SHORT COMMUNICATION

# Hartmann's procedure versus primary anastomosis for Hinchey stage III diverticulitis: a prospective case-control study<sup>☆</sup>



O. Vergara-Fernandez<sup>a,\*</sup>, M. Morales-Cruz<sup>a</sup>, F. Armillas-Canseco<sup>a</sup>,  
R. Pérez-Soto<sup>b</sup>, E. Arcia-Guerra<sup>a</sup>, M. Trejo-Ávila<sup>a</sup>

<sup>a</sup> Departamento de Cirugía de Colon y Recto, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Tlalpan, Mexico City, Mexico

<sup>b</sup> Departamento de Cirugía Endócrina, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Tlalpan, Mexico City, Mexico

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### KEYWORDS

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### Abstract

**Introduction:** Hartmann's procedure (HP) is the conventional treatment in patients with complicated diverticulitis. Segmental resection with primary anastomosis (PA) is a treatment alternative for those patients. Our aim was to compare the postoperative results of HP and PA in patients with complicated diverticulitis (Hinchey stage III).

**Methods:** A case-control study was conducted on patients operated on for purulent Hinchey stage III diverticulitis, within the time frame of 2000 and 2019.

**Results:** Twenty-seven patients that underwent PA were compared with 27 that underwent HP. The patients that underwent HP had a greater probability of morbidity at 30 days (OR 3.5; 95% CI 1.13–11.25), as well as a greater probability of major complications (OR 10.9; 95% CI 1.26–95.05).

**Conclusion:** The patients that underwent segmental resection and PA presented with lower morbidity rates and higher stoma reversal rates than the patients that underwent HP.

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\* Corresponding author. Departamento de Cirugía de Colon y Recto. Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán. Dirección: Vasco de Quiroga 15, No. XVI, Col. Sección XVI. Tlalpan, Mexico City. Mexico. Fax: +(52) 55 55739321.

E-mail address: [omarvergara74@hotmail.com](mailto:omarvergara74@hotmail.com) (O. Vergara-Fernandez).

**PALABRAS CLAVE**

Enfermedad  
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## Procedimiento de Hartmann vs. anastomosis primaria para diverticulitis Hinchey III: estudio prospectivo de casos y controles

**Resumen**

**Introducción:** El tratamiento convencional en pacientes con diverticulitis complicada es el procedimiento de Hartmann (PH). La resección segmentaria con anastomosis primaria (AP) es una alternativa para el tratamiento de estos pacientes. El objetivo fue comparar los resultados postoperatorios entre el PH y la AP en pacientes con diverticulitis complicada (Hinchey III).

**Métodos:** Se realizó un estudio de casos y controles de pacientes intervenidos por diverticulitis purulenta Hinchey III del 2000 a 2019.

**Resultados:** Se estudiaron 27 pacientes con AP y se compararon con 27 pacientes con PH. Los pacientes a los que se les realizó PH tuvieron mayor probabilidad de morbilidad a 30 días (RM 3.5; IC 95% 1.13–11.25) y mayor probabilidad de complicaciones mayores (RM 10.9; IC 95% 1.26–95.05).

**Conclusión:** Los pacientes con resección segmentaria y AP tuvieron menor morbilidad y mayores tasas de reversión de estoma que los pacientes que se sometieron a PH.

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**Introduction and aims**

Diverticulitis is defined as diverticular inflammation that can be acute or chronic and uncomplicated or complicated due to the presence of abscess, fistula, bowel obstruction, or free perforation. Diverticulitis develops in 4–15% of the patients with diverticulosis.<sup>1,2</sup> Peritonitis resulting from diverticular disease can be caused by pus (Hinchey stage III) or fecal material (Hinchey stage IV), following diverticular perforation, which presents in 1% of patients.<sup>3</sup>

Conventional surgical treatment for perforated diverticulitis consists of segmental resection of the affected colon, with a temporary end colostomy and distal stump closure, traditionally known as Hartmann's procedure (HP).<sup>3</sup> Whether to continue performing HP or instead offer primary anastomosis (PA) after resection of the colon, with or without a protective loop ileostomy, is currently a subject of debate.

