

# Causes of Postoperative Pain Following Inguinal Hernia Repair: What the Literature Shows

Extensive review and analysis of the published data on postoperative herniorrhaphy pain raises the question whether mesh causes pain after hernia repair.

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**F**or more than 20 years, there has been widespread international acceptance of the routine use of prosthetic mesh for primary inguinal hernia repair. Randomized controlled clinical trials have shown unequivocally a dramatic reduction in recurrence rates as compared to primary sutured repairs when the repairs have been done outside specialty centers, ie, using the Shouldice repair. However, postoperative pain syndromes have been recognized as a bona fide problem with mesh repairs. This issue has been greatly enhanced by concerns raised by advocacy groups, medico-legal problems, and cost containment among institutions. This article will explore the relationship between prosthetic materials and post-herniorrhaphy pain syndromes and identify subsets of patients and conditions whereby it may be better not to use mesh prostheses. This summary of facts and recommendations hopefully will provide a template for future hernia repairs and elevate the quality of surgical care.

## Materials and Methods

To study the link between postoperative pain among

inguinal hernia patients (inguinodynia) and prosthetic mesh, the author performed a retrospective online literature search from 1998 to 2011. The review included an analysis of different open and laparoscopic hernia repair techniques: non-mesh versus open mesh and laparoscopic mesh repairs were evaluated regarding the incidence of postoperative chronic pain. Risk factors associated with postoperative inguinal herniorrhaphy pain were listed and substantiated by published research results. These factors addressed the issues of preoperative pain, anesthesia, fear of pain, prolonged operative times, wound infections, hemorrhage, timing of surgery, and surgeon experience. Subsets of patients where prosthetic materials should not be used were identified. Ultimately, a summary of comprehensive findings was discussed referencing whether mesh did indeed cause pain following hernia repair, the mechanism of pain from mesh, and those recommendations as to how best avoid mesh pain.

## Classification of Postoperative Pain

Three separate types of chronic postoperative pain have been delineated including somatic or nociceptive pain, neuropathic pain, and visceral pain (Table 1). A common denominator in each type of pain is the presence of mesh. Somatic or nociceptive pain was found to be the most

common type of pain. Usually, it emanated from preoperative pathological causes. These may have included previous ligament injury, mesh injury, and new ligament or muscle injury caused by surgery. In addition there may be an aggressive scarification reaction, osteitis pubis, or a vigorous inflammation of the pubic tubercle. Lastly, a significant offender has been reactions to the prosthetic mesh/material.

The second type of pain is neuropathic pain. This involves direct nerve damage or injury. Certain intraoperative problems and/or technical issues may have transpired, including incorporation of nerve/nerves with staples, sutures, or mesh. Those nerves commonly involved included the ilioinguinal, iliohypogastric, genital branch of the genito-femoral nerve, and lateral femoral cutaneous nerve.

Mesh placement will usually negatively impact the genital branch of the genito-femoral nerve. Femoral nerve injury involving either the motor, sensory, or both functions may have been negatively impacted. A routine finding and phenomenon is the overlapping of the nerve distribution in the groin along with the symptoms and signs of the specific nerve injury.

The third type of chronic postoperative pain is visceral pain. The etiology may be of intestinal origin. Also, properitoneal tissue compromise may occur emanating from the mesh. Dysuria or difficulty starting the stream of urine may contribute to visceral pain. Other genitourinary problems such as dysejaculation syndrome (customarily predating surgery) and erectile dysfunction (ED) may play a part in visceral pain. However, one must be aware of the fact that erectile dysfunction cannot occur secondary to groin hernia surgery. Those nerves responsible for ED originate from the second through fourth sacral nerve roots, and not through the sensory

