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Dufourmentel Rhomboid Flap for Lumbosacral Meningomyelocele Reconstruction: Algorithmic Approach

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ABSTRACT

Myelomeningocele (MMC) is incompatible with life. It is a complex anomaly affecting the central nervous system (CNS). The neural tube is typically opened. Reconstruction of the tube is the surgical goal to create a closed media of neurotropics needed for conduction of the neural function.

In this retrospective study, we reviewed a total number of 28 infants admitted to the Neurosurgery Department at Mansoura University. Their age ranged between 10 and 32 days.

We classified the defect into mild, moderate and major; mild defect was defined as a defect less than 5 cm in diameter, the moderate one between 5-10cm in diameter while the major defect more than 10cm. A single flap design was enough to reconstruct mild defects in a tension free repair. Two-flap design was used to cover moderate defects. In Major defect, three-flap design was adapted to provide a reliable and relaxed repair.

In this study, our flap design allows minimal acute angle of rotation, which make the transposition of each flap within a short distance easier. Also, extensive undermining is not required to preserve blood supply of the flap.

INTRODUCTION

Myelomeningocele (MMC) is incompatible with life. It is a complex anomaly affecting the central nervous system (CNS). The neural tube is typically opened. Reconstruction of the tube is the surgical goal to create a closed media of neurotropics needed for conduction of the neural function **[1]**. The incidence of this anomaly has decreased; this is due to the advance in the prenatal diagnosis and the elective termination of the pregnancy. Folic acid and multivitamins supplementation has been shown to reduce the risk of the neural tube defects when taken in early pregnancy **[2]**.

There are multiple methods for reconstruction of the defect, but the concept of the tension free repair is still the major consideration in large MMC **[3]**. The reconstruction ladder of the defect starts from simple skin graft up to muscular flaps, passing through different variables of fasciocutaneous flaps **[4]**.

The efficient redistribution of the available tissues by combined use of transposition and advancement principles is useful in the repair of relatively large skin defects with reduced tension along the closure **[5]**.

In this work we applied the well-known Dufourmentel **[6]** flap to cover the large defects of MMC. A single flap design is used to cover small defect. Double flap for moderate defects while three-flap design to cover very large defect. The target is to have a tension free repair by a single or multiple flap design.

PATIENTS AND METHODS

In this retrospective study, we reviewed a total number of 28 infants admitted to the Neurosurgery Department at Mansoura University. Their age ranged between 10 and 32 days. Sixteen of them were males and 12 were females (Fig. 1). Twenty infants presented with flaccid paralysis of both lower limbs while the other eight infants had paraparsis of both lower limbs.

All infants had hydrocephalous with frontal bossing. Their hydrocephalous was treated with shunt prior to surgical repair and reconstruction of the MMC. We classified the defect into mild, moderate and major; mild defect was defined as defect less than 5cm in diameter, the moderate one is between 5-10cm in diameter while the major defect more than 10cm. A single Dufourmental flap design was enough to reconstruct mild defects

in a tension free repair (Fig. 2). Two-flap design was used to cover moderate defects.

In Major defect, three-flap design was adapted to provide us with a reliable relaxed repair. After the induction of general anesthesia, all infant were turned to prone position. The neural palacode was dissected from the surrounding tissues. The dermal remnants were resected. Reconstruction of the neural tube began by closing the pia matter. The Dura matter then dissected from the fascia on both sides of the defect from the cranial to caudal directions. Mid-line Dural repair was done after complete release of the Dura. After converting the oval or circular defects into a rhomboid shape, flap design was done.

The pedicle of each flap was carefully placed to be perfused either with intercostal or lumbar perforators for the proper flap viability. Final repair of the repositioned was done in a tension free manner. Finally, light and fluffy dressing were used (Figs. 3-5).

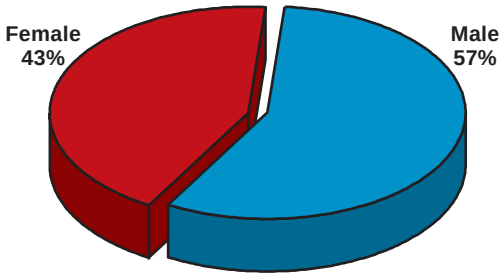


Fig. (1): Sex Distribution of the patients.

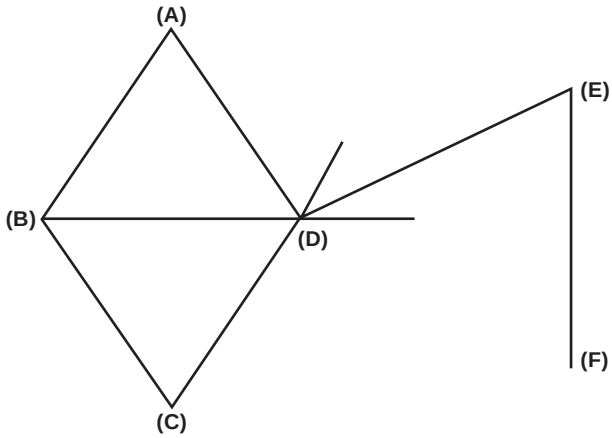


Fig. (2): Dufourmental flap design **[6]**.

