

# Management of CSF leak following spinal surgery

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## Abstract

**Purpose** Postoperative CSF leak is a known complication of spinal surgery especially after surgery for neural tube defects (NTD). The problem can metamorphose into a severe infection. This article hopes to shed some light on the management of these problems and suggests precautions so as to reduce their occurrence.

**Materials and methods** A retrospective analysis of 102 children, between the ages of 1 day and 12 years, operated for various spinal pathologies, over the past 2.5 years by the same surgeon (CB) was done. The various methods of dural closure were noted. The methods of management of postoperative CSF leaks were analysed, and the patients were followed till discharge.

**Results** The incidence of CSF leak was found to be 12.7 %. The methods of management included lumbar drain only ( $n=7$ ), lumbar drain with re-exploration ( $n=3$ ), lumbar drain followed by lumboperitoneal shunt ( $n=2$ ) and only lumboperitoneal shunt ( $n=1$ ). The use of fibrin glue did not seem to significantly prevent the incidence of CSF leak in cases.

**Conclusions** Primary and meticulous dural closure is sine qua non in preventing postoperative CSF leak. A lumbar drain is a convenient and economical method of managing the problem initially failing which more invasive methods like re-exploration may be employed.

**Keywords** CSF leak · Primary dural closure · Dural graft · Lumbar drain

## Introduction

Postoperative cerebrospinal fluid (CSF) fistulae are a well-known complication of spinal surgery especially after surgery for neural tube defects since the full dural cover for the placode may be deficient. In many cases, tension-free closure of the dura necessitates the need for a dural graft. No CSF leak is too trivial to be ignored. CSF leaks, though may appear trivial can progress to meningitis and its sequelae. Hence, it is essential to look out for it, detect and treat it early. The availability of dural closure augmenting agents does not lessen the importance of meticulous surgical technique employed in dural closure. We present our experience in the management of spinal postoperative CSF leaks.

## Materials and methods

A retrospective analysis of case records was undertaken including all children operated for spinal pathologies over the past 2.5 years by the same surgeon at the same hospital. The data obtained were described in the following paragraph. The total number of children was 102 ( $n=102$ ).

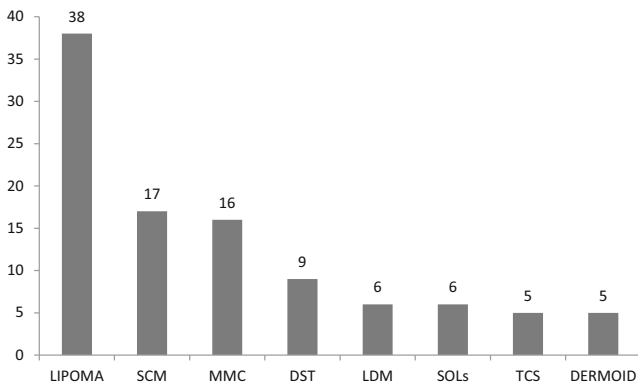
The age range was between 1 day to 12 years. The number of male children was 49 and the number of females was 53. The age distribution was as follows: neonates ( $n=13$ ), infants ( $n=44$ ), children up to the age of 6 years ( $n=7$ ) and children greater than 6 years ( $n=16$ ).

The pathologies were myriad in character and their numbers were as indicated in Fig. 1

## Technique

Dural closure was done in all cases with 5–0 or 6–0 vicryl (polyglactin 910) in a continuous fashion with two bites for

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**Fig. 1** The incidence of various pathologies. *SCM* split cord malformation, *MMC* myelomeningocele; *DST* dermal sinus tract, *LDM* limited dorsal myeloschisis, *SOL* tumours, *TCS* tethered cord syndrome

