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A "New" Nonmesh Technique for Inguinal Hernia Repair: Revisiting E. Wyllys Andrews and His Imbricating Operation

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Abstract: The use of prosthetic mesh to repair inguinal hernias has been common practice at surgical centers around the world for more than 30 years. Open tissue repairs are the alternative for patients who cannot have, do not want, or are not offered mesh. Open tissue repairs are troubled by inferior recurrence rates in most clinical trials. In this article, we will review a long-forgotten tissue repair described by Andrews in 1895. In addition, we report on our early experience with the Andrews technique for primary inguinal hernia tissue repair.

INTRODUCTION

Implantation of synthetic mesh to repair primary and recurrent inguinal hernias has been standard practice for over 30 years and has become even more common with the expanded use of laparoscopic repair since its introduction in 1991.[1] Mesh hernia repairs have lower recurrence rates and similar complication rates to tissue repairs. Mesh-based inguinal repair remains a strong recommendation backed by level 1 evidence. Inter-surgeon concordance in the most recent hernia guidelines and associated analysis remains excellent.[2,3] Interestingly, mesh repair has even been found to be superior and cost-effective in resource-limited settings, with recent studies from sub-Saharan Africa showing the feasibility of low-cost mesh options with increasing adoption and successful training on the procedure.[4,5]

Nevertheless, instances necessitating tissue repair persist. Systemic infection, gross contamination of the surgical site, lack of mesh availability, and, increasingly, patient preference are all reasons that a surgeon may opt for tissue repair. Given the litigation and media attention that some applications of surgical mesh have drawn, it is not surprising that patients continue to question the use of any mesh at all. As tissue repairs remain necessary and are requested with increasing frequency,[6] investigating the past may help us improve outcomes for patients in contemporary practice.

Common tissue repairs such as Bassini and McVay have higher recurrence rates than mesh repair.[7] The Shouldice Clinic has reported a recurrence rate of less than 1% with their tissue repair but this extraordinarily low recurrence rate has not been replicated by other centers.[8] The Desarda repair has been shown to produce short-term results that are similar to the Shouldice and Lichtenstein repairs, but long-term results are still pending.[9–11]

In this report, we briefly review the history of hernia repair and reintroduce a tissue repair similar to one first described by Andrews in 1895.[12] This version of the Andrews repair is a 2-layer repair that closes the floor by attaching the conjoint tendon to the inguinal ligament. It then brings the external oblique fascia under the cord, with fixation again to the inguinal ligament.

BRIEF HISTORY OF NONMESH INGUINAL HERNIA REPAIR

Before the 1890s, inguinal hernia repair simply included mobilization and high ligation of the sac. With early recurrence rates that approached 75%, this technique was reserved for incarceration or severe symptoms. In the late 1880s, William Halsted and Edoardo Bassini described repairs that reconstructed the internal ring and reinforced the floor.[13–15] This resulted in a recurrence rate that was often less than 10%. Halsted's repair approximated the inguinal ligament to the combined conjoint tendon/external oblique under the spermatic cord, thus leaving the cord in a subcutaneous position.[16,17] Bassini approximated the conjoint tendon and the inguinal ligament under the cord, and the external oblique was sewn to the inguinal ligament over the cord.[18] Andrews described his imbricating repair in 1895; this included repairing the floor by suturing the conjoint tendon to the inguinal ligament (Bassini) and adding a second layer by attaching the external oblique fascia to the inguinal ligament under the spermatic cord (Halsted) while also using the external oblique to close a layer over the spermatic cord.[12,19] Other inguinal hernia operations from this era were described by a variety of surgeons, including Ferguson, MacEwen, and McBurney. They are largely of historical interest, as only the Bassini operation became commonly used through the first half of the 20th century.[16,20,21]

In 1948, Dr. Chester McVay from the University of South Dakota described a new repair useful for indirect, direct, and femoral hernias.[22] This repair sutures the conjoint tendon to Cooper's ligament medially and the conjoint tendon to the inguinal ligament over the femoral vein. The McVay repair (Cooper's ligament repair) is often accompanied by tension at the suture line attaching the conjoint tendon to Cooper's ligament. Therefore, the McVay repair includes a "relaxing

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incision," typically created by incising the fascia of the internal oblique aponeurosis or anterior rectus sheath to allow the internal oblique muscle and overlying fascia to approximate Cooper's ligament without tension.

