**Original Article**

**Duration of horizontal decubitus after section of a tight filum terminale as a means to prevent cerebrospinal fluid leakage**

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**Abstract**

Object: The untethering of a tethered spinal cord by transecting a tight filum terminale is a relatively simple surgical procedure that can prevent or ameliorate neurological symptoms. Postoperatively patients are usually kept flat in order to prevent a cerebrospinal fluid (CSF) leak. However, the optimal period of maintaining patients flat has not been determined yet. The authors present their experience, compare with ones of previous reports, and try to determine the optimal period.

Methods: We retrospectively analyzed surgical results of pediatric patients with tethered spinal cord by a tight filum terminale. The patients’ charts were reviewed for demographic data, clinical presentation, surgical therapy, and clinical course.

Results: One hundred-sixty-one patients underwent sectioning of a tight filum terminale. They all were kept lying flat for 8 days. Magnetic resonance imaging (MRI) was performed 10 to 14 days after the surgery. None of the patients developed a CSF leak. Pseudomeningocele, which was confirmed by MRI, developed in one patient (0.6%). The occurrence rate of a CSF leak was significantly lower in our series than that of previous reports in which patients maintained flat less than 72 hours ($P = 0.0069$).

Conclusion: To keep patients flat for a longer time after transection of a tight filum terminale seems to lower the rate of CSF leakage and psuedomeningocele.

Key Words: Cerebrospinal fluid leakage, tight filum terminale, untethering

**INTRODUCTION**

The untethering of a tethered spinal cord by transecting a fatty filum terminale is a relatively simple surgical procedure that can prevent or ameliorate neurological symptoms. Complication rates are usually not high ranging from 0-13.2%.[1-8] A CSF leak, the pathologic flow of CSF outside the skin through a neoformed tract, can be a serious complication, to which meningitis can ensue. The occurrence rates of a CSF leak have been reported as 0-5.9%. In order to prevent a CSF leak, patients are usually kept lying flat postoperatively. However, the optimal duration has not been fully determined yet. We retrospectively analyze surgical results of pediatric patients with tethered spinal cord by a tight filum terminale treated with transection of a filum, describe complications, compare with the result of previous series, and try to determine the optimal period.
MATERIALS AND METHODS

We selected all patients operated on for the release of a tethered spinal cord by sectioning a tight filum terminale at the Division of Neurosurgery, National Centre for Child Health and Development, Tokyo over the period of May 2003 to October 2010. Preoperative magnetic resonance imaging (MRI) was performed in all the patients. Indication for surgical untethering was whether there were a low-lying conus (lower than the caudal edge of L2) or normal-positioned conus with neurological symptoms of tethered cord.

At the surgery we usually performed one level laminotomy at L4, or partial laminectomy of lower L3 and upper L4 in older patients. Dura was incised and a filum terminale was identified by its pale color and midline location. Surgical untethering was performed using a microscope in all cases. Neurophysiologic intra-operative monitoring was used. We monitored free running bulbo-cavernous reflex (BCR) and stimulated electromyography of the muscles of the lower extremities and external anal sphincter. We stimulated the filum and confirmed that no evoked electromyography was observed. The filum was coagulated by bipolar and sectioned. The samples of 5mm in length were sent for histological examination. The dura was closed primarily using 4-0 Neurolon with interlocking. Dural sealant was not used. The laminoplasty was performed using sutures after laminotomy or small bone particles were put back after laminectomy. The paraspinal muscles and the fascia were closed using 2-0 Surgilon. In addition, the fascia was sutured using 3-0 Surgilon, and 3-0 Prolene with “Figure of Eight” technique. The dermal layer was approximated using 4-0 or 3-0 PDS suture. The epidermal layer was sutured using 5-0 Ethilon. Postoperatively MRI was performed 10 to 14 days after the surgery. Patients were assessed periodically at outpatient visits.

A comprehensive literature search was also performed using PubMed database with key words such as “a filum terminale”, “a fatty filum”, and “a tight filum”. Case series consisting of detailed description of complications and duration of maintaining patients flat were included and the clinical outcome was analyzed.

The outcomes for the two groups were compared using the Chi-square test. A value of P < 0.05 was considered significant.

RESULTS

One hundred-sixty-one patients underwent sectioning of a tight filum terminale from May 2003 to October 2010. The median age at surgery was 29 months (range 3 to 226 months). There were 107 males and 54 females. Untethering was performed for symptoms, which included bladder dysfunction, constipation, leg/back pain, and gait disturbance, in 126 patients (78.3%), and for prophylaxis in 35 patients (21.7%). Thirty-nine patients (24.2%) with the conus within the normal level and neurological symptoms were operated. Preoperative MRI showed low-lying conus (lower than caudal edge of L2) in 122 patients (75.8%) and a fatty filum in 119 patients (73.9%).

