

My Journey Through the Evolution of Ventral and Incisional Hernia Repair. The State of the Art and What is in the Future.

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In 1968, I scrubbed in and watched my first incisional hernia repair as a medical student. This was a suture repair that approximated the edges without tension at the suture line and was considered the standard care at the time. The operating surgeon explained that the goal of any hernia repair is to correct the symptoms or problems that are associated with the hernia - such as pain, discomfort, and disfigurement - and to restore normal abdominal function. Surgical intervention is also necessary to prevent more serious complications such as incarceration and strangulation.

Since my first hernia repair 48 years ago, I have seen the modes and methods of hernia repair evolve around the purpose of reducing recurrence rates. The recurrence rate is of significant importance because a hernia recurrence indicates complete failure of the intended purpose and objective of the operation. Aside from the need for reoperation with the associated risks, pain, and inconvenience for the patients, hernia recurrence is associated with \$3.2 billion in annual healthcare costs in the U.S. A decrease of the recurrence rate by each percentage point is associated with \$32 Million in health care savings.¹

Although suture hernia repair addressed the obvious problem by closing the defect, recurrence rates were unacceptably high at 63%². Such a negative outcome barely justified surgical intervention in the first place, and left the surgical community and patients desperate for an improved approach.

By the 1980s, reinforcing the repair over the suture line using synthetic mesh was introduced as a plausible solution to dismal recurrence rates. In the first years of mesh repair, there was initial skepticism on whether the mesh would be more beneficial than harmful. Within a few years of clinical review, it became evident that the mesh repair decreased the incidence of recurrent incisional herniae significantly compared to suture repair alone. However, the introduction of the foreign body to the repair translated into a new type of complication: mesh infection. Each case of mesh infection requires a second operation for its removal, usually resulting in a recurrent hernia and an extra \$75,000 in healthcare costs.³ Furthermore, the overall incidence of surgical site infections (SSI) increased, leading to prolonged hospitalization with associated patient suffering. With these new complications, the improved recurrence rates were still unacceptably high, begging for the next improvement in hernia repair.

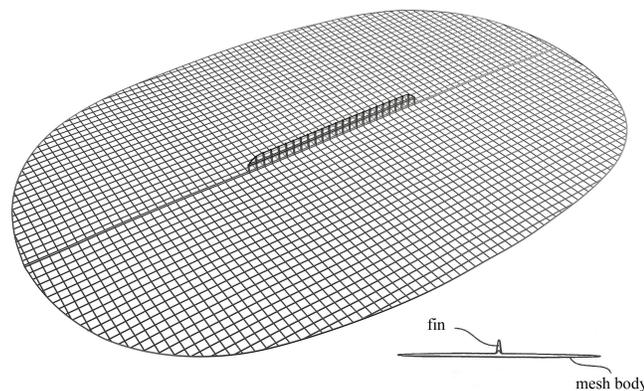
Minimally invasive ventral and incisional hernia repair was first reported in 1992 and showed immediate advantages over the open repair as far as complications and recovery. However, recurrence rates remain generally unaffected since traditional laparoscopic hernia repair does not approximate the defect edges and instead uses the prosthetic as a bridge repair.⁴ It is also technically more difficult because the mesh has to be perfectly positioned over the hernia defect with restricted mobility, leading to a longer

operation. These disadvantages may explain why only 22% of ventral hernia repairs are performed laparoscopically, even though the laparoscopic approach is widely accepted as the standard of care for a majority of other surgical procedures.⁵

Recent literature indicates that when the repair is done laparoscopically with a mesh *and* the defect is closed, recurrence rates range from 0-7% and the infection rate is less than 1%.^{6,7} These outcomes are the best-reported outcomes of any previous method, indicating a potential trend in the next phase of ventral hernia repair. The biggest obstacle in obtaining these optimal outcomes is adopting the technical skill required to perform defect closure exclusively in the restrictive laparoscopic mode.