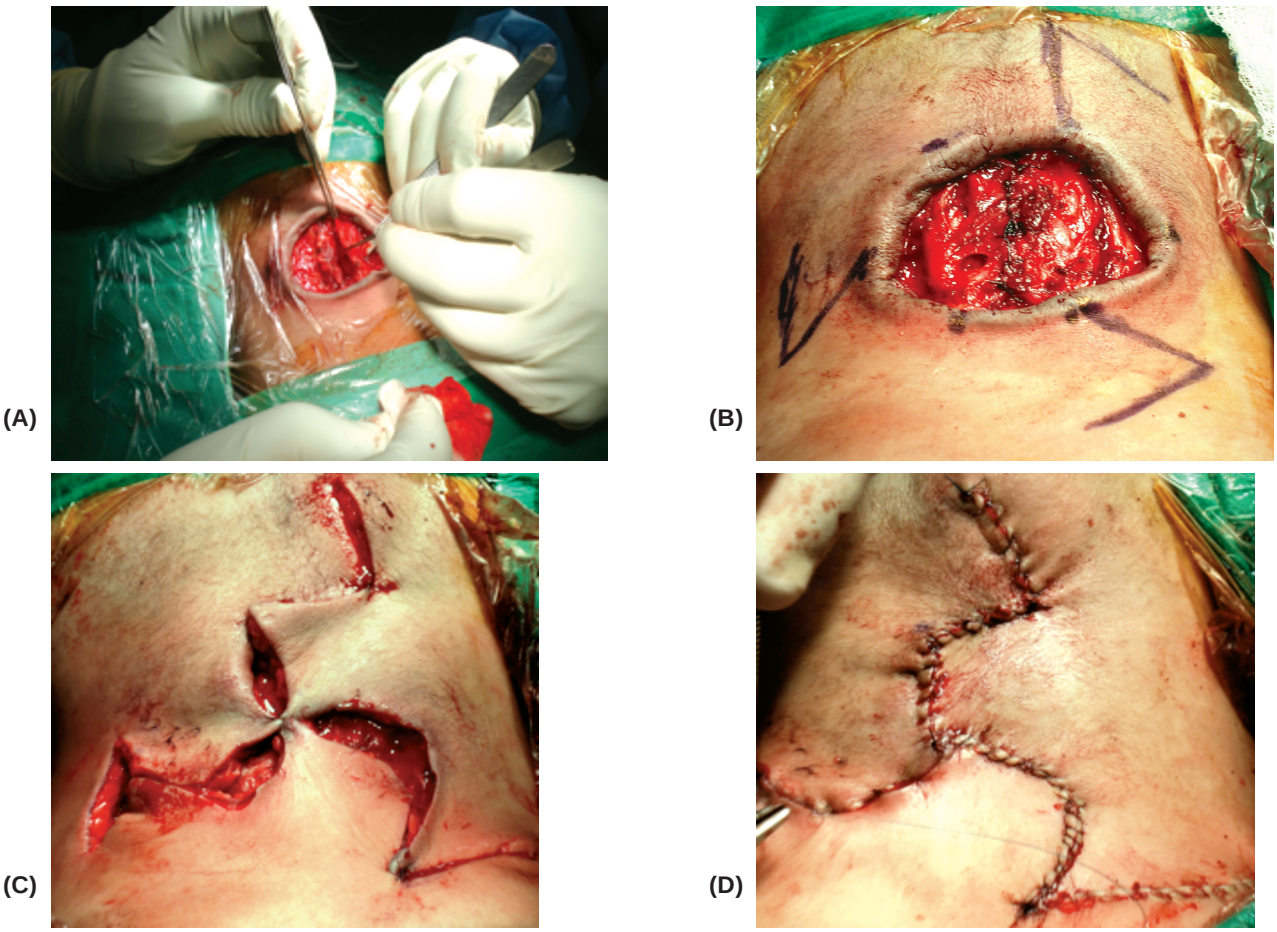
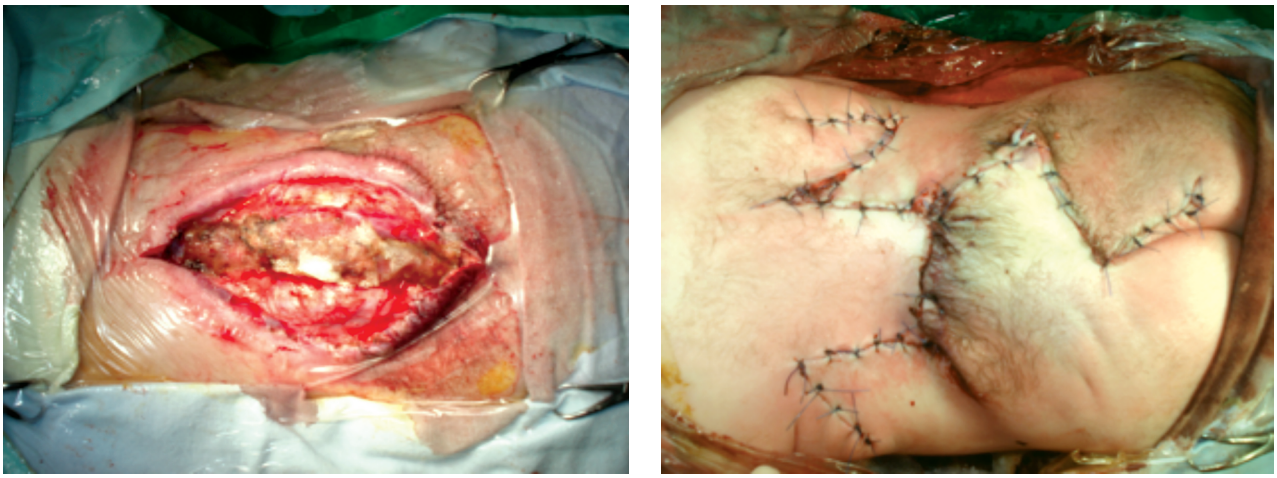


