

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



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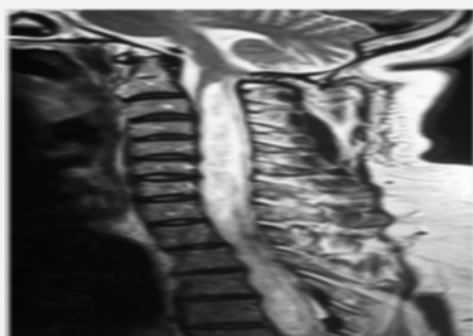
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## Introduction

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

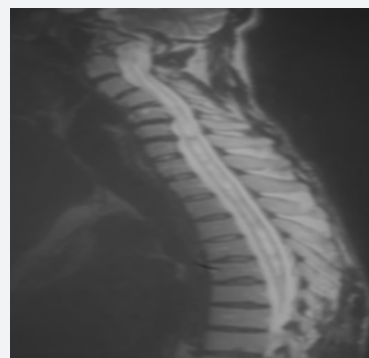
### Patients



**Figure 1:** Intramedullar cavitation extending through cervical and dorsal medulla.

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).



**Figure 2:** Bulbomedullary syringomyelia.



**Figure 3:** Intramedullary cyst localized in front of T1-T2.

Table 1:

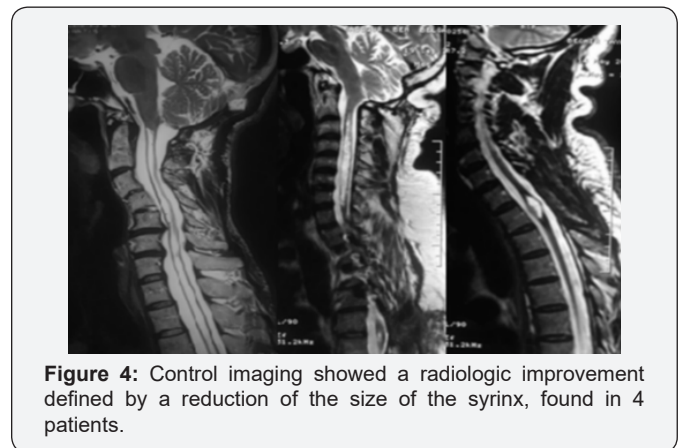
	Sex	Age	Medical Background	Motor Deficit	Sensitive Deficit	Localization of the Syrinx	Postoperative Course
1	M	51	None	Paraparesis	Yes	Intramedullar cyst at the level of T1 and T2	Improvement of the motor deficit and sexual disorders
2	M	41	Operated for chiari malformation type I (decompression of the cervicooccipital hinge), Reoperated after 4 months due to the onset of a hydrocephalus (ventriculoperitoneal 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 cervicooccipital 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 T11	Worsening of the paraparesis 3 years after the first surgery	None	From C1 to T11	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 T12	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 hypoesthesia (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). Two patients had almost the same radiologic lesions as found on preoperative MRI.



**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, craniocervical 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 lumboperitoneal 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 subarachnoid 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 arachnoiditis 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 pia mater of the dorsal cord surface and the dorsal arachnoid membrane; however, there are no arachnoid trabeculae on the ventral surface. Using the standard technique for syringo-subarachnoid shunting, the dorsal subarachnoid space is the usual site for distal catheter placement and the anatomy of this space may contribute to delayed shunt malfunction. In the modified technique described here, the shunt is inserted into the syrinx at the dorsal root entry zone and the distal tip is inserted into the anterolateral subarachnoid space.

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, Zammel I (2017) Cervicothoracic syringomyelia caused by cervical spinal stenosis: Case report and literature review. *Surg Neurol Int* 8(1): 288.
3. Elliott NSJ, 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. Akakin A, Yilmaz B, Ekşi MŞ, Kılıç T (2015) Treatment of Syringomyelia due to Chiari Type I Malformation with Syringo-Subarachnoid-Peritoneal 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): 63-80.
8. Park TS, Cail WS, Broaddus WC, Walker MG (1989) Lumboperitoneal shunt combined with myelotomy for treatment of syringohydromyelia. *J Neurosurg* 70(5): 721-727.
9. Colak A, Boran BO, Kutlay M, Demircan 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 TT, 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.



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