Research Article

A comparative study between open appendicectomy and laparoscopic appendicectomy

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Abstract

Aims and objectives of the study: To study and compare the results of Laparoscopic appendicectomy (LA) and Open appendicectomy (OA) with reference to the: Operative time, post-operative complications, post-operative pain, time taken for oral resumption, hospital stay and resume of household activities/regular work by patients. **Materials and Methods:** All clinically diagnosed cases of appendicitis in patients presenting at Kullolli Hospital, Vishram Bag, and Sangli. 50 cases each of open appendicectomy and laparoscopic appendicectomy were studied. Patients were informed about the study in all respects and a written and informed consent was obtained. **Method of collection of data:** By History, by clinical examination and by Laboratory investigations. METHOD: All the screened patients after relevant examination, laboratory tests and pre-operative fitness, were allotted in one of the two groups namely: Open appendicectomy by McBurney's grid-iron incision and Laparoscopic Appendicectomy by standard 3 ports. **Results:** The mean duration of operation (calculated from beginning of skin incision to completion of skin closure) was significantly longer in LA than in OA group (60.1min. Vs 32.6 min respectively, p<0.001). Patients in LA group had a highly significant less pain (mean pain score at 48 hrs post-operatively 4.85 Vs 6.63, p=0.001) as compared to those in OA group. The overall post-operative complication rate in OA group was 6% and in LA group was 0%. There is a significant earlier return to oral feeds after LA than after OA (25.44 hrs. vs. 30.64 hrs. p= 0.006). In the present series there is a highly significant reduction in the post-operative hospital stay in LA group as compared to OA group (3.90 days vs. 6.68 days, p=0.001). In the present series the time taken for resumption of home activities/work is significantly lesser in LA group than in OA group (9.42 days vs. 16.54 days, p=0.001). Conclusion: This study concluded that in experienced hands laparoscopic appendicectomy had a definite advantage over open appendicectomy with reference to less post-operative pain, shorter hospital stay, earlier oral feed resumption and earlier return to regular work in the former. Only operative time was longer in laparoscopic appendicectomy which can still be reduced with more case experience.

Keywords: Appendicectomy, Laparoscopic Appendicectomy, Appendix.

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INTRODUCTION

Appendicitis is one of the commonest condition with which a patient comes to a surgeon and also true is the fact that appendicectomy is amongst the first major surgery performed by a trainee in surgery. Although more than a century has elapsed since McBurney[1] first performed open appendicectomy in 1894, this procedure remains the treatment of choice for most of the surgeons. In 1983 Kurt Semm[2] performed the first laparoscopic appendicectomy. Since its initial description in 1983, laparoscopic appendicectomy has struggled to prove its superiority over open technique. This study is intended to compare the safety, efficacy and treatment benefits of laparoscopic appendicectomy versus open appendicectomy in our scenario and to compare the results of this study with those of the other few studies done in past.

AIMS AND OBJECTIVES OF THE STUDY

To study and compare the results of Laparoscopic appendicectomy and Open appendicectomy with reference to the:

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- Operative time
- Post-Operative complications
- Post-Operative pain
- Time taken for oral resumption
- Hospital stay
- Resume of household activities/regular work by patients.

MATERIALS AND METHODS

SOURCE OF DATA: All clinically diagnosed cases of Appendicitis in patients presenting at Kullolli Hospital, Vishram Bag, Sangli.

1. 50 cases each of open appendicectomy and laparoscopic appendicectomy were studied.
2. Patients were informed about the study in all respects and a written and informed consent was obtained. Period of study was from August 2008 – July 2010.
3. Follow up period was 1 week, 1 month, 2 months post-operatively as well as telephonic conversation whenever needed.

Inclusion Criteria

1. A patient who has been diagnosed as having appendicitis which may include acute or recurrent cases.
2. Patients more than 10 years of age.
3. Patients who are fit for surgery.

Exclusion Criteria

1. Patients below 10 yrs of age.
2. Patients unfit for laparoscopic surgery- example a case of General Peritonitis, severe cardio-respiratory disease, bleeding disorders.
3. Patients who have not given written consent for surgery.

Selection Method: Patients were selected on the basis of History, clinical examination and USG findings if needed. Follow up assessment was performed using clinical assessment. Proforma specially made for the study was used.

OBSERVATIONS AND RESULTS

OA denotes open appendicectomy group and LA denotes laparoscopic appendicectomy group.

