Incidence of Intra-abdominal Collection in Open vs. Laparoscopic Appendectomy

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Abstract: Aim: The value of laparoscopy in appendicitis is not established. Studies suffer from multiple limitations. Our aim is to compare the safety and benefits of laparoscopic versus open appendectomy in term of incidence of intra-abdominal collection postoperatively.

Methods: A total of 2594 patients diagnosed with appendicitis were analyzed and studied in a retrospective manner. Patient's records were gathered from 2002 till 2011 and underwent open or laparoscopic appendectomy. Intra-abdominal collection was compared in both surgery types. Both groups were same with respect to age and gender.

Results: Data of 2594 patients were reviewed through clinical charts. We excluded 962 patients found to be either older than 60 or less than 12 year old, on steroid or having diabetes mellitus. A total of 1632 patients included in the study. Of these, 458(28.1%) underwent laparoscopic appendectomy and 1174(71.9%) were operated by open technique. Acute appendicitis diagnosed in 82.9%, however complicated appendicitis found in 17.1%, p<0.001. There were 14(0.9%) patients found to have intra-abdominal collection, 6 (1.3%) patients operated by laparoscopic surgery and 8 (0.7%) patients operated by open technique. Wound infection developed in 7(0.6%) vs. 1(0.2%), p<0.001 in open and laparoscopic group respectively. There was no mortality case documented.

Conclusions: Laparoscopic appendectomy is safe and feasible with equivalent risk of intra-abdominal collection to open surgery. Wound infection,however, has shown significant reduction rate in laparoscopy compared to open appendectomy. In addition, laparoscopy surgery has shown shorter hospital stay than open surgery.

Keyword: Intra-abdominal collection; Open; Laparoscopic; Appendectomy

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* In this study we are investigating on going debates about the true advantage of laparoscopic appendectomy in comparison to open surgery. Appendicitis is a common presentation in emergency room thus we need to master surgical approach and to mitigate patient progress Particularly, to watch post operative complication. Here we approved that laparoscopic surgery added further advantages over open surgery in term abdominal collection, less rate of wound infection and shorter hospital stay.

Introduction

Open appendectomy through McBurney point is the procedure of choice for the management of acute appendicitis[1]. With advert of laparoscopy in the field of surgery, practice of surgery has completely changed. It is now possible to perform almost any

kind of procedure by high sophisticated technique of laparoscopy. In 1983, Semm[2] performed the first laparoscopic appendectomy which was in his favor. However, limited resources and ongoing debates in the field of laparoscopic appendectomy has contributed in the shortage of beneficial utility of laparoscopic surgery. Ever since then, the efficiency and superiority of laparoscopic approach compared to open technique has been the area of controversy.

Laparoscopic surgery is resulting in significantly shorter hospital stay, less postoperative pain, faster return to daily activities, and better cosmetic outcome has made laparoscopic surgery very attractive[3-5]. Several randomized trials and meta-analyses comparing laparoscopic with open appendectomy end with conflicting results[6]. Some of these studies demonstrated better clinical outcomes with the laparoscopic approach, while others showed marginal or no clinical benefit. At present, there is trend towards greater utilization of laparoscopic appendectomy.

In the current study, we aimed to study the safety and feasibility of laparoscopic versus open appendectomy in term of incidence of intra-abdominal collection postoperatively. using retrospective trial between 2002 and October 2011, which was done at security forces Hospital, Saudi Arabia.

Methods and Materials

Patients:

Data was collected retrospectively through clinical charts from general surgery department, Security Forces Hospital at Riyadh, Saudi Arabia.

A total of 2594 patients diagnosed with acute appendicitis have been studied and reviewed. All of these patients underwent appendectomy in either open or laparoscopic surgery from 2002 to October 2011. Exclusion criteria were homodynamic instability, chronic medical or psychiatric illness, cirrhosis, older age, pediatric age group and on immunosuppressant medications like steroid. The parameters examined in this study including Patient's characteristics (age, sex), intra-operative findings (acute, gangrenous or perforated appendix), the length of hospital stay, and incidence of post operative intra-abdominal collections. We aimed to compare the incidence of intra-abdominal collection in open vs. laparoscopic appendectomy as a primary end point as well as safety and feasibility of laparoscopic surgery.

Diagnosis and Operation

The diagnosis of appendicitis was made in the emergency department, by bedside clinical examination and radiological images if required or suspected. The decision about the type of surgery was made based on surgeon preference and availability of laparoscopic set however laparoscopic appendectomy has started bit at around 2007 thus open appendectomy was only procedure offered before that time. Open appendectomy was typically performed through McBurney point and inflamed appendix excised in a usual manner. On the other hand, in laparoscopic group, surgery performed by senior registrar

and senior resident. Three trucars inserted into abdominal cavity, base of the appendix ligated using endo-loop. Specimens were retrieved in endo-bag through supra-pubic wound. All patients received prophylaxis antibiotics, 30 minutes before induction of aneasthesia and up to three doses postoperatively unless if they presented with signs of sepsis then therapeutic dose of antibiotics were always considered for both anaerobic and aerobic coverage.

