

# Laparoscopic Versus Open Appendectomy; Which Method to Choose?

## A Prospective Randomized Comparison

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**Abstract-** Appendicitis is the most common surgical emergency with the incidence rate of 6-10%. Although several studies have compared the two approaches of open (OA) and laparoscopic appendectomy (LA) the technique of choice is still a matter of controversy. Considering this background we designed a study to compare OA and LA outcomes in our center. One hundred patients were included in this study performed from April 2008 to April 2009 at Shahid Sadoughi hospital, Yazd, Iran. Patients who gave informed consent were randomized to either OA or LA groups and were operated by McBurney's or laparoscopic technique, respectively. Patients received our center's routine diet, antibiotics and analgesic regimens. The patients' pain was measured by visual analogue scale (VAS) at their entrance to the recovery room and in 6-hour intervals up to 24 hours. Post-operation follow up visits were in weeks 1, 2 and 4. The data of operation time, hospital stay, intra-operation complications, time to resume normal activity, short term complications and neuralgia were collected and analysed. The average operation time was  $34.4 \pm 8.42$  min in LA and  $41.7 \pm 8.84$  in OA hand ( $P=0.001$ ). No intra-operative complication and no LA to OA conversion were encountered in operations. Post-operative complication rate was higher in OA group ( $n=10$ ) compared to LA ( $n=3$ ). The post-operative pain showed less pain in OA only at 6 and 12 hours post-operative times. Patients' mean hospital stay was  $52.32 \pm 19.2$  and  $42.96 \pm 13.8$  hours in LA and OA groups, respectively ( $P=0.003$ ). Time to resume normal activity didn't show a significant difference between two groups ( $P=0.53$ ). Only one case of neuralgia in the OA group was confronted in the follow up visits. LA has less complications and cosmetic scar with the cost of more pain. Decision between OA and LA for each patient should be made individually.

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### Introduction

Appendicitis with the incidence rate of 6-10% is considered as the most common surgical emergency (1). About one decade after McBurney had introduced open appendectomy (OA) (2) the laparoscopic technique was performed by Semm in 1983 (3).

Despite OA being associated with low morbidity and mortality rates (4) the popular minimally invasive approach showed more advantages such as less wound infection, less pain, and faster recovery in the cost of more operating time and hospital cost (5-8). LA can have extra benefits for female patients as decreasing adhesions and fertility problems and better cosmetic results (9).

Numerous studies have compared OA with LA, but the role of laparoscopy is still a controversial issue. Some studies have showed better clinical results for LA (10-13), while some others fail to prove a significant advantage (14-18) or demonstrated disadvantages such as higher cost or intra-abdominal abscess (15,19-21). With this background and considering the few studies comparing laparoscopic and open appendectomy in third-world countries this study was designed to compare the prospective outcomes of LA with OA in terms of operating time, postoperative pain, hospital stay, time to resume the normal activity, intra and post operation complications, and neuralgia.

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## Materials and Methods

This prospective comparative study was performed in Shahid Sadoughi hospital, Yazd, Iran, from April 2008 to April 2009. The merits and drawbacks of LA and OA were explained to all of the patients with diagnosis of acute appendicitis according to Alvarado score (22). Our exclusion criteria for this study were being older than 9 years, showing signs of generalized peritonitis, having a palpable mass in RLQ suggesting appendiceal abscess, or being pregnant. Patients who gave their informed consent were randomized to either LA or OA groups. The randomization technique was by having patient open a concealed envelope from a randomized order of envelopes by a blinded technician. The study was approved by local Ethics Committee and all of the researchers obliged themselves to practice in accordance to Helsinki declaration.

All of the patients received prophylactic ceftriaxone (1 gram, every 12 hours) and metronidazole (500 mg, every 8 hours). All of the surgeries were performed by the same surgeon (S. K.). The OA surgeries were performed through a McBurney's muscle-splitting incision. For the LA patients, the classic three port technique was performed through two 10 mm (umbilical and right iliac fossa) and one 5 mm (suprapubic) ports. All of the removed appendices were sent for pathologic study.