| <b>Table 1. Classifications of Chronic Postoperative Pain</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Somatic (nociceptive) pain                                 | <ul style="list-style-type: none"> <li>• Most common</li> <li>• Pain from preoperative pathological causes</li> <li>• Previous ligament/mesh injury</li> <li>• New ligament/muscle injury caused by surgery</li> <li>• Aggressive scarification reaction                             <ul style="list-style-type: none"> <li>○ Osteitis pubis</li> </ul> </li> <li>• Reactions to prosthetic material/mesh</li> </ul>                                                                                                                                                                        |
| 2. Neuropathic pain                                           | <ul style="list-style-type: none"> <li>• Direct nerve damage or injury</li> <li>• Incorporation of nerve with staples/sutures/mesh</li> <li>• Nerves commonly involved include:                             <ul style="list-style-type: none"> <li>○ Ilioinguinal</li> <li>○ Iliohypogastric</li> <li>○ Genito-femoral</li> <li>○ Lateral femoral cutaneous</li> </ul> </li> <li>• Mesh placement will usually negatively impact the genital branch of the genito-femoral nerve</li> <li>• Femoral nerve injury</li> <li>• Neuropathy symptoms and overlap of nerve distribution</li> </ul> |
| 3. Visceral pain                                              | <ul style="list-style-type: none"> <li>• Intestinal involvement</li> <li>• Properitoneal tissue compromise can emanate from mesh</li> <li>• Dysuria or difficulty starting stream of urine</li> <li>• Dysejaculation syndrome (pain and/or dysfunction usually predates surgery)</li> <li>• Erectile dysfunction complaints                             <ul style="list-style-type: none"> <li>○ Anatomically impossible</li> <li>○ Beware of “altered agenda”</li> </ul> </li> </ul>                                                                                                       |

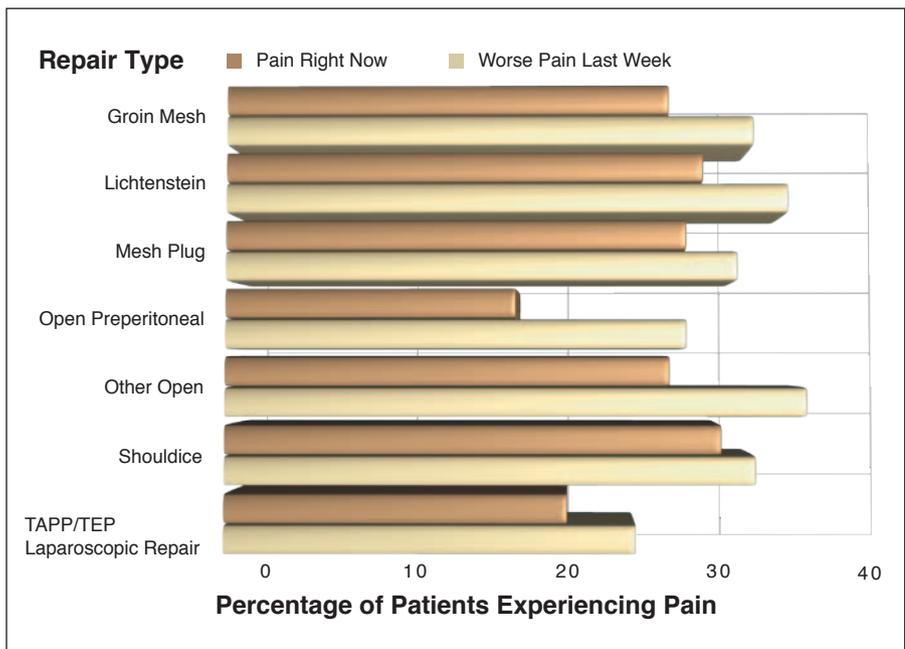
nerves in the groin. Therefore, it is anatomically impossible to create impotence from groin hernia surgery, despite that which a plaintiff’s attorney may say.

**Definition of Chronic Postoperative Groin Pain**

Chronic postoperative groin pain has been defined as pain lasting more than 30 days and interfering with the patient’s activities of daily living or work activities. Mesh inguinodynia is a phrase coined by Heise and Starling in 1998<sup>1</sup> and refers to pain following hernia repair. This term is also well described and discussed by Mazin.<sup>2</sup> Courtney, Duffy, et al<sup>3</sup> studied a series of 5,506 patients operated on

over 1 year. All types of repairs were included. According to this report, 3% of their patients experienced severe pain after 3 months; 8% of the patients required further surgery for various causes; and 15% went to pain clinics. Chronic pain affected walking, work, sleep, interpersonal relationships, and mood.

