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Original Article

Surgery Section

Combination of Liechtenstein Repair with Herniorrhaphy in Open Inguinal Hernia Repair- A Prospective Observational Single Center Study

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ABSTRACT

Context: This study is about documentation of a technique which includes a combination of both hernioplasty and Herniorrhaphy, and its outcome in terms of recurrence rate and postoperative complications. It also compares the outcome of this method with routinely used techniques reported in the literature.

Materials and Methods: LR with Herniorrhaphy was performed in the patients admitted with inguinal hernia under concerned surgeon. Their follow-up was assessed after 12 months. Incidences of recurrence rate and other postoperative complications like painful scar, atrophy of testis, urinary retention, hematoma, sinus and infection were noted and compared with other techniques of repair from published data.

Statistical Analysis: was carried out by calculating the mean, standard deviation (SD), percentage and incidence rates.

Results: LR with Herniorrhaphy performed in 475 patients showed recurrence rate of <<0.01% (n=1) and very low incidences of other postoperative complications like painful scar (0.01%, n=5), sinus (0%, n=0), atrophy of testis (0%, n=0), retention of urine (0.01%, n=6), hematoma (<<0.01%, n=1) and infection (0%, n=0); as compared to published data with different techniques.

Conclusion: LR with Herniorrhaphy can be used for open inguinal hernia repair as the gold standard procedure as it has got low recurrence rate and other postoperative complications as compared to other techniques. However, the result of this study is based on the data from a single center, thus we recommend multicentric trials to test the efficacy of this technique.

Keywords: Complication, Direct, Groin, Haematoma, Hernioplasty, Herniorrhaphy, Inguinal, Indirect, Painful scar, Sinus, Swelling

INTRODUCTION

Inguinal hernia is one of the biggest challenges in surgical practice because of its frequency, complexity as well as the socio-economic consequences. The incidence and prevalence of inguinal hernia are not precisely known [1]. Inguinal hernia repair is the only cure; spontaneous recovery has never been reported [2]. The chance of a person having to undergo an inguinal hernia operation during his/her life is quite high, 27% in the case of men and 3% in the case of women [3].

Inguinal Hernia repair includes various techniques such as Herniotomy only in children and in adults Bassini's repair, different types of Darnings, mesh plug, Lichtenstein's repair, Prolene Hernia System (PHS) and many more modifications. More recently laparoscopic approach has been added. The most important criteria for the choice of repair methods are recurrence rates, postoperative pain, testicular atrophy and the length of convalescence and ease of performance. Until the last decade Shouldice technique 1945 (double breasting of tissues) was regarded as the standard for open hernia repair in Europe [4]. The low recurrence rate as claimed by Shouldice could not be achieved by surgeons in non-specialised centres [5,6]. Using patches and plugs tension-free techniques repair have produced excellent results, with low morbidity compared with conventional methods [7,8].

In our center, Dhiraj General Hospital which is a 1,200 bedded hospital catering to rural population of Vadodara and Waghodiya of Gujarat state, most teams in the general surgery service under both emergency and elective settings undertake open inguinal hernia repairs. In our unit we adopted the Lichtenstein method along with posterior wall repair, which uses a nonabsorbable mesh along with nonabsorbable suture to achieve tension repair, for open inguinal hernia surgery. In the present study, we sought to report our experience in inguinal hernia operation by using Lichtenstein Repair with Herniorrhaphy (posterior wall repair) over a four-year period.

The primary objective of this study was to compare the hernia recurrence rate and other post-operative complications with our method against published data, and our secondary objective was to report the incidence of post- operative complications after hernia repair such as painful scar, sinuses, atrophy of testis, infection, hematoma/seroma and urinary retention.

MATERIALS AND METHODS

The Study Setting

This was a prospective study, which was carried out over a period of four years (September 01, 2009 to August 31, 2013) in the Department of Surgery of Dhiraj General Hospital, which is a 1200-bedded multispecialty hospital, which caters to the rural population of Vadodara and Waghodiya, Gujrat, India.

All the surgical patients with inguinal hernia, admitted to the hospital during September 01, 2009 to August 31, 2013, and were willing to participate, were enrolled for the study.

