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Research Article

Comparative study between laparoscopic and open repair of umbilical and para umbilical hernia

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ABSTRACT

Background: Laparoscopic repair of umbilical and para umbilical hernia has largely replaced conventional (Open) repair. The purpose of the study is to compare the effectiveness of laparoscopic vs. open repair of umbilical & para umbilical hernia in a tertiary care government hospital.
Methods: Place of study: Minimal access surgery unit, MMC/GH Chennai, between April 2013 - March 2014. Selection criteria: Patients above 18 years of age were included and those with complicated Umbilical / Para umbilical hernia, coagulopathy, severe cardiopulmonary disease, ascites and renal failure were excluded. 42 patients with Umbilical and para umbilical hernias were randomly categorized into two equal groups. Group L treated with laparoscopic mesh repair and Group O treated by conventional mesh repair and patient, surgeon and hospital related parameters were assessed.
Results: The operative time, post-operative pain, mean hospitalisation, time to return to routine activity and work, complications and recurrence rates were assessed and P values derived and compared between the two types of repair and found better in patients undergoing laparoscopic repair.
Conclusions: Though the cost of bilayered mesh and fixation device are high in laparoscopic repair, the patient benefits in terms of less hospital stay, less pain and early return to routine activity and work make it superior to open repair. Laparoscopic umbilical/para-umbilical hernia repair is technically safe, effective and feasible, with a better clinical outcome in patients seeking treatment in a Government Hospital set-up.

Keywords: Laparoscopic mesh repair, Umbilical hernia, Tertiary care

INTRODUCTION

Umbilical and Para umbilical hernia are frequently encountered in surgical practice & account for 10-12% of abdominal wall hernias.[1] Obesity & multiparity are the most important pre disposing factors.[1,12] It has known to occur since biblical times. Umbilical hernia repair has been reported by Celeus in the 1st century, William Cheselden in 1740. William Mayo's in 1901 described the classical overlapping repair - vest over trousers in 19 patients.[4] The initial high recurrence rate - 10-30% following suture repair has been brought down to <2% by the introduction of prosthetic mesh repair. Laparoscopic mesh repair is now being accepted as an effective alternative to open mesh repair of umbilical/paraumbilical Hernia.

METHODS

This study sample consists of 21 patients who were repaired by Laparoscopic method (Lap group) and 21 patients who were repaired by open method (Open group)

at the minimal access surgery unit, MMC/govt. general hospital, Chennai (Figure 1).

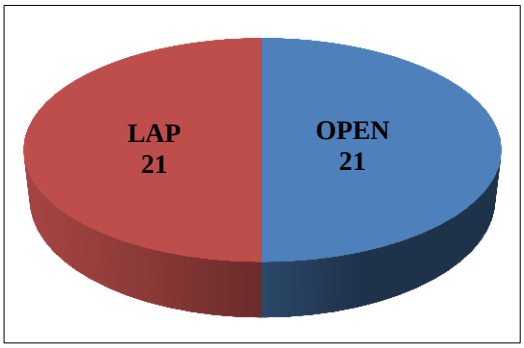

Figure 1: Study sample - umbilical/paraumbilical hernia.

Patient selection criteria

Inclusion criteria

- Healthy patients above 18 years of age.

Exclusion criteria

Those with:

- Complicated umbilical/para umbilical hernia
- Coagulopathy
- Severe cardiopulmonary disease
- Ascites
- Renal failure

In our study all patients received a single dose of 1gm of Inj. Cefotaxime at the time of induction of anaesthesia. Patients were administered regional/general anaesthesia.

Statistical test: Fisher T test, Chi square test.

Open method:[7]

- Infra umbilical smile incision and a mesh of appropriate size used in the repair.

Lap IPOM method:[3,7]

- Intra peritoneal onlay mesh repair done & Mesh fixation was done using absorbo tackers in all cases.
- Parenteral analgesia was given on the day of surgery and switched to oral medication.

Objectives

To compare the effectiveness of laparoscopic repair vs. open repair of umbilical & para umbilical hernia in a tertiary care government hospital with reference to

1. Surgeon related results
    - Operative time
2. Patient centered outcomes
    - Post-operative pain
    - Mean hospitalisation
    - Time to return to routine activity and work
3. Complications
4. Recurrence rates
5. Economy viz: hospital stay, hospital cost and community costs and assess cost-benefit ratio.

