Delayed and nondelayed bilateral bipedicled fasciocutaneous flaps in large meningomyelocele defects: a preliminary results

Arzu Akcal, Semra Karsidag, Tahsin Görgülü, Kemal Uğurlu

ÖZET:

"Delay" yapılmış ve yapılmamış bilateral fasyokutan fleplerin, geniş meningomyelosel defektlerinde kullanımı: Ön çalışma sonuçları

Nöral tüp ve ilişkili yapıların konjenital füzyon defektleri spinal disrafizm olarak sınıflandırılmaktadır. Meningonyelosel spinal disrafizm defektlerinin en sık görülenidir ve 800-1000 canlı doğumda 1 görülmektedir. Tedavi edilmemiş meningomyeloselli hastalarda ilk 6 ayda mortalite oranı %65 ile 70 arasındadır.

Ocak 2006 ile Ocak 2011 arasında primer kapatılamayacak kadar geniş meningomyelosel defekti olan 10 (6 kız ve 4 erkek) yenidoğan çalışmamıza dahil edildi.

"Delay" yapılmamış fasyokutan flep uygulanan 5 yenidoğanın meningomyelosel defekti %50'den azdı ve bu fasyokutan flepler delay yapılmadan orta hatta ilerletilerek primer kapatıldı. "Delay" yapılan grup da 5 yeni doğandan oluşmaktaydı ve bu grupta meningomyelosel defekt boyutu orta aksiller hattan itibaren ölçüldüğünde %50'den fazla olması nedeni ile fleplerde dolaşım problemlerini önlemek amacı ile delay fenomeninin avantajlarından yararlanıldı. Flep "delay" yapılmasından bir hafta sonra nöral defekt onarıldı ve flepler orta hatta ilerletildi. Flep delayinin beklenilmesi aşamasında hastaların takibinde lokal veya santral sinir sistemi enfeksiyonları izlenmedi.

Sonuç olarak, "delay" yapılmış bipediküllü flepler geniş meningomyelosel defektlerin onarımında basit ve güvenilir ve daha az hemorajiye neden olmaları nedeni ile alternatif bir yöntem olduğunu düşünmekteyiz ve kliniğimizde seçilmiş hastalarda kullanmaktayız.

Anahtar kelimeler: Meningomyelosel defekti, delay fenomeni, bilateral bipediküllü fasyokutan flepler

ABSTRACT:

Delayed and nondelayed bilateral bipedicled fasciocutaneous flaps in large meningomyelocele defects: a preliminary results

Congenital fusion defects of the neural tube and the related structures are classified as spinal dysraphism. Meningomyelocele is a defect which is the most common form of spinal dysraphism and occurs at an approximate rate of 1 in 800-1000 live births. In untreated meningomyelocele patients, mortality rate is 65-70% within the first 6 months.

Between 2006 January and 2009 January, 10 (6 female and 4 male) newborns with a meningomyelocele defect large enough that could not repaired primarily were included the our study.

In the nondelayed group which were consisted of five newborns whose diameter of the meningomyelocele defect were less than 50%, flaps were advanced to the midline and the defect was closed. In delayed group, we preferred to take advantages of the delaying phenomenon in five newborns whose diameter of the meningomyelocele defect were more than 50% of the mid-axillary distance to prevent disrupting circulation of the flaps. After 1 week, defects were closed following repair of the neural defects and advancement of the delayed flaps. The monitoring of the patients during the delay period revealed no local and central nervous system infection symptoms.

In conclusion, we propose that delayed bipedicle flaps as an alternative method for the repair of large meningomyelocele defects due to their simple and reliable nature which also causes less hemorrhage, and we use them on selected patients in our clinic.