In 1945, Edward E. Shouldice first described the use of running surgical wire to create a 4-layer repair of the inguinal floor. His first 2 layers used an overlapping reconstruction of the transversalis fascia, whereas the 3rd and 4th layers approximated the fascia of the internal oblique to the inguinal ligament.[23] The Shouldice repair has gained wide acceptance over the past 70 years due to its low recurrence rate and feasibility under local anesthesia.[24] The Shouldice Clinic in Ontario, Canada is the worldwide champion of this repair and reports a recurrence rate of 0.2%.[25] Authors outside of the Shouldice Clinic usually report higher recurrence rates. In a recent single-center report, the Shouldice repair had a recurrence rate approaching 3%, but multicenter trials with this repair often report even higher recurrence rates likely related to significant difficulty in teaching this technique.[3,26,27]

In 2001, Desarda[9] described a repair that reconstructed the floor of the inguinal canal with a strip of the external oblique. Dr. Desarda has demonstrated his repair on YouTube and published a large series with a very low recurrence rate.[10,28] Recently, a systematic review comparing Shouldice to the Desarda repair suggested that the 2 repairs are equivalent in terms of complication rate and recurrence.[29] Several studies comparing the Desarda repair to the Lichtenstein repair suggest that the outcome between the 2 operations is similar.[30] Occasionally, the Desarda repair can be technically difficult if the external oblique is found to be weak or thin with split fibers.[31] As others have pointed out, using the external oblique to reinforce the floor is not a new concept,[32] but revisiting the old may help improve outcomes when the mesh is not an option today.

EDWARD WYLLYS ANDREWS (1856–1927)

Andrews[33] (Fig. 1) was born in 1856 to a family with a rich tradition of medical leadership in Chicago, Illinois. His father, Edmund Andrews, was a surgeon and one of the founders of the Chicago Medical College, the forerunner of the Northwestern University School of Medicine.[34]

Andrews followed in his father's footsteps and became one of the most prominent Chicago surgeons of his era. He was the valedictorian of his graduating class at Northwestern University in 1881 and attended medical school at the Chicago Medical College, where his father was the first Professor of Surgery. Andrews spent his entire academic career affiliated with the Northwestern University School of Medicine, serving as the Chair of the Department of Surgery from 1916 to 1919. He also served as the Chief of Staff at the Mercy Hospital and Surgeon-in-Chief at the Cook County Hospital.[35,36] He was considered an authority on several surgical topics but is most noted for his imbricating "radical" hernia repair (Fig. 2), a novel approach to the treatment of hydrocele and his research on the use of "dissolving" metal clips to seal blood vessels without suture ligation.[37,38]

THE MODIFIED ANDREWS REPAIR

The technique described combines the Bassini repair (often with a relaxing incision) and Halsted's use of the external oblique placed under the spermatic cord to reinforce the inguinal floor.[17] Unlike Halsted's repair, the final position of the cord in the technique described below is under a layer of the external oblique as in the imbricating operation of Andrews.[12] This technique has the advantages of the Bassini repair and is reinforced by the addition of the external oblique under the spermatic cord. In addition, by closing the external oblique to the inguinal ligament over the cord, the cord does not sit in the subcutaneous space as in the Halsted repair. This confers the advantage of a spatial offset between the internal and external rings, which is lost in the Halsted repair with the reconstruction of only the internal ring. The modified Andrews repair can be used to repair both direct and indirect inguinal hernias but not femoral hernias.

FIGURE 1. Edward Wyllys Andrews, MD, FACS, 1856–1927 (https://www.facs.org/about-acs/archives/past-highlights/andrewshighlight/)[33]

Technique

The modified Andrews repair can be performed with sedation and local, spinal, or general anesthesia. An incision is made over the medial aspect of the inguinal ligament. The external oblique is opened, and a Penrose drain is placed around the spermatic cord. The cord is then mobilized, and the ilioinguinal nerve is preserved or sacrificed based on the surgeon's preference.[39,40] The direct or indirect hernia is reduced or resected. The initial stage of the repair is a Bassini technique, approximating the shelving edge of the inguinal ligament to the conjoint tendon with 2-0 braided synthetic sutures. (Fig. 3). A relaxing incision can be performed if there is any evidence that the Bassini repair is under tension (Fig. 4). The second layer of the repair is like what Halsted described, where the external oblique is sutured to the inguinal ligament under the cord with interrupted 2-0 braided synthetic sutures (Fig. 5). Finally, the external oblique is closed over the cord by suturing the free edge of the inguinal ligament to the external oblique fascia above the cord in an imbricating fashion like that described by Andrews in 1895 (Fig. 2). The Scarpa's fascia and skin are then closed with absorbable synthetic sutures.