Table 1: Sex Distribution

Sex	Open (%)	Lap (%)	P value
Male	23(46)	22(44)	
Female	27(54)	28(56)	0.841
Total	**50(100)**	**50(100)**	

Chi-Sq = 0.040 DF = 1, P-Value = 0.84 NOT SIGNIFICANT

Table 2: Age Distribution

Age(Years)	Open		Lap	
	No.	%	No.	%
11-20	19	38	20	40
21-30	22	44	19	38
31-40	5	10	7	14
41-50	3	6	2	4
51-60	0	0	1	2
Above 61	1	2	1	2
Mean Age	25.1	-	26.2	-
SD	10.3	-	11.9	-
SE Mean	1.5	-	1.7	-

Chi-Sq = 1.778 DF = 5 NOT SIGNIFICANT

The mean age in OA group was 25.1 yrs and in LA group was 26.2 yrs.

Table 3: Mean Weight of patients

Procedure	N	Mean(Kg)	St. Dev.	SE Mean
Open	50	47.74	9.41	1.3
Lap	50	48.50	12	1.7

TWO-SAMPLE T FOR OPEN WT. VS LAP WT, T-VALUE = -0.37 P-VALUE = 0.711 NOT SIGNIFICANT

Table No. 4: USG-Abdomen Findings

USG Diagnosis	Appendicectomy		P value
	Open(50)	Lap(50)	
Normal	28	32	
Abnormal	16	17	P= 0.145
Not done	6	1	

CHI-SQ = 3.868 DF = 2, P-VALUE = 0.145 NOT SIGNIFICANT

Table 5: Presenting Complaints of patients

Complaints	Appendicectomy	
	Open(50)	Lap(50)
Abd Pain (P)	50	50
Vomiting (V)	42	44
Fever (F)	18	3
Anorexia (A)	34	36
Other symp. (O)	9	6

CHI-SQ = 10.771 DF = 4, P-VALUE = 0.029 SIGNIFICANT

Table 6: Clinical and Laboratory parameters

	Open	Lap
Clinically Acute	20(40%)	16(32%)
Avg. TLC for Acute	9895	9936
Clinically Rest (Recurrent)	30(60%)	34(68%)
Avg. TLC Rest (Recurrent)	7890	7837

t-value = 0.29 P-Value = 0.770 NOT SIGNIFICANT, The laboratory parameters in both the OA and LA groups were comparable (p=0.770)

Table 7: HPR Results of Open and Lap Appendicectomies

Pathology	Open	Lap
Normal app.(N)	3(6%)	3(6%)
Chronically Inflamed app.(C)	22(44%)	22(44%)
Acutely Inflamed app.(A)	20(40%)	21(42%)
Gangrenous app.(G)	5(10%)	4(8%)

Chi-Sq = 0.136 DF = 3, P-Value = 0.987 NOT SIGNIFICANT, The overall negative appendicectomy rate was 6% (OA 6% and LA 6%). So there was no significant difference in the histopathological reports of cases in OA or LA group (p=0.987).

Table 8: Operative Time

Procedure	Mean(min.)	Std. Deviation
Open	32.60	4.655
Laparoscopy	60.10	7.659

Z-Test: Two Sample For Means Z = 21.69 P < 0.001 **HIGHLY SIGNIFICANT**

Table 9: Change of Plan

Need for change plan	Appendicectomy		Total	P value
	Open(50)	Lap(50)	100	
No	46(92%)	49(98%)	95(95%)	P=0.169
Yes	4(8%)	1(2%)	5(5%)	

CHI-SQ = 1.895 DF = 1, P-VALUE = 0.169 NOT SIGNIFICANT

Table 10: Post-operative Pain

Procedure	N	Average Pain Score At 48 hrs.	Std. Deviation	SE Mean
OA	50	6.63	0.68	0.09
LA	50	4.85	1.26	0.18

t-Value = 8.79 P-Value = 0.001 **HIGHLY SIGNIFICANT**

Pain score was calculated with the Numerical Rating Scale (with zero score being no pain and a score of ten being the worst pain which the patient can imagine). Patients in LA group had a highly significant less pain (mean pain score at 48 hrs post-operatively 4.85 Vs 6.63, p=0.001) as compared to those in OA group.

Table 11: Post Operative Complications

Post Operative Complication	OA	LA	
Yes	03(6%)	00(0%)	% significant
No	47(94%)	50(100%)	

The post-operative complications in both OA and LA groups were only percentage significant. There were no major or minor post-operative complications in LA group. In OA group 2 patients (4%) had prolonged ileus and so took longer time for resumption of oral fluids, one patient in OA group developed superficial skin infection at the drain site, which was managed conservatively by higher antibiotics and dressings, he had no significant morbidity. The overall post-operative complication rate in OA group was 6% and in LA group was 0%.