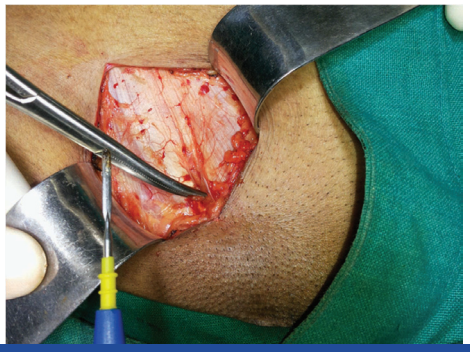
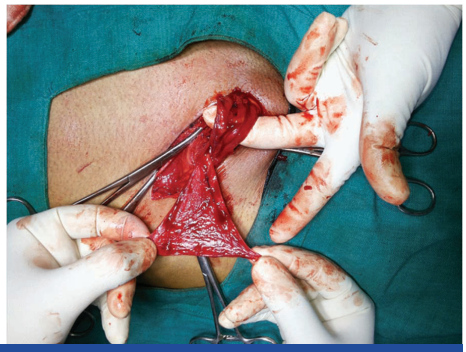
Before their enrolment, all the participants were explained about the nature and the purpose of the study. Consents were obtained from the patients.

The Study Subjects

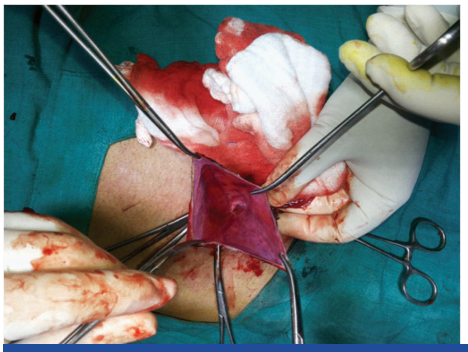
A total of 479 patients who fulfilled the below mentioned criteria were enrolled in the study. Four patients missed the follow-up after surgery and hence, were excluded from the study. Thus, a total of 475 patients were enrolled in the study. Out of which 16 were emergency cases, while remaining 459 were electives.

All the patients above 20 years of age with inguinal hernia and those who were willing to give informed consent were included in the study.

While, the patients who were not willing to give informed consent for open surgery, those who were suffering from critical or terminal

[Table/Fig-1]: Skin Incision taken at 2cm above and parallel to inguinal ligament extending from superficial to deep inguinal ring **[Table/Fig-2]:** External aponeurosis is exposed and incised **[Table/Fig-3]:** Cord structures are hooked and sac is separated



[Table/Fig-4]: Sac is opened and contents are reduced **[Table/Fig-5]:** Sac transfixed and ligated **[Table/Fig-6]:** The stump of sac is fixed to the muscles forming the deep inguinal ring that is internal oblique and transverse abdominis muscle



[Table/Fig-7]: Cord sructures are lateralised and posterior wall repair is done starting from pubic tubercle to deep ring taking continuous interlocking sutures
[Table/Fig-8]: Mesh is fixed to posterior wall and cord structure reposited **[Table/Fig-9]:** External oblique aponeurosis sutured

illness, those who were already enrolled in the study and the patients with immune-compromised statuses were excluded from the study.

The demographic profile, complete histories, information on the vitals and relevant systemic examinations of all the patients who were fitting in the inclusion criteria and willing to participate in the study were recorded in a proforma and the patients were subjected to the following investigations – X-ray chest, PA view, complete blood count (CBC) with the use of a 'Sysmex KX21 Three Part Differential Automated Hematology Analyser', Erythrocyte Sedimentation Rate (ESR), C-Reactive Protein (CRP) by the latex agglutination method (the CRP Latex Kit was manufactured by Rapid Diagnostics, Pvt. Ltd.) and other relevant investigations in case required to rule out secondary pathology.

