A Comparative clinical Study on Open Appendicectomy & Laparoscopic Appendicectomy

Shree Rajkumar Saha

Abstract-Appendicectomy is one of the most commonly performed surgeries worldwide. As it was commonly done by conventional open method but with the gradual advancement of more and more laparoscopic surgical procedures laparoscopic appendectomy is also practiced now a day.
Methods: Total of 86 patients were selected initially for the study and 6 patients were excluded. Out of 80 patients 40 were in the open group and 40 were in the laparoscopy group.

Index term--Abscess, After8, After16, After24, After 48, Collection, Collection Problem, Ceal.Leak, Cosmesis Scar, Delay Healing, Disruption, DtOTTime, Gamma distribution, , G.I.Obstruction, IleusPost, Indoor Work, Likelihood, Lognormal distribution, LNGD, Or, Outdoor Work, , Retention, Stay Days, Surgery, , Transition Matrix. UTI, Vomating, Weibull distribution, WoundAbcess.

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1 Introduction

Appendicectomy is one of the most commonly performed surgeries worldwide. It is commonly done by conventional open method but with the gradual advancement of more and more laparoscopic surgical procedures laparoscopic appendectomy is also practiced nowadays. However, it has not yet been established which procedure is the gold standard.

The aim of this study is to compare the outcomes of these two surgical procedures on different aspects and to find out any significant statistical difference between them. Age and sex factors were kept almost identical. Comparison was done on the basis of –operative time, post op. pain control, postoperative complications(wound, infective, urinary, pulmonary, g.i.t),post op. stay in the hospital, cost of surgery, time to return to indoor and outdoor activity, satisfaction with cosmesis and other complications if any.

2 Materials and Method

2.1 Data collection strategy.

This Prospective observational study was performed in the Department Of General Surgery of Advanced Medicare and Research Institute (AMRI Hospitals), P-4and5, C. I.T. **Scheme-** LXXII, Block – A, Gariahat Road (Beside Dhakuria Bridge), Kolkata – 700 029, West Bengal between 1/2/2007 to 31/1/2010.

Inclusion criteria – All Consecutive Patients admitted in **the hospital between Feb. 2007 to August 2009,in the age group of 10-80 yrs**, irrespective of male or female sex, with features of acute appendicitis, who underwent appendicectomy (Either open or Lap)

Exclusion criteria – following group of patients were excluded out of study –

a) Children below 10 yrs of age

b) Suspicion of peritonitis of reasons other than appendicitis.

c) Diseases of appendix other than appendicitis.

d) All types of incidental appendicectomy.

e) Previous pelvic surgery.

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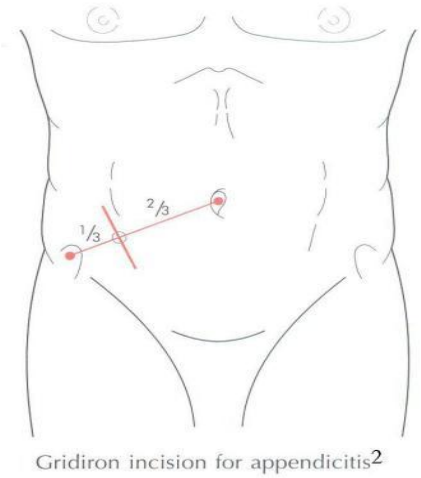
2.1.1Pt's were assessed as per ALVARADO SCORE system.(Measure of acute appendicitis.)

Symptoms		Score
	Migration of pain to RIF	1
	Anorexia	1
	Nausea, vomiting	1
Signs		
	Tenderness (RIF)	2
	Rebound tenderness	1
	Elevated temperature	1
Lab		
	Leucocytosis.	2
	Shift to left	1
Total		10

A score of 7 is strongly predictive of acute appendicitis.

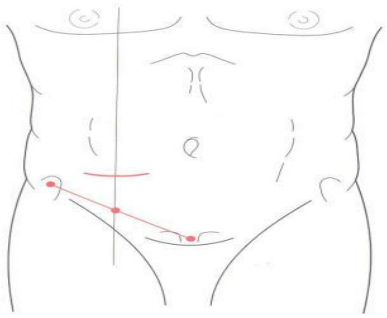
Those patients with equivocal score (5-6) ,special investigations – abdominal USG/CECT is done to avoid negative appendicectomy.

2.2 Open Appendicectomy



Gridiron incision for appendicitis[2]

Fig. 1.1 Gridiron incision: (Gridiron: a frame of cross beams to support a ship during repairs. The incision is made at M.B point at right angles to a line joining the Rt. Anterior superior iliac spine to the umbilicus[2]



Transverse or skin crease (Lanz) incision[2]

Fig.1.2 LANZ incision – transverse skin crease incision, appropriate to the size and obesity of the patient is made approximately 2 cm below the umbilicus centered on mid cliavicular midninguinal line. In this incision exposure is better and if necessary may be extended medially by retraction or division of the rectus abdominals muscles.[2]

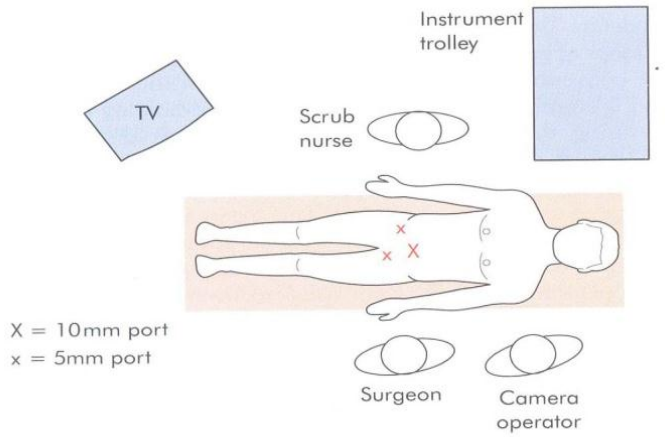
2.3 Laparoscopic appendicectomy

Patients asked to evacuate the bladder just before entering into operation theatre.

Position of Patient–Supine.

I.V.drip on Rt .Hand and extension used for i.v access by anesthetist at the time of surgery.

Left arm – by the side of the patient and kept in position with the help of a folded drape surrounding it and the ends placed under the chest.



