

Chapter 23

The Prolene Hernia System Repair for Inguinal Hernia Repair: A Review

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Abstract

Inguinal hernia repair ranks among the most frequently performed surgical procedures globally, with mesh-based tension-free techniques established as the standard of care due to their low recurrence rates and favorable postoperative outcomes. The Prolene Hernia System (PHS), introduced by Gilbert, features a bilayer polypropylene mesh designed to reinforce both the posterior preperitoneal space and the anterior inguinal floor via a single anterior approach. The theoretical benefits of the PHS include comprehensive coverage of the myopectineal orifice, a reduced risk of recurrence, minimal tissue tension, and enhanced biomechanical support. Numerous randomized controlled trials and observational studies have compared PHS with Lichtenstein repair and other mesh-based techniques. Current evidence indicates comparable recurrence rates, chronic pain outcomes, and complication profiles, with some studies suggesting shorter operative times and faster recovery with PHS. Despite the increasing popularity of laparoscopic and robotic approaches, PHS remains a valuable option for open repair, particularly in selected patients undergoing primary unilateral inguinal hernia repair. This chapter evaluates the Prolene Hernia System and compares it with the Lichtenstein and plug mesh repair techniques.

Keywords: Prolene Hernia System, Open hernia repair, Tension-free repair, PHS, Inguinal hernia, Chronic pain, Recurrence.

Introduction

The Prolene Hernia System, a bilayer patch device developed by Gilbert, is designed for the treatment of inguinal hernia. This system comprises a bilayer polypropylene mesh, which includes an in-lay mesh and an over-lay mesh connected centrally. The underlay patch facilitates posterior mesh repair, while the connector serves as a plug repair. Additionally, the on-lay patch covers the posterior and lateral walls of the inguinal canal and is secured with a few sutures for stabilization. Gilbert applied this repair method to 759 patients, with 512 receiving local anesthesia and 244 receiving regional anesthesia. Notably, there were no reported recurrences, with seroma formation occurring in 4.2% of cases and wound infection in 0.7% of cases (Gilbert et al., 1999). The Prolene Hernia System offers the advantage of positioning the underlay patch in the preperitoneal space, making it suitable for treating direct and indirect inguinal hernias as well as femoral hernias. The underlay patch is not sutured, allowing it to conform to the shape of the abdominal cavity (Awad & Fagan, 2004).

The European Hernia Society guidelines for adult inguinal hernia treatment recommend the Prolene Hernia System as an alternative to the Lichtenstein inguinal hernia repair (Simons et al., 2009). In contrast, the Hernia Surge guidelines, issued by the Australasian Hernia Society, do not endorse the Prolene Hernia System for surgical management of inguinal hernias in adults. This is due to concerns about the excessive use of foreign material, extensive dissection of the anterior and posterior planes, which may lead to complications, and the increased costs associated with this type of mesh (Tran, 2018).

This chapter seeks to evaluate the Prolene Hernia System in the surgical management of inguinal hernias in adults. It compares the Prolene Hernia System with other mesh-based repairs, such as the Lichtenstein and Plug mesh repair, as well as laparoscopic inguinal hernia repairs, with a focus on complications, chronic pain, and recurrence rates. A comprehensive literature review was conducted using PubMed, Google Scholar, Semantic Scholar, and Cochrane databases to identify original research studies, observational studies, clinical trials, clinical reviews, review articles, systematic reviews, and meta-analyses from 1990 to 2026. The search utilized the following keywords: “Prolene

Hernia System,” “Open hernia repair,” “tension-free repair,” “PHS,” “Inguinal hernia,” “chronic pain,” and “recurrence.” All articles were in English, and additional articles were identified through manual cross-checking. Case reports, commentaries, and editorials were excluded, while all articles involving adult patients were included in this review.

