Original article

Short-Term Outcomes of Posterior Fossa Decompression with or without Duraplasty for Chiari Malformation Type 1: Insights from a Tertiary Care Hospital

Muhammad Idris Khan, Adnan Munir, Sajjad Ullah, Sikandar Ali Khan

Abstract

Objectives: To assess and compare short-term outcomes of patients who underwent posterior fossa decompression with and without duraplasty for Chiari Malformation Type 1 (CM1).

Methodology: This retrospective cohort study was conducted at Khyber Teaching Hospital's Peshawar, Pakistan, in December 2023 after securing permission from the Institutional Review Board (IRB) with reference. We included patients who underwent posterior fossa decompression for Chiari Malformation Type 1 (CM1) over a one-year period from March 2022 to March 2023 at Khyber Teaching Hospital. Retrospective data of specified duration concerning CM1 Patient's demographics, preoperative symptoms, surgical details including the use of duraplasty, and postoperative outcomes were extracted from electronic health records at Khyber Teaching Hospital, Peshawar. Data was analyzed by SPSS27. Descriptive statistics were employed to summarize demographic characteristics and baseline clinical data and frequencies were reported. Comparative analyses between posterior fossa decompression surgery with duraplasty and that without duraplasty groups were performed using t-tests for continuous variables and chi-square tests for categorical variables. P value$\leq$ 0.05 was considered significant.

Results: 52 patients were included in our study out of which 28 underwent posterior fossa decompression with duraplasty and 24 without duraplasty. 8 patients (15.4%) experienced postoperative complications. Cerebrospinal fluid leaks were observed in 3 cases (5.8%), all of which occurred in the PFD with duraplasty group. The mean length of hospital stay for patients undergoing PFD with duraplasty was 6.2 days (SD ± 1.4), while for those undergoing PFD without duraplasty, it was 5.4 days (SD ± 0.9).

Conclusion: Posterior fossa decompression with duraplasty carries the risk of CSF leak so the preferred procedure for Chiari Malformation Type 1 is posterior fossa decompression without duroplasty. Those patients requiring posterior fossa decompression with duroplasty should be highly individualized

KEYWORDS: Type 1 Chiari malformation, Posterior fossa decompression, Duraplasty, Short term outcome.

INTRODUCTION

Chiari Malformation Type 1 (CM1) is characterized by the extension of the cerebellar tonsils, which is the bottom region of the cerebellum, into the upper spinal canal. This displacement may result in a blockage of the passage of cerebrospinal fluid (CSF), which can cause a variety of neurological symptoms, including headaches, vertigo, and in more serious situations, neurolo gical impairments.[1] One surgical procedure that is frequently used to relieve symptoms is posterior fossa decompression (PFD), which increases the amount of space inside the posterior cerebral fossa.[2] There is still disagreement about whether this surgical strategy should involve duraplasty, a treatment that entails enlarging the Dura mater.[3,4]

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This study looks at the short-term results of PFD with and without duraplasty for the treatment of CM1 in an effort to add to the body of knowledge already in existence. In order to manage difficult neurological diseases, tertiary care hospitals concentrate their specialized medical skills and resources. This study focuses on the experiences and outcomes from these hospitals.[5,6] Over time, the treatment of Chiari Malformation Type 1 has changed, with surgery now being the main option for people whose symptoms are severe or chronic.[7,8] A recognized method for treating the anatomical defects linked to CM1 is posterior fossa decompression. In order to provide more room for the cerebellum, the surgeon performs posterior skull dissection (PFD), which involves removing a tiny amount of bone and, if necessary, the higher spinal vertebrae. This attempts to return normal CSF flow and relieve pressure on the brain.[9,10]

Duraplasty is controversial when performed during PFD; supporters claim it improves CSF flow even more and guards against issues like CSF leaks, while detractors claim it may raise the risk of some complications without offering appreci-able extra benefits.[11,12] There is a need for more thorough research to inform clinical decision-making because the available literature on the topic offers contradicting information.[13] In this study, we aim to explore the short-term outcome of patients undergoing posterior fossa decom-pression with duraplasty and those without duraplasty.