Position of surgeon, assistants and equipment for laparoscopic appendicectomy.[2]

Figure 2

2.4 Observed factors

During this study period both group of patients (open and laparoscopic appendicectomy) were observed for the following items for comparative study and analysis at the end of the study:

2.4.1 Duration of surgical procedure:

Time taken from starting of skin incision to the final closure of the skin wound.

2.4.2 Cost of surgical procedure

Here only operation theatre cost was considered which included anesthetic drugs, iv fluids, antibiotics, gas used for Laparoscopy, instruments and other consumable charges**.**

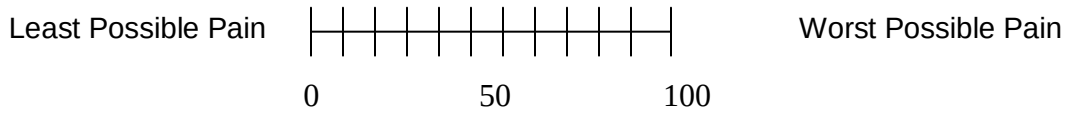
2.4.3 Post operative pain control

International Association for the study of Pain has described pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.[41]So pain is a subjective complaint and there is no definitive marker to measure the intensity of pain by patients. So, different methods for pain assessment e.g., McGill Pain Questionnaire, Memorial Pain Assessment Card (MPA) etc. are in use world wide. Among these MPAC consists of three 100 mm visual analogue scales -pain scale, Relief scale, Mood scale and one with diff. adjectives of pain (e.g. Mild, moderate, severe etc.)

Of these 4, one -Pain scale was used in our study for the assessment of severity of pain.

In Pain V.A. scale – a 100 mm long line marked with least possible pain to the left end and worst possible pain marked at the right end was produced to the patient and asked them to mark of his/her own on the unscratched scale as per his/her own feeling of pain intensity at that moment and the score measured in millimeter from the left end of the line up to the mark given by the patient. and this scale was used for assessment of pain at 8hr interval in First 24 hrs and then at the end of 48 hrs. Analgesics were used as per necessity of the situation. This assessment of pain intensity was done routinely at the ward once patients were fully awake, the effect of anesthetic agents was over and patients could tell about their pain experience

PAIN VISUAL ANALOGUE SCALE



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2.5 POST OPERATIVE COMPLICATIONS

Here post operative complications were assessed as –

2.5.1 Wound complications

(i) Wound hematoma, seroma or persistent discharge.

(ii) Delayed wound healing

(iii) Wound disruption

2.5.2 Infections–

(i)Postoperative intraperitoneal abscess/subdiphragmatic abscess or collection

(ii) Post operative septic wound complication

2.5.3 Urinary Complications

(i) Urinary retention.

(ii) Urinary tract infection.

2.5.4 G. I. Complications

(i) Post operative ileus.

ii) Post operative Small gut obstruction.

iii) Nausea, vomiting

(iv Cecal / stump leakage.

2.5.5 Pulmonary complications- e.g. Chest infection, cough etc.

2.6 Post operative stay in the hospital

It has been calculated from the date of surgery to the date of discharge.

2.7 Return to normal indoor activity

it is defined as return to usual work of domestic and social life at the discretion of the patient. It was assessed as follows:

a. When patients are fully mobilized.
b. Able to perform their daily house hold activities e.g. Maintenance of personal hygiene, self dress up without assistance and able to go to toilet without help and can take food normally.
c. Good condition of operation wound
d. No fever.
e. Pain sensation is minimal.

2.8 Follow up and patient's satisfaction

Patients were followed up at OPD after 1st and 2nd week and were assessed as below:

a) Cosmesis of wound scar
b) Return to both house hold work and outdoor / office work.
c) Further complications if any.

3 Modeling, methodology and analysis of data:

3.1 Age and Sex

In the open appendectomy group out of 40 patients, 25 were female and 15 were male. In the Laparoscopic appendectomy group also there were 25 female and 15 male patients. Applying Chi-square test, p-value = 1.00. Thus sex ratios of the two groups do not differ significantly.

Regarding age distribution of the patients in both the study groups, applying Mood Median Test the age distributions were found to be significantly similar at 1% level of significance. Graphically we can also see it as follows:

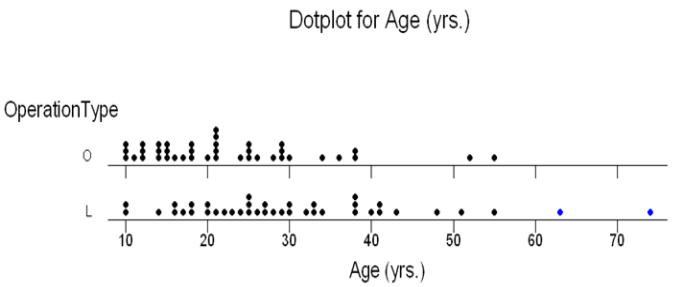


Fig 3.

Thus keeping the age and sex factors similar we studied and compared our observations in both the groups on the following criteria.

4 Total Operating time:

The following figures show the operation times of the patients:

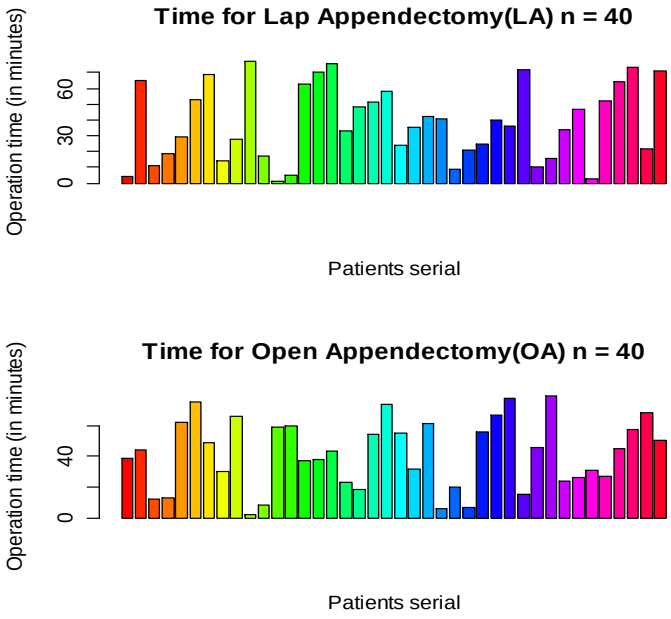


Fig 4. The median value for operating time in open group was 35 mins. (range 15-60 minutes) and for Laparoscopic group it was 42.5 mins (range 20-120) with a p-value = 0.004. and thus operating time in LA group was significantly higher than that in OA group.