Discussion

Prolene Hernia System

Berende et al. conducted a retrospective study on the Prolene hernia system for the treatment of inguinal hernia in adults, involving 217 patients. Postoperative hematoma formation was observed in 1.3% of cases. After a follow-up period of 32 months, the recurrence rate was 1.8%, and chronic pain was reported in 3.2% of cases (Berende et al., 2007). Yener et al. examined the quality of life following Prolene hernia system hernioplasty for adult inguinal hernia. This study included 30 patients, with superficial wound discharge occurring in 10% of cases. After an 8-year follow-up, the recurrence rate was 3.3%, and chronic pain was noted in 6.6% of cases (Yener et al., 2012). Mayagoitia et al. also conducted a retrospective study on the Prolene hernia system for inguinal hernioplasty. Among the 125 patients who underwent Prolene hernia system repair, no recurrences were observed after a follow-up of 27.5 months, and chronic pain was reported in one patient (Mayagoitia, 2004). Mottin et al. performed a retrospective study on the Prolene hernia system for managing inguinal hernia. This study included 96 patients, with postoperative wound infection occurring in 2.8% of cases. At a follow-up of 49 months, the recurrence rate was 1.04%, and the chronic pain rate was 2.08% (Mottin et al., 2011).

Faraj et al. conducted a retrospective analysis of the Prolene Hernia System for treating inguinal hernia in adults. This study included 150 patients, and after a follow-up period of 5.5 years, the recurrence rate was found to be 2.3%, while the incidence of chronic pain was 1.8% (Faraj et al., 2010). Hasegawa et al. also performed a retrospective study to evaluate the long-term outcomes of the Prolene Hernia System in adult inguinal hernia treatment. This study encompassed 367 patients, with postoperative complications observed in 5.5% of cases, a recurrence rate of 1.8%, and chronic pain occurring in 1.9% of cases (Hasegawa et al., 2006). Farrakha et al. investigated the feasibility of the Prolene Hernia System for adult inguinal hernia treatment. Their study included 154 patients, with superficial wound infection occurring in 5% of cases and scrotal edema in 3.4% of cases (Farrakha et al., 2006). Additionally, Obaid et al. conducted a retrospective study on the Prolene Hernia System for managing inguinal hernia in adults. This study involved 42 patients, with a wound infection rate of 4.6% and no recurrences observed after a 2-year follow-up (Obaid & Quazi, 2017).

Comparison of the Prolene hernia system and the Mesh plug and Lichtenstein hernia repair for inguinal hernia in adults

Badkur et al. conducted a randomized prospective study comparing the Prolene hernia system with the Lichtenstein repair for inguinal hernia in adults. The study involved 67 patients, with 33 undergoing the Prolene hernia system and 34 undergoing the Lichtenstein repair. The Prolene hernia system was associated with a longer operative time; however, it resulted in reduced postoperative pain compared to the Lichtenstein repair (15.15% vs. 41.18%). No differences were observed in recurrence and chronic pain between the two procedures (Badkur & Garg, 2015). Similarly, Pierides et al. conducted a prospective randomized clinical trial comparing the same two procedures. This trial included 300 patients, with 150 assigned to the Prolene hernia system and 150 to the Lichtenstein repair. The study found no significant differences in chronic pain between the procedures (9.8% vs. 12.7%), and after a 5-year follow-up, the recurrence rates were 8% for the Prolene hernia system and 1.7% for the Lichtenstein repair (Pierides & Vironen, 2011).

Decker et al. conducted a meta-analysis comparing the Prolene hernia system with the Lichtenstein repair for inguinal hernia. This analysis included seven studies encompassing 1,377 patients. The findings indicated no significant differences in recurrence rates (OR = 0.86, 95% CI, 0.32–2.88) or chronic pain (OR = 1.00, 95% CI, 0.65–1.55) between the two procedures. However, the Prolene hernia system was associated with a shorter time to return to normal activities (MD = -0.54, 95% CI, -1.07 to -0.11). Overall, the study demonstrated that both the Prolene hernia system and the Lichtenstein repair yielded comparable outcomes (Decker et al., 2019). Zhao et al. conducted a meta-analysis of randomized controlled trials focusing on open mesh techniques for inguinal hernia repair. This study incorporated ten trials with a total of 2,708 patients. The results showed no significant differences in recurrence rates among the Lichtenstein, Prolene hernia system, and mesh plug repair techniques (RR = 0.71, 95% CI, 0.32–1.56). The study concluded that the Prolene hernia system, plug mesh, and Lichtenstein repair were equally effective for treating inguinal hernia in adults (Zhao et al., 2009). Ran et al. conducted another meta-analysis of randomized controlled trials comparing open tensionless repair techniques for inguinal hernia in adults. The analysis revealed that the Prolene hernia system, mesh plug, and Lichtenstein repair exhibited comparable postoperative complications, recurrence rates, and chronic pain rates (Ran et al., 2020).

