LUMBOSACRAL-DORSAL FIXATION WITH LUQUE’S RODS FOR CORRECTION OF CONGENITAL KYPHOSIS ASSOCIATED WITH MYELOMENINGOCELE

by

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Abstract
We describe our surgical procedure for correction of the kyphotic deformity in three children (3 – 8 years) with myelomeningocele. The patients have been followed for a minimum of one year.

Introduction
Lumbar kyphosis is a deformity affecting about 21 % of cases with myelomeningocele (MMC) [2]. It occurs mainly in patients with a high neurological lesion, generally affecting the lower thoracic spine [2,4,12]. The deformity compromises skin integrity with recurrent
infection [8,10], reduces the abdominal and respiratory capacity and produces lack of balance so [12,17] patients must use their arms as support in order to sit.

The deformity is progressive and evolves rapidly in children. The progression is faster when the curve is exceeds 90° [14]. When the child grows up, the deformity becomes aesthetically unacceptable with severe functional impairment [1,2,11].

In this report we describe our surgical procedure for correction of kyphosis in three patients (Table 1). The procedure includes vertebrectomy at the apex of the deformity, correction by means of Luque´s rods anchored in the vertebral bodies at the lumbosacral level with sublaminar wire to the sound thoracic spine (Fig 1).

**Fig. 1**

![Image of vertebral surgery](image)

*A: The vertebrectomy is indicated. B: Luque’s rods inserted towards the sacrum.*

*C & D: Final result with sublaminar wiring and postero-lateral grafting.*
Surgical technique

The patient is kept prone for a posterior approach. A straight incision is extended, in the middle line, independently of former wounds, from two levels caudal to the apex of the kyphosis and cephalically over 4 to 5 healthy thoracic levels. At the defect level of the neural tube, the spine is exposed subperiostally. The remaining dural sac is dissected as a pocket and set aside. At the apex level, dissection of the paravertebral muscles is carried out, being careful to protect the retroperitoneal structures. The disc closest to the apex is incised. Discectomy is completed taking care to completely release the bone from the cephalic and caudal discs in order to enable a proper bony union. The vertebral bodies and the transverse apophyses are totally resected. At this moment the spine is completely unstable.

Light stress is applied on the caudal part of the resected vertebral body, exposing the remaining body. Then, two 1/8 Luque´s rods (moulded into the thoracic curve, trimmed up to the desired dorsal level) are applied with a low speed drill and radiological control, not to penetrate the abdominal cavity. The insertion is carried out in the dorsal half of the vertebral body, paramedian, towards the sacrum and pointing to the midline. The rod is directed to the body of S1 or S2. Once the rods have reached the lumbosacral level, their cephalic ends are bent until they are L-shaped. Finally, they are fastened with sublaminar wires to 3 or 4 healthy thoracic vertebrae immediately cranial to the defect of the neural arch. Fastening of the rods corrects the kyphotic deformity with shortening at the apex level where a bone graft of the resected vertebral body is applied. The patient is closed as usual with special attention in the muscular plane.

Prophylactic antibiotic treatment is administered for 48 h after the procedure. Drain is removed within the first 24 h. Sitting is allowed during the first week. Corset is not required. The patients leave the hospital after one week.
**Case 1:**

Boy, age 8 years with MMC and rachischisis from T10 until sacrum. Complete neurological lesion from T11. Had ventricle-peritoneal derivation and correction of MMC eight days old. At 6 y.o he was intervened for sac rotation at the lumbar level, for cutaneous erosion associated with a progressive kyphosis of 134° with apex at L2-L3. Serious impairment of balance requiring support of his arms for sitting. At 7 y.o, a vertebrectomy of L3 was performed, which was plated from L2 to L4. Persisting 90° kyphosis and skin compromise. For that reason it was decided to remove the plates and apply lumbosacral fixation to the vertebral bodies from L4 to S2 with sublaminar wiring from T9 to T6. This resulted in a kyphosis of 28° with proper balance, attaining the independence of arms in sitting and healing of the skin. Post-operatively he had a neuroinfection, which was solved with antibiotics without sequels. After one year bony union was confirmed.