5 Post Operative Pain Control

5.1 Graphical analysis:

The following are the box-plots and line diagrams of assed pains after 8, 16, 24 and 48 hours corresponding to the two operation methods.

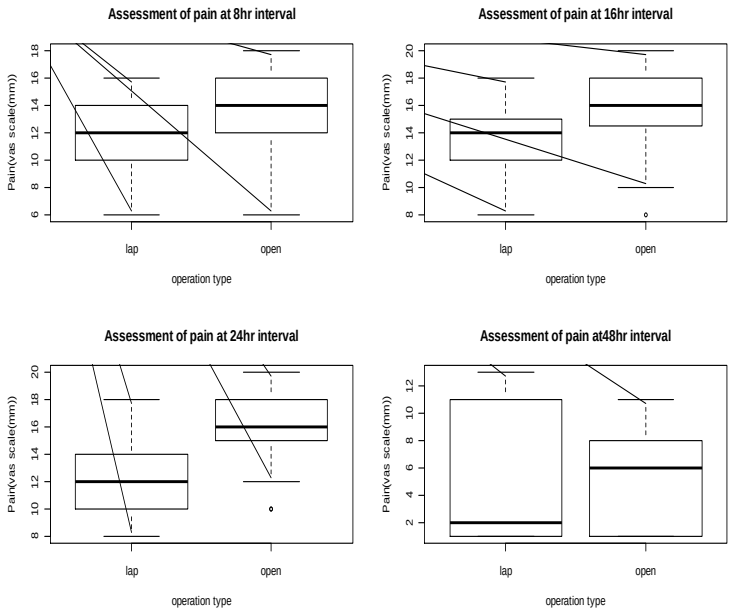


Figure 5. *We observe mean and quartile pain in 8hrs,16h,24h to be less in case of LAP surgery, but in 48h mean pain is less and 3rd quartile pain is lower in case of OPEN surgery.*

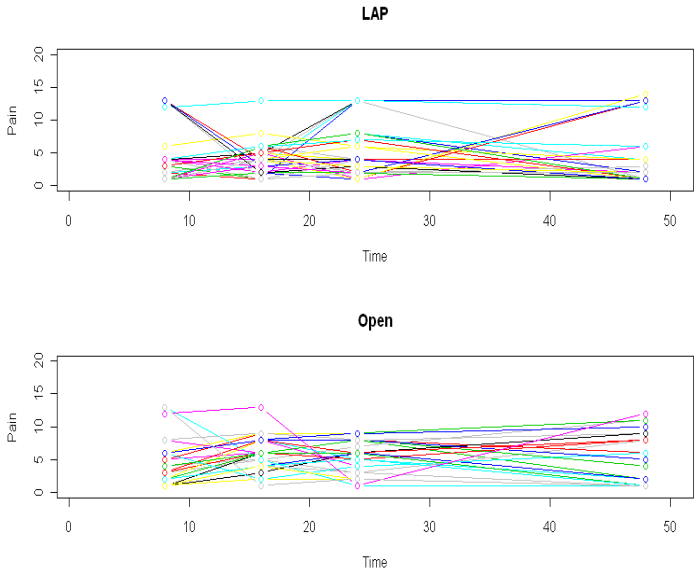


Fig 6.: It is not clear whether there is the significant change of pain with respect to time.

5.2 Longitudinal analysis of pain : Parametric model

we may consider the Longitudinal(LNGD) study for different timepoints of pain for the both groups of patients. So here we assume three LNGD model:

1.$Pain_{ij}=a+a_i+b(j)+q(surgery=open)+e_{ij}$
where, $a_i:N(0,s_a^2)$,$e_{ij}:N(0,s_e^2)$; , i=person in the treatment
b=time coefficient(parameter); j=8,16,24,48;

2. $Pain_{ij}=a+a_i+g_j+q(surgery=open)+e_{ij}$
where, $a_i:N(0,s_a^2)$,$e_{ij}:N(0,s_e^2)$; , i=person in the treatment
g_j=jth time factor ; j=8,16,24,48;

3.$Pain_{ij}=a+a_i+q(surgery=open)+e_{ij}$
where, $a_i:N(0,\sigma_a^2)$,$e_{ij}:N(0,\sigma_e^2)$; , i=person in the treatment
j=8,16,24, 48

We obtain the following results from analyzing the three models:

TABLE 1.Analysis of model -1

Fixed effect(intercept	*Value*	*Std.Error*	*DF*	*t-value*	*p-value*
(Intercept)	4.194	0.535	239	7.841	0.000
Surgeryopen	1.025	0.490	78	2.091	0.040
timepts	0.195	0.163	239	1.197	0.233

TABLE 2 .Model-2 estimated values and std.error, p-value as follow

Fixedeffect(intercept)	*Value*	*Std.Error*	*DF*	*t-value*	*p-value*
(Intercept)	4.275	0.469	237	9.107	0.000
surgeryopen	1.025	0.490	78	2.090	0.040
as.factor(timepts)2	0.413	0.517	237	0.798	0.425
as.factor(timepts)3	0.638	0.516	237	1.233	0.219
as.factor(timepts)4	0.575	0.517	237	1.113	0.267

TABLE 3 .Model-3 estimated values and std.error, p-value as follow

	Value	*Std.Error*	*DF*	*t-value*	*p-value*
(Intercept)	4.681	0.347	240	0.347	0.000
surgeryopen	1.025	0.490	78	2.090	0.040

TABLE- 4 Confidence interval and AIC of three models

MODEL	*parameter*	*Confidence interval*	*AIC*	*BIC*
Model 1	surgeryopen	(0.064 , 1.986)	1720.917	1739.712
Model 2	Intercept	(3.146, 5.242)		
	surgeryopen	(0.064 , 1.986)	1721.851	1748.119
Model 3	Intercept	(3.355, 5.195)		
	surgeryopen	(0.064 , 1.986)	1718.558	1733.607
	Intercept	(4.002 , 5.361)		

Comments: Here model- 3 is the best model because no significant time point effect or time factor effect (considering model-1 and model-2)available in the longitudinal analysis of pain after surgery

5.3 Analysis of transition matrix

lap (individually)

	a	b	c
a	1	6	1
b	0	19	12
c	0	0	1

open(individually)

	a	b	c
a	1	1	1
b	0	7	12
c	0	1	17

1.Pain transition 8th h to16th h a=minor,b=middle, c=severe

	a	b	c
a	1	0	0
b	4	20	1
c	1	7	6

	a	b	c
a	0	1	1
b	0	6	4
c	0	2	26

2.Pain transition 16th h to 24th h a=minor,b=middle, c=severe

	a	b	c
a	4	2	0
b	5	21	1
c	1	5	1

	a	b	c
a	0	0	0
b	1	5	3
c	0	12	19

3.Pain transition 24th h to 48th h a=minor,b=middle, c=severe

Comment: Thus VAS score was significantly lower in the laparoscopic group.

