Chiari I Malformation: An Analysis of Surgical Risk Factors and Complications using an International Database

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Introduction

- Chiari I malformations are common in adults, and a frequent procedure in neurosurgical practice.
- Despite a number of studies, to date there is no consensus about the indications or surgical technique for this common condition.
- Growing emphasis on value-based care has emphasized reduction of readmissions and reoperations, and is particularly relevant in Chiari, which has traditionally been associated with a high complication rate.
- In this study we provide the first large, multi-center study providing a contemporary profile of risk factors and complications for this frequent operation.

Methods

The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database was queried to determine 30-day outcomes following surgery for Chiari I malformations in adults between 2005 and 2016. Demographics, clinical risk factors, and postoperative events were analyzed, along with reoperation and readmission reasons.

Results

- 672 adult patients were identified in the cohort, with a female predominance (80%).
- The overall cohort readmission rate was 9.3%, and 6.8% of patients returned to the operating room.
- Obesity (45.7%) was predictive of both readmission and reoperation risk.
- Male sex and American Society of Anesthesiology (ASA) class were predictive for reoperations.
- The most common reason for reoperation was CSF leak, which was responsible for nearly two-thirds of reoperations and 4% of the cohort.
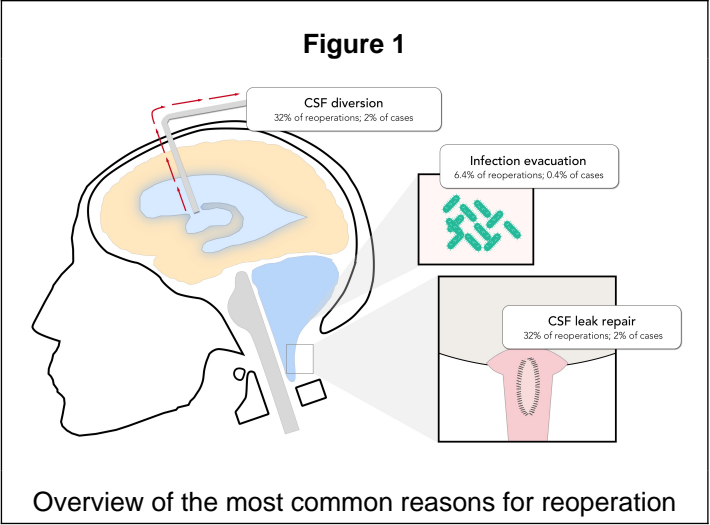
Conclusions

Surgery for Chiari in adults is common, and carries a definitive risk profile including rates of readmission and reoperation higher than other common neurosurgical procedures. This cohort provides a representative sample of contemporary neurosurgical outcomes in surgery for Chiari I malformations.

Learning Objectives

1) Identify risk factors associated with readmission and reoperation after surgery for Chiari I malformations.
2) Characterize the readmission and reoperation rate for Chiari malformation surgery.
3) Describe the most common reasons for readmission or reoperation after Chiari decompression, their frequency, and council patients in preparation for surgery.

Table 1

Operative factors		Number of Reoperations*	Univariate p value	95% Confidence Interval	p value
Sex					
	Male	13 (11%)	*0.018*	*2.582 (1.218 - 5.470)*	*0.013*
	Female	23 (5.1%)			
Race**					
	Black	7 (7.1%)			
	White	24 (6.2%)	0.925		
	Other	1 (5.3%)			
Obesity					
	Obese	26 (10%)	*0.001*	*2.968 (1.367-6.445)*	*0.006*
	Not Obese	10 (3.3%)			
Diabetes					
	Diabetic	1 (3.7%)	0.554		
	Non-diabetic	35 (6.6%)			
Hypertension					
	Hypertensive	11 (11%)	*0.040*	1.189 (0.535-2.644)	0.670
	Non-hypertensive	25 (5.4%)			
COPD					
	History of COPD	1 (14%)	0.3736		
	No history of COPD	35 (6.3%)			
Smoking					
	Smoker	8 (5.4%)	0.5382		
	Non-smoker	28 (6.8%)			
Functional status***					
	Independent	35 (6.4%)	0.5589		
	Partially independent/dependent	1 (8.3%)			
ASA classification					
	1-2	8 (2.6%)	*< 0.001*	*4.276 (1.863-9.814)*	*0.001*
	3-5	28 (11%)			

*Data available from 2011-2016 (n=560)
**Of available data (n=504)
***Of available data (n=556)

Risk factors for Reoperation

Figure 1

CSF diversion
32% of reoperations; 2% of cases

Infection evacuation
6.4% of reoperations; 0.4% of cases

CSF leak repair
32% of reoperations; 2% of cases

Overview of the most common reasons for reoperation

Table 2

Operative factors		Number of Readmissions*	Univariate p value	95% Confidence interval	p value
Sex					
	Male	12 (10%)	0.947		
	Female	45 (10%)			
Race**					
	Black	14 (14%)			
	White	38 (10%)	0.327		
	Other	1 (5.3%)			
Obesity					
	Obese	41 (16%)	*< 0.001*	*3.164 (1.724 – 5.808)*	*< 0.001*
	Not Obese	16 (5.3%)			
Diabetes					
	Diabetic	3 (11%)	0.870		
	Non-diabetic	54 (10%)			
Hypertension					
	Hypertensive	14 (14%)	0.163		
	Non-hypertensive	43 (9.4%)			
COPD					
	History of COPD	0	1.000		
	No history of COPD	57 (10%)			
Smoking					
	Smoker	12 (8.1%)	0.317		
	Non-smoker	45 (11%)			
Functional status***					
	Independent	54 (9.9%)	0.089		
	Partially independent/dependent	3 (25%)			
ASA classification					
	1-2	24 (7.7%)	*0.031*	1.639 (0.932 – 2.881)	0.086
	3-5	33 (13%)			

*Data available from 2011-2016 (n=560)
**Of available data (n=504)
***Of available data (n=556)

Risk factors for Readmission