Key words: Meningomyelocele, delaying phenomene, bilateral bipedicled fasciocutaneous

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[1]Uzm. Dr., Kilis Devlet Hastanesi, Plastik ve Rekonstrüktif Cerrahi Kliniği, Kilis-Türkiye
[2]Doç. Dr., Şişli Etfal Eğitim ve Araştırma Hastanesi, Plastik ve Rekonstrüktif Cerrahi Kliniği, İstanbul-Türkiye
[3]Uzm. Dr., Ereğli Devlet Hastanesi, Plastik ve Rekonstrüktif Cerrahi Kliniği, Konya-Türkiye
[4]Doç. Dr., Şişli Etfal Eğitim ve Araştırma Hastanesi, Plastik ve Rekonstrüktif Cerrahi Kliniği, İstanbul-Türkiye

Yazışma Adresi / *Address reprint requests to:*
Uzm. Dr. Tahsin Görgülü, Ereğli Devlet Hastanesi, Plastik ve Rekonstrüktif Cerrahi Kliniği, Konya-Türkiye

Telefon / *Phone:* +90-372-315-0515

E-posta / *E-mail:*
tahsinmd@gmail.com

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INTRODUCTION

Congenital fusion defects of the neural tube and the related structures are classified as spinal dysraphism. Meningomyelocele is a defect which is the most common form of spinal dysraphism and affects spinal cord along with vertebrae and the overlying skin, while occurring at an approximate rate of 1 in 800-1000 live births (1,2). The etiologic factors have been reported to have a role in its development are as follows genetic factors, geographical factors, low socioeconomic level, and folic acid deficiency (3). In 75% of the cases, lumbosacral region is affected, however, motor and sensory losses are observed in lower extremities, rectum, and bladder (4). In untreated meningomyelocele patients, mortality rate is 65-70% within the first 6 months. When closure of the defect have been planned, special attention should be given the conservation of the functions of the neural tissues and prevention of a possible sepsis. Despite small defects which can be closed primarily by undermining the flap margins, reported studies show that primary closure is not possible in 25% of cases (5).

Current reconstruction techniques performed to large defects can be classified as: skin grafts, skin flaps, muscle or musculocutaneous flaps. Although skin grafting is a simple procedure and early complication rate is low, in the advanced stages, they frequently require a second operation due to frequent ulceration and infection (6,7). The innovations is this field have been towards reducing the tension at the suture lines on large defects involve rotation flaps, rhomboid flap modifications, V-Y plasties, and techniques with bipedicled flaps (5, 8-18). In order to achieve coverage with muscle and musculocutaneous flaps, apart from utizilizing the latissimus dorsi and gluteus maximus; bilateral bipedicle flaps, bilateral V-Y advancement flaps, Limberg musculocutaneous flaps, and musculocutaneous island flaps have been employed (19-22).

In our study, we have performed a repair with bilateral bipedicle fasciocutaneous flap in a single session in patients whose with diameter of the meningomyelocele defect were smaller than 50% of the mid-axillary distance. In patients with diameter of the meningomyelocele defect were more than 50% of the mid-axillary distance, we applied a delay procedure to the bilateral bipedicle fasciocutaneous flaps. Both patient groups were evaluated with regard to the postoperative complications and recovery. In the present study, we reported our results in meningomyelocele repair with bilateral bipedicle fasciocutaneous flap and comparison of fasciocutaneous flaps with and without delay.

PATIENT-METHOD

Between 2006 January and 2009 January, 10 (6 female and 4 male) newborns with a meningomyelocele defect large enough that could not repaired primarily were included the our study. Demographic data, defect features, durations and methods of operations, and accompanying abnormalities of ten newborns were noted. Protruded neural tissue was replaced into the vertebral canal and dural repair was performed by the Neurosurgery team also venticuloperitoneal shunt were applied.

