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Original Research Article

A comparative study of Lichtenstein hernioplasty performed under spinal anaesthesia versus local anaesthesia in treatment of unilateral inguinal hernia

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ABSTRACT

Background: Lichtenstein mesh repair technique is widely used throughout the world in inguinal hernia repair. Hernioplasty done under local anaesthesia certainly has some benefits but it is yet to be proven as standard procedure. The aims of this study are to provide the data of a comparative study between Lichtenstein hernioplasties done under local versus spinal anaesthesia as well as add more data in this scenario.
Methods: In this non randomized clinical study, 84 patients were selected by calculation of sample size. 42 patients were operated under spinal anaesthesia and another 42 were operated under local anaesthesia.
Results: Mean duration of operation was slightly was slightly more in local anaesthesia i.e. 62.5 minutes (SD=17.8) versus 51.1 minutes (SD=21.5) in spinal anaesthesia. At 6 hours, 12 hours and 24 hours postoperative pain was significantly less in local anaesthesia group in comparison to spinal anaesthesia group with p=0.04, p=0.042, p=0.041 respectively. Postoperative complications like urinary retention, hypotension, and headache were more in spinal anaesthesia than in local anaesthesia. Duration of hospital stay was significantly less in local anaesthesia group i.e. 24.5 hours (SD=12.8) in comparison to spinal group 57.1 hours (SD=16.7).
Conclusions: The study concludes that in local anaesthesia group, postoperative pain was significantly less and postoperative complications like urinary retention, headache, and hypotension were less evident compared to spinal anaesthesia. Hence the study concludes that local anaesthesia can be used as an alternative of spinal anaesthesia as a standard mode of anaesthesia for Lichtenstein hernioplasty operation.

Keywords: Inguinal hernia, Lichtenstein repair, Hernioplasty, Spinal anaesthesia, Local anaesthesia

INTRODUCTION

A hernia is the bulging of part of the contents of the abdominal cavity through a weakness in the abdominal wall.[1] 75% of abdominal wall hernias occur in the groin, and it has been documented that while the lifetime risk of inguinal hernia is 27% in males, it is 3% in females, indicating thereby a gender predisposition of inguinal hernias.[2,3] Incidence of inguinal hernia has a bimodal age distribution in males, with peaks before the first year and after 40 years of age.[4]

Various open techniques of repair of inguinal hernia, like Shouldice and McVoy, Bassini, Lichtenstein etc., have been known and practiced till date. Among above mentioned techniques, Lichtenstein mesh repair technique is widely used throughout the world.[5] Historical background be considered, Lichtenstein

method of inguinal hernia repair had initially been done under local anaesthesia at the Lichtenstein clinic, but it is also done under spinal anaesthesia as a standard procedure in current days practice.[6]

Like in any surgical procedure performed under spinal anaesthesia when hernioplasty is carried out there are complications of spinal anaesthesia itself in many instants. Common complications which follows the administration of spinal anaesthesia in immediate and post-operative periods are hypotension, nausea, vomiting, post dural puncture headache, urinary retention and so on.[7-10] But the incidence of all the above mentioned complications is quite low in case of local anaesthesia.

There were comparative studies done between Lichtenstein hernioplasty performed under spinal anaesthesia and that under local anaesthesia. The results were different in different studies. Studies in the past were mainly done outside India, which is the reason behind non availability of Indian data. Hernioplasty done under local anaesthesia certainly has some benefits but it is yet to be proven as standard procedure. The aims of this study are to provide the data of a comparative study between Lichtenstein hernioplasties done under local versus spinal anaesthesia as well as add more data in this scenario.

Objectives of the study

This study aims to compare hernioplasty done under spinal anaesthesia and local anaesthesia and to find out better anaesthesia choice for the procedure. Comparison of Lichtenstein hernioplasty under spinal anaesthesia v/s local anaesthesia with respect to clinical outcome of hernioplasty based on preoperative, intra operative and postoperative factors (pain, complication, duration of stay in hospital) and also to evaluate proper technique for painless procedure in between spinal anaesthesia and local anaesthesia.

