LAPAROSCOPIC TRANS-ABDOMINAL PRE-PERITONEAL MESH REPAIR VERSUS OPEN (LICHTENSTEIN) MESH REPAIR FOR INGUINAL HERNIA - A COMPARATIVE STUDY

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HOW TO CITE THIS ARTICLE:

Gurukiran CS, Pavan BM, Naveen Kumar M, Raveesh PM, Suhas. "Laparoscopic trans-abdominal pre-peritoneal mesh repair versus open (lichtenstein) mesh repair for inguinal hernia - a comparative study". Journal of Evolution of Medical and Dental Sciences 2013; Vol2, Issue 30, July 29; Page: 5540-5551.

ABSTRACT: BACKGROUND: Repair of Inguinal Hernia is one of the most common elective surgeries performed worldwide. Our objective in this study is to compare results after hernioplasty using a Laparoscopic (TAPP) Technique to that using Open (Lichtenstein) Technique, in an effort to determine if the advantages could be reproduced in practice. **Methodology:** This was a prospective clinical study comparing Open Lichtenstein Mesh Repair and Laparoscopic Trans Abdominal Pre-peritoneal Mesh Repair (TAPP) consisting of 40 patients with inguinal hernia, who were randomly assigned to TAPP Repair Group (n=20) or Open Repair Group (n=20). Patients were then operated, followed up in the early postoperative period as well as the later post-operative period until 6 months after surgery. **Results:** The Primary endpoints were length of post operative pain, complications, hospital stay, and patient satisfaction. There were 7 patients (17.5%) patients who had minor complications. In Lichtenstein Group, there were minor complication in 6 patients (30%) and in TAPP Group there was 1 patient (5%). Hence patients in Lichtenstein group had significantly more complications as compared to TAPP Group. Recovery period is fast for laparoscopic hernia repair with a mean post operative hospital stay of 2.80 days compared to 5.35 days for open repair, and were able to resume their normal work earlier with 6.65 days compared to 12.20 days. Post operative pain for laparoscopic TAPP repair was of lower score than that of open mesh repair by visual analogue scale assessment. Patient's operated by laparoscopic technique responded with good to excellent grading in terms of results, post operative pain and recovery and in terms of cosmesis. **CONCLUSION:** This study supports the view that laparoscopic pre-peritoneal mesh repair is safe and efficient when compared to open mesh repair of inguinal hernia.

KEYWORDS: Transabdominal Pre-peritoneal Mesh Repair, Inguinal Hernia, Open Lichtenstein Repair, Post Operative Hospital Stay, and Pain Score.

INTRODUCTION: Repair of inguinal hernia is one of the commonest surgical procedures Performed worldwide. The lifetime risk for men is 27% and for women is 3%¹.

Since Bassini published his landmark paper on the technique of tissue repair ² in 1887, numerous modifications have been proposed. There has been a revolution in surgical procedures for groin hernia repairs after the introduction of prosthetic material by Usher ³in 1958. Open Pre-peritoneal mesh repair by Stoppa⁴ was found to significantly reduce recurrence rate for multi-recurrent groin hernias. However, it was associated with significant postoperative pain and morbidity. The concept of Tension Free Open Mesh Repair was first described by Lichtenstein in 1989⁵.

Ger reported the first laparoscopic hernia repair in 1982 by approximating the internal ring with stainless steel clips⁶. The laparoscopic transabdominal preperitoneal (TAPP) repair was a

revolutionary concept in the hernia surgery and was introduced by Arregui⁷ and Dion⁸ in the early 1990s. Laparoscopic groin hernia repair can be done by TAPP approach and also Total Extra Peritoneal (TEP) approach⁹

The techniques of laparoscopic hernia repair reproduce the concept of Stoppa by placing a large mesh in the pre-peritoneal space to cover half of the abdominal wall and all the weak areas including area of internal ring, Hasselbach's triangle and the femoral ring.

The advantages of laparoscopic repair include the same decreased incidence of recurrence observed with the Stoppa technique with the added benefits of lesser pain, reduced discomfort, short hospital stay and early resumption of normal daily activities. TAPP allows a better view of the inguinal anatomy and also allows evaluation of opposite side as well.

Our Purpose in this study is to compare results after hernioplasty using a Laparoscopic (TAPP) Technique to that using Open (Lichtenstein) Technique, in an effort to determine if the advantages could be reproduced in practice.

