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Absorbable and Semi-Resorbable Meshes in Open Inguinal Hernia Repair : Biological Assumptions, Scar Substitution, and Verified Clinical Evidence of Recurrence

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Abstract

Semi-resorbable and long-term resorbable meshes have been developed to reduce long-term foreign-body mass while preserving early mechanical support in inguinal hernia repair. These devices share a central biological assumption: as the temporary polymer component loses strength and/or resorbs, host tissue remodeling and scar maturation will provide durable load-bearing reinforcement. Clinical evidence supporting this concept in the inguinal region remains limited and heterogeneous. In this narrative review we synthesize verified clinical reports restricted to open inguinal hernia repair in humans published within the last two decades, excluding animal studies, ventral/incisional hernia literature, laparoscopic approaches, and animal-derived biologic meshes. We summarize outcomes and recurrence signals reported for fully absorbable meshes, long-term resorbable synthetic meshes, and partially absorbable hybrid meshes used in Lichtenstein-type repairs. Across studies, recurrence patterns and reoperation findings support the hypothesis that, in selected settings, resorption and mechanical transition may outpace effective scar substitution, resulting in insufficient neo-fascial reinforcement.

Keywords: Inguinal Hernia; Lichtenstein; Resorbable Mesh; Semi-Resorbable Mesh; Polypropylene; Poly-L-Lactic Acid; Scar Substitution; Recurrence.

Introduction

Mesh-based, tension-free repair has substantially reduced recurrence after inguinal hernia surgery. At the same time, chronic postoperative inguinal pain and foreign-body related symptoms remain relevant patient concerns. In response, lightweight and partially/long-term resorbable constructions have been proposed to reduce the permanent implant burden. The premise is that early mechanical support and handling can be preserved while leaving less permanent polymer in the groin.

However, any strategy that reduces permanent material necessarily increases reliance on the host response. In the inguinal region—characterized by dynamic stress, layered fascial interfaces, and varied defect phenotypes—the repair must transition from prosthetic support to biological reinforcement without a mechanically vulnerable interval. This review focuses on open anterior repairs (Lichtenstein-type) and summarizes verified clinical evidence of recurrence associated with absorbable, long-term resorbable, and partially absorbable meshes. The intent is not to endorse or criticize specific commercial products but to clarify how material classes and resorption kinetics interact with tissue remodeling and recurrence risk.

Scope and Eligibility Criteria

To maintain clinical specificity and avoid extrapolation, this review is restricted to: (i) adults undergoing open inguinal hernia repair (Lichtenstein-type or closely related open anterior tension-free techniques); (ii) synthetic absorbable, long-term resorbable, or partially absorbable meshes; and (iii) clinical endpoints including recurrence, reoperation findings, or durability signals. We exclude animal or preclinical implantation studies; ventral/incisional hernia literature; laparoscopic inguinal repairs; and animal-derived biologic meshes, because these represent distinct anatomical, biomechanical, and immunologic contexts.

Material Classes and the Scar-Substitution Assumption Definitions

For clarity, we use the following practical definitions. Fully absorbable meshes are intended to resorb completely (e.g., PGA/TMC constructions). Long-term resorbable synthetic meshes are designed to persist for months to years before full resorption, theoretically extending the period of mechanical support. Partially absorbable meshes combine a permanent polypropylene (PP) component with an absorbable component (e.g., poliglecaprone or polyglactin) to reduce permanent mass while retaining a residual PP scaffold.

Although these categories differ in chemistry and resorption timelines, they share a mechanistic dependency: durable success requires timely conversion of early prosthetic reinforcement into a mechanically competent scar/neo-fascia. When early stiffness and handling are largely provided by the resorbable component, the repair may be vulnerable if scar maturation does not provide sufficient load-bearing continuity before the mesh's mechanical contribution diminishes.

Scar Substitution and the 'Mechanical Transition' Concept

The concept of scar substitution assumes that a temporary scaffold promotes fibroblast ingrowth and collagen deposition, ultimately producing a durable connective-tissue layer once polymer mass and strength decline. In practice, scar formation is staged: early collagen deposition and later maturation/organization do not occur instantaneously. Therefore, a key risk is a transient "mechanical transition" (or "mechanical gap") period in which the prosthesis contributes less strength but the host tissue has not yet matured into a stable, load-bearing structure. Whether such a gap becomes clinically meaningful likely depends on defect phenotype (e.g., medial versus lateral inguinal hernia), tissue quality, and local stress environment.