RESULTS

Table 1 shows independent samples T-test to compare mean values between surgical procedures.

Table 1: Independent samples T-test to compare mean values between surgical procedures.

Variables	Surgical procedure	N	Mean ± SD	t-value	P value
Age (year)	Open	21	47.81 ± 12.644	4.227	<0.001
	Lap	21	32.38 ± 10.947		
Post-operative pain at 6 hours	Open	21	6.00 ± 0.000	-	-
	Lap	21	6.00 ± 0.000		
Post-operative pain at 24 hours	Open	21	7.48 ± 0.680	21.280	<0.001
	Lap	21	3.05 ± 0.669		
Return to daily activities (day)	Open	21	4.286 ± 0.956	10.648	<0.001
	Lap	21	1.762 ± 0.515		
Return to work (day)	Open	21	23.62 ± 5.005	7.419	<0.001
	Lap	21	14.81 ± 2.136		
Operating time (minutes)	Open	21	38.05 ± 3.500	16.106	<0.001
	Lap	21	62.00 ± 5.848		
Hospital stay (hours)	Open	21	85.52 ± 9.755	14.889	<0.001
	Lap	21	32.29 ± 13.165		

Age distribution

The mean age group was 32.38 years in the Lap group and 47.81 years in the open group (Figure 2).

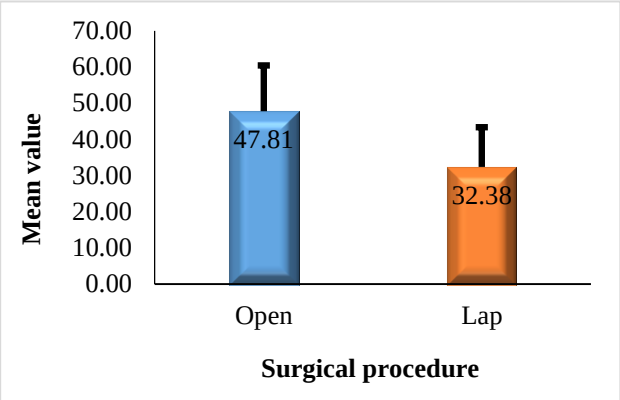

Figure 2: Age distribution - Mean Age (year).

Operative time

- Operating time of hernia repair varies considerably between surgeons and also between surgical centers and reduces with experience.
- In our study, most of the open cases were completed within 38.05 minutes while in the Lap group it took 62 minutes (Figure 3).

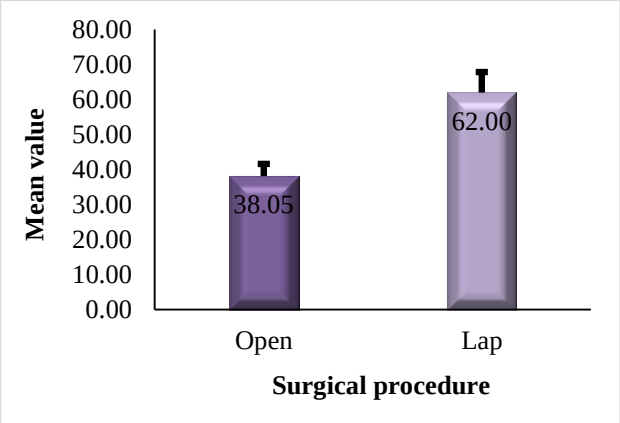

Figure 3: Operating time (Minutes).

Post op pain

It was assessed 6th hourly on day one and then daily during the first week followed by every week by telephone for the remaining 3 months using a visual analogue scale.

Post-operative pain (VAS score) was greatest in the open group 7.48 in comparison to 3.05 in lap group on the 1st day (Figure 4).

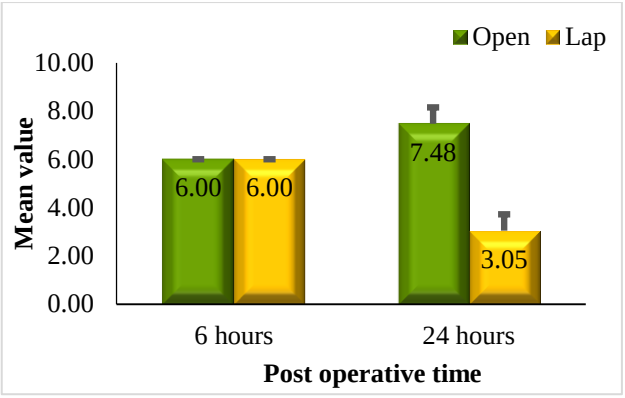

Figure 4: Post-operative pain (VAS).