METHODOLOGY This was a prospective study. Cases were taken from those admitted in surgical wards at Sree Siddhartha Medical College Hospital and Research Centre, Tumkur, for treatment of Inguinal Hernia. **SAMPLE SIZE:** 40 patients (20 Open Lichtenstein and 20 Laparoscopic Repair). **STUDY DURATION:** October 2010 to October 2012

All male patients, who were 18 years of age or older with a diagnosis of inguinal hernia who gave written informed consent and were medically fit to undergo the procedure were included in the study. Patients who required emergency exploration for complications of hernia like, bowel obstruction, strangulation, gangrene etc. and recurrent inguinal hernia were excluded from the study.

All the patients were admitted and a detailed history and clinical examination was out as per written proforma. Preoperatively the patients were offered options of either laparoscopic TAPP or open Lichtenstein repair for inguinal hernia, and were educated about the advantage, disadvantage, type of anesthesia, and also the cost for each.

After taking consent for either procedure (TAPP or Open Repair), the patient was investigated and after getting fitness, the patient was taken up for surgery.

After surgery, patients were advised and encouraged to ambulate and start their activities of daily life as early as possible. Prophylactic antibiotics are given for duration of 5 to 7 days, of which parenteral antibiotics are given for atleast 48 hours. Analgesics (either NSAIDS - Diclofenac Sodium or Tramadol) at 12 hour interval for a period of 3-5 days, shifted on to oral tablets as early as possible.

Dressing was changed once on postoperative day 2. Patients were observed for any complications like hematoma, seroma, recurrence, wound sepsis during their stay and also assessed for postoperative pain.

Patients were discharged once free of complications and once they resumed their activity of daily normal life. Patients were discharged with next day or within 48 hours.

At discharge they were advised to come for stitch removal after 7-8 days and follow up after 1 month, 3 month of surgery and every 6 months thereafter. Patients were instructed to avoid heavy work for a period of 3-4 weeks.

DATA ANALYSIS:

- 1) Operative Steps and per operative complication were noted in detail and tabulated.
- 2) Post operative assessment with respect to post operative pain, hospital stay and other complications were included as per protocol attached. Patient was followed up for a period of six months after surgery. That is one week after surgery, once in a month for 3 months, and once 6 months after surgery.
- 3) At the end of the study comparison was made between open Lichtenstein repair and Laparoscopic TAPP repair regarding.
 - a) Safety and efficacy.
 - b) Duration of surgery with hospital stay
 - c) Post operative morbidity.
 - d) Patient satisfaction.
 - e) Cost Effectiveness.

STATISTICAL METHODS: Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean $\pm$ SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Student t test (two tailed, independent) has been used to find the significance of study outcome parameters between two groups. Chi-square and Fisher Exact test has been used to find the significance of frequency of study characteristics between two groups.

Significant Figures

- + Suggestive Significance $0.05 < p < 0.10$.
- *Moderately Significant $0.01 < p \leq 0.05$
- ** Strongly Significant $p \leq 0.01$

STATISTICAL SOFTWARE: The statistical software namely SPSS 15.0, Stata 8.0, Medcale 9.0.1 and Systat 11.0 were used for the analysis of data and Microsoft Word and Excel have been used to generate graphs, tables etc.

RESULTS: Our study included 20 patients operated by Laparoscopic Pre peritoneal Mesh repair (study group) with inguinal hernias and they were compared with 20 patients operated for inguinal hernia by open Lichtenstein repair during the same period (control group).

Age of the patients in our study group (TAPP) ranged from 20- 70 years with mean age of 40.35 years and age of the patients in our control group (Lichtenstein) ranged from 19- 80 years with mean age of 48.20 years.

In our study, in Lichtenstein Group, 45% were agriculturists, 15% were laborers, 10% were students and 30% belonged to other professions and in TAPP Group, 60% were agriculturists, 5% were laborers, 10% were students and 25% belonged to other professions.

In our study in Lichtenstein group, 35% of patients had various associated diseases. In TAPP group, 25% of patients had associated diseases.

Totally 30% of all patients had some associated disease along with inguinal hernia. The study contained 10 (50%) left sided hernias, 10 (50%) right sided hernias and 0 bilateral hernias with 13 indirect and 7 direct hernias in the Lichtenstein Group.

There were 6 (30%) left sided hernias, 14 (70%) right sided hernias and 0 bilateral hernias with 16 indirect and 4 direct hernias in the TAPP Group.

Mean Operating Time was calculated from the time of induction to time of wound closure.

