A comparative study of various open methods of inguinal hernia repair in our hospital

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ABSTRACT *Background:* prospective study of 100 cases of inguinal hernias which were treated by four different surgeries viz., The Modified Bassini, The Shouldice, The Lichtenstein and The Mesh Plug techniques. The study was conducted with an objective to compare the effectiveness of the four procedures and complications if any.

Methods: 100 cases of inguinal hernia admitted in JSS Medical College Teaching Hospital, Mysore were selected on the basis of the nonprobability (purposive) sampling method.

Results: In the post operative period, severe pain was complained in 7 cases of Shouldice repair and 1 case of Modified Bassini while 7 cases of Lichtenstein and 10 cases of Mesh plug had pain-free postoperative period. Post-operative wound infection developed in 2 cases of Modified Bassini, 2 in Shouldice and 1 in Lichtenstein repair. Haematoma at the operated site was found in 2 cases of shouldice and 1 in Mesh Plug repair. The duration of hospitalization was 1-3 days in 1 case of Lichtenstein and 6 cases of Mesh plug and was >9 days in 1 case of Modified Bassini, 3 cases of Shouldice and 3 cases of Lichtenstein repair while in the rest it ranged from 4-9 days. In the study period no recurrence of hernia was recorded.

Conclusion: The patients who underwent tissue repairs, especially Shouldice complained of higher intensity of pain which could probably be attributed to the extensive dissection involved. The postoperative haematoma and infection rates were insignificant.

INTRODUCTION

Of the study of the many operations available in a general surgeon's armamentarium, that of hernia repairs has been written about repeatedly[1]. The rapid changes that have been witnessed in open approach surgeries, prosthetic materials and laparoscopic surgeries have made hernia surgery a most interesting field of endeavour that demands renewed discipline and dedication[2]. Though a variety of procedures are performed none can be termed as an ideal procedure as each one is accompanied by varied early and late complications, the most significant being recurrence. In 1891, William Bull, one of the most prominent surgeons, wrote of hernia repairs, "It is wise to estimate the value of given procedures by the relative proportion of relapses"[3].

In our institution, inguinal hernia repair is one of the common surgeries performed daily. This study aims at studying the effectiveness of 4 different hernia repairs viz. The Modified Bassini, The Shouldice repair, The Lichtenstein repair and The Mesh plug technique and to arrive at a conclusion as to the best modality of treatment after comparison of morbidity and recurrence of various procedures among themselves and in relation to standard published material.

OBJECTIVES

- To compare the effectiveness of the different surgeries viz. The Modified Bassini repair, The Lichtenstein repair, The Shouldice repair and The Mesh Plug technique.
- To compare the results of different techniques and complications if any.
- To arrive at a conclusion as to the best modality of treatment in the present setup.

METHODOLOGY

- The present study is a prospective study of 100 cases of inguinal hernia admitted in JSS Medical College Teaching Hospital, Mysore during the study period.
- 100 cases for the purpose of the study were selected on the basis of the nonprobability (purposive) sampling method.

The inclusion criteria are:
- All patients with direct and indirect inguinal hernia were included in the study
- Uncomplicated hernias included
- Hernias treated with open approach surgeries were included

The exclusion criteria are:
- Infants with inguinal hernias
- Recurrent hernias
- Complicated hernias
- Hernias treated with laparoscopic method

The data was collected in a prepared proforma.

The diagnosis of inguinal hernia was made by clinical examination.

The preoperative evaluation included history and clinical findings.

Routine lab investigations like Hb%, urine examination, RBS, Serum urea and creatinine, HIV, HBsAg were done.

X Ray and ECG were done for patients above 40 years for anesthetic evaluation.

Preoperative treatment included:
- Correction of anemias
- Weight reduction if obese
- Improvement of nutritional status
- Treatment of respiratory infection of any
- Abstinence from smoking /alcohol

- Advice regarding breathing exercises

The type of anesthesia used was spinal anesthesia
The patients were randomly chosen for the 4 different hernia repairs viz The Modified Bassini repair, The Shouldice repair, The Lichtenstein repair, and The Mesh Plug technique. However, patients with poor muscle tone were advocated hernioplasty.

A single dose of preoperative broad spectrum antibiotic given followed by the same for 3 days postoperatively.

Analgesics - Injection Diclofenac Na was given postoperatively for 2 days and later SOS.

Post operative care and complications
After surgery all patients were monitored carefully for pain, bleeding, wound infection and urinary retention.

Pain was assessed using verbal graphic rating scale.
A wound infection ranged from minimal discharge of pus from a single cutaneous suture to extensive and invasive process requiring lengthy hospitalization and intravenous antibiotics.

