Introduction

The Lichtenstein technique, performed and refined over several decades, revolutionized hernia surgery as a result of its reduced risk for morbidity and its potential use in patients previously unsuitable for this type of procedure.1 Surgeons quickly popularized this technique of tension-free mesh hernia repair, and it became the gold standard for the treatment of inguinal hernias.2 of which approximately 600,000 are surgically treated each year in the United States.3 Since the introduction of Lichtenstein mesh repair, overall hernia recurrence rates have fallen to 2% or lower.4 However, with the reduced risk for recurrence, irreversible long-term complications such as chronic pain have become increasingly clinically relevant.4 Specifically, chronic pain that affects quality of life and is at least partially disabling occurs more frequently than recurrences, and may completely attenuate the benefits of the hernia repair.4 A survey of 2,456 men and women randomly sampled from the Swedish Hernia Registry revealed that 758 patients (31%) experienced some degree of pain 2 or 3 years after surgery; 144 patients (6%) reported that the pain interfered with their daily activities.5 Many variables, including age and degree of pain before surgery, were independently associated with an increased risk for postprocedural pain. Variables potentially under the surgeon’s control included postoperative complications and operative technique.5

Self-Gripping Mesh

In 2008, Covidien launched ProGrip™ mesh (Figure 1), a self-gripping mesh indicated for use in inguinal and incisional hernia repairs. ProGrip™ was designed to offer patients greater comfort following surgery, and allow physicians the ability to position and secure the mesh in less than 60 seconds, which may contribute to a reduction in operating

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The macroporous polyester mesh has resorbable polylactic acid (PLA) micro-grips on one side of the mesh, which secure quickly without sutures, tacks, fibrin glue, or any other form of fixation (Figure 2).

“[ProGrip™ mesh is] a revolution because for the first time we can lay mesh without a suture, avoiding any risk for nerve entrapment and with the respect of the anatomical structures,” said Philippe Chastan, MD, general surgeon at the Clinique des 4 Pavillons in Lormont, France, who participated in the development of the mesh.

**ProGrip™ Mesh: First Impressions**

Andrew Kingsnorth, MS, FRCS, FACS, professor of surgery at the Peninsula College of Medicine & Dentistry, Derriford Hospital in Plymouth, United Kingdom, performs open inguinal hernia repair. Pr. Kingsnorth noted that he first encountered ProGrip™ mesh at the 2007 meeting of the European Hernia Society. “I had been thinking to myself that we should have a mesh that self-sticks to the wall, so I was incredibly enthusiastic,” Pr. Kingsnorth said.

William Carney, MD, FACS, chairman of the Division of General Surgery at Conemaugh Memorial Medical Center in Johnstown, Pennsylvania, added that he was quite interested in using the self-fixing properties of ProGrip™ mesh. "It's a unique concept," Dr. Carney said. "It's sutureless, flat on one side with little absorbable, almost feet on the other side. It looked like it would just stick to the tissue wherever you laid it, which is a neat idea."

As director of The Bon Secours Hernia Center at Bon Secours Mary Immaculate Hospital in Newport News, Virginia, Steven Hopson, MD, FACS, said that he is always interested in evaluating new advances in mesh for hernia repair. “When I was approached by a [Covidien representative], I thought the concept [of ProGrip™ mesh] was really different,” he said. “One of the things to keep in mind, and not just in mesh, but in all medicine today—because we have to look at cost and utilization—is that a new product really has to be a game changer, a paradigm shift in what we do.

"The concept of hernia surgery in general is that you take a piece of mesh, [place] it, and attach the mesh to the patient. We’ve learned that the way you fixate the mesh is very important with regards to postoperative pain and recurrence,” Dr. Hopson said. "With ProGrip™ mesh, instead of relying solely on mechanical fixation of the mesh to the tissue and the patient, the grips on the mesh do the work for you. The fixation is integrated into the mesh. I thought that was a really great idea and that was what piqued my interest in using it."

