

## Is laparoscopic appendectomy better choice compared to open appendectomy

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**Objective:** To compare laparoscopic appendectomy to open appendectomy for operation time, complications, hospital stay, time off work, cosmetic effects and diagnostic accuracy above the age of 12 years, to see if it was better choice as compared to open appendectomy, the existing gold standard.

**Methodology:** It is a prospective non-randomized controlled 3 years trial conducted at QAMC/BVH Bahawalpur, Pakistan from October 1, 2014 to September 30, 2017. It included 290 patients of acute appendicitis, 138 were operated laparoscopically and 152 by open appendectomy. Operation time, complications, hospital stay, time off work, cosmetic effects and diagnostic accuracy were compared in two groups. Data analysis was done on SPSS version 23.

**Results:** Mean age of patients was 25.19±10.19 in laparoscopic group and 26.08±10.71 in open appendectomy group. Of 290, 45(29.60%) were obese in open appendectomy and 47(31.15%) were obese in laparoscopic group. Operation time was 29.03±8.33 minutes in open group and 39.10±8.82 minutes in laparoscopic group. Hospital stay was 3.13±1.42 days and 2.05±1.34 days in open appendectomy and

laparoscopic group, respectively. Time off work was 12.09±3.68 and 8.70±3.83 days in open appendectomy and laparoscopic group. Overall per-operative complications were 0.65% to 2.17% (P=0.276) and postoperative were 18.42 to 9.42% (P=0.02) in open and laparoscopic group, respectively. Most significant was wound infection 9.86% to 3.62% in open and laparoscopic group, respectively. In obese patients, there was significant difference in complications in open (9.86%) to laparoscopic (2.89%) groups. Conversion and re-exploration were 0 to 2.17% and 2.63% to 1.44% in open and laparoscopic groups, respectively. Diagnostic failure was 9.8% to 2.17% (P=0.005) in open and laparoscopic group. Patients were happy with scar in 72.46% in laparoscopic group and worried in 34.21% in open group.

**Conclusion:** Laparoscopic appendectomy is better choice above the age of 12 years as compared to open appendectomy, even more feasible in obese patients. (Rawal Med J 201;43:301-305).

**Key words:** Laparoscopic appendectomy, open appendectomy, appendectomy.

### INTRODUCTION

Acute appendicitis is a common cause of acute abdomen with lifetime risk of 7-10%. It is common in 2<sup>nd</sup> and 3<sup>rd</sup> decade with recurrence rate of 38%. Appendectomy is the procedure of choice started by McBurney in 1894. It continued for about 100 years till Semm in 1983 performed first appendectomy laparoscopically. Laparoscopic appendectomy (LA) is performed in 58% of patients. Open appendectomy (OA) is considered as the gold standard but now the superiority of LA is much debated. Gold standard is the procedure that is accurate, best available and has attained the level of perfection. New procedure is evaluated by

comparing the time honored current standard i.e. gold standard. As LA has become widespread, debate goes on if it is not gold standard why is it not at least considered the operation of first choice. This study was conducted to compare LA to OA for operation time, complications, hospital stay, time off work, cosmetic effects and diagnostic accuracy above the age of 12 years and to see if LA was better choice as compared to OA, the existing gold standard.

### METHODOLOGY

This study was conducted at department of surgery, QAMC/BVH Bahawalpur. It was a

prospective, non-randomized, controlled trial from October 1, 2014 to September 30, 2017. Acute appendicitis was diagnosed on Alvarado score above 6 and USG and CT were done in suspicious of other pathology and unclear cases. The patients were allotted laparoscopic group or open appendectomy group after explaining the procedure. Informed written consent was taken. All patients above 12 years with acute uncomplicated appendicitis fit for general anesthesia were included in the study. Patients having symptoms of acute appendicitis for more than four days having palpable mass or complicated appendicitis (abscess, phlegmon, peritonitis) and those with cirrhosis, cardiac failure, bleeding disorder, pregnancy, previous laparotomy and unfit for anesthesia were excluded from the study. The patients were also studied in female and male group and obese and non-obese group. Patients with BMI > 30 were taken as obese. All operations were done by the same surgical team. Open appendectomy was done by Mc Burney's incision and LA was done by three port's method. Antibiotics ceftriaxone and metronidazole were used for two days, and then shifted to oral route. For post-operative analgesia, injection toradol was used. Patients age, gender, BMI, operation time, complications, hospital stay, time off work, diagnostic accuracy and cosmetic results were recorded. Diagnostic failure was label ed if clinical examination, per-operative investigation and laparoscopy failed to coincide the histopathology of appendix. Patients were asked about satisfaction of scar, if they were happy, worried or unconcerned. Statistical analysis was done using SPSS version 23. Mann Whitney U test and Chi-square test was used to compare values. P<0.05 was taken as significant.

## RESULTS

Of 290 patients of acute appendicitis, 152 were operated by OA and 138 by LA. Age distribution is shown in Table 1, gender and obesity distribution in Table 2, operation time is shown in Table 3 and hospital stay is in Table 4. Time Off work was 12±3.68 and 8.70±3.83 days in open and laparoscopic group.