Procedure of Repair

The inguinal hernia repair was performed using following steps: Under complete aseptic precautions parts cleaned, painted and draped, Skin Incision taken at 2cm above and parallel to inguinal ligament extending from superficial to deep inguinal ring [Table/Fig-1]. External oblique aponeurosis is exposed [Table/Fig-2] and incisised along the line of skin incision extending medially till superficial inguinal ring, superomedial flap is separated from conjoint tendon and Inferolateral flap is dissected upto upturn part of inguinal ligament. Then, Cord structures are hooked and sac is separated [Table/Fig-3]. Then, Sac is opened, Contents are reduced, [Table/Fig-4] then Sac is twisted, transfixed, ligated with Vicryl No. 2 round body needle [Table/Fig-5] and excised. Then, the stump of sac is fixed to the muscles forming the deep inguinal ring that is Internal Oblique and Transverse Abdominis Muscle [Table/Fig-6]. Then, Cord sructures are lateralised and Posterior wall repair is done starting from pubic tubercle to deep ring taking continuous interlocking sutures using prolene 2/0 round body needle [Table/Fig-7]. Prolene Mesh is kept and fixed to the posterior wall of inguinal canal, that is fixed medially to the periosteum of pubic tubercle, inferiorily to the inguinal ligament, superomedially to the conjoint tendon and laterally it is fixed to the internal oblique muscle and beyond the deep inguinal ring medially, engulfing the cord structures and is sutured proximal to the deep inguinal ring with prolene 2/0 round body needle. [Table/Fig-8] Then, Cord structures are reposited, external oblique aponeurosis is sutured by taking continuous interlocking suture starting from beyond the angle of external oblique muscle incison laterally and superficial inguinal ring medially [Table/Fig-9] using prolene 1/0 round body needle and finally the skin is sutured with ethylon 3/0.

Age (in years)	Male (%)	Female (%)	Over all (%)
20-30	137 (28.84%)	0 (0%)	137 (28.84%)
30-40	151 (31.79%)	2 (0.01%)	153 (32.21%)
40-50	78 (16.42%)	1 (0.01%)	79 (16.63%)
>50	99 (20.84%)	5 (0.01%)	104 (21.89%)
Over all	467 (98.32%)	8 (0.02%)	475 (100%)
Mean Age at Surgery (in years)			42.8 ± 14.3
Diabetics	52 (11.1%)	1 (12.5%)	53 (11.16%)
Smokers	84 (17.9%)	1 (12.5%)	85 (17.89%)
Body Mass Index (kg/m²)		**Number (Percentage)**	
<18.5		189 (39.79%)	
18.5 – 22.9		214 (45.05%)	
>23.0		72 (15.16%)	
Overall (Mean ± Standard Deviation)		19.8 ± 4.6	
ASA Grade (American Society of Anesthesiologists)			
ASA I		290 (61.05%)	
ASA II		178 (34.47%)	
ASA III		6 (0.01%)	
ASA IV		1 (<0.01%)	

[Table/Fig-10]: Characteristics of study participants (n=475)

Duration of Surgery

In the beginning author took around 45-48 min for unilateral indirect inguinal hernia repair, while 38-40 min for unilateral direct hernia by this technique. After completing around 100 surgeries it took around 30-32 min for indirect while 25-27 min for direct hernia; after 475 surgeries author is completing indirect hernia repair in 16-18 min and direct hernia in 12-13 min from skin incision to skin suture.

Follow-up of Study Participants

After their discharge, patients were asked for follow up after a period of 6-12 mnth, for routine assessments and investigations. Four patients out of 479 skipped the follow-up and therefore were excluded from the study.

STASTICAL ANALYSIS

It was carried out by using mean, standard deviation (SD), incidence rate and percentage.

RESULTS

A total of 475 patients were enrolled in the study, the characteristics of study participants and Inguinal hernia are described in [Table/Fig-10] and [Table/Fig-11] respectively. After their repair, post operative complications were noted on their follow-up. The characteristics and incidences of post-operative complications are mentioned in [Table/Fig-12] and [Table/Fig-13].

