



Minimally invasive step-up approach for the management of postoperative intraabdominal abscess after laparoscopic appendectomy

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Abstract

Background Postoperative intraabdominal abscess (IAA) is the most feared complication after laparoscopic appendectomy (LA). We aimed to evaluate the management of this complication in a large cohort of patients undergoing LA in order to design a treatment algorithm.

Methods We included a consecutive series of patients undergoing LA for acute appendicitis from January 2008 to December 2018. The cohort of patients with postoperative IAA was divided into three groups based on the implemented treatments: G1: antibiotics only, G2: CT-guided drainage, and G3: laparoscopic lavage. Characteristics of the fluid collections and outcomes were analyzed in the three groups.

Results A total of 1668 LA were performed; the rate of IAA was 2.2% (36 patients). There were 12 (33%) patients who received antibiotics only (G1), 8 (22%) underwent CT-guided percutaneous drainage (G2), and 16 (45%) underwent laparoscopic lavage (G3). The median size of the abscesses was 2.7 (1.2–4) cm in G1, 6.2 (4.5–8) cm in G2, and 9.6 (8–11.4) cm in G3 ($p < 0.04$). Patients with two or more fluid collections underwent a laparoscopic lavage in all cases. Treatment failure occurred in 16% (2/12), 12.5% (1/8) and 12.5% (2/16) of the patients in G1, G2, and G3, respectively. None of the patients in the entire cohort required open surgery to resolve the postoperative IAA.

Conclusions A minimally invasive step-up approach based on the size and number of fluid collections is associated with excellent outcomes. A treatment algorithm for post-appendectomy IAA is proposed.

Keywords Laparoscopic appendectomy · Intraabdominal abscess · Antibiotics · Percutaneous drainage · Laparoscopy

Acute appendicitis is one of the most common abdominal surgical emergencies. The life risk of having this entity range from 7 to 14% in the USA, and every year about 300,000 patients undergo an appendectomy [1]. Since its introduction by Semm in the early 80's, the laparoscopic approach has gained worldwide acceptance [2, 3].

Laparoscopic appendectomy (LA) is associated with reduction in wound infection rates and ileus, shorter hospital stay, and reduced postoperative intraabdominal adhesions [4]. One of the most feared complications after LA, however,

is the intraabdominal abscess (IAA). This entity increases length of hospital stay, costs, morbidity, and mortality rates [5–7].

Although several therapeutic options have been proposed, there is lack of information regarding a standardized management of IAA after LA. Therefore, we aimed to evaluate the management of the IAA after LA in a large cohort of patients, and to propose a treatment algorithm.

Methods

After approval by the Institutional Review Board of our Institution, data were collected from all patients who underwent LA for acute appendicitis from January 2008 to December 2018. Patients who required conversion to open surgery were excluded.

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The diagnosis of acute appendicitis was based on three aspects: clinical presentation, laboratory parameters, and imaging. Ultrasound was carried out in all patients, and a computed tomography (CT) was performed when the clinical exam and ultrasound findings were inconclusive or in those cases with Alvarado's Score < 6 [8].

All the procedures were performed by general surgery residents with the supervision of an attending surgeon. A unique preoperative dose of antibiotics 30 min before surgical incision was administered in all cases (ciprofloxacin 500 mg and metronidazole 500 mg or ampicillin-sulbactam 1000 mg, adapted to our local infectology guidelines) [9].

LA was performed using three ports that were placed at the umbilicus region (10 mm), suprapubic region (10 mm) and left lower quadrant (5 mm). An exploratory laparoscopy was accomplished to confirm diagnosis of acute appendicitis. Transection of the appendix with scissors was performed over an endoloop and removed inside a protective bag through the suprapubic port after dissection of the mesoappendix with electrocautery, followed by peritoneal irrigation and suction with warm saline water when free fluid was found in the abdominal cavity. A silicone flexible drain was placed when in cases of perforated appendix with generalized purulent peritonitis. Patients with purulent fluid in the abdominal cavity or perforated appendicitis continued antibiotics for 7 days. Patients were discharged when they could tolerate oral intake and have a stable clinical condition. Follow-up was planned at 7 and 30 days after patient's discharge.

IAA was defined as a patient with fever, abdominal pain or ileus with the confirmation of an abscess by an imaging method (ultrasonography or CT scan). Patient's characteristics and intraoperative variables related to postoperative IAA were analyzed.

The management of patients with IAA were divided into 3 groups based on the implemented treatments: G1: patients treated with empiric intravenous antibiotics only (ciprofloxacin 500 mg every 12 h and metronidazole 500 mg every 8 h or ampicillin-sulbactam 1000 mg every 12 h), G2: patients treated with CT-guided drainage plus intravenous antibiotics (adjusted according to culture and sensitivity results), and G3: patients treated with laparoscopic lavage of abdominal cavity plus intravenous antibiotics (adjusted according to culture and sensitivity results). Treatment failure was defined as persistence of symptoms (fever, ileus or abdominal pain) for more than 48 h after setting up the treatment and evidence of persistence of the fluid collection in CT scan. Characteristics of the fluid collections and outcomes were analyzed in the three groups.