**Table 1. Age distribution.**

Age	OAn = 152		LAn = 138	
12-20	52	34.21%	43	31.15%
21-30	65	42.76%	60	43.47%
31-40	20	13.15%	18	13.04%
41-50	10	4.57%	11	7.97%
>50	5	3.29%	6	4.34%
Mean±SD	25.19±10.19		26.08 ±10.71	

**Table 2. Gender distribution and obesity.**

Gender	OAn=152		LAn=138	
Male Total	80	52.63%	74	53.62%
Obese	25	16.44%	25	18.11%
Female Total	72	47.36%	64	46.37%
Obese	20	13.15%	18	15.9%
Total Obese	45	29.60%	43	31.15%
Total non-Obese	107	70.40%	95	68.84%

**Table 3. Operative time.**

Operative Time(min)	OAn=152		LA n=138		P value*
>15	10	6.58%	2	1.45%	P<0.0005
16-20	12	7.89%	3	2.17%	
21-25	12	7.89%	8	5.80%	
26-30	65	42.76%	10	7.25%	
31-35	26	17.11%	15	10.87%	
36-40	12	7.89%	25	18.11%	
41-45	8	5.26%	35	25.36%	
46-50	7	4.61%	40	28.99%	
Means± SD	29.03±8.33		39.10±8.82		

\* Mann Whitney U test

**Table 4. Hospital stay.**

Hospital Stay(Days)	OAn=152		LAn=138		P Value*
1-2	50	32.89%	115	83.33%	P<0.0005
3-4	85	55.92%	10	7.25%	
5-6	10	6.58%	10	7.25%	
>6	7	4.61%	3	2.17%	
Mean± SD	3.13±1.42		2.05±1.34		

\* Mann Whitney U test

**Table 5. Comparison of complications.**

Complication	OAn=152		LAN=138		p-value
Per-operative total	1	0.65%	3	2.17%	0.276
Bleeding	0	0	1	0.72%	0.476
Bowl Injury	1	0.65%	2	1.44%	0.464
Conversion per-operative	00	00	3 (Bleeding:1 Injury:2)	2.17%	0.107
Post-operative total	28	18.42%	13	9.42%	0.020
Obese	15	9.86%	4	2.89%	0.014
Haematoma	1	0.65%	2	1.44%	0.464
Wound Infection	15	6.57%	5	3.62%	0.029
Intra-abdominal Abscess	4	2.63	5	3.62%	0.440
Faecal fistula	3	1.97%	1	0.65%	0.348
Wound Dehiscence	3	1.97%	0	0	0.143
Hernia	2	1.31%	0	0	0.274
Re-exploration	4	2.63%	2	1.44%	0.389
	Abscess : 1 Fistula : 2 Dehiscence : 1		Abscess : 1 Fistula : 1		

Comparison of complications shown in Table 5. In OA 15 (9.8%) patients out of 152 and in LA, 3 (2.17%) patients out of 138 patients, histopathology report declared normal appendix. Regarding patient satisfaction about scar, 100 (72.26%) vs. 30 (19.73%) were happy, 3 (2.17%) vs. 52 (34.21%) were worried in laparoscopic and OA group, respectively. Rest remained unconcerned about scar.

## DISCUSSION

Laparoscopic appendectomy is challenging the open appendectomy, the gold standard for more than 100 years for acute appendicitis. After spectacular success of laparoscopic cholecystectomy calling as gold standard, surgeons are eager to see rank of LA as compared to OA.<sup>9,10</sup>

The operative time in our study was 29.03±8.33 and 39.10±8.82 minutes in open and laparoscopic groups, respectively. In a study by Liping et al found 11.59 minutes in excess and Katkhouda et al noted 60 minutes to 31 minutes in excess in laparoscopic group than open one.<sup>10</sup> They attributed the additional time for setup, insufflation, trocar entry and diagnostic laparoscopy. Operation time was 31.36±11.43 and 54.9±14.7 in open and LA as reported by Biondi et al.<sup>4</sup> A study by Mason in obese patients concluded open and LA time 69±38 and 55±28 respectively, in obese patients. Ciarrocchiet al noted significant decrease in operation time in LA

as compared to OA. Most studies use endoloops and ligature, if stapler is used for meso appendix and base of appendix, laparoscopic surgery time will reduce. No doubt a difference of 10 minutes is significant but still acceptable due to time consumed inset up and port introduction.

In our study, the overall complication rate 0.65% vs. 2.17% and 18.42% vs. 9.42% per-operative and post-operative in open and laparoscopic groups were found. In a study by Gulleret al per-operative complications were 0.4% in OA and in 0.3% in LA but difference was insignificant. Difference of per-operative complication in our study is also insignificant. Due to these 3 per-operative complications, we had to convert the LA to OA. Katkhouda et al has mentioned 8% conversion rate.<sup>10</sup> In their three patients, the cause of conversion was bleeding.<sup>12</sup> In our study, the overall post-operative complications were 18.42% and 9.42% in open and laparoscopic group, which are significant. These were 9.47% complications in LA and 14.74% in OA.<sup>11</sup> Overall complications by Katkhouda et al were 18.5% and 17.1% in open and LA, respectively which were insignificant.<sup>12</sup> So in all of studies OA had higher rate of complications.

