Original Research Paper

Volume - 11 | Issue - 02 | February - 2021 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Neurosurgery

LIMBERG FLAP A BETTER METHOD OF CLOSURE OF LUMBAR MYELOMENINGOCELE DEFECTS: A PROSPECTIVE STUDY

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ABSTRACT **Background:** Myelomeningocele is the most common and complex congenital malformation of the central nervous system with an incidence of approximately 1 in 1000 live births. The lumbosacral area is the commonest site for defect. Early closure of a myelomeningocele defect is advocated because it reduces infection rates even though it is not associated with an improved neurological outcome.

Aims & objectives: The aim of this study was to evaluate the effectiveness and outcome of direct repair and a Limberg flap repair for skin defects that occur in myelomeningocele.

Settings and Design: This was a prospective, randomized controlled study.

Material and methods: A tertiary care centre based, non-randomized, prospective, comparative study was conducted in the Department of Neurosurgery, GSVM Medical College, Kanpur, from January 2018 to October 2019, in 22 patients with lumbar myelomeningocele. 7 patients who underwent Limberg flap repair constituted Group A and 15 patients who underwent direct repair constituted Group B. Post operatively the outcomes were compared at 6 months, on the basis of cosmetic appearance and complications such as wound dehiscence, CSF leak, neurological deficit, hydrocephalus, necrosis and wound infection.

Results : Lesser complications and a better cosmetic outcome were seen post operatively at 6 months with Limberg flap technique compared to direct repair. Our study show better result with Limberg flap over direct repair of myelomeningocele defect closure up to the follow up period of 6 months.

Conclusion: Because of various defect sizes and patient characteristics, no single protocol exists for the reconstruction of myelomeningocele defects. Most lumbar myelomeningocele defects can be managed by direct skin repair alone. In cases of large defects, in which direct repair is not possible, local flaps may be used to cover the defect. Overall, Limberg flap is a better technique for closure in these patients.

KEYWORDS : Myelomeningocele; Limberg flap; Direct repair.

INTRODUCTION

Myelomeningocele (Fig. 1) is a form of spina bifida. Neural tube formation occurs at the 4th week of gestation by the elevation of lateral edge of the neural plate towards each other and their fusion. Neural tube defect occurs due to failure of this process.[1] Spina bifida is the failure of posterior closure of the neural tube.[2] Incidence of open neural tube defect is about 0.5 – 1.0 per thousand live births in the United States[3] and global prevalence is reported to be around 0.8-1.0 per 1000 live births[4].

If the neurological deficits are minimal, the survival rates of these patients are good. Patients present with various complaints like bilateral lower limb paralysis, hydrocephalus, and saddle anesthesia. Surgical closure of the defect is the primary treatment. The main objective for closure is to preserve neural tissue and have a good skin closure which is tension free thereby preventing wound dehiscence and secondary infection[5]. There are many options of repair such as primary closure, and several reconstructive options exist for soft tissue closure including local flap, skin grafting,[6] VY plasty, musculo cutaneous flap[7], and Limberg flap (Fig. 2). This study is aimed at comparing direct repair and closure with an advancement flap (Limberg flap), and their outcomes.

Fig. 1- Presentation of a lumbar myelomeningocoele

Fig. 2- Pre operative picture after marking of flap

MATERIAL AND METHODS:

A prospective, comparative, interventional, non-randomized study was conducted in a tertiary care centre from January 2018 to October 2019 in the Department of Neurosurgery, GSVM Medical College, Kanpur, comparing closure of myelomeningocele defects using a Limberg flap and direct repair. Total 22 patients underwent surgery with direct or Limberg flap repair. The outcomes of these two repair techniques were considered to determine which closure technique should be used for the reconstruction of defects of myelomeningoele. A total of 22 patients were included in our study, out of which (n=15) patients were selected for direct repair, and (n=7) patients selected for Limberg flap. Pre-anaesthetic checkup and all routine investigations were done and in some cases imaging technique was adopted. The procedure was explained to the patient and informed written consent was taken.

The study was performed after clearance from the Institutional Ethical Committee, based on its guidelines. Both the groups were comparable with respect to mean age, sex and nutritional status.

SURGICAL TECHIQUE:

1) FIRST TECHNIQUE – DIRECT REPAIR:

In this technique myelomeningocele defects were closed by direct repair. After direct repair of the dural defect with non-absorbable sutures, an adjacent skin flap above the muscle was undermined to release tension, and the wound was closed directly by nylon 3-0.