DISCUSSION

Although, along time many types of surgical procedures have been tried to treat inguinal hernia, the high number of recurrences couldn't be avoided. There is no consensus regarding the "best" surgical treatment of hernia. Based on medical publications [9-12] we have witnessed that recurrence persists with or without the use of meshes. The recurrence rate of inguinal hernia following primary repair has been reported to be 0.5%–10.0% [13-16]. The reported rates of chronic pain (0.7%–62.9%) [17-19], wound infection (1.0%–7.0%), [20] urinary retention (0.2%–22.2%) [21,22], hypoesthesia (4.3%–67.0%) [23,24] and other postoperative complications after hernia repair also extend over wide ranges. Such wide variations in incidences may be attributed to differences in patient factors (e.g. gender, age, comorbidities and the subjective perception of symptoms) and institutional factors (e.g. surgeon's experience, method of repair, type of anaesthesia and duration of follow-up). Thus, choice of repair method for inguinal hernia remains controversial.

Nowadays, mesh repair of inguinal hernia is the most common operation. Approximately 20 million groin hernioplasties are performed each year worldwide, over 17,000 operations in Sweden, over 12,000 in Finland, over 80,000 in England and over 8,00,000 in the USA [25–29]. Countless studies have been reported in the medical literature in attempts to improve the overall out- comes following hernia operations and, due to this fact, the procedure has

Characteristic	Study Participants (Percentage)
Side of Inguinal Hernia	
Right	217 (45.68%)
Left	189 (39.79%)
Bilateral	69 (14.53%)
Type of Unilateral Hernia (n=406)	
Direct	122 (30.04%)
Indirect	256 (63.05%)
Pantaloon	28 (6.89%)
Episode	
Primary	427 (89.89%)
Recurrent	48 (10.11%)
Presentation	
Swelling	338 (71.16%)
Swelling, pain	97 (20.42%)
Swelling, pain, incarceration	34 (7.16%)
Sweling, pain, strangulation	6 (1.26%)

[Table/Fig-11]: Characteristic of inguinal hernia in study participants (n=475)

Late Post-Operative Complication	Direct Inguinal Hernia	Indirect Inguinal Hernia	Pantaloon Inguinal Hernia	Over all
Recurrence	1 (16.67%)	0 (0%)	0 (0%)	1 (16.67%)
Sinuses	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Painful Scar	1 (16.67%)	3 (50%)	1 (16.67%)	5 (83.33%)
Atrophy of Testis	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Over all	2 (33.33%)	3 (50%)	1 (16.67%)	6 (0.01%)

[Table/Fig-12]: Late post operative complications of study participants

Early Post Operative Complication	Direct Inguinal Hernia	Indirect Inguinal Hernia	Pantaloon Inguinal Hernia	Over all
Retention of Urine	4 (57.14%)	1 (14.28%)	1 (14.28%)	6 (85.71%)
Haematoma	0 (0%)	0 (0%)	1 (14.28%)	1 (14.28%)
Infection	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Over all	4 (57.14%)	1 (14.28%)	2 (28.56)	(0.01%)

[Table/Fig-13]: Early post operative complications of study participants

evolved immensely, especially over the last few decades. Recurrence of inguinal hernia was initially a significant problem; however with the advent of the tension-free mesh repair as described as Lichtenstein Repair (LR) [30], recurrence rate has consistently been reported as low as 1–4% [31–34], a drop from up to 50–60%.

The postoperative complications with LR + Herniorrhaphy [Table/Fig 14] in the study subjects approximate to 0.02% (n=13), that is very less. Of that retention of urine was found in 0.01% (n=6) cases, painful scar in 0.01% (n=5) cases, hematoma in <0.01% (n=1) cases and recurrence was also found in <0.01% (n=1) cases. While

