

Chapter 22

The Mesh Plug Repair for Inguinal Hernia in Adults: A Review

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Abstract

Inguinal hernia repair ranks among the most frequently performed surgical procedures globally. The advent of prosthetic mesh has markedly decreased recurrence rates and revolutionized the management of groin hernias. Among the tension-free techniques developed, the mesh plug repair, introduced by Rutkow and Robbins in the 1990s, has emerged as a straightforward and effective method. This technique involves the insertion of a conical polypropylene mesh plug into the hernia defect, supplemented by additional mesh reinforcement when necessary. Its widespread acceptance is attributed to its technical simplicity, brief operative duration, low recurrence rates, and suitability for outpatient surgery. Nonetheless, concerns regarding mesh-related complications, such as migration, chronic pain, erosion into adjacent organs, and foreign body sensation, have prompted increased scrutiny of this technique. Recent international hernia guidelines have increasingly endorsed flat mesh repairs and laparo-endoscopic approaches over mesh plugs. This chapter examines the mesh plug repair, its clinical outcomes, advantages, limitations, complications, and its contemporary role in inguinal hernia surgery. Additionally, we compare the mesh plug repair with other open mesh inguinal hernia repairs and laparoscopic inguinal hernia repairs.

Keywords: Mesh plug, Open hernia repair, Tension free repair, Plug and Patch, Inguinal hernia, Chronic pain, and Recurrence.

Introduction

Rutkow and Robbins pioneered the mesh plug repair technique for inguinal hernia, which entails the insertion of a manually crafted umbrella plug mesh into the internal ring, secured to the crura with two or three interrupted sutures. In cases of direct inguinal hernias, the mesh plug is introduced through the defect with the narrow end first and is affixed with multiple interrupted sutures to the adjacent tissues. Subsequently, a flat Marlex mesh is employed to reinforce the repair by attaching it to both the anterior and posterior walls of the inguinal canal. The lateral section of the flat Marlex mesh is divided to accommodate the spermatic cord, with the lateral leaf anchored to the medial leaf. Closure of the external oblique aponeurosis and the skin follows. Rutkow and Robbins later adopted the Prefix Plug, a prefabricated mesh plug, to replace the hand-rolled plug mesh (Robbins & Rutkow, 1995; Rutkow, 2003). The mesh plug repair demonstrated a reduced operative time and comparable recurrence rates to the Lichtenstein repair, and it was feasible under local and regional anesthesia (Amid, 2005; Faylona, 2017; Reuben & Neumayer, 2006).

The European Hernia Society guidelines on the treatment of inguinal hernia in adult patients suggest that Mesh Plug repair may serve as an alternative to the standard Lichtenstein repair for managing primary inguinal hernias in adults (Simons et al., 2009). Conversely, the Hernia Surge guidelines of the Australasian Hernia Society indicate that, although the recurrence rates and chronic pain associated with Mesh Plug and Lichtenstein repairs are comparable, the Mesh Plug is not recommended for primary treatment of adult inguinal hernias. This recommendation is due to the excessive use of foreign material, the requirement to access both the anterior and posterior planes, and the additional costs involved (Tran, 2018).

This chapter seeks to evaluate the Plug Mesh repair technique within the context of surgical management for adult inguinal hernias. It provides a comparative analysis of Plug Mesh hernia repairs against other mesh-based methods, such as the Lichtenstein and Prolene hernia systems, as well as non-mesh-based open inguinal hernia repairs, with a particular focus on complications, chronic pain, and recurrence rates. A thorough literature review was performed utilizing databases including PubMed, Google Scholar, Semantic Scholar, and Cochrane to identify original research studies, observational studies, clinical trials, clinical reviews, review articles, systematic reviews, and meta-analyses

spanning from 1984 to 2026. The search incorporated keywords such as “Mesh Plug,” “Open hernia repair,” “tension-free repair,” “Plug and Patch,” “Inguinal hernia,” “chronic pain,” and “recurrence.” All articles were in English, and additional relevant articles were identified through manual cross-checking. Excluded from this review were case reports, commentaries, and editorials, while all articles involving adult patients were included.

Discussion

The Mesh Plug Repair for inguinal hernia

Rutkow and Robbins introduced the mesh plug repair technique for inguinal hernias in a cohort of 2,403 patients, with 1,708 receiving the hand-rolled mesh plug and 695 receiving the Perfix mesh plug. The follow-up period extended to six years, during which minimal complications were observed, and the recurrence rate was reported at 1% (Rutkow & Robbins, 1995). Bringman et al. conducted a prospective study on the application of mesh plug repair for inguinal hernias, involving 139 patients. This study reported 17 minor complications and two recurrences over a nine-month follow-up period (Bringman et al., 2000). Zieren et al. also performed a prospective observational study on the Mesh Plug technique for inguinal hernia repair. This study included 359 patients who underwent 400 mesh plug inguinal hernia repairs under local anesthesia. The wound infection rate was 1.5%, and the recurrence rate was 0.25% at 42 months of follow-up (Zieren et al., 2001). Mori et al. conducted a study on Mesh plug repair for inguinal hernia, involving 244 patients. The study reported a wound infection rate of 1.6% and a recurrence rate of 12.7% after a five-year follow-up (Mori et al., 2001).

