

Inguinal Hernia Repair using Prolene Hernia System – a Simplified Technique for Beginners

Neha Mahajan¹, Nitin Sharma², Nikhil Gupta³

ABSTRACT

Introduction: Surgical repair of the inguinal hernia is the most common general surgery procedure performed today. Even today inguinal hernias pose a great burden on the healthcare system. Hence even modest improvements in clinical outcomes are warmly welcomed. This study describes the technique of Prolene Hernia System (PHS) in its simplified form for the beginners to learn it quickly.

Material and methods: A prospective study was conducted in 50 patients in a tertiary centre from April 2010 to Oct 2011 for period of 18 months. Patients' demographic data was collected and patient selected as per the selection criteria. The PHS mesh repair was performed as described by Gilbert et al³ with some simplification and modification as described. Absorbable sutures were used to fix the mesh in the described four stitch technique. All data collected from study were entered in the database for statistical analysis.

Results: All participants were males and most of them were from manual labour background (38 patients (76%). Most of the patients belonged to 26-35 year age group (18 patients (36%). 40 participants were found to have indirect hernias (80%). Right sided hernia was found more common (33 patients (66%). The mean duration of surgery was 31.96 min (SD – 2.303). Intraoperative complication included 2 cases of nerve damage (4%). The mean pain score in first 24 hours was 6.82/10 (SD – 1.848). None of the patients reported recurrence of hernia (0% recurrence).

Conclusion: The PHS mesh, consisting of an underlay patch, an overlay patch, and a joining connector, has potential benefits over the traditional Lichtenstein, Mesh Plug Repair (MPR) and Laparoscopic repairs. The PHS mesh provides complete coverage of the entire myopectineal orifice through the underlay placed in the preperitoneal space, the overlay placed in the inguinal canal and the connector which maintains the mesh in position. In our study we also found that use of absorbable sutures helped in relieving neuralgia and lessened chronic groin pain by causing less permanent nerve entrapment without affecting the recurrence rate.

Keywords: Hernia, Prolene Hernia System (PHS), Myopectineal Orifice, Absorbable Sutures, Recurrence.

INTRODUCTION

Surgical repair of the inguinal hernia is the most common general surgery procedure performed today.^{1,2} The majority of abdominal wall hernias occur in the groin, totaling approximately 75% of the total incidence.³ The lifetime risk of developing inguinal hernia is about 24%.^{4,5} An overwhelming majority of inguinal hernias occur in males as compared to females with the ratio of 12:1 (male: female).⁶ Incidence of inguinal hernias in males has a bimodal distribution with

peaks before 1 year of age and then again after age 40.⁴ In men, indirect hernias predominate over direct hernias at a ratio of 2 : 1. Direct hernias are very uncommon in women.⁷ Even today inguinal hernias pose a great burden on the healthcare system. Hence even modest improvements in clinical outcomes are warmly welcomed. Since the description of the onlay mesh technique by the Lichtenstein institute in 1989, several tension-free techniques have been described. The most commonly used techniques include the mesh plug method, the laparoscopic transabdominal preperitoneal repair and totally extraperitoneal repair approaches, preperitoneal approach of Nyhus and, more recently, the Prolene Hernia System (PHS), a one piece bi-lobed device connected by a mesh cylinder. Each addresses a different area of weakness in the groin apparatus and each claims low levels of recurrence.⁸

The PHS combines three mechanisms of action. The internal round preperitoneal component reinforces the myopectineal orifice, as described by Rives. The external oval component placed over the fascia transversalis reinforces the floor of the groin, as with the Lichtenstein technique. Finally, the internal and the external components are linked together by a cylinder placed in the hernia ring, similar to the mesh plug technique. This study describes this technique in its simplified form for the beginners to learn it quickly.

MATERIAL AND METHODS

The study was designed with an aim of including 50 patients with inguinal hernias, who fulfilled the selection criteria over a period of 18 months from April 2010 to Oct 2011. The study was conducted in the department of surgery, ESI PGIMS, Basaidarapur, New Delhi, a 600 bedded tertiary care hospital. Only the adult patients with inguinal hernias in the age group of 15-65 years were included in the study. Patients with recurrent inguinal hernia, obstructive hernia,

¹Senior Resident, Department of Surgery, Government Doon Medical College, Dehradun, ²Senior Resident, Department of ENT, Government Doon Medical College, Dehradun, ³Associate Professor, Department of General surgery, Atal Bihari Vajpayee Institute of Medical Sciences and Dr. Ram Manohar Lohia hospital, New Delhi, India

Corresponding author: Dr. Nitin Sharma, R/O H. no. 219/C, Sector – 5, Nanak Nagar, Jammu, J and K - 180004

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strangulated hernia or sliding hernia were excluded from the study. Patients were interviewed according to the proforma and clinical diagnosis was made by detailed physical examination. Informed written consent was taken. Patient characteristics including age, sex, occupation, hernia site, and type, strain factors, any coexisting conditions and any addictions including smoking history were recorded.

