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Reconstructive strategy for meningomyelocele surgery defects

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Abstract
The global prevalence of myelomeningocele has been reported to be 0.8–1 per 1,000 live births. The prevalence and regular call of defect coverage for the same in our institute lead us to study further for the same. The aim of our study was to collect the data of meningomylocele defects encountered and methods of its coverage with various flap mentioned in the books and to do modification in it if required for better result as per our experience. From January 2018 to May 2019, 25 patients with myelomeningocele defects underwent repair at our institution. Of these patients, twenty were male and five were female, with a mean age of 35 days. Fifteen patients (60%) underwent direct repair (Primary Closure), four patients (16%) underwent a reading man flap, two patient (8%) underwent bilobed flap and four patents (16%) underwent transposition flap procedure to cover the myelomeningocele defect. Of total 25 cases 1 case had complication of epidermal loss at distal most end of flap. It was managed conservatively and 1 case had infection in post-operative period which was also managed conservatively by daily dressing. Thus the overall complication rate in our study is 10%. Most myelomeningocele defects can be managed by direct skin repair alone. In cases of large defects, in which direct repair is not possible, local fasciocutaneous flaps may be used to cover the defect with modification to the axis of flap for better coverage and smaller requirement of STSG. Complete coverage can be done without STSG using reading man flap. Results are better with the use of modified local fasciocutaneous flap with no major downside.

Keywords: fasciocutaneous flap, meningomyelocele defect, reading man flap, direct closure

Introduction
Myelomeningocele is a form of spina bifida. Spina bifida is a birth defect. At four weeks of gestation, the lateral edge of the neural plates elevate toward each other and fuse to form a tube known as the neural tube. Failure of this process results in a neural tube defect. When the failure involves a posterior closure, it is called spina bifida. The global prevalence of myelomeningocele has been reported to be 0.8–1 per 1,000 live births. The prevalence and regular call for defect coverage for the same in our institute lead us to study further for the same. The aim of our study was to collect the data of meningomylocele defects encountered and various flap coverage to be used as mentioned in the books and do modification in it if required for better result as per our experience. We started a team work with the Neurosurgery department for the same and all cases which were to be operated were properly examined before the operation for planning in advance and discuss the same with Neurosurgeon. The coverage is challenging with the limited donar site available for planning of flap. In the beginning we started the coverage of defect with simple primary closure with undermining of skin flap surrounding for the defect that were possible to be closed primarily. For defects which were not possible to be closed primarily we started to cover with simple transposition local fasciocutaneous flap coverage and STSG at donar site. We modified the axis of the fasciocutaneous flap to more on defect site rather than perpendicular to defect which helped us to cover the defect more easily without tension and create a comparatively small area of grafting. In this we changed the axis but made sure the number of perforators remained the same or increased as in the standard flap. Again we moved further and used bilobed transposition flap in an attempt to avoid the STSG at donar site. Results were good as compared to simple transposition flap but primary closure of donor site was still difficult with high tension closure & in some case there was requirement of small graft. With our experience and attempt to give some more good results we moved to reading man flap coverage for the defect and covered the defect completely without the need for STSG at donar site. Tension at the closure site of donor area was less as compared to bilobed flap.

Material & Methods
From January 2018 to May 2019, 25 patients with myelomeningocele defects underwent repair at our institution. Of these patients, twenty were male and five were female, with a mean age of 35 days. Fifteen patients (60%) underwent direct repair (Primary Closure), four patients (16%) underwent a reading man flap, two patient (8%) underwent bilobed flap and four patents (16%) underwent transposition flap procedure to cover the myelomeningocele defect.

In all patients, repair of the neural tube and dura mater was performed by a neurosurgeon. In all patients, a small myelomeningocele skin defect were repaired by a plastic surgeon. Defect created after surgery for MMC was evaluated in each case. Surrounding tissue was examined to check for the laxity. Small myelomeningocele defects were covered by direct repair. After direct repair of the dural defect with non-absorbable sutures, an adjacent skin flap above the muscular layer was undermined to release tension,

and the wound was closed directly. For defect requiring flap coverage it was marked and fasciocutanoeus transposition, bilobed or reading man flap was planned and raised accordingly. Defect was sutured in two layers, inner with vicryl (3-0) interrupted sutures and skin with Ethilon (3-0) vertical mattress or using skin stapler. Negative suction drain was put in all cases for minimum of five days. Inset was given to the recipient site and closed in two layers. Dynaplast strapping done. Proper positioning of the patient. In transposition and bilobed flap small skin graft was put at donar site to cover the area.