Statistical analysis:

Data analyzed was performed using SPSS statistical software; version 17.0, A P value of less than 0.05 was considered statistically significant.Intra-abdominal collection defined if patient presented either in early or late pelvic collection diagnosed clinicallyand with radiological images. Acute appendicitis defined if patient presented with classical appendicitis presentation without signs of sepsis or appendix perforation. However complicated appendicitis defined if perforation, gangrenous and mass forming appendicitis were presented.

Results:

Patient's Characteristics:

A total of 2594 patients with acute appendicitis were collected during our study period. We excluded 962 patients, as they have not met our criteria. Total of 1641 patients were included in the study and analyzed individually in details.1160 patients were subjected to open appendectomy, 459 patients to laparoscopic appendectomy and 22 patients converted from laparoscopy to open appendectomy. There were no significant differences in both age and gender in both types of surgery.

Out of the total 1160, open procedures, 977 (84.2%) were diagnosed with acute appendicitis and 183 (15.8%) were diagnosed to have complicated appendicitis including perforation, gangrenous and mass forming appendicitis.In the laparoscopic group, out of 459 patients, 373 (81.3%) were operated and found to have acute appendicitis, and 86 (18.7%) diagnosed with complicated appendicitis. Shortly we could say; majority of our patients presented with acute appendicitis in both type of surgery, as it shown in table 1.

Post-operative Complication:

Intra-abdominal Collection

Vast majority of our procedures were performed safely with uneventful post-operative course, accounted for 1618 patients (98.6%). Nevertheless, 14 patients (0.9%) found to have postoperative intra-abdominal collection. Out of these patients, 5 patients (0.4%) operated by open surgery, (4 patients presented in acute condition and 1 as complicated appendicitis) while 6 patients (1.3%) operated by laparoscopic surgery (4 patients were in

acute and two complicated appendicitis). In converted cases, however, three patients were reported with intra-abdominal collection (1 found in acute and 2 in chronic presentation).

Incidence of intra-abdominal collection seems higher in laparoscopic group (1.3%) vs. (0.4%), with respect to the diagnosis title either acute or complicated appendicitis, however it has no reach statistical difference, (p=0.236), as it shown in table 2&3.
All patients who developed intra-abdominal collection were treated successfully with antibiotics and radiological-guidance drainage of the collection.

Wound Infection

In our data analysis, we revealed 9 patients with postoperative wound infection. Greater incidence of wound infection noticed in those underwent open surgery compared to laparoscopy and converted groups with statistical significant different evident, reported at 7 (0.6%) vs. 1(0.2%) & 1(4.5%), p <0.001), respectively. In open group, Out of 7 patients with wound infection, 2 of them were diagnosed with acute appendicitis and 4 in chronic condition. Whereas in laparoscopic and converted group, wound infection was seen only in one patient in each in acute setting, as summarized and illustrated in table 2&3.

Hospital Stay

Hospital stay has reached the highest duration in converted patients from laparoscopy to open surgery, to reach an average of (3.81 ± 2.17 days, p=0.02) with significant different reported in comparison to open and laparoscopic group. In addition,hospital stay was registered longer in open surgery compared to laparoscopic surgery, rated at (2.98 ± 1.67 vs. 2.75 ± 1.82, p=0.048), respectively. Hospital stay is summarized in table 4.

DISCUSSION

Long time has elapsed since acute appendicitis is the most common intra-abdominal disease requiring emergency surgery[7]. Current concern is in how to utilize higher technology system to perform such a common illness inemergency setting. In order to support the era of laparoscopic surgery, proof of its advantages in term of post-operative complication should be discussed and analyzed. On top of this, laparoscopic surgery has advert with lots of advantages to pleased post operative course in term of early recover, fast bowel function, less pain and lesser rate of wound infection [8-10]. Postoperative complication, however, have shown era of discussion and controversy regards incidence of intra-abdominal collection in different type of surgical approach, either laparoscopic or traditional open appendectomy. Numerous prospective randomized studies, meta-analyses, and systematic critical review have proposed the topic of laparoscopic technique, however a general consensus of heterogeneity of the variables and defects in the methodology have attributed in difficulty to determine a conclusions[6]. However, Wei et al [10] conducted randomized prospective study in 220 patients diagnosed with acute appendicitis; 108 underwent open and 112 underwent laparoscopic appendectomy,

concluded in favor of laparoscopic appendectomy with better cosmoses and lesser complications. With this in mind, we have designed our study to touch conclusions in our institute. We noticed rate of intra-abdominal collection was slightly higher in laparoscopic group, did not reach statistical significant though. However, wound infection was extremely higher in open surgery at, 7(0.6%) vs. 1(0.2%), p<0.001, greater wound infection reported in complicated appendicitis performed by open surgery at 5(2.7%) vs. 0(0%), p<0.001).

