

Abdominal Wall Reconstruction: The Rise of Endoscopic Component Separation

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Primary repair of ventral hernia defects theoretically provides superior biomechanical outcomes in patients when compared to mesh repairs [1,2]. On the other hand, synthetic mesh repairs have been shown to significantly decrease ventral hernia recurrence [3,4]. Historically, primary repair of large, midline abdominal wall hernias were considered impossible because the fascial edge was retracted laterally into the flank from shortening of the external oblique muscle [5]. The development of abdominal wall component separation has enabled the use of autologous tissue in the reconstruction of significant defects when prosthetic biomaterials are contraindicated, as is the case in contaminated wounds.

Component Separation

First described by Ramirez et al. [5] the technique of component separation allows a primary repair of defects that would have otherwise necessitated the placement of synthetic materials. This technique involves the creation of bilateral myofascial flaps which are then approximated in the midline. It is performed using a midline laparotomy, followed by the elevation of skin and subcutaneous tissues from the abdominal musculature to the anterior axillary line. The external oblique aponeurosis is then divided from the inguinal region to the costal margin. A sliding myofascial flap is created, consisting of the internal oblique and transversus, which can then be approximated in the midline.

The restoration of a more physiological abdominal wall compared to mesh repair has produced improved functional outcomes [2]. However, the elevation of skin and subcutaneous tissues from abdominal musculature creates a large wound, associated with a significant postoperative potential space and involves the division of perforating vessels originating from the inferior epigastrics. The nature of this repair leaves patients susceptible to serious wound complications including seroma formation, flap necrosis, and wound infection [6-9].

Endoscopic Component Separation

Numerous endoscopic approaches have been devised in light of the limitations of open component separation [7,10-12]. Briefly, the endoscopic approach involves a small incision at the costal margin lateral to the rectus abdominis muscle. The external oblique is exposed and incised. After exposure of the internal oblique muscle, a potential space is created using a balloon dissector between the two oblique muscles to the level of the inguinal ligament. A second lateral abdominal wall port is placed that allows for release of the external oblique.

The endoscopic technique offers an advantage when compared to open component separation by avoiding the creation of a large potential space and division of perforating vessels supplying the skin and subcutaneous tissues. The avoidance of vascular compromise and minimization of postoperative wound size is thought to be important in avoiding postoperative wound complications.

The endoscopic approach is not without drawbacks, the most compelling of which is a 14% decrease in degree of myofascial advancement, as demonstrated by Rosen et al. in a porcine model [13]. There is also the general impression that the endoscopic approach is a more challenging operation to learn and perform, and there may be

a significant learning curve for clinician as has been demonstrated in other minimally invasive procedures.

Open component separation and its endoscopic alternative were first compared in 2000 by Lowe et al. [7]. Following this publication there was a dearth of comparative studies until 2010 when authors, faced with an increasing number of complex abdominal wounds and a substantial complication rate following open component separations, turned their attention to an endoscopic alternative. These studies compared endoscopic to open component separation in regards to wound complications, length of stay, hernia recurrence, and operative time.

Wound Complications

A major issue with open component separation is its high wound complication rate [6-9]. All studies comparing open to endoscopic component separation demonstrated a trend toward decreased wound complications in the endoscopic group [14-18], although only two, Albright et al. [16] and Giurgius et al. [18], were able to achieve statistical significance. In both studies, patients were not adequately matched in terms of preoperative wound contamination. There was a significantly higher rate of contaminated or infected wounds in the open group of Giurgius et al. [18] (33% vs. 5%, $p=.03$). Albright et al. [16] also contained a much higher percentage of contaminated cases in the open group although this result was not statistically significant (35.7% vs. 9.1%, $p=NS$). A subgroup analysis was performed by both authors for patients with only clean wounds in each group. These analyses were able to preserve a statistically significant reduction in wound complications. Still, this calls into question the generalizability of these results, as one of the major indications for component separation is a contaminated wound.

Clarke [15] reported a significantly higher rate of skin necrosis and chronic pain in open repairs. The total number of wound complications was not reported in either group, and important outcomes, such as seroma formation, were not addressed.

Recurrence

The average estimated time to hernia recurrence status post endoscopic component separation is 14-17 months and 16-25 months when using the open technique [14,15]. Two studies with follow-up times adequate to assess hernia recurrence both did not demonstrate

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any significant difference in hernia recurrence between the two techniques [14,15].

It is worth noting that there is a difference in the pathophysiology between a central and lateral hernia recurrence. The former is caused by a complex combination of patient comorbidities and operative factors, and the latter is likely due to deep muscular injury during fascial release, a technical error. Therefore future analysis of hernia recurrence should consider these two entities separately.

Length of Stay

No current literature demonstrates a statistically significant result in regards to length of stay post endoscopic versus open component separation. The data published by Harth in 2010 and 2012 demonstrate a trend toward decreased length of stay in endoscopic patients, but this stands in contrast to other recent studies in which length of stay was increased in endoscopic patients, albeit slightly [14,16-18].

Operative Time

There has been no single study that has demonstrated a significant decrease in operative time, though the published data that does comment on operative time seems to suggest that it will be decreased with the endoscopic approach [14,16-18]. The lack of definitive data from the available comparative studies highlights the need for high quality prospective studies in the future.

Further Study

Current practice patterns include the placement of a biological prosthesis when completing component separation in a contaminated field [10,16,18]. Recent evidence associates this with an increase in cost [17] although it is not clear whether this strategy reduces hernia recurrence. Further delineation of this topic will be important as the cost associated with biological mesh must be justified.

Conclusion

Endoscopic component separation offers theoretical advantages to its open alternative, and while current evidence for the procedure is not overwhelming there are promising results in terms of reduced wound complications and equivalent recurrence rates. Endoscopic component separation may become the preferred method of abdominal wall reconstruction in the presence of contamination in the future, if these promising results are supported by high quality prospective studies.

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