Fig. (3): 18 days male infant with large MMC reconstructed by three-dufoumental flap technique (A) The defect after dural repair (B) Flap design (C) Flap rotation (D) Flap inset.

(A) **(B)**

Fig. (4): 20 days female infant with moderate MMC reconstructed by two-Dufoumental flap technique (A) Moderate defect of MMC (B) Two Dufourmental flap closure.



(A) **(B)**

Fig. (5): 17 days male infant with large MMC reconstructed by three-Dufoumental flap technique (A) Major defect of MMC (B) Three-Dufourmental flap closure.

RESULTS

In these study 28 infants with variable sizes of the defect from mild to major were managed by fasciocutaneous Dufourmentel flaps. All wound healed within 3 weeks without major complications. There was one case of major defect (17cm) reconstructed by 3-flap design in which the edges of the flap had slight sloughing. After, serial wound management the wounds healed within 6 weeks from the operation.

DISCUSSION

Myelomeningocele is a type of spina bifida that results from failure of caudal neurulation during the 4th week of gestation, which leads to a posterior midline defect with exposed meninges and dysplastic neural tissue **[7]**. The proper defect closure maximize the neurological salvage by preventing both infection and neural desiccation **[8]**.

The intermediate zone of epithelium covering the sac of MMC with the lack of the dermal components makes the reconstruction mandatory for the proper coverage of such defect. Reconstruction of MMC defects started by delayed skin graft **[9]**.

In a series of 130 infants with MMC defect Patterson and Till stated that: The defect if more than 5cm in diameter requires a close cooperation between the neurosurgeon and plastic surgeon for proper reconstruction **[10]**.

Some authors reported satisfactory results with the use of split thickness skin graft with low morbidity and mortality **[9]**. However, long term follow up by the same authors relieved 23% incidence of the chronic skin ulceration requiring secondary surgery **[11]**. The time factor between the neural tube repair and the skin graft may lead to meningitis and the skin graft is unstable on pressure area. Bilateral; relaxing flank incision will lead to primary repair **[12]**. But this maneuver results in a bilateral small defect and not suitable for large defect.

Many authors prescribed the use of musculocutaneous flaps for the proper padding of the defect such a latissmus dorsi muscle flap and gluteus Maximus musculocutanous flap **[13,14]**. However utilizing of such muscles may lead to significant donor site morbidity beside well and defined bulkiness over the reconstructed spine.

Sarifakioglu and his colleagues **[15]** used the bilateral V-Y fasciocutaneous sliding flap to reconstruct large MMC defect. They have noticed that extensive dissection of the flap may result in a vascular compromise.

Ayad W et al., reconstructed the MMC defects by latissmus dorsi turn over flap and skin graft. They reported some complication as seroma, bulkiness and late cutaneous ulceration of the partial thickness skin graft **[16]**. Rios JL et al., reported complication of muscles harvest as: Seroma, friction of the wound layers and fat necrosis from the liberal use of electrocautry **[17]**.

Lacobucci et al., **[18]** described the anatomical basis and studied the faciocutaenous flap used for MMC reconstruction, they stated that good pedicle and limited dissection lead to good results.

Dufourmentel modified Limbrig flap technique in 1962 to close defects with any acute angle **[6]**. The Dufourmentel flap can be used to close a rhomboid with any acute angle from 60-90º; however, it is slightly more complicated to construct. With rhomboid defect angles of less than 60º, the Dufourmentel flap is narrower than a Limberg flap. This makes donor site closure much easier.

In this study, our flap design allows minimal acute angle of rotation, which make the transposition of each flap within a short distance easier. Also, extensive undermining is not required to preserve blood supply of the flap.

Conclusion:

Dufourmentel flap is a versatile technique for lumbosacral meningomyelocele reconstruction. With algorithmic planning, the armamentarium of MMC reconstruction could be expanded. This method is easy to use, had less tension lines and could be used from mild to major defects.

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