ORIGINAL ARTICLE

Frequency of Post-Operative Cerebrospinal Fluid Leak after Infratentorial Surgery

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ABSTRACT

Introduction: *The infratentorial space (posterior fossa) is the region of the brain below the tentorium cerebelli and contains structures like of the midbrain, pons, medulla oblongata and the cerebellum. Cerebellopontine angle (CPA); an extra-axial region between the cerebellar hemisphere and the pons and is the site of exit for the cranial nerves 5th to 12th is also located infratentorialy. Primary brain tumors are commonly located in the posterior cranial fossa in children and approximately 54 – 70% of all intracranial tumors in children are infratentorial. Eighty-eight percent of all tumors fall into one of the 4 categories, astrocytoma, medulloblastoma, ependymoma and craniopharyngioma.*

Objective: *The objective of the study is to determine the frequency of post-operative Cerebro spinal fluid (CSF) leak after infratentorial surgery.*

Material and Methods: *This study was conducted at Department of Neurosurgery, PGMI Lady Reading Hospital, Peshawar. Duration of the study was six months and the study design was descriptive case series in which a total of 132 patients were observed by using 21.4% CSF leak11, 95% confidence level and 7% margin of error with the help of WHO software for sample size determination. More over consecutive non probability sampling technique was used for sample collection.*

Results: *In this study 67% patients were in age range < 20 years, 20% patients were in age range 21 – 35 years, 10% patients were in age range 36 – 50 years while 3% patients were 51 – 60`years. Mean age was 22 years with a standard deviation of ±5.71. Fifty three patients were male and 47% patients were female. More over 7% patients had CSF leak.*

Conclusion: *Our study concludes that the incidence of CSF leak after infratentorial surgery was 7% which give us an insight into our complication rate so that we should modify our surgical technique such as we can use fibrin glue or artificial dura in case our rate is high.*

Key Words: *CSF leak, Infratentorial surgery, Posterior fossa.*

INTRODUCTION

The infratentorial space (posterior fossa) is the region of the brain below the tentorium cerebelli and contains structures like of the midbrain, pons, medulla oblongata and the cerebellum.[1] Cerebellopontine angle (CPA); an extra-axial region between the cerebellar hemisphere and the pons and is the site of exit for the cranial nerves 5th to 12th is also located infratentorialy.[2] Primary brain tumors are commonly located in the posterior cranial fossa in children and approximately 54 – 70% of all intracranial tumors in children are infratentorial. Eighty-eight percent of all tumors fall into one of the 4 categories, astrocytoma, medulloblastoma, ependymoma and craniopharyngioma.[3] About 15 – 20% of all intracranial tumor in adults including mennningiomas, hemangioblastoma, pilocytic astrocytoma are located in the posterior fossa.[4]

Menningioma represent about 20% of all intracranial tumors and 15% of all intracranial meningiomas are in the posterior fossa which includes petroclival, cerebellar convexity, foramen magnum, jugular foramen, cerebellopontine angle (CPA) and the lateral tentorial.[4] The most common tumor in the CPA is the acoustic schwannomma and also surgery for pain relief in case of trigeminal neuralgia can be approached through this part of the infratentorial region.[5,6] Posterior cranial fossa tumors can cause brainstem compression, herniation and death. With the advent of new diagnostic techniques like CT scan and MRI, posterior cranial fossa tumors are commonly diagnosed nowadays. The main treatment for the infratentorial tumor is surgery followed by chemotheraphy or radiotheraphy.[7] The surgical approaches to the posterior cranial fossa can be divided into five including; the cerebellopontine angle lesion, the surgical therapy for facial pain and spasm, the cerebellar region, the Chiari I malformation and the petroclival lesions.[4] The main complications following the infratentorial surgery is the CSF leaks, wound infection, meningitis, cerebellar hematoma, hydrocepahalus and cerebellar mutism.[4,8]

Post-operative CFS leakage can be a challenging and potentially hazardous problem following many complex cranial procedures. This is especially true for surgical approaches to the infratentorial region because a watertight dural reconstruction is not always feasible and CSF pulsation waves are greatest in this location.[8] CSF leaks are a psychological and physical burden for the patient as well as a frustrating experience for the surgeon. CSF leaks lead to longer hospital stays, risk of infections/meningitis, discomfort to the patient, and, last but not least, higher costs. Therefore, everything must be done to avoid postoperative CSF leaks.[9] The frequency of the cerebrospinal fluid leaks is higher for the patients undergoing the infratentorial surgery compared to the supratentorial surgery. No difference is seen depending on pathology (vascular malformations, head injuries, tumors, microvascular decompressions, and varia). The patients undergoing radiotheraphy and chemotheraphy had an increase in the frequency of the CSF leaks compared to that who do not have undergone any radio or chemotheraphy either pre or post-operatively. Similarly the technique of the dural closure also had a significant influence on the CSF leaks i.e. the frequency is increased with the no suture or interrupted suture compared to the continuous or the interlocking suture.[10]

The rationale of the current study is to know about the postoperative CSF leak after infratentorial surgery. As mentioned earlier the infratentorial compartment harbors almost 30% of adult brain tumor and 70% of the pediatric brain tumor. The CSF leak are more likely in this region and they increases the surgical morbidity as well as the mortality of the patient and to follow patients at our institution undergoing the infratentorial surgeries for the CSF leak in the hoped to know about the exact figure having the complication. This will give us an insight into our complication rate and we will modify our surgical technique such as we can use fibrin glue or artificial dura in case our rate is high.

