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A new alternative flap in the closure of meningomyelocele defects: Modified S flaps

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ABSTRACT

Back defects may occur after several factors such as cancer, trauma and pressure sores. These conditions are more frequent in adult group, whereas the etiological factor in newborn infants is usually meningomyelocele defects. The aim of this study is to define more reliable and easily applicable surgical technique for the closure of meningomyelocele defects.

This study included a total of 15 infants who underwent operation with the diagnosis of meningomyelocele and were treated with a modified S flap at our clinic between January 2016 and January 2017. During surgery, two flaps with a random pattern planned from the healthy skin on the right and left side of the meningomyelocele defect were transposed to close the defect. The flap donor sites were primarily sutured by elevating the surrounding skin. The left-sided flap was designed with superior pedicle and the right one with inferior pedicle.

Of the participants, 13 were females and two were males with a mean age of 3.2 (min-max: 1 to 16) days. The mean follow-up was 11.5 (min-max: 5 to 17) months. The mean defect size was 6.5x5 (min-max: 5x4 to 7x6) cm. The mean flap size was 6.5x2.9 cm for the flap planned from the left side and right side of the defect. Complication was observed only in one patients including partial necrosis.

Our study results suggest that modified S flap is an easily applicable flap. The greatest advantage of this flap is the shortening of the operation time. However, the major disadvantage of this flap is the random pattern flap (absence of a known blood vessel)

Key Words: S flap, transposition flap, meningomyelocele

Introduction

Back defects may be related to various etiological factors, such as traumas, congenital malformations, spinal surgery, radiation ulcers, pressure ulcers, malignant skin tumors, and soft tissue tumors (1) .The most common cause of back defects in newborns is congenital malformations, while sacrococcygeal teratomas and meningomyelocele are known as main reasons (1).

Neural tube defects occur within the first four weeks of gestation and can be seen in a variable range from anencephaly to spina bifida. The most common form of spina bifida is meningomyelocele. Its etiology is multifactorial including genetic, geographical, and ethnic factors, low socioeconomic status, and folic acid deficiency (2). The incidence of neural tube defects has been reported as one per 1,000 live births (3).

Meningomyelocele is a complex disease affecting medulla spinalis and central nervous system. In newborn infants, it is often considered as an urgent condition due to the easy infection of the brain membranes and the increased mortality. To close meningomyelocele defects, several surgical methods have been defined from simple to difficult, and even algorithms have been developed (4). Primary repair, bilateral flaps (5), dorsal intercostal artery perforator flap (6), and latissimus dorsi myocutaneous flap (7) are among the surgical treatment alternatives which can be used to close these meningomyelocele defects.

In this study, we aimed to investigate the efficacy of the modified S flaps in the closure of meningomyelocele defects and discuss current surgical alternatives available for use in many areas in the light of literature data.

Materials and Methods

A modified S flap was performed in 15 newborns with meningomyelocele between January 2016 and January 2017. We attempted to perform surgery as early as possible to avoid infections and as late as possible to achieve the best hemodynamic stability.

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Table 1. Demographics Data of Patients and Flaps

	Age (Days)	Gender	Defect Size	Flap Size	Drug	Complication	Follow-up Period
1	3	Female	7x5 cm	7x4 / 7x4 cm	----------	----------	16 months
2	1	Female	6x5 cm	6x2.5/6x2.5 cm	----------	----------	17 months
3	4	Female	5x4 cm	5x2.5/5x2.5 cm	----------	----------	17 months
4	2	Female	6x5 cm	6x2.5/6x2.5 cm	2 months folic acid use	----------	17 months
5	2	Female	7x4 cm	7x4/7x4 cm	----------	Partial necrosis	16 months
6	1	Female	6x5 cm	6x2.5/6x2.5 cm	----------	----------	6 months
7	2	Female	7x6 cm	7x3/7x3 cm	----------	----------	12 months
8	1	Male	7x6 cm	7x3/7x3 cm	----------	----------	12 months
9	3	Female	7x4 cm	7x2/7x2 cm	----------	----------	11 months
10	1	Female	7x4 cm	7x4/7x4 cm	----------	----------	8 months
11	16	Female	6x5 cm	6x3/6x3 cm	----------	----------	13 months
12	5	Female	7x6 cm	7x3/7x3 cm	----------	----------	7 months
13	2	Male	7x5 cm	7x2.5/7x2.5 cm	9 months folic acid use	----------	5 months
14	3	Female	7x6 cm	7x3/7x3 cm	----------	----------	7 months
15	2	Female	6x5 cm	6x2.5/6x2.5 cm	----------	----------	9 months

Fig. 1a. A 2-day-old female baby. Unlike the other 14 patients, there was a history of folic acid use for 2 months in pregnancy. There was a 6x5 cm meningomyelocele sac on the thoracolumbar area

All operations were performed under general anesthesia.

