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VARIOUS RECONSTRUCTIVE TECHNIQUES FOR MENINGOMYELOCELE DEFECT CLOSURES DONE IN A TERTIARY CARE CENTRE IN SOUTHERN INDIA.

Plastic Surgery

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ABSTRACT

Background: Meningomyelocele is a defect of the spinal cord, vertebrae, and the overlying skin and is the most common form of open spinal dysraphism. The global prevalence has been reported to be 0.8–1 per 1,000 live births. Early closure is considered to be the standard of care procedure. Various surgical methods have been reported, such as primary skin closure, local skin flaps, musculocutaneous flaps, and skin grafts. The aim of this study was to describe the clinical characteristics of myelomeningocele defects and present the surgical outcomes of recent cases of myelomeningocele closures using various reconstructive techniques at our institution. **Methods:** Patients who underwent surgical closure of myelomeningocele at our institution from July 2022 to August 2023 are included in this study. A review of their cases were performed, and , defect size, location, surgical procedures, complications, and the their final results were analyzed. **Results:** A total of 15 patients underwent surgical closure for myelomeningocele defects. 8 cases were closed with direct skin repair, while 7 cases required local skin flaps to cover the skin defects. Out of those 7 cases, 3 cases was repaired using a double – limberg flap and 2 cases were repaired using the bilateral bipedicle advancement flap, and the rest 2 was repaired using a limberg flap. One case of partial flap necrosis occurred, requiring revision surgery with flap advancement and a split-thickness skin graft. All wounds eventually healed completely. **Conclusion:** Meningomyelocoele defects can be managed by direct skin repair alone. In cases of large defects, when direct repair is not possible, various methods of local flaps may have to be used to cover the defect. Complications such as wound dehiscence and partial flap necrosis have occurred in this study; however, all such complications were successfully managed with simple supportive measures .

KEYWORDS

Meningomyelocoele (MMC), flap cover, Wound closure techniques, skin defect.

INTRODUCTION

Meningomyelocoele (MMC) is one of the most complex congenital malformation of the CNS that is compatible with life. Different closure techniques are available for defect reconstruction, but wound healing and tension-free closure of the skin in the midline remain major considerations in large meningomyelocoele (MMC) . It is a form of spina bifida. 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 [1,2.] The global prevalence of myelomeningocele has been reported to be 0.8–1 per 1,000 live births [3]

Causes of meningomyelocoeles (MMC) are multifactorial such as folic acid deficiency, chromosomal abnormalites such as trisomies, triploidy and single gene mutation. Other causes such as maternal obesity, maternal uncontrolled diabetes and exposure to teratogens and drugs like valproate, carbamazepine have also been listed as causes contributing to the formation of meningomyeloceles [4,5].

Although small meningomyeloceles(MMC) may be agreeable to direct or primary closure with the local surrounding skin, the closure of large meningomyelocele skin defects needs more complex methods. The goals of closure are to preserve the function of the neural tissue and to prevent secondary infection [6]. If the myelomeningocele defect is small, direct repair can be performed; however, if the defect is large, various other reconstructive options are available [7,8]. Several reconstructive options exist for soft tissue closure, including local flaps, musculocutaneous flap variations, and skin grafting [9]. In this study, we report our past 1 year experience with the treatment of myelomeningocele defects. We used direct repair or a Limberg flap along with a double limberg and a bipedicle flap to close the myelomeningocele defects performed in our institution. flaps were chosen depending on the defect size and shape of the defect.

AIMS AND OBJECTIVES

To assess and analyse the efficacy of the different methods of reconstruction flaps used according to need in the surgical repair of Meningomyelocoeles (MMC) in our institution.

Study Design

A retrospective observational study

Study Duration

1 year (January 2022–February2023)

METHODOLOGY

A retrospective observational study was conducted, which included a total number of 15 patients with MMC defects who underwent repair by plastic surgeons from (January 2022–February2023) . Out of the 15 patients, there were 10 males and 5 females. Eight patients (53%) had undergone direct repair, 2 patients (13%) had undergone Limberg flap repair, 3 patients (20%) had undergone the double limberg flap procedure to cover the MMC defect and 2 patients (13%) had undergone repair using the bipedicle flap. In all patients, repairs of the neural tube and dura mater were performed by the neurosurgeon. All MMC defects were closed by plastic surgeons. A review of all the cases operated was completed, and patient demography including defect size, defect location, surgical procedures, complications, and the final results were analysed. All 15 patients had lumbosacral defects. The flap was chosen depending on the defect size and shape. All the defects were closed without any undue tension at the suture margins. The mean follow-up period was 6 months. The mean age of the 15 patients operated was 58 days. The mean defect size was 8 cm^2 in the direct repair cases, 12 cm^2 in the Limberg flap cases and 27 cm^2 the bilateral limberg cases. The mean defect size was 35 cm^2 in the bilateral bipedicle advancement cases. The average operative time was 50 min for direct repair, 80 min for the bipedicle flaps, 62 min for the Limberg

flaps and 75 min for the double limberg flaps.