No intra-operative complications were observed. Pathological examination demonstrated fat tissue within the filum in 120 patients (74.5%) and neural tissue in 8 patients (5%).

Postoperatively patients were kept lying flat in supine position for 8 days. The wound was carefully observed daily and cleaned with saline on the postoperative day 3. The dressings were kept at the wound until the sutures were removed on the postoperative day 8. MRI was performed 10 to 14 days after the surgery and patients were discharged home after that.

None of the patients experienced a CSF leak postoperatively. Postoperative MRI demonstrated pseudomeningoecele, a fluid collection outside the limits of the dura and within the soft tissues, in one patient (0.6%). No patients developed wound infection. The mean follow-up period was 33.4 months (range 7 to 92 months). One patient (0.6%) experienced retethering of the filum. The overall complication rate was 1.2%.

A PubMed search of the literature with our criteria yielded 2 case series of a tight or fatty filum terminale undergoing untethering with detailed description of complications and duration of keeping patients flat.[1,2] The patients were maintained lying flat for 24-72 hours in these reports. The overall rate of CSF leakage was 4.6% (13/282). The overall rate of combined CSF leakage and pseudomeningoecele was 7.8% (22/282). The rate of CSF leakage, and that of combined CSF leakage and pseudomeningoecele were significantly lower in our series than in previously reports (P = 0.0069, 0.0017, respectively).

DISCUSSION

The untethering of a tethered spinal cord by transecting a fatty filum terminale is a relatively straightforward procedure that can prevent or ameliorate neurological symptoms. Recently surgical untethering of a tight filum for prophylaxis has also been advocated and performed.[1-4] The low complication rate is necessary as there is an ongoing debate of prophylactic surgeries including those of the occult variant of tethered cord (i.e. when the conus is above the lower endplate of L2).

CSF leakage can be a serious complication of untethering, to which meningitis potentially ensue. In order to prevent a CSF leak, patients are usually kept lying flat postoperatively. Duration of keeping flat ranged from 24
to 72 hours in previous reports.\textsuperscript{[1,7]} The mean occurrence rate of CSF leakage was 4.6% from these studies. In our series the rate of CSF leakage was 0% (0/161) and the rate of combined pseudomeningocele formation and CSF leakage was 0.6% (1/161), which were significantly lower than in previous reports ($P = 0.0069, 0.0017$, respectively). In another report, the complication rate was rather low.\textsuperscript{[4]} The rate of a CSF leak and a pseudomeningocele was 0% (0/318) and 0.6% (2/318), respectively. We did not include the article for the comparison as it did not address the duration of keeping patients flat. The rate of pseudomeningocele in previous reports may be underestimated as postoperative MRI is usually not taken routinely and relatively small pseudomeningoceles may not be addressed. In our series postoperative MRI was performed in all patients. Therefore, the differences between the rate of pseudomeningocele in our series and previous reports could be even larger.

The low complication rate of CSF leakage and pseudomeningocele in our series can be due to longer duration of keeping patients flat (8 days). The other factor that may contribute to the low complication rate is the way the fascia is closed. As the fascia is considered to be important for prevention of CSF leakage, we used 3 kinds of suture to close it tight. At first, we closed the paraspinal muscles and the fascia together using 2-0 Surgilon, then closed the fascia using 3-0 Surgilon between the sutures of 2-0 Surgilon, and finally added the sutures to the fascia using 3-0 Prolene with “Figure-of-Eight” technique. In addition, after dural closure we put Surgicel, an absorbable hemostat made of oxidized regenerated cellulose, onto the dura. The laminoplasty was performed using sutures after laminotomy or small bone particles were put back onto the Surgicel after laminectomy. This also may contribute to prevent CSF leakage compared to simple laminectomy. We did not use any dural sealants, subcutaneous drains, dermal adhesives, or pressure dressings. They do not seem necessary for prevention of CSF leakage in this untethering procedure.

Although there is a limitation in this study, as potential confounding factors such as the use of dural sealant, the way of dural and fascial closure, and whether laminoplasty or simple laminectomy was performed, were not analyzed due to limited information in previous reports, maintaining patients flat for longer than 72 hours postoperatively seems to lower the rate of CSF leakage. The optimal period, which could be between 72 hours and 8 days, remains to be determined by further studies.

Medico-legal and socio-economic restraints are an obstacle to prolonged hospitalizations in many countries. Maintaining the patients flat in bed after the hospital discharge, in the comfort of their homes could be a practical way to effectively implement our suggested postoperative policy.

**CONCLUSIONS**

To keep patients flat for a longer time after transection of a tight filum terminale seems to lower the rate of CSF leakage and pseudomeningocele.

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