After the operation all of the patients were NPO and received antibiotics for 48 hours. The routine analgesic used for patients was morphine (5 mg intramuscular, every 8 hours). Soft diet was started after 48 hours and patients were discharged after normal diet was tolerated. Post operation follow up visits were in weeks 1, 2 and 4. Patients were asked to contact the therapy team in case of any problem.

Patients' data such as operation time, hospital stay and intra operation complications were collected from their hospital files. Time to resume normal activity, short term complications and neuralgia data were obtained through post operative visits. The patients' pain was measured using a visual analogue scale (VAS) with 10cm line between 0 as no pain and 10 as the worst pain ever experienced. Patients mark their pain at the time they enter the post-op recovery room and in 6 hour intervals up to 24 hour after the operation.

### Statistical methods

Statistical analysis was performed using SPSS software, version 15 (SPSS Inc., Chicago, IL). The data was presented as number/percent or mean± standard

deviation. The pain difference was analysed by student t test. Fisher exact test and Mann-Whitney U test were used for complications and time for hospital stay and normal activity resume, respectively. The level of significance was defined at  $P < 0.05$ .

## Results

The total number of 100 patients, in two groups of open and laparoscopic appendectomy, was followed up for one month in this study. The LA and OA groups participants' mean age was  $26.94 \pm 9.51$  and  $25.36 \pm 8.92$ , respectively ( $P = 0.394$ ). Twenty three men (46%) and twenty seven women (54%) underwent LA while 28 men (86%) and 22 women (22%) were operated by OA technique. No statistically significant difference was observed in male to female ratio ( $P = 0.212$ ).

The average skin to skin operation time was  $34.4 \pm 8.42$  min in LA hand and  $41.7 \pm 8.84$  in OA hand ( $P = 0.001$ ). No intra operative complication was encountered in operations. There was no conversion to open surgery in LA operations.

Post-operative complication rate was higher in OA group. Urinary retention ( $n = 2$ ) and pulmonary infection ( $n = 1$ ) were the only post-operative complications in LA hand while OA group complications comprised wound infection ( $n = 2$ ), uterine infection ( $n = 1$ ), pulmonary infection ( $n = 1$ ) and urinary retention ( $n = 6$ ) (Table 1).

**Table 1.** Complication rate in LA and OA groups [data is presented as Number (percent)]

Complication	Laparoscopic	Open
Intra operative	0	0
Urinary retention	2 (4%)	6 (12%)
Pulmonary infection	1 (2%)	1 (2%)
Wound infection	0	2 (4%)
Visceral infection	0	1 (2%)*
Neuralgia	0	1 (2%)

\*one case of uterine infection in OA group]

**Table 2.** Pain in the 24 hour post operation period

Hours after surgery	Open appendectomy group	Laparoscopic Appendectomy Group	P value
0	$4.94 \pm 2.66$	$5.26 \pm 2.14$	0.465
6	$4.38 \pm 2.51$	$5.44 \pm 2.41$	0.033
12	$3.46 \pm 2.38$	$4.68 \pm 2.29$	0.009
18	$2.82 \pm 2.52$	$3.26 \pm 1.98$	0.137
24	$1.36 \pm 1.26$	$1.78 \pm 1.69$	0.193

