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CASE REPORT

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Secondary closure of a giant omphalocele by translation of the muscular layers: a new method

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Abstract The current report describes a case of an infant girl with a giant omphalocele in whom a new surgical technique was used for closing the abdominal wall after epithelialization of the omphalocele for 16 months. The technique used was translation of the muscular layers of the abdominal wall. The functional and cosmetic results appear superior compared with other suggested treatments used for this abdominal wall defect.

Keywords Giant omphalocele · Surgical treatment · Abdominal wall · Ventral hernia

Introduction

Omphaloceles are characterized by a central defect at the site of the umbilical ring. The size of this abdominal wall defect varies from 4 cm to 12 cm. The sac usually contains stomach and intestinal loops, and in half of cases, the liver is also included. Regardless of the defect's size, the abdominal musculature is normally developed, and the rectus muscles are intact at the margins of the defect. Treatment depends on the size of the defect; small and moderate omphaloceles are often primarily closed, but this is not feasible for giant omphaloceles. Giant omphaloceles are associated with a small, underdeveloped peritoneal cavity with a high degree of visceroabdominal disproportion that prohibits safe primary closure. Several techniques have been introduced in the last decades, such as closing with dura, silo prostheses, skin flaps, different kinds of meshes, and the use of tissue expanders [1–6]. The disadvantages of most of these techniques are the risk of a large ventral hernia and the use of prosthetic materials.

In adults, reconstruction of large midline abdominal wall hernias that cannot be closed primarily poses a similar problem. Several techniques have been advocated to repair these defects. In 1990, Ramirez et al. developed a technique for reconstructing abdominal wall defects without the use of prosthetic material [7]. The technique is based on enlargement of the abdominal wall surface by translation of the muscular layers without compromising the innervation and blood supply of the muscles. This technique has been modified and used in larger series by others [8–11]. We used this technique for treating a giant omphalocele. This is the first case report that describes this technique in an infant with a giant omphalocele.

Case report

During the mother's first pregnancy, a prenatal ultrasound showed a giant omphalocele at 27 weeks of gestation. Because of a breech presentation combined with the prenatally diagnosed omphalocele, the infant was delivered by planned cesarean section at 39 weeks. Her Apgar score was 9 at 1 min, and birth weight was 2,720 g. The giant omphalocele had a diameter of 12 cm, and bowel and liver were included. The omphalocele was banded circumferentially with dry wraps and elastic bandages. The infant needed low-flow oxygen for 2 days. Because of a high insensible water loss, we started with an intravenous fluid infusion of 100 ml/kg/day at day 0 with increasing amounts of fluid in the following days. Except for a malrotation, there were no other associated malformations. An initial nonoperative management was decided upon because of the large defect and the ability of the amnion to support epithelial proliferation and migration from

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Fig. 1 Giant omphalocele 2 weeks after birth, with partial epithelialization of the sac

the skin edges. During the period of epithelialization (Fig. 1), three episodes of sepsis occurred, which were treated with antibiotics. Tube feeding was started on day 3, and full enteral (tube) feeding was reached at day 7.

When the omphalocele was fully epithelialized at 2 months, the baby was discharged; her weight was 4,200 g. Closure of the abdominal wall was planned for the age of 16 months; at that time, the child weighed 8.2 kg (Fig. 2). A translation of the abdominal muscular layers on both sides was performed, and the nonrotation was operated by dividing duodenum bands and broadening the mesentery of the small bowel; an appendectomy was also done. Two subcutaneous drains to prevent seroma were placed, and a umbilicus was created.

Postoperatively, the child was treated with intravenous morphine for 1 day, and feeding was started on day 2. She was discharged on postoperative day 6. After 2 months of follow-up at the outpatient clinic, the abdominal wall proved to be sufficient, and the wounds had healed by primary intention (Fig. 3).

Surgical technique

The technique used is based on enlargement of the abdominal wall surface by translation of the muscular layers without comprimising the innervation and vascularization of the muscles (Fig. 4). The arterial blood supply of the abdominal skin is mainly via the intercostal arteries and the perforating branches of the epigastric artery. The abdominal cavity is entered via an incision just lateral from the scar tissue of the skin on the omphalocele. The liver and bowels are dissected free from the skin. Thus, the lateral border of the rectus abdominal muscle can be identified properly, from the inside of the abdomen. The skin and subcutaneous fat are dissected free from the anterior rectal sheath and the aponeurosis of the external oblique muscle to about 3–5 cm lateral of the lateral border of the rectus sheath. The aponeurosis of the external oblique muscle is incised 1-2 cm laterally of the lateral border of the rectus abdominis muscle. The aponeurosis of the external oblique muscle is transected longitudinally over its full length.

Fig. 2 Ventral hernia of the abdominal wall caused by a giant omphalocele, after epithelialization at 16 months, just before surgical treatment

Fig. 3 Results after translation of the muscular layers 2 months after operation

Transection includes the muscular part of the external oblique muscle on the thoracic wall. In this way, the rectus abdominis muscle can be shifted medially at a maximum in the upper abdomen. The external oblique muscle is separated from the internal oblique muscle in the avascular plane between both muscles up to the midaxillary line. Mobilization is essential because the fibrous interconnections between both muscles prevent optimal median shift of the rectus abdominal muscle. The abdominal wall is closed in the midline with a running suture of a nonabsorbable or slowly absorbable suture material, taking big "bites" of fascia. If further mobilization of the rectus abdominis muscle is warranted, the posterior rectus sheath can be transected longitudinally over its full length. Suction drains are placed subcutaneously, and the subcutis and skin are closed.