The no. and duration of use of analgesics (injection and oral) were observed lower in the Laparaoscopic group in comparison to open conventional method. So, LA group patients suffered less post operative pain than OA group which was statistically significant (p-value =0.039)

6 Post Operative Complications:

6.1 WOUND

6.1.1 Collection

In this study 4 cases of serious collection in wound were seen in open appendectomy group and two of them later showed sign of infection. They were managed by conservative method and with daily dressing.

TABLE -5 In Lap group – no such collection was seen.

	Open n=40	*LAP n = 40*	**P Value**
Collection in wound	4 (10%)	Nil	0.018
Infection in wound	2	Nil	

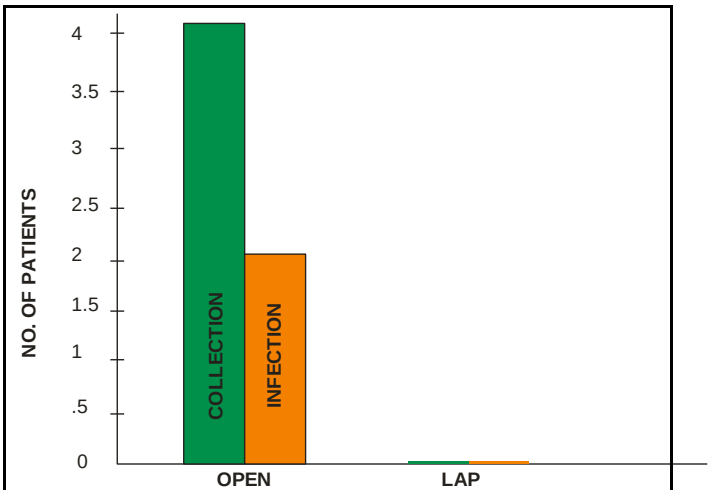


Fig-7 Bar chart showing number of patients with wound in the two surgical methods

Thus at 5% level of significance collection in wound is significantly low in Lap. Group than in O.A. group

6.1.2 Delay in wound healing

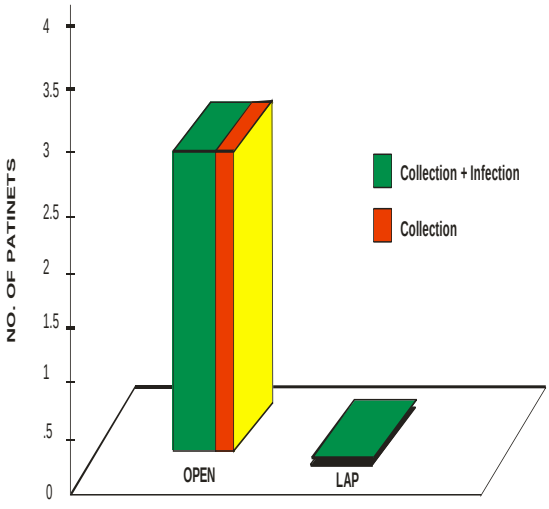
In this study 3 cases of delayed wound healing were noted in the open appendectomy group – out of them 2 were associated with wound collection and subsequent infection and managed conservatively and 1 case was associated 1 only serious collection in the wound.

In Lap group no such delay in wound healing could be seen.

TABLE 6

	Open (n=40)	*LAP (n=40)*	**p-value**
Delay in Healing	3 (7.5%)	Nil	0.036

Fig-8 Bar chart showing number of patients with delay in wound in the two surgical methods



Type of Procedure

Thus as 5% level of significance delay in wound healing is significantly lower in Lap – Appendicectomy group than in O.A.

6.1.3 Wound Disruption

No case of wound disruption was found in either study group.

6.2 INFECTION

6.2.1Intra peritoneal collections

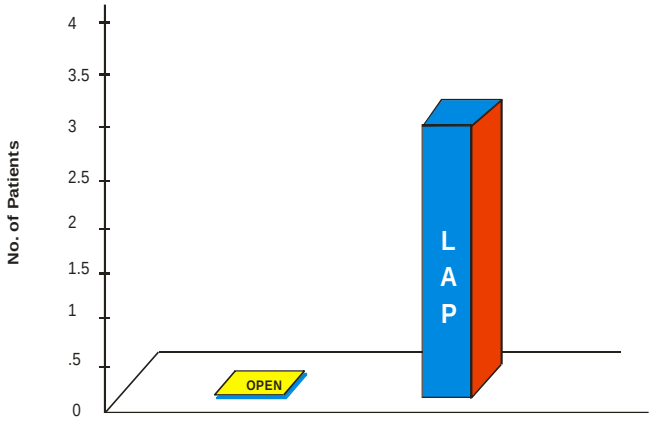
In Laparoscopic group 3 patients had intraperitoneal collections who subsequently underwent serial USG and was under conservative treatment. None of them required active interventions. No case of intraperitoneal abscess was found.

In contrast – no case of intraperitoneal collection or abscess was found in open group.

TABLE 7

	Open Appen (n=40)	*LAPAppendecto (n=40)*	**p-value**
Intraperitone Collection	Nil	3 (7.5%)	0.036

Fig-9 Bar chart showing number of patients with delay in Intraperitoneal Collection in the two surgical methods



Type of Procedure

Thus at 5% level of Significance Post operative intraregional collection / abscess formation is significantly higher in LA group than OA group.