Surgical technique

Patients were admitted on the day prior to surgery for pre-anaesthetic check up as per the institute protocols. All patients received antibiotic prophylaxis with single preoperative dose of intravenous cefotaxime at the time of induction. All repairs were performed under regional anaesthesia.

Prolene hernia system repair – as we do it

The PHS mesh repair was performed as described by Gilbert et al³ with some simplification and modification as described. The inguinal canal was approached from an anterior approach. An oblique 4-5 cm skin incision was made in the inguinal region and the scarpa's fascia and the external oblique aponeurosis were divided. Special care was taken to preserve the ilioinguinal nerve and the hypogastric nerve. The cord structures were looped up in the region of the pubic tubercle using hernia ring. The cremaster was incised and the cord structures and hernia sac were dissected from it by blunt and sharp dissection. The hernia sac was then delineated and dissected free from the cord structures. Indirect sac was twisted, transfixated with polyglactin 910 suture and excised. A pocket was created in the preperitoneal space of Bogros by passing a finger or a piece of gauze on sponge holder through the lax deep inguinal ring itself. The inferior epigastric vessels were saved from injury by holding them using Langenback retractor and thus, avoiding their injury during dissection of preperitoneal space. The onlay mesh was folded and held in sponge holder, maintaining the orientation of the patch. The circular underlay patch of the PHS mesh was folded over the sponge holder and deployed in the preperitoneal space through the internal ring and expanded (fig-1,2). The onlay mesh was then spread out over the posterior wall of the inguinal canal. A slit was made in the overlay patch to accommodate the cord structures and to recreate the deep inguinal ring. The longer end of the onlay patch covered the posterior wall and overlapped the pubic tubercle. The onlay patch was secured using 4 interrupted sutures of 2-0 polyglactin 910 one each to the pubic tubercle, the conjoint tendon, the reflected part of the inguinal ligament and along lateral slit of mesh. The extended portion of the onlay patch was placed under the external oblique aponeurosis laterally and the inguinal canal was closed in layers.

For direct hernias, the attenuated transversalis fascia covering the posterior wall of the inguinal canal was opened and the hernia sac and contents reduced. Similarly, a pocket in the preperitoneal space of bogros was created with blunt dissection using a finger and gauze. The underlay patch was folded and inserted through the defect and spread out in the preperitoneal space created. The defect in the transversalis fascia was narrowed with interrupted sutures

of 2-0 polyglactin 910. The onlay patch was then sutured to the pubic tubercle, conjoint tendon, and the reflected part of the inguinal ligament as described above. The extended portion of the onlay patch was placed under external oblique aponeurosis laterally and the inguinal canal was closed in layers.

For pantaloon hernia, the inferior epigastric vessels were ligated and divided, thus converting the two defects into one large defect. This was then treated in similar way, by opening the transversalis fascia and deploying the PHS mesh (fig-3,4,5,6,7).

Postoperative care & follow-up

Three doses of prophylactic cefotaxime were given to all the patients one dose preoperatively and two doses postoperatively. All patients received single dose of analgesic (50 mg diclofenac intramuscular) in the immediate postoperative period and as required thereafter. Nurses involved with preoperative and postoperative care were instructed to give uniform information to all patients. Patients were encouraged to resume their normal activities and no restrictions were imposed regarding physical activity. Patients were assessed for any sign of complications and first wound dressing was changed after 48 hours. Thereafter patients were discharged if no sign of any complication was visible.

All patients visited surgical OPD on the 8th postoperative day for wound inspection and stitch removal and also to note if there were any complications. Patients were followed in surgical OPD's for a period of 6 months to 18 months (median follow up 12 months) for any signs of recurrence and other complications.

Outcome measures

All demographic data and patient characteristics were recorded. Operative time (skin incision to skin closure), intraoperative complications including iatrogenic vessel and nerve injury and as well as anaesthesia related complications were recorded. Pain score after first 24 hours was recorded by Visual Analog Scale. Any postoperative complications such as seroma, hematoma, wound infection, urinary retention, intractable neuralgias, hypo/hyperesthesia, recurrence and chronic groin pain were documented.

