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Original Research Article

Clinical outcome following duraplasty in type 1 Arnold Chiari malformation

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ABSTRACT

Background: Few authors support the use of duraplasty and few authors have reported a higher rate of complications associated with the same. The objective of the present endeavor was to study clinical outcome following duraplasty in type 1 Arnold Chiari malformation.
Methods: Retrospectively, 24 cases and prospectively 18 cases diagnosed and operated for Chiari malformation type I were included. Patients with Chiari type II, III, and IV were excluded. A questionnaire was used to assess the improvement in neck pain and disability due to it, head pain and disability due to it and improvement in general health before and one year after surgery. The results of the questionnaire of both groups were analyzed and compared.
Results: The most common age group of presentation was 2nd decade (35.71%) followed by 3rd decade (26.19%). The male to female ratio was 1.2:1. The most common presenting complaint was sensory disturbances (66.66%) followed by neck pain in 14 patients (33.33%). The most common sign was limb weakness in 21 patients (50%). 24 patients were operated with foramen magnum decompression with duraplasty and 18 patients were operated without duraplasty. There were more complications in the duraplasty group. Patients showed an overall clinical improvement of 83.33% in the duraplasty group compared to a lower overall clinical improvement rate of 55.50% in the no duraplasty group. Specific symptoms like neck pain showed similar rate of improvement of (88.89%) in the duraplasty group compared to no duraplasty group (80%).
Conclusions: Foramen magnum decompression with duraplasty is superior to foramen magnum decompression without duraplasty although slightly higher rate of complication is seen with duraplasty.

Keywords: Arnold Chiari malformation, Clinical outcome, Duraplasty

INTRODUCTION

Herniation of various degrees of hindbrain is known collectively as Chiari malformations.[1]

"Chiari malformation type I (CIM) is defined as the downward displacement of the cerebellar tonsils and the medial portions of the inferior cerebellar lobules through the foramen magnum into the upper cervical spinal canal".[2] Syringomyelia is commonly seen in such patients.[3] Patients present with a wide range of symptoms that include headache, neck pain, and generalized discomfort with nausea, vomiting, dizziness, hearing loss, visual disturbances, paraesthesias, weakness, and fatigue and gait difficulties.[4]

Chiari I malformation diagnosis is based on evidence. One has to show that the cerebellar tonsils are not in the normal position but are seen below the foramen magnum. There is syrinx present. This is also found to be associated with the craniovertebral junction bone anomalies as well as posterior cranial fossa bone

anomalies. The radiological work-up plays the most important role in diagnosing this condition with MRI being the investigation of choice.[5]

The treatment of choice of this condition is decompression of the foramen magnum. This is due to the main hypothesis of pathogenesis of Chiari malformation being the herniation of cerebellar tissue because of larger cerebellar mass in a smaller posterior cranial fossa. However, there are various methods of foramen magnum decompression described in the literature with variations that include the size of the decompression, choice of dural opening and duraplasty with an allograft or an autograft. Numerous studies have shown advantages and complications with each of these techniques.[6]

Various studies have been published regarding the use of duraplasty. However, no conclusive advantages or disadvantages have been decided.[7-9]

Hence, present study was undertaken to study Clinical outcome following duraplasty in type 1 Arnold Chiari Malformation.

METHODS

The type of present study is retrospective and prospective analysis. Patients treated in Department of Neurosurgery, Vydehi Institute of Medical Sciences and Research Centre, Bangalore from January 2010 to December 2017 was included.

Retrospective analysis of the Neurosurgery OT records showed a total number of 40 cases of CMI cases operated. Out of 40 patients 6 patients could not be contacted for follow up and hence were excluded from the study. Another 8 patients were operated for CMI till December 2017 was prospectively included into the study. Thus, the final sample size for the present study was 42.

Inclusion criteria

Patients diagnosed and operated for Chiari malformation type I.

Exclusion criteria

Patients with Chiari type II, III, and IV.

Patients operated for CMI in Department of Neurosurgery at Vydehi Institute of Medical Sciences and Research Centre from January 2010 to December 2017 was included.

Patients who meet the inclusion criteria were recruited.

Detailed clinical history of all retrospectively included cases was obtained from the case records of the patients and prospectively recorded in the cases operated till December 2017.

Patients were being divided into two groups based on whether foramen magnum decompression is done with duraplasty or without duraplasty.

Patients retrospectively operated with foramen magnum decompression with duraplasty were included under group A and patients operated with foramen magnum decompression without duraplasty were included under group B. Prospective cases were assigned to respective groups depending on the operating surgeon's decision.

Written informed consent was taken from all patients enrolled in the study prospectively.

A questionnaire was used to assess the improvement in neck pain and disability due to it, head pain and disability due to it and improvement in general health before and one year after surgery. The answers to this questionnaire were recorded over telephone by a person who is not involved in the study.

Numeric Rating scale (NRS) for Neck pain (NRS neck) head pain (NRS -Head), Neck Disability index (NDI), Headache Disability index and General health by RAND 36-Item Health Survey 1.0. (SF-36) were used to prepare the questionnaire and assess overall clinical improvement.

The results of the questionnaire of both groups were analyzed and compared.

Statistical analysis

SPSS version 21 will be used for data analysis. Fisher's test was applied to compare the percentage of improvement in each symptom. P value of less than 0.05 was considered to be statistically significant.

RESULTS

Table 1 shows distribution of study subjects as per age. Majority of the study subjects were found to be present in the age group of 20-30 years i.e. 35.7% followed by the age group of 30-40 years i.e. 26.2%.

Table 1: Distribution of study subjects as per age.

Age (years)	Number	%
0-10	2	4.7
10-20	6	14.3
20-30	15	35.7
30-40	11	26.2
40-50	6	14.3
> 50	2	4.7
Total	42	100

There were six patients each in the age group of 10-20 years and 40-50 years. There were two patients each in the age group of 0-10 years and above the age of 50 years.