METHODS

This non randomized clinical study was conducted by Department of General Surgery at College of Medicine and JNM Hospital, Kalyani. The study was conducted during the period from January 2018 to June 2019 which included all patients undergoing hernioplasty operation for unilateral inguinal hernia repair during the study period.

A total of 84 patients were studied, 42 in one group named S Group and 42 in other group named L. Calculation is based on fact that 60% of the surgeries are done under spinal anesthesia and 40% in local anesthesia in College of medicine and JNM hospital, Kalyani on routine basis.

Calculation of sample size

Confidence interval = 95%
Power of test = 80%
P_1=Proportion of group 1
P_2=Proportion of group 2
r= Ratio (group 2/group 1)
$z_{\alpha/2}$= Desired level of statistical significance (Typically 1.96; for α=0.05)
z_β = Desired power (Typically 0.84; for 80% power)

$$\bar{p} = \frac{P1+P2}{2}$$

n = Sample Size in each group

As per Pocock formula[22]

$$n = \frac{\frac{P1(1-P1)+P2(1-P2)}{2}}{(P1-P2)} (z_{\alpha/2} + z_\beta)$$

Sample design

Patients were selected into 2 groups i.e. S and L group. Selection was done by envelope method, i.e. patients coming under inclusion criteria were told to choose one envelope in which previously written letter, either L or S. S group - operated by standard Lichtenstein hernioplasty under spinal anesthesia. L group - operated by standard Lichtenstein hernioplasty under local anesthesia

All patients with reducible, uncomplicated unilateral inguinal hernias in the age between 18 to 60 years were included in the study. Patients with bilateral and recurrent inguinal hernias were excluded from the study.

Data recorded during preoperative, intra operative & postoperative period were arranged in a master table and various statistical methods were applied for the data analysis to arrive at specific conclusions.

Anaesthetic procedure

Spinal anaesthesia

Anaesthesia was administered as standard procedure in subarachnoid space at L3-L4 space with 5% Bupivacaine (H). Anaesthetic failure patients were converted to GA and were excluded from the study.

Local anaesthesia

Mixture local solution is prepared for infiltration. It included 20 ml of 1% Lidocaine with Epinephrine, 30 ml of 0.25% Bupivacaine without epinephrine and 10 ml of Sodium bicarbonate solution and then diluted with 40 ml of normal saline.[23,24]

Plan of data analysis and statistics

The data collected was entered in MS Excel 2016. The data was analyzed by IBM SPSS version 22.0 (licensed). Proportions were calculated. Chi-square test was used to compare the proportions. Two-tailed significance test with p value of 0.05 or less was considered to be statistically significant.

Ethical issue

This study started after the clearance from ethical committee of College of Medicine and JNM Hospital. This is a non-randomized clinical study. All the operative procedures followed were standard procedures. The participants were explained in detail about the study. Written informed consent was taken from the participants before enrolment. Participants were free to opt out of the study at any time they want.

RESULTS

Total 84 participants were included in the study. As per the protocol fixed before-hand, 42 participants were given local anaesthesia (the L group) and other 42 participants were given spinal anaesthesia (the S group) for surgical repair of hernia. The results of the analysis of data are shown below with the help of tables and diagrams.

Socio-demographic background

Table 1 shows the age distribution of the study participants. The mean (±standard deviation) age of the participants put under local anesthesia, i.e. the L group was 40.9 (±8.6). While those in the S group i.e. those who were given spinal anesthesia had a mean (±standard deviation) age of 42.6 (±8.9).

Table 1: Central tendencies and dispersion measures of age of the participants in the two study groups (n=84).

Age (in years)	Study Groups		P value
	Local anaesthesia	Spinal anaesthesia	
Mean (±SD)	40.9 (±8.6)	42.6 (±8.9)	0.956
Median (inter-quartile range)	42.0 (12.0)	43.0 (11.0)	0.513
Minimum	22	19	--
Maximum	55	56	--

Among the participants studied all of the 84 participants (100.00%) were of male gender.