STATISTICAL ANALYSIS

All data collected from study were entered in the database for statistical analysis. The statistical analysis was performed using the SPSS (version 19.0, SPSS, inc., chicago, il) software package. The primary end point was recurrence rate. The secondary end points included pain score by visual analogue scale, and postoperative complications.

RESULTS

During the period from April 2010 to Oct 2011, fifty patients who met the eligibility criteria were recruited to participate in the study. Those with bilateral hernias were treated on one side at a time to keep the simplicity of data as well as to accurately determine the pain score. All patients were followed for the first six months and forty-six patients

completed a median follow-up of 12 (range 6-18) months.

Patient characteristics

All participants were males and most of them were from manual labour background (38 patients (76%). Most of the patients belonged to 26-35 year age group (18 patients (36%). The mean age of presentation was 40.58 yrs (SD = 10.469). Out of these 50 patients, 15 patients were found smokers (30%). 40 participants were found to have indirect hernias (80%). Right sided hernia was found more common (33 patients (66%).

RESULTS

The mean duration of surgery was 31.96 min (SD – 2.303). Intraoperative complication included 2 cases of nerve damage (4%). Damaged nerves were transacted to avoid postoperative neuralgia. There was no injury to vessels or

to vas deferens. All patients were observed for minimum period of 24 hours within hospital for better postoperative monitoring of pain scores and for evaluating immediate postoperative complications. Hospital stay was extended beyond 24 hours in eight patients due to postoperative



Figure-1: PHS extended mesh

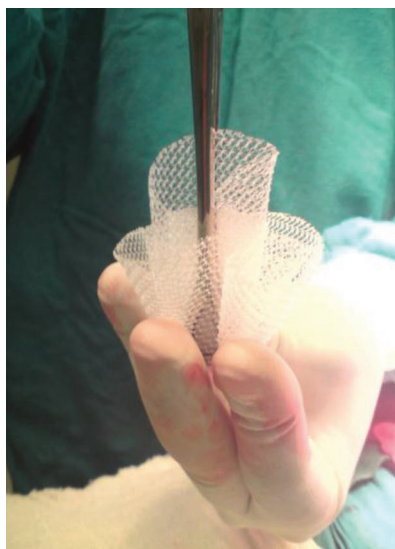


Figure-2: Holding PHS mesh in position before insertion



Figure-3: Spreading PHS mesh - underlay component using sponge on holder



Figure-4: Spreading PHS mesh - overlay component

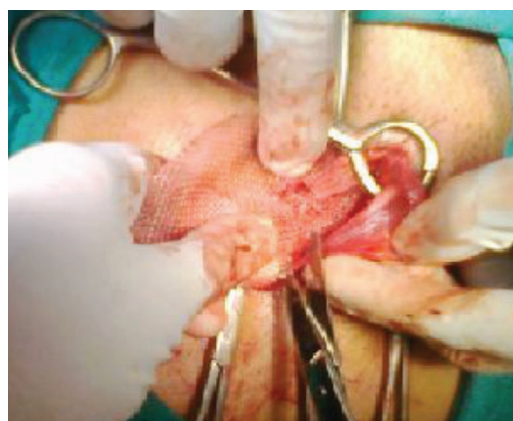


Figure-5: Lateral slitting of the mesh for accommodating cord

Study	Year of study	Number of patients	Type of repair	Recurrence rate with absorbable suture
Hilgert RE ²⁵	1999	220	Shouldice repair	3%
Nordin P ²⁶	2003	46745	Various repairs	1.03%
Desarda MP ²⁴	2008	229	Tissue repair	0
Paajanen H ²⁷	2011	302	Lichtenstein repair	1.4%

Table-1: Various studies suggesting use of delayed absorbable suture as safe alternative.

