Surgical Management for Non-Traumatic Syringomyelia using Syringo-Subarachnoid Shunt “T-Tube”: An Experience of 6 Cases

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Introduction

The natural history of syringomyelia is highly variable. In some cases, patients do improve or stabilize without surgery, while others deteriorate even with aggressive interventions. Various surgical procedures for the treatment of syringomyelia have been introduced, including posterior fossa decompression, syringostomy, syringoperitoneal shunting. But even though satisfactory results have been reported for most of these procedures, some authors have been critical of these techniques. Through this paper, we will try to make our contribution by reporting the results we have got after surgical management of 6 patients operated for syringomyelia by syringo-subarachnoid shunt using T-Tube.

Methods

Patients

The mean age of our patients was 55.4 years. Etiologies of our patients' syringomyelia are various: only one patient had post traumatic syringomyelia (6 years after trauma). One has an idiopathic intra medullar cyst; the four others were previously surgically managed: 3 for decompression of cervico-occipital hinge, and one for an intradural meningioma (Table 1). All patients had motor dysfunction, 4 had sensory disorders, and 3 had sexual or genital disturbances. About radiologic localizations of the syrinx, 4 patients had an intramedullar cavitation extending through cervical and dorsal medulla (Figure 1). 1 patient had bulbomedullary syringomyelia (Figure 2), and 1 had an intramedullary cyst localized in front of T1-T2 (Figure 3).
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Table 1:

|   | Sex | Age | Medical Background | Motor Deficit | Sensitive Deficit | Localization of the Syrinx | Postoperative Course |
|---|-----|-----|--------------------|---------------|-------------------|--------------------------|---------------------|
| 1 | M   | 51  | None               | Paraparesis   | Yes               | Intramedullar cyst at the level of T1 and T2 | Improvement of the motor deficit and sexual disorders |
| 2 | M   | 41  | Operated for chiari malformation type I (decompression of the cervicooccpital hinge), Reoperated after 4 months due to the onset of a hydrocephalus (ventriculo-peritoneal shunt) | Heaviness in the lower limbs (6 years after the first surgery) | None | From C2 to T8 | Improvement of the motor deficit, transitory deep sensibility trouble |
| 3 | F   | 44  | Operated for chiari malformation type I (decompression of the cervicooccpital hinge), partial improvement during the first 5 years followed by worsening of the paraparesis with onset of right brachial neuralgia | Brachial neuralgia, anesthesia of the upper limbs, worsening of the paraparesis, and distal amyotrophia | None | Bulbomedullar junction arachnoiditis | Total regression of the brachia neuralgia and improvement of the motricity of the 4 limbs |
| 4 | M   | 43  | Operated for chiari malformation type I associated to a syringomyelia extending from C1 to T1 | Worsening of the paraparesis 3 years after the first surgery | None | From C1 to T1 | Stable |
| 5 | M   | 55  | Cervical traumatism responsible for complete tetraplegia and genital disturbance. Partial improvement of the deficit after reeducation. 4 years later: worsening of the brachial deficit associated to respiratory deficiency. Operated for the implementation of syringopleural shunt | No improvement 6 years after the first shunt | Yes | From C6 to T2 | No motor improvement, improvement of the respiratory deficiency |
| 6 | F   | 43  | Operated for a dorsal meningioma (at the level of T3 and T4). 24 years later: recurrence of the tumor extending from T3 to T4, she was reoperated with complete exeresis of the tumor. Regained the ability to walk but kept a sequellar spastic paraparesis | 4 years after the first surgery: worsening of the motor deficit of the two lower limbs associated to thermoalgesic hypoesthesis (level T10) | Yes | From C2 to T8 | Improvement of both motor and sensitive deficits |

Surgical technique

The used technique for all our patients was a syringo-subarachnoid shunt made through the implementation of a t-tube. Positioning was strict ventral. We proceed to a laminectomy followed by a durotomy in front of the widest portion of the intramedullary cavitation. The arachnoid is opened by making flecks, through which we carefully introduce the tip of the catheter at the level of the dorsal groove until the extraction of CSF out from the syrinx. Finally, the two arms of the T-catheter are attached to the arachnoid.

Follow up

Only one patient had transitory disturbances of the proprioceptive sensitivity, followed by a recover of the same anterior neurologic status. Two patients presented neither deterioration nor amelioration of motor or sensitive functions. The 3 other patients improved their preoperative status. This improvement concerned at most sensitive features. All our patients had postoperative MRI 6 months after surgery. This control imaging showed a radiologic improvement defined by a reduction of the size of the syrinx, found in 4 patients (Figure 4).

Discussion

Syringomyelia is a known to be a disorder in which a cyst or cavitations are formed within the spinal cord. This abnormality called a syrinx can expand and elongate over time, destroying the spinal cord [1]. Syringomyelia is associated with numerous different pathologies, including spinal trauma, craniocephal anomalies mainly chiari malformations, meningitis, spinal tumor [2]. The pathogenesis of syringomyelia is still a subject...
of controversies. The most commonly accepted theory is that the spinal cord’s cavitation occurs when CSF is forced to get through the fourth ventricle into the central canal. This may be the consequence of either a caudally directed pulse wave, or a pressure gradient at the level of the foramen magnum [3]. Physiopathological theories has conditioned therapeutic approaches for syringomyelia and led to the development of several operative procedures depending on its supposed etiology and pathogenesis [4]. Posterior fossa decompression [5], syringoperitoneal shunt [6], syringopleural shunt [7], myelotomy coupled with lumbo-peritoneal shunt [8], syringo-subarachnoid shunt [9], and several other techniques, have all been described with varying success.