Studies	Techniques	Recurrence	Painful Scar	Sinus	Atrophy of Testis	Retention Urine	Haematoma	Infection
Current Study	LR+ HR	1/475	5/475	0/475	0/475	6/475	1/475	0/475
2014, Kai Xiong Cheong [35]	LR	20/520	6/520	0/520	0/520	7/520	25/520	3/520
2012, Berrevoet et al., [36]	TIPP	3/72	-	-	-	-	-	-
	LR	2/70	-	-	-	-	-	-
2006, Dogru et al., [37]	TIPP	0/69	-	-	-	-	-	-
	LR	1/70	-	-	-	-	-	-
2007, Gunal et al., [38]	TIPP	1/39	-	-	-	-	-	-
	LR	1/42	-	-	-	-	-	-
2007, Nienhuijs et al., [39]	TIPP	2/86	-	-	-	-	-	-
	LR	2/85	-	-	-	-	-	-
2004, Muldoon et al., [40]	TIPP	1/121	-	-	-	-	-	-
	LR	5/126	-	-	-	-	-	-
2012, Koning et al., [41]	TIPP	2/143	-	-	-	-	-	-
	LR	4/159	-	-	-	-	-	-
1999, Kawji et al., [42]	TIPP	0/21	-	-	-	-	-	-
	LR	0/83	-	-	-	-	-	-
2008, Karatepe et al., [43]	TIPP	0/19	-	-	-	-	-	-
	LR	0/21	-	-	-	-	-	-
2010, Hamza et al., [44]	TIPP	0/25	-	-	-	-	-	-
	LR	0/25	-	-	-	-	-	-
2008, Erhan et al. [45]	TIPP	1/24	-	-	-	-	-	-
	LR	0/70	-	-	-	-	-	-
2007, Farooq et al., [46]	TIPP	0/33	-	-	-	-	-	-
	LR	0/34	-	-	-	-	-	-
2013, Paulo Kasab et al., [47]	MV	2/75	-	-	-	-	-	-
	BT	2/69	-	-	-	-	-	-
2013, L. Timisescu et al., [48]	LR	1/91	0/91	0/91	0/91	4/91	9/91	5/91
2001, George H Sakorafas et al., [49]	LR	1/540	-	-	-	-	-	-
2011, Anuradha Anand et al., [50]	LR	4/489	11/489	-	2/489	-	-	1/489
	PHS	0/190	2/190	-	3/190	-	-	1/190
	DR	1/88	4/88	-	1/88	-	-	0/88
	MP	1/50	1/50	-	0/50	-	-	0/50
	HT	2/9	0/9	-	0/9	-	-	0/9
2012, G. G. Koning et al., [51]	TREPP	0/50	-	-	-	-	18/50	0/50
2013, Motohito Nakagawa et al., [52]	MR	0/46	30/46	-	-	-	2/46	-
	PHS	0/45	31/45	-	-	-	1/45	-
2011, Konrad Pielacinski et al., [53]	LR	2/59	-	-	-	-	6/59	-

[Table/Fig-14]: Comparison of outcome of different techniques used for open hernia repair
Abberation: HR: Herniorrhaphy, TIPP: Open Transinguinal Pre-peritoneal Mesh Repair, LR: Lichtenstein Repair, MV: McVay Technique, BT: Bassini Technique, DR: Darn Repair, MP: Mesh Plug, PHS: Prolene Hernia System, HT: Herniotomy, TREPP: Transrectus sheath peritoneal technique, MR: Marcy Repair


[Table/Fig-15]: Preoperative picture shows huge bilateral inguinal hernia.
[Table/Fig-16]: Intra-operative picture shows appendix in hernia sac (Amyand's Hernia)

Technique	Recurrence	Atrophy Testis	Retention	Painful Scar	Hematoma
Current Study	<0.01%	0%	0.01%	0.01%	0.01%
LR [35-50, 53]	1.73%	1%	1.8%	1.5%	5.97%
TIPP [36-46]	1.83%	-	-	-	-
MV [47]	2.67%	-	-	-	-
BT [47]	2.89%	-	-	-	-
DR [50]	1.14%	4.54%	-	4.54%	-
MP [50]	2%	2%	-	2%	-
TREPP [51]	0%	-	-	-	36%
MR [52]	0%	65.2%	-	65.2%	4.35%
PHS [50,52]	0%	14.04%	-	68.8%	2.22%

[Table/Fig-17]: Comparison of recurrence and postoperative complications with various techniques

0% cases were reported for sinuses, mesh migration, infection and atrophy of testis in the study participants.

There were two unusual cases encountered in the study, one in which there was bilateral huge direct inguinal hernia with the defect more than 7cm on both the sides [Table/Fig-15] and in second case complete indirect hernia with congenital sac containing appendix [Table/Fig-16]. In both the cases repair was done by this technique, with no postoperative complications.

[Table/Fig-17] suggests that LR with Herniorrhaphy is better than LR alone in terms of low recurrence rate and low incidences of post operative complications. Study noted similar recurrence rate as that of TREPP, MR and PHS but those techniques have high incidences of other postoperative complications like atrophy of testis, hematoma and painful scar which limits the use of the same in routine practice.

