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Original Research Article

A Retrospective Assessment Cerebrospinal Fluid Leak in Posterior Fossa Surgeries with Different Dural Closure Methods

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Abstract

Aim: The aim of the present study was to compare 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 Neurosurgery, Medical College Trivandrum Thiruvananthapuram, Kerala, India. All the cases underwent posterior fossa surgeries during the period of 2 years in the department of Neurosurgery was included in the study. 100 patients were 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 35 men (35%) and 65 women (65%). The etiology of craniotomy had equal distribution as well, with a total of 75 (75%) tumors, 15 (15%) cysts, 6 (6%) chiari malformations, 2 (2%) decompressions, and 2 (2%) inflammations. The incisional CSF leak within 30 days was noted in 6 patients. Non-incisional CSF leak was noted in 15 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

Introduction

Cerebrospinal fluid (CSF) leakage is one of the most common complications after neurosurgical intervention. CSF leakage is associated with substantial morbidity and increased healthcare costs. [1] CSF leakage may lead to the development of a pseudomeningocele (PMC), wound healing problems requiring surgical re-closure, surgical site infection, meningitis, and pneumocephalus. The exact magnitude of the problem in children, however, is still unknown and may be larger than in adults for several reasons. First, almost half of all pediatric brain tumors resides in the posterior fossa, and posterior fossa surgeries are thought to be more prone to CSF leakage. [2] Second, intraventricular tumors are more common in the pediatric population. [3]

It is common practice to reapproximate the dura to prevent the leakage of cerebrospinal fluid (CSF) at the end of craniotomy procedures. Dural closure occurs by reapproximation 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. According to the literature, CSF leaks vary from 4% in transsphenoidal procedures to 32% in posterior fossa procedures. [4] Recognizing the risk factors for this complication and improving the technique of dural closure may reduce the associated morbidity and its surgical burden.

Hutter et al [5] suggested a theory for explanation of this finding that optimal sealing of the intradural compartment by dural augmentation avoids bacterial migration through microlesions even by the dural suture itself. Furthermore, our analysis suggests that patient-centered variables are more influential in the development of infection than the selection of dural substitute materials or dural repair techniques. Among the factors examined, infratentorial craniotomy was found to be associated with postoperative CSF leak. Infratentorial surgery predisposes a patient to CSF leak because the hydrostatic pressure of the fluid column puts

additional stress on the dural suture. [6] The association between CSF leak and diabetes mellitus has so far rarely been identified in the current literature. Possible explanation for this finding might be that diabetes mellitus impairs wound healing resulting in failure of dural closure.

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.

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 Neurosurgery, Medical College Trivandrum Thiruvananthapuram, Kerala, India. All the cases underwent posterior fossa surgeries during the period of 2 years in the department of Neurosurgery was included in the study. 100 patients were included in the study. Consent was obtained from all patients and data collected retrospectively from medical records.

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 100 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=100	p-Value
Sex, n (%)		0.512
Male	35 (35%)	
Female	65 (65%)	
Etiology of craniotomy, n (%)		0.316
Tumor	75 (75%)	
Cyst	15 (15%)	
Chiari malformations	6 (6%)	
Decompression	2 (2%)	
Inflammation	2 (2%)	
Type of posterior fossa craniotomy		0.092
Retrosigmoid	42 (42%)	
Suboccipital	50 (50%)	
Other	8 (8%)	
History of diabetes, n (%)	7 (7%)	0.763
Current smoking, n (%)	9 (9%)	0.165
Former smoking, n (%)	12 (11%)	0.743
Intraoperative CSF diversion, n (%)	43 (43%)	<0.001
Lumbar drain	14	
Lumbar puncture	14	
External ventricular drain	12	
Postoperative CSF diversion (LSAD/EVD), n (%)	25 (25%)	0.025
Intraoperative abdominal fat grafting procedure, n (%)	15 (15%)	<0.001
Prior surgery, n (%)	12 (12%)	0.624

There was no significant difference in gender. The total patient population consisted of 35 men (35%) and 65 women (65%). The etiology of craniotomy had equal distribution as well, with a total of 75 (75%) tumors, 15 (15%) cysts, 6 (6%) chiari malformations, 2 (2%) decompressions, and 2 (2%) inflammations.

Table 2: Outcomes

	N	p- Value
Incisional CSF leak within 30 days, n (%)	6 (6%)	0.192
Non-incisional CSF leak (otorrhea, rhinorrhea) within 30 days, n (%)	9 (9%)	0.212
Pseudomeningocele within 30 days, n (%)	15 (15%)	0.650
Postoperative abdominal fat graft wound infection (requiring wound revision and readmission)	1 (1%)	0.156

The incisional CSF leak within 30 days was noted in 6 patients. Non-incisional CSF leak was noted in 15 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. [7] 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. [8] A suturable bovine matrix dural substitute was associated with a 50% risk of complications, such as CSF leak, aseptic meningitis, hydrocephalus,and symptomatic pseudomeningocoele, compared to 18% of cases where no dural substitute was used. [8] Azienda Ospedaliero et al [9] 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 [10], 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. [11] There was no significant difference in gender. The total patient population consisted of 35 men (35%) and 65 women (65%). The etiology of craniotomy had equal distribution as well, with a total of 75 (75%) tumors, 15 (15%) cysts, 6 (6%) chiari malformations, 2 (2%) decompressions, and 2 (2%) inflammations. The incisional CSF leak within 30 days was noted in 6 patients. Non-incisional CSF leak was noted in 15 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. [12] Andrew T Hale et al[13] 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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