Extended Component Separation for Repair of High Ventral Hernia in Pediatric Omphalocele

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Summary: Abdominal wall reconstruction ideally involves maintenance of domain by restoration of competent fascia and innervated muscle. Component separation allows closure of ventral hernias, but the technique is limited for high abdominal defects in the epigastric region. We describe an extended component separation that facilitated mobilization of the rectus abdominis muscle along its costal insertion to close an upper midline defect in a child with giant omphalocele, who had already undergone previous traditional component separation. *(Plast Reconstr Surg Glob Open 2015;3:e503; doi: 10.1097/GOX.0000000000000481; Published online 4 September 2015.)*

Component separation involves mobilization of the rectus abdominis muscle and fascia with preservation of innervation for functional reconstruction of the abdominal wall. The technique has previously been shown to improve abdominal wall physiology and quality of life in adults with large hernias.[1] Although reports of component separation in children are less common,[2–4] van Eijck et al[4] found no detrimental physiologic effect and a normalization of abdominal muscle thickness over time.

Component separation may be a useful approach for abdominal wall closure in both adults and children; however, mobility of the rectus muscle is limited for high abdominal defects where the muscle inserts into ribs. This may be particularly significant for congenital defects such as giant omphaloceles. We describe an extended component separation that achieves additional mobility of the rectus muscle in the epigastrium and allows for functional abdominal wall reconstruction of high defects.

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CASE REPORT

Our patient was born with a diaphragmatic hernia and an omphalocele that extended from sternum to below the umbilicus. He underwent repair of the diaphragmatic hernia by a subcostal incision shortly after birth. The giant omphalocele was treated with daily silver sulfadiazine dressings over several months until epithelialized. Reduction of the hernia was achieved by prolonged compression.

An initial attempt for reconstruction was taken at 2 years of age, in which a 12-cm rectus diastasis was noted. He underwent anterior component separation from costal margin to iliac crest with additional release of the posterior rectus sheath to obtain adequate mobility for midline closure.

At 4 years of age, most of his abdominal closure remained intact; however, there was a residual infrasternal defect from the level of his mid-costal margin to sternum (Fig. 1). He was also noted to have a mild diastasis of the costal margin. Both clinical examination and magnetic resonance imaging demonstrated rectus muscles overlying and inserting into several rib levels on either side of the defect.

He was brought to the operating room by a combined general surgery and plastic surgery team for final reconstruction. On exploration, we confirmed that the costal margin converged to midline at an unusually high level. The superolateral scar from the previous component separation was identified stopping at the level of the costal margin; the residual abdominal wall defect was cephalad to this level. We

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performed an extended component separation to achieve midline musculofascial closure.

TECHNIQUE

The rectus fascia was incised along the abdominal defect to expose the medial border of the rectus muscle. The incision was made slightly anterior so that the fascia could be turned over for closure as the posterior rectus fascia (Fig. 2, see axial section). This fascia was left in continuity with the perichondrium of the costal margin. Incision and medial subperichondrial dissection allowed enough mobilization of the fascia to close along the midline as the posterior rectus fascia. This closure was reinforced with an acellular porcine dermis implant.

The external oblique muscle was incised 1 cm lateral to the lateral border of rectus continuing cranially over the ribs up to the lateral border of the pectoralis major muscle. In spite of this release, the rectus muscles could not be mobilized medially. The rectus insertions into rib were therefore released; however, muscular continuity with the pectoralis major was maintained by the fascial aponeurosis between the 2 muscles to ensure a robust blood supply, to avoid rectus muscle retraction, and to maintain normal anatomic relationships (Fig. 2, see axial/sagittal insets). Given that the aponeurosis is very thin, release of the rectus muscle insertion and pectoralis major muscle origin on the ribs was performed using subperichondrial dissection. The midline periosteum of the sternum was incised to initiate a subperiosteal plane that was subsequently dissected laterally over the ribs. As the dissection moved laterally, the plane between the pectoralis and intercostals was opened to allow for this.

Care was taken to avoid injury to the serratus anterior muscle slips. The lateral border of the pectoralis major was released until the composite rectus and pectoralis major muscles flaps could be mobilized to the midline (Fig. 1). The muscles and anterior fascia were then approximated to achieve direct closure (Fig. 2).

OUTCOME

The patient had an uncomplicated postoperative course and is now 6 months from repair without evidence of recurrence.