CASE SERIES

We have performed 20 modified Andrews operations on 19 patients since September 16, 2019 (Table 1). One patient with bilateral hernias had staged repairs 2 months apart. Patients were offered tissue repair of their hernias if they refused mesh or if they had a contraindication to mesh (chronic infection site or frequent catheterization due to bladder dysfunction). The average operative time was 79 minutes, and all were teaching cases. Five repairs were conducted under a general endotracheal anesthetic, and 5 operations occurred under sedation with the use of an laryngeal mask airway. The remaining 10

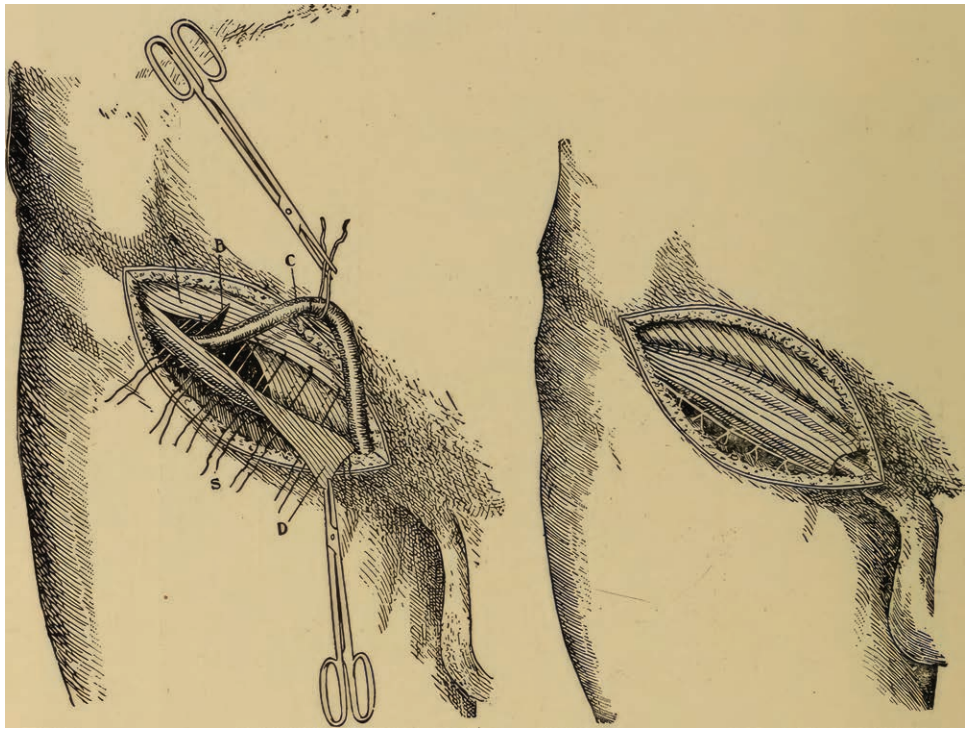

FIGURE 2. The imbricating hernia repair of Andrews. A, Segment of external oblique. B, Mattress deep stitches in posterior imbrication. C, Cord lifted. D, Lower flap of the external oblique. The (D) specifically shows suturing the external oblique to the free edge of the inguinal ligament over the spermatic cord (c1907 https://www.flickr.com/photos/internetarchivebookimages/14781986951)

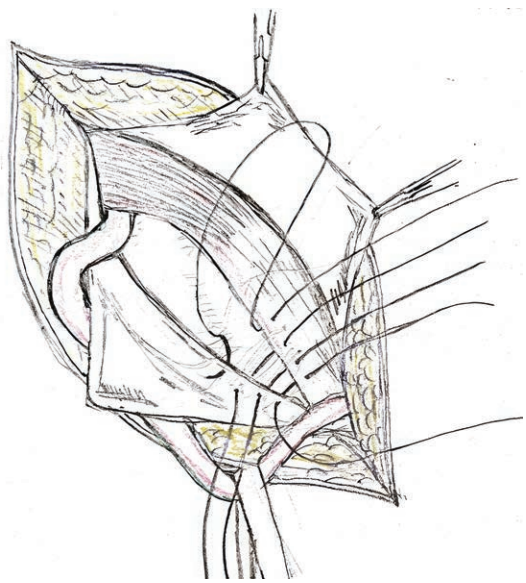

FIGURE 3. Bassini repair of the floor. Attachment of the conjoint tendon to the shelving edge of the inguinal ligament (original artwork by H Wang).