CONCLUSION

LR with Herniorrhaphy can be used for open inguinal hernia repair as the gold standard procedure as it has got very low recurrence rate (<0.01%) and other postoperative complications like Retention of urine, Painful scar, Hematoma and Atrophy of testis as compared to other techniques. However, the result of this study is based on the data from a single center, thus we recommend multicentric trials to test the efficacy of this technique.

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REFERENCES

[1] Rutkow IM. Epidemiologic, economic, and sociologic aspects of hernia surgery in the United States in the 1990s. *Surg Clin North Am.* 1998;78(6):941-51, v-vi.
[2] Simons MP, Aufenacker T, Bay-Nielsen M, Bouillot JL, Campanelli G, Conze J, et al. European Hernia Society guide- lines on the treatment of inguinal hernia in adult patients. *Hernia*. 2009;13(4):343-403. doi: 10.1007/s10029-009-0529-7. *Epub* 2009 Jul 28.
[3] Primatesta P, Goldacre MJ. Inguinal hernia repair: incidence of elective and emergency surgery, readmission and mortality. *Int J Epidemiol.* 1996;25(4):835-39.
[4] Kingsnorth AN, Mr G, Nott DM. Prospective randomised trial comparing the shouldice technique and placation darn for inguinal hernia. *Br J Surg.* 1992;79:1068–70.
[5] Panos RG, Beck DE, Maresh JE, Hardford FJ. Preliminary results of a perspective randomised study of Cooper's ligament versus shouldice hernioplasty technique. *Surg Gynecol Obstet*. 1992;175:315–19.
[6] Beetls GL, Oosterhius KJ, PM GO, Baetin CG, Kootstra G. Long term follow up (12–15 years) of a randomized controlled trial comparing Bassini—Stellen, shouldice and high ligation with narrowing of the internal ring for primary inguinal hernia repair. *J Am Coll Surg.* 1977;185:352–57.
[7] Scott NW, McCormack K, Graham P, Go PMNYH, Ross SJ, Grant AM. Open mesh versus non-mesh repair of inguinal hernia. *Cochrane Database Syst Rev.* 2002;4:CD 002197.
[8] EU Hernia Trialist Collaboration Mesh compared with non-mesh methods of open groin hernia repair: systematic review of randomised controlled trials. *Br J Surg.* 2000;87:854–59.
[9] Maggiore D, Müller G, Hafanaki J. Bassini vs Lichtenstein: two basic techniques for inguinal hernia treatment. *Hernia.* 2001;5(1):21-24.
[10] Aroori S, Spence RA. Chronic pain after hernia surgery--An Informed Consent Issue. *Ulster Med J.* 2007;76(3):136-40.
[11] Staal E, Nienhuijs SW, Keemers-Gels ME, Keemers-Gels ME, Rosman C, Strobbe LJ. The impact of pain on daily activities following open mesh inguinal hernia repair. *Hernia.* 2008;12(2):153-57.
[12] Shin D, Lipshultz LI, Goldstein M, Barmé GA, Fuchs EF, Nagler HM, et al. Herniorrhaphy with polypropylene mesh causing inguinal vasal obstruction: a preventable cause of obstructive azoospermia. *Ann Surg*. 2005;241(4):553-58.
[13] Bay-Nielsen M, Kehlet H, Strand L, et al. Quality assessment of 26,304 herniorrhaphies in Denmark: a prospective nationwide study. *Lancet*. 2001;358:1124-28.