6.2.2 Wound infection

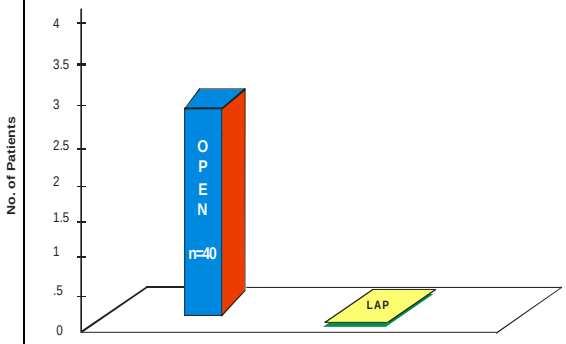
In this study group – no wound infection was noted in the lap group.

In open group – 3 patients had wound infections.

TABLE 8

	Open Appendictory (OA) (n=40)	*LAP Appendictomy (LA) (n=40)*	**p-value**
Wound Infection	3 7.5%	Nil	P=0.036

Fig. 10 showing number of patients with wound in the two surgical methods



Type of Surgical Procedure

Thus at 5% level of significant post O.P. wound infection is significantly low in LA group then OA group.

6.3URINARY DISTURBANCE

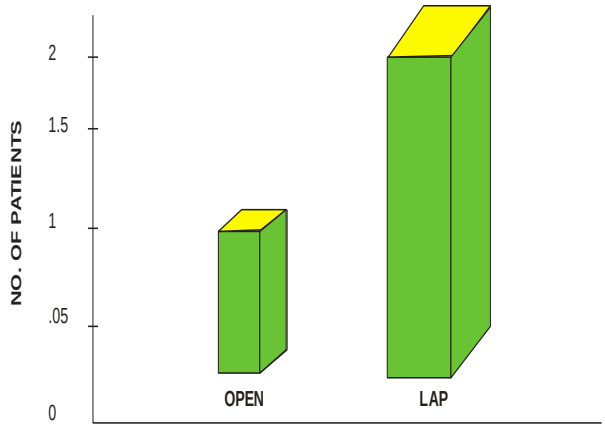
6.3.1Retention of Urine

In our study two cases of post op. urinary retention in OA group and one in LA group happened which needed catheterization for bladder evacuation.

TABLE 9

	Open n=40	*LAP n = 40*	**P**
AUR	2 5%	1 2.5%	0.555

Fig. 11Bar chart showing number of patients with Retention of Urine surgical methods



Type of Procedure

Thus there is no significance statistical difference regarding post operative retention of urine in either group.

6.3.2 UTI

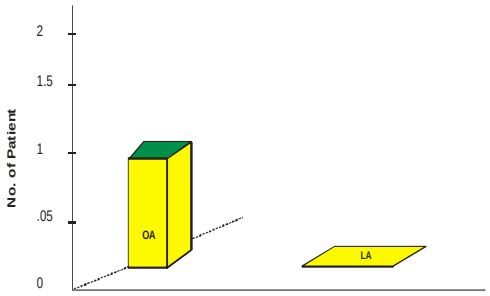
TABLE 10

In our study one case of UTI was found in OA group and none in LA group p value = 0.311

Observied value for UTI	*OA n=40*	*LAP n = 40*	**P**
	1 (2.5%)	0 -	0.311

Fig.

Ffig 12-Bar chart showing number of patients with UTI in the two surgical methods



Thus there was no significant difference in rate of UTI found in either group.

6.4Chest –

No cases of chest infection or any other chest complications were noted in either study group.

6.5 G.I.T.

6.5.1Nausea and vomiting

In this study group 5 patients were found to have post operative Nausea and vomiting in open method.

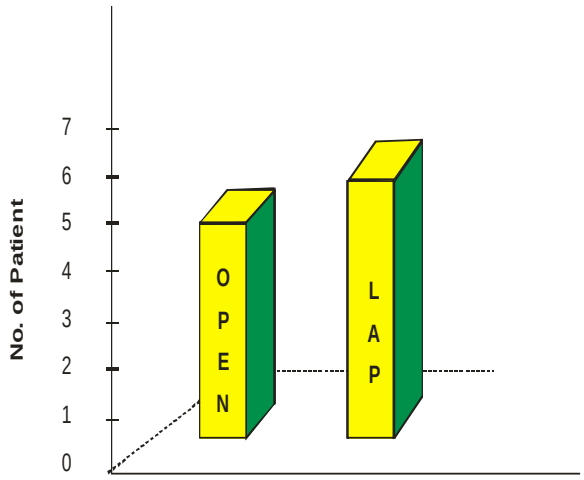
In laparoscopy 6 patients had increased nausea and vomiting.

All of then were managed by IV-fluid, injection antiemetic and had delay in taking oral feed.

TABLE 11

	Open n=40	*LAP n = 40*	**P Value**
Nausea and vomiting	5 12.5%	6 15%	0.745

Fig. 13 Bar chart showing number of patients wit iting in the two surgical methods



So there is no significant statistical difference in Nausea and Vomiting observed in either group.

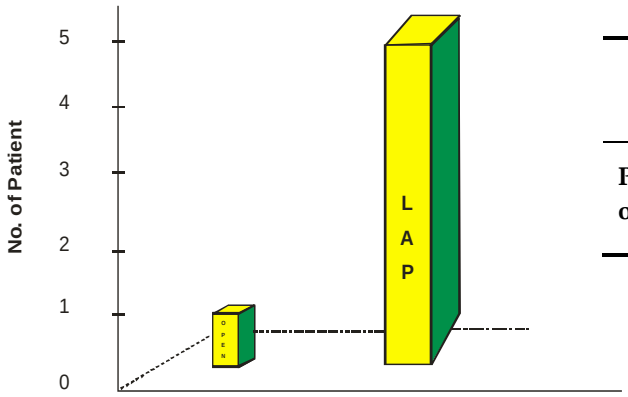
6.6 ILEUS

In our observation we found one patient developing post operative Ileus in open appendectomy method. In contrast there were 5 patients who had developed post operative Ileus. All these cases were managed by iv. fluids, delay in oral intake of food and other conservative treatment None of them required any active interventions.

TABLE 12

	Open (n=40)	*LAP (n=40)*	**P-value**
Post OP ILEUS	1 (2.5%)	5 (12.5%)	0.042

Fig. 14 Bar chart showing number of patients with ILEUS in the two surgical methods



Type of Procedure

Thus at 5% level of significance rate of post Operative Ileus is significantly more in LA group than OA group.

