

A Retrospective Cohort Study Assessing the Cerebrospinal Fluid Leak in Posterior Fossa Surgeries with Different Dural Closure Methods

Vir Abhimanyu Pandit¹, Shashank Abhishek², Chandra Kant Diwakar³, Debish Aanand⁴

¹Associate Professor, Department of General Surgery, , Narayan Medical College and Hospital, Jamuhar, Sasaram, Bihar, India

²Associate Professor, Department of Urology, Narayan Medical College and Hospital, Jamuhar, Sasaram, Bihar, India

³Associate Professor, Department of Otorhinolaryngology, Narayan Medical College and Hospital, Jamuhar, Sasaram, Bihar, India

⁴Assistant Professor , Department of General Surgery, , Narayan Medical College and Hospital, Jamuhar, Sasaram, Bihar, India

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Corresponding author: Dr. Vir Abhimanyu Pandit

Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to evaluate the occurrence of cerebrospinal fluid leak in posterior fossa surgeries where different dural closure materials are used.

Material & Methods: A retrospective cohort study, conducted in the Department of General Surgery, All the cases underwent posterior fossa surgeries during the period of 2 years in the department of Neurosurgery was included in the study. Consent was obtained from all patients and data collected retrospectively from medical records.

Results: There was no significant difference in gender. The total patient population consisted of 20 men (40%) and 30 women (60%). The etiology of craniotomy had equal distribution as well, with a total of 38 (76%) tumors, 8 (16%) cysts, 2 (4%) chiari malformations, 1 (2%) decompressions, and 1 (2%) inflammations. The incisional CSF leak within 30 days was noted in 10 patients. Non-incisional CSF leak was noted in 16 patients.

Conclusion: The study concluded that, in cases of posterior fossa surgeries, closure with pericranium has a significant protection against CSF leak.

Keywords: Cerebrospinal fluid leak, Posterior fossa surgeries, Dural closure methods

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Introduction

Cerebrospinal fluid (CSF) leak remains a significant source of morbidity in neurosurgery, particularly after posterior fossa surgery. [1] CSF leakage is associated with substantial morbidity and increased healthcare costs. [2] It is six times more likely to occur in the infratentorial procedures than in the supratentorial procedures. [3] The incidence in posterior fossa surgery can be as high as 17%. [1] CSF leakage poses a risk of significant morbidity and remains potentially life-threatening due to the risk of meningitis. [1,4,5] CSF leakage may lead to the development of a pseudomeningocele (PMC), wound healing problems requiring surgical re-closure, surgical site infection, meningitis, and pneumocephalus.

Posterior fossa craniotomies can be complicated by cerebrospinal fluid (CSF) leak, infection,

meningitis, neurologic deficits, and intracranial hypotension, which may be caused by defective closure of the dura. The standard method of dural closure involves the use of interrupted and/or running suture to appose the edges of the dura together to create a watertight seal. In addition, if a dural defect is noted with too much tension required for apposition of the dura, secondary dural closure with the use of pericranium, muscle, glue, sealants, or fat graft has been performed to augment the closure.

In addition, biologic and synthetic compounds such as fibrin glue or polyethylene glycol (PEG) sealants can be used. [6] Treatment of postoperative CSF leak following posterior fossa surgery remains a difficult and perplexing problem. [7] Treatment options include either to start with conservative

measures including re-suturing of the wound and to opt for CSF lumbar drainage in case the CSF leakage doesn't stop, [8,9] or to institute CSF lumbar drainage simultaneously with the conservative measures as the initial intervention. [10]

Dural closure occurs by re approximation of the dural edges with suture or by inserting a graft material between the dural defect. CSF leakage is a latent risk of cranial surgery with dural opening. Numerous techniques and materials have been described for dural closure. Most techniques utilize autologous tissue grafts of fat, muscle or pericranium, with or without the use of postoperative lumbar CSF drainage. Various adhesive substances for duraplasty are currently in use, including collagen matrix and fibrin glue. However, dural closure with synthetic grafts has been suggested to contribute to the occurrence of infection and CSF leak. [11] According to the literature, CSF leaks vary from 4% in transsphenoidal procedures to 32% in posterior fossa procedures. [12]

Hence the purpose of the study was to compare the occurrence of CSF leak in posterior fossa surgeries where different dural closure materials are used.

Material & Methods

A retrospective cohort study, conducted in the Department of General Surgery, Narayan Medical college and Hospital, Jamuhar, Sasaram, Bihar, India. All the cases underwent posterior fossa

surgeries during the period of 2 years in the department of Neurosurgery was included in the study. Consent was obtained from all patients and data collected retrospectively from medical records.

Methodology

Demographic data, co morbidities, type of surgery done, duration of surgery, pre operative CSF diversion, Material used for the duroplasty, usage of tissue glue and presence of CSF leak were documented. CSF leak is defined as the leaking of cerebrospinal fluid into the extradural space expressed as fluid coming through the surgical wound or development of pseudo-meningocele.

A total of 50 cases of posterior fossa surgery cases during this study period were included in this study. Cases without the required data in the records and those who were not willing to participate in the study were excluded from the study.