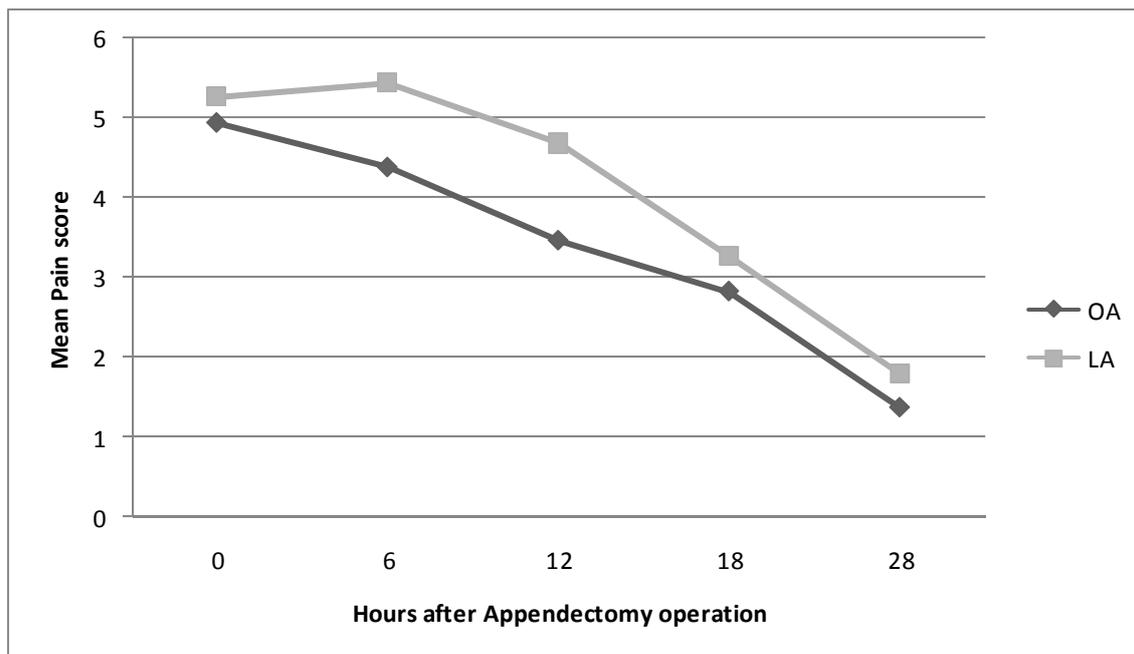


Figure 1. Average pain score changes in 24 hour post operative period

In pathologic study, 70 and 74 percent of removed appendices were diagnosed as acute appendicitis, respectively in LA and OA groups.

The post operative pain measured in this study showed a statistically less pain in OA hand six and twelve hours after the surgery. The pain severity doesn't show statistically difference between two groups in other time spans (Table 2). The average of the pain scores during the post operation day was lower in OA group. The P value for this difference ( $4.08 \pm 1.73$  for LA and  $3.39 \pm 1.84$  for OA) was 0.06, reaching the statistical significance (Figure 1). Patients' mean hospital stay was  $52.32 \pm 19.2$  hours for patients in LA group while this period was  $42.96 \pm 13.8$  for OA hand ( $P=0.003$ ).

According to follow up visits patients in OA group resumed their normal activity after  $3.2 \pm 2.47$  days, while this period for patients in LA group was  $3.1 \pm 1.46$  which does not show a significant difference ( $P=0.53$ ). Only one case in OA complained of neuralgia ( $P=0.753$ ). No other complication was confronted in the follow up visits.

## Discussion

The purpose of this study was to compare LA with OA regarding the operation time, intra operative and post operative complications and 24-hour post operative pain. The LA operation time was shorter in the present study ( $34.4 \pm 8.42$  for LA compared to  $41.7 \pm 8.84$  for OA).

Several studies reported a shorter operation time for OA technique (16,17,19,21), while some couldn't show a significant difference (23-25) and some reported a shorter operation time for LA (8). The shorter time in our study can be measuring skin to skin operation time and not considering the time for laparoscopic settings in operation room. Heikkinen et al. reported a shorter operation time for LA but a longer operation room time for this group (8).

Patient may have complications such as wound infection, fever, urinary infection or retention, deep abdominal infection and intestinal obstruction. In the present study OA group had higher post operative complication rate which is in agreement with several previous studies (6,10,11,16-20). Urinary retention was the most common complication in both groups (Table 1). It is suggested that lower rate of wound infection in LA technique can be due to avoidance of direct contact of infected appendix using a sterile bag through trocar site (26,27). The lower complication rate in LA technique can be explained by the advantage of minimally invasive surgery and reduced damage to viscera and intestinal serous membrane compared to open approach (28).

