

Use of drains and post-operative complications in secondary peritonitis for complicated acute appendicitis at a national hospital

Uso de drenajes y complicaciones posoperatorias en peritonitis secundaria por apendicitis aguda complicada en un hospital nacional

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Abstract

Introduction: Acute appendicitis is the main cause of emergency surgical care. Post-operative patients with complicated acute appendicitis present complications, many of them expected. The use of drains is one of the measures to prevent these complications; however, recent meta-analyses do not justify this therapeutic measure. This study evaluates the relationship between use and non-use of drains, post-operative complications in patients with complicated peritonitis secondary to acute appendicitis. **Methods:** A retrospective observational cohort study was conducted. The outcomes were analyzed by Chi-square test and Student's t-test; Fisher exact test was performed. **Results:** The average operating time was 1.46 h (1.0-2.5) and 1.66 (1-3) for patients without drains and with drains, respectively, the difference was significant ($p = 0.001$). Post-operative fever was more prevalent in group with a drains odds ratio (OR) 3.4 (confidence interval [CI] 95% 1.4-7.9). The mean time of hospitalization was 7.3 (3-20) and 8.8 days (3-35) for patients without drains and with drains, respectively. ($p = 0.01$). The Chi-square analysis was significant for evisceration Grade III and residual collection $p = 0.036$, OR not evaluable. Reoperation was not significant among both groups, $p = 0.108$ OR 6.3 (CI 95% 0.6-62.4). **Conclusions:** There is a relationship between the non-use of drains and collections and evisceration in post-operative patients with open appendectomy, by complicated acute appendicitis.

KEY WORDS: Drains. Acute appendicitis. Secondary peritonitis.

Resumen

Antecedentes: La apendicitis aguda es la principal causa de emergencia quirúrgica. Los pacientes posoperados de apendicitis aguda complicada presentan complicaciones, muchas de ellas esperadas. El uso de drenajes es una de las medidas para prevenir estas complicaciones; sin embargo, recientes metaanálisis no justifican esta medida terapéutica. Este estudio evalúa la relación del uso o no uso de drenajes con las complicaciones en los pacientes con peritonitis secundaria a apendicitis aguda. **Método:** Se realizó un estudio de cohorte observacional retrospectivo. Los resultados se analizaron mediante la prueba de χ^2 al cuadrado, la prueba t de Student y la prueba exacta de Fisher. **Resultados:** El tiempo operatorio promedio fue de 1.46 horas (rango: 1.0-2.5 h) y de 1.66 horas (rango: 1-3 h) para pacientes sin drenajes y con drenajes, respectivamente; la diferencia fue significativa ($p = 0.001$). La fiebre posoperatoria fue más prevalente en el grupo con drenajes (odds

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ratio [OR]: 3.4; intervalo de confianza [IC] del 95%: 1.4-7.9). El tiempo promedio de hospitalización fue de 7.3 días (rango: 3-20 días) y de 8.8 días (rango: 3-35 días) para los pacientes sin y con drenajes, respectivamente ($p = 0.01$). La prueba de χ^2 al cuadrado fue significativa para evisceración de grado III más colección residual ($p = 0.036$; OR no evaluable). Las tasas de reoperación no fueron significativamente diferentes entre ambos grupos ($p = 0.108$; OR: 6.3; IC 95%: 0.6-62.4). **Conclusiones:** Existe relación entre la no utilización de drenajes y la presencia de colecciones y evisceración en pacientes posoperados con apendicitomía abierta por apendicitis aguda complicada.

PALABRAS CLAVE: Drenajes. Apendicitis aguda. Peritonitis secundaria.