Mean hospitalisation

Hospital stay: 32.29 hours (1.37 days) in the lap group and 85.52 hours (3.56 days) in the open group (Figure 5).

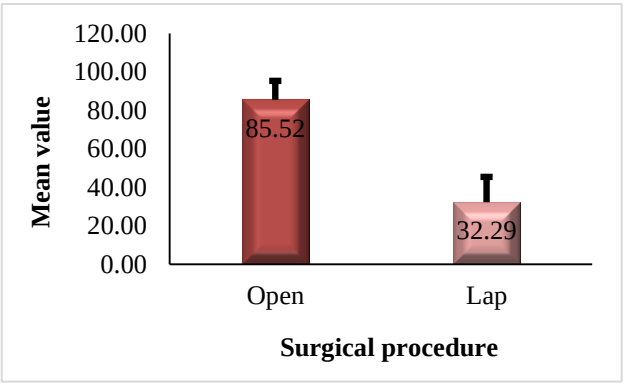

Figure 5: Mean hospital stay (hours).

Time to return to routine activity

In laparoscopic repair, the patients were able to perform routine activities by the 2nd day whereas most of the patients in the open group were able to perform routine activities by the 5th day (Figure 6).

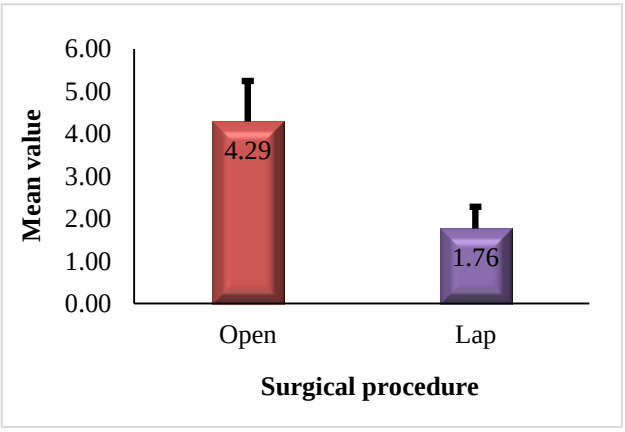

Figure 6: Return to daily activities (day).

Time to return to work

In our study, 70.29% in the lap group resumed work on the 14th day whereas 54.45% in the open group resumed work on the 16th day (Figure 7).

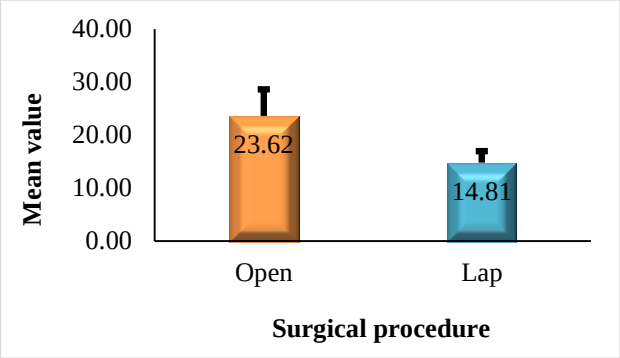

Figure 7: Return to work (days).

Complications

Wound infection and Recurrence was found to be higher in the open group 9.5% than in the Lap group (Figure 8).

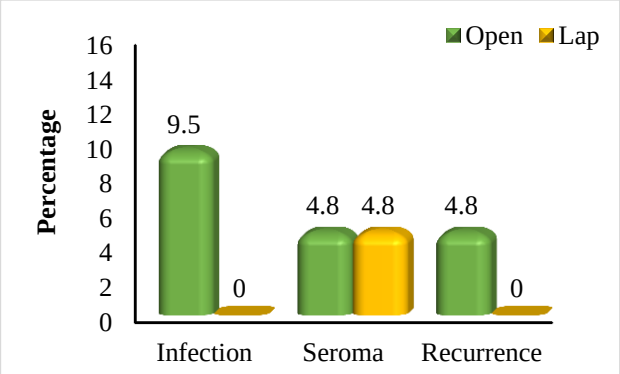

Figure 8: Complications.