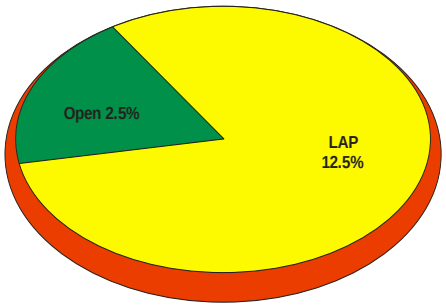


Fig. 15 Pie Chart Showing Rate of Post Operative Ileus.

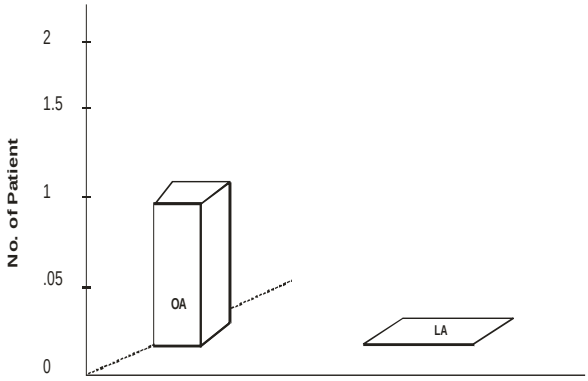
6.7 Gut Obstruction

In Laparoscopy group one case of post operative gut obstruction was observed which was managed conservative. In OA group no case of gut obstruction could be seen.

TABLE 13

	Open n=40	*LAp n = 40*	**P Value**
Postop Gut obstruction	1 2.5%	Nil	0.311

Fig. 16 Bar chart showing number of patients Gut Obstruction in the two surgical methods



Type of Procedure

Thus there was no statistical significant difference regarding post op. Gut obstruction in both the groups.

7 Total duration of stay in the hospital from the date of operation

7.1 Model based analysis

$$f(x;k,\theta) = x^{k-1}\frac{e^{\frac{x}{\theta}}}{\theta^{k}\Gamma(k)} \quad \text{for } x \geq 0;\ \text{and } k,\theta > 0 \qquad (1)$$

where k> 0 : the shape parameter, θ >0 :the scale parameter, x_i=day

$$f(x;\lambda,k) = \begin{cases} \frac{k}{\lambda}\left(\frac{x}{\lambda}\right)^{k-1} e^{-\left(\frac{x}{\lambda}\right)^{k}}, & x \geq 0 \\ 0, & x < 0 \end{cases} \qquad (2)$$

where k> 0 :the shape parameter, λ>0 :the scale parameter, x_i=day

we observe that $f_L(x;m,s) = \frac{1}{\sigma}\left(\frac{\ln x - \mu}{\sigma}\right) f_N(\ln x;m,s)$

$$f(x;\mu,\sigma) = \frac{1}{x\sigma\sqrt{2\pi}} e^{-\frac{(\ln x - \mu)^2}{2\sigma^2}}, \quad x > 0 \qquad (3)$$

where μ and σ are the parameters hence x_i=days

And pick up best one with help of the AIC, where AIC=2k-2(ln(L)) where k is the no of paramers & L is the maximum value of mle.

TABLE 14

Probe dens model	*Operation type*	*AIC (stay s days)*	*AIC (indoor and out door days)*	*comment s*
Gamma	Lap Appendectomy(LA) n=40	6.909	10.329	Not significa nt
	OpenAppendectomy (OA) ,n = 40	6.286	11.390	
Weibull	Lap Appendectomy (LA) n=40	6.800	8.898	Less significa nt
	OpenAppendectomy (OA) ,n = 40	6.709	9.308	
Log-Normal	Lap Appendectomy (LA) n=40	6.104	8.183	Significant respect than other two
	(OA) ,n = 40	6.256	9.018	

2.2 Estimation of parameter with likelihood method

Here we finaly decided to use the lognormal model .

We estimatethe parameter with likelihood estimation technique andcheck the consistency with help of simulation technique.

Hence required formula as follows:

and there we get solution after differentiating w.r.t , m, s, and

$$\hat{\mu} = \frac{\sum \ln x_k}{n} \quad \text{and} \quad \hat{\sigma}^2 = \frac{\sum \left(\ln x_k - \hat{\mu}\right)^2}{n}$$

for equity Lap & open w.r.t days

we have, $H_{01}: \mu_{1i} = \mu_{2i}, \sigma_{1i} = \sigma_{2i}; i = 1,2,3$

The test statistic is

D =-2(ln(likelihood for null model)-ln(likelihood for alternative model))

$$= -2\ln\left(\frac{\text{likelihood for null model}}{\text{likelihood for alternative model}}\right)$$. which follows χ^2 with d.f