Introduction

Acute appendicitis is one of the main surgical pathologies in the population¹, the estimated incidence is 9.4-11 por 10,000 person-years, with a lifetime incidence of 7-9%². Approximately 4-20% of patients will present with periappendiceal abscess or phlegmon³. Actually, the main established treatment is appendectomy; some centers apply open appendectomy and/or laparoscopic appendectomy for complicated appendicitis. Patients who had appendectomy for complicated appendicitis are more likely to develop post-operative complications such as intraperitoneal abscess (abdominal or pelvic) or wound infection⁴. Complicated appendicitis has a mortality rate of less than 1%⁵. There are several methods applied to prevent or decrease the incidence of these post-operative complications. These methods are the insertion of intra-abdominal drain after the surgery, use of antibiotics, delayed wound closure, and laparoscopic technique⁶. Typically, abdominal drainage is most familiar. Drains usually are well tolerated but can lead to bleeding, fistula formation, or intra-abdominal abscesses⁷, but drain failure is reported in previous studies ranging from 4.5% to 26% in adults with intra-abdominal abscesses associated with appendicitis⁸. Nowadays, the use of intra-abdominal drain after open appendectomy for acute complicated appendicitis is an issue in discussion. Through the development of this study, we will describe the use of drains and establish their relationship with post-operative complications and thus propose the best surgical approach for our patients.

Methods

This was a retrospective, observational cohort study. Records were obtained from patients admitted to Hospital Sergio Bernales during the year 2014, with complicated appendicitis (localized peritonitis, generalized peritonitis, and abscessed appendicular plastron) who underwent emergency surgery. The registration UIN of

the study is the research registry 4054. The sample size was 50 patients without drains, chosen for convenience, and 100 patients with drains due to complicated acute appendicitis. A pairing by date, age and sex, and diagnosis in order to avoid any bias the match was made by date, age, sex and diagnosis in order to avoid bias. Patients without drains were operated by a single surgeon; while patients with drains were operated by 10 different surgeons. The treatment of the appendicular base was dependent on its state of the base, in some cases only to free stump, invagination, or raffia of the base. Patients with drains had cavity drying in case of localized peritonitis and cavity lavage after generalized peritonitis; the drains were placed in the right colic parietal space and the rectovesical space. No sample of peritoneal fluid was taken in most cases. The abdominal drains were laminar (Penrose), which were removed when the drainage volume was less 10-20 ml/day. In the post-operative period, if the patient presented with fever or clinical deterioration, an ultrasound study was performed in search of residual abscesses, or the antibiotic scheme was changed. We did not consider the body mass index. The inclusion criteria were patients of both sexes, older than 18 years of age, diagnosis of complicated peritonitis due to acute appendicitis, complete clinical history, and exclusion criteria were patients younger than 18 years, hemorrhagic diathesis or oral anticoagulation, pregnancy, immunocompromised, laparoscopic appendectomy, and incomplete clinical records.

Statistical analysis

The data were collected by three general surgeons and validated by expert judgment. $p < 0.05$ was considered statistically significant, calculating the corresponding 95% confidence intervals (CI). The statistical methods used were Chi-square and Student's t-test. All the information was analyzed using the statistical program Statistical Package for the Social Sciences 18. The study had the approval from the Ethics Committee of the "Sergio E. Bernales" Hospital and

the postgraduate section of the Faculty of Medicine from The San Martín de Porres University.

Results

The study identified 150 patients with open emergency appendectomy for complicated appendicitis during the period of study. A total of 50 patients without drains were chosen for convenience and 100 patients with drains due to complicated acute appendicitis during 2014. The mean age of the unexposed (patients without drains) and exposed (patients with drains) was 36.76 (15-70) and 35.00 (15-72), respectively. The predominant sex in both groups was male 30 (60%) and 60 (60%) without drains and drains. When assessing clinical characteristics of the patients, we found that disease time was 41 (10-144) h, for patients without drains and 61.2 (10-144) h for patients with drains, symptoms, and signs with similar proportions. Analysis of Chi-square and odds ratio (OR) showed no difference between the two groups in the symptoms and signs. Both groups were similar in the blood count, according to the Chi-square test. Once the diagnosis was made, antibiotic prophylaxis was indicated (Table 1). The pre-operative diagnosis was acute appendicitis complicated with generalized peritonitis 16 (32%) and 26 (26%) for patients without drains and drains. The other group acute appendicitis complicated with localized peritonitis 34 (68%) and 74 (74%) for patients without drains and drains, respectively. No differences were found between the two groups in the pre-operative diagnosis in the Chi-square and OR tests. The post-operative diagnosis was acute appendicitis with generalized peritonitis, acute appendicitis with localized peritonitis, and acute appendicitis with abscessed appendicular plastron 13 (26%) and 26 (26%); 31 (62%) and 62 (62%); and 6 (12%) and 12 (12%) for patients without drains and drains, respectively. The operative time was 1.46 h (1.0-2.5) and 1.66 (1-3) for patients without drains and drains, respectively, the difference is significant ($p < 0.001$) (Table 2).