Bleeding was defined as subcutaneous haematoma which can result from careless ties or cautery.

Urinary retention was termed as inability to urinate requiring catheterization.

Discharge
The patients were discharged when fit and asked to come for regular follow up after 15 days, 1 months, 3 months, 6 months, 1 year and 2 years. Different patients were followed up for different periods with many dropouts. The patients were advised to return to prehernia lifestyle except lifting heavy weights.

All were followed-up for post-operative pain, interference with activities of daily living, use of analgesics, visit to a GP and recurrence.

The age / sex incidence, mode of presentation, precipitating factors, surgical treatment, post operative complications were all evaluated and compared with standard published literature.

RESULTS
Statistical methods employed in the analysis Following statistical methods were employed in the present study\
- Contingency Coefficient Analysis
- Chi-square test
- Independent samples 't' test

Contingency Coefficient Analysis by Cross tabs procedure
The Crosstabs procedure forms two-way and multiway tables and provides a variety of tests and measures of association for two-way tables. The structure of the table and whether categories are ordered determine what test or measure to use. Crosstabs' statistics and measures of association are computed for two-way tables only. If you specify a row, a column, and a layer factor (control variable), the Crosstabs procedure forms one panel of associated statistics and measures for each value of the layer factor (or a combination of values for two or more control variables). For example, if GENDER is a layer factor for a table of MARRIED (yes, no) against LIFE (is life exciting, routine, or dull), the results for a two-way table for the females are

computed separately from those for the males and printed as panels following one another.

Chi-Square Test
The Chi-Square Test procedure tabulates a variable into categories and computes a chi-square statistic. This goodness-of-fit test compares the observed and expected frequencies in each category to test either that all categories contain the same proportion of values or that each category contains a user-specified proportion of values.

Independent samples 't' test
The Independent-Samples T Test procedure compares means for two groups of cases. Ideally, for this test, the subjects should be randomly assigned to two groups, so that any difference in response is due to the treatment (or lack of treatment) and not to other factors. This is not the case if you compare average income for males and females. A person is not randomly assigned to be a male or female. In such situations, one should ensure that differences in other factors are not masking or enhancing a significant difference in means. Differences in average income may be influenced by factors such as education and not by sex alone.

Table 1 : Age and sex distribution

Age groups		Sex		Total
		Male	Female	
21-30	F	24		24
	%	24.7%		24.0%
31-40	F	19	2	21
	%	19.6%	66.7%	21.0%
41-50	F	27		27
	%	27.8%		27.0%
51-60	F	9	-	9
	%	9.3%	-	9.0%
61-70	F	14	1	15
	%	14.4%	33.3%	15.0%
70+	F	4		4
	%	4.1%		4.0%
Total	F	97	3	100
	%	100.0%	100.0%	100.0%

CC - 0.233   P < 0.332

In our study the incidence of hernia was common in the younger age group, greatest in the 41-50yrs age group and men were affected more than women.

Table 2 : Mean age and standard deviation

	N	Mean	Std. Deviation	Minimum	Maximum
Male	97	44.16	16.00	21	85
Female	3	47.33	19.73	34	70
Total	100	44.26	16.02	21	85

t=0.336   P < 0.738 (NS)

Table 3 : Occupational status

Valid	Frequency	Percent	Cumulative percent
Farmer	34	34.0	34.0
Labourer	23	23.0	57.0
Teacher	13	13.0	70.0
Conductor	8	8.0	78.0
Student	10	10.0	88.0
Others	12	12.0	100.0

Total	100	100.0	

Chi-square for occupation - 29.720 P < 0.000

The occurrence of hernia is common among the farmers and labourers accounting for 57% in comparison to other occupations like teacher or conductor

Table 4 : Symptoms

Symptoms Right		Position		Total
		Left		
Swelling	F	31	23	54
	%	47.7%	51.1%	49.1%
Swelling with pain	F	33	21	54
	%	50.8%	46.7%	49.1%
Pain	F	1	1	2
	%	1.5%	2.2%	1.8%
Total	F	65	45	110
	%	100.0	100.0	100.0%

CC – 0.045   P < 0.895

54 % of patients presented with swelling in the groin while a similar 54 % presented with pain associated with swelling and only 2 % of them presented with pain alone.