**Case 2:**

Boy, age 6 years with MMC and rachischisis from T9 to sacrum. Complete neurological level from T10. Had ventricle-peritoneal derivation system and closure of the defect at 5 months of age. At 3 y.o a lumbar spondylodesis for 80° kyphosis was performed. In spite of this the kyphosis progressed to 115° with apex at L2-L3. The child was operated with Thoraco-lumbosacral fixation and resection of the deformity resulting in 12° kyphosis and proper balance. During follow up the rods migrated posterior and were removed after one year with no consequence on the correction.

**Case 3:**

Girl, age 3 years 8 months with MMC and rachischisis from T9 to sacrum. Complete neurological lesion from T10. Surgical closure of MMC 9 days after birth. Admitted with 108° kyphosis with apex on L2 and serious balance problems with sitting. A vertebrectomy of
L2 was performed with rods anchoring from L3 to Sacrum and sublaminar wiring in T8 to T6. This resulted in a residual 21° kyphosis, proper spondylodesis after 6 months. At follow up after one year she was able to sit independently without support of her arms.

**Table 1**

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Initial angle</th>
<th>Extension/apex</th>
<th>Neurol. Level</th>
<th>Post-surgical angle</th>
<th>Resected vertebra</th>
<th>Complications</th>
<th>Surgical Time</th>
<th>Blood loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>134°</td>
<td>T10-L5, L2-L3</td>
<td>T11</td>
<td>28°</td>
<td>L2 &amp; L3</td>
<td>Meningitis</td>
<td>3.15 h</td>
<td>300 ml</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>115°</td>
<td>T9-S1, L2-L3</td>
<td>T10</td>
<td>12°</td>
<td>L2 &amp; L3</td>
<td>Dorsal migration of rods</td>
<td>3.50 h</td>
<td>180 ml</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>108°</td>
<td>T9-S1, L2</td>
<td>T10</td>
<td>21°</td>
<td>L2</td>
<td>None</td>
<td>3 h</td>
<td>320 ml</td>
</tr>
</tbody>
</table>

**Discussion**

A great variety of surgical procedures have been described for the problem of kyphosis in myelomeningocele. They all exhibit a high operative and postoperative morbidity. Luque-Galveston’s pelvic fixation [3,9,16] and Dunn’s lumbosacral stabilization [5] can effectively solve the problem, but are time-consuming, highly bleeding procedures. In addition, they produce a too rigid fixation that will arrest the child’s development. In 1995, Torode and Godette [17] described a dorsolumbar fixation with Luque´rods against the vertebral bodies of the lowest lumbar or first sacral vertebra. We here report our modifications of this procedure which advantageously reduce the surgical blood loss.

The main purpose is to maintain balance and improve skin cover [15], as well as abdominal and respiratory capacity. We believe that the system does not interfere with the development as there is no compression and the system basically avoids angular and translational instability. In addition, cephalic migration is not precluded.
Vascular studies have shown that the abdominal aorta does not participate in the kyphotic deformity [7,13,18]. The risk of vascular injury can be eliminated by careful dissection and by reducing distraction with vertebral shortening.

Existing renal-urethral malformations make routine investigation mandatory [6]. Up to date, complications after manipulation of the remaining dural sac have not been seen. Finally, we do not think a corset to be necessary, as the system stiffness will permit consolidation of the graft. In this way the skin lesion is not aggravated, easing the rehabilitation.

In 1996, Castens [2] reported 151 cases of kyphosis associated with myelomeningocele, corresponding to 21% of all cases of MMC studied in an 18 year period. This is one of the largest series. Nevertheless, reports on surgical treatment include a lower number of patients. We report a surgical procedure that eases the treatment of patients with kyphosis related to MMC. However, a greater number of cases are warranted in order to give more accurate figures on complications, effect on development and long term results. The protocol will therefore continue in order to collect more cases.

References