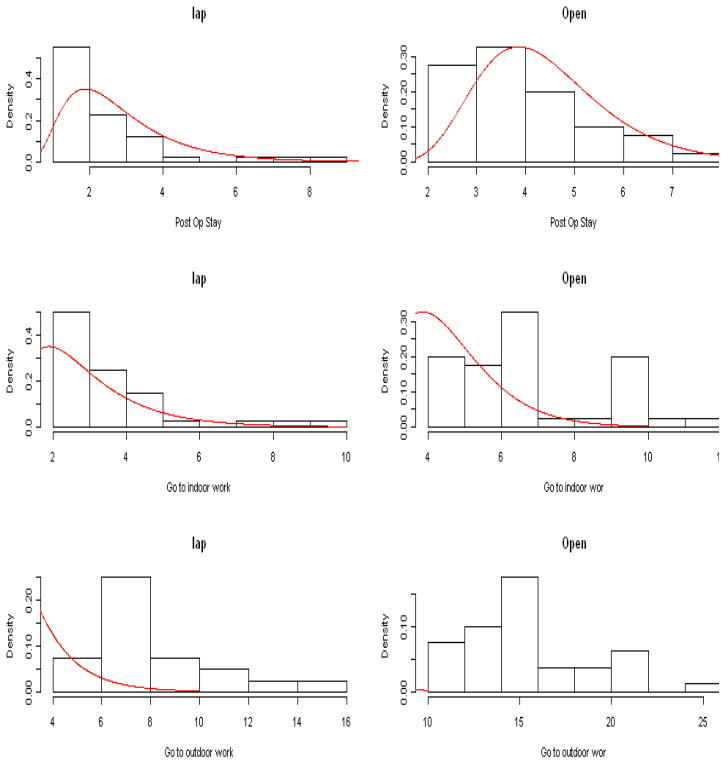
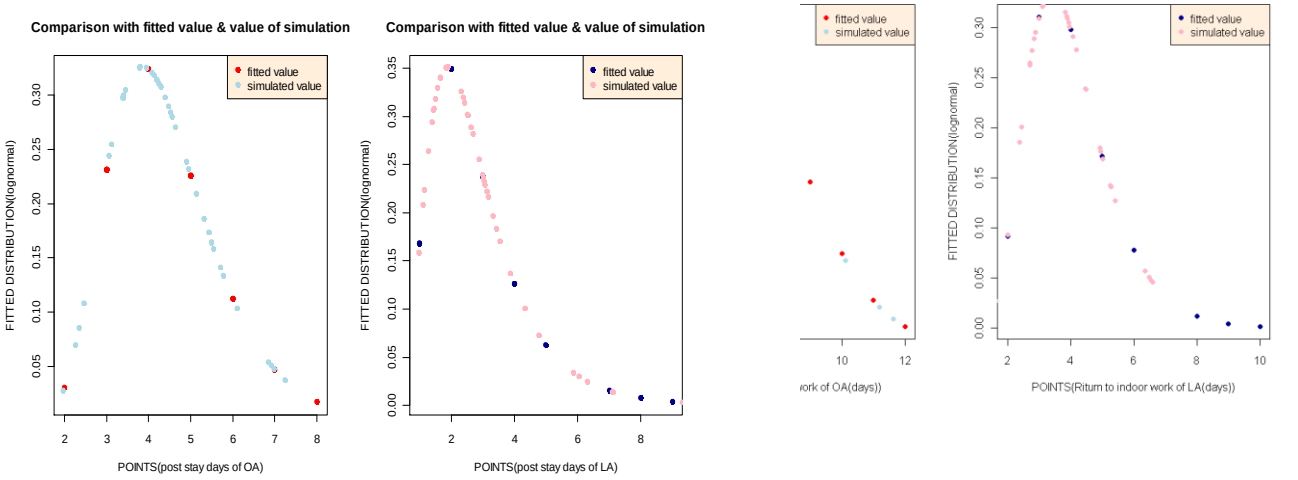


Fig. *16* *Here points of days[go to out door work] seen maximum in right side*

7.3*Justification the fitted value with simulation



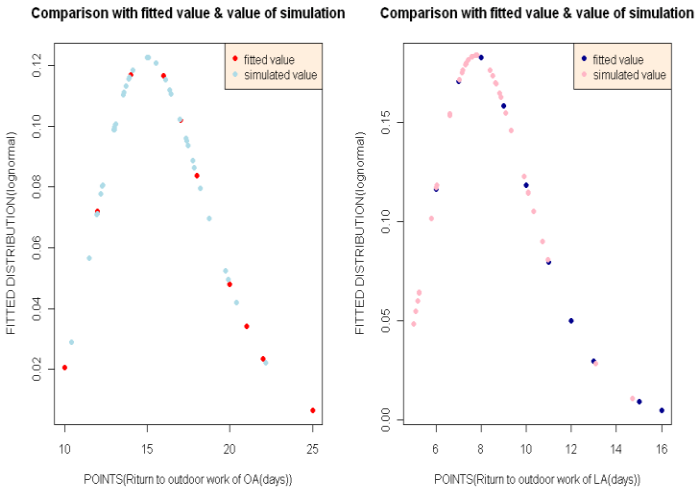


Fig. 17

Table 15 Estimated parameters and the consequence of likelihood ratio test

parameter	Post Stay Days		Return to Indoor Work (Days)		Return to Outdoor Work (Days)		comments
Operation type	open	Lap	Open	Lap	Open	lap	In every case we may reject the null hypothesis that that post operation days and other days for OA and LA differ significantly.
meanlog ^ μ	1.442	0.911	1.952	1.336	2.750	2.122	
sdlog	0.303	0.5240	0.268	0.3314	0.213	0.267	
Likelihood ratio test statistic value	37.532		9.130		373.249		
Tabulated chi square with 2 d.f	5.991		5.991		5.991		
P-value	7.08e-09		1.55e-13		0.000		The null hypo rejected

Return to normal indoor activity –

So, Pt's who underwent Lap-appendicectomy routine indoor activities much earlier than the Open group and the time to return to normal indoor life was statistically significantly lower in LA group than in OA group.

Return to outdoor Work –

In this study the Patients underwent open appendectomy returned to outdoor works with a median of 15 days from operation date (range 10-25) whereas in the Laparoscopy group it was only 8 (range 5-16). As such, the Laparoscopy group enjoyed the freedom of early return to outdoor work significantly earlier than the Open group. started daily

7.4*Cumulative Hazard rate of patients post stay days, return to indoor and return to out door

variable	*Type surgery*	*Average cost*	*T-value*	*T-tabulated value with 78 df*	*P-value*	*Difference of two mean(D)*	*Confidence interval of D*
Cost	open Lap	8515.0 15562.5	2.129	1.665	0.039	7047.5	(368.78, 13726.21)
Log(cost)	open lap	8.980 9.411	3.974	1.665	0.000	0.431	(0.214, 0.647)

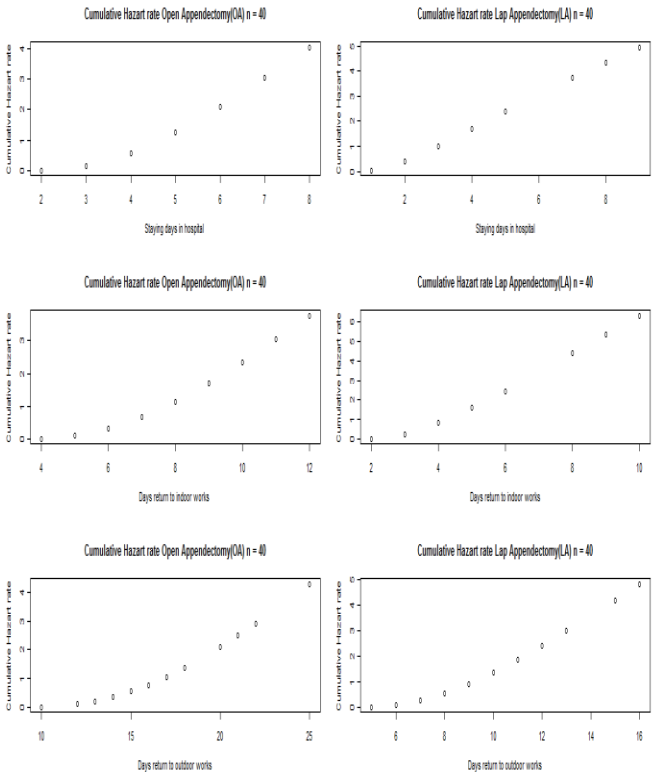


Fig. 18 It is clear from the figures that patients undergoing LAP need less time to return to normal life than those undergoing OPA