Thereafter, bilateral fasciocutaneous flaps were planned at the both side of the defects and elevated to transpose to midline to cover the defect. Whereas medial side of the flaps were placed at the both side of the defect, lateral sides were placed along the posterior axillary line in the craniocaudal direction. The length of the flaps were adjusted to two centrimeter more than vertical length of the defect and the wide of the flaps were equal to the radius of the flap. The dissection of the bilateral bipedicle fasciocutaneous flaps were started at the lateral side of the flaps which were along the posterior axillary line and the dissection were continued up to the defect margins (Figure 1). Then, we preferred to take advantages of the delaying phenomenon in five newborns whose diameter of the meningomyelocele defect were more than 50% of the mid-axillary distance to prevent disrupting circulation of the flaps. In these five newbons, meningomyelocele repair was performed after the delaying procedure completed in second session before the precise closure of the defect. We waited at least one week before the precise closure the defect for completion of the delaying procedures. The monitoring of the patients

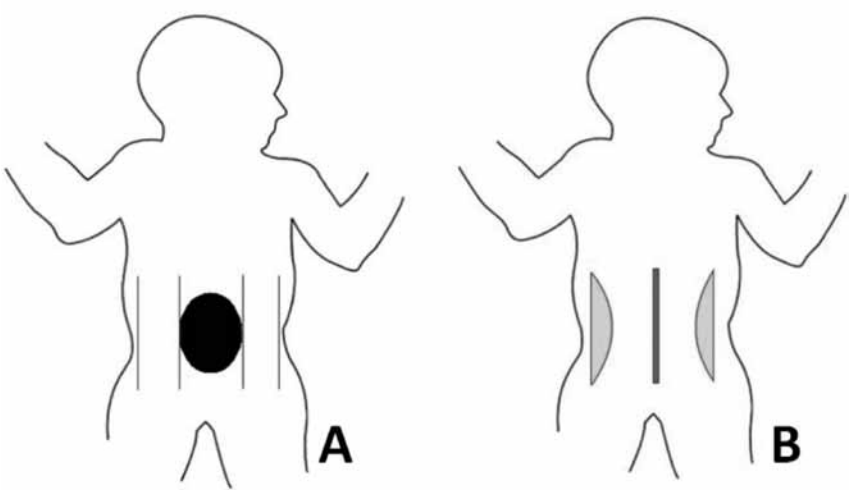

Figure 1 A: Bilateral fasciocutaneous flaps were planned at the both side of the defects and elevated to transpose to midline to cover the defect. The medial side of the flaps were placed at the both side of the defect, lateral sides were placed along the posterior axillary line in the craniocaudal direction. The length of the flaps were adjusted to two centrimeter more than vertical length of the defect and the wide of the flaps were equal to the radius of the flap. **B:** In five cases, the delaying phenomenon preferred and in five newborns flaps were adoptd to defect without delaying.

during the delay period revealed no local and central nervous system infection symptoms.

In the non-delayed group which were consisted of five newborns whose diameter of the meningomyelocele defect were less than 50 %, flaps were advanced to the midline and the defect was closed. In these group, donor site defects were closed both primarily and both with a split thickness skin grafts. The grafts were monitored with a tie-over dressing in the first 5 days.

RESULTS

All of the five newborns have thoracolumbar meningomyelocele in the delayed bilateral bipedicled fasciocutaneous group. All of the five newborns have lumbosacral meningomyelocele in the nondelayed group. All of the newborns went uneventfully in the postoperative period. However, one of the newborns who have thoracolumbar meningomyelocele and associated anomalies died in her sixth months. Mean defect area were 45.1 cm^2 in the delayed bilateral bipedicled fasciocutaneous group and were 37.1 cm^2 in bilateral bipedicled fasciocutaneous group (nondelayed group). Mean timing of the first session of the surgery were 3 days in delayed bilateral bipedicled fasciocutaneous group and second sesion were performed average one week later. Mean timing of the surgery in the bilateral bipedicled fasciocutaneous group were 3 days. Demographic datas, type of the interventions and duration of the operation were listed in Table 1.

All the defects were repaired with good quality tissue and without tension. No major surgical complication was noticed. Flap loss, and total flap necrosis were not seen. Two patients in bilateral bipedicled fasciocutaneous group demonstrated minimal detachment on the suture line, however, it healed secondarily without requiring any additional treatment. Moreover, one patient in non-delayed group, exhibited partial flap loss less than 10% of the total flap surface area and it was left to secondary healing and healed without any problem. No systemic and local wound complication were seen in the delayed group. Mean follow up time was 14 months.