The aim of the present work was to compare the postoperative results of HP and PA in patients with purulent perforated diverticulitis (Hinchey stage III) operated on at our hospital.

**Methods**

A case-control study was conducted that included patients operated on for purulent perforated diverticulitis (Hinchey stage III classification) at the *Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán*, within the time frame of January 2000 and December 2019.

Patients that underwent segmental resection and PA, with or without protective loop ileostomy, were the cases. They were matched at a 1:1 ratio with the controls, which were the patients that underwent HP.

The diagnosis of acute perforated diverticulitis was made according to computed tomography findings that were described utilizing the modified Hinchey classification.<sup>4</sup>

The postoperative variables analyzed were total surgery duration (minutes), need for transfusion, need for intensive care, use of vasopressors, morbidity and mortality at 30 days, and the percentage of patients that underwent intestinal transit restoration. Complications were graded according to the Clavien–Dindo classification, in which grades III–V are those of greater morbidity.<sup>5</sup>

The statistical analysis was carried out utilizing the SPSS version 22.0 program (IBM Corp., Armonk, NY, USA).

The categorical variables were compared using the chi-square test and the continuous variables were contrasted using the Student's t test. All tests were two-tailed and statistical significance was set at a  $p < 0.05$ .

The present study meets all the ethics codes for research on humans, according to the *Asociación Mexicana de Cirugía General* and the Declaration of Helsinki, as well as the Federal Law for the Protection of Personal Data. The study was reviewed and approved by the Research and Ethics Committee of our hospital (approval number: CI-2638-18-19-1). The authors declare that patient informed consent was not required, given that the study contains no personal information that could identify the patients and that they are anonymous.

**Results**

A total of 54 patients with Hinchey stage III acute perforated diverticulitis, operated on within the time frame of 2000 and 2019, were included. The cases consisted of 27 patients that underwent PA, and the controls were made up of 27 patients that underwent HP.

Mean age of the HP group was  $61.8 \pm 15.7$  years and was  $55 \pm 15.7$  years in the PA group. A total of 55.5% of the patients were women and 44.5% were men.

With respect to the postoperative result analysis, surgery duration was similar between the two groups (HP: 257.6 min vs. PA: 304.8 min). A greater probability of requiring vasopressors was found in the HP group (OR: 7.9; 95% CI

**Table 1** Results after the surgical intervention.

	HP (n = 27)	PA (n = 27)	OR (95% CI)	p
Surgery duration, min	257.6 ± 105	304.82 ± 118	0.84 (0.26–2.6)	0.37
Blood transfusion, n	7 (26%)	4 (14.8%)	2.5 (0.6–9.89)	0.14
Critical area requirement, n	11 (40.7%)	4 (14.8%)	4.8 (1.2–18.4)	0.017
Hospital stay, days	16.8 ± 13	13.8 ± 9	–	0.2
Vasopressor requirement, n	9 (33.3%)	4 (14.8%)	7.97 (1.27–49.69)	0.026
Morbidity at 30 days, n	15 (55.5%)	7 (25.9%)	3.57 (1.13–11.25)	0.026
Morbidity at more than 30 days, n	8 (29.6%)	1 (3.7%)	10.94 (1.26–95.05)	0.01
Mortality at 30 days, n	1 (3.7%)	0	1.03 (0.9–1.1)	0.5
Stoma reversal, n	8 (29.6%)	20 (74%)	0.089 (0.023–0.34)	0.001

CI: confidence interval; HP: Hartmann’s procedure; OR: odds ratio; PA: primary anastomosis.