Statistical Analysis

Statistical analysis was done using SPSS software. Mean±S.D was used for age, time of interventions and meningitis settled. Chisquare test was applied for comparison of types of interventions and leakage stopped / meningitis settled. Level of significance determined by calculating p value (<0.05).

Results

Table 1: Demographics

	N=50	p-Value
Sex, n (%)		0.446
Male	20 (40%)	
Female	30 (60%)	
Etiology of craniotomy, n (%)		0.314
Tumor	38 (76%)	
Cyst	8 (16%)	
Chiari malformations	2 (4%)	
Decompression	1 (2%)	
Inflammation	1 (2%)	
Type of posterior fossa craniotomy		0.074
Retro sigmoid	20 (40%)	
Suboccipital	26 (52%)	
Other	4 (8%)	
History of diabetes, n (%)	3 (6%)	0.734
Current smoking, n (%)	4 (8%)	0.172
Former smoking, n (%)	5 (10%)	0.798
Intraoperative CSF diversion, n (%)	20 (40%)	<0.001
Lumbar drain	7	
Lumbar puncture	7	
External ventricular drain	6	
Postoperative CSF diversion (LSAD/EVD), n (%)	13 (26%)	0.022
Intraoperative abdominal fat grafting procedure, n (%)	8 (16%)	<0.001
Prior surgery, n (%)	5 (10%)	0.612

There was no significant difference in gender. The total patient population consisted of 20 men (40%) and 30 women (60%). The etiology of craniotomy had equal distribution as well, with a total of 38 (76%) tumors, 8 (16%) cysts, 2 (4%) chiari malformations, 1 (2%) decompressions, and 1 (2%) inflammations.

Table 2: Outcomes

	All (n=122)	p-value
Incisional CSF leak within 30 days, n (%)	10 (5%)	0.183
Non-incisional CSF leak (otorrhea, rhinorrhea) within 30 days, n (%)	16 (8%)	0.205
Pseudomeningocele within 30 days, n (%)	7 (14%)	0.663
Postoperative abdominal fat graft wound infection (requiring wound revision and readmission)	2 (1%)	0.161

The incisional CSF leak within 30 days was noted in 10 patients. Non-incisional CSF leak was noted in 16 patients.

Discussion

Development of surgical techniques of posterior cranial fossa disorders, in terms of historical events, is very recent. In looking back at the historical literature, surgeons since the time of antiquity avoided any kind of surgical intervention within the posterior fossa as this region of the brain is extremely sensitive to any type of manipulation. CSF leaks are the most common surgical complication in the posterior fossa which can be minimized with watertight dural closure. [13] CSF leaks are the most common surgical complication in the posterior fossa. [13] They can be minimized with watertight dural closure. Dural closure can be done either with native available dura and if not available with different dural substitutes. Dural closure is found to be best when using native dura. [14] A suturable bovine matrix dural substitute was associated with a 50% risk of complications, such as CSF leak, aseptic meningitis, hydrocephalus, and symptomatic pseudomeningocele, compared to 18% of cases where no dural substitute was used. Azienda Ospedaliero et al [15] concluded that duraplasty with autologous pericranium and standardized closure of soft tissues seem promising in reducing the CSF-related complications during Chiari surgery.

In a study conducted by Abuzayed Bet al [16], in department of Neurosurgery, Istanbul University, Turkey, found that duraplasty using autologous fascia lata reinforced by on-site pedicled muscle flap is an effective technique to control CSF leak, especially when dura is poorly vascularized and less viable. Entirely synthetic and absorbable dura substitutes are now available with proper approval. These include Cerafix Dura Substitute (Acera Surgical, St. Louis, MO, USA) and Ethisorb (Codman, Raynham, MA, USA) and G patch. These products have the advantage of ready availability, can be cut to shape, and as they are manufactured can be produced with uniform handling characteristics. Furthermore, as they are not derived from biological sources, there is no risk of disease

transmission. [17] There was no significant difference in gender. The total patient population consisted of 20 men (40%) and 30 women (60%). The etiology of craniotomy had equal distribution as well, with a total of 38 (76%) tumors, 8 (16%) cysts, 2 (4%) chiari malformations, 1 (2%) decompressions, and 1 (2%) inflammations. The incisional CSF leak within 30 days was noted in 10 patients. Non-incisional CSF leak was noted in 16 patients.

In addition to abdominal fat grafting, the use of intraoperative CSF diversion is an adjunct technique to posterior fossa craniotomy intended to provide relaxation of neural structures for better surgical corridors and also to reduce the pressure of CSF to aid in dural closure and reduction of CSF leaks. It is a commonly used procedure for the reduction of intraoperative fluid leak rates not only in posterior fossa surgery but also in surgery for pituitary adenomas. [18] Andrew T Hale et al [19] showed that, in paediatric patients undergoing tumor resection in posterior fossa, graft dural closure may be protective against CSF leak, wound infection, and hydrocephalus compared to primary dural closure.

Conclusion

The study concluded that, in cases of posterior fossa surgeries, closure with pericranium has a significant protection against CSF leak.

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