



Original Research Article

Cerebrospinal fluid leak in posterior fossa surgeries with different dural closure methods -a retrospective cohort study

Lijo J Kollannur^{1,*}, Shaji U Abu¹, Sreenath K¹¹Dept. of Neurosurgery, Govt. Medical College, Thrissur, Kerala, India

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ABSTRACT

Introduction : CSF leaks are the most common surgical complication in the posterior fossa which can be minimized with watertight dural closure which can be done either with native available dura and if not available with other materials.

Materials and Methods : Aim of the study was to compare the occurrence of CSF leak in posterior fossa surgeries where different dural closure materials are used. This was a 5 year retrospective cohort study, conducted in the department of Neurosurgery, Government medical college, Thrissur, Kerala, India.

Results and Discussion : A total of 49 cases were included in the study. The mean age of the study was 44.86 ± 16.99 (4 years- 70 years). Out of the 49 cases 18(36.7%) were male patients and 31(63.3%) were female patients. Total posterior fossa procedures are distributed as CP angle tumor excision 27(55.1%), Foramen magnum decompression for chiari malformation 12(24.5%), Other tumors of posterior fossa 7(14.3%) and vascular lesions of posterior fossa 3(6.1%). Out of the total 49 cases 20 (40.85%) are closed with pericranium, 14 cases (28.6%) are closed with primary dura, 9 cases (18.4%) with fascia lata and 6(12.2%) are closed with artificial dural patch. Out of the total 49 procedures 10(20.4%) has CSF leak and no CSF leak detected in 39(79.6%). It is found that cases closed with pericranium has got a significant capacity to decrease the CSF leak 13 (65%) out of 20 cases ($\chi^2=4.43$, $df=1$ $p=0.035$). Odds ratio found to be 0.21 that gives 79% protection against CSF leak (95% CI=0.047-0.0968).

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

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1. Introduction

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 fossa¹ which can be minimized with watertight dural closure. Dural closure can be done either with native available dura and if not available with other materials. So choosing the best method for dural closure like native

dura, pericranium, fascia lata, synthetic materials like Cerafix Dura Substitute (Acera Surgical, St. Louis, MO, USA), Ethisorb (Codman, Raynham, MA, USA) and G patch (most commonly used in our institute) is very crucial. The purpose of the study was to compare the occurrence of CSF leak in posterior fossa surgeries where different dural closure materials are used.

2. Materials and Methods

Aim of the study was to compare the occurrence of CSF leak in posterior fossa surgeries where different dural closure materials are used. This was a retrospective cohort study, conducted in the department of Neurosurgery, Government medical college, Thrissur, Kerala, India.

* Corresponding author.

E-mail address: lijojcollannur@gmail.com (L. J. Kollannur).

All the cases underwent posterior fossa surgeries during the period of 2014-2019 in the department of Neurosurgery is 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 pseudomeningocele. A total of 49 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 was done using SPSS software. Level of significance determined by calculating p value (<0.05).

3. Results

A total of 49 cases were included in the study. The mean age of the study was 44.86 ± 16.99 (4 years- 70 years). Out of the 49 cases 18(36.7%) were male patients and 31(63.3%) were female patients. In the study group number of patients with diabetes and hypertension are 6(12.2%) and 13 (26.5%) respectively. The mean duration of surgical procedures was 403.76 ± 176.68 minutes (180 - 960 minutes). Total posterior fossa procedures are distributed as CP angle tumor excision 27(55.1%), Foramen magnum decompression for chiari malformation 12(24.5%), Other tumors of posterior fossa 7(14.3%) and vascular lesions of posterior fossa 3(6.1%). Out of the total 49 cases 20 (40.85%) are closed with pericranium, 14 cases (28.6%) are closed with primary dura, 9 cases (18.4%) with fascia lata and 6(12.2%) are closed with artificial dural patch. Among the total 49 cases 28 cases (57.1%) tissue glue were used. Preoperative csf diversion was present in the cases with the following frequencies of lumbar drain 2(4.1%), ventriculo peritoneal shunt 1(2%), external ventricular drainage 1(2%) and 45 cases with no preoperative csf diversion (91.8%). Out of the total 49 procedures 10(20.4%) has CSF leak and no CSF leak detected in 39(79.6%). Among the male subjects of study group (18 cases) csf leak is found in 5 cases (27.78 %) contrary to the female subjects (31 cases) where csf leak is only in 5 cases (16.12%) showing less csf leak in female population (P value 0.329). Mean duration of surgical procedure is less in females (364.00 ± 125.025 min.) compared to males (472.22 ± 229.59 min) which is found to be statistically significant ($p=0.03$) showing that the protective factor in female population may be the less surgical time. Out of the 13 hypertensives in the study group 11 (84.6%) has no csf leak. It shows an apparent protection of hypertension against CSF leak but not found to be statistically significant (p value 0.6). It is found that out of the total 49 cases 6 has diabetes and none of them