Distribution of the study participants according to site of hernia and study groups (n=84)

Overall left and right sided hernia was comparable in percentages (51.2% and 48.8% respectively). While among the S group the proportion of left and right sided hernia were equal (50.0%), the percentage in L group was 52.4% and 47.6% respectively. The differences in proportions between the two study groups were however not statistically significant (p=0.827).

Distribution of the study participants according to type of hernia (directness) and study groups (n=84)

Most of the participants presented with indirect type of hernia. The percentages were 83.3%, 76.2% and 79.8% among the L and S groups and overall respectively. In the L and S groups respectively 16.7% and 21.4% respectively presented with direct type of hernia. Pantaloon type was seen however with one participant belonging to the S group, i.e. the patient with pantaloon type of hernia was operated under spinal anaesthesia. The differences in proportions between the two study groups thus observed were however not statistically significant for trend (p=0.500).

Distribution of the study participants according to type of hernia (completeness) and study groups (n=84)

The distribution of different types of hernia among the two study groups is shown in Table 4. Overall incomplete hernia was mostly reported (89.3%). While among the L group the proportion of incomplete hernia was (88.1%), the percentage in S group was 90.5% for incomplete hernia. Again the differences in proportions between the two study groups were however not statistically significant (p=0.724).

Intra-operative clinical outcomes

Distribution of the participants as per content of the hernia according to intervention groups (n=84)

It was observed that in L group majority of the participants (64.3%) had omentum as hernia content. In the S group this proportion was observed to be 57.1%. Overall 60.7% of the participants had omentum as the content of hernia with remaining 39.3% had intestine.

Table 2 is a multiple response table, which summarizes the proportions of different intra-operative difficulties encountered. Unclear anatomy was observed in 50.0% of the L group and 75.0% of the S group. Increased muscle tone was observed in three (37.5%) of the S group participants. However, cauterization difficulty was different in proportion in L group (70.8%) and S group (0.0%), which was statistically significant on Fisher's Exact Test (p<0.001).

Table 3 discusses the distribution of participants in different study groups as per perception of intra-operative pain. It was observed that in both the group L and S, majority of the participants (78.6% and 88.0% respectively) had no perception of pain intra-operatively. Around 16.7% of those who underwent local anaesthesia

had mild perception of pain, while a similar mild intra-operative pain was reported by 4.8% of those given spinal anaesthesia. Moderate and severe pain was reported by one participant each for L group and for S group it was two and one participant respectively. The observed difference in trend was not statistically significant (p=0.342).

Table 2: Distribution of the participants according to different intra-operative difficulties encountered among the study groups (n=32).*

Different intra-operative difficulties	Type of anaesthesia			P value
	Local anaesthesia	Spinal anaesthesia	Total	
	N (%)	N (%)	N (%)	
Unclear anatomy	12 (50.0)	6 (75.0)	18 (56.3)	0.411
Cauterization difficulty	17 (70.8)	0 (0.0)	17 (53.1)	<0.001
Increased muscle tone	12 (50.0)	3 (37.5)	15 (46.9)	0.837

*Multiple response.

Table 3: Distribution of the participants according to intra-operative pain perceived among the study groups (n=84).

Intra-operative pain	Type of Anaesthesia			P value
	Local anaesthesia	Spinal anaesthesia	Total	
	N (%)	N (%)	N (%)	
No pain	33 (78.6)	37 (88.0)	70 (83.3)	0.342
Mild pain	7 (16.7)	2 (4.8)	9 (10.7)	
Moderate pain	1 (2.4)	2 (4.8)	3 (3.6)	
Severe pain	1 (2.4)	1 (2.4)	2 (2.4)	
Total	42 (100.0)	42 (100.0)	84 (100.0)	

Table 4: Central tendencies and dispersion measures of the duration of operation (in mins) in the two study groups (n=84).