Post-operative complications

After the post-operative period, one patient (2%) went to the intensive care unit, with favorable evolution. Post-operative fever was more prevalent in the group with drains OR 3.4 95% CI (1.4-7.9). The antibiotic rotation was performed in 11 (22%) and 27 (27%) patients without drains and drains. The

Table 1. Disease characteristics. Use of drains and post-operative complications in secondary peritonitis for acute appendicitis on complicated

Sign and symptoms	Without drains	With drains	p
Disease time (h)	42.5 (20-96)	44.3 (24-96)	0.560
Symptoms			
Murphy chronology (%)	39 (78)	79 (79)	1.000
Vomiting chronology (%)	43 (86)	92 (92)	0.260
Liquid depositions chronology (%)	21 (42)	44 (44)	0.860
Temperature	37.6 (36.5-39)	37.6 (36-39.2)	0.860
Ecography			
Appendicitis suspect (%)	20 (40)	40 (40)	0.910
Appendicular plastron (%)	10 (20)	40 (40)	
Blood count			
Leukocytes	15.6 (10.9-19.0)	15.3 (10.0-19.0)	0.450

Table 2. Disease, pre and post-operative time. Use of drains and post-operative complications in secondary peritonitis for acute appendicitis

	Without drains	With drains	p
Post-operative diagnosis			
Generalized peritonitis	13 (26%)	26 (26%)	1.000
Localized peritonitis	31 (62%)	62 (62%)	
Abscess apendicular plastron	6 (12%)	12 (12%)	
Wait and operative time			
Pre-operative wait time (H):	11.4 (4.5-23)	10.24 (3-30)	0.001
Operative time	1.46 horas (1.0-2.5)	1.66 horas (1-3)	

hospitalization time was 7.3 days (3-20) and 8.8 days (3-35) for patients without drains and with drains, respectively, ($p = 0.01$). Among the complications, the results in the Chi-square analysis; surgical site infection was present in 13 (26%) and 29 (29%) patients without drains and drains, the result was not significant. In turn, evisceration Grade III + residual collection was presented in the group of patients without drains 3 (6%), the results were significant $p = 0.036$. Thus, there is a relationship between evisceration Grade III and residual collection; however, we cannot establish if it is a risk factor, to elucidate this incognita we need to increase the sample size. Abdominal eversion was present in 4 (4%) patients with drains; the result was not significant, the risk factor was not evaluable; Scrotal abscess was also observed in 2 (2%) patients with drains, the results were not significant. The enterocutaneous fistula was present in 6 (6%) of the patients with drains; the results were not significant. Surgical reoperation and exploratory laparotomy were performed in 3 (6%) of patients

without drains and 1 (1%) of patients with drains; the results were not significant. There was no mortality (Table 3).