Despite reported benefits of ProGrip™ mesh in open procedures, some surgeons performing laparoscopic
When I first saw [ProGrip™ mesh], I ran screaming," said Jorge Granja, MD, assistant professor of surgery, and general surgeon at the University of Minnesota Medical Center, Fairview in Minneapolis, Minnesota, who performs inguinal hernia repairs laparoscopically via the total extraperitoneal approach. "I was pretty intimidated by the strong grip it had on itself and on the tissue around it. I thought that it would grab everything around it, including itself, and be difficult to manipulate in the small space I had." Once Dr. Granja increased the number of laparoscopic procedures in which he used the material, he said that his fears were unfounded. However, he still had reservations while he worked through the 10 to 20 cases necessary to grow completely comfortable with ProGrip™ mesh.

"My observation of inguinal hernia repair is that the mesh we use has a large impact on the results we get and on the patient’s quality of life," Dr. Granja said. Previously, Dr. Granja used 3DMax™ Mesh (Bard) because it did not require too much fixation. "Then, I saw work being done with polyester mesh and fibrin glue at a meeting," he said. "They were using a soft mesh and fixating it by gluing it. So I tried that for a number of cases, but it was very costly. The fibrin glue in our hospital [costs] up to $2,000 [for each application]. I thought that was a disservice to the patient, and it did not get a better result."

Once he became comfortable with ProGrip™ mesh, Dr. Granja found that the mesh had the advantage of being soft, but had a temporary firm memory state due to the PLA grips on one side. "Now, I’m placing this mesh in a small space covering a surface that it completely sticks to, so I don’t have to worry about tacking or sewing it, and I don’t have to worry about it moving," Dr. Granja said.

David Siegel, DO, FACOS, general surgeon at St. John Macomb-Oakland Hospital in Madison Heights, Michigan, added, "This mesh affixes to the entire surface rather than in just a few corner spots, so there is much less pulling or tugging. Before, the mesh was pulled wherever the stay sutures were, but now you have the entire mesh affixed to the floor of the hernia. That’s definitely a huge bonus." Mesh fixation is essential to avoid dislocation or migration, as these effects could result in a recurrence, which, along with chronic pain, is one of the 2 outcomes surgeons most want to avoid following hernia surgery.

Using ProGrip™ Mesh: Indications and Procedural Applications

ProGrip™ mesh is indicated for inguinal and incisional hernia repairs. It is primarily used in open inguinal repairs but many surgeons, including several of the interviewed faculty members, also are using ProGrip™ mesh for laparoscopic inguinal and open incisional hernia repairs. "At first, I would use it for all my inguinal hernia repairs except for large direct inguinal hernias, but as my experience grew, and I would do sort of a pseudo-Bassini hernia repair with an absorbable suture, I would use it on almost any inguinal hernia," Dr. Carney said. Dr. Siegel previously performed laparoscopic inguinal hernia repair, but now uses only an open approach with ProGrip™ mesh.

Dr. Granja noted that he uses ProGrip™ mesh for laparoscopic inguinal repair, as well as for open incisional repair. He added that there might be some limited use for the mesh in small incisional repair. "When it comes to very large [incisional repairs], I think the literature supports..."
[the use of the component separation technique] for the primary closure, which I think is the technique [that] will evolve for large and complex incisional hernias,” Dr. Granja said. Dr. Hopson currently uses ProGrip™ mesh for open inguinal and open incisional repairs, and considers the mesh size its only limitation for use in incisional repair (Figure 3). The Parietex™ composite mesh material itself—a large-pored, lightweight mesh—has been found safe and effective for incisional hernias.9

“The 30-cm sheets are much anticipated, and I think the biggest advantage to having the larger sheets is that we will be able to evaluate and repair larger open incisional hernias,” said Dr. Hopson, who will soon begin a clinical trial to evaluate the use of larger sheets of ProGrip™ mesh in these procedures. “My main interest with ProGrip™ mesh has been open incisional hernia repair,” he said. Recently, larger sheets of ProGrip™ mesh (30×15 cm and 20×15 cm) have become available.