Our results were deviated from the study conducted in Japan at 2008, Data was collected prospectively on 293 patients with acute appendicitis, who underwent open or laparoscopic appendectomy from January 2006 to 2008,They concluded incidence of intra-abdominal collection was higher at laparoscopic appendectomy in complicated appendicitis (5.3% vs. 2.1%), P = 0.002, while similar to open approach in uncomplicated appendicitis. Nevertheless, we reported no significant different in the incidence of intra-abdominal collections between two groups. In addition, same study group noticed lower incidence of wound infection in laparoscopic group (5.3% vs.12.8%, p= 0.002) comparing to open surgery [11], which has revealed true in our study group as well.

Namir et al[12]. A prospective randomized double-blindedstudy investigated 247 patients with acute appendicitis and compared laparoscopic vs. open appendectomy. They found the overall complication rate was similar in both groups (18.5% versus 17% in the laparoscopic and open groups respectively), which was equivalent to our results, but some early complications in the laparoscopic group required a reoperation.Another review in 2008 Cochrane Review[13], Tripler Army Medical Center, U.S.A, a retrospective chart review of all appendicitis patients 18 years and older undergoing appendectomy from 1996 to 2007 at one military treatment facility and one civilian hospital in Hawaii, a total of 2,464 patients with appendicitis. 1,924 laparoscopic (78%) and 540 open (22%) were performed. Concluded by no significant differences in the number of postoperative abscesses after laparoscopic vs. open appendectomy (2.2% vs. 1.9%; p = 0.74).

Moreover, Complicated appendicitis in this study significantly associated with a higher incidence of postoperative abscess formation (67% vs. 25%; p < 0.01) with the respect of the way had been operated. When it comes to hospital stay, we reported longer overall stay in open than laparoscopic surgery, however it showed significant longer stay in converted cases to open surgery (3.81 ± 2.17 days, p=0.02). Recently, a meta-analysis[5] stated only 0.6 day shorter in laparoscopic group compared to open surgery, which was not significant. However with increased experience, shorter hospital stay is anticipated in laparoscopic arm shortly in the future [14]. Therefore, we concluded from our results that surgeon experience is an important parameter to influence patient fast recovery as we reported faster recovery in patients whom operated laparoscopically.

In term of wound infection, significant advantage of laparoscopic surgery contributed in reduction of wound infection. We found greater incidence of wound infection reported in open surgery, particularly in complicated appendicitis 5 (2.7%) vs. 2(0.2%), p<0.001). This finding in open surgery could be explained by several reasons; close contact of

severely inflamed appendicitis to skin during removal which is not the case in laparoscopic surgery. In laparoscopy, appendicitis extracted byendo-bag with complete contact isolation from the skin that contribute in lesser incidence of wound infection as this regards reported in numerous studies before [11, 12, 15]. Secondly, in open surgery, in cases of perforated appendicitis, abscess would be drained out through the wound, which estimated to be the direct reason in higher incidence of wound infection in complicated appendicitis. However in laparoscopy, abscess drained by suction tip followed by vigorous irrigation that help to reduce the rate of wound infection even in converted cases.

In our technique, high quality surgeon with high experiences in laparoscopic surgery had been participated in our data, therein, we reported 22(1.3%) incidence of laparoscopic conversion to open surgery due to appendiceal mass presentation and shortage of operative time. A high conversion rate correlates withless surgeon experience [16]. Operative time seems to be longer in laparoscopic group which has evident in wei et al study (30 ± 15.2 min vs.28.7 ± 16.3 min, p=0.05) in laparoscopic and open surgery respectively [10].

Finally, from our point of interest, numerous studies showed diversity results in the incidence of intra-abdominal collection, in our study showed clinically an increase in the rate of postoperative intra-abdominal collection following laparoscopic appendectomy, but statistically not significant. Therefore we assumed several theories for the possible increased of postoperative intra-abdominal abscess incidence in laparoscopic appendectomy. Inflammatory mediators may travel throughout the abdominal cavity particularly duringhigh pneumoperitoneum pressure. Furthermore, in open appendectomy, the appendix base is usually managed outside the abdominal cavity (division and stump inversion), contributed in decrease the incidence of intra-abdominal collection, however higher rate of wound infection could be anticipated due to wound contact. In the counterpart, in the laparoscopic appendectomy, appendix stump managed intra-peritoneal, which may declare a suggested cause for higher incidence of intra-abdominal collection. Interestingly, in a prospective randomized study[10], they enrolled 220 patients in their study groups reported significant difference in the incidence of intra-abdominal collection in favor of laparoscopic group (1.8% vs. 8.3%) and they suggested the reason to reduce postoperative abscess formation is by a meticulous irrigation of the peritoneal cavity with changing patient position in order to drain out all contaminated fluid in the abdominal cavity.