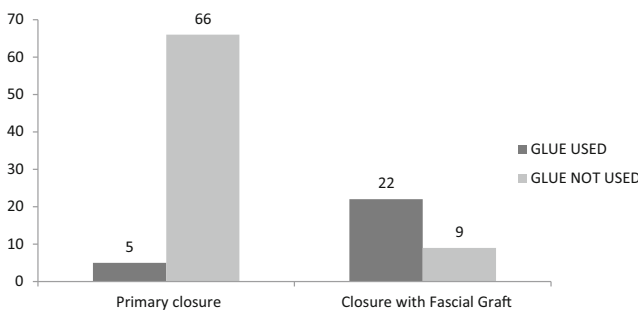
every millimetre. The dural cavity was filled with saline before the final stitch and a Valsalva manoeuvre was done subsequent to this to check for any possible CSF leak. If primary closure was not feasible, an autologous lumbar fascial graft was harvested and used to make good the dural defect. In cases where reinforcement was needed, fibrin glue was employed. The need for reinforcement was left to the discretion of the operating surgeon. The wound was closed in layers with vicryl and any dead space was obliterated. The wound edges were trimmed of excess adipose tissue and skin closure was with 4–0 absorbable sutures. The patients were nursed with no restriction on movement/position in the postoperative period and were discharged by the third postoperative day unless problems occurred.

The methods used for closure are given in Fig. 2

**Results**

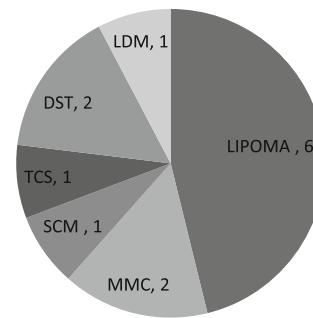
The number of children who developed postoperative CSF leak was 13. The incidence of CSF leak was therefore was 12.7 %. The diagnoses of the cases with CSF leak are plotted in Fig. 3.

The leaks occurred between the first and the eighth postoperative days; their frequency of distribution is presented in Table 1:



**Fig. 2** Methods of closure

**DIAGNOSES IN CASES OF CSF LEAK**



**Fig. 3** Diagnoses in cases with CSF leak

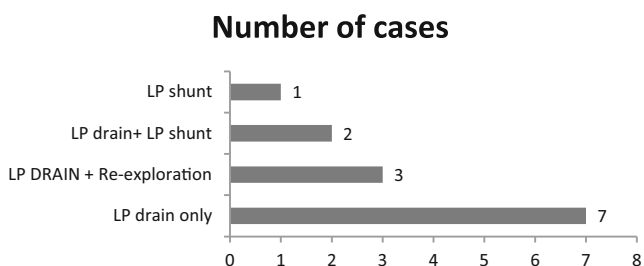
Once the CSF leak was detected, the patient was managed with a lumbar drain as the initial step (Fig. 4). In only one case where the patient had a pseudomeningocele, it was decided to directly place a lumboperitoneal shunt in the child. In all those in whom a graft was used, the closure was reinforced with fibrin glue.

*The technique of placement of a lumbar drain* The procedure was done under GA in the OR using an epidural anaesthesia catheter set. The lumbar puncture was done a few millimeters away from the incision preferably one or two levels above and the catheter threaded through the needle and the needle withdrawn. The same needle is used to puncture the skin a short distance away for the LP site. The needle is tunneled from the distal site to the LP site and brought out through the LP site. The catheter is then threaded and brought out several centimetres away from the LP site and then connected to an external drainage system and managed akin to an external ventricular drain. The catheter is taped to the skin. (Fig. 5a–e). The patient is placed under an empirical cover of antibiotics. The lumbar drain is kept open till the drainage is minimal or stops, which usually happens by around the eighth day after insertion of the drain. We found that in most cases ( $n=7$ ), the leak subsided gradually. Two cases required a lumboperitoneal shunt due to persistence of CSF leak even after 10 days. In three cases of persistent leak, it was decided to re-explore the wound.

Interestingly, in the data analysed, it was observed that the use of fibrin glue was not a deterrent to the occurrence of CSF leak; though the numbers were statistically too small for comment (Fig. 6). One child developed an infection attributable to the leak. Three developed a pseudomeningocele which subsided without any specific therapy.