Wound infection was the most common significant complication. In our study, wound infection was 9.86% vs. 2.89% in open and laparoscopic group, respectively. Liping et al has noted significantly reduced wound infection with LA 3.01% vs 7.53%.<sup>9</sup> Klinger et al noted 6% and 7% in laparoscopic and OA wound infection, respectively and in another study wound infection was half in LA as compared to OA.

Intra-abdominal abscesses are more frequent in case of LA. In our study, intra-abdominal abscesses were 2.63% vs. 3.62% in open and laparoscopic group but statistically are insignificant. Katkhouda et al noted in 33 (7.17%) out of 1042 in LA and 40 (3.77%) out of 1062 in OA.<sup>12</sup> Biondi et al had 4.17% and 0.32% abscesses in laparoscopic and OA, respectively.<sup>10</sup> Generally, LA has more chances of intra-abdominal abscesses, although difference is insignificant. These can be reduced by restricting irrigation and suction to localized area of abscess and not spilling irrigation fluid to whole peritoneum.

Wound dehiscence in our study was 1.90% to 00 in

open vs. LA. Biondi et al noted the wound dehiscence was 17.1% in OA and 0 in LA with significant difference.<sup>10</sup> Re-exploration is always embarrassing in both open and LA. In our study, the reoperation rate was 2.63% to 1.44% in open and laparoscopic one with a insignificant difference. Liping et al had reoperation rate in 18(2.36%) out of 763 in LA and 17 (2.11%) out of 804 in OA.<sup>11</sup>

There are benefits of diagnosis in LA as laparoscopy aids diagnosis. We have noted clear benefits in our study, as diagnostic failure was 9.8% and 2.17% in open and laparoscopic group (P=0.005). Benefits of diagnostic value in equivocal cases in women to reduce negative appendisectomies are valuable. Palesty et al noted incidental appendectomy in 20% females vs. 0% males in US study. In a study, laparoscopic exploration failed to reveal appendicitis in 7 out of 29 women (24%) as compared to man 1 in 26 (4%) with false negative appendectomy is 10%.

In our study, the hospital stay was 3.13±1.42 vs. 2.05±1.34 in open and LA. In a large meta-analysis by Liping et al hospital stay was reduced by 0.79 days in laproscopic group.<sup>11</sup> Masoomiet al noted hospital stay 4.60±3.67 and 2.62±2.40 days in open and LA in obese patients. All studies favor LA as regards to hospital stay.

Time off work in our study was 12.09±3.68 and 8.70±3.83 days in open and laparoscopic group with significant benefit to laparoscopic group. Liping et al noted 5.45 days<sup>11</sup> and Katkhouda et al 5 to 7 days less hospital stay in LA.<sup>12</sup> Biondi et al noted 16.1±3.3 in OA and 11.5±3.1 in LA.<sup>10</sup> All studies agree on significant reduced time off work in LA. Analgesia required was in 12.6% of patients in OA and 6.1% in LA in total of 260 patients studied by YuG et al.

Extraordinary popularity of laparoscopic cholecystectomy as gold standard in 95% patients, lead to thought that why LA cannot gain popularity and was limited to 58%. Some reasons are obvious that in 70% of cases, patients are non-obese, thin lean, open appendectomy is essentially a minimal invasive surgery as it is done through a small incision in right iliac fossa as compared to three ports in lower abdomen.<sup>17</sup> Second reason is that application of endoloop and ligature knots are taken as troublesome by surgeons but still many surgeons

believe that LA is an appropriate procedure. With the easy availability of use of staplers for meso appendix and base of appendix, LA will gain popularity.

Taking obese patients as separate group, LA has established its use and had many advantages. In our study, only 4(2.89%) obese in LA suffered complication as compared to 15(9.86%) obese in open group which is significant (P=0.01). The study reflects the clear benefits of laparoscopic surgery in obese and female patients and shows feasible and safe in young patients Pediatric group, children below 12, and pregnant were not part of our study. Similar has been reported in 2016 in literature concluding laparoscopic appendectomy is first choice in obese, female, elder patients; equally feasible and safe in young patient with no clear advantage over open one; reduces hospital stay and morbidity in children with no major benefit; not considered first choice in pregnant; beneficial and cost effective in complicated appendicitis provided surgeon is experienced ; not preferred in pediatrics age group where abdomen is too small for basic physical requirement of LA.

## CONCLUSION

Laparoscopic appendectomy is better choice above the age of 12 years as compared to open appendectomy, the existing gold standard, even more feasible in obese male and female patients.

### Author Contributions:

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