DISCUSSION

Component separation was first described by Ramirez et al[5] in 1990 as a novel method of functional abdominal wall reconstruction. It allows for active

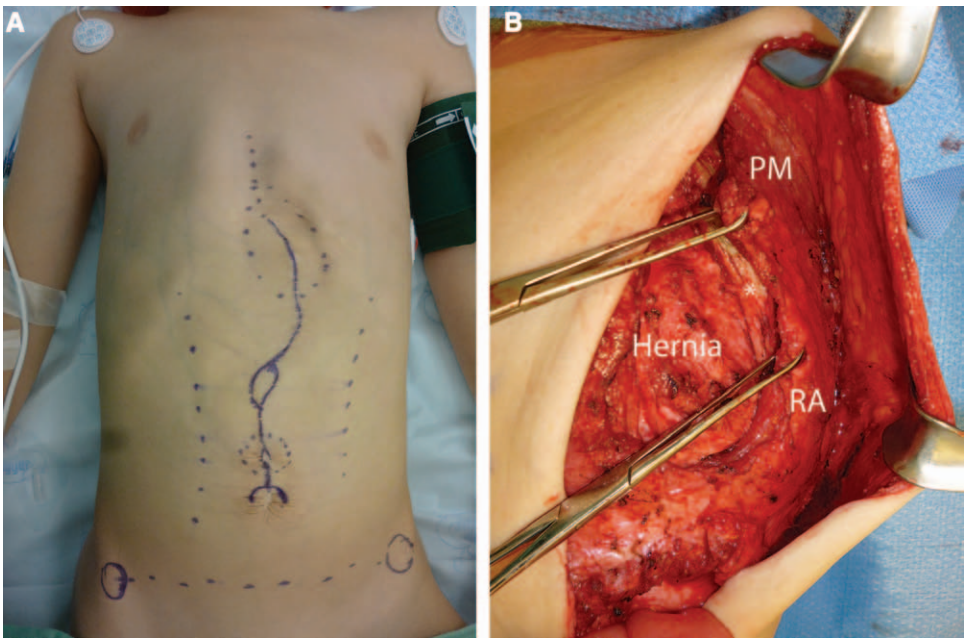

Fig. 1. A, Preoperative defect: Skin markings demonstrate residual hernia in epigastric region (superior dotted circle) and small supraumbilical recurrence (inferior dotted circle). Previous scar is marked with solid line. Lateral borders of rectus are indicated with dotted lines. Note high xyphoid process falling at the level of the nipples. B, Intraoperative mobilization: The patient's head is superior and the retractors expose the patient's left thorax. A composite rectus (denoted RA on diagram)-pectoralis (denoted PM on diagram) muscle flap has been mobilized off the costal margin. Alice clamps attached along the medial border. The rectus insertion and lower pectoralis origin have been released from the ribs. Release along the lateral border of rectus and pectoralis major allows the flap to be mobilized to midline.