In their sentinel study, Bay-Nielsen, Perkins, and Kehlet<sup>4</sup> reported up to 37% of patients having chronic pain after inguinal herniorrhaphy. They cited no differences in regard to types of hernias, different surgical techniques, or different types of anesthesia. Greater than 50% of those patients with chronic pain had associated functional impairment.



**Figure 1.** Technical comparison of elicited pain. TAPP, trans abdominal preperitoneal; TEP, total extra peritoneal. Adapted from Fränneby U, et al. *Ann Surg.* 2006;244(2):212-219.

**Mesh Inguinodynia**

Whereby the phrase “mesh inguinodynia” was coined by Heise and Starling in 1998, they questioned whether mesh had caused pain syndromes or helped to eliminate them. In their study of 117 reoperated patients, 20 had a primary mesh herniorrhaphy and 3 had laparoscopic repairs. Two patients required mesh removal 1 to 2 years postoperatively. Sixteen patients had removal of the mesh and ilioinguinal or iliohypogastric nerve removal. Those patients undergoing mesh removal and neurectomy had a higher percentage (62%) of good to excellent results as compared to those patients undergoing mesh removal only (50%).

A recent 5-year comprehensive study by Paajanen, Scheinin, and Vironen<sup>5</sup> was unencumbered by governmental policies and restrictions. It was a nationwide analysis of complications related to inguinal hernia surgery in Finland that included 55,000 hernia operations. The

“open” mesh repair was the most frequent surgery in Finland in the 5-year timeframe. Two-thirds of the complications were related to chronic pain and infection. The vast majority were manual workers or retired persons. The Lichtenstein hernioplasty demonstrated the lowest complication rate of 3.9%. Although counterintuitive, most complications occurred when “specialists” performed the operation. It was concluded that 33% of patients having open surgery had chronic pain. Twenty percent of patients undergoing laparoscopic repairs had chronic pain. Surprisingly, 47% of all patients undergoing all types of inguinal hernia repairs had chronic neuropathic pain. This study concluded that mesh caused pain 7 times more often than non-mesh repairs. However, the pain from the mesh repairs was temporary, finite, and self-limiting. This group of investigators used 24 different meshes, including lightweight mesh, heavyweight mesh, and partially absorbable mesh. The

same complication rate was noted for each mesh sub-type.

Furthermore, they determined that the causes for pain included general anesthesia, lengthy surgery, wound infection, and hemorrhage. Operations removing the mesh and orchiectomies did not abolish the pain. Most complications were related to primary hernia repairs, non-emergency repairs, and the “open” technique. In this study, the laparoscopic repairs had the highest number of complications. No specific mesh was the primary culprit causing pain. The investigators concluded that mesh did not increase the rate of chronic pain; however, those factors influencing chronic pain were increased: preoperative pain levels, age fewer than 40 years, pain at other sites (such as back pain), psychosocial issues, and a history of heavy manual labor.

A study conducted by Fränneby et al showed that the laparoscopic repair technique caused the least immediate and least delayed pain (Figure 1).<sup>6</sup> The Shouldice repair (no mesh), the Lichtenstein repair (tension-free mesh repair), and other groin mesh repair techniques had very similar outcomes. These results would tend to indicate that mesh per se was not responsible for an increased rate or intensity of chronic pain.

**Risk Factors Associated With Postoperative Pain**

Poobalan, Bruce, Smith, et al<sup>7</sup> concluded that high postoperative pain scores occurred in patients who experienced high pain levels in the first week after surgery. In addition, high chronic pain scores occurred in patients undergoing recurrent hernia repair and those patients who experienced high levels of pain preoperatively. Those patients undergoing outpatient surgery also seemed to develop higher pain scores. These

investigators concluded that chronic pain occurred less often after open mesh and laparoscopic repairs as compared to non-mesh repair procedures.