For statistical analysis, the program IBM SPSS (version 20.0) was used. For all statistical methods, $p < 0.05$ was considered statistically significant.

Table 1 Patients demographics and preoperative variables

Demographics and preoperative variables	n = 1668
Mean age	35.1 (14–95)
Gender	
Male	878 (52.6%)
Female	790 (47.4%)
ASA Score I–II	1635 (98%)
Obesity (BMI > 30 kg/m ²)	80 (4.8%)
Leukocytosis > 20,000	114 (6.8%)

ASA American Society of Anesthesiologists, BMI Body Mass Index

Table 2 Comparison between patients who developed intraabdominal abscess (IAA) and those who did not

Variables	IAA n = 36	Non-IAA n = 1632	p value
Obesity (BMI > 30 kg/m ²)	10 (22%)	70 (4.2%)	< 0.01
Leukocytosis (> 20,000/mm ³)	11 (25%)	103 (6.3%)	< 0.01
Perforated appendicitis	29 (81%)	257 (15.7%)	< 0.01
Mean hospital stay in days	6.6 (4–34)	1.6 (1–13)	< 0.01

BMI Body Mass Index

Results

In the period of the study a total of 1668 laparoscopic appendectomies were performed. The mean age was 35.1 (14–95) years and 878 patients (52%) were male. Most of the patients had a good performance status, with ASA score of I–II in 98% of them. Obesity (BMI > 30 kg/m²) was found in 80 patients (4.8%) (Table 1).

The rate of IAA was 2.2% (36 patients). When comparing to patients without postoperative fluid collections, IAA was significantly associated to obese patients (22% vs. 4.2%, $p < 0.01$), leukocytosis greater than 20,000/mm³ (25% vs. 6.3%, $p < 0.01$), and perforated appendicitis (81% vs. 15.7%, $p < 0.01$). There was also a significant increase on the mean hospital stay in patients with IAA, as compared to those without postoperative IAA: 6.6 (4–34) days vs. 1.6 (1–13), $p < 0.01$ (Table 2).

“Among the patients with postoperative IAA, 12 (33%) received antibiotics only (G1), 8 (22%) underwent CT-guided percutaneous drainage (G2), and 16 (45%) underwent laparoscopic lavage of the abdominal cavity (G3). The median size of the abscess was 2.7 (1.2–4) cm in G1, 6.2 (4.5–8) cm in G2, and 9.6 (8–11.4) cm in G3 ($p < 0.04$). Patients with two or more fluid collections underwent a laparoscopic lavage in all cases.”

Treatment failure occurred in 16% (2/12), 12.5% (1/8) and 12.5% (2/16) of the patients in G1, G2, and G3, respectively. Two patients in G1 required percutaneous drainage, one patient in G2 underwent a laparoscopic lavage, and two patients in G3 required re-laparoscopic lavage. No patient in the entire cohort needed an open surgery to resolve the postoperative IAA.

Based on our results, a treatment algorithm for the management of postoperative IAA was proposed (Fig. 1).

Discussion

We aimed to evaluate the management of postoperative IAA after LA in a large cohort of patients in order to design a treatment algorithm. We found that a step-up approach based in the size and number of fluid collections was associated with favorable outcomes.

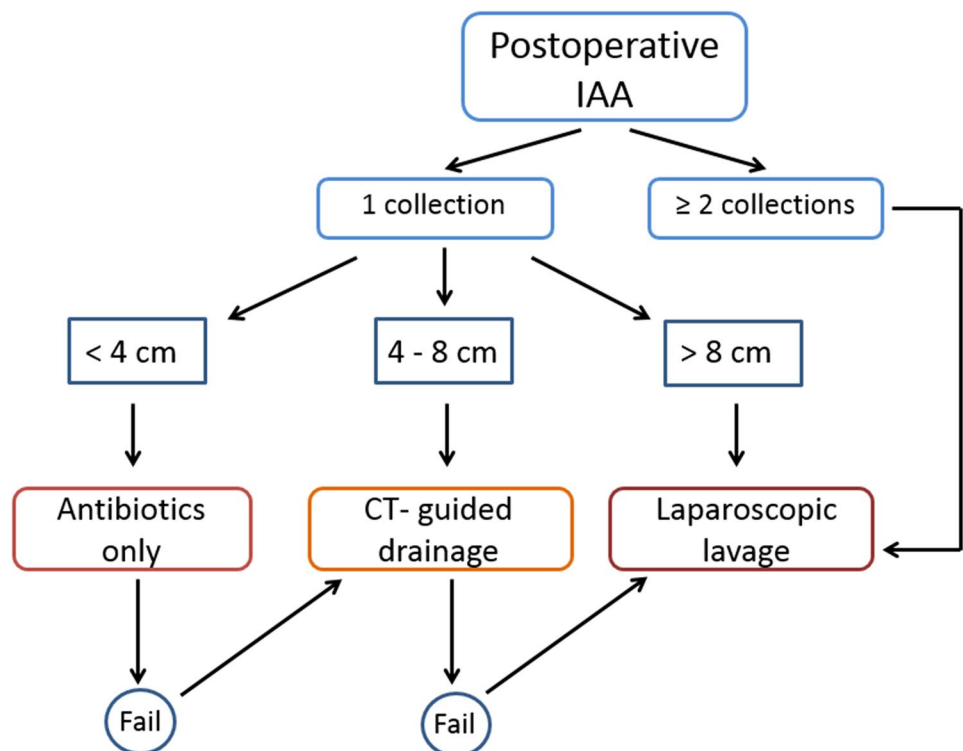
IAA is a serious complication and has been reported in up to 19% of the patients with complicated appendicitis [10]. A recent meta-analysis conducted by Athanasiou et al. [11] found a rate of IAA of 8% and 6% after laparoscopic and open appendectomies, respectively, with no statistically significant difference between them [OR = 1.11(0.85, 1.45)]. In our series, the rate of IAA was 2.2%, which did not vary from a previous report of the same group [5]. There are several established risk factors associated to postoperative IAA such as obesity, leukocytosis, perforated appendicitis,