METHODOLOGY

This retrospective cohort study was conducted at Khyber Teaching Hospital's Peshawar, after securing permission from the Institutional Review Board (IRB) with reference letter no. 78/DME/ KMC in December 2023. The purpose of this retrospective cohort study was to evaluate the short-term results of posterior fossa decom-pression (PFD) with duraplasty versus that without duraplasty for Chiari Malformation Type 1 (CM1). In this study retrospective data of one-year period, from March 2022 to March 2023 from the CM1 patients record, at the tertiary care facility Khyber Teaching Hospital was approached. The study population comprised all patients diagnosed with CM1 who underwent surgical intervention at Khyber Teaching Hospital during the specified study duration. Electronic medical records were systematically reviewed to identify eligible cases based on diagnostic codes and surgical procedure logs. Those patients who were diagnosed to have a Chiari Malformation Type 1 on Computed Tomographic (CT) scan and Magnetic Resonance Imaging (MRI) by certified radiologist and underwent posterior fossa decompression surgery between March 2022 and March 2023 were included. Those patients with other congenital anomalies, re-do posterior fossa decompression surgery and incomplete medical records or insufficient follow-up data. The entire data collection and analysis process was conducted with careful adherence to patient confidentiality. Patient demographics, preoperative symptoms, surgical details including the use of duraplasty, and postoperative outcomes were extracted from electronic health records at Khyber Teaching Hospital, Peshawar. The follow-up period for assessing short-term outcomes extended up to six months post-surgery. Data was analyze by SPSS27. Descriptive statistics were employed to summarize demographic characteristics and base-line clinical data and frequencies were reported. There Shapiro Walk test was used to check the normality of the data ($p = 0.217$). Comparative analyses between posterior fossa decompression surgery with duraplasty and that without duraplasty groups were performed using t-tests for continuous variables and chi-square tests for categorical variables if less than 20% of expected frequencies are < 5 / Fisher exact test if more than 20% of expected frequencies are < 5. Adjustments for potential confounding factors were made using multivariate analyses as necessary. P value ≤ 0.05 was considered significant.

RESULTS

A comprehensive analysis of the 52 patients diagnosed with Chiari Malformation Type 1 (CM1) who underwent posterior fossa decom-pression (PFD) at Khyber Teaching Hospital reveals diverse demographic characteristics. The mean age of the study population was 34.2 years (SD ± 7.5), with a range from 22 to 50 years. Female patients constituted the majority, comprising 61.5% (n=32) of the cohort. Preoperative symptoms varied, with headache being the most prevalent complaint (88.5%, n=46), followed by dizziness (48.1%, n=25) and neck pain (34.6%, n=18) as shown in table 1.

The surgical approach differed among the patients. 28 individuals (53.8%) underwent posterior fossa decompression surgery with duraplasty and 24 patients (46.2%) underwent the surgery without duraplasty. Analysis of the demographic data revealed no statistically significant differences in the distribution of surgical approaches based on age (p = 0.274) or gender (p = 0.521) (Table 1).

Table 1: Demographic and Surgical Characteristics (n=52)

Characteristic	PFD with Duraplasty n (%) 28(53.8)	PFD without Duraplasty n (%) 24(46.2)
Number of Patients	28	24
Mean ± SD Age (years)	34.2 ± 7.5	34.3 ± 8.1
Gender (Female)	18(64.2)	14 (58.3)
Gender (Male)	10 (35.7)	10 (41.6)
Preoperative Headache	25 (89.3)	21(87.5)
Preoperative Dizziness	14 (50.0)	11(45.8)
Preoperative Neck Pain	9 (32.1)	9 (37.5)

of the 52 patients, 8 (15.4%) experienced postoperative complications. Cerebrospinal fluid leaks were observed in 3 (5.8%) cases, all of which occurred in the PFD with duraplasty group. This difference was statistically significant (p = 0.041). Other complications included infection (3.8%, n=2), meningitis (1.9%, n=1), and wound dehiscence (1.9%, n=1) (Table 2).

The mean length of hospital stay for patients undergoing PFD with duraplasty was 6.2 days (SD ± 1.4), while for those undergoing PFD without duraplasty, it was 5.4 days (SD ± 0.9). The difference was statistically significant (p = 0.027), indicating a longer duration of hospitalization in the duraplasty group (figure 1).

Assessment of symptom improvement at the six-month follow-up revealed that 23 (84.6%) patients in the PFD with duraplasty group reported significant relief, compared to 18 (75.0%) patients in the PFD without duraplasty group. However, this difference did not reach statistical significance (p = 0.368), suggesting comparable efficacy in symptom alleviation between the two surgical approaches as shown in table 2.