All the flaps were designed as transposition flaps and with random patterns, and the flaps on the left and right sides of the defect were elevated with superior and inferior pedicle, respectively.

A written informed consent was obtained from each parent. The study was approved by the Ethics Committee and conducted in accordance with the principles of the Declaration of Helsinki.

Surgical technique: In our routine practice, if the horizontal axis of the defect, which develops following meningomyelocele sac excision, is smaller than 4 cm, the defect is primarily closed with the surrounding skin detachment. The exception is the gibbus deformity, which makes the defect difficult to close. However, according to our experience, we do not recommend forced primary suturing in closing meningomyelocele defects.

Dehiscence at the wound site and necrosis of the detached skin both increase the risk of mortality and make it difficult to obtain local flap alternatives in cases where the second session of intervention is performed. Therefore, flap alternatives should always be kept in the forefront to close the defect.

After measuring the horizontal and vertical axis length of the defect area which develops following the meningomyelocele sac excision, two transposition flaps with random patterns are designed from the left and right of the defect.

Horizontal length may vary from patient to patient, but vertical length of both flaps should be the same as the vertical length of the defect.

The flap in the left side of the defect is planned with superior pedicle and the right sided flap is planned with inferior pedicle. Following the closure of the defect, the flaps planned in this way form an "S" appearance (Figure 1). The flaps are elevated over the paravertebral muscles in a fasciocutaneous manner. Flap donor sites are closed with skin to skin suturing to the lateral of the flap after the skin in the lateral of the flap is approached by elevating and is sutured to the subjacent muscle layer with the help of absorbable suture. We close the donor site of the flap in this way, since closing the donor site by direct suturing to the

Fig. 1b and 1c. Following the excision, the defect area of 6x5 cm was closed with 6x2.5 cm flaps planned from the left and right side

Fig. 1d. No complications were observed intraoperatively and postoperatively

Fig. 1e. Excellent healing findings are seen in the images of 17th postoperative month

flap may lead to tension-related complications at the flap edge. In cases where the flaps cannot be transposed completely to the defect area, minimal (approximately 0.5 cm) back-cut can be performed to the flap pedicle area.

In almost all patients in our study, findings of arterial insufficiency were observed in the distal ½ of both flaps at the end of the operation. However, after about 10 to 15 min, the blood circulation of the flaps was almost completely normal.

Results

Of a total of 15 patients, 13 were females and two were males with a mean age of 3.2 (min-max: 1 to 16) days. The mean follow-up was 11.5 (min-max: 5 to 17) months. Patient characteristics are shown in (Table). The mean defect size was 6.5x5 (min-max: 5x4 to 7x6) cm. The mean flap size was 6.5x2.9 (min-max: 5x2.5 to 7x4) cm for the flap planned from the left side of the defect and 6.5x2.9 cm for the flap planned from the right side of the defect. The operation time was approximately 40 minutes. Complication was observed only in one patient including partial necrosis (6.6%). Partial necrosis was observed in the medial part of the flap planned from the left side of the defect, and the patient underwent revision surgery at the first postoperative week and the defect was grafted after debridement (Figure 2).

The majority of the flaps gave the signs of arterial insufficiency during the operation; however, the arterial circulation completely recovered in the subsequent follow-up period, suggesting that several factors play an important role in blood circulation and wound healing of infants. No mortality was observed during the follow-up period.

Fig. 2a and 2b.A 2-day-old female baby. There was a 7x4 cm meningomyelocele sac on the thoracolumbar area. The defect area of 7x4 cm was closed with 7x4 cm flaps planned from the left and right side

Figure 2c. Superficial necrosis of approximately 3x2 cm was developed in the junction line of the left sided flap with the right sided flap in the midline. The superficial necrosis, in which the subjacent important structures were not exposed, was debrided and grafted in the second session of surgery

Discussion

Meningomyelocele, also known as open spina bifida, is one of the most common causes of back area defects in newborn infants resulting from failure of neural tube closure due to many etiological factors, which we still know very little, in embryological life.