Fasih et al. conducted an evaluation of the mesh plug technique for inguinal hernia repair, focusing on early outcomes. In their study, 200 patients underwent the mesh plug repair, and after a one-year follow-up, minor complications were observed in 2% of cases, with a recurrence rate of 0.5% (Fasih et al., 2000). Similarly, Abu-Own et al. investigated the mesh plug technique for managing inguinal hernias in adults, reporting that it was associated with shorter operative times, reduced postoperative pain, and a quicker return to work (Abu-Own et al., 2000). Palot et al. conducted a three-year follow-up of 140 patients who underwent the mesh plug repair for inguinal hernia, finding that groin pain occurred in 6.3% of cases, with a recurrence rate of 0.9% (Palot et al., 1998). Dieudonné et al. performed the mesh plug repair on 3990 patients, with follow-up extending to 10 years; they reported a wound infection rate of 0.6%, testicular atrophy in 0.8%, and a recurrence rate of 1.4% (Dieudonné, 2001).

Comparison of the Plug Mesh repair with the Lichtenstein repair and Prolene Hernia System repair

Singh et al. conducted a randomized controlled trial to compare mesh plug repair with Lichtenstein inguinal repair. The study involved 200 patients, with 100 undergoing mesh plug repair and 100 undergoing Lichtenstein hernia repair. Follow-up was conducted for six months, revealing similar postoperative complications and recurrence rates between the two groups (Singh et al., 2016). In another randomized clinical trial by Frey et al., the Lichtenstein repair was compared with the mesh plug repair for inguinal hernias. This study included 595 patients, with 297 in the Lichtenstein group and 298 in the mesh plug group. Over a 12-month follow-up period, no differences were observed in postoperative complications and recurrence rates between the procedures. However, the reoperation rate was higher in the Lichtenstein group compared to the mesh plug group (4.2% vs. 1.4%) (Frey et al., 2007). Destek et al. conducted a prospective randomized study comparing Lichtenstein repair with mesh plug repair for inguinal hernia management. The study included 102 patients, with 52 undergoing mesh plug repair and 50 undergoing Lichtenstein repair. No differences were found in postoperative complications and recurrence rates between the procedures, although the mesh plug was associated with a reduced operative time compared to the Lichtenstein repair (Destek & Gul, 2018).

A prospective double-blind randomized controlled trial conducted by Kingsnorth et al. compared the Lichtenstein repair with the Perfix plug and patch repair for inguinal hernia. In this study, 141 patients were randomized, with 68 undergoing the Lichtenstein repair and 73 receiving the plug and patch repair. The plug and patch repair demonstrated a shorter operative time and reduced postoperative pain compared to the Lichtenstein repair, while recurrence rates showed no significant difference between the procedures (Kingsnorth et al., 2000). Huang et al. conducted a prospective study comparing the Mesh plug repair with the Prolene Hernia System for inguinal hernia treatment. This study included 393 patients, with 192 undergoing mesh plug repair and 234 receiving Prolene hernia system repair. The mesh plug repair was associated with a shorter operating time (25 minutes versus 34 minutes); however, the incidence of chronic groin pain was higher in the mesh plug group (8.9% versus 2.8%), and recurrence rates were similar between the groups (Huang et al., 2005). Droezer et al. conducted a long-term follow-up of a randomized controlled trial comparing the Lichtenstein repair with the Plug and Patch repair for inguinal hernia. This study involved 595 patients, and at a median follow-up of 6.5 years, recurrence rates were similar between the groups (mesh plug: 7.8% versus Lichtenstein: 8.2%), with no significant differences in chronic pain (Droezer et al., 2014). A retrospective study by Hayashi et al. assessed the short- and long-term outcomes following the use of the Mesh plug and Prolene hernia system for inguinal hernia treatment. This study included 1141 patients, with 184 undergoing the Mesh plug repair and 957 receiving the Prolene hernia system. There were no significant differences in postoperative complications between the procedures, and recurrence rates were similar between the groups (Hayashi et al., 2014).