Table 12: Time for oral resumption

Procedure	N	Mean time for oral resumption(hrs)	Std. Deviation	SE Mean
OA	50	30.64	11.96	1.69
LA	50	25.44	4.93	0.69

t-value = 2.84 P-Value = 0.006 **SIGNIFICANT**

Table 13: Hospital stay

Procedure	N	Mean Hospital stay in days	Std. Deviation	SE Mean
OA	50	6.68	1.96	0.29
LA	50	3.9	1.02	0.14

t-value = 8.89 P-Value = 0.001 **HIGHLY SIGNIFICANT**

Table 14: Time taken for full home activity/work

Procedure	N	Mean Hospital stay in days	Std. Deviation	SE Mean
OA	50	16.54	3.42	0.48
LA	50	9.42	1.74	0.25

T-Value = 13.11 P-Value = 0.001 **HIGHLY SIGNIFICANT**

Table 15: Complaints/Complications At F/U

Complaints/Complications	OA		LA		Total %
	No.	%	No.	%	
AFTER 1 week					
Burning Micturition	4	8%	3	6%	7%
Scar-site pain	5	10%	2	4%	7%
Discharge (serous) from wound	3	6%	0	0%	3%
Discharge (pus) from wound	0	0%	0	0%	0%
AFTER 1 month					
Pain in abdomen	5	10%	4	8%	9%
Intestinal Obstruction	0	0%	0	0%	0%
AFTER 2 months					
Pain in abdomen	2	4%	0	0%	2%
Intestinal Obstruction	0	0%	0	0%	0%

Analysis of f/u at 1 week: Chi-Square Test: Chi-Sq = 4.333 DF = 2, P-Value = 0.115 NOT SIGNIFICANT

Analysis of f/u at 1 month: Chi-Square Test: Chi-Sq = 0.122 DF = 1, P-Value = 0.727 NOT SIGNIFICANT

Analysis of f/u at 2 months: Chi-Square Test: NO APPLY

DISCUSSION

Although more than 25 years have elapsed since the introduction of Laparoscopic Appendicectomy (LA), there is no consensus on its advantages and disadvantages compared to Open Appendicectomy (OA). Past and recent studies done all over the world have given varied results. In the present series there was no statistical difference in gender distribution or mean age/ age group distribution or mean weight distribution of patients in both Open Appendicectomy (OA) group and Laparoscopic Appendicectomy (LA) group. That means both study groups were comparable with respect to these parameters Kazemier *et al*[3], Kehagias I *et al*[4], Shaikh AR *et al*[5] and Wei HB *et al*[6] have shown superiority of LA over OA in various aspects. Kazmier *et al* had concluded that LA is associated with less post-operative pain and fewer wound infections. Kehagias I et had concluded that LA is associated with decreased wound infections and shorter hospital stay than OA. Shaikh AR *et al* and Wei HB *et al* had concluded that LA is associated with early return to oral feeds, shorter hospital stay and earlier return to regular activities as compared to OA. Minne L *et al*[7], Peiser JG *et al*[8], have all failed to show any benefits of LA over OA. Minne L *et al* and Peiser JG *et al* all have concluded that Laparoscopic Appendicectomy is comparable to OA with regards to post-operative

complications, hospital stay and return to activities and work. So according to these studies LA does not offer any significant benefit over OA.

USG-Abdomen findings

According to Shaikh *et al*[5] inflamed appendix on USG-Abdomen was present in 62.5% cases undergoing LA and 78.8% in cases undergoing OA. In rest of the cases USG-abdomen was done but had revealed a normal looking appendix. In present series USG-Abdomen was done in 98% cases undergoing LA and 88% cases undergoing OA. USG-Abdomen findings suggestive of appendicitis were present in 32% cases in OA and 34% cases in LA group. Also in 1 patient in LA group a 40mm clear ovarian cyst was present on the right side and another patient from the same group was diagnosed as having a 14 weeks live uterine gestation.

Presenting complaints of patients

According to Shaikh AR *et al*[5] patients were diagnosed on a clinical basis with a history of right lower quadrant pain or periumbilical pain migrating to the right lower quadrant with nausea and/or vomiting, fever of more than 38°C and/or leucocytosis above 10,000 cells per cubic mm, right lower quadrant guarding, and tenderness on physical examination. All those patients in whom a clinical diagnosis of acute appendicitis was not established or had a palpable mass in the right lower quadrant, suggesting an appendiceal abscess and those who did not give consent were excluded from the study. In the present study also, patients were diagnosed on a clinical basis with a history of right lower quadrant pain or periumbilical pain migrating to the right lower quadrant with nausea and/or vomiting, fever, right lower In the present series, there is a highly significant difference between time taken for open vs. laparoscopic appendicectomy. This means that Laparoscopic Appendicectomy took significantly longer time for completion than Open Appendicectomy (60.1 min Vs 32.6 min., $p<0.001$). The longer operative time for LA may be due to the additional steps of carbon-di-oxide insufflations, trocar entry under direct vision, diagnostic laparoscopy or frequent cleaning of lens of laparoscope.