**Patient and Surgeon Benefits of Self-Gripping Mesh**

**Pain Reduction**

Anecdotally, all of the interviewed faculty members have found their patients report less pain after receiving ProGrip™ mesh in hernia procedures. Dr. Siegel evaluates all his patients 1 week after surgery, and then again at week 3 if they are not reporting complete improvement. “Now, I’m seeing far fewer people at week 3 because they’re doing so well at week 1,” he said. Although he was more conservative with post-discharge activity instructions before using ProGrip™ mesh—evaluating patients on a case-by-case basis—Dr. Siegel now suggests that patients pay attention to their symptom severity when returning to usual activities. “A lot of [patients] are back to work, biking, jogging, within a week,” Dr. Siegel said.

“I think patient satisfaction has been good,” Dr. Hopson said. “For inguinal and open incisional repair with ProGrip™ mesh the patients seem to have less post-operative pain and discomfort.” Dr. Carney agreed that patients appear to have reduced postoperative pain. “The reason I went to this mesh is because I don’t have any sutures entrapping nerves in the groin,” Dr. Carney said. Before using ProGrip™ mesh, he reported a chronic pain rate of approximately 10%. “I’ve probably cut that in half,” he added. Most of his patients are able to resume sedentary activities quickly, but he instructs them not to do any heavy lifting until at least 3 weeks postsurgery. “A wound is a wound, and it still takes the body 21 days to get about 98% of the wound strength,” Dr. Carney noted.

**Recurrence**

In addition to avoiding pain, the other main complication surgeons want to avoid in hernia repair is recurrence. “The whole purpose of a hernia repair is not to get a recurrence,” Dr. Carney said. “Typically a hernia surgeon’s goal is to reproduce their results. In my 17-year career, I think the recurrence rate is very low because it’s the same procedure repeated again and again.” Dr. Granja added that, in his opinion, the self-gripping properties of ProGrip™ mesh may reduce the recurrence rate. “In my mind, in so far as ProGrip™ mesh is fixated in a complete fashion, recurrences would be a technical problem on the part of the surgeon and not of the mesh. Using ProGrip™ mesh should bring recurrences down to a negligible rate.”

Dr. Siegel considers ProGrip™ mesh to be a safe option because he has seen no change in his already low recurrence rate since he started using ProGrip™ mesh. “I think no matter what type of repair you do, if you do it right you will have a less than 1% recurrence rate, so I don’t think that has changed,” he said.

Figure 3. Dr. Hopson places ProGrip™ mesh in an open incisional hernia repair with component separation. Image courtesy of Covidien Inc.
Operating Time

Dr. Siegel has noted a significant drop in operating time since using ProGrip™, in addition to a reduction in reported patient pain. “My surgical times have dropped by probably 10 to 12 minutes, and I only do about 5% to 10% of my surgeries,” said Dr. Siegel, who now spends more time instructing residents. “Even in the hands of residents, the time is being cut as well,” he added. “I’ve tried probably 40 meshes in the last 10 years; I’d try all of them once or twice to see if I liked them and to give myself a chance to see if a mesh presented a better way of doing things. This is the first time I made a change and I’m happier that I did.” Pr. Kingsnorth noted. ProGrip™ mesh is evolving into a superior option for inguinal hernia repair, “in particular because of the speed with which you can perform the surgery,” he said.

ProGrip™ Mesh: Clinical and Preclinical Evaluations

In 2006, Dr. Chastan and colleagues followed 52 patients (70 hernias) after hernia repair using the lightweight (40 g/m²), large-pored mesh polypropylene incorporating resorbable PLA micro-grips (Figure 4). The aim of this study was to report the clinical outcomes with 1-year follow-up after open inguinal hernia repair using ProGrip™ mesh. During the procedures, Dr. Chastan found that mesh fixation to tissue frequently eliminated the need for sutures and no perioperative complications were reported. Following the operation, most patients were discharged at day 1, and the average duration before patients returned to normal activities was approximately 5 days. One month after surgery, the study found no reports of neurological pain or other major complications.