**Table 1** Occurrence of CSF leak

Postoperative days	1	2	3	4	5	6	7	8
No. of cases of leak	2	3	2	NIL	NIL	3	2	1

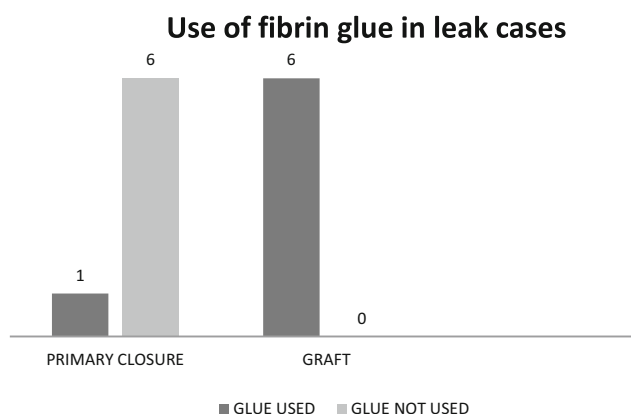


**Fig. 4** Management of cases with CSF leak

The follow-up data was available for an average period of 3 months in all cases of CSF leak.

**Discussion**

Postoperative CSF leak following spinal surgery is a well-known complication especially after surgery for neural tube defect where dural grafts may be needed. The incidence of postoperative CSF leak in other series ranges from none [7] to 11 % [4]. Another study with a comparable number of patients had an incidence of 4.6 % [18] whilst Chern et al. [3] reported an incidence of 5.9 % out of a large sample of 222 patients.

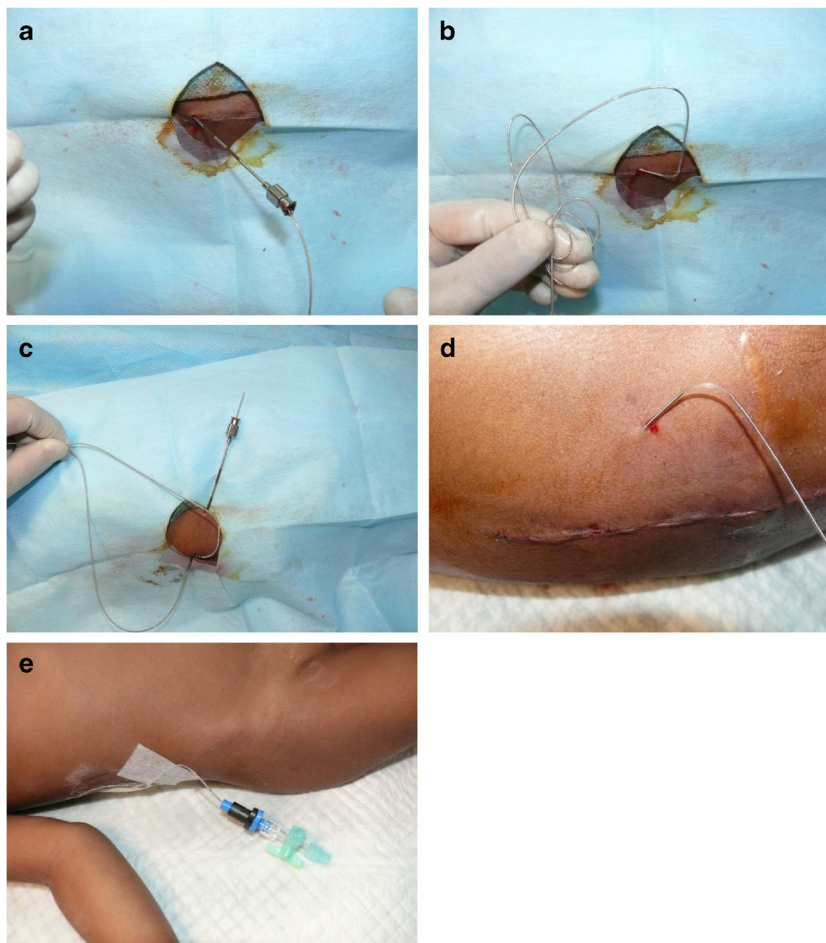


**Fig. 6** Use of fibrin glue

Pseudomeningocoeles occurred in 4.1 %, which when summed give an incidence of 10 %. Our incidence was 12.7 % and was comparable to this last series.