Conversion from LA to OA

In the present series one case in LA group (i.e. 2% cases), undergoing interval appendicectomy for recurrent appendicitis was converted to OA due to peri-appendicular adhesions and difficulty in dissection. This result is in accordance with that found in Minne L *et al* and Kehagias I *et al*. Also in OA group 4 patients (8%) had to be converted to a muscle cutting incision from a muscle splitting incision because of peri-appendicular adhesions and difficult dissection around appendix and difficult position of appendix. The need for a change of plan (i.e. LA converted to OA or OA muscle splitting quadrant guarding, and tenderness on physical examination. In the present study the association of patients in both groups with respect to the presenting complaints was statistically significant.

Pre-operative Laboratory findings

In Shaikh AR *et al*[5] the average TLC in OA group was 13,800 cells/cmm and in LA was 13,500 cells/cmm. In present series there is no significant difference between average TLC in both groups. Thus average TLC in both OA and LA groups are comparable.

Final Histopathological Reports

According to Chariati A *et al*[9], the suspected appendicitis were confirmed by histological examination and had revealed 1% normal appendix, 8.1% chronic appendicitis, 78% acute appendicitis and 12.9% gangrenous or perforated appendicitis. According to Cothren CC *et al*[10], the final HPR in OA group showed 1.3% normal appendix, 74.3% inflamed appendicitis and 24.3% perforated appendicitis. The LA group showed 7.9% normal appendix, 78.4% inflamed appendicitis and 13.7% perforated appendicitis. In the present series in OA group 6% showed normal appendix, 44% chronic appendicitis, 40% acute appendicitis and 10% gangrenous/perforated appendicitis. In LA group 6% showed normal appendix, 44% chronic appendicitis, 42% acute appendicitis and 8% gangrenous/perforated appendicitis. The final histopathology report was not significantly different in the 2 groups. According to Tarnoff *et al*[11] the overall negative appendicectomy rate was 14%. The overall negative appendicectomy rate was 6% in the present study.

Operative time

converted to OA muscle cutting) was not significantly different in the OA and LA group.

Post-operative pain

Minne L *et al* 1997[7] has reported no statistical difference in pain in both LA and OA group (4 vs. 3.7 LA and OA respectively [0 indicates least pain; 10, most pain]).In series by Kazemier G *et al* 1998[3] there was less use of analgesic on the first 2 postoperative days and it was statistically significant ($p<0.001$). In the present series there is a highly significant difference between post-operative pain score (Numerical Rating Scale of 4.85 Vs 6.63, $p=0.001$) between both LA Vs OA groups. Thus LA is associated with significantly less post-operative pain than OA. The less pain after LA as compared to OA was because in LA we are taking 3 small incisions (1 for umbilical 10mm trocar and 2 for supra-pubic and right iliac fossa 5 mm trocars) as compared to a single large incision (about 3-4 cm) in OA. Because of this large incision in OA there is more tissue cutting and destruction leading to more pain than in LA.

Post Operative Complications: In the present study development of post-operative complications in the form of prolonged paralytic ileus, intra-abdominal abscess, wound infections and respiratory infections were studied in both the groups.

Prolonged paralytic ileus: In present series 2 cases (4%) cases developed prolonged paralytic ileus after OA and none after LA. These cases were treated conservatively with Intra-venous fluids and keeping nil by mouth, till the return of peristaltic activity.

Wound infections: There are comparatively more wound infections after OA than after LA. This was confirmed by Pokala N *et al*[12](8.2% vs. 2.3% after OA and LA respectively), Kehagias I *et al*[4] (12.8% vs. 5.3% after OA and LA respectively) and Wei HB *et al*[6](13% vs. 0% after OA and LA respectively). In the present study also 1 (2%) patient developed wound infection after OA and none after LA.

Intra-abdominal Abscess

In the present series neither OA nor the LA group had any incidences of postoperative intra-abdominal abscess formation.

Respiratory complications

In Pokala N *et al*[12] 4.9% cases had developed respiratory complications from OA and none from LA group. In the present series there were no cases with respiratory complications from either group. Thus in the present series post-operative complications were seen in 6% patients in OA group and 0% in LA group. In the present series as the total number of patients studied in each OA and LA groups were less, post-operative complications in both groups were only percentage significant. Only if more number of patients would have been studied, then may be a proper comment about post-operative complications would have been possible.