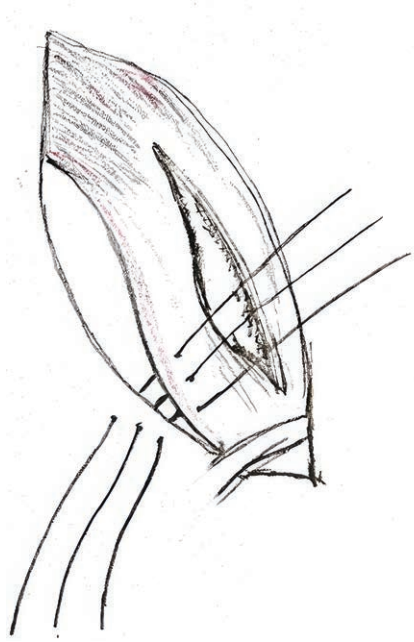

FIGURE 4. Relaxing incision on the internal oblique fascia to reduce tension on the repair (original artwork by H Wang).

hernia repairs only required sedation and local anesthesia. One patient was discharged 23 hours after the operation, and the rest were discharged on the day of surgery. Intraoperatively all patients received an incisional field block of 0.25% bupivacaine. Postoperative pain was managed with high-dose oral acetaminophen and small supplemental doses of oxycodone. Six of 20 repairs required a relaxing incision of the fascia of the internal oblique for the first layer of the repair. There were no recurrences found during an average follow-up of 13 months (range, 1–37 months).

Four patients experienced a complication. Two patients developed epididymitis, requiring intravenous antibiotics and admission during the 5th week after surgery. Both patients had known chronic bladder dysfunction, requiring catheterization early after surgery for urinary retention. A third patient developed pain at the internal ring 1 year after surgery. There was no evidence of recurrence, and the pain resolved with conservative measures. The fourth patient had urinary retention requiring a Foley catheter for a month postoperatively, eventually requiring urologic intervention for chronic management of his bladder outlet. He developed a pulmonary embolism as an outpatient, presenting

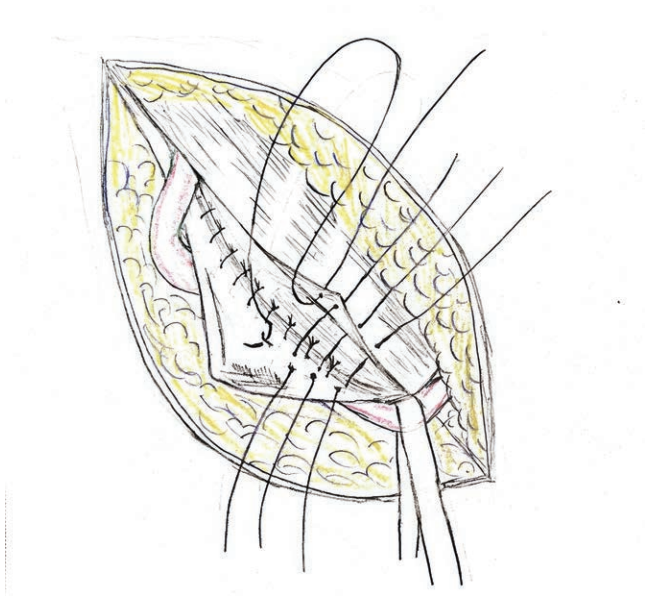

FIGURE 5. Halsted-type repair of the inguinal floor, suturing the free edge of the external oblique fascia to the inguinal ligament under the cord (original artwork by H Wang).

TABLE 1.

Descriptive Characteristics of the First 20 Patients

Number of patients	**19**
Number of operations	20*
Mean age	67 (18–85)
Outpatient surgery	18
Anesthetic	5
General endotracheal	
Laryngeal mask airway	5
Sedation only	10
Intraoperative bupivacaine (0.25%)	20
Mean operative time	79 min (70–96)
Mean follow-up	13 months (1–37)

*One patient had bilateral inguinal hernias and had staged repairs several months apart.

with shortness of breath 3 weeks after surgery, and was managed with anticoagulation.

CONCLUSIONS

We have described a technique for inguinal hernia repair without mesh. Our technique is very similar to an operation originally described by Andrews in 1895. This operative technique combines elements of both the Bassini and the Halsted repairs. This method is easy to teach, and we believe that the recurrence rate may approximate that of the Shouldice repair. Further prospective studies will be required to validate these assumptions, both with regard to teachability and durability.

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