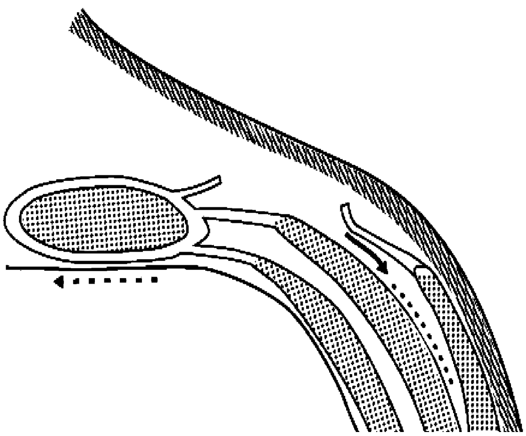

Fig. 4 Schematic drawing of the separation of the external oblique muscle from the internal oblique muscle in the avascular plane between both muscles up to the midaxillary line

Discussion

Staged repair of a giant omphalocele is in many centers the treatment of choice, but the final closure still gives problems with the use of prosthetic materials, plural operations, or tissue expanders to restore abdominal wall integrity to decrease the intraabdominal pressure. A residual ventral hernia often results. Collagen-based biomaterials have been applied for abdominal wall defects in adults and children, but in the long term, degradation of the patches may result in reherniation [12].

De Ugarte et al. reported a case with tissue expanders in the abdominal wall instead of the intra-abdominal cavity. Between the internal oblique and transverse abdominis muscles, a space was created [6]. This was advocated to be a safe and anatomically logical approach for reducing the degree of visceroabdominal disproportion. However, the neurovascular bundle runs between the internal oblique and the transverse muscle and may easily be damaged, resulting in denervation of the abdominal wall muscles. With the component separation technique, the abdominal wall surface is enlarged by translation of the muscular layers without damaging the innervation and blood supply of the muscles. However, because the perforating branches of the epigastric artery are transected, the skin's blood supply is at risk because it then solely depends on the intercostal arteries and branches of the pudendal artery. Furthermore, it is essential to properly identify the plane between the internal and the external oblique muscle because transection of the internal oblique muscle may result in abdominal wall rupture, as the transverse muscle is too weak to resist the intraabdominal pressure.

The reherniation rate varies from 0–30% in adult series. Most herniations are located in the upper abdomen and need no operation. How this will develop in children operated for a giant omphalocele with this technique will be further studied.

Despite these pitfalls, the component separation technique is an outstanding procedure for closing the skin-covered giant omphalocele. It provides a way to enlarge the abdominal cavity with a cosmetically pleasing and strong abdominal wall with no prosthetic materials and a normal abdominal cavity; moreover, these results can be achieved in only one surgical procedure.

References

1. Gross RE (1948) A new method for surgical treatment of large omphaloceles. Surgery 24:277–283
2. Shuster SR (1967) A new method for the staged repair of large omphaloceles. Surg Gyn Obst 125:837–843
3. Dunn JCY, Fonkalsrud EW (1997) Improved survival of infants with omphalocele. Am J Surg 173:284–287
4. Bax NMA, van der Zee DC, Pull ter Gunne AJ, et al. (1993) Treatment of giant omphalocele by enlargement of the abdominal cavity with a tissue expander. J Pediatr Surg 28:1181–1184
5. Harjai MM, Bhargava P, Sharma A, et al. (2000) Repair of a giant omphalocele by a modified technique. Pediatr Surg Int 16:519–521
6. De Ugarte DA, Asch MJ, Hedrick MH, Atkinson JB (2004) The use of tissue expanders in the closure of a giant omphalocele. J Pediatr Surg 39:613–615
7. Ramirez OM, Ruas E, Lee Dellon A (1990) Components separation method for closure of abdominal wall defects: an anatomic and clinical study. Plast Reconstr Surg 86:519–526
8. Girotto JA, Ko MJ, Redett R, Muehlberger T, Talamini M, Chang B (1999) Closure of chronic abdominal wall defects: a long-term evaluation of the component separation method. Ann Plast Surg 42:385–395
9. Shestak KC, Edington HJD, Johnson R (2000) The separation of anatomic components technique for the reconstruction of massive midline abdominal wall defects: anatomy, surgical technique, application and limitations revisited. Plast Reconstr Surg 105:731–738
10. de Vries Reilingh TS, van Goor H, Rosman C, et al. (2003) "Components separation technique" for the repair of large abdominal wall hernias. J Am Coll Surg 196:32–37
11. Bleichrodt RP, de Vries Reilingh TS, Maylar A, van Goor H, Hansson B, van der Kolk (2005) Components separation technique to repair large midline hernias. Ann Surg (in press)
12. Wachem van PB, Gullik van TM, Luyn van MJA, Bleichrodt RP (2001) Collagen-based prostheses for hernia repair. In: Bendavid R, et al. (eds) Abdominal wall hernias: principles and management. Springer, Berlin Heidelberg New York, p 255