Table 5 : Duration of symptoms

Duration –Right		Position		Total
		Right	Left	
<1 year	F	51	36	87
	%	78.5%	80.0%	79.1%
1-2 years	F	6	2	8
	%	9.2%	4.4%	7.3%
2-3 years	F	3	2	5
	%	4.6%	4.4%	4.5%
3-4 years	F	4	-	4
	%	6.2%	-	3.6%
4+ years	F	1	5	6
	%	1.5%	11.1%	5.5%
Total	F	65	45	110
	%	100.0%	100.0	100.0%

CC – 0.262   P < 0.089

79.1% patients presented within the first 1 yr of onset of complaints while 5.5 % of them presented after 4 yrs.

Table 6 : Extent of hernia

Extent – Right		Position		Total
		Right	Left	
Incomplete	F	49	36	85
	%	76.6%	78.3%	77.3%
Complete	F	15	10	25
	%	23.8%	21.3%	22.7%
Total	F	64	46	110
	%	100.0%	100.0%	100.0%

CC – 0.020   P < 0.834

The hernia was incomplete in 85 cases and complete in 25 cases

Table 7 : Personal history

Valid	Frequency	Percent	Valid percent	Cumulative percent
Smoker	27	27.0	27.0	27.0
Non-Smoker	73	73.0	73.0	100.0
Total	100	100.0	100.0	

In our study 27 % were smokers and 73 % non smokers

Table 8 : Precipitating factors

Valid	Frequency	Percent
BPH	2	3.2
COPD	4	6.5
Constipation	2	3.2
Strenous work	32	51.6
BPH and Str. Work	5	8.1
COPD and Str. Work	10	16.1
Consti and Str. Work	7	11.3
Total	62	100.0

Chi-square - 75.968   P < 0.000

The incidence of hernia was more common in people who undertook strenuous work accounting for 51.6 % of cases. It was also a component in 35.5 % of patients who had two precipitating factors.

Table 9 : Associated illness

Valid	Frequency	Percent
HTN	8	50.0
DM	3	18.8
IHD	1	6.3
Multiple	4	25.0
Total	16	100.0

8 % of the patients suffered from hypertension while 16 of them had multiple illness like hypertension, diabetes and ischaemic heart disease

Table 10 : Abdominal tone

Valid	Frequency	Percent
Good	73	73.0
Poor	27	27.0
Total	100	100.0

The abdominal tone was good in 73 % of the patients and poor in 27 %

Table 11 : Types of hernia

Valid	Frequency	Percent
Right-indirect	34	34.0
Right-direct	16	16.0
Left-indirect	23	23.0
Left-direct	11	11.0
Pantaloon	6	6.0
Bilateral	10	10.0
Total	100.0	100.0

Chi – square   31.880   P < 0.000

Right indirect hernia was seen in 34 cases being the most frequent type while pantaloon was the least common accounting for 6 cases
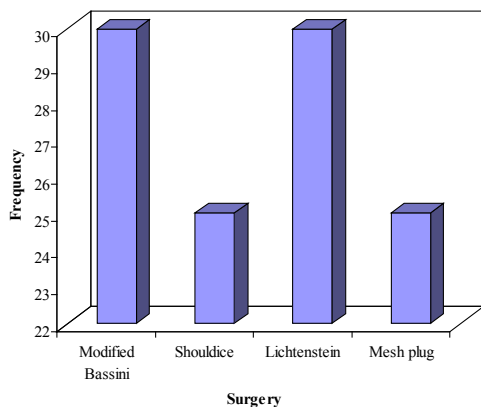
Table 12 : Types of surgery

Surgery		Position		Total
		Right	Left	
Modified Bassini	F	17	13	30
	%	26.6%	28.3%	27.3%
Shouldice	F	15	10	25
	%	23.4%	21.7%	22.7%
Lichtenstein	F	16	14	30
	%	24.2%	31.8%	27.3%

Meshplug	F	16	9	25
	%	24.2%	20.5%	22.7%
Total	F	66	44	110
	%	100.0%	100.0%	100.0%

CC – 0.080   P < 0.873

Fig. 26 : Types of surgery

In our study 30 cases each underwent Modified Bassini and Lichtenstein repair while 25 cases underwent Shouldice and Mesh plug repair. They were randomly chosen for the different surgeries
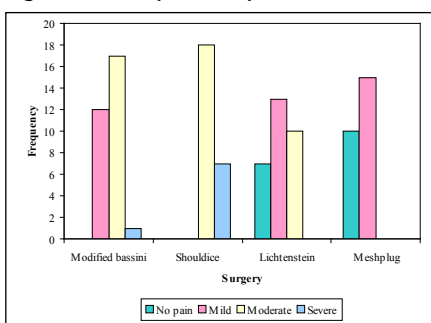
Complications of surgeries