Discussion

The study found that the no insertion of abdominal drainage after open appendectomy at an emergency service for complicated appendicitis has relation with evisceration more residual collection ($p = 0.036$); had no significant effect on development of surgical site infection ($p < 0.05$); then intra-abdominal drains prevent post-operative residual abscess, nonetheless do not prevent or significantly decrease the incidence of development of wound infection. The function of the abdominal drain is to prevent the collection of inflammatory materials, drainage of already formed collection, by doing first and second function, it may reduce bacterial invasion and colonization at the site of surgery and thus decrease the incidence of surgical site infection^{8,9}. However, the evidence report some disadvantages such as blockage or obstruction of drain with consequent failure of its function, existence of drain inside the human body may be recognized as foreign body which can initiate inflammatory response and may interfere with surgical site healing and insertion of intra-abdominal drain can increase the duration of patient's stay in the hospital with subsequent extra cost^{8,10,11}. The difference in the period of hospital stay was longer for the drainage group versus without drains ($p = 0.001$), the mean length of stay for the non-drainage group was 7.3 days, while for the drainage group was 8.8 days. The main reason for the prolonged stay in the group of drains would be the drain care and the criteria for their retirement according to the evolution of the patient. According to the literature, the use of drains in uncomplicated acute appendicitis is not recommended¹². There is currently no consensus on the use of drains in complicated acute appendicitis; there are two meta-analyses^{10,11} and cohort studies that do not recommend the use of drains^{8-10,12}; although others are not conclusive¹³. Li et al., after an meta-analyses about the use of intra-abdominal drains to prevent intraperitoneal abscess after open appendectomy for complicated appendicitis, found six randomized clinical trials and 521 participants, he concluded that there is insufficient evidence to determine the effects of abdominal drainage and no drainage on intraperitoneal abscess at 14 days or for wound infection at 14 days with a low-quality evidence. The increased

Table 3. Post-operative complications. Use of drains and post-operative complications in secondary peritonitis for acute appendicitis

	Without drains (%)	With drains (%)	p
Surgical site infections	13 (26)	29 (29)	0.847
Evisceration grade III + residual collection	3 (6.0)	-	0.036
Abdominal eventration	-	4 (4.0)	0.302
Scrotal abscess	-	2 (2.0)	0.553
Enterocutaneous fistula	-	6 (6.0)	0.179
Exploratory laparotomy	3 (6.0)	1 (1.0)	0.108

risk of 30-day overall complication rate (morbidity) in the drainage group was rated as very low-quality evidence. Therefore, the effect of abdominal drainage on the prevention of intra-peritoneal abscess or wound infection after open appendectomy is uncertain for patients with complicated appendicitis; also, the increased rates for overall complication rate and hospital stay for the drainage group compared to no drainage group are not clear¹⁴. Abdulhamid and Sarker made a cohort retrospective study that includes perforated appendicitis with localized abscess formation only, the study concludes that abdominal drain after open emergency appendectomy for complicated appendicitis did not bring any considerable advantage in terms of prevention or significant reduction of post-operative intraperitoneal abscess and wound infection, even its use prolongs the hospital stay and doubled the cost of operation¹⁵. Beek et al., in a cohort retrospective study, concluded that peritoneal drains seem to reduce overall complication rate, re-interventions rate, and readmission rate in patients treated with perforated appendicitis¹⁶. Most studies in favor of the use of drains are not recent and have a smaller sample size¹⁷. Our study is in favor of the use of drains; although it includes all types of complicated acute appendicitis with localized, generalized and abscess due to appendicitis; nonetheless, the hospital stay was more prolonged for the drain group, similar most studies⁸⁻¹². According to the European Association of Endoscopic Surgery, routine use of drains does not reduce the incidence of abscesses. The use of abdominal drainage after open appendectomy for perforated appendicitis is controversial. Our study found that use of drains decrease the abdominal abscess and surgical site infections, although the difference was significant ($p < 0.001$), it did not represent a risk factor. Despite

the limitations of a retrospective study based on a single hospital, these results support the need for evidence for any clinical improvement using abdominal drainage in patients undergoing open appendectomy for complicated appendicitis.

Conclusions

There is relationship between the non-use of drains and collections and evisceration in post operated patients with open appendectomy, by complicated acute appendicitis in our centre.