Duration of operation (in mins)	Study groups		P value
	Local anaesthesia	Spinal anaesthesia	
Mean (±SD)	62.5 (±17.8)	51.1 (±21.5)	0.212
Median (inter-quartile range)	60.0 (30.0)	45.5 (33.3)	0.001
Minimum	25	25	--
Maximum	96	96	--

Table 4 shows the mean, median and maximum and minimum values of duration of operation (in mins). The mean (±SD) duration of operation for those put under local anaesthesia, i.e. the L group was 62.5 (±17.8) minutes. While those in the S group i.e. given spinal anaesthesia had a mean (±SD) duration of 51.1 (±21.5) mins. The range in the L and S both groups was 25 - 96 mins. The median operation duration in L and S groups were respectively 60.0 and 45.5 mins. The difference in median was found to be statistically significant amongst the study groups (p=0.001).

Post-operative clinical outcomes

Distribution of the study participants in the two groups according to reported pain as per visual analogue scale at 2 hours post-operatively (n=84): Most of the patients i.e. 81.0% in the S group and 61.9% in the L group reported to not have felt any pain. While 7.1% in the L group reported that it *"hurts little more"*. The trend difference observed in the two groups was not statistically significant (p=0.072).

Distribution of the study participants in the two groups according to reported pain as per visual analogue scale at 6 hours post-operatively (n=84): Among the participants who were given local anesthesia, 33.3%, 42.9%, 11.9%, 9.5%, 2.4% reported pain in an ascending order along the VAS from no pain to *"hurts whole lot"*. On the other hand those belonging to S group 9.5%, 23.8%, 33.3%, 19.0%, 9.5% and 4.8% reported pain in an ascending order starting with "no hurt" and moving upwards respectively. The trend difference observed was statistically significant (p=0.004).

Distribution of the study participants in the two groups according to reported pain as per visual analogue scale at 12 hours post-operatively (n=84): Among the participants who were given local anesthesia, 28.6%, 47.6%, 19.0%, 4.8% reported pain in an ascending order along the VAS from "no hurt" to *"hurts even more"*

respectively. On the other hand those belonging to S group 9.5%, 38.1%, 28.6%, 11.9%, 7.1% and 2.4% reported pain in an ascending order starting with "no hurt" and moving upwards respectively to "hurts worst". The trend difference observed was statistically significant (p=0.042).

Distribution of the study participants in the two groups according to reported pain as per visual analogue scale at 24 hours post-operatively (n=84): Among the participants who were given local anaesthesia, 52.4%, 38.1%, 7.1%, 2.4% reported pain in an ascending order along the VAS from "no hurt" to "hurts even more" respectively. On the other hand those belonging to S group 23.8%, 2.4%, 14.3%, 9.5% reported pain in an ascending order starting with "no hurt" and moving upwards respectively to *"hurts even more"*. The trend difference observed was statistically significant (p=0.041).

Distribution of the study participants in the two groups according to reported pain as per visual analogue scale at 48 hours post-operatively (n=84): Most of the patients (57.1%) in the L group reported no pain. While among the S group this proportion was 35.7%. However majority in S group (59.5%) reported *"hurts little bit"* as per VAS. In both the groups 4.8% participants responded as *"hurts little more"*. The trend difference observed in the two groups was not statistically significant (p=0.132).

Distribution of the study participants according to presence of post-operative complications and the intervention groups (n=84): Majority of the participants in the L group (71.4%) did not have any post-operative complication following hernia surgery. However, among those who were operated under spinal anesthesia 52.4% reported to have at least one post-operative complication following successful completion of surgery. The higher proportion of post-operative complication among S group as compared to L group was found to be significant statistically (p value - 0.045).