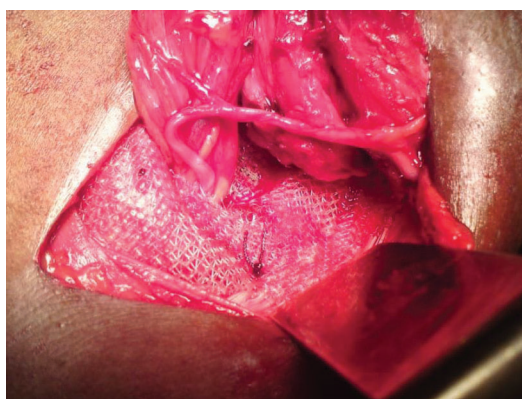


Figure-6: Spread out overlay component

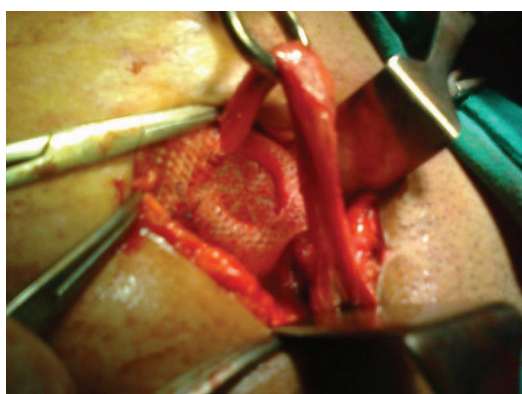


Figure-7: PHS mesh fixed

complications. The mean duration of hospital stay was 1.9 days (SD – 1.488).

The mean pain score in first 24 hours was 6.82/10 (SD – 1.848). Pain scores decreased markedly at two weeks after surgery. At two weeks, the PHS pain score was 1.24/10 (SD – 0.797). About 40 patients (80%) resumed their daily routine activities in less than 48 hours. Mean time to return to daily routine activities was 1.9 days (SD – 0.587).

Two patients developed postoperative wound infection (4%). Infection was easily controlled by continuation of antibiotics for 4-5 more days. No mesh required removal because of infection. However, patients with infection tend to have higher pain scores and required more analgesics.

There were no reported instances of restriction of daily activities secondary to the groin pain. None of the patients reported recurrence of hernia (0% recurrence).

DISCUSSION

Surgical repair of groin hernias is one of the most commonly performed procedures in surgical practice. Despite various advances in hernia repair, the Lichtenstein repair continues to enjoy the status of most popular repair technique all over the world owing to the ease of operation, low rates of local recurrence and high levels of patient safety and comfort.^{9, 10} but Lichtenstein repair is also not free from disadvantages. There have been reports of chronic irritation and pain after the Lichtenstein procedure, probably caused by tension, or nerve compression while fixing the sutures.^{11, 12, 13} Also, recurrent indirect inguinal hernias have been cited following anterior repairs due to peritoneal sac found protruding

through the internal inguinal ring between the posterior wall and the onlay patch. Thus, anterior repair acts only as a lid and not a stopper. Moreover, anterior repair does not afford any protection against the femoral hernias.³

Better understanding of the groin anatomy and pathophysiology of the abdominal wall led to the development of newer techniques. In an attempt to improve on the Lichtenstein repair, a number of MPRs were introduced. But the problem created by MPR of primary hernia was that the remainder of the canal's posterior wall, both medial and lateral to the indirect inguinal ring, remained unprotected without a mesh and became at greater risk to herniate. Lateral recurrences, which were usually interstitial, occurred and most appeared a few years after the last repair. Like Lichtenstein repair, MPRs also did not afford any protection against femoral hernias.³

Advances in laparoscopic surgery and concepts of preperitoneal hernia repair led to introduction of laparoscopic hernia repair. Both acute and chronic pain were reported to be less after laparoscopic groin hernia repair.^{14, 15} However, laparoscopic hernia requires general or regional anaesthesia, longer learning curve, longer operative time, and the risk of serious complications is greater.^{14, 16} Neumayer et al demonstrated that the recurrence rates were higher for laparoscopic inguinal hernia repairs when compared with the open onlay mesh repair. Serious complications included trocar injury to bowel and bladder, vascular injury to femoral vessels, nerve entrapment, transaction of vas deferens and hernial site hemorrhage.^{15, 16, 17}

Requirements for an ideal repair led to the development of this new bilayer polypropylene device called as PHS. The PHS mesh, consisting of an underlay patch, an overlay patch, and a joining connector, has potential benefits over the traditional Lichtenstein, MPR and laparoscopic repairs. The PHS mesh provides complete coverage of the entire myopectineal orifice through the underlay placed in the preperitoneal space, which protects the medial and femoral triangles, and the overlay, which protects the lateral triangle of the myopectineal orifice. The connector maintains the mesh in position either through the internal ring for indirect hernias or through the transversalis fascia for direct hernias decreasing the likelihood of mesh migration. In contrast to laparoscopic preperitoneal repairs, the underlay of the PHS mesh is not fixed to the surrounding structures, allowing for greater flexibility of the underlay to contour to the abdominal wall in a tension-free manner.¹⁸

Demographic data of this study was similar to the previous studies conducted in the subject. Males outnumber females in the incidence of inguinal hernias (male: female = 12:1).⁶ In our study, all the participants were males. The mean age of presentation in the study was 41.05 years (SD – 11.245) which corresponds to the bimodal distribution in inguinal hernias with peaks before 1 year of age and then again after age 40.⁴ the inclusion criteria did not include the patients below 15 years of age in the study.