The pain score in the present study was lower in the OA group in 6 and 12 hours after the surgery while in other time spans the difference was not significant (table 2). While some studies did not report less pain score for LA technique (13,15,29) a review including 67 studies

reported an eight mm less pain score on a 100 mm VAS (21). Higher pain score in the present study can be an effect of not blinding the patients and patients giving high score for the pain they feel according to the surgical scar they observe, along with the fact that patients with LA can experience more shoulder pain than OA patients (30).

Patients' hospital stay period has been reported in variable range in the literature (21). Higher hospital stay for LA patients in the present study can be because of our conservative policy as this was our initial laparoscopic appendectomy experience; while discharging open patients more lately is more a tradition as it is shown that OA patients' hospital stay can be shortened (31). Our results did not show a shorter time to resume normal activity after LA while reported by some previous studies (21). It is suggested that LA has higher rate of intra-abdominal abscess compared to OA, while OA causes more wound infection (21, 32). The post operation complication rate was very low for both groups in our study. In conclusion, LA has less complications and cosmetic scar with the cost of more pain. Considering the higher cost of laparoscopic approach, LA does not have significant superiority to OA. Decision between OA and LA for each patient should be made individually according to some minimally invasive surgery benefits such as improved cosmesis.

## References

1. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiol* 1990;132(5):910-25.
2. McBurney C. IV. The Incision Made in the Abdominal Wall in Cases of Appendicitis, with a Description of a New Method of Operating. *Ann Surg* 1894;20(1):38-43.
3. Semm K. Endoscopic appendectomy. *Endoscopy* 1983;15(2):59-64.
4. Eriksson S, Granström L. Randomized controlled trial of appendectomy versus antibiotic therapy for acute appendicitis. *Br J Surg* 1995;82(2):166-9.
5. Shaikh AR, Sangrasi AK, Shaikh GA. Clinical outcomes of laparoscopic versus open appendectomy. *JLS* 2009;13(4):574-80.
6. Ortega AE, Hunter JG, Peters JH, Swanson LL, Schirmer B. A prospective, randomized comparison of laparoscopic appendectomy with open appendectomy. Laparoscopic Appendectomy Study Group. *Am J Surg* 1995;169(2):208-12; discussion 212-3.
7. Hellberg A, Rudberg C, Kullman E, Enochsson L, Fenyö G, Graffner H, Hallerbäck B, Johansson B, Anderberg B, Wenner J, Ringqvist I, Sörensen S. Prospective randomized multicentre study of laparoscopic versus open appendectomy. *Br J Surg* 1999;86(1):48-53.
8. Heikkinen TJ, Haukipuro K, Hulkko A. Cost-effective appendectomy. Open or laparoscopic? A prospective randomized study. *Surg Endosc* 1998;12(10):1204-8.
9. Tzovaras G, Liakou P, Baloyiannis I, Spyridakis M, Mantzos F, Tepetes K, Athanassiou E, Hatzitheofilou C. Laparoscopic appendectomy: differences between male and female patients with suspected acute appendicitis. *World J Surg* 2007;31(2):409-13.
10. Milewicz M, Michalik M, Ciesielski M. A prospective, randomized, unicenter study comparing laparoscopic and open treatments of acute appendicitis. *Surg Endosc* 2003;17(7):1023-8.
11. Martin LC, Puente I, Sosa JL, Bassin A, Breslaw R, McKenney MG, Ginzburg E, Sleeman D. Open versus laparoscopic appendectomy. A prospective randomized comparison. *Ann Surg* 1995;222(3):256-61; discussion 261-2.
12. Bresciani C, Perez RO, Habr-Gama A, Jacob CE, Ozaki A, Batagello C, Proscurshim I, Gama-Rodrigues J. Laparoscopic versus standard appendectomy outcomes and cost comparisons in the private sector. *J Gastrointest Surg* 2005;9(8):1174-80; discussion 1180-1.
13. Ignacio RC, Burke R, Spencer D, Bissell C, Dorsainvil C, Lucha PA. Laparoscopic versus open appendectomy: what is the real difference? Results of a prospective randomized double-blinded trial. *Surg Endosc* 2004;18(2):334-7.
14. Olmi S, Magnone S, Bertolini A, Croce E. Laparoscopic versus open appendectomy in acute appendicitis: a randomized prospective study. *Surg Endosc* 2005;19(9):1193-5.
15. Katkhouda N, Mason RJ, Towfigh S, Gevorgyan A, Essani R. Laparoscopic versus open appendectomy: a prospective randomized double-blind study. *Ann Surg* 2005;242(3):439-48; discussion 448-50.
16. Golub R, Siddiqui F, Pohl D. Laparoscopic versus open appendectomy: a metaanalysis. *J Am Coll Surg* 1998;186(5):545-53.
17. Chung RS, Rowland DY, Li P, Diaz J. A meta-analysis of randomized controlled trials of laparoscopic versus conventional appendectomy. *Am J Surg* 1999;177(3):250-6.
18. Temple LK, Litwin DE, McLeod RS. A meta-analysis of laparoscopic versus open appendectomy in patients suspected of having acute appendicitis. *Can J Surg* 1999;42(5):377-83.