According to our experience, It has been shown that it is difficult to close the defects in the presence of gibbus or in defects over 4 cm. In these cases where primary closure is unable to be performed, various flap alternatives are used to close the back defects. There are many flap alternatives from local flaps to free flaps. The surgical technique to be used depends on the experience of the surgeon. For free flaps, it is often challenging to select the recipient vessel. The superficial gluteal artery and the fourth lumbar artery can be used as a recipient vessel in many cases; however, there are still problems about the veins. Interpositional vein graft may be necessary in some cases. Latissimus dorsi and rectus abdominis flaps can be counted among the free flap alternatives (1).

In our study, we closed all defects of back area with locoregional flaps without the need for free flaps. In none of 15 patients in whom we performed modified S flaps, we did not consider free tissue transfer, no matter how large the defect was. The S flap was previously described for the closure of defects in many areas of the body, but not used in the back area. Previously, the S flap use for finger pulp (8), nipple areola reconstruction (9), and extremities (10) were described. Emsen defined the O-S flap technique for closing the defects of back area (11). In this technique, the flaps are designed from the superolateral and inferolateral of the defect and the resultant scar remains in S shape in the vertical plane.

However, we elevate the flaps from the right and left side of the defect and let the resultant scar in S shape in the horizontal plane.

The O-S flap benefits from the skin elasticity in the vertical plane, while the modified S flap benefits from the skin elasticity in the horizontal plane (11). We consider that the vertical axis in the back area is more challenging than the horizontal axis in terms of skin elasticity and flap choices.

Latissimus dorsi flap can also be used to close the defects of the back area. However, it is necessary to consider a lot about sacrificing the muscle. Since meningomyelocele patients are usually paraplegic, sacrificing the muscle would be a radical decision.

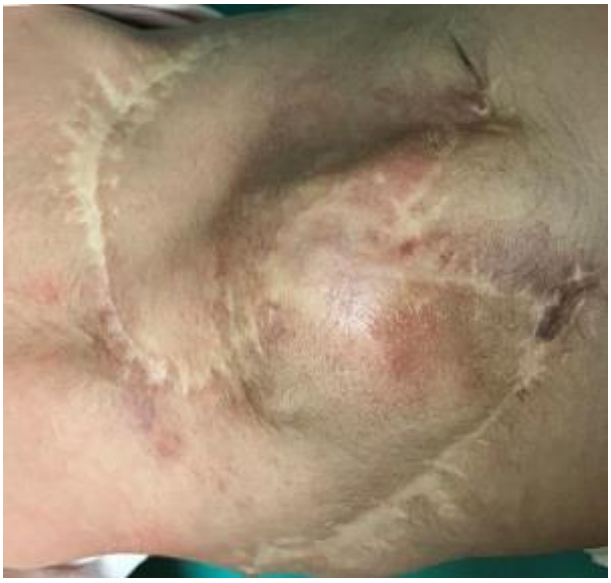


Fig. 2d and 2e. The presence of normal healing is seen in the images of 16th postoperative month despite of a major gibbus deformity that have existed since birth on the thoraolumbar area

Therefore, the decision for this attempt should be meticulously evaluated due to donor site morbidities and possible problems related to the sacrificed muscle in the future (12). Therefore, the use of partial latissimus dorsi flap would make more sense not to sacrifice the entire muscle (7).

In addition, trapezius flaps can be used to close the defects of the back area, although these flaps are not considered among the alternatives in meningomyelocele defects, as they are often used for the defects of the upper back and meningomyelocele defects usually appear in the middle and lower back area (13). However, de Fontaine et al. used four muscle flaps consisting of two-sided trapezius and latissimus dorsi muscles for closing the thoracolumbar meningomyelocele defect (14). We believe that less invasive surgeries should be performed in the newborns due to sacrificing of four muscles, and prolonged surgery for muscle flaps in newborns infants may increase the risk of mortality and morbidity.

Furthermore, different local flaps in the closure of meningomyelocele defects are available apart from free flap and muscle flaps. The Z advancement-rotation flaps (15), Limberg flaps (16) and bilobed flaps are among the alternative local flaps.

There are also promising advancements regarding the closure of these defects on behalf of the future, and several studies relating to the closure of meningomyelocele defect with latissimus dorsi flaps in the intrauterine life are still ongoing (17).