Results

From January 2018 to May 2019, 25 patients with myelomeningocele defects underwent repair at our institution. Of these patients, twenty were male and five were female, with a mean age of 35 days. Fifteen patients (60%) underwent direct repair (Primary Closure), four patients (16%) underwent a reading man flap, two patient (8%) underwent bilobed flap and four patents (16%) underwent transposition flap procedure to cover the myelomeningocele defect.

Flap Type Distribution

Table 1

Flap Type	Cases
Direct repair	15
Reading man flap	04
Bilobed flap	02
Transposition flap	04
Total	25

Of total 25 cases 1 case had complication of epidermal loss at distal most end of flap. It was managed conservatively and 1 case had infection in post-operative period which was also managed conservatively by daily dressing.

Hospital stay

The average hospital stay was 10 days post-surgery.

Conclusion

- Most myelomeningocele defects can be managed by direct skin repair alone.
- In cases of large defects, in which direct repair is not possible, local fasciocutaneous flaps may be used to cover the defect with modification to the axis of flap for better coverage and smaller requirement of STSG.
- Complete coverage can be done without STSG using reading man flap.
- No new complications were found other than the one already mentioned in various studies done in past. The ratio of complication is much less as compared to other studies.
- Results are better with the use of modified local fasciocutaneous flap with no major downside.

Discussion

Defects of the neural tube result from failure of the spinal tube to close during the 1st month of gestation, and they vary in severity from anencephaly to occult spina bifida. Folic acid deficiency, genetics, and geographic factors, together with low socioeconomic standards, are possible causes for these lesions. (2, 4) Closure of an MMC defect is usually performed during the initial few days after birth. Regardless of the technique used, it should be tension free, provide good soft-tissue padding of the neural tube, prevent CSF leakage, and provide stable and durable wound healing, especially for large defects. Additionally, the techniques used to reconstruct the defect should result in less morbidity. From the literature, it is seen that several authors prefer musculocutaneous flaps for managing neonates with large MMC defects, but it is recognized that musculocutaneous flap coverage of large lumbosacral MMC defects is associated with high complication rates. (3,5) Additionally, compared with musculocutaneous flaps, the dissection of local skin flaps is much easier to perform, requires less operative time, and results in less blood loss. Thus, several authors prefer using skin flaps such as advancement flaps, bipedicled flaps, local transposition flaps, bilobed flaps, double Z-plasty, rotation flaps, and reading man flaps, which can be used successfully in the closure of large MMC defects. (7,8,9,10). We modified the axis of the fasciocutaneous flap to more on defect site rather than perpendicular to defect which helped us to cover the defect more easily without tension and create a comparatively small area of grafting. In this we changed the axis but made sure the number of perforators remained the same or increased as in standard flap. In some cases there was requirement of small graft. With our experience we moved to reading man flap. The Reading Man flap is a fasciocutaneous trans positional flap that is raised around the defect. The flap was first described in 2007 for the closure of skin defects in face, trunk and extremities. The name of the flap was given because its design resembles the silhouette of a man who is reading a book held in his hand. After determination of the relaxed skin tension lines in the defect area, we designed two skin flaps in an unequal Z-plasty manner. Once its direction was decided, the central limb of the unequal Z-plasty was drawn as an imaginary tangential line passing through the margin of the defect. The length of the central limb of the Z-plasty was designed to be 50% longer than the diameter of the circular defect. Beginning from the free end of this line another imaginary line is drawn with an angle of 60 degree. Then beginning from the other end of the central limb our third imaginary line was drawn with an angle of 45 degree. The two skin flaps were elevated as fasciocutaneous flaps and one flap was moved to the defect and the other was transposed to cover the first flap's donor site. This flap is one of the most popular procedures in the reconstruction of MMCs. (14) In contrast to musculocutaneous flaps, the Reading Man flap does not disrupt the back muscles and the donor area can be closed primarily. In this way, morbidity related to muscle disruption is prevented and the maintenance of trunk posture is better achieved at a later stage. In our study Reading Man flap was used successfully, according to the defect size.