CASE 1

A three days old newborn were presented with lumbosacral meningomyelocele. Protruded neural tissue was replaced into the vertebral canal, venticuloperitoneal shunt were applied and dural

Table 1: Datas of the study

Patients /Gender	Age Defect diameter Horizontal (cm)	Timing of the operation Duration of operation Procedure	Complication
1	6x8	Delayed+Bipedicled flap	-
2	6,5x7	Delayed+Bipedicled flap	-
3	6x6	Delayed+Bipedicled flap	-
4	5x8,5	Bipedicled flap	-
5	5x9	Bipedicled flap	-
6	5,5x6	Bipedicled flap	Minimal Detachment
7	5x7	Bipedicled flap	1x1 Necrosis
8	6x10	Delayed+Bipedicled flap	-
9	5x6	Bipedicled flap	Minimal Detachment
10	6x6	Delayed+Bipedicled flap	

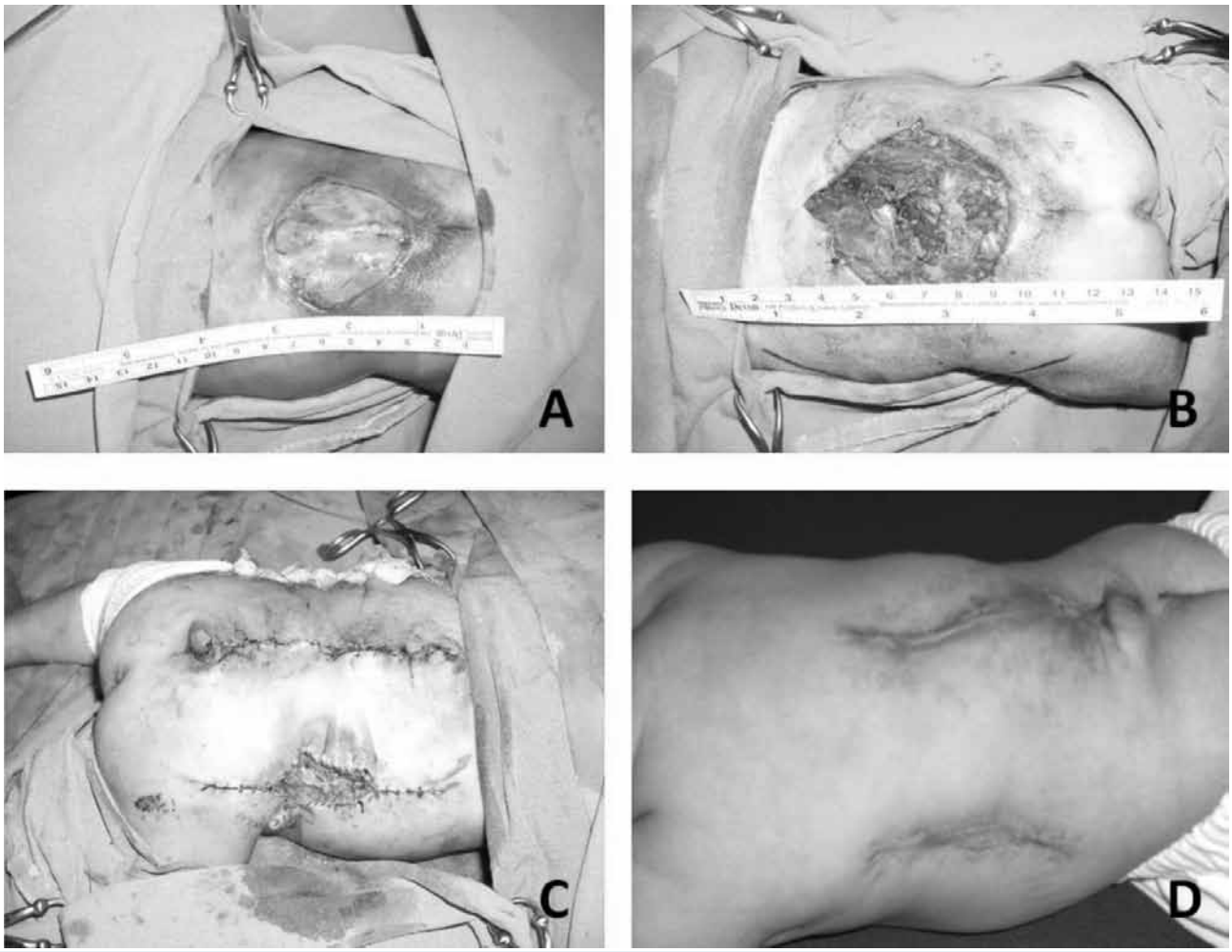

Figure 2 A: A three days old newborn were presented with lumbosacral meningomyelocele.
B: Protruded neural tissue was replaced into the vertebral canal.
C: Bilateral bipedicled fasciocutaneous flaps were marked on the back of the child and adopted to defect withour delaying. In the early postoperative period we observed venous congestion but total or partial flap loss did not occured.
D: His follow up went uneentfully.

repair was performed by the Neurosurgery team. Bilateral bipedicled fasciocutaneous flaps were marked on the back of the child as mentioned above. Skin incisions were made vertically down to the muscle fascia, and undermining was performed until the lateral border of the flap. After elevating the flaps, they were sutured to each other. At the end, the suture lines were distant from the dural closure. Skin and subcutaneous tissue were closed by 5/0 prolene and 4/0 vicryl respectively (Figure 2). Donor area was covered with split thickness skin graft. His mean follow up time was 9 months. Mean operation time was less than one hour.

CASE 2

A two days old newborn were presented with thorocolumbar meningomyelocele. Before repairing the protruded tissue, bilateral bipedicled fasciocutaneous flaps were marked on the back of the child as mentioned and fasciocutaneous flaps were elevated but did not transpose to defects. The flaps were sutured the back to the elevated area for waiting one week for completion of the "delay" phenomenon. Two or more penrose drains was