The ideal material to be used in dural closure is still a matter of debate. The use of vicryl to close dura is supported by an animal study reported by Vallfors et al. [16], wherein the use of absorbable sutures was associated with a decrease in subdural adhesions. Numerous alternatives are available to close

**Fig. 5** a LP done away from incision and catheter threaded. b Needle withdrawn. c Needle tunneled and catheter threaded. d Needle withdrawn. e Catheter connected to drainage system



**Table 2** Incidence of CSF leak in various studies

Study	Incidence of CSF leak
Kaufman et al. [7] ( <i>n</i> =26)	None
Wang B et al. [18] ( <i>n</i> =87)	4.6 %
Ostling et al. [13] ( <i>n</i> =100)	5 %
Chern et al. [3] ( <i>n</i> =222)	10 % (pseudomeningocele and CSF leak)
Della Puppa et al. [4]	11 %
Chidambaram et al. (2012) ( <i>n</i> =102)*	12.7 %

\*Represents the current series

the dura such as prolene, aneurysm clips [1] Silastic duraplasty [2] skin sealants such as collodion, fibrin glue, Tissucol, 2-otocynoacrylate, Histoacryl blue [15], nonpenetrating titanium clips [7], autologous fibrin tissue [10], vicryl mesh [17], TissuePatch absorbable dural sealant [4] and also the PEG sealant system [6].

Layered closure of the wound is done by us with vicryl, though there have been studies wherein an additional layer of vascularized tissue between the skin and the spinal cord has been recommended to lessen the incidence of CSF leak and other complications especially after surgery for NTDs [8]. We do not advocate nursing in any specific position after spinal surgery though studies have been reported claiming a decreased incidence of CSF leak after prolonged nursing in the horizontal decubitus position [3, 11]. These studies report an incidence of CSF leak quite similar to ours (Table 2).

The use of a lumbar drain in the management of spinal CSF leak has been reported earlier [5]. The procedure was effectively employed to deal with postoperative CSF fistula in two cases operated on earlier for lipomeningomyelocele. It has also been reported earlier in cases of cranial CSF leak [14]. The basic principle was to regulate the flow of CSF through the fistula and facilitate healing.

It was observed in our study that the use of dural sealants (in our case fibrin glue) did not deter the occurrence of CSF leak. The fibrin glue was used in an ad hoc manner so our data are not statistically significant. This, however, has been noticed in large studies [12] which were however designed for cranial CSF leak cases. Most cases of CSF leak occurred early in our experience, and we have not had to re-explore any leak case in the recent past.

Several techniques can be adopted to minimize the incidence of the leak. Primary dural closure is perhaps the best. If a graft is to be used proper closure of the graft is mandatory, i.e. the sutures have to be tight enough to prevent but snug enough to prevent leak. The closure of the muscle and fascia lent strength to the wound, but if these entail a significant dissection and blood loss these can be skipped. If primary wound closure is impossible, a flap can be rotated to close the wound. This flap is best if it is a vascularized myocutaneous flap. Sometimes the placement of a drain prophylactically may be needed. In Liu et al.'s study, the majority developed a pseudomeningocele as

opposed to overt leaks unlike in our series [9]. And as in our series, the majority of the pseudomeningoceles did not need any specific treatment. And as in our series, the use of fibrin glue did not make any difference.

## Conclusion

Postoperative CSF leak is a major complication. A poor dural closure technique always heralds trouble. The need for a primary, meticulous closure of the dura is mandatory in all cases, failing which horrendous sequelae can ensue. Lumbar drainage is very useful and in most cases is all that is required to treat the leak. We do not advocate re-exploration routinely as suturing the wet dura is not easy and the leak may persist. The technique we have adopted is safe, simple and inexpensive.

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