In our study, the mean operative time in TAPP Group was 106.45 minutes which was significantly more with $p < 0.001$ when compared with Lichtenstein Group, which was 39.55 minutes.

Thus overall the operative time was significantly more in TAPP Group (106.45 min) with $p < 0.001$, when compared with Lichtenstein Group (39.55 min). [Table: 1]

In our study, pain score (as per Visual Analogue Scoring) was significantly less in TAPP Repair Group (5.95) as compared to Lichtenstein Repair Group (7.35) with $p < 0.001$, on Day 0 of Surgery.

In addition, even on Day 3, the pain score in TAPP Repair Group (3.10) was significantly less ($p < 0.001$) as compared to pain score in Lichtenstein Group (5.40).

Also, in both the study groups, the pain score significantly reduced ($p < 0.001$), from Day 0 to Day 3 of surgery, indicating good recovery from surgery in both procedures. [Table: 2]

In our study, there were no major complications seen in any patient. There were 7 patients (17.5%) patients who had minor complications. In Lichtenstein Group, there were complications in 6 patients (30%) and in TAPP Group there was 1 patient (5%).

Patients in Lichtenstein group had significantly more ($p < 0.001$) complications as compared to TAPP Group. [Table: 3]

In our study, the length of hospital stay of patients in Lichtenstein Group was significantly more ($p < 0.001$) with a mean of 5.35 days, as compared to patients in TAPP Group whose mean stay was 2.80 days. [table:4]

In our study, patients in TAPP group were able to resume their routine work faster (6.65 days) as compared to patients in Lichtenstein Group (12.20 days), with $p < 0.001$. [Table: 5]

Significant number of patients (80%) responded with Good to Excellent grading in TAPP Group when compared with those patients (17%) in Open Group ($p < 0.001$). In our study, there were no recurrences seen in any patients in either group.

The Cost of Procedure was higher in TAPP Group (Rs.10915.12) as compared to Lichtenstein Group (Rs.7471.15).

The TAPP procedure was Rs.3443.98 costlier than Lichtenstein Repair, on an average, in our hospital. [Table: 6]

DISCUSSION: In our study the mean operative time was 106.45 min for Laparoscopic TAPP Hernia Repair and 39.55 minutes for Open Lichtenstein Hernia Repair. Hence the overall mean operative time was significantly less in Open Hernia Repair than in Laparoscopic Repair which is comparable to other studies.

According to Sudhir Kumar Jain and ChodanNorbu study¹⁰ laparoscopic groin hernia repair takes longer than open mesh repair Meta analysis of 16 randomized trials of Trans-abdominal pre-peritoneal repair (TAAP) demonstrated on overall increase of minutes compared with open repair. Memon and colleagues reviewed the data from 29 randomized clinical trials and concluded that patients who underwent laparoscopic repair of groin hernia took longer time for surgery.

Operative time of different studies:

Study	Laparoscopic Hernia repair		Open hernia repair	
Sudhirkumar Jain ChodanNorbu.InternetJournalof surgery 2006				
a) McCormack ¹¹		14.8 mins longer than open repair		13.8mins
b) Memon	(n=3017)	15.2 mins longer than open repair	(n=2972)	
c) MRC Trial group ¹²	(n=468)	58.4 mins	(n=460)	43.3 mins
d) Picchio ²³	(n=53)	49.6 mins -	(n=52)	33.9mins
e) Chung ¹³		Laparoscopic repair was longer in all groups		
1) Carmen .D. Dirksen	(n=88)	82 mins	(n=87)	45 mins
2) John.H. Payne ¹⁷	(n=48)	68 mins	(n=52)	56 mins
3) In our study	(n=20)	106.45mins	(n=20)	39.55mins

Table 1: Comparison of Operating Time (in minutes)

Operation time (min)	Range	Mean	SD	Std. Error	95% Confidence Interval for Mean		t-value	P-value
					Lower Bound	Upper Bound		
Lichtenstein open repair	30-55	39.55	6.82	1.53	36.36	42.74	8.051	0.001**
TAPP repair	70-250	106.45	36.53	8.17	89.35	123.55		

In our study operative time is significantly more in study group B (laparoscopic TAPP) with $p < 0.001$.

In our study laparoscopic hernia repair was in the beginning of the learning curve. Hence expected to take more time to complete the procedure.