These same premises were echoed by Nienhuijs, Staal, and Strobbe et al.<sup>8,9</sup> They identified risk factors for chronic postoperative pain as a high degree of pain conveyed by the surgeon to the patient preoperatively, high expectations of pain by the patient, a younger age (ie, fewer than 40 years), the patient's fear of pain, and the fact that regional anesthesia decreased pain only during the day of surgery. This same group of investigators concluded that only 11% of patients undergoing surgery for inguinal hernia repair developed chronic pain; 3% of these patients experienced moderate to severe pain of neuropathic origin. Of those patients encumbered by chronic pain, 33% had to limit their leisure activities.

In a different study, one of the previously quoted investigators, Paajanen<sup>10</sup>, gave credibility to the fact that chronic pain was reported less often after open mesh and laparoscopic repairs than non-mesh procedures. He also reiterated similar findings from other investigators listing factors associated with chronic postoperative groin pain; those being general anesthesia and postoperative hemorrhage. Further conclusions reiterated by Paajanen were in concert with prior findings from other investigative sources regarding lightweight versus heavyweight mesh products. He proved that lightweight mesh caused less postoperative pain; lightweight mesh had a higher recurrence rate; lightweight mesh caused less chronic pain; and lightweight mesh increased patient comfort allowing for better sexual function.

In reference to other opinions on mesh versus non-mesh repairs, more

**Table 2. Lessons Learned From the Literature**

- Mesh should not be used in patients 40 years of age or younger
- Laparoscopic or non-mesh repairs are recommended in patients with recurrent operations or contralateral hernia repair
- Intraoperative hemorrhage increases postoperative pain and infections
- Intraoperative contamination is a contraindication for mesh placement
- Use of biological mesh can be considered in contaminated sites, but not grossly contaminated sites (pus or bowel content)
- Mesh should not be used in patients with allergies to the synthetic material
- Mesh should not be used in a patient with a recent history of infection with MRSA

MRSA, methicillin-resistant *Staphylococcus aureus*

studies have suggested that chronic pain is reported less often after open mesh and laparoscopic repairs versus non-mesh repairs. Kalliomäki et al<sup>11</sup> reviewed the results of 2,834 patients undergoing hernia repairs. His data were somewhat conflicting whereby he cited factors for increased postoperative pain as: an open repair; increased preoperative pain; fewer than 3 years since the last surgery; the type of surgical procedure; the degree of specialization and experience of the surgeon; and the presence of diverse postoperative complications.

Another strong endorsement for the use of synthetic mesh came from the European Union Hernia Trialists Collaboration.<sup>12</sup> This group emphatically stated that the use of synthetic mesh reduces the risk of hernia recurrences and chronic pain. In 2008, an International Consensus Conference in Rome was held consisting of eight international experts in hernia repair.<sup>13</sup> Guidelines for prevention and management of chronic postoperative herniorrhaphy pain were

presented as a result of this meeting. Mesh was not implicated as a source of pain, but the technical aspects of mesh placement were causes of pain. They noted that the suturing or affixation method and device used are responsible for creating pain, mostly neuropathic in origin.

### **Subsets Where Prosthetic Materials Should Not Be Used**

After conducting an exhaustive review of the available literature regarding postoperative pain in inguinal herniorrhaphy patients, multiple recurring facts were obvious from the vast majority of the study results (Table 2). Firstly, there is generalized agreement that mesh is not recommended in patients 40 years of age or younger who have demonstrated severe preoperative pain out of proportion to the physical findings. Most experts advocate the use of the laparoscopic technique or non-mesh repairs for patients with prior complicated open mesh repairs with recurrence or contralateral hernias requiring repair. There was

universal agreement that intraoperative hemorrhage increased postoperative pain and increased the postoperative infection rate. Intraoperative gross contaminations, ie, spillage of bowel contents and/or purulence, are contraindications for the use of mesh. The use of “biological mesh” (preferably non-cross-linked) can be considered in the face of a previously infected or contaminated site but not grossly contaminated with pus or bowel contents.