In men, indirect hernias predominate over direct hernias at a ratio of 2 : 1.⁷ In our study, 78% participants were found to

have indirect hernias. Right sided hernias are more common than left sided hernias.⁷ In our study right sided hernia was found more common with 63% patients having right sided hernia.

Sorensen et al found in their study that smoking is an important risk factor for recurrence of groin hernia, presumably due to an abnormal connective tissue metabolism in smokers.¹⁹ In our study, 32% of all the patients were found smokers. Other co-morbid diseases were found in 24% of all the participants which corresponds to similar studies done previously in this subject.^{9, 20, 21}

Four stitch technique of PHS

We followed a four stitch technique by 2-0 polyglactin 910 (vicryl) in PHS mesh group with significant decrease in operative time and considerable decrease in postoperative pain. Lesser number of sutures decreased the chances of nerve entrapment while ensuring correct positioning of the mesh. P. Witkowski et al conducted a study in 111 patients in 4 hospitals from September 2003 to September 2005 to evaluate need for fixation sutures in ventral hernias. They found that avoiding mesh fixation to the surrounding tissue in ventral hernioplasty simplifies the operation, decreases the time of the procedure, and decreases the risk of suture-related complications without compromising the outcome.²²

Absorbable suture (Table 1)

Recently many studies have reported that chronic groin pain after inguinal hernia operation is more common than previously assumed. It occurs in 20-30% of patients at long-term follow-up. The possible causes include irritation or damage of inguinal nerves by sutures or mesh inguinodynia, inflammatory reaction against the mesh, or simply scar tissue.²³ Some authors routinely divide the nerves if they are at risk of being incorporated within a nonabsorbable suture. This fear is taken care of by absorbable sutures. The polyglactin 910 sutures used in the present study disappear by hydrolysis from tissues in 60-90 days and the biomechanical strength retention remains up to 65% in 2 weeks. Desarda MP²⁴ in his study of 229 patients found that absorbable sutures decrease incidence of chronic groin pain without jeopardizing the safety of repair and without any increase in recurrence rate. In our study we also found that use of absorbable sutures helped in relieving neuralgia and lessened chronic groin pain by causing less permanent nerve entrapment without affecting the recurrence rate. We also noted that there was less foreign body sensation with knots of polyglactin 910 suture, which is a common problem with knots of prolene suture.

Moreover, the technique of PHS mesh placement was learned with ease by most residents which also corresponds to similar study by Nienhuijs et al in a teaching setting.²⁸ Operating times for PHS compared favourably with those of laparoscopic procedures.

80% of the patients were discharged on the first postoperative day with mild pain and no signs of complications. These results are in line with earlier results of open mesh techniques.^{8,20}

After PHS repair the patients tended to return to work and sporting hobbies sooner. Vironen et al⁹ and Kingsnorth et al²⁹ have shown similar results in their study.

A french study found that all 206 recurrences in their series were located at the myopectineal orifice and that the choice of mesh must take this into account.³⁰ PHS aims to prevent any form of hernia recurrence through the myopectineal orifice, including occult femoral hernias.⁸ The technical advantage of PHS is that for indirect hernias the security of a preperitoneal layer is achieved without having to open the transversalis fascial layer.⁸ In our study no recurrence occurred in the PHS repair.

Gilbert et al, who pioneered the technique, in his study have shown similar recurrence rates for PHS repair in the hands of hernia specialists and general surgeons.³¹ Similar outcomes were noticed in our study, the deployment of the preperitoneal component through the hernial orifice was done without difficulty in all cases. Definitely PHS has succeeded in achieving goal of zero% recurrence without increasing the complication rate. These low recurrence rates with PHS may stem from complete coverage of the myopectineal orifice and flexibility of the PHS mesh.

CONCLUSION

PHS offers complete protection against all types of groin hernias including femoral hernias as well, which are not taken care of by other anterior repairs. Also, learning curve for PHS is short which is equivalent to other anterior repairs and better than laparoscopic repairs.

Also, it can be stated that absorbable sutures help in decreasing incidence of chronic groin pain without increasing the recurrence rate, though further studies are required in this respect to prove this fact.

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