placed into the wound. In the second session protruded neural tissue was replaced into the vertebral canal, venticuloperitoneal shunt were applied and dural repair was performed by the Neurosurgery team. Bilateral bipedicled flap were reelevated and transposed to defect. Donor site defect were closed with split thickness skin graft. Skin and subcutaneous tissue were closed by 5/0 prolene and 4/0 vicryl respectively (Figure 3). Her mean follow up time was one year. Mean operation time was less than one hour.

DISCUSSION

Several surgical techniques have been suggested for soft tissue closure of various spinal defects including primary closure, split-thickness skin grafts, local skin flaps, muscle flaps, and fasciocutaneous or myocutaneous flaps (7,20, 23-35). The target of all those techniques is to provide durable, tension-free, and watertight closure with well-vascularized tissue in order to achieve a reduction in the complication rate.

Small and simple defects, particularly lower than 5 cm in diameter, can be managed by tight closure of the dura layer and primary closure by undermining the wound edges and the creation of simple local skin flaps. However, reconstructing meningomyelocele defects larger than 5 to 6 cm, present a unique difficulty. The inability to achieve tension-free closure with simple undermining of the skin has triggered the development of several techniques involving both neurosurgical and plastic surgery principles. Defects that can not be primarily repaired constitute 25% of all defects and attempting to perform primary repair in such defects will lead to necrosis, detachment, and infection (21).

The usage of cutaneous graft in face of large meningomyelocele defects has been first proposed by Mustardee (6). Subsequently, Luce and Walsh advocated skin graft due to its simplicity (39). However, sking graft presents with problems such as wound healing and complications associated with lack of enough soft tissue to protect the underlying neural tissue. Closure with split-thickness skin grafts has been demonstrated to be unstable, susceptible to trauma, prone to ulcerate with time, as well as being associated with higher rates of CSF leak and meningitis (23,24).