MATERIAL AND METHODS

The study type was Descriptive case series performed in the department of Neurosurgery, PGMI Lady Reading Hospital, Peshawar.The duration of study was six months. All patients of either sex undergoing infratentorial surgery, having complete dural closure peroperatively were included in this study,while all those patients who were having previous history of infratentorial surgery, incomplete dural closure peroperatively, combined supra and infratentorial approach and the patient who do not survived 30 days postoperatively were excluded.

After permission from hospital ethical committee, patients admitted in Neurosurgery Department of Lady Reading Hospital patients who had undergone infratentorial surgery, were approached. Those who fulfill inclusion criteria were included in the study. Informed consent was taken from all patients. These patients were further assessed through detailed history, including personal particulars, name, age, sex, address, symptoms and clinical examination, and radiological findings.

The patients were followed post operatively for 30 days through mobile contact and were assessed by a Neurosurgeon, fellow of the College of Physicians and Surgeons of Pakistan (CPSP) with a minimum five year post fellowship experience, for any CSF leak. All the observation and examination were done by trainee, data was recorded in a predesigned Performa. Exclusion criteria had followed strictly to control confounders and bias in the study results.

The data was analyzed using the statistical program SPSS version 17. Descriptive statistics like mean ± standard deviation was used for age. Frequency/ percentage was calculated for categorical variables. Outcome was stratified among the age and gender, and the time since the onset of the CSF leak to see the effect modifiers. All results were presented in the form of charts and graphs.

RESULTS

Total 132 patients were observed to determine the frequency of post-operative CSF leak after infratentorial surgery. Majority of the patients (67%) were in age range < 20 years (Table 1). Mean age was 22 ± 5.71 years. Gender distribution among all patients was analyzed as 70 (53%) patients were male and 62 (47%) patients were female. Perioperative CSF leak among all patients was analyzed as 9 (7%) patients had CSF leak. Stratification of perioperative CSF leak with age and gender distribution is given in table no 2 and 3 respectively.

Table 1: *Age Distribution (n = 132).*

Age	Frequency	Percentage
< 20 years	89	67
21 – 35 years	26	20
36 – 50 years	13	10
51 – 65 years	4	3
Total	132	100

Table 2: *Stratification of CSF Leak with Age (n = 132).*

Perioperative CSF Leak	< 20 years	21-35 years	36-50 years	51-65 years	Total
Yes	6	2	1		9
No	83	24	12	4	123
Total	89	26	13	4	132

Chi Square test was applied in which P value was 0.003

Table 3: *Stratification of CSF Leak with Gender (n = 132).*

Perioperative CSF Leak	Male	Female	Total
Yes	5	4	9
No	65	58	123
Total	70	62	132

Chi Square test was applied in which P value was 0.002

DISCUSSION

The infratentorial space (posterior fossa) is the region of the brain below the tentorium cerebelli and contains structures like of the midbrain, pons, medulla oblongata and the cerebellum[1]. Cerebellopontine angle (CPA); an extra-axial region between the cerebellar hemisphere and the pons and is the site of exit for the cranial nerves 5th to 12th is also located infratentorialy[2]. Primary brain tumors are commonly located in the posterior cranial fossa in children and approximately 54 – 70% of all intracranial tumors in children are infratentorial. Eighty-eight percent of all tumors fall into one of the 4 categories, astrocytoma, medulloblastoma, ependymoma and craniopharyngioma.[3]

In this study 7% patients had CSF leak. In literature the overall frequency of the CSF leaks account for the about 21.4%[11] to 24%[10] after infratentorial surgery. In study done by Gnanalingham KK et al[12] Postoperatively, more patients in the craniectomy group were noted to have CSF leakage (27 compared with 4%; $p < 0.01$) and pseudomeningoceles (23 compared with 9%; $p < 0.05$). There was no significant difference between the two groups in the numbers of patients with CSF infections, wound infections, or hydrocephalus requiring permanent CSF drainage.

Patients with CSF leaks had a longer duration of hospital stay (20.7 compared with 14.9 days; $p < 0.01$), and were more likely to have CSF infections (35 compared with 12%; $p < 0.01$) and wound infections (24 compared with 1%; $p < 0.01$) than patients without CSF leaks. Postoperatively, wound exploration and reclosures for CSF leakage were more likely in the craniectomy group (11 compared with 0%; $p < 0.01$). Multivariate analysis revealed that the only predictor of CSF leakage postoperatively was the type of surgery (that is, craniotomy compared with craniectomy; odds ratio 10.8; $p = 0.03$).

Kehler U et al[13] had observed a CSF leak rate of 7.7% (n = 42) in 545 cranial surgeries at the time of discharge from the hospital. Dural suture augmentation was performed in 472 cases, using multiple different augmentation techniques and materials (fibrin glue, fleece-bound sealant, etc.). Significantly more CSF leaks developed in posterior fossa surgery ($P < 0.001$), in craniectomies more than in craniotomies ($P < 0.001$), if pneumatized spaces were opened ($P = 0.015$), if the dura defect after closure remained larger than 1 cm ($P = 0.001$), and in patients younger than 66 years ($P = 0.05$). The risk of a CSF leak was higher if no dural suture or only interrupted sutures were performed. Dural closures with running sutures showed less CSF leaks ($P < 0.001$) as compared with stitch-by-stitch sutures. No differences were found when comparing primary surgery with reoperation. The kind of intracranial pathology did not influence the incidence of a CSF leak. No significant difference was observed with regard to previous radiotherapy/systemic therapy, augmentation of the dura suture with various materials, wound drains, CSF drains, and the duration of hospital stay.

CONCLUSION

Our study concludes that the incidence of CSF leak after infratentorial surgery was 7%, which give us an insight into our complication rate so that we should modify our surgical technique such as; one can use fibrin glue or artificial durato minimize this rate.

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