2) SECOND TECHNIQUE – LIMBERG FLAP REPAIR:

The Limberg flap is an example of a transposition flap (Fig. 3). Although angles may vary, the Limberg flap is basically a parallelogram with two 120° angles and two 60° angles. In the cases included in this study, the neurosurgeon covered the dural defect during standard dural repair. The margin of the defect was then trimmed into a parallelogram to act as the Limberg flap (Fig. 4). A horizontal line equal to the length of one side of the rhomboidal defect was determined, followed by a second line parallel to one side of the

rhombus. A skin incision was made to the muscle fascia first, and then the Limberg flap was dissected above the muscle fascia. After the dissection, the Limberg flap was transpositioned to the myelomeningocele defect. (Fig. 5, Fig. 6)

Fig. 3- After excision of myelomeningocoele

Fig. 4- Raising of a Limberg flap

Fig. 5- Limberg flap repair

Fig. 6- Followup after 10 days before removal of stitches

Fig. 7- Follow up at 6 months

Fig. 8- Another image of follow up at 6 months

RESULTS

A total of 22 patients underwent surgical closure of myelomeningocele defect. All defects were closed successfully. The mean follow up period was 6 months. The mean defect size was **13.8 ± 2.24 cm²** in the direct repair cases and **47.85 ± 3.76 cm²** in the Limberg flap cases (p<.0001). The average operative time was **106.33 ± 8.88 minutes** for direct repair and **137.14 ± 8.26 minutes** for the Limberg flap (p<.0001). Out of the 15 patients who underwent direct repair, 60% (n=9) developed wound infection, 60% (n=9) had wound dehiscence, 60% (n=9) had wound necrosis, 53.33% (n=8) had CSF leak, 26.67% (n=4) had neurological deficit and 26.67% (n=4) had hydrocephalus. Out of 7 patients who underwent closure by Limberg flap, 14.28% (n=1) had wound infection, 28.57% (n=2) had neurological deficit, 14.28% (n=1) had hydrocephalus, 14.28% (n=1) had wound dehiscence, 14.28% (n=1) had necrosis and 28.57% (n=2) had CSF leak (Table 1). Despite these complications, all wounds healed successfully after simple secondary procedures.

Table. 1- A comparison between direct repair and Limberg flap in terms of outcome and complications:

Procedure	Direct Repair	Limberg Flap	p-Value
Wound dehiscence	9 (60%)	1 (14.28%)	**0.0448**
CSF leak	8 (53.33%)	2 (28.57%)	0.2770
Neurological deficit	4 (26.66%)	2 (28.57%)	0.7599
Hydrocephalus	4 (26.66%)	1 (14.28%)	0.5186
Necrosis	9(60%)	1 (14.28%)	**0.0448**
Infection	9 (60%)	1 (14.28%)	**0.0448**
Cosmetic appearance	Poor	Better	

DISCUSSION

The aim of surgical repair of myelomeningocele is to cover the exposed spinal cord and the nerve roots, to prevent CSF leak and to reduce chances of central nervous system infection. In a previous study done by **Geover Joslen Lobo[8] et.al** from August 2014 to January 2018 on 22 infants comparing primary closure and V Y plasty, 9 who underwent primary closure had CSF leak, 3 developed hydrocephalus, 6 had wound dehiscence, 3 had neurological deficit and 1 died. Of the 13 infants who underwent VY plasty, 3 had CSF leak, 1 had hydrocephalus, 5 had neurological deficit, and no wound dehiscence and no deaths. In another study done by **Jung- Hwan Shim[9] et. al** from January, 2004 to December, 2013 on 14 patients who underwent surgical closure of myelomeningocele defect, 2 patients underwent Limberg flap closure and 12 underwent direct repair. Both patients who underwent Limberg flap repair developed hydrocephalus, paraplegia, wound dehiscence and 1 had wound infection and necrosis. 5 of the 12 patients who underwent direct repair developed hydrocephalus, 3 developed weakness of the lower extremities, 2 had infection, 1 had wound dehiscence and 1 died. In our study which was done from January, 2018 to October, 2019 on 22 patients comparing direct closure and Limberg flap.

Out of the 15 patients who underwent direct repair, 60% (n=9) developed wound infection, 60% (n=9) had wound dehiscence, 60% (n=9) had wound necrosis, 53.33% (n=8) had CSF leak, 26.67% (n=4) had neurological deficit and 26.67% (n=4) had hydrocephalus. Out of 7 patients who underwent closure by Limberg flap, 14.28% (n=1) had wound infection, 28.57% (n=2) had neurological deficit, 14.28% (n=1) had hydrocephalus, 14.28% (n=1) had wound dehiscence, 14.28% (n=1) had necrosis and 28.57% (n=2) had CSF leak (Table 1). Despite these complications all wounds healed successfully after simple secondary procedures.

Thus, wound infection, necrosis and dehiscence was lesser in the Limberg Flap group than the Direct Repair group. This was found to be statistically significant. However, there was no statistical significance between the two groups in terms of CSF leak, neurological deficit and hydrocephalus. Operative time needed however, was more for the Limberg Flap group. (p<.0001)

CONCLUSION

Our study shows superior results of Limberg flap repair over direct repair of myelomeningocele defect closure upto a follow up period of 6 months, both on the basis of cosmetic outcome and complications. (Fig. 7, Fig. 8) Wound related complications, such as wound infection, necrosis and dehiscence are more common after direct repair than in Limberg Flap. However, there is no difference between the two groups in terms of the occurrence of CNS complications such as CSF leak, neurological deficit and hydrocephalus. Intra-operative time was significantly more, however, with the Limberg Flap group.

Most lumbar myelomeningocele defects can be managed by direct skin repair alone. In cases of large defects, in which direct repair is not possible, local flaps may be used to cover the defect. Overall, Limberg flap is a better technique for closure in these patients.

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