Laparoscopic vs conventional open surgery in appendicitis: where are we standing?

Cirugía abierta convencional vs laparoscópica en apenditicis: ¿dónde estamos?

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Abstract

Appendicitis is one of the most frequent indications for surgical intervention, mostly in the pediatric population and, to a lesser degree, in adults. Conventionally, the surgical approach to appendicitis has been the gold standard for over a century, providing the highest success ratio. However, as with every surgical procedure, it may have complications. The technique for appendectomy has evolved in the past decades to decrease the incidence of complications, resulting in two great variants: open appendectomy (OAP) and laparoscopic appendectomy (LAP). Several aspects remain controversial when comparing these alternatives, including adverse events, pain scores, length of hospital stay, recovery time, and costs. Current evidence suggests that LAP has been widely adopted, providing great results. However, some authors have stated that the associated complications do not outweigh the inherent risks, speaking particularly of the IAA. Nonetheless, current, high-quality evidence reports that LAP and OAP are almost equally safe in most scenarios, with a slight tilt in the benefits balance towards the LAP. The lower incidence of SSI, shorter length of stay, lower pain scores, and faster recovery more than make up for the marginally higher cost. Given this scenario, several studies have compared these alternatives. This review aims to compare the complication rates and associated costs of OAP vs. LAP to provide a clear conclusion as to which is the best alternative to treat appendicitis.

Keywords: Appendicitis, open appendectomy, laparoscopic appendectomy, surgical complications, surgical technique.

Resumen

La apendicitis es una de las indicaciones más frecuentes de intervención quirúrgica, mayoritariamente en la población pediátrica y, en menor medida, en la adulta. Convencionalmente, el abordaje quirúrgico de la apendicitis ha sido el estándar de oro durante más de un siglo, brindando la tasa de éxito más alta. Sin embargo, como todo procedimiento quirúrgico, puede tener complicaciones. La técnica de apendicectomía ha evolucionado en las últimas décadas para disminuir la incidencia de complicaciones, dando como resultado dos grandes variantes: apendicectomía abierta (OAP) y apendicectomía laparoscópica (LAP). Varios aspectos siguen siendo controvertidos cuando se comparan estas alternativas, incluidos los eventos adversos, las puntuaciones de dolor, la duración de la estancia hospitalaria, el tiempo de recuperación y los costos. La evidencia actual sugiere que LAP ha sido ampliamente adoptada, proporcionando excelentes resultados. Sin embargo, algunos autores han afirmado que las complicaciones asociadas no superan los riesgos inherentes, hablando en particular del absceso intraabdominal. No obstante, la evidencia actual informa que LAP y OAP son casi igualmente seguros en la mayoría de los escenarios, con una ligera inclinación en el balance de beneficios hacia LAP. La menor incidencia de infección del lecho quirúrgico, la estancia más corta, las puntuaciones de dolor más bajas y la recuperación más rápida compensan con creces el costo marginalmente más alto. Ante este escenario, varios estudios han comparado estas alternativas. Esta revisión tiene como objetivo comparar las tasas de complicaciones y los costos asociados de OAP versus LAP para brindar una conclusión clara sobre cuál es la mejor alternativa para tratar la apendicitis.

Palabras clave: Apendicitis, apendicectomía abierta, apendicectomía laparoscópica, complicaciones quirúrgicas, técnica quirúrgica.

Introduction

Abdominal pain is one of the most common complaints for patients presenting to the emergency department (ED), accounting for almost 7% of all the ED visits[1,2]. Evaluation of abdominal pain requires the exploration of several differential diagnoses that may require surgical intervention. Abdominal pain can be the main symptom of gastrointestinal, gynecologic, urologic, vascular, and even non-abdominal pathologies like diabetic ketoacidosis[3,4]. Although the diagnostic spectrum is considerably large, clinical presentation, evolution, physical examination, and imaging tools usually narrow this spectrum enough to provide a single diagnosis. Moreover, epidemiological data is also quite useful, given that appendicitis is the most common cause of abdominal pain in various age groups, predominantly the pediatric population. Nevertheless, it also represents a common cause of abdominal pain in adulthood[5,6].