[14] Flum DR, Horvath K, Koepsell T. Have outcomes of incisional hernia repair improved with time? A population-based analysis. *Ann Surg*. 2003;237:129-35.
[15] Jansen PL, Klinge U, Jansen M, Junge K. Risk factors for early recurrence after inguinal hernia repair. *BMC Surg*. 2009;9:18.
[16] Butters M, Redecke J, Köninger J. Long-term results of a randomized clinical trial of Shouldice, Lichtenstein and transabdominal preperitoneal hernia repairs. *Br J Surg*. 2007;94:562-65.
[17] Kingsnorth AN, Bowley DM, Porter C. A prospective study of 1000hernias: results of the Plymouth Hernia Service. *Ann R Coll Surg Engl*. 2003;85:18-22.
[18] The MRC Laparoscopic Groin Hernia Trial Group. Laparoscopic versus open repair of groin hernia: a randomised comparison. *Lancet.* 1999;354:185-90.
[19] Cunningham J, Temple WJ, Mitchell P, et al. Cooperative hernia study. Pain in the postrepair patient. *Ann Surg.* 1996;224:598-602.
[20] Jenkins JT, O Dwyer PJ. Inguinal hernias. *BMJ*. 2008;336:269-72.
[21] Finley RK Jr, Miller SF, Jones LM. Elimination of urinary retention following inguinal herniorrhaphy. *Am Surg*. 1991;57:486-88.
[22] Koch CA, Grinberg GG, Farley DR. Incidence and risk factors for urinary retention after endoscopic hernia repair. *Am J Surg.* 2006;191:381-85.
[23] Beldi G, Haupt N, Ipaktchi R, Wagner M, Candinas D. Postoperative hypoesthesia and pain: qualitative assessment after open and laparoscopic inguinal hernia repair. *Surg Endosc.* 2008;22:129-33.
[24] Forte A, D'Urso A, Gallinaro LS, et al. [Complications of inguinal hernia repair]. *G Chir.* 2002;23:88-92. Italian.
[25] Heikkinen TJ, Haukipuro K and Hulkko A. A cost and outcome comparison between laparoscopic and Lichtenstein hernia opera- tions in a day-case unit. A randomized prospective study. *Surg Endosc*. 1998;12:1199–203.
[26] Cheek CM, Black NA and Devlin HB. Groin hernia surgery: a sys- tematic review. *Ann R Coll Surg Engl.* 1998;80(1):S1–80.
[27] Rutkow IM. Demographic and socioeconomic aspects of hernia repair in the United States in 2003. *Surg Clin North Am*. 2003;83:1045–51.
[28] Swedish Hernia Register. http://www.svensktbrackregister.se (10 June 2007, date last accessed).
[29] Amid PK. Lichtenstein tension-free hernioplasty: its inception, evolution and principles. *Hernia*. 2004;8:1–7.
[30] Heikkinen T, Bringman S, Ohtonen P, et al. Five-year outcome of laparoscopic and Lichtenstein hernioplasties. *Surg Endosc.* 2004;18:518–22.
[31] Lepere M, Benchetrit S, Debaert M, et al. A multicentric comparison of transabdominal versus totally extraperitoneal laparoscopic hernia repair using PARIETEX meshes. *J Soc Laparoendosc Surg*. 2000;4:147–53.
[32] Olmi S, Erba L, Magnone S, et al. Prospective study of laparoscopic treatment of incisional hernia by means of the use of composite mesh: indications, complications, mesh fixation materials and re- sults (in Italian). *Chir Ital.* 2005;57:709–16.
[33] MacFadyen BV Jr and Mathis CR. Inguinal herniorrhaphy: complications and recurrences. *Semin Laparosc Surg*. 1994;1:128–40.