Verified Clinical Evidence : Fully Absorbable Meshes

Symeonidis and colleagues reported long-term outcomes after open inguinal hernia repair using a fully absorbable polyglycolic acid/trimethylene carbonate (PGA/TMC) mesh. Recurrence occurred during follow-up, raising the concern that complete resorption may not reliably translate into durable inguinal reinforcement in all patients (Symeonidis et al., 2013). While cohort size was limited, the study is clinically relevant because it directly tests the feasibility of total polymer disappearance in an anatomic region where long-term mechanical stability is essential.

Shamim described two cases of recurrent inguinal hernia in which reoperation suggested absence of mesh material ("mesh dissolution"), highlighting that in rare circumstances a repair may fail with minimal recognizable residual reinforcement at the surgical site (Shamim, 2010). Case reports cannot establish frequency or causation, but they provide clinically tangible illustrations of the scenario that scar substitution may be inadequate when mesh material is no longer present.

Verified Clinical Evidence : Long-term Resorbable Synthetic Meshes

Long-term resorbable synthetic meshes were introduced to extend mechanical support compared with fully absorbable materials, theoretically providing more time for constructive remodeling. Ruiz-Jasbon and colleagues conducted a prospective safety and performance study of a synthetic long-term resorbable mesh in Lichtenstein repair with follow-up to 3 years (Ruiz-Jasbon et al., 2014). A clinically important observation was heterogeneity by hernia type: outcomes were favorable in patients with lateral inguinal hernia, whereas higher recurrence rates were observed in patients with medial or combined hernias (Ruiz-Jasbon et al., 2014). This pattern is compatible with the concept that medial defects may represent broader tissue weakness, increasing reliance on sustained reinforcement.

Öberg reported a longitudinal imaging approach after inguinal repair using an absorbable mesh, emphasizing practical challenges in illustrating in vivo absorption and tissue replacement over time using magnetic resonance imaging (Öberg et al., 2015). While imaging cannot replace operative inspection, such work underscores that the timeline of material disappearance and tissue replacement is not easily inferred without dedicated studies.

Verified Clinical Evidence : Partially Absorbable Hybrid Meshes (PP + Absorbable Component)

Partially absorbable meshes retain a permanent PP scaffold while incorporating an absorbable component to reduce long-term polymer burden. Because a residual PP network remains, these materials are often perceived as less vulnerable to complete loss of reinforcement. Randomized and prospective studies nevertheless provide important information on recurrence and durability.

A multicenter randomized trial by the Polish Hernia Study Group compared heavyweight polypropylene mesh with a lightweight poliglecaprone–polypropylene composite mesh in Lichtenstein hernioplasty. At 12 months, recurrence rates did not differ between groups, while short-term pain was reduced in the partially absorbable mesh arm (Polish Hernia Study Group & Śmietański, 2008). Pielaçiński and colleagues reported a randomized trial comparing Lichtenstein repair using non-absorbable versus partially absorbable mesh, concluding that both approaches were effective in short-term observation and that partially absorbable mesh was associated with a lower risk of certain postoperative complications, while recognizing the need for larger and longer follow-up studies (Pielaçiński et al., 2011).

Bury and colleagues reported five-year results from a randomized clinical trial comparing a polypropylene mesh with a partially absorbable monofilament mesh for inguinal hernia repair. At 60 months, no difference in recurrence was observed between groups, while early postoperative pain reduction was reported in the partially absorbable mesh group (Bury et al., 2012). Paajanen and colleagues performed a single-surgeon randomized trial comparing three meshes in Lichtenstein repair (including a partly absorbable PP–polyglactin mesh) and reported that recurrence and chronic pain outcomes were similar among groups at both 2 and 5 years when operative technique was standardized (Paajanen et al., 2013).

Systematic Synthesis and Implications for Recurrence

Across the eligible clinical evidence base, several themes emerge. First, fully absorbable meshes provide the most direct test of whether scar substitution alone can maintain inguinal integrity. Recurrence signals in a clinical series (Symeonidis et al., 2013) and illustrative reoperation findings in case reports (Shamim, 2010) indicate that complete polymer disappearance may, at least in selected cases, be accompanied by insufficient durable reinforcement.