Table 5 is a multiple response table summarizing the different post-operative complications suffered by the participants. Among the L group, eleven participants (91.7%) had scrotal swelling. Headache and seroma was reported in three and five number of participants respectively in the L group. However urinary retention and hypotension was not reported post-operatively among those given local anaesthesia. On the contrary, among the S group urinary retention, hypotension, headache, seroma and scrotal swelling was observed among 31.8%, 27.3%, 45.5%, 22.7% and 36.4% of those who had post-operative complications. The differences in proportion of urinary retention i.e. higher percentage in S group were statistically significant. Similarly, the higher proportion of scrotal swelling in the L group compared to S group was also statistically significant.

Table 5: Distribution of the study participants according to different post-operative complications and the intervention groups (n=34).*

Post-operative complications	Type of anaesthesia			P value
	Local anaesthesia	Spinal anaesthesia	Total	
	N (%)	N (%)	N (%)	
Urinary retention	0 (0.0)	7 (31.8)	7 (20.6)	0.035
Hypotension	0 (0.0)	6 (27.3)	6 (17.6)	0.069
Headache	3 (25.0)	10 (45.5)	13 (38.2)	0.421
Seroma	5 (41.7)	5 (22.7)	10 (29.4)	0.444
Scrotal swelling	11 (91.7)	8 (36.4)	19 (55.9)	0.006

*Multiple response.

Table 6: Central tendencies and dispersion measures of duration of hospital stay after surgery (hrs) for the participants in the two study groups (n=84).

Duration of hospital stay after surgery (hrs)	Study groups		P value
	Local anaesthesia	Spinal anaesthesia	
Mean (±standard deviation)	24.5 (± 12.8)	57.1 (± 16.7)	0.006
Median (inter-quartile range)	24.0 (8.0)	48.0 (24.0)	0.001
Minimum	12	24	--
Maximum	72	96	--

Table 6 summarizes the mean, median and maximum and minimum values of duration of hospital stay after surgery. The mean (±SD) post-operative duration of hospital stay for those put under local anesthesia, i.e. the L group was 24.5 (±12.8) hours. While those in the S group i.e. those given spinal anesthesia had a mean (±SD) post-operative duration of hospital stay of 57.1 (±16.7) hours. The range in the L group was 12-72 hrs while in S group it was 24 - 96 hrs. The median duration of stay in L and S groups were respectively 24.0 and 48.0 hrs. The differences were statistically significant amongst the study groups with respect to both mean and median.

Central tendencies and dispersion measures of duration for return to sedentary activities (days) for the participants in the two study groups (n=84): The mean (± standard deviation) duration for return to sedentary activities for those put under local anaesthesia, i.e. the L group was 8.7 (±3.4) days. While those in the S group i.e. those given spinal anaesthesia had mean (±SD) duration of 11.4 (±6.5) days. The range in the L group was 6-21 days while in S group it was 6 - 30 days. The median duration for return to sedentary activities in L and S groups were 7 days as observed in both the groups. The differences were statistically significant amongst the study groups with respect to the group means under the assumption of unequal variances in the two study groups.

DISCUSSION

Inguinal hernia in the earlier phase is a neglected morbidity. As the disease progresses, it can lead to grave complications in the form of obstructed and strangulated hernia.[13] Early intervention can stop this progression and the complications can be avoided.[14] Uncomplicated hernia can be operated under local anaesthesia as a standard procedure as well as under spinal anaesthesia.

Mean age of the patients in this study was 40.9 years for local anaesthesia group and 42.6 years for the spinal anaesthesia group. All the participants were male. Large population in both study groups had unilateral indirect incomplete inguinal hernia. Considering the content of the hernia sac, slightly higher population had omentum as the content. Majority of the study population were healthy and few were having co-morbidities like hypertension, both diabetes and hypertension and diabetes alone in the descending order of frequency.

Intraoperative difficulties faced by the surgeon are of paramount importance in this study. It consists of cauterization difficulty, unclear anatomy and increased muscle tone.