Several ancient reports have been considering that the results of syringo-subarachnoid shunt as disappointing. Among their arguments to explain this failure were discussed the difficulty of manipulation of the T-tube with a high risk of medullar lesion [6,10], and the frequency of shunt obstruction as a result of the collapse of the syrinx cavity around the shunt tip [4,11]. This failure was mainly discussed in post-traumatic syringomyelia, where spinal injury produces numerous abnormalities, such as arachnoid adhesions, spinal deformity or stenosis in addition to the syrinx, limiting the efficiency of any shunting procedure [12].

The new surgical techniques of implantation of T-Tube have managed to break out with the anterior shortages [6,10]. In our new shunting procedure, we inserted just one arm of the T-tube into the syrinx cavity and located the other arm outside the cord, in the sub-arachnoid space. Thus, we can protect the cord from tube rotation, but also have the possibility to easily remove the tube when necessary, without prejudice on the cord. Also, we could easily anchor the tube to the dura, and thus prevent migration resulting in shunt malfunction.

According to several authors [13], the most important factor in the occlusion of the shunt system is the development of arachnoitis and adhesions of the arachnoid around tip of the shunt tubing. Anatomically [9], the dorsal and ventral spinal subarachnoid spaces are different. Many trabeculae exist between the two subarachnoid spaces. Spinal deformity or stenosis in addition to the syrinx, limiting the efficiency of any shunting procedure [12].

The results of our series support the reports claiming the interest of T-Tube shunt technique. Clinically, 50% of the cases of our series improved their preoperative status, and 50% kept the same signs without postoperative worsening. 66% had radiological improvement with regression of the syrinx; the others had the same preoperative aspects with no worsening.

We do think that with further technical refinement, we could reach better clinical and radiological results.

**Conclusion**

According to our good results, this new technique seems to be promising in the treatment of non-traumatic syringomyelia. For post-traumatic syringomyelia, an associated broad release of subarachnoid spaces is required. The study of a larger series is necessary in order to a better evaluation of the effectiveness of this technique.

**References**

1. Milhorat T, Capocelli A, Anzil A, Kotzen R, Milhorat R (1995) Pathological basis of spinal cord cavitation in syringomyelia: analysis of 105 autopsy cases. J Neurosurg 82(5): 802-812.
2. Badri M, Gader G, Bahri K, Zamel I (2017) Cervicothoracic syringomyelia caused by cervical spinal stenosis: Case report and literature review. Surg Neurol Int 8(1): 288.
3. Elliott NS, Bertram CD, Martin BA, Brodbelt AR (2013) Syringomyelia: A review of the biomechanics. J Fluids Struct 40: 1-24.
4. Batzdorf U, Klekamp J, Johnson JP (1998) A critical appraisal of syrinx cavity shunting procedures. J Neurosurg 89(3): 382-388.
5. Akakon A, Yilmaz B, Ekşi MŞ, Köç T (2015) Treatment of Syringomyelia due to Chiari Type I Malformation with Syrigo-Subarachnoid-Peri toneal Shunt. J Korean Neurosurg Soc 57(4): 311-313.
6. Barbaro NM, Wilson CB, Gutin PH, Edwards MS (1984) Surgical treatment of syringomyelia: Favorable results with syringoperitoneal shunting. J Neurosurg 61(3): 531-538.
7. Williams B, Page N (1987) Surgical treatment of syringomyelia with syringopleural shunting. Br J Neurosurg 1(1): 63-68.
8. Park TS, Cail WS, Broadus WC, Walker MG (1989) Lumbo-peritoneal shunt combined with myelotomy for treatment of syringohydromyelia. J Neurosurg 70(5): 721-727.
9. Colak A, boran BO, Kutlay M, Demirican N (2005) A modified technique for syringo-subarachnoid shunt for treatment of syringomyelia. J Clin Neurosci 12(6): 677-679.
10. Lund-Johansen M, Wester K (1997) Syringomyelia treated with a nonvalved syringoperitoneal shunt: a follow-up study. Neurosurgery 41(4): 858-864.
11. Aghakhani N, Baussart B, David P, Lacroix C, Benoudiba F, et al. (2010) Surgical treatment of posttraumatic syringomyelia. Neurosurgery 66(6): 1120-1127.
12. Lee J, Alameda GJ, Camilo E, Green BA (2001) Surgical treatment of post-traumatic myelopathy associated with syringomyelia. Spine (Phila Pa 1976) 26(24 Suppl): 119-127.
13. Iwasaki Y, Koyanagi I, Hida K, Abe H (1999) Syringo-subarachnoid shunt for syringomyelia using partial hemilaminectomy. Br J Neurosurg 13(1): 41-45.