Hayashi et al. conducted a retrospective assessment of the outcomes associated with the Prolene hernia system and the Mesh plug in the treatment of inguinal hernia in adults. The study encompassed a total of 1,141 repairs, with 957 utilizing the Prolene hernia system and 154 employing the Mesh plug. The wound infection rates (1.3% for Prolene hernia system vs. 3.8% for Mesh plug) and recurrence rates (1.5% vs. 1.1%) were comparable between the two procedures (Hayashi et al., 2014). Dalenbäck et al. conducted a prospective randomized controlled trial to compare the Prolene hernia system, the Mesh plug, and the Lichtenstein repair for primary inguinal hernia in adults. The study involved 472 patients, divided into three groups: 155 patients underwent the Prolene hernia system, 159 patients received the Mesh plug, and 158 patients underwent the Lichtenstein repair. The results indicated no significant differences in postoperative complications, recurrence rates, or chronic pain among the procedures. Notably, both the Prolene hernia system and the Mesh plug were associated with reduced operative times (Dalenbäck et al., 2009). Sanjay et al. conducted a randomized controlled trial comparing the Prolene hernia system with the Lichtenstein repair for inguinal hernia repair. This study included 64 patients, with 31 undergoing the Prolene hernia system and 33 receiving the Lichtenstein repair. The findings revealed no significant differences in terms of postoperative complications, recurrence rates, or chronic pain (Sanjay et al., 2006).

Sanjay et al. conducted a meta-analysis to compare the Prolene hernia system with the Lichtenstein repair for open inguinal hernia repair. This analysis included six studies encompassing 1,313 patients. The findings indicated that the Prolene hernia system was associated with a higher rate of postoperative complications compared to the Lichtenstein repair (RR=0.71, 95% CI, 0.55-0.93). However, no significant

differences were observed in recurrence rates and chronic pain between the two procedures (Sanjay et al., 2012). Kingsnorth et al. conducted a randomized double-blind study comparing the Prolene hernia system and the Lichtenstein repair. This study involved 206 patients, with 103 patients assigned to each treatment group. The results demonstrated that the Prolene hernia system was associated with shorter operative time and fewer postoperative complications compared to the Lichtenstein repair (Kingsnorth et al., 2002). Huang et al. conducted a prospective study comparing the Prolene hernia system with the mesh plug repair in inguinal hernia. This study included 393 patients, with 234 patients undergoing the Prolene hernia system and 192 patients undergoing the mesh plug repair. The Prolene hernia system was found to reduce postoperative pain but was associated with a longer operative time compared to the mesh plug repair. The recurrence rate was similar between the two groups (Huang et al., 2005).

Nienhuijs et al. conducted a randomized clinical trial to compare the Prolene hernia system, mesh plug repair, and Lichtenstein repair for open inguinal hernia repair. The study randomized 344 patients into three groups: 111 patients received the Prolene hernia system, 113 patients underwent mesh plug repair, and 110 patients underwent the Lichtenstein repair. The results indicated no significant differences in postoperative pain and quality of life among the procedures (Nienhuijs et al., 2005). Similarly, Magnusson et al. conducted a prospective randomized controlled trial comparing the Ultrapro Hernia system, the Prolene hernia system, and the Lichtenstein repair for inguinal hernia repair. This study included 309 patients, with 99 patients receiving the Prolene hernia system, 108 patients undergoing Lichtenstein repair, and 102 patients undergoing Ultrapro repair. After a follow-up period of three years, no differences were observed in postoperative complications and recurrence rates among the procedures (Magnusson et al., 2016).