8 Cost of operation

8.1Graphical analysis:

1. Mean cost (Including outlier)

2. Mean cost (Excluding outlier)

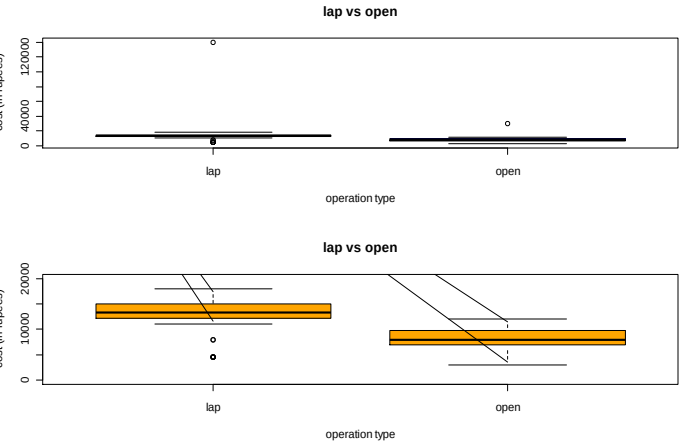


Fig. 19

8.2Test

Here for comparing the cost ,we use the *t – test* with given cost of surgery both Open and lap and taking log transformation of cost. we also perform same test (after removing skewness)of data, the cosequence as follows:

our null hypo is, H_0: $\hat{\mu}_1 = \hat{\mu}_2$

TABLE 16

Comments: In Open Group we found mean cost of Operative procedure of Rs. 8515/- and in Laparoscopy group it was Rs. 15562.5/- and P value = 0.039 and calculated t-value is greater i.e. statistically very significantly high in Laparoscopy group over Open group at 5% level.

9 Cosmesis:

Regarding cosmesis the VAS was used and the value on the lower side of scale indicating better result of cosmesis of scar and Patients observation was noted. The median value for open group was 2 [range 1-6] and that for Lap Group was 1 [0-3].

TABLE 17

Kruskal-Wallis Test: Cosmesis versus OperationType

Kruskal-Wallis Test on Cosmesis

Operatio	N	Median	Ave Rank	Z
L	40	1.000	32.8	- 2.97
O	40	2.000	48.2	2.97
Overall	80		40.5	

H = 8.84 DF = 1 P = 0.003

H = 10.46 DF = 1 P = 0.001 (adjusted for ties)

TABLE 18

	Open n=40	*LAP n = 40*	**P Value**
Cosmesis of Scar	2 [1-6]	1 [0-3]	=0.001

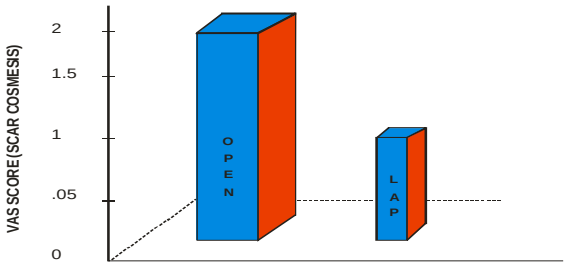


Fig. 20 Type of procedure

So, Laparoscopic group had better satisfaction with cosmesis and the difference was statistically significant (P = .001)

10 Other complication

No other complications could be seen in any group.

11 Summary

Here we consider two type of operation technique - one is Laparoscopic Appendicectomy (LAP) and the other Open Appendicectomy(OA) . Here we analysis the data graphically, also apply some statistical test. And here important analysis is fitting data with some standard probability model and longitudinal analysis and hazard rate analysis.

Age: With help of dot plot we see that we get 60+ patients in LAP.

Time required for surgery: From the bar diagram we see that more time is needed in LAP.

Cost of surgery: We see need more cost in LAP with Histogram. Also, performing the t-test we find significant difference in the two costs.

Pain: Graphically, from box plots and line diagrams, it is not clear how pain varies with time in the two surgical methods. However, from the transition matrix this variation is quite clear. Also fitting the longitudinal model we get better significant relation between pain and surgical method.. Here LAP gives better result.

Post operation stay, Going to indoor work and Going to outdoor work: Here we get better fitted model is lognormal model and performing the likelihood ratio test between the two surgery procedure In every case we may reject the null hypothesis that that post operation stay days and others days for OA and LAP differ significantly. Hazard analysis we also get the require remedy's days is less in case of LAP.

12 Conclusion

From the present study it has been observed that appendectomy done either by open method or laparoscopically is comparable in terms of operation time, post operative pain control, post operative Complication, post operative stay, convalescence, cost and cosmesis.

Where OA(open appendicectomy) was associated with less operative time, less cost and less chance of post operative Intra Peritoneal collection and ileus in one hand, it had got disadvantages like more post operative pain sensation, more number of analgesic used, more incidence of operative wound collection, delay in wound healing, more stay in hospital and delay to start oral feeding and return to normal life.

On the other hand LA(lap appendicectomy) was associated with more operative time, increased operative cost and more incidences of intra-peritoneal collection and ileus but there are advantages like less pain sensation, less requirement of analgesics, less wound complications, less hospital stay and earlier introduction of oral feeding and quicker return to normal life.

So finally we conclude from our study that laparoscopic appendicectomy is not only comparable to conventional open method in regards to feasibility and safety but also with more and more successful use of it, one day it may be the gold standard approach in treating a case of acute appendicitis in near future.

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Computer language and Packages

R, Minitab, SPSS, Microsoft Excel.