Indeed, appendicitis is the most common abdominal surgical emergency worldwide, and it can evolve into severe complications such as peritonitis, abscess, sepsis, and death, not to mention the financial burden it entails[7,8]. The incidence of appendicitis is approximately 233 per 100,000 patients per year. Furthermore, the incidence rates of appendicitis have increased from 1990 to 2019 in developing countries; however, such parameters have decreased in developed countries[9]. Historically, the gold standard treatment for appendicitis has been surgical appendectomy, providing the best clinical outcomes of any treatment alternative. Nonetheless, as with any surgical procedure, postoperative complications are always a possibility. Surgical site infection (SSI), bleeding, intraabdominal abscess, wound dehiscence, and atelectasis are some of the appendectomy-associated complications[10].

Open appendectomy (OAP) has been the leading option to treat appendicitis, but current trends are leaning towards laparoscopic appendectomy (LAP), a modern solution to an old problem[11,12]. Some studies suggest that the complication rate of LAP is lower in contrast to OAP, mainly regarding incision site infection[13]. Nonetheless, surgical-associated costs are significantly greater in the LAP group, making it only financially viable if OAP infection rates exceed 23%[14]. Given this scenario, several studies have compared these alternatives. This review aims to compare the complication rates and associated costs of OAP vs. LAP to provide a clear conclusion as to which is the best alternative to treat appendicitis.

Which is the best appendectomy approach? is modern always better?

The surgical approach has always been the undebatable gold standard of management for appendicitis for nearly 140 years[15,16]. However, over time, the technique for

appendectomy has evolved to decrease its associated complications and costs, like SSI and in-hospital stay length. In retrospective, LAP was first performed in 1983 by Semm, who reported outstanding results[17]. Since then, it has become a well-accepted surgical approach and has been reported to shorten in-hospital stay length, provide better cosmetic results, and decrease postoperative pain and recovery time[18,19]. Nonetheless, other authors have warned in their studies against the complications of LAP, particularly the intra-abdominal abscess (IAA), and especially in the management of perforated appendicitis[20,21]. As a result, the decision as to whether LAP is superior to OAP remains a subject of debate.

Firstly, appendectomy has an overall complication rate ranging from 8 to 31%, led by SSI, with the highest individual incidence amounting to 10% of all the complications[22]. However, surgical technique is not as closely related to complications as other factors. For instance, perforated appendicitis is more likely to develop postoperative infections. Likewise, preoperative antibiotics, intraoperative irrigation, and surgery duration have the highest predictive power for postoperative infections[23–25]. Given the several risk factors associated with the outcomes, it is difficult to make a comparison between two surgical techniques while adjusting for these confounding factors. However, several recent studies have made significant efforts towards making an unbiased comparison between these two alternatives.

Biondi et al.[26] performed a retrospective study of 583 patients with acute appendicitis. Two groups were compared for operative time, length of stay, postoperative pain, complication rate, and surgical-associated costs. LAP was associated with a shorter hospital stay, less need for analgesia, and a faster return to normal activity. Likewise, the overall complication rate was lower in the LAP group, particularly when contrasting SSI (1.4% vs. 10.6%, P<0.001). However, the cost of LAP was higher by about 150 €. The authors concluded that LAP was a safe and efficient approach for appendicitis, providing significant clinical benefits over OAP against marginally higher hospital costs.

Likewise, Shimoda et al.[27] performed a single-center study in 185 patients that underwent appendectomy. Similarly, to previous studies, the population was divided into a LAP group and an OAP group. According to univariate analysis, the LAP group had a significantly shorter length of stay and duration until resuming oral intake. Furthermore, the LAP group had significantly lower rates of postoperative anemia due to blood loss, as well as lower rates of SSI. However, the study was small in population, and no adjustment for confounding factors was performed. In addition, Nazir et al.[28] reported similar findings in a population of 130 patients. The LAP group had significantly lower rates of SSI and a shorter length of stay. Moreover, contrary to other studies, the LAP group had a shorter mean operating time, but this variable is strongly related to surgeon expertise.