Cost factor

- The cost benefit comparing open and lap hernia repair could not be done as all our patients were treated free of cost.
- Govt. offers Rs. 30000 for ventral hernia with mesh repair under Chief Minister's Comprehensive Health Insurance Scheme.
- The feasibility of providing lap hernia repair for the same cost was calculated by us.

Hospital cost: Though the operative costs were higher following lap ventral hernia repair there was a decrease in overall hospital cost. Shorter hospital stay and using reusable equipment reduced overall cost of procedure (Table 2).

Table 2: Cost factor analysis.

Parameters	Lap (Rs.)	Open (Rs.)
Mesh	Bilayered 25000	Prolene 8000
Fixation a. If tackers b. If sutures	 14000 300	 1300
Operation theatre charges	2500	2500
Hospital stay (750 per day)	1500	4500
Medicines (ward)	1500	4500
OT medicine (surgical/anaesthesia)	4000	3000
Fees a. Surgeon b. Anaesthetist	 7500 2500	 7500 2500
Total (Rupees)	58500	33800

DISCUSSION

The term hernia is derived from the Greek word meaning an offshoot or bulge. A ventral hernia is defined as a protrusion of intra-abdominal structures through a defect in the abdominal wall. Hence hernia is a defect and when not treated early becomes a disease.[1,2]

The thesis of inevitability: A link between strenuous activity and hernia occurrence is not the only cause and it is likely that a congenital or acquired weakness in the connective tissue or muscles is also present, indicating that the hernia occurrence was almost inevitable.

- Hendry et al. in 2009

All hernias occur at the sites of weakness of the abdominal wall which are acted on by repeated increase in abdominal pressure. The treatment of ventral hernia disease has evolved over decades. The surgical technique of ventral hernia repair has evolved markedly within the last fifty years. The introduction of prosthetic materials has made a paradigm shift in the surgical technique of hernia repair.

Patients with hernia of[1,4]

- Defects larger than 2 cm
- And previous umbilical hernia repairs of any size benefit from the lap technique

In the case of intraperitoneal implants, prosthesis must possess two simultaneously contradictory properties:

- It must stimulate adequate abdominal-wall incorporation, and therefore be capable of precipitating an intense fibroblastic reaction,

- But that very reactivity must not extend to the visceral interface, where the prosthesis can cause fibrotic adhesions capable of developing into fistulas

The first meshes to be introduced into hernia repair were composed of monofilament

- Polyethylene and polypropylene.
- They demonstrated good incorporation to the abdominal wall on one hand, but substantial side effects were reported.
- Animal and clinical studies revealed a number of serious mesh related complications: migration, erosion, adhesions and fistulation.

The development of new meshes composed of polyester or extended polytetraflouroethylene (ePTFE), have different pore size on the visceral and parietal side.[5]

In order to reduce the adhesive potential of monofilament IPM even further, without compromising incorporation to the abdominal wall, recent development has been the introduction of composite meshes.[6]

- They are characterized by a mono- or multifilament dual layer, having different properties on the parietal and visceral side.
- They are composed of polyester or polypropylene on the parietal side,
- While the visceral side is either coated with an absorbable film or covered by ePTFE to reduce formation of adhesions

The laparoscopic technique in ventral hernia repair, first proposed by the Blanche in 1993,[4,13] has been progressively accepted and used because of the benefits associated with laparoscopy

- Reduced postoperative pain
- Reduced hospital stay
- Fast recovery
- Shorter return to normal activity
- Reduction in the complications linked to decreased mobility
- Lower recurrence rates
- High Quality Of Life (QOL)
- And reduced socioeconomic cost

This technique involves posterior patching of the fascial defect with a large overlap of mesh, based on Laplace's law.

The large surface of the mesh

- Allows substantial tissue ingrowth for permanent mesh fixation,
- And the intraabdominal pressure tends to hold the mesh in place against the posterior fascia.

The main differences compared with the open technique are:

- The smaller incisions
- Minimal soft tissue dissection needed for the placement of a large mesh overlap
- And entry point at a different site, which decreases the incidence of wound complications

Patient characteristics

- In our study 47.6% males & 52.4% females underwent open repair.
- 38.1% males & 61.9% females underwent lap repair (Figure 9).