POST OPERATIVE PAIN:-

Comparison of postoperative pain between Laparoscopic (Transabdominal Preperitoneal) and Open Mesh Repair

ORIGINAL ARTICLE

Investigator	Results
TAPP versus open mesh	
Filipi, et al	Less pain in Laparoscopic group
Heikkinen, et al ⁵	Less pain in Laparoscopic group
Aitola, et al ¹⁹	Less pain in Laparoscopic group
Heikkinen, et al ²⁰	No difference in pain between laparoscopic and open hernia repair
Paganini, et al	No difference in pain between laparoscopic and open hernia repair
Wellwood, et al ²²	Less pain in Laparoscopic group
Picchio, et al	No difference in pain between laparoscopic and open hernia repair
Anadol, et al ²⁵	Less pain in Laparoscopic group
Multicenter prospective randomized trials	
SCUR ²⁶	No difference in pain between laparoscopic and open hernia repair
VA ¹⁴	Less pain in Laparoscopic group

Table 2: Comparison of Post Operative Pain

Comparison between the study groups on Day 0	Mean	SD	Std. Error Mean	95% confidence interval		t-value	P-value
				Lower Bound	Upper Bound		
Lichtenstein open repair	7.35	0.59	0.13	7.09	7.61	5.204	0.001**
TAPP repair	5.95	1.05	0.23	5.49	6.41		

Comparison between the study groups on Day 3	Mean	SD	Std. Error Mean	95% confidence interval		t-value	P-value
				Lower Bound	Upper Bound		
Lichtenstein open repair	5.40	0.88	0.20	5.01	5.79	8.693	0.001**
TAPP repair	3.10	0.79	0.18	2.75	3.45		

Comparison within Lichtenstein open repair from day 0 to day 3	Mean	SD	Std. Error Mean	95% confidence interval		t-value	P-value
				Lower Bound	Upper Bound		
Post-operative pain on Day 0	7.35	0.59	0.13	7.09	7.61	9.233	0.001**
Post-operative pain on Day 3	5.40	0.88	0.20	5.01	5.79		

ORIGINAL ARTICLE

Comparison within TAPP repair from day 0 to day 3	Mean	SD	Std. Error Mean	95% confidence interval		t-value	P-value
				Lower Bound	Upper Bound		
Post-operative pain on Day 0	5.95	1.05	0.23	5.49	6.41	17.105	0.001**
Post-operative pain on Day 3	3.10	0.79	0.18	2.75	3.45		

Evidences solid that laparoscopic repair leads to less postoperative pain and is associated with similar or less risk of persisting pain than open mesh repair.

In our study: The pain score (as per Visual Analogue Scoring) was significantly less in TAPP Repair Group (5.95) as compared to Lichtenstein Repair Group (7.35) with $p < 0.001$, on Day 0 of Surgery. In addition, even on Day 3, the pain score in TAPP Repair Group (3.10) was significantly less ($p < 0.001$) as compared to pain score in Lichtenstein Group (5.40). The difference between the two groups was statistically significant.

COMPLICATION RATE:- Studies comparing complications between laparoscopic and open mesh repair are **Complication rate**

Sl. No.	First author	Laparoscopic repair	Open mesh repair
1.	Mc Cormack ¹¹	8/2315 visceral 7/2498 vascular	1/2599 visceral 5/2758 vascular
2.	Grant ²⁷	15 serious complications	4 serious complications
3.	MRC trial group ¹²	5.6%	1.4%
4.	Neymayer	36%	33.4%

Our Study	Laparoscopic repair	Open Lichtenstein repair
Major Complication	0%	0%
Minor Complication	30%	5%

Table 3: Comparison of post operative complications

	Lichtenstein open repair		TAPP repair		Total	
	No. of patients	Percentage	No. of patients	Percentage	No. of patients	Percentage
NEUR	3	15.0		0.0	3	7.5
SER	2	10.0	1	5.0	3	7.5
WI	1	5.0		0.0	1	2.5
Total	6	30.0	1	5.0	7	17.5

Incidences of complications after laparoscopic inguinal hernia repair are significantly higher.

ORIGINAL ARTICLE

In our study, there were no major complications seen in any patient. There were 7 patients (17.5%) patients who had minor complications. In Lichtenstein Group, there were complications in 6 patients (30%) and in TAPP Group there was 1 patient (5%).

Patients in Lichtenstein group had significantly more ($p < 0.001$) complications as compared to TAPP Group.

POST OPERATIVE HOSPITAL STAY:- In our study, the length of hospital stay of patients in Lichtenstein Group was significantly more ($p < 0.001$) with a mean of 5.35 days, as compared to patients in TAPP Group whose mean stay was 2.80 days.