Similar research was performed by Takami et al.[29] on about 180 patients who underwent appendectomy. The population was evenly distributed into the same two groups as in other studies. The statistical analysis reported the mean operative time was significantly longer in the LAP group; nonetheless, the LAP group still came ahead of the OAP group in several clinical parameters. For instance, patients that underwent LAP had a shorter length of stay and had fewer complications than the OAP group (16.7% vs. 27%, odds ratio (OR) 0.376; 95% CI 0.153-0-932; p = 0.0327). In contrast to previous studies, Takami et al. did not find significant differences regarding the time spent returning to oral intake. In conclusion, the authors suggested performing LAP as a safe and efficient alternative to manage appendicitis, especially in complicated cases.

Conversely, other authors have stated that the benefits of LAP in comparison to OAP do not outweigh the associated costs. Moreover, LAP may have a significantly greater risk of some complications. For instance, Yeom et al.[30] carried out a retrospective study on 84 patients, out of whom 25 were treated through LAP. Results showed that 12% of the LAP patients required a second intervention for conversion from LAP to OAP. Furthermore, there were no differences between groups regarding SSI, stump leakage, postoperative ileus, or blood loss. However, the incidence of intraabdominal abscess (IAA) was significantly higher in the LAP group (20% vs. 3.4%; P=0.02). However, conclusions should be drawn carefully, since the groups were not equally distributed and confounding factors like pain duration since onset or peritonitis were not accounted for.

Most reports of a higher incidence of IAA come from the earlier studies regarding LAP to manage appendicitis. Some research has shown a similar postoperative incidence of IAA between LAP and OAP[31–33], and some has reported an even lower incidence. For instance, Masoomi et al.[34] reported a significantly lower incidence of IAA in the LAP group (1.65% vs. 3.57%) on a large administrative basis. Some authors suggest that the risk factors associated with the formation of an IAA rely on the efficacy of peritoneal irrigation, the method for appendiceal stump closure, and other predictive factors like a preoperative leukocyte count >17.000 and higher serum concentrations of C-reactive protein. However, when accounting for these factors, the incidence of IAA is similar or lower in the LAP group in contrast to the OAP group[20,21].

A meta-analysis by Jaschinski et al.[35] included 9 systematic reviews comparing the outcomes of patients with appendicitis that underwent either LAP or OAP. It was reported in 8 of the 9 reviews that the mean operative duration was shorter in the OAP group by almost 18 minutes. However, pain scores and the incidence of SSI were lower in the LAP group in all the studies. No difference in mortality was reported, and half the studies showed a higher incidence of IAA in the LAP group,

while the other half reported a lower incidence. Thus, this overview indicates discordant results regarding the magnitude of the effects reported. However, both LAP and OAP had comparable safety and efficacy profiles, with a slight tilt in the balance in favor of the LAP.

Another, more recent systematic review by Jaschinski et al.[36] included 85 studies involving over 9700 participants. Except for a higher rate of IAA after LAP in the adult group, LAP showed significant advantages over OAP in pain intensity, wound infections, length of hospital stay, and time until return to normal activity in adults. The incidence of IAA was not greater in the LAP group in the pediatric population, but the pain scores and SSI were in favor of the LAP group. The studies with adult patients had the greatest methodologic quality; therefore, the authors concluded that LAP was superior to OAP in most adult scenarios when accounting for risk factors for IAA. However, the quality of evidence in the pediatric population was low to moderate, so further studies are needed to provide solid conclusions in this subpopulation.

Conclusions

Appendicitis is one of the most frequent indications for surgical intervention, mostly in the pediatric population and, to a lesser degree, in adults. Conventionally, the surgical approach to appendicitis has been the gold standard for over a century, providing the highest success ratio. However, as with every surgical procedure, it has complications. The technique for appendectomy has evolved in the past decades to decrease the incidence of complications, resulting in two great variants: OAP and LAP. Current evidence suggests that LAP has been widely adopted, providing great results. However, some authors have stated that the associated complications do not outweigh the inherent risks, speaking particularly of the IAA. Nonetheless, current, high-quality evidence reports that LAP and OAP are almost equally safe in most scenarios, with a slight tilt in the benefits balance towards the LAP. The lower incidence of SSI, shorter length of stay, lower pain scores, and faster recovery more than make up for the marginally higher cost. Although the decision between LAP and OAP is currently surgeon-dependent, given the current evidence, it is more than likely that future guidelines will provide specific indications for LAP as well as for OAP.

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