had csf leak (p value 0.185). Among the different surgical procedures done the occurrence of CSF leak is found in the following order. Foramen magnum decompression for chiari malformation 3 cases (25%), CP angle tumor excision 6 cases (22.2%), Other tumors of posterior fossa 1(14.3%) and vascular lesions of posterior fossa 0(0%) with an observation of maximum leak in foramen magnum decompression and minimum in vascular lesion. Out of the 14 cases of primary dural closure 3 had csf leak but in fascia lata closure (9 cases) and artificial dural patch closure (6 cases) none of them reported with csf leak but not found to be statistically significant. It is found that cases closed with pericranium has got a significant capacity to decrease the CSF leak 13 (65%) out of 20 cases ($\chi^2 4.43$, $df=1$ $p=0.035$). Odds ratio found to be 0.21 that gives 79% protection against CSF leak (95% CI=0.047-0.0968). Out of the 28 cases where tissue glue was used 7 cases (25%) has csf leak and 21 cases (75%) has no csf leak but it is not found to be statistically significant showing that no statistical evidence of advocating tissue glue in preventing csf leak. Regarding the preoperative csf diversion all the cases with some type of preoperative csf diversion (4 cases) has no post operative csf leak and all the cases with postoperative csf leak (10 cases) was without any preoperative csf diversion showing the protective evidence of csf diversion even though not found to be statistically significant.

4. Discussion

Posterior cranial fossa is the largest and deepest of the three cranial fossa, approximately one eighth of the intracranial space. It is strategically important situated at the outlet of the cerebrospinal fluid flow from the ventricular system, where we found pathways regulating consciousness, vital autonomic functions, motor activities and sensory reception of the head body and extremities in addition to the centres for controlling balance and gait. Out of the 12 cranial nerve pairs 10 have a segment within the posterior fossa. Development of surgical techniques for the treatment of posterior fossa disorders is, in the terms of historical events, 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. Early surgeons quickly realized that this region of the brain is extremely sensitive to any type of manipulation. Loss of respiration, sudden death, and distortion of the brain stem, all could lead to a rapid demise of the patient. As we shall see, surgery of the posterior fossa really only came in being with the origins of the twentieth century.² The first successful surgeries in the posterior fossa occurred at the end of the 19th century and involved drainage of cerebellar abscesses through trephine openings behind the mastoid process.² In 1893 Charles McBurney, an American surgeon best known for the eponymic landmark used in diagnosing appendicitis, reported the first successful

removal of cerebellar tumor.³ Surgical treatment of lesions in the posterior fossa has expanded since that time to include a wide spectrum of pathologies.³ Cushing not only was a talented Neurosurgeon with meticulous technique but also was responsible for many of the most important contributions to his field.⁴ Walter Dandy (1886–1946), student of Cushing, made the observation that “surgery of the brain is the outgrowth of three discoveries of the nineteenth century, namely, anesthesia, asepsis and cerebral localization.”⁵ The progress in these areas of neurosurgery led to more routine attempts to treat pathology of the posterior fossa.⁵ Introducing the operating microscope to the field of neurosurgery in the 1950s enabled revolutionary advances in technique to be made, especially when operating on the small and sensitive structures found in the posterior fossa.²

In a 10-year (1992–2002) retrospective study conducted by Dubey A et al. surgery in the posterior fossa has been reported to have a complication rate as high as 32%. Cerebrospinal fluid leaks presenting in 65 (13%) patients followed by meningitis in 46 (9.2%) patients, wound infection in 35 (7%) patients, and CN palsies in 24 (4.8%).¹ CSF leaks are the most common surgical complication in the posterior fossa.¹ 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.⁶ 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.⁶ Azienda Ospedaliero et al. concluded that duraplasty with autologous pericranium and standardized closure of soft tissues seem promising in reducing the CSF-related complications during Chiari surgery.⁷ In a study conducted by Abuzayed Bet al., 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.⁸ 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.⁹ Andrew T Hale et al. 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.¹⁰

In our study we analysed the csf leak in posterior fossa surgeries done over a period of 5 years in our institution and found that the cases closed with pericranium has got a significant capacity to decrease the CSF leak (p value 0.035, odds ratio 0.21).

5. Conclusion

Study concludes that, in cases of posterior fossa surgeries, closure with pericranium has a significant protection against CSF leak.

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None.

8. Conflict of interest

None.

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Author biography

Lijo J Kollannur Assistant Professor

Shaji U Abu Associate Professor

Sreenath K Senior Resident

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