greater operative time, diabetes mellitus, and peritoneal irrigation during the surgery [5, 6]. Most of those factors were indeed found in our cohort. Dhaou et al. [7] reported a hospital stay of 10 (7–14) days after the diagnosis of IAA. We also found that IAA was associated with a significant longer hospital stay.

Once the diagnosis of IAA is established, several treatment modalities have been proposed [12–14]. Image-guided percutaneous drainage and laparoscopic lavage are often chosen to treat this complication [15]. A conservative approach with antibiotics only, however, also seems reasonable in some cases [16]. It has been observed in the pediatric population that antibiotics only (triple scheme) are associated with very good outcomes when compared with surgical management.[17]. In our series, a conservative approach was decided in 12 patients (median size of 2.7 cm) and it was successful with full resolution of the complication in 84% of cases. Only 2 patients (16%) required percutaneous drainage because of abscess persistence.

Image-guided percutaneous drainage is currently available in most institutions, and both ultrasound- and CT-guided drainage have shown very good outcomes with success rates greater than 80% [18–20]. To our knowledge, there is a lack of information regarding the radiology’s threshold to perform image-guided drainage of IAA after LA. However, an attempt to establish a radiology cut-off point for percutaneous drainage in abscesses related to other entities has been made [21–23]. CT-guided percutaneous drainage election in

Fig. 1 Minimally invasive step-up approach algorithm for the management of postoperative intraabdominal abscess (IAA) after LA



our cohort was based on abscess size, abscess localization, and patient's clinical condition, and was performed as initial approach in 8 patients (median size 6.2 cm) with a success rate of about 87.5%. Only 1 patient (12.5%) needed laparoscopic lavage to resolve the complication.

Laparoscopic lavage of the abdominal cavity is often necessary for larger collections. Several publications have supported this approach, mainly when percutaneous drainage is not feasible or it is not available [24, 25]. Considering that a new laparoscopic procedure could be related with other complications such as bowel injury, fistulas or ileus, we believe that a laparoscopic lavage should be reserved for patients with very large or multiple collections in which percutaneous drainage usually fail or is contraindicated. In our cohort, a total of 18 patients (16 as first approach and 2 after percutaneous drainage failure) underwent laparoscopic lavage with a 95% of effectiveness. Only one patient needed a re-laparoscopic lavage (5%) to resolve the complication.

Overall, decision making should be subject to the complexity of the cases with a step-up approach basis. This is in alignment with the EAES consensus which established that IAA can be managed by a conservative method (antibiotics only), or by a percutaneous drainage or a laparoscopic approach in those patients with complicated abscesses, or those who decline in their clinical condition [26]. Our study suggests that unique fluid collections less than 4 cm can be treated conservatively with antibiotics only, collections between 4 and 8 cm with imaging guided percutaneous drainage, and collections greater than 8 cm with laparoscopic lavage. In case of failure, every chosen treatment can be scaled to the next step, with very good overall outcomes (Fig. 1).

The main limitation of our study is its retrospective nature. In addition, a relatively small number of patients developed postoperative IAA and were included in the analysis. However, considering the limited available information in the literature regarding the management of postoperative IAA after LA, we believe our study could help future research collaborations to elucidate the best treatment modalities for this complication.

Conclusion

Obese patients, white blood cell count > 20,000 and perforated appendicitis are associated with a higher risk of postoperative intraabdominal abscess after LA. A minimally invasive step-up approach based on the size and number of fluid collections seems to be safe and feasible. A treatment algorithm is proposed in order to manage this complication to avoid unnecessary procedures.

Compliance with ethical standards

Disclosures Francisco Laxague MD, Francisco Schlottmann MD, MPH, José M. Piatti MD and Emmanuel E. Sadava MD, have no conflicts of interest or financial ties to disclose.

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