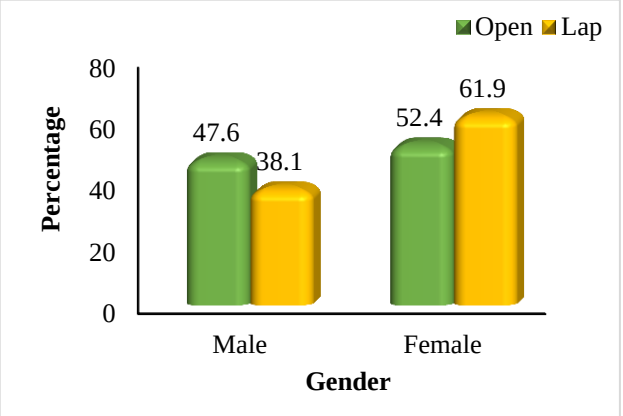

Figure 9: Gender distribution.

Operative time

- Operating time of hernia repair varies considerably between surgeons and also between surgical centers and reduces with experience. The Operating time decreases once the Surgeon attains proficiency in Lap Cholecystectomy and masters the anatomy.
- In our study, most of the open cases were completed within 38.05 minutes while in the Lap group it took 62 minutes.

Antibiotic prophylaxis

Single dose at induction reduces infection rate by 50% (Sarabria et al).

Antibiotic prophylaxis is not routinely indicated in elective open/lap hernia repair. Should be considered in:

- Advanced age.
- Recurrent hernia.
- Immunosuppressive conditions.
- Long duration of surgery.
- Use of drainage tube.

In our study all patients received a single dose of Injection Cefatoxime 1gm at the time of induction of anesthesia.

Acute post-operative pain

Acute post-operative pain is considered to reflect the amount of surgical trauma caused by an operative procedure.[10] Adequate postoperative analgesia is pivotal in achieving an optimal surgical outcome and patient satisfaction (Kehlet et al., 2001). Inadequate pain control will lead to an increased incidence of nausea, delayed recovery, prolonged hospital stay and unanticipated admissions after day surgery (Pavlin et al., 2002). Laparoscopic hernioplasty has been proven to confer less postoperative pain than open hernia repair and enhances the functional outcome - Liem et al., 1999.

Factors influencing post-operative pain

1. Age: Younger people have more pain in the post-operative period

◦ Lower pain threshold,

◦ Diminished number of nerve cells

◦ A slower clearance of analgesics from the body in the elderly (ready et al., 1987; Moore et al., 1990), old patients might have learned to cope with postoperative pain better than younger people. The elevated pain in young patients is attributed to their higher level of activity and more critical expectations for the postoperative course (Callesen et al. - 1998).

2. Gender: Women perceive more post-operative pain than men (Ellermeier et al., 1995; Keogh et al., 2001; Pickering et al., 2002

◦ The mechanism remains unclear but it has been attributed to biological, hormonal, psychological and physiological differences (Riley et al., 1998). Ellermeier et al. (1995)

3. Mesh stapling: Patients who had prosthetic stapling reported a significantly higher pain score on straining but equivalent pain score at rest compared to those without stapling.[10,14]

4. Trocar size: Reducing the size of the trocars does not reduce post-operative pain.

In our study, Post-operative pain (VAS score) was greatest on the 1st day in the open group - 7.48 in comparison to - 3.05 in the Laparoscopic group. Younger age group and female patients were found to have more pain compared to the rest.

Return to routine activity

Immediate resumption of normal activities is recommended after hernia surgery as long as the patient can carry out the activity comfortably (Iles JD, dsz1972). Normal activity has not been shown to increase the risk of hernia recurrence or jeopardize wound healing (Bourke et al., 1978; Barwell NJ, 1981). It has been reported that after laparoscopic hernia repair patients tends to return to normal activity earlier than after conventional repair[12].

In our study: Laparoscopic repair the patients were able to perform routine activities by the 2nd day whereas most of the patients in the open group were able to perform routine activities by the 5th day only.

Return to work

In 1970s and 1980s, patients often took two to three months off work after open hernia repair (Welsh et al., 1978; Semmence et al., 1980; Bourke et al., 1981). In the past 2 decades, the reported convalescence period following umbilical hernia repair has been decreasing (Rider et al., 1993; Robertson et al., 1993) and most of patients returned to work in 3 weeks in United Kingdom (Rider et al., 1993; Robertson et al., 1993).

Fear of hernia recurrence is the main concern of patients with respect to early return to work (Kerry RL, 1971).