Various methods of closure, which utilize cutaneous flaps (eg, advancement, bipedicle, transposition, rotational, V-Y advancement, and rhomboid flaps), may prove to be effective for smaller defects (23,25,26). However, such flaps are less suitable for larger defects due to high rates of wound complications (ischemia and necrosis), increased donor-site morbidity, insufficient padding of the neural plaque, and the occasional need for additional lateral and relaxing incisions (23). In bilateral bipedicled fasciocutaneous flap, tension free closure was achieved by distributing the tension to two different flaps that have dual blood supply without concorring flap ischemia or necrosis.

Closure with flaps based on thoracolumbar or lumbodorsal fascia has been reported to provide reliable coverage. In fact, fascial coverage may be as effective as muscle flaps, yet requires less extensive

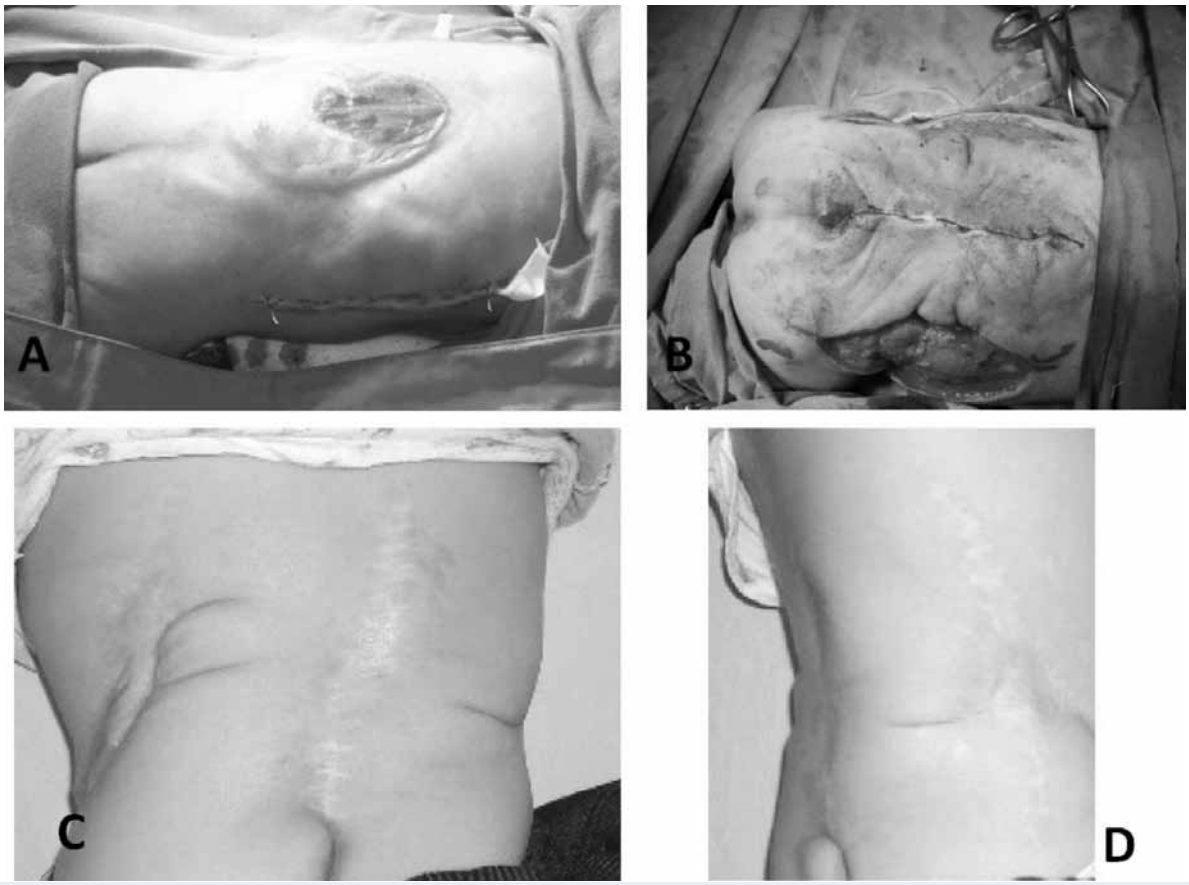

Figure 3 A: A two days old newborn were presented with thorocolumbo meningomyelocele. Before repairing of neural tissue, bilateral bipedicled fasciocutaneous flaps were marked on the back of the child as mentioned and fasciocutaneous flaps were elevated but did not transpose to defects. Two or more pen-rose drains was placed into the wound.
B: In the second session protruded neural tissue was replaced into the vertebral canal, venticuloperitoneal shunt were applied and dural repair was performed by the Neurosurgery team. Bilateral bipedicled flap were reelevated and transposed to defect.
C: Anterior view of the his back in the postoperative one year.
D: Lateral view of the his back in the postoperative one year.

dissection, resulting in shorter operating time and reduced blood loss (34-37). Cruz et al. (13) reported achievement of satisfactory results with double Z-rhomboid flaps in a study comprised of 10 newborns. While Campobasso et al. recommended "Limberg" flap, Ulusoy et al. (26) reported successful results with modified V-Y advancement flap.

There are many reports on successful reconstruction of meningomyelocele defects by musculocutaneous flaps. The advantages of muscle flaps are associated with their ability to provide tension-free, durable, watertight, and viable soft-tissue coverage over the repaired neural plaque, with minimal vascular compromise (38). However, they also have some disadvantages such as loss of a major muscle, large volume blood loss, and prolongation of the operation length (26-29). Losing normal functions of the back muscles is an important concern for the paraplegic cases and patients dependent on a wheelchair. Moreover, usage of muscles such as gluteus maximus, may complicate treatment of possible compression wounds in the future. However Ramirez (39) and Moore (20) described bilateral bipedicled musculocutaneous flap for large defects. In our report, flap design was similar to this techniques but latissimus dorsi and gluteus maximus muscles were