Following this early report, subsequent studies of the new ProGrip™ mesh also showed positive results for both patients and surgeons. Hollinsky and colleagues compared outcomes in rats in which polypropylene meshes were fixed either by hernia stapler, fibrin glue, ProGrip™ mesh, or unfixed mesh. Results showed that, after 5 days, the strength of incorporation was significantly higher in the ProGrip™ mesh and hernia staple-fixated group than in the fibrin glue or unfixed mesh group. After 2 months,
ProGrip™ mesh showed significantly better incorporation than all other groups.10 Also, inflammatory reactions, relatively high at 5 days, were reduced at 2 months. There also were no signs of mesh degradation after 2 months.10 Hollinsky and colleagues concluded that ProGrip™ mesh resulted in greater tissue strength of incorporation than other fixation systems, and that it represented an economic alternative to hernia-stapler fixation or fibrin glue fixation.10

In another animal model, Kolbe and colleagues examined the impact of ProGrip™ mesh on fertility due to concerns that self-gripping mesh could damage susceptible tissue layers around the ductus deferens.11 The researchers compared outcomes in 10 rats in which either standard lightweight polypropylene mesh or ProGrip™ mesh was wrapped surgically around the prepared ductus deferens; in 5 control rats, the ducts were bluntly separated from adherent tissue. At 2 months, the mesh implants were recovered with the ductus deferens for histology and analysis by electron microscopy.11 The lumen of the ductus deferens was unrestricted in all animals, and there was only some minor inflammation with infiltrating cells. The researchers concluded that self-gripping mesh posed no harm to the ductus deferens in rat models, and that given the larger dimensions of the human ductus deferens, the risk for detrimental fertility effect on exposed tissue could be excluded.11

Recently, Kapischke and colleagues compared reports of postoperative pain following the use of ProGrip™ mesh with traditional open Lichtenstein repair in 50 patients receiving groin hernia repair.12 On postoperative day 1, pain scores on the visual analog scale (VAS) for patients who received repairs using ProGrip™ mesh were significantly lower than patients who received traditional open repairs. Later administration of analgesics also was markedly reduced for patients receiving repairs using ProGrip™ mesh over those receiving...
Using ProGrip™ Mesh: Tips, Techniques, And Surgeon Benefits

When Dr. Granja first began using ProGrip™ mesh, he folded the mesh so that when he set it into place it would unroll to where he wanted. "Early on I think it’s important to set yourself up for success by placing it consistently and understanding where it’s situated before you start unrolling," Dr. Granja said. Dr. Siegel folds the mesh so that the back end is completely unexposed to the tissue until he is ready to unfold it. Although he rarely uses this approach, Dr. Siegel will occasionally place a suture through the mesh and tack it down. "That way everything lays into place because you have a stay suture medial with the pubic bone," Dr. Siegel said. "You cut that afterward, but it allows you to get the mesh into place."

Dr. Hopson recommends ensuring that the dissection is complete before placing the mesh. "It's easy to place, but it's much easier if you have the dissection complete and your planes defined before you place the mesh," he said. "That makes it a lot easier to manipulate the mesh into place." Dr. Carney notes that the mesh has a flap that sticks to itself and creates a pseudo internal ring. He said that he uses a small clamp to hold this flap back; the front part of the mesh covers most of the Hesselbach triangle. "I’ll fold the mesh in half on the nonsticky anterior side, and then I’ll take a forceps beneath the spermatic cord, lift that up, and create my pseudo internal ring. I’ll take the apex that goes to the pubic tubercle and set that down with the forceps."

Using his finger, Dr. Carney then implants the mesh along the shelving edge lateral to the internal ring. "I’ll put the cord down in position, and just flatten the mesh over Hesselbach’s triangle and lateral portion of the internal ring," Dr. Carney explained. "If it doesn’t seem like it’s laying right to me, I can take it out completely, set it on the drapes, flatten it out, and reposition my clamp and forceps and start over. I’ve not had a problem."

Future Development

"The mesh was primarily designed for open inguinal hernia repair, and now it’s being applied to open incisional repair and laparoscopic inguinal repair," Dr. Hopson said. "We’re looking forward to using it for umbilical hernia repair as well, so I think the evolution continues with this type of mesh and technology."
References

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