Time for oral resumption

Previously Kazemier *et al* 1997[3] found no significant difference between time to oral resumption in either OA or LA groups. According to Shaikh AR *et al* 2009[5] less time was needed to return to a regular diet (20.1 +/- 2.9 in LA vs. 22.0 +/- 4.7 days hrs. in OA) after LA than after OA. According to Wei HB *et al* 2010[6] LA was associated with a shorter time until return to a general diet (20.2 +/- 12.4 hrs in LA vs. 36.5 +/- 10 hrs in OA). In present series also, there is a significant earlier return to oral feeds after LA than after OA (25.44 hrs. vs. 30.64 hrs. p= 0.006). In OA as compared to LA there is more handling of intestines, also in OA the intestines are exposed to outer environment for longer time, so there is a relatively longer period of paralytic ileus after OA than after LA. So in LA group as there is earlier return of peristaltic activity of intestines, there is early resumption of oral feeds.

Hospital stay

In the present series there is a highly significant reduction in the post-operative hospital stay in LA group as compared to OA group (3.90 days vs. 6.68 days, p=0.001). Patients in LA group had smaller incisions, less post-operative pain, earlier resumption of oral feeds and so were more comfortable in post-operative period than those in OA group. So they returned home earlier than those in OA group. So, LA gives a benefit of lesser hospital stay as compared to OA.

Time taken for full home activity/work

In the present series the time taken for resumption of home activities/work is significantly lesser in LA group than in OA group (9.42 days vs. 16.54 days, p=0.001). As there is earlier return to home after LA than after OA, the patients are more comfortable in homely environment and so there is earlier return to full home activity/work.

Diagnostic Laparoscopy during LA

In present study we had a patient with simple ovarian cyst which was tackled laparoscopically by Laparoscopic Ovarian cystectomy, with no additional incision, which would not have been possible with OA. Also in another patient undergoing LA and willing for Tubal ligation, a laparoscopic tubal ligation was carried out with the same trocar placement (except that a 7 mm trocar was used) at the same sitting, which would not have been possible in OA. In one patient, acute appendicitis was diagnosed with 14 weeks of live gestation, we had performed LA with no added complication and the patient was discharged from hospital on the 2nd post-operative day.

Complaints/ complications at F/U

In the present series 100% follow-up was done in both groups either by follow up of patients at the hospital or by telephonic conversation whenever needed. In the present study in OA group 8%, 10% and 6% patients presented with burning micturition, scar-site pain and serous wound discharge at 1 week respectively. In LA group 6% and 4% presented with burning micturition and scar-site pain respectively and none with discharge from wound at 1 week [P-value was 0.115 (Not-significant)].During the follow-up at 1 week, 1 month and 2 months, there was no significant difference in complaints or complications between the two groups i.e. OA or LA.

CONCLUSIONS

The following conclusions are made from the present study: A total of 100 cases were studied, 50 cases each of Open Appendicectomy (OA) and Laparoscopic Appendicectomy (LA). In the present series there was no statistical difference in gender distribution or mean age/ age group distribution or mean weight distribution of patients in both Open Appendicectomy (OA) group and Laparoscopic Appendicectomy (LA) group. The

Laparoscopic Appendicectomy takes a significantly longer time for completion than Open Appendicectomy but Laparoscopic Appendicectomy is associated with significantly less post-operative pain and significantly less hospital stay than Open Appendicectomy. The post-operative complications in both LA and OA groups are only percentage significant. Change of plan in OA from muscle splitting to muscle cutting was necessary in 8% of cases and conversion from LA to OA was necessary in 2% of cases. Overall negative appendicectomy rate was 6%. Time taken for oral resumption after Laparoscopic Appendicectomy is significantly less than that in Open Appendicectomy group. The return to full home activity/work is significantly earlier after Laparoscopic Appendicectomy than Open Appendicectomy (9.42 days vs. 16.54 days, p=0.001).Laparoscopic approach for appendicectomy has a useful diagnostic value in detecting any other associated intra-abdominal pathology which may not be possible with Open approach. Also simple therapeutic procedures like ovarian cystectomy, laparoscopic tubal ligation can be done at the same setting. The difference between complications at follow-up in both the groups is not statistically significant. Thus, in experienced hands Laparoscopic Appendicectomy is a safe and feasible approach for Appendicectomy without any added complications and an advantage of doing a diagnostic laparoscopy.

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