Patients with active and heavy work duties took a median sick leave of 7 weeks. The impact of occupation on convalescence seems to be universal in all countries. Patients should be advised and encouraged to return to work once they feel comfortable (Taylor et al., 1983). The decision of returning to work is mainly based on patients' own assessment of their physical condition. As prolonged sick leave may result in loss of income or even the job, economic consideration is a major impetus in returning to work early. Most patients managed to return to work within 3 weeks following ambulatory umbilical hernia repairs. A sick leave of 3 weeks appears to be

appropriate for most patients after uncomplicated ambulatory umbilical hernia repair.[12]

A significant benefit of laparoscopic hernioplasty is an earlier return to work (Andersson et al., 2003). This translates into a significant economic savings to the society because of fewer working days lost (Heikkinen et al., 1998; Lal et al., 2003).

Liem et al. (1997) proved that patients who underwent laparoscopic hernia repairs regained their physical performance faster and returned to full activity earlier than those after conventional hernia repairs.

Complications

Limitations of laparoscopy:[15]

Nonetheless, laparoscopy is not always possible and it has limits associated with:

- The patient's general condition
- Potential anaesthetic complications
- Number of previous surgical interventions and their likelihood of invoking sepsis,
- The characteristics of the hernia, it's size and reducibility of the sac
- Mechanical limits that prevent solid repair
- Problem associated with the size of the prosthesis

Complications

- Prolonged ileus
- Seroma (present for >8 weeks)
- Iatrogenic bowel injury
- Chronic pain
- Post-operative respiratory distress
- Mesh infection
- Mesh removal

Wound infection

It was found to have Lower incidence in Lap repair.[16]

Seroma

Seroma is a collection of serum in a surgical wound. Its Incidence is 2.4% for Open Hernia Repair and 5.7% for laparoscopic hernia repair.[9] It contains leukocytes and may also contain some red blood cells. Formation of seroma in the wound of patients after hernia repair is rather common and typically presents on the third or fourth post-operative day. They are especially seen after repair of a large hernia. Wound appears raised but not inflamed.

Seroma is found to occur more with laparoscopic repairs (12.2 %) than after conventional repair (8.9%) and the overall incidence being in the range of 5-25% (Hernia surgery - Palanivelu).

Steps to prevent seroma formation[15]

- Minimal dissection of the hernia sac.
- Most seroma resolve spontaneously over 4-8 weeks though in some cases it may persist even for months. Usually requires only conservative management.
- Persistent/Symptomatic seroma may require surgical intervention rarely.

Cost effectiveness

Laparoscopic repair is more expensive than conventional repairs from a hospital perspective, but from a societal point of view 75% of these extra costs can be offset.

The fact that patients after laparoscopic repair are able to return to work earlier is not included in most of the large scale studies, but when it's done the effective difference between conventional and laparoscopic repairs will become even less.

Cost containment strategies are:[12]

- Reusable laparoscopic instruments
- Sutures for fixation of the mesh

Cost-benefit ratio

Laparoscopic repair was found 12% to 15% costlier than Conventional repair. While deciding the cost benefit ratio of Lap vs. Open repair, the long-term benefits like early return to work and reduced recurrence rates were taken into consideration[12] (Table 3).

Table 3: Cost benefit analysis.

Cost	Lap	Open	Difference (Lap-Open)
Hospital cost	58500	33800	24700
Community cost (sick leave)	1200	7200	6000
Total cost	59700	41000	18700

Mesh fixation

Staples or titanium screws are commonly used. It has been found that these staples could cause chronic pain.[8] To overcome this, the mesh can be left in place without fixation or it can be fixed with fibrin glue. Both methods although appear effective their impact on chronic pain is unclear. Recently absorbable tacks are available for fixation of the mesh. The most novel method of fixation is a "self-gripping" mesh with micro hooks made of polylactic acid which is semi-absorbable.[15]

Inference

The study clearly favors laparoscopic umbilical hernia repair over conventional open repair:

- No cut on the muscles as the holes are made in between the fibres.
- Pain is minimum.
- Less hospital acquired infections.
- Early return to work.
- No residual weakness.
- Low chronic pain frequency.
- Low incidence of recurrence.

Lap repair advantages

- Larger mesh placed serves the purpose even after maximal allowance for mesh contraction
- Although complications are quiet rarely reported in laparoscopic repair, can be avoided with adequate knowledge of anatomy and meticulous dissection
- Early return to routine activities and work plays an important role in reducing the overall operational cost.
- Quality Adjusted Life Years (QALY) is better with laparoscopic repair than open repair.