Surgical Technique

Direct repair- After the direct repair of the dural defect with non-absorbable sutures, an adjacent skin flap above the muscular layer was undermined to release the tension. At first, a few stay sutures were taken; if there was no undue tension, then the wound was closed primarily. Post surgery was uneventful in direct repair cases.

Limberg Flap-

Limberg flap is a type of transposition flap. The Limberg flap is a parallelogram with two 120° angles and two 60° angles (Figure 1). Once the dural defect was closed by the neurosurgeon, the defect shape and size were assessed and marking was done for the Limberg flap. The margin of the defect was trimmed into a parallelogram to act as the Limberg flap. A line was extended from the parallelogram as a continuation of the short diagonal. Drawing a second line from the distal end of the first line forms an apex of the flap. The second line was made equal in length and parallel to one of the adjacent defect sides. A skin incision was made on the muscle fascia first, and then the Limberg flap was dissected above the muscle fascia. The Limberg flap was then transposed to the MMC defect and suturing was done by the standard surgical technique.

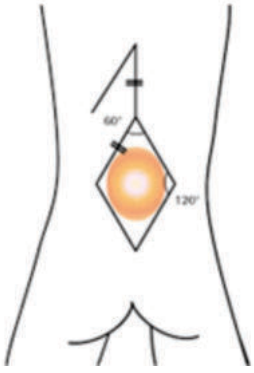

Fig 1 – Depicting the Angulation of the limberg flap [10]

Double Limberg –

It is a modified form of the limberg flap. One of the cases we performed was of a 16 days old female child,referred to our institution from another centre for lumbar meningomyelocele. Repair of neural tube and duramater was performed by the neurosurgery team. Defect was closed with double limberg flap. This specific case developed a tip necrosis,requiring revision with flap advancement and a split-thickness skin graft. (Figure 2,3,4,5,6)

Figure 2 – Lumbar Meningomyelocele on a 16 day old female child.

Figure 3 – Double Limberg flap was planned.

Figure 4 – Flap inset given

Figure 5 – On Post-Op day 5 the baby developed a flap tip necrosis.

Figure 6 – Patient underwent flap advancement and a split-thickness skin graft.

Bipedicle Flap-

In cases, where there was tension over the suture line, we adopted standard planning techniques for bipedicled flaps in our tertiary care institution. The planning of the flaps was done for the defect after the excision of the MMC sac and dural closure. The defect size was measured in length "Y" and width "X." Both "X" and "Y" were divided into equal halves and the flaps were planned on both sides of the defect. The horizontal dimension of the flap is marked at 1.5"X" from the margin of the defect limiting at the posterior axillary line on either side. The vertical height of the flap was marked at 2"Y" both above and below the defect. These markings are joined on either side to draw bipedicled flaps on both sides from the defect margin (Figure 7). The case done was of a 17 day old female child referred to our centre . Repair of the neural tube and duramater was performed initially by the neurosurgery team followed by a bipedicle flap by the plastic surgeon. (fig.8,9,10,11)

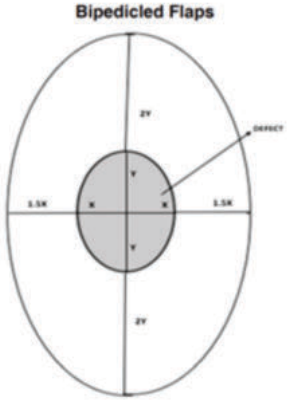

Figure 7 – Depicting the measurements of bipedicle flap.

Figure 8,9 – 17 day old female child presented with MMC.

Figure 10 - Repair of neural tube and duramater was performed by the neurosurgery team and bilateral bipedicle flap raised.