Table 13 : Postoperative pain

Surgery		Post operative pain				Total
		No pain	Mild	Mod-erate	Se-vere	
Modified bassini	F	-	12	17	1	30
	%	-	40.0%	56.7%	3.3%	100.0%
Shouldice	F	-	-	18	7	25
	%	-	-	72.0%	28.0%	100.0%
Lichtenstein	F	7	13	10	-	30
	%	23.3%	43.3%	33.3%	-	100.0%
Meshplug	F	10	15	-	-	25
	%	40.0%	60.0%	-	-	100.0%
Total	F	17	40	45	8	110
	%	15.5%	36.4%	40.9%	7.3%	100.0%

CC – 0.625   P < 0.000

Fig 27 : Post operative pain

Severe pain was complained in 7 cases of Shouldice repair and 1 case of Modified Bassini while 7 cases of Lichtenstein and 10 cases of Mesh plug had pain-free postoperative period

Table 14 : Wound infection and haematoma

| Surgery | Infection | | Haematoma | |
| | Frequency | Percent | Frequency | Percent |

Modified Bassini	2	1.81	0	0
Shouldice	2	1.81	2	1.81
Lichtenstein	1	0.91	0	0
Meshplug	0	0	1	0.91
Chi-square	0.40		0.333	
P value	0.819 (NS)		0.564 (NS)	

**Fig. 28 : Wound infection and haematoma**
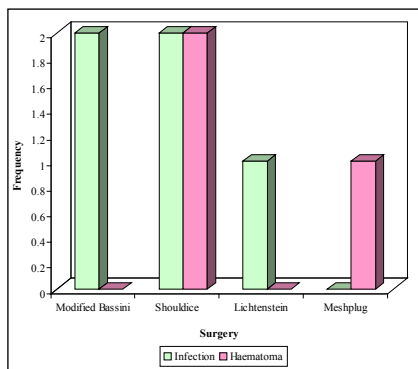
Post-operative wound infection developed in 2 cases of Modified Bassini, 2 in Shouldice and 1 in Lichtenstein repair. Haematoma at the operated site was found in 2 cases of shouldice and 1 in Mesh Plug repair.

Table 15 : Duration of hospitalization

Surgery		Hospitalization				Total
		1-3 days	4-6 days	7-9 days	>9 days	
Modified bassini	F	-	11	18	1	30
	%	-	36.7%	60.0%	3.3%	100.0%
Shouldice	F	-	-	22	3	25
	%	-	-	88.0%	12.0%	100.0%
Lichtenstein	F	1	11	15	3	30
	%	3.3%	36.7%	50.0%	10.0%	100.0%
Meshplug	F	6	15	4	-	25
	%	24.0%	60.0%	16.0%	-	100.0%
Total	F	7	37	59	7	110
	%	6.4%	33.6%	53.6%	6.4%	100.0%

CC – 0.544   P < 0.000

Fig. 29 : Duration of hospitalization
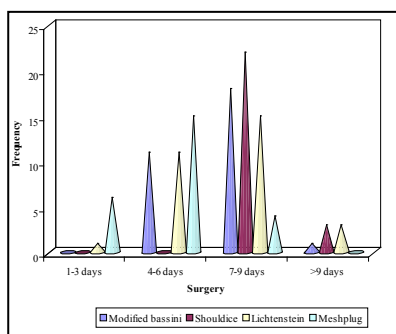
The duration of hospitalization was 1-3 days in 1 case of Lichtenstein and 6 cases of Mesh plug and was >9 days in 1 case of Modified Bassini, 3 cases of Shouldice and 3 cases of Lichtenstein repair while in the rest it ranged from 4-9 days.

Discussion

In the study of Ira M. Rutkow, the highest incidence was in the age group 45-64 which was 30 cases and next was 26 cases both in 15-44 and >65 age group. In our study, 50 cases were in 15-44 age group and 16 cases in >65 age

group.

In a study by Ira M. Rutkow, 90% of total cases were male and 10% female. In a study by Martin Kurzer[105] of British hernia centre, 97% cases were male and 3% female. The sex incidence of our study is comparable with the British hernia centre results.

In our study the farmers and labourers who constitute 57% are comparable with constantly / intermittently strenuous work group of M. Bay Nielson, who constitute 47.2%. Also the teachers and conductors who make up 21% in our study are comparable with the walking, no heavy lifting group of 28.3%.

In the present study 98.2% presented with swelling in the inguinal region and only 1.8% presented with pain alone with no swelling and 49.1% presented with swelling and pain. The pain complained of was dull aching type.