PROS and CONS - open/lap repair

- Open repair can be performed by all surgeons under any anaesthesia, as day care procedure.
- There is no learning curve and working cost is less in open repair.
- Laparoscopic repair is only 12 to 15% costlier than open repair in this study.
- The learning curve and slightly increased working cost are the disadvantages, which have been overcome today by using re-usable equipment and mastering the anatomy.

Impact

Laparoscopic ventral hernia mesh repair though considered as an advanced procedure can be easily performed by a surgeon proficient in laparoscopic cholecystectomy.

The first step is a proper understanding & knowledge of Endo anatomy which reduces the apprehension.

The so-called learning curve can be overcome by performing the initial cases under the supervision of a trained laparoscopic surgeon

Cost cutting measures to be adopted are:

- Usage of reusable instruments as in Open procedures
- Cost of lap instruments can be reduced
- Hospitals to reduce equipment cost as the same are used for other popular laparoscopic procedures
- Manufacturers must lend an ear to market needs. e.g. To reduce number of tacks in a disposable tacker.

Why lap hernia repair is important in India

- In the west,
  - The support systems are better.
  - Travel by car or by public transport - user friendly
  - Existence of ramps and escalators at railway stations and subways.
  - Most people can afford a rest after surgery.
- In India, the situation is quite the reverse.
  - Buses have high steps and usually it is a fight or atleast a struggle to get on to the bus.
  - No ramps in most railway stations or subways.
- All the systems require straining, if someone who has had surgery has to go out.
- Hence minimally invasive procedure like laparoscopy for ventral hernia is more appropriate for countries like ours than to the US and Europe.

Impact of providing lap ventral hernia repair in govt. hospitals

- The myth that laparoscopic ventral hernia repair is for corporate hospitals only has been broken and it can be performed in govt. hospitals.
- The government hospitals, which offer modern health care to the lower socioeconomic group, can also offer laparoscopic hernia repair to them.

- Most of our patients suffering from umbilical/par umbilical hernia are daily wage manual laborers. Offering them laparoscopic hernioplasty will provide quicker convalescence and make them return to work early.

- Patients start earning soon reducing financial stress on the family thereby preventing the children from going to work and enabling them to continue their studies.

- Also the earlier convalescence reduces emotional burden and apprehension of the family in caring for the operated person.

- This allows the members of the family to devote time and energy to other valuable issues in the family.

- Laparoscopic hernioplasty is slowly replacing Open herinioplasty as the gold standard of Umbilical hernia repair.

- Increased Cost and Learning Curve are only over blown myths.

They can be easily overcome by mastering an in depth knowledge of Endo anatomy and technical dexterity and using re-usable equipment and promoting day care surgery (Table 4).

Table 4: Impact of the study.

Parameters	Lap repair	Open repair
Anaesthesia	General	Local/Regional
Age group	32.8 years	47.81 years
Operative time	62 minutes	38.05 minutes
Post-op pain	Less	Mild to moderate
Hospital stay	1.3-2 days	3.5-6 days
Return to routine activities	1-2 days	4-6 days
Return to work	1-2 weeks	3-4 weeks
Complication	Seroma	Wound infection
Recurrence	Less	Slightly more
Cost (Rupees)	58500	33800

CONCLUSION

- This laparoscopic hernia repair is a complex but very efficient method in experienced hands. To achieve the best possible results, it requires an acceptance of a learning curve, structured well-mentored training and high level of standardization of the operative procedure

- Though the cost of bilayered mesh and fixation device are high in Laparoscopic repair, the patient benefits in terms of less hospital stay, less pain and early return to routine activity and work make it superior to Open repair.

- Laparoscopic umbilical/para-umbilical hernia repair is technically safe, effective and feasible, with a better clinical outcome in patients seeking treatment in a government hospital set-up

- With increasing experience, and development of new meshes and fixation devices, it is now an accepted option in the management of ventral hernia, associated with few adverse effects

Laparoscopic hernioplasty has 3 G effect

- Good to the patient & family - less post-operative pain, better cosmesis, early return to daily activity and work.

- Good to the employer/insurance company - early return of employee to work, less sick leave and no necessity to find a replacement.

- Good to the society - earlier return to work and less work loss days cause considerable economic savings to the society.

"The final word on hernia will probably never be written. In collecting, assimilating and distilling the wisdom of today we must provide a base from which further advances may be made". - Sir John Bruce.

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Ethical approval: The study was approved by the institutional ethics committee

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