1.27–49.69), as well as a greater probability of needing intensive care (OR: 4.8; 95% CI 1.2–18.4), compared with the PA group. A stoma was constructed in 26 (96%) of the 27 patients in the HP group, whereas 21 (77%) of the 27 patients in the PA group had a constructed stoma. In the five unprotected patients in the PA group, intervention-related mortality was null, and the morbidity rate was only 16% (n = 1). In addition, overall morbidity was substantially lower in the patients that had no protective stoma (16 vs. 25.9%, p = 0.45).

Regarding morbidity and mortality, the patients that underwent HP had a greater probability of morbidity at 30 days (OR: 3.5; 95% CI 1.13–11.25) and a greater probability of major complications (OR: 10.9; 95% CI 1.26–95.05). Mortality at 30 days was similar in the two groups (OR: 1.03; 95% CI 0.9–1.1) (Table 1).

The patients in the HP group had a lower probability of undergoing intestinal transit restoration, compared with the patients in the PA group that had protective loop ileostomy (HP 29.6 vs. PA 74%; OR 0.14; 95% CI 0.045–0.486).

## Discussion

The treatment for acute perforated diverticulitis consists of broad-spectrum antibiotics and surgical resection. Between 15 and 32% of the patients with diverticulitis will require emergency surgery.<sup>6</sup> Depending on the surgical team or patient characteristics (malnutrition, hemodynamic instability, tissue characteristics), HP or segmental resection and PA, with or without a protective loop ileostomy, can be performed.<sup>7</sup>

In the present study, major complications and general morbidity were less frequent in the patients with purulent perforated diverticulitis that underwent PA, with or without a loop ileostomy. The probability of stoma closure was also greater in that group of patients.

In 2017, The French group of Bridoux et al.<sup>8</sup> published the DIVERTI trial, reporting a similar mortality rate (4 vs. 7.7%; p = 0.423) and morbidity rate (44 vs. 39%; p = 0.423), but a larger number of restored patients (stoma closure) at 18 months of follow-up for the PA group vs. the HP group (96 vs. 65%; p = 0.001). Lastly, the DIVA group published the LADIES study,<sup>9</sup> reporting similar postoperative results in the two groups analyzed, but a stoma-free survival rate at one year that favored the PA group (94.6 vs. 71.7%; p ≤ 0.001).

In our case series, the patients with Hinchey stage III acute diverticulitis that underwent HP had a greater probability of developing postoperative complications, as well as a greater probability of requiring vasopressors (33.3 vs. 14.8%, p = 0.026) and needing treatment in the intensive care unit (40.7 vs. 14.8%, p = 0.017), contrasting with that reported in the abovementioned clinical trials. However, we found a lower possibility of intestinal transit restoration in the HP group, compared with the PA group (29.6 vs. 74%, p = 0.01), which is consistent with that reported in the literature.

The study by Acuna et al.<sup>10</sup> that included 238 patients from four clinical trials stands out from the meta-analyses published on the topic. Those authors found that the number of complications and the postoperative mortality rate were similar, with a percentage of one-year stoma-free patients of 85 vs. 61% (OR 1.4; p < 0.001), favoring PA.

The main limitations of the present study include those inherent in a case-control study design, the fact that the sample was from a single center, and the low number of patients in each group. Another limitation is selection bias, given that patients with Hinchey stage III classification generally present with a deficient physiologic status (due to sepsis, dehydration, systemic inflammatory response, etc.). It is most likely that the patients selected for PA were generally patients whose disease was less severe and who had fewer comorbidities, thus producing the perceived favorable result. Nevertheless, said limitation is a constant one, even in international clinical trials.

Despite those limitations, given that our study is the first to be conducted in Mexico, we believe it can provide a basis for considering PA a safe and effective alternative, as well as serving as a reference for its application in the Mexican population.

## Conclusion

In the present study, the patients with purulent perforated diverticulitis (Hinchey stage III) that underwent Hartmann’s procedure had a greater probability of developing postoperative complications and a lower probability of restoring their intestinal transit, compared with the patients that had primary anastomosis (with or without protective loop ileostomy).

## Financial disclosure

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## Conflict of interest

The authors declare that there is no conflict of interest.

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