From this we can conclude that laparoscopic hernia repair had less post operative hospital stay than open hernia in our study.

Table 4: Comparison of Stay in Hospital

Hospital stay (days)	Range	Mean	SD	Std. Error	95% Confidence Interval for Mean		t-value	P-value
					Lower Bound	Upper Bound		
Lichtenstein open repair	3-9	5.35	1.53	0.34	4.63	6.07	6.226	0.001**
TAPP repair	1-5	2.80	1.01	0.22	2.33	3.27		

RETURN TO NORMAL WORK: - The literature has clearly proven that patients have a shorter convalescence and a faster return to work and activities after laparoscopic, compared with open mesh, inguinal hernia repair.

Comparison of time to return to work between laparoscopic (Transabdominal preperitoneal) and Open mesh repair Time to Return to Work in days		
Investigator	Laparoscopic	Open
Payne, et al ¹⁷	9 days	17 days
Heikkinen, et al ¹⁸	14 days	19 days
Aitola, et al ¹⁹	7 days	5 days
Heikkinen, et al ²⁰	14 days	21 days
Paganini, et al ²¹	15 days	14 days
Wellwood, et al ²²	21 days	26 days
Picchio, et al ²³	46 days	43 days
Multicenter Prospective Randomised Control Trials		
MRC ¹²	10 days	14 days
SCUR ²⁶	15 days	18 days
VA ¹⁵	4 days	5 days

Table 5: Comparison of Days for Return to Normal Work

Return to normal work (days)	Range	Mean	SD	Std. Error	95% Confidence Interval for Mean		t-value	P-value
					Lower Bound	Upper Bound		
Lichtenstein open repair	8-20	12.20	2.95	0.66	10.82	13.58	8.115	0.001**
TAPP repair	5-8	6.65	0.81	0.18	6.27	7.03		

In our study, patients in TAPP group were able to resume their routine work faster (6.65 days) as compared to patients in Lichtenstein Group (12.20 days), with $p < 0.001$.

RECURRENCE: - Comparison of recurrence rates between laparoscopic (transabdominal preperitoneal) and open mesh repair.

Recurrence Rate		
Investigator	Laparoscopic	Open
TAPP versus open mesh		
Payne, et al	0	0
Filipi, et al	0	2 (7%)
Heikkinen, et al	0	0
Aitola, et al ¹⁹	13%	8%
Heikkinen, et al	0	0
Paganini, et al	2 (3.8%)	0
Wellwood, et al ²²	0	0
Douek, et al ²⁴	2 (2%)	3 (3%)
Anadol, et al ²⁵	0	0

Investigator	Recurrence rate	
	Laparoscopic	Open
Multicenter prospective randomized trials		
MRC ¹²	7(1.9%)	0
SCUR ²⁶	4	11
VA ¹⁴	10.1%	4.9%

Most of the studies mentioned above are done much earlier recent studies shows less incidence of recurrence

In our study: There were no recurrences in either group.

COST EFFECTIVENESS: One of the major criticisms of laparoscopic hernia repair is increased cost compared with open repair, which has been consistently demonstrated by many studies. It has also been shown that most of the increased cost is attributed to longer operative times and more expensive equipment.

Since ours is a teaching hospital and laparoscopic operation theater is well equipped, we are able to cut down the cost of the surgery.

Table 6: Comparison of Cost of the Procedures

Cost of Procedure	Lichtenstein	TAPP
Range	6825 – 9120	9800 - 11200
Mean $\pm$ SD	7471.15 $\pm$ 756.4	10915.12 $\pm$ 1687.6

PATIENT SATISFACTION: Patients were pleased and satisfied with laparoscopic procedure since they had less post operative pain, early recovery, and especially with cosmetically acceptable scar which gave laparoscopic procedure good to excellent grading.

CONCLUSION: The results supports the view that laparoscopic preperitoneal mesh repair is safe and efficient when compared to open mesh repair of inguinal hernia.

There is a definitive learning curve for surgeons who are newly exposed. The implication rate reduces as the surgeons become more experienced in this procedure comparable with that of open mesh repair.

In conclusion the study supports the view that laparoscopic pre-peritoneal mesh repair of inguinal hernia is safe and efficacious and offers definitive advantages over mesh repair and should be an available option for all patients requiring elective hernioplasty.

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Date of Submission: 18/06/2013.
Date of Peer Review: 18/07/2013.
Date of Acceptance: 20/07/2013.
Date of Publishing: 23/07/2013