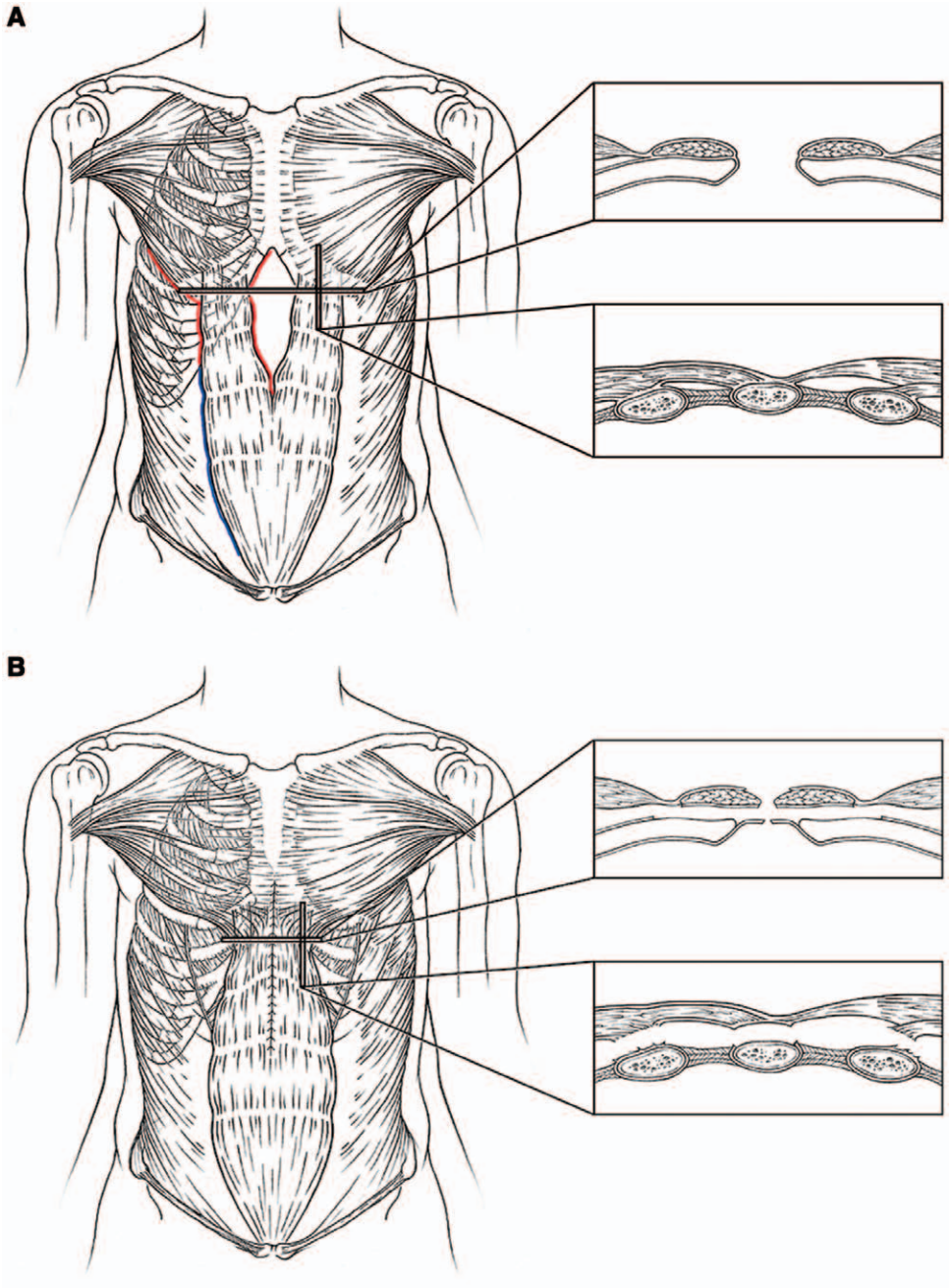

Fig. 2. A, Preoperative abdominal wall defect. The hernia extended up to sternum and was adjacent to the rectus muscle insertion into the costal margin. The course of the rectus muscle was over top of the ribs as seen on the inset of axial view. Blue line depicts extent of previous component separation and red line depicts new incisions for extended component separation. Inset of sagittal view illustrates both the rectus insertions and lower pectoralis origins on adjacent ribs of hernia defect. B, Abdominal wall closure following extended component release with rectus muscle mobilized to midline. Medial closure of rectus leaves a lateral defect overlying rib and intercostal muscle. Rectus fascia in continuity with rib perichondrium was used to create the posterior rectus sheath (axial view inset). Mobilization of the composite flap requires release of the rectus insertion and lower pectoralis origin (sagittal view inset). Illustration credit: M. Gail Rudakewich.

muscular support of the abdominal wall in situations where inert allograft, xenograft, or synthetic mesh would otherwise be needed for reconstruction.

Anterior release of the external oblique allows mobilization of the rectus abdominis and its fascia medially. Mobility is greatest in the midabdomen and

is limited in the epigastric and suprapubic regions (10, 5, and 3 cm per side, respectively, in adults).[5] In adults, who frequently have incisional hernias centered around the umbilicus, this release is adequate; however, if further mobility is needed, the addition of a posterior component release can allow further medialization of the rectus.[6]

Abdominal wall defects in children differ in the fact that they may not be centered around the umbilicus and can extend far cranially or caudally. In our case, the defect extended high into the epigastric region, making traditional component separation inadequate to fully cover the subxyphoid area.

We achieved mobilization by continuing the release of the external oblique muscle over the costal margin and up to the lateral border of pectoralis major and by releasing the insertion of rectus from ribs. Continuity of the rectus muscle with pectoralis major was maintained to ensure complete closure of the defect and to avoid dysfunction from muscular shortening.

Medial translation of the rectus above the level of the costal margin leaves a physiologically inconsequential lateral defect as the ribs and intercostals prevent herniation into that potential space.

The extended component release may be used in high midline defects that would otherwise require mesh. Although we report our experience in a child, this approach follows principles of reconstruction and may be generalizable.

Long-term results and morbidity need to be further assessed.

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