Zhao et al. conducted a meta-analysis of randomized controlled trials examining open mesh techniques for inguinal hernia repair. This study incorporated 10 studies involving 2708 patients and found no significant differences in recurrence rates among the mesh plug, Lichtenstein, and Prolene hernia systems (RR = 0.71, 95% CI, 0.32–1.56). However, both the mesh plug and Prolene hernia systems were associated with reduced operative times (Zhao et al., 2009). Similarly, Yu et al. performed a meta-analysis comparing mesh plug repair and Lichtenstein repair for inguinal hernia management. This analysis included 11 studies with a total of 2929 patients, of whom 1457 underwent mesh plug repair, and 1472 underwent Lichtenstein repair. The findings indicated that mesh plug repair resulted in shorter operative times but extended the time required for patients to return to work (MD = 1.48, 95% CI, 0.58–2.38). No significant differences were observed in postoperative complications and recurrence rates between the two procedures (Yu et al., 2021).

Table 1: Comparison of Complication Rate, Recurrence Rate, and Chronic Pain Following Mesh Plug Repair, Lichtenstein Repair, and Prolene Hernia System

Study	Study type	Operative techniques compared	Overall Complications	Recurrence Rate	Chronic Pain
Singh et al., 2016	Randomized controlled study	Mesh plug repair vs Lichtenstein repair	Negligible postoperative complications; no significant difference between groups.	No significant difference; recurrence rates were very low during 6-month follow-up.	Not specifically reported; postoperative pain similar between groups.
Féry/Dalenbäck et al., 2007-2009 (BOOP Trial)	Randomized clinical study	Lichtenstein Repair vs Mesh Plug Repair vs Prolene Hernia System	No statistically significant difference in early or late complications among the three groups.	7 recurrences among 472 patients (1.5%), evenly distributed between groups.	No significant differences in long-term pain outcomes between techniques.
Destek et al., 2018	Randomized clinical study	Mesh Plug Repair vs Lichtenstein repair	Similar complication rates	Similar recurrence rates are at 2-year follow-up.	Significantly less pain in MPR patients at day 1, 2 weeks, and 6 months.
Zhao et al., 2009	Meta-analysis	Lichtenstein Repair (LR) vs Mesh Plug Repair (MPR) vs Prolene Hernia System (PHS)	No significant differences in complications.	No significant differences in recurrence between LR, MPR and PHS	No significant differences in chronic pain between techniques

Comparison of the Mesh Plug repair with the Trans-Abdominal Preperitoneal (TAPP) and Total Extraperitoneal (TEP) repairs

Khoury et al. conducted a randomized prospective controlled trial to compare laparoscopic extraperitoneal hernia repair with mesh plug hernia repair. The study included 292 patients, with 150 undergoing laparoscopic extraperitoneal repair and 142 undergoing mesh plug repair. While no major complications were observed, minor complications were more prevalent in the mesh plug group compared to the laparoscopic extraperitoneal group (23% vs. 13%). There was no significant difference in recurrence rates between the two procedures (Khoury, 1998). In a separate prospective non-randomized study, Pikoulis et al. compared laparoscopic preperitoneal mesh repair with mesh plug inguinal hernia repair. This study involved 471 patients, with 237 undergoing laparoscopic preperitoneal repair and 234 undergoing mesh plug repair. Postoperative complications were similar across both groups; however, the recurrence rate was higher in the laparoscopic preperitoneal repair group (2.5% vs. 0.4%). Additionally, the mesh plug repair was associated with lower costs and a quicker return to normal activities (Pikoulis et al., 2002).

Gong et al. conducted a prospective randomized controlled trial to compare mesh plug inguinal hernia repair with Transabdominal Preperitoneal (TAPP) and Total Extraperitoneal (TEP) techniques. The study randomized 164 patients into three groups: 62 patients underwent mesh plug repair, 50 patients underwent TAPP repair, and 52 patients underwent TEP repair. The results indicated no significant differences in postoperative complications and recurrence rates among the procedures. However, mesh plug repair was associated with a shorter operative time and reduced costs (Gong et al., 2011). Additionally, Shi et al. performed a network meta-analysis comparing mesh plug, Lichtenstein, transabdominal preperitoneal, and total extraperitoneal hernia repairs. This analysis included 38 studies with a total of 3,255 patients. The findings revealed no significant differences in postoperative complications, wound infection rates, seroma formation, and recurrence rates among the Lichtenstein repair, mesh plug repair, Transabdominal Preperitoneal, and Total Extraperitoneal repairs (Shi et al., 2020).

Conclusion

The mesh plug technique marked a significant advancement in the development of tension-free inguinal hernia repair, substantially reducing recurrence rates during the prosthetic era of hernia surgery. This procedure is characterized by its technical simplicity, short operative duration, rapid recovery, and durable outcomes comparable to other open mesh techniques. However, the increasing awareness of complications associated with the plug, such as migration, erosion, chronic pain, and foreign body sensation, has led many surgeons to prefer flat mesh repairs and minimally invasive approaches. While mesh plug repair remains an effective option for selected patients, its role in inguinal

hernia surgery has become more restricted. Future research focusing on long-term outcomes and innovative prosthetic designs may further elucidate its position within contemporary inguinal hernia management.

Declaration

Conflict of interest: There is no conflict of interest

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