Table 1

Study	Study Type	Comparison of repair	Complications	Recurrence	Chronic Pain
Badkur et al., 2015	Randomized prospective study	Prolene Hernia System- (PHS) vs Lichtenstein	Early complications: 15.2% PHS vs(41.1%) Lichtenstein	No differences in recurrence rates between the procedures	1/33 (3.0%) PHS vs 2/34 (5.9%) Lichtenstein
Pierides et al., 2011	Randomized clinical trial	PHS vs Lichtenstein	Long-term sensory dysfunction: 5% PHS vs 14% Lichtenstein (P=0.022)	0.8% PHS vs 1.7% Lichtenstein at 5 years	Chronic pain at 5 years: 11% overall; no significant difference between groups
Decker et al., 2019	Meta-analysis	PHS vs Lichtenstein	No difference in complications	No difference 0.86, 95% CI (OR 0.32-2.28)	No difference (OR 1.00, 95% CI 0.65-1.55)
Sanjay et al., 2012	Meta-analysis	PHS vs Lichtenstein	Higher peri-operative complications with PHS; RR favoring Lichtenstein = 0.71 (95% CI 0.55-0.93)	No significant difference	No significant difference
Zhao et al., 2009*	Meta-analysis	PHS vs Lichtenstein vs Mesh Plug	Not readily identifiable from accessible sources	No significant difference reported in pooled analyses	No significant difference reported in pooled analyses
Ran et al., 2020	Meta-analysis	Mesh Plug vs Lichtenstein vs Mesh Plug	No significant difference in seroma, hematoma, infection, or overall postoperative complications	No significant difference (P=0.77)	No significant difference (P=0.90)

Table showing the recurrence rates and chronic pain between the Prolene hernia system, Lichtenstein repair, and Plug mesh repair.

Comparison of the Prolene Hernia System and the Transabdominal Preperitoneal (TAPP) and Total Extraperitoneal Repair (TEP)

Abdelhamid et al. conducted a retrospective study comparing the Prolene hernia system with the transabdominal preperitoneal (TAPP) approach for primary inguinal hernia repair. The study included 250 patients, with 200 undergoing the TAPP procedure and 50 receiving the Prolene hernia system. The recurrence rates for TAPP and the Prolene hernia system were comparable, at 1.5% and 4.5%, respectively. However, the Prolene hernia system was associated with a shorter operative time and lower cost (Salah Abdelhamid, 2017). In an observational study by Susmallian et al., the Total Extraperitoneal (TEP) repair was compared with the Prolene hernia system for inguinal hernia repair. This study involved 577 patients, with 293 undergoing TEP repair and 284 receiving the Prolene hernia system. The Prolene hernia system resulted in reduced postoperative pain, although overall outcomes were similar between the two methods (Susmallian et al., 2021). Choi et al. also compared the Total Extraperitoneal repair with the Prolene hernia system for inguinal hernia repair. Their findings indicated that the Total Extraperitoneal repair had a shorter operative time but was associated with a higher incidence of postoperative complications, such as seroma and hematoma formation (Choi et al., 2012).

Conclusions

The Prolene hernia system presents a viable alternative to the Lichtenstein repair for managing inguinal hernia in adults. The strategic placement of the inlay mesh within the preperitoneal space effectively reduces the risk of recurrence. This procedure is feasible under local or regional anesthesia. However, the increased incidence of complications, such as hematoma formation and mesh migration, has resulted in a decline in the adoption of this open tension-free inguinal hernia repair method. Despite these challenges, the Prolene hernia system remains relevant in inguinal hernia management, and it is advantageous for general surgeons to acquire proficiency in this technique.

Declaration

Conflict of interest: There is no conflict of interest.

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