Painless operative procedure is always desired and appreciated by both patient and surgeon. In this study, in both spinal and local anaesthesia group major proportion of patient did not complain of pain intra-operatively. The number of patient complaining of mild pain is greater in local anaesthetic group and that complaining of moderate to severe pain is almost equal in both the groups (p=0.342). This data correlates with findings of Goyel.[15] They have concluded that local anaesthesia is better in terms of intra operative pain management but this result is contradicting the findings of Singh.[16]

Postoperative pain is the most important variable and the soul of this study. Patient and surgeon satisfaction with acceptability depends upon postoperative pain. The post op pain is compared using visual analogue scale. Readings were taken on 2nd hour, 6th hour, 12th hour, 24th hour and 48th hour post operatively. Taking 2 hour postoperative period into consideration, both in local and spinal group, majority of the patients did not complain of pain. However, of those who did complain of pain, more of them were from the local anaesthesia group. The difference observed in the two groups were not statistically significant, p=0.072. At 6th postoperative hour, results were different. Patients operated under local anaesthesia were in VAS 0-2 and some patients complained little more pain and that was controlled by analgesics. However in spinal group patients complained of comparatively more pain. Majority were in VAS 2-4 categories. The comparison was statistically significant, p=0.004.

As the time progressed to 12th postoperative hour, local group had less postoperative pain as compared to spinal anaesthesia. 95.2% patient has VAS score of 0 to 4 in local anaesthesia. In spinal anaesthesia, 78.6% patients have VAS score of 2 to 6. The comparison is statistically significant, p=0.042.

On 24th hour again one reading was taken. In both group patients were limited to VAS score 0 to 6. 52.4% patients of local anaesthesia had no pain whereas 23.8% of patients did not complain any pain. P=0.041, which is statistically significant.

On 48th hour of postoperative pain, both group had similar results, p=0.132. These findings regarding postoperative pain very well correlates with various studies done by Mengal et al, Jethva et al, Goyal et al, Ramani et al, Umerzai et al and Shafique et al.[15,20-24] All of them have observed that postoperative pain is less with local anaesthesia but result not correlates with observation of Singh who had found postoperative pain is similar in both groups.[16]

Postoperative pain control was better in local anaesthesia because pre-incisional field block with local anaesthesia reduces the build-up of nociceptor molecules and that also lasts for longer duration in the postoperative period.[25]

Among the various postoperative complications, urinary retention, hypotension, headache, seroma, scrotal swelling was observed. Urinary retention (31% patients of SA) and hypotension (27% patients of SA) were exclusively seen in spinal anaesthesia. Post dural puncture headache were observed in spinal anaesthesia group, whereas rare in local anaesthesia group. Urinary retention and headache was observed by Singh, Saxena et al, and Shafique et al in their study.[16,17,24] The occurrence of scrotal swelling was more in local anaesthesia which is similar to the findings by Shafique et al in their study. They observed scrotal swelling was more evident in local anaesthesia i.e. 6% versus nil in spinal anaesthesia.[24]

Mean duration of hospital stay after operation was 24.5±12.8 hours in comparison to 57.1±16.7 hours in case of spinal group, p=0.006. Early mobilization was possible with less or nil pain in case of local anaesthesia

group, hence were discharged earlier than the spinal group. This result is similar with study by Saxena.[17]

Return to sedentary work was observed to be less in local group. i.e. mean duration were 8.7±3.4 days where in spinal anaesthesia group the finding was 11.4±65 days. The comparison is statistically significant, p=0.001.

CONCLUSION

Total of 84 patients were included and operated for unilateral inguinal hernia, 42 under local anesthesia and 42 under spinal anesthesia. The study concludes that local anesthesia certainly has some advantages over spinal anesthesia - postoperative pain and postoperative complications like urinary retention, headache, and hypotension were more evident in spinal anesthesia. However, some drawbacks were also observed in local anesthesia, which was not evident in spinal anesthesia such as intra operative difficulties like unclear anatomy, cauterization difficulty and increased muscle tone and local complication i.e. scrotal swelling was more evident in local anesthesia. Hence the study concludes that Local anesthesia can be used as an alternative of spinal anesthesia as a standard mode of anesthesia for Lichtenstein hernioplasty operation.

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