On the other hand, there are some disadvantages of using modified S flaps in the closure of meningomyelocele defects including the use of increased flap size in closing large defects, increased risk of arterial insufficiency compared to the axial flaps, and increased amount of scar formation.

In conclusion, flap planning with modified S flaps is quite simple and no anatomical marking and arterial identification are necessary. In addition, it has no donor site morbidity and donor sites of the flaps can be easily closed with shorter duration of surgery and no functional loss. Therefore, S flaps may be alternative flap models in the closure of meningomyelocele defects. However, we do not recommend using these flaps in larger defects due to the risk of developing necrosis in the flaps. In addition, these flaps should never be used in infants with high-risk meningomyelocele defects in terms of infection and mortality. We are of the opinion that these flaps must always with a known perforator in this patient group.

Conflict of Interest: None

References

1. Behr B, Wagner JM, Wallner C, Harati K, Lehnhardt M, Daigeler A. Reconstructive Options for Oncologic Posterior Trunk Defects: A Review. Front Oncol. 2016; 8; 6: 51.
2. Jabaiti S, Al-Zaben KR, Saleh Q, Abou Alrob M, Al-Shudifat AR. Fasciocutaneous Flap Reconstruction after Repair of Meningomyelocele: Technique and Outcome.Pediatr Neurosurg 2015; 50(6): 344-349.
3. Lapid O, Rosenberg L, Cohen A. Meningomyelocele reconstruction with bilobed flaps. Br J Plast Surg 2001; 54(7): 570-572.

4. Mathes DW, Thornton JF, Rohrich RJ. Management of posterior trunk defects. Plast Reconstr Surg 2006; 118(3): 73-83.
5. Atik B, Tan O, Kiymaz N, Yilmaz N, Tekes L. Bilobed fasciocutaneous flap closure of large meningomyeloceles. Ann Plast Surg 2006; 56(5): 562-564.
6. Brunetti B, Tenna S, Aveta A, Poccia I, Segreto F, Cerbone V,et al. Posterior trunk reconstruction with the dorsal intercostal artery perforator based flap: Clinical experience on 20 consecutive oncological cases. Microsurgery 2016; 36(7): 546-551.
7. Sarifakioglu N, Bingül F, Terzioglu A, Ates L, Aslan G. Bilateral split latissimus dorsi V-Y flaps for closure of large thoracolumbar meningomyelocele defects. Br J Plast Surg 2003; 56(3): 303-306.
8. Niechajev IA. S-flap: a method for reconstruction of sensibility on the finger pulp. Plast Reconstr Surg 1987; 80(6): 810-813.
9. Feng S, Zhang B, Kappos EA, Tremp M, Yang C. Modified S-Flap for Nipple Reconstruction. Aesthetic Plast Surg 2017; 41(2): 312-317.
10. Isik D, Guner S, Kalender AM, Isik Y, Atik B. A modified rotation flap design: the S-flap. Dermatol Surg 2011; 37(9): 1329-1334.
11. Emsen IM. Closure of Large Myelomeningocele Defects Using the O-S Flap Technique. J Craniofac Surg 2015; 26(7): 2167-2170.
12. Osinga R, Mazzone L, Meuli M, Meuli-Simmen C, von Campe A. Assessment of long-term donor-site morbidity after harvesting the latissimus dorsi flap for neonatal myelomeningocele repair. J Plast Reconstr Aesthet Surg 2014; 67(8): 1070-1075.
13. Eseoğlu M, Eroğlu A, Kemer S, Arslan M. Determination of the Effect of Diameter of the Sac on Prognosis in 64 Cases Operated for Meningomyelocele. Korean J Spine 2017; 14(1): 7-10.
14. de Fontaine S, Estievenart J. Closure of thoracolumbar myelomeningocele with a four muscle flap technique in the newborn. Acta Chir Belg 2013; 113(6): 455-459.
15. 15.Gümüş N. A new approach to closure of myelomeningocele defect: z advancement-rotation flap. Ann Plast Surg. 2008; 61(6): 640-645.
16. Shim JH, Hwang NH, Yoon ES, Dhong ES, Kim DW, Kim SD. Closure of Myelomeningocele Defects Using a Limberg Flap or Direct Repair. Arch Plast Surg. 2016; 43(1): 26-31.
17. Meuli-Simmen C, Meuli M, Adzick NS, Harrison MR. Latissimus dorsi flap procedures to cover myelomeningocele in utero: a feasibility study in human fetuses. J Pediatr Surg 1997; 32(8): 1154-1156.