Table 2: Short-Term Outcomes and Complications

Outcome/Complication	PFD with Duraplasty n (%) 28 (53.8)	PFD without Duraplasty n (%) 24 (46.2)	p-value
Length of Hospital Stay (days mean ± SD)	6.2 ± 1.4	5.4 ± 0.9	0.027*
Postoperative Complications (%)			
Cerebrospinal Fluid Leaks (%)	3(10.7)	0%	0.041*
Infection (%)	1(3.6)	1(4.2)	0.854*
Meningitis (%)	00	1(4.2)	0.298*
Wound Dehiscence (%)	1(3.6)	00	0.487*
Total Postoperative Complications (%)	5(17.9)	3(12.5)	-
Improvement in Symptoms at 6 months n(%)	23(84.6)	18(75.0)	0.368*

PFD= posterior fossa decompression Note: p-values≤ 0.05 represents statistical significance

T-tests were conducted to compare continuous variables between groups. The age difference between the PFD with duraplasty and without duraplasty groups was not statistically significant (p = 0.786), ensuring homogeneity in age distribution across the study population. Chi-square tests were performed for categorical variables. A statistically significant association was found between the occurrence of cerebrospinal fluid leaks

and the use of duraplasty (p = 0.041), highlighting a potential risk associated with this specific surgical modification.

Multivariate analyses were conducted to adjust for potential confounding factors. Logistic regression analysis revealed that the association between duraplasty and cerebrospinal fluid leaks remained significant after adjusting for age and gender (p = 0.049), reinforcing the notion that duraplasty may independently contribute to this complication.

DISCUSSION

Chiari Malformation Type 1 (CM1) can arise from both hereditary and acquired causes, primarily affects teenagers and young adults. In our study, the demographic characteristics of our patient cohort were consistent with existing literature, with the median age of diagnosis in adults aligning closely with the findings of Aska Arnautovic et al., who reported a median age of 40.5 years in adult patients and 8 years in pediatric patients. The average age of presentation in our cohort was also similar to the 35-year average reported in prior studies, confirming the consistency of our findings with established data. The reported range of the post-operative complications in the literature corresponds with the observed rate of post operative complications (15.4%) in our investi-gation.[14,15] Complication rates ranging from 10% to 20% have been reported by systematic reviews in a variety of studies assessing PFD for CM1. Interestingly, the cerebrospinal fluid leakage rate (5.8%) in our study is within the stated ranges of 4% to 8%. The greater frequency of leaks observed in the group that underwent duraplasty is consistent with the results of earlier investigations, suggesting a possible correlation between duraplasty and this particular consequence.[16]

The PFD with duraplasty group's longer hospital stay (6.2 days) than the PFD without duraplasty group's (5.4 days) is consistent with the general pattern documented in the literature.[13] Extended hospital stays in duraplasty patients have been reported in multiple studies including a meta-analysis. The results of the current study are further supported by the reported mean hospital stay in earlier investigations, which varied from 5.8 to 7.4 days.[17]

The six-month follow-up assessment of symptom improvement (84.6% in the PFD with duraplasty group vs. 75.0% in the PFD without duraplasty group) is in line with improvements that have been documented in the literature. Overall improvement rates following PFD, independent of duraplasty, range from 70% to 90% according to long-term research.[18]

The results highlight the complex procedure involved in deciding between PFD with and without duraplasty. Although both methods are effective in reducing symptoms, duraplasty should be carefully considered due to its higher risk of CSF leakage and longer hospital stays. These findings are consistent with the current discussion in the literature about the advantages and dis-advantages of duraplasty in CM1 surgery.[19,20]

There are inherent limitations to this study due to its retrospective design, and the short-term follow-up may not fully capture all of the outcomes related to each surgical method. Generalizability of findings is another frame factor. This work provides important new information about the short-term effects of PFD for CM1 both with and without duraplasty. The results underscore the significance of tailored treatment approaches that consider the particularities of every patient's clinical manifestation and possible hazards linked to particular surgical adjustments.

CONCLUSION

Posterior fossa decompression with duraplasty carries the risk of CSF leak so the preferred procedure for Chiari Malformation Type 1 is posterior fossa decompression without duroplasty. Those patients requiring posterior fossa decompression with duroplasty should be highly individualized.

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