not included to flap that only based to thoracolumbar fascia and this manuever both reduced the blood loss and operation time. And furthermore, when we have concerns about flap circulation, we preferred to wait for 7 days in order to take full advantage of surgical "delay".

In the current study, we performed "delay" procedure based on the ratio between the defect and the back width. While these flaps are nourished from parascapular and circumflex scapular arterial branches in the superior aspect and from superficial branches of the circumflex iliac artery in the inferior aspect, due to increased tension and stenosis of the pedicle inflicted by large defects, complications such as necrosis and detachment can occur. Therefore, we applied a delay procedure of 1-week in newborns having a defect surpassing the 50% of the back width. No detachment or necrosis was determined in the delay group. Although the defect was smaller, non-delay group demonstrated wound detachment in 2 patients and minimal marginal necrosis in 1 patient.

Closure of the defect by paying attention to protect the related sensory and functional structures, is the primary goal of meningomyelocele repair. Closure must be performed immediately after birth in the early neonatal period to prevent central nervous system infections (36). Among untreated patients, mortality rate has been found to vary between 65% and 75% in the first 6 months of life (37-40). In the present study, the patients were examined by the neurosurgery and plastic surgery team immediately after birth and subsequently the defects smaller than 50% of the back width were repaired with a bilateral bipedicle fasciocutaneous flap in average 3 days after bith. In cases with defects larger than 50% of the back width, bilateral bipedicle fasciocutaneous flap delay and shunt were simultaneously and immediately performed. After 1 week, defects were closed following repair of the neural defects and advancement of the delayed flaps. The monitoring of the patients during the delay period revealed no local and central nervous system infection symptoms. Within that period, we paid attention to carry out wound management and antibiotherapy in a regular and appropriate way.

In conclusion, we suppose that delayed bipedicle flaps as an alternative method for the repair of large meningomyelocele defects due to their simple and reliable nature which also causes less hemorrhage, and we use them on selected patients in our clinic.

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