[34] McCormack K, Scott NW, Go PM, et al. Laparoscopic techniques versus open techniques for inguinal hernia repair. *Cochrane Database*. 2003;1:CD001785.
[35] Kai Xiong Cheong, Hong Yee Lo, Jun Xiang Andy Neo, Vijayan Appasamy, Ming Terk Chi. Inguinal hernia repair: are the results from a general hospital comparable to those from dedicated herniacentres? *Singapore Med J.* 2014;55(4):191-17.
[36] Berrevoet F- NCT00323673-unpublished data. Data for combined analysis was taken from the published Cochrane review cited as Willaert W, De Bacquer D, Rogiers X, Troisi R, Berrevoet F. Open Preperitoneal Techniques versus Lichtenstein Repair for elective Inguinal Hernias. *Cochrane Database Syst Rev.* 2012;7:CD008034.
[37] Dogru O, Girgin M, Bulbuller N, et al. Comparison of Kugel and Lichtenstein operations for inguinal hernia repair: results of a pro- spective randomized study. *World J Surg*. 2006;30:346–50.
[38] Gu nal O, Ozer S, Gu rleyik E, et al. Does the approach to the groin make a difference in hernia repair? *Hernia.* 2007;11:429–34.
[39] Nienhuijs S, Staal E, Keemers-Gels M, et al. Pain after open preper- itoneal repair vs Lichtenstein repair: a randomized trial. *World J Surg*. 2007;31:1751–57.
[40] Muldoon RL, Marchant K, Johnson DD, et al. Lichtenstein vs anterior preperitoneal prosthetic mesh placement in open inguinal hernia repair: a prospective, randomized trial. *Hernia.* 2004;8:98–103.
[41] Koning GG, Keus F, Koeslag L, et al. Randomized clinical trial of chronic pain after the transinguinal preperitoneal technique com- pared with Lichtenstein's method for inguinal hernia repair. *Br J Surg*. 2012;99:1365–73.
[42] Kawji R, Feichter A, Fuchsjager N, et al. Postoperative pain and return to activity after five different types of inguinal herniarrha- phy. *Hernia.* 1999;3:31–35.
[43] Karatepe O, Adas G, Battal M, et al. The comparison of preperito- neal and Lichtenstein repair for incarcerated groin hernias: *a ran- domised controlled trial*. *Int J Surg.* 2008;6:189–92.
[44] Hamza Y, Gabr E, Hammadi H, et al. Four-arm randomized trial comparing laparoscopic and open hernia repairs. *Int J Surg.* 2010;8:25–28.
[45] Erhan Y, Erhan E, Aydede H, et al. Chronic pain after Lichtenstein and preperitoneal (posterior) hernia repair. *Can J Surg.* 2008;51:383–87.
[46] Farooq O, Batool Z, Din AU, et al. Anterior tension - free repair versus posterior preperitoneal repair for recurrent hernia. *J Coll Physicians Surg Pak*. 2007;17:465–68.
[47] Paulo Kassab, Ettore Ferrari Franciulli, Carolina Kassab Wroclawski, Elias Jirjoss Ilias, Osvaldo Antônio Prado Castro, Carlos Alberto Malheiros. Meshless treatment of open inguinal hernia repair: a prospective study. *Einstein*. 2013;11(2):186-89.
[48] L Timiæescu, F Turcu, R Munteanu, C Gîdea, L Drãghici, O Ginghinã, et al. Treatment of Bilateral Inguinal Hernia - Minimally Invasive versus Open Surgery Procedure. *Chirurgia*. 2013;108:56-61.
[49] George H Sakorafas, Ioannis Halikias, Christos Nissotakis, Nikolaos Kotsifopoulos, Alexios Stavrou, Constantinos Antonopoulos, et al. Open tension free repair of inguinal hernias; the Lichtenstein technique. *MC Surgery.* 2001;1:3.
[50] Anuradha Anand, Prem A Sinha, Karthik Kittappa, Manoj H Mulchandani, Samuel Debrah, Roger Brookstein. Review of Inguinal Hernia Repairs by Various Surgical Techniques in a District General Hospital in the UK. *ndian J Surg.* 2011;73(1):13–18.
[51] GG Koning, CS Andeweg, F Keus, MW A van Tilburg, CJ H M van Laarhoven, WL Akkersdijk. The transrectus sheath preperitoneal mesh repair for inguinal hernia: technique, rationale, and results of the Wrst 50 cases. *Hernia.* (2012) 16:295–99.
[52] Motohito Nakagawa, Takeshi Nagase, Tomotaka Akatsu, Shun Imai, Naoki Fujimura, Tatsuo Asagoe, et al. A randomized prospective trial comparing clinical outcomes 3 years after surgery by Marcy repair and Prolene Hernia Systemrepair for adult indirect inguinal hernia. *Surg Today.* 2013;43:1109–15.
[53] Konrad Pielacinski, Andrzej B Szczepanik, Andrzej Misiak, Tadeusz Wróblewski. Randomized clinical trial comparing inguinal hernia repair with Lichtenstein technique using non-absorbable or partially absorbable mesh. Preliminary report. *Videosurgery and Other Miniinvasive Techniques.* 2011;6 (4):190-206.

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