Inspired by the recognition that defect closure in a minimally invasive environment is foreboding enough to prevent surgeons from attempting it, a new hybrid laparoscopic method of repair using a new mesh configuration has been developed. Preliminary clinical results on 108 patients using this method support the same acceptable recurrence rates (1.85%) and infection rates (0%) as laparoscopic outcomes where the defects are closed.⁸ Additionally, the learning barrier is eliminated by adding a slightly modified mesh that has a projecting “fin” along its central axis that extends 5-8mm above the plane of the mesh’s main body (Figure 1).

Figure 1. Finned mesh with cross-section view



This new method begins like a traditional open hernia repair with an incision over the defect and removal of the hernia sac. The modified mesh is then introduced directly into the abdomen and the “fin” is sutured between the defect edges. The procedure is converted to a traditional laparoscopic repair, with the mesh centered and suspended within the approximated defect. It is thus ready to be tacked onto the peritoneal surface of the abdominal wall to complete the repair. Since existing open and basic laparoscopic techniques are used for this repair, this hybrid method achieves a laparoscopic repair with mesh-reinforced defect closure with minimal technical difficulty, and could become the next step in the progressive evolution of ventral and incisional hernia repair.

The Future

The best possible outcome of hernia repair is prevention. It has been documented that patients with a lower collagen I/III ratio are at a higher risk for primary or recurrent

incisional hernia.⁹ Currently, this collagen ratio is identified by using skin or fascial tissue processing, which requires an invasive procedure for tissue biopsy. The next logical step in development would be a non-invasive diagnostic test that would reveal this particular genetic profile. This would provide an inexpensive path to identify patients that are likely to develop a hernia after surgery, and prophylactic measures could then be taken. One such preventative measure could include using the finned mesh to reinforce the repair after a laparotomy.

Looking even further into the future, the specific collagen profile could be altered with gene manipulation and thus obliterate the risk for incisional hernia in the first place. Either way, even with the massive progress over the last 40 years in hernia repair, its evolution will undoubtedly continue to advance beyond what it is today. Only time will tell.

¹ Poulouse BK, Shelton J, Phillips S, et al. (2012) Epidemiology and cost of ventral hernia repair: making the case for hernia research. *Hernia* 16:179-183

² Burger JW, Luijendijk RW, Hop WC, et al. (2013) Long term follow up of a randomized controlled trial of suture versus mesh repair of incisional hernia. *Ann Surg* 240(4):578-583 [discussion: 583-585]

³ Le D, Deveney CW, Reaven NL, et al. (2013) Mesh choice in ventral hernia repair: so many choices so little time. *Am J Surg* 205:602-607

⁴ Sauerland S, Walgenbach M, Habermalz B, et al. (2011) Laparoscopic versus open surgical techniques for ventral or incisional hernia repair. *Cochrane Database Syst Rev*, DOI: 10.1002/14651858.CD007781.pub2, Mar 16, 2011

⁵ Aher CV, Kubasiak JC, Daly SC, et al. (2014) The utilization of laparoscopy in ventral hernia repair: an update of outcomes analysis using ACS-NSQIP data. *Surg Endosc*, DOI: 10.1007/s00464-014-3798-x, Sep 24, 2014.

⁶ Nguyen DH, Nguyen MT, Askenasy EP, Kao LS, Liang MK (2014) Primary fascial closure with laparoscopic ventral hernia repair: systematic review. *World J Surg* 38:3097-3104

⁷ Light D, Bawa S (2016) Trans-fascial closure in laparoscopic ventral hernia repair. *Surg Endosc* [Epub ahead of print]

⁸ Christoudias G, Nunziata, M (2016) A simplified laparoscopic approach to ventral hernia repair: a new “finned” mesh configuration with defect closure. *Surg Endosc* 30(6):2632-2640.

⁹ Junge K, Klinge U, Rosch R, et al. (2004) Decreased collagen type I/III ratio in patients with recurring hernia after implantation of alloplastic prostheses. *Langenbecks Arch Surg* 389:17-22.