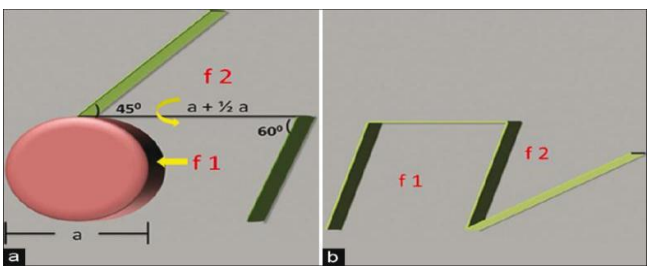
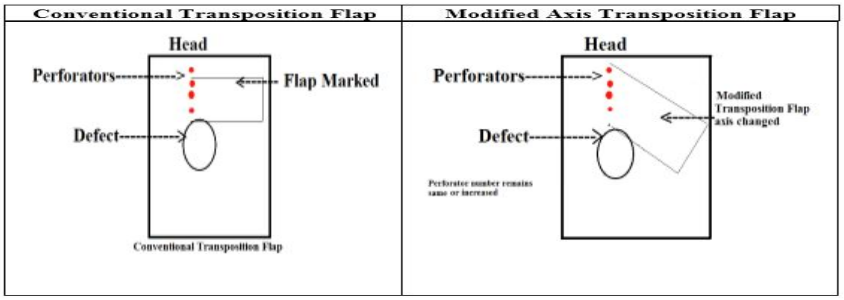
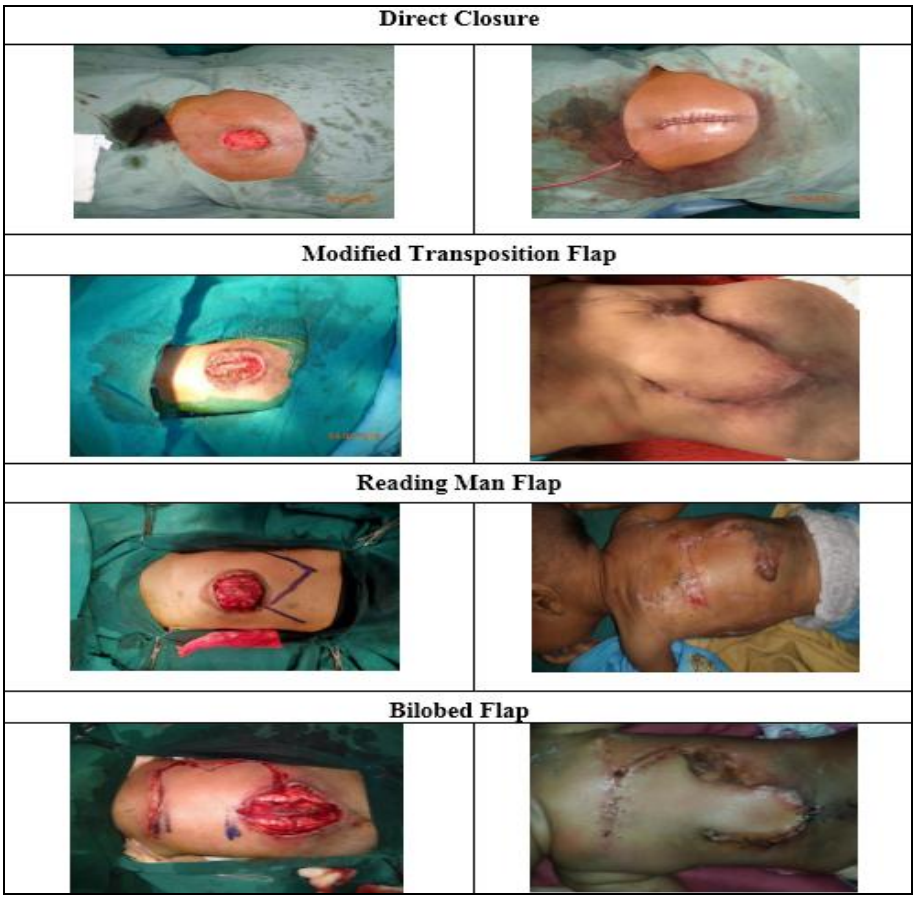


Fig 1

Similarly, the bipedicled flap is a fasciocutaneous flap, but it is perfused by a superior and inferior pedicle. Primary closure was possible by undermining of the wound margins in almost 60% of cases. However, the remaining 40% of patients with large defects require a more complex procedure. (9, 11) In the literature, flap reconstruction is recommended for defects that are > 5 cm in diameter, but this is not suitable for all patients because of different weights and usable skin tissue on the back. We closed small defects not only with primary repair but also with flaps. We believe that defects should be considered based on ratios, not on sizes, and that all decisions on patients' reconstruction surgery should be made on an individual basis. Because of tension-free repair and the lack of unnecessary flap use, we did not observe any complications in the patients who had primary closure. Postoperative complications following MMC wound closure are well described. (6, 12, 13, 14) Among the most common are CSF leak, meningitis, seroma, hematoma, skin flap necrosis, wound infection, and dehiscence. The average complication rates have been reported between 7.7% and 33 %.(6, 12, 14) but our overall complication rate was only 10%. Compared with the literature, this is very low; these results verified the reliability of technique. To reduce wound complications, tension-free closure is the key element. To obtain this, knowledge of flap principles is mandatory. We believe that the success of a reconstruction is much more related to surgical planning in terms of deciding whether to use flaps or primary closure. According to our decision and results obtained, other fasciocutaneous flaps can also be easily used, e.g., rotation flaps, advancement flaps, and so on.



Clinical Pictures



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