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19. Garbutt JM, Soper NJ, Shannon WD, Botero A, Littenberg B. Meta-analysis of randomized controlled trials comparing laparoscopic and open appendectomy. *Surg Laparosc Endosc* 1999;9(1):17-26.
20. Kehagias I, Karamanakos SN, Panagiotopoulos S, Panagopoulos K, Kalfarentzos F. Laparoscopic versus open appendectomy: which way to go? *World J Gastroenterol* 2008;14(31):4909-14.
21. Sauerland S, Jaschinski T, Neugebauer EA. Laparoscopic versus open surgery for suspected appendicitis. *Cochrane Database Syst Rev* 2010;(10):CD001546.
22. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med* 1986;15(5):557-64.
23. Wei HB, Huang JL, Zheng ZH, Wei B, Zheng F, Qiu WS, Guo WP, Chen TF, Wang TB. Laparoscopic versus open appendectomy: a prospective randomized comparison. *Surg Endosc* 2010;24(2):266-9.
24. Carbonell AM, Burns JM, Lincourt AE, Harold KL. Outcomes of laparoscopic versus open appendectomy. *Am Surg* 2004;70(9):759-65; discussion 765-6.
25. Cothren CC, Moore EE, Johnson JL, Moore JB, Ciesla DJ, Burch JM. Can we afford to do laparoscopic appendectomy in an academic hospital? *Am J Surg* 2005;190(6):950-4.
26. Williams MD, Collins JN, Wright TF, Fenoglio ME. Laparoscopic versus open appendectomy. *South Med J* 1996;89(7):668-74.
27. Richards W, Watson D, Lynch G, Reed GW, Olsen D, Spaw A, Holcomb W, Frexes-Steed M, Goldstein R, Sharp K. A review of the results of laparoscopic versus open appendectomy. *Surg Gynecol Obstet* 1993;177(5):473-80.
28. Wei B, Qi CL, Chen TF, Zheng ZH, Huang JL, Hu BG, Wei HB. Laparoscopic versus open appendectomy for acute appendicitis: a metaanalysis. *Surg Endosc* 2011;25(4):1199-208.
29. Moberg AC, Berndsen F, Palmquist I, Petersson U, Resch T, Montgomery A. Randomized clinical trial of laparoscopic versus open appendectomy for confirmed appendicitis. *Br J Surg* 2005;92(3):298-304.
30. Lintula H, Kokki H, Vanamo K. Single-blind randomized clinical trial of laparoscopic versus open appendectomy in children. *Br J Surg* 2001;88(4):510-4.
31. Ramesh S, Galland RB. Early discharge from hospital after open appendectomy. *Br J Surg* 1993;80(9):1192-3.
32. Hemmila MR, Birkmeyer NJ, Arbabi S, Osborne NH, Wahl WL, Dimick JB. Introduction to propensity scores: A case study on the comparative effectiveness of laparoscopic vs open appendectomy. *Arch Surg* 2010;145(10):939-45.