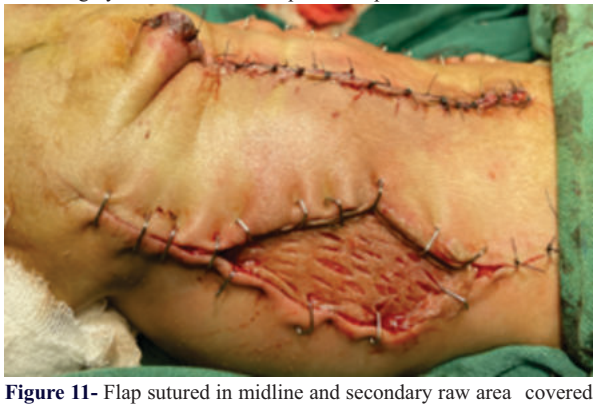

Figure 11- Flap sutured in midline and secondary raw area covered with split skin graft

RESULTS

A total of 15 patients underwent surgical closure for meningomyelocele defects. All 15 patients had lumbosacral defects. The flap was chosen depending on the defect size and shape. All the defects were closed without any undue tension at the suture margins. The mean follow-up period was 6 months. The mean age of the 15 patients operated was 58 days. The mean defect size was 8 cm^2 in the direct repair cases, 12 cm^2 in the Limberg flap cases and 27 cm^2 in the bilateral limberg cases. The mean defect size was 35 cm^2 in the bilateral bipedicle advancement cases. 8 cases were closed with direct skin repair, while 7 cases required local skin flaps to cover the skin defects. Out of those 7 cases, 3 cases was repaired using a double – limberg flap and 2 cases were repaired using the bipedicle flap, and the rest 2 was repaired using a limberg flap. One case of double limberg flap repair had a partial flap tip necrosis, requiring revision with flap advancement and a split-thickness skin graft. All wounds eventually healed completely.

DISCUSSION

Primary healing of small defects can mainly be attained by a wide undermining of wound edges and tensionless primary repair. In a case series of 130 patients, Patterson and Till mentioned that most of the MMC defects were closed by direct repair, while other reconstructive options were required in the remaining cases, that is, only 25%.[11] To close the larger defects has always been challenging. Various options ranging from a simple skin graft to the local flaps to various regional flaps or even the perforator flaps have been mentioned in the literature which can be observed further.

Musculocutaneous flaps are an option for the closure of extremely wide MMC defects as described by Mustarde in 1968,[12] as shown in 1978, when McCraw et al.[13] had used bilateral latissimus dorsi musculocutaneous flaps for the closure of MMC. McDevitt et al. in 1982 had shown the use of bilateral latissimus dorsi musculocutaneous flaps with extended gluteal fasciocutaneous flaps for the closure of thoracic and lumbar d defects.[14] Other options mentioned in the literature were distally based latissimus dorsi flaps,3 Limberg latissimus dorsi musculocutaneous flaps[15] and reverse latissimus dorsi musculocutaneous flaps.[16] Ramirez et al. had shown in 1987 that the combination of latissimus dorsi and gluteus maximus musculocutaneous flaps could be used for lower sacral defects.[17] These flaps were not used much because of extensive flap dissection, increased blood loss and prolonged operative time.

In previous literature, it had been emphasised that the use of local flaps for moderate to large lumbosacral MMC defects can be considered as a viable option. Other flaps were the double -rhomboid flaps, V-Y advancement flaps, bilobed flaps, rotation flaps and Limberg flaps.[18-20] The first mentioned use of the Limberg flap for closing MMC defects was stated by Ohtsuka et al.[21]

Shim et al.[22] had shown the utility of the Limberg flaps for the closure of MMC. In the mentioned study by Shim et al., the mean age of the patients was 32 days when compared with our study, which was 58 days. There was a significant difference in terms of average operative times, that is, 190.9 min and 220 min compared to 60 min and 52 min in the direct and the Limberg flap closures, respectively, of our study. One patient was operated with the double Limberg flap in the study by Shim et al. whereas we had 2 patients operated with the double Limberg flap one of whom had developed a flap tip necrosis. No local transposition and the triple rotation techniques were used in our study.

According to earlier literature, the best time for MMC defect closure is within 48 h of birth. Early surgical intervention is associated with reduced mortality, lesser incidence of meningitis and improved muscle function. In addition, the technical difficulties are much less during the first 48 h of life than they are at a later age. The mean age of our cases were 58 days and all our cases received a positive outcome and a complete recovery. [22]

CONCLUSION

Most myelomeningocele defects can be managed by direct skin repair alone. In cases of certain large defects, in which direct repair is not possible, different local flaps may be used to cover the defect. Complication such as a single flap necrosis had occurred in this study; however, the complication was successfully managed with simple secondary procedures. With this study, we concluded that the flap required for the closure of an MMC would be decided according to the size of the defect since almost all the cases performed in our care had a complete recovery.

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