In a study by Mike S.L. Liem and others, 93% presented with swelling in the groin and 83% with discomfort and / or pain. The low incidence of pain in our study in comparison to that of Mike S.L. Liem and others, can be explained by high threshold of pain in the Indian population.

In a study by Mike S.L. Liem and others, the precipitating factors were COPD in 10%, BPH in 5% constipation in 5%, strenuous activity in 24%.

In our study on comparison to the study by Mike S.L. Leim and others, the number of people, involved in strenuous work is 51.6% (farmers and labourers) and the high incidence is explained by the fact that agriculture is the main occupation in India.

The unfortunate evolutionary defect is humans, the absence of posterior rectus sheath below the arcuate line and only a rather insubstantial transversalis fascia, unsupported by muscle or aponeurosis, resisting the intra-abdominal pressure and holding the breach between the abdomen and thigh is compounded by humans having adopted the upright posture and changed from quad-rapedal and bipedal location. It is believed that this change has opened up and stretched the groin region and brought about alterations in the functional efficacy of the shutter mechanism which led to greater propensity to develop inguinal hernia.

In the present study 30 cases each underwent modified Bassini and Lichtenstein repair while 25 cases each underwent shouldice and Mesh plug repair. The patients were randomly chosen for the different surgeries. In cases of bilateral hernia, both sides were operated simultaneous as it obviates the need for a second anaesthesia and surgery, decreased psychological stress, financial savings and avoidance of risk of incarceration or disability caused by hernia on the opposite side.

In the present study only immediate post operative pain was evaluated. the severity of pain was more for tissue repairs i.e., Modified Bassini and Shouldice, more so in the Shouldice and less in the Lichtenstein and Mesh plug repairs. This can be probably explained by the extensive dissections involved in the tissue repairs. In a study by James E. McGillicuddy, with a sample of 672 men, 3 of Shouldice and 6 of Lichtenstein complained of neuritis of >1m duration. In our study chronic pain was not assessed and this is important to assess chronic persistent pain intrinsic to each type.

Infection as a complication may be recognised as only a minimal discharge of pus from around a single cutaneous suture, or it may be an extensive and invasive process requiring lengthy hospitalization, intravenous antibiotics and repeated operations. In our study 1.81% of Modified Bassini, 1.81% of Shouldice and 0.91% of Lichtenstein developed post operative wound infection. Here the p-value was found to be insignificant i.e., 0.819. In a study by Emmanouilidis T, it was 1% in Modified Bassini. In a study by Robert Bendavid, it was 1% in Shouldice, as per Martin Kurzer it was 1.3% in Lichtenstein and 1% in Mesh Plug as per T. Fasih. Our study is comparable with these studies.

In our study, the incidence of haematoma was 1.81% in Shouldice and 0.91% in Mesh Plug. Here the p-value was insignificant i.e., 0.564. In a study by Emmanouilidis T it was 0.6% in Modified Bissini, as per Robert Bendavid116 it was 0.3% in Shouldice, as per Martin Kurzer it was 2% in Lichtenstein and 2% in Mesh Plug as per a study by T. Fasih.

None of the patients with tissue repair were discharged during this early postoperative period. 1 case of Modified Bassini, 3 of Shouldice were discharged after 9 days and 3 of Lichtenstein (1 was bilateral) were discharged late because of other medical conditions. From the study it can be derived that Shoudlice required longer period of hospitalization i.e., 22 cases (7-9 days) and 3 cases (>9 days). This can be attributed to the higher postoperative pain score recorded secondary to extensive dissection required.

In our study no recurrence was recorded, as the follow-up was inadequate. Patients were asked to come for regular follow up but there were many drop outs. The truth of the matter is that apparently most patients who have recurrences go to another surgeon to have them repaired.

CONCLUSION

The present study is a comparative study of four types of open methods of inguinal hernia repairs viz. The Modified Bassini, The Shouldice, The Lichtemstein Tension free Mesh repair and The Mesh Plug repair. The study was conducted with an intention to compare the effectiveness of the different surgeries and complications if any. All patients were intensively monitored in the immediate post operative period and the complications noted. The patients who underwent tissue repairs, especially Shouldice complained of higher intensity of pain which could probably be attributed to the extensive dissection involved. The post-operative haematoma and infection rates were insignificant. The patients were followed up in the postoperative period for variable durations. Drop-outs to followup were many. Therefore no recurrence was noted during the study period.

With limited follow up, it can be concluded that except for a higher intensity of pain complained of in the tissue repairs, all the four procedures are comparable but need to be followed up for years to conclude on the long term effects.

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