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Conflicts of interest

The authors declare that they have not conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

References

1. Gorter RR, Eker HH, Gorter-Stam MA, Abis GS, Acharya A, Ankersmit M, et al. Diagnosis and management of acute appendicitis. EAES consensus development conference 2015. *Surg Endosc.* 2016;30:4668-90.
2. Dahlberg MJ, Pieniowski EH, Boström LÅ. Trends in the management of acute appendicitis in a single-center quality register cohort of 5,614 patients. *Dig Surg.* 2018;35:144-54.
3. Maxfield MW, Schuster KM, Bokhari J, McGillicuddy EA, Davis KA. Predictive factors for failure of nonoperative management in perforated appendicitis. *J Trauma Acute Care Surg.* 2014;76:976-81.
4. Markides G, Subar D, Riyad K. Laparoscopic versus open appendectomy in adults with complicated appendicitis: systematic review and meta-analysis. *World J Surg.* 2010;34:2026-40.
5. Huston JM, Kao LS, Chang PK, Sanders JM, Buckman S, Adams CA, Cocanour CS, Parli SE, Grabowski J, Diaz J, Tessier JM, Duane TM. Antibiotics vs. Appendectomy for Acute Uncomplicated Appendicitis in Adults: Review of the Evidence and Future Directions. *Surg Infect (Larchmt).* 2017;18(5):527-35.
6. Sartelli M, Baiocchi GL, Di Saverio S, Ferrara F, Labricciosa FM, Ansaldi L, et al. Prospective observational study on acute appendicitis worldwide (POSAW). *World J Emerg Surg.* 2018;13:19.
7. Lorenz J, Thomas JL. Complications of percutaneous fluid drainage. *Semin Intervent Radiol.* 2006;23:194-204.
8. Jani P, Nyaga P. Peritoneal drains in perforated appendicitis without peritonitis: a prospective randomized controlled study. *East Cent Afr J Surg.* 2011;16:62-71.
9. Rather SA, Bari SU, Malik AA, Khan A. Drainage vs no drainage in secondary peritonitis with sepsis following complicated appendicitis in adults in the modern era of antibiotics. *World J Gastrointest Surg.* 2013;5:300-5.
10. Gravante G, Overton J, Elshaer M, Sorge R, Kelkar A. Intraperitoneal drains during open appendectomy for gangrenous and perforated appendicitis. *World J Surg Proc.* 2013;3:18-24.
11. Beek MA, Jansen TS, Raats JW, Twiss EL, Gobardhan PD, van Rhede van der Kloot EJ, et al. The utility of peritoneal drains in patients with perforated appendicitis. *Springerplus.* 2015;4:371.
12. Petrowsky H, Demartines N, Rousson V, Clavien PA. Evidence-based value of prophylactic drainage in gastrointestinal surgery: a systematic review and meta-analyses. *Ann Surg.* 2004;240:1074-84.
13. Li Z, Zhao L, Cheng Y, Cheng N, Deng Y. Abdominal drainage to prevent intra-peritoneal abscess after open appendectomy for complicated appendicitis. *Cochrane Database Syst Rev.* 2018;5:CD010168.
14. Cheng Y, Zhou S, Zhou R, Lu J, Wu S, Xiong X, Ye H, Lin Y Wu T, Cheng N. Abdominal drainage to prevent intra-peritoneal abscess after open appendectomy for complicated appendicitis. *Cochrane Database Syst Rev.* 2015 Feb 7, (2): CD10168.
15. Abdulhamid AK, Sarker SJ. Is abdominal drainage after open emergency appendectomy for complicated appendicitis beneficial or waste of money? A single centre retrospective cohort study. *Ann Med Surg (Lond).* 2018;36:168-72.
16. Horn CB, Coleoglu Centeno AA, Guerra JJ, Mazuski JE, Bochicchio GV1, Turnbull IR. Drain Failure in Intra-Abdominal Abscesses Associated with Appendicitis. *Surg Infect (Larchmt).* 2018 Apr;19(3):321-5.
17. Tander B, Pektaş O, Bulut M. The utility of peritoneal drains in children with uncomplicated perforated appendicitis. *Pediatr Surg Int.* 2003;19:548-50.