Our study has some limitations; this study carried out in retrospective fashion, however large volume data was collected and facilitated by electronic base computer system that minimizes mistyping or data loss. Moreover, we didn't include all aspect of differences between both types of surgery. We concerned about intra-abdominal collection as a primary outcome although it may strengthencertain point in the study interest.
In addition, these data were collected from highly standard single institute center, operated and observed by highly ranked stuffs, which contributed in reduction of complication rate as overall.

Conclusion

At the end laparoscopic surgery is safe procedure and promising approach that can be practiced safely with precaution. Laparoscopic surgery has declared equivalent incident of intra-abdominal collection to open surgery. In addition, significant advantage of laparascopic surgery has clearly evident in shorter hospital stay and less wound infection. A well-designed randomized clinical trial is required to address this regards and to establish different arms of comparisons between open and laparoscopic appendectomies in the future.

Knowledge

This study was based entirely on the Authors' work, with no involvement of any third party in data analysis or writing the article

Conflict of Interest Statement

The Authors do not have any potential or actual personal, political, or financial interest in the material, information, or techniques described in the paper.

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Table 1: Patient's Characteristics.

Variables			Surgery Type			Total
			Open Appendectomy	Laparoscopic Appendectomy	Lap Converted to Open Appendectomy	
Age	12 - 30 Years	Count	946	361	18	1325
		%	81.50%	78.60%	81.80%	80.70%
	31 - 40 Years	Count	154	67	2	223
		%	13.30%	14.60%	9.10%	13.60%
	41 - 60 Years	Count	60	31	2	93
		%	5.20%	6.80%	9.10%	5.70%
Gender	Male	Count	735	268	15	1018
		%	63.40%	58.40%	68.20%	62.00%
	Female	Count	425	191	7	623
		%	36.60%	41.60%	31.80%	38.00%
Diagnosis	Acute Appendicitis	Count	977	373	10	1360
		%	84.20%	81.30%	45.50%	82.90%
	Complicated Appendicitis	Count	183	86	12	281
		%	15.80%	18.70%	54.50%	17.10%
Total		Count	1160	459	22	1641

Table 2: Incidence of Post- operative Complication in Open vs. Laparoscopic Appendectomy.

Complications		Surgery Type			Total	P value
		Open Appendectomy	Laparoscopic Appendectomy	Lap Converted to Open Appendectomy		
Intraabdominal Collection	Count	5	6	3	14	0.236
	%	0.40%	1.30%	13.60%	0.9%	
Wound Infection	Count	7	1	1	9	**<0.001**
	%	0.60%	0.20%	4.50%	0.50%	
NO Complications	Count	1148	452	18	1618	
	%	99.00%	98.50%	81.80%	98.60%	
Total		1160	459	22	1641	

Table 3: Post-operative Complication in Accordant to Diagnosis.

Diagnosis			Surgery Type			Total	P-value
			OA	LA	Conversion		
AA	Complication	Intra-abdominal Collection	4 0.40%	4 1.10%	1 10.00%	9 0.70%	< 0.001
		Wound Infection	2 0.20%	1 0.30%	1 10.00%	4 0.30%	
		NO Complications	971 99.40 %	368 98.70 %	8 80.00%	1347 99.00 %	
	Total		977	373	10	1360	
CA	Complication *	Intra-abdominal Collection	1 0.50%	2 2.30%	2 16.70%	5 1.80%	0.001
		Wound Infection	5 2.70%	0 0.00%	0 0.00%	5 1.80%	
		NO Complications	177 96.70 %	84 97.70 %	10 83.30%	271 96.40 %	
	Total		183	86	12	281	

AA: Acute appendicitis, CA: Chronic appendicitis, Conversion: Laparoscopic converted to open surgery, OA: open appendectomy, LA: laparoscopic appendectomy,

Table 4: Hospital Stay in Both Surgical Techniques.

Surgery Type	Hospital Length of Stay (Mean ± SD)	P-value
Open Appendectomy	2.98 ± 1.67	
Laparoscopic Appendectomy	2.75 ± 1.82	**0.048**
Lap Converted to Open Appendectomy	3.81 ± 2.17	**0.02**