Second, long-term resorbable synthetics attempt to mitigate this limitation by extending mechanical support. Nonetheless, the prospective experience reported by Ruiz-Jasbon et al. suggests that durability may not be uniform across hernia phenotypes, with medial and combined hernias showing higher recurrence than lateral hernias (Ruiz-Jasbon et al., 2014). This observation aligns with the concept that certain defects may require more sustained reinforcement than a scar-dependent strategy can reliably deliver.

Third, partially absorbable meshes with a permanent PP component demonstrate that reducing permanent mass does not inevitably increase recurrence risk in randomized settings (Polish Hernia Study Group & Śmietański, 2008; Pielaçiński et al., 2011; Bury et al., 2012; Paajanen et al., 2013). These studies support the notion that, when a durable PP scaffold remains, long-term mechanical competence may be preserved in standard-risk cohorts. However, the absence of differences in broad trial populations does not exclude vulnerability in specific biological contexts, nor does it directly address scenarios where the dominant early mechanical contribution derives from a resorbable component.

Finally, a systematic review and meta-analysis of absorbable meshes in inguinal hernia surgery synthesized available clinical evidence and discussed the balance between potential reductions in chronic pain and concern for recurrence (Öberg et al., 2017). The authors emphasized that the evidence base is limited and heterogeneous, and that recurrence conclusions require careful interpretation (Öberg et al., 2017). For the practicing surgeon, the key point is not that resorbable strategies are intrinsically unsafe, but that the "durability mechanism" shifts along a spectrum: the closer a device moves toward complete or near-complete resorption, the more the long-term outcome becomes a test of host scar competence rather than implant persistence.

Clinical Implications (Non-Device-Specific)

From a practical standpoint, the reviewed evidence supports several cautious, non-device-specific implications.

- Defect phenotype matters: the differential recurrence patterns observed with a long-term resorbable mesh in medial versus lateral hernias suggest that phenotype-based selection may be important (Ruiz-Jasbon et al., 2014).
- Early handling is not a surrogate for durability: improvements in handling can reflect temporary polymer contributions; long-term success remains dependent on scar maturation and the presence and performance of a permanent scaffold, if any.
- Shared decision-making should acknowledge uncertainty: in the absence of large, phenotype-stratified trials, surgeons should be transparent that evidence for some resorbable strategies in the inguinal region remains emerging and that recurrence may be influenced by factors not fully captured by current studies.

In addition, study design features in the cited trials highlight practical considerations that should be made explicit when results are discussed. Follow-up intensity varies across studies, and recurrence detection can be influenced by whether surveillance is clinical, imaging-based, or triggered by symptoms. Hernia type definitions and reporting (lateral, medial, combined) are not uniform, limiting cross-study comparisons. These limitations argue for a conservative interpretive style in manuscripts that discuss resorbable materials: claims about "equivalence" or "superiority" should be bounded to the studied population, the specific mesh class, and the follow-up interval actually reported.

Limitations of the Evidence and Research Priorities

Eligible clinical studies remain few, sample sizes are often modest, and materials are heterogeneous, spanning fully absorbable, long-term resorbable, and partially absorbable constructs. Follow-up duration varies, and recurrence ascertainment methods differ. In addition, operative confirmation of "absence of residual material" is rarely standardized; negative findings at reoperation may reflect true material loss, fragmentation, migration, or inability to identify thin remnants macroscopically.

Future research in open inguinal hernia repair should prioritize:

- standardized reporting of hernia phenotype (lateral, medial, combined) and defect characteristics;
- consistent definitions and objective assessment of recurrence; and
- structured evaluation of tissue response and residual material when reoperation occurs, including histology when feasible. Such approaches would clarify whether—and in which contexts—mechanical transition outpaces effective scar substitution.

Conclusions

In open inguinal hernia repair, absorbable, long-term resorbable, and partially absorbable meshes represent distinct strategies to reduce permanent foreign-body mass. Verified clinical reports published within the last two decades indicate that recurrence can occur in settings where reinforcement ultimately depends on scar substitution, and that recurrence risk may vary by hernia phenotype. Partially absorbable meshes with a permanent PP scaffold appear to maintain durability comparable to conventional PP in randomized trials, whereas fully and long-term resorbable strategies highlight the potential for mismatch between resorption/mechanical transition and scar maturation in selected contexts. Well-designed, phenotype-stratified clinical studies with standardized recurrence assessment are needed. These findings should not be interpreted as a contraindication to absorbable or semi-resorbable meshes as a class, but rather as an illustration of potential limitations in selected biological and anatomical contexts.

Conflict of Interest

None.

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Ethical Approval
Not Applicable.

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