Recurrent hernias caused by mesh extrusion are best approached laparoscopically or with primary tissue repair. Mesh should not be utilized for patients with allergies to the synthetic mesh material, such as polyester, polypropylene, polytetrafluoroethylene (PTFE), etc. Patients with allergies to bonded mesh coatings (ie, fatty acids, poly[lactic acid], polyglactic acid) are not candidates for mesh repairs. Patients with a recent history of infection with methicillin-resistant *Staphylococcus aureus*, even at a remote site, are at an increased risk of mesh infection for years thereafter. Therefore, the use of mesh is discouraged in this patient population.

Technical expertise was also an issue creating variances in postoperative pain. Patients whose surgeons have multiple patients developing disabling chronic pain from their mesh repairs and individualized techniques for repair should seek other surgeons with a higher level of technical expertise. Surgeons who are technically uncomfortable or technically challenged by the use of mesh with open or laparoscopic approaches are encouraged to use the technique with which they have had the best results in their hands. However, those surgeons with extensive experience and success using the Shouldice or other non-mesh repair

on a routine basis should continue exercising their skills by performing repairs without mesh. Lastly, the Nyhus type I and II defects are ideally repaired with sac inversion and narrowing of the internal ring without creating ischemia of the spermatic cord. Mesh is discouraged in this scenario.

### Discussion

The extensive review and analysis of the published data on postoperative herniorrhaphy pain raise the question whether mesh causes pain after hernia repair. Currently, there is no definitive answer because mesh will cause pain at times and on other occasions it has been proven not to cause pain. The next logical question would be the origin or mechanism of mesh-related pain. Five main factors of causation have been positively identified. The first factor is that bulky heavyweight mesh material will cause pain. Secondly, the patient’s idiosyncratic reactions with an exaggerated scarification response can generate significant pain. The third cause of pain is the scenario in which the surgeon exhibits an inattention to the technical details of mesh implantation. A fourth cause of pain may be allergic reactions to the mesh materials (ie, polypropylene, polyester, PTFE, and/or the coatings of mesh). The fifth direct cause of pain emanates from direct or indirect nerve injury or inflammation surrounding the nerves secondary to the mesh affixation process or the mere presence of the mesh.

In summary, the following recommendations are presented to mitigate the possibility of postoperative herniorrhaphy pain. The routine use of lightweight mesh for groin hernia repairs is strongly advised. Affixation of the mesh with a biological adhesive is an option when using the

laparoscopic technique. As part of standard technique, any sutures or tacks are to be placed meticulously with direct visualization, precision, and awareness of the surrounding structures, especially nerves. It is important to determine the patient’s prior history of mesh placement and synthetic material sensitivities. This would also apply in the case of xenograft or allograft use of biological meshes. Continuous intraoperative exquisite attention to technical and anatomical details is paramount. The surgeon should avoid placing a mesh in a previously or currently hostile groin environment. This refers to infected or inflamed tissues. In this case, one may consider approaching the groin from the opposite side (ie, laparoscopically or employ the use of a biological mesh). Lastly, the surgeon must tailor the procedure to the individual patient, not the patient to the procedure. In hernia surgery, one cannot use the same technical procedure on all patients. Different patients require different repairs and the use of different mesh products. Using the same technical approach for all one’s patients is a setup for chronic pain.

The anatomy of the inguinal region has been long considered very challenging and possibly the most difficult anatomical area in the body. Multiple repair variations and advancements have been made by forward-thinking individuals such as Bassini, Condon, Nyhus, McVay, and Lichtenstein. Each has contributed to the improvement for the quest of the perfect hernia repair. No longer is the attitude of “it’s only a hernia repair” permeating the surgical community. Exquisite attention to the minutest surgical and anatomical details as well as to adoption of extraordinary meticulous technique of repair is now

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the norm. Current-day icons in the field of hernia research have brought to the forefront the absolute need for knowledge of the precise anatomy and avoidance of the cavalier attitude of performing “just a hernia repair.” A template or blanket technique for repair of every patient with a hernia is to be condemned. The precise need for individual technique with some standardization is paramount in each and every patient. ■

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