Table 2 shows distribution of study subjects as per sex. Males were 24 i.e. 57.1% and the females were 18 i.e. 42.9%. Thus, it has been noted that the males were more than the females. The male to female ratio was found out to be 1.2:1. Thus it can be said that the males are commonly affected by this condition than the females.

Table 3 shows distribution of study subjects as per clinical presentation. Majority of the patients presented with sensory symptoms i.e. 66.7% followed by limb weakness in 50% of the cases and followed by spasticity in 45.2% of the cases. Limb pain was seen in 40.6% of the cases. Headache was noted in 19.1% of the cases. Neck pain was noted in 33.3% of the cases. There was one case of limb deformity and two patients presented with cerebellar signs. Similar trend was observed in the duraplasty and non duraplasty groups.

Table 2: Distribution of study subjects as per sex.

Sex	Number	%
Male	24	57.1
Female	18	42.9
Total	42	100

Table 3: Distribution of study subjects as per clinical presentation.

Symptom	Number	%	Duraplasty group (A)		No duraplasty group (B)	
			Number	%	Number	%
Neck pain	14	33.3	9	64.3	5	35.7
Headache	8	19.1	4	50	4	50
Limb pain	15	40.6	9	60	6	40
Sensory symptoms	28	66.7	16	57.1	12	42.9
Spasticity	19	45.2	11	57.9	8	42.1
Limb weakness	21	50	13	61.9	8	38.1
Limb deformity	1	2.4	0	0	1	100
Cerebellar signs	2	4.8	2	100	0	0

Table 4: Distribution of study subjects as per surgical procedure.

Surgical procedure	Number	%
Duraplasty (group A)	24	57.1
No duraplasty (group B)	18	42.9
Total	42	100

Table 4 shows distribution of study subjects as per surgical procedure. Out of a total of 42 patients studied in the present study, 24 were operated by duraplasty technique. They were labeled as group "A". 18 patients were operated by non duraplasty group and they were labeled as group "B".

Table 5: Distribution of study subjects as per choice of grafts in patients underwent duraplasty (N = 24).

Type of graft	Number	%
G patch	14	58.3
Autologus graft	10	41.7
Total	24	100

Table 5 shows distribution of study subjects as per choice of grafts in patients underwent duraplasty. Out of 24 patients operated using duraplasty technique, G patch was used in 14 cases i.e. 58.3% of the cases. Autologus graft was used in 10 patients i.e. 417% of the cases.

Table 6 shows efficacy of duraplasty procedure compared to non-duraplasty procedure. This table shows the comparative efficacy of the two techniques used in the present study. It was found that clinical improvement was significantly more in duraplasty group compared to non duraplasty group. It was found that Improvement in sensory symptoms was significantly more in duraplasty group compared to non duraplasty group. It was found that Improvement in spasticity was significantly more in duraplasty group compared to non duraplasty group. It was found that Improvement in limb weakness was significantly more in duraplasty group compared to non duraplasty group. But in terms of complications, improvement in the neck pain, improvement in the limb pain, both the groups were comparable.

DISCUSSION

Majority of the study subjects were found to be present in the age group of 20-30 years i.e. 35.7% followed by the age group of 30-40 years i.e. 26.2%. Arnautovic A et al, did an extensive review of demographics of patients diagnosed with Chiari I malformation published in various articles from 1965 to 2013 and found that the

median age of adult patients was 40.5 years with a range of 37 to 45.3 years and in pediatric patients it was 8 years with a range of 6 to 10.5. Overall age of presentation was analyzed to be 35 years with a range of 27.3-40 years.[10] These finding was consistent with the data in our series which showed most of the patients were in their 2nd or 3rd decade at the time of presentation. An Indian series of 75 cases published in 2017 also showed a similar mean age of 35 years.[11]

Table 6: Efficacy of duraplasty procedure compared to non-duraplasty procedure.

Parameters		Duraplasty group	Non duraplasty group	Chi square	P value
Complications	Yes	5	1	2.29	0.065
	No	17	17		
Clinical improvement	Yes	20	10	3.889	0.024
	No	4	8		
Improvement in neck pain	Yes	8	4	0.207	0.324
	No	1	1		
Improvement in headache	Yes	5	2	1.905	0.083
	No	0	1		
Improvement in limb pain	Yes	8	5	2.637	0.052
	No	0	2		
Improvement in sensory symptoms	Yes	13	6	3.548	0.029
	No	2	7		
Improvement in spasticity	Yes	9	4	4.55	0.016
	No	1	5		
Improvement in limb weakness	Yes	11	3	7.87	0.002
	No	1	6		

There was a slight male preponderance (56%) in present series. Arnautovic et al, analysis of 145 articles showed an overall female dominance in both adult and pediatric series.[10] But our observation was in accordance with Ramnarayan R et al, study.[7]

The most common presenting complaint in our series was sensory disturbance which was seen in 28 patients (78.13%). This was consistent with the findings of two Indian series, Ramnarayan R et al, noticed sensory disturbances in 62% of their patients and B.D Bharath Singh N et al, who noticed 68% of their patients presented with sensory complaints.[7,11]

Many articles in the literature report headache and neck pain as the most common presenting complaint. Authors noticed neck pain in 14 patients (33.33%), which was the fifth most common complaint in our series. The most common sign was limb weakness seen in 21 patients (50%). Zhao JL et al, stated that treatment of choice is Foramen magnum decompression.[12] But Schijman E et al, observed that it can be done with duraplasty or without dural opening as an alternative.[13]

Out of the 42 cases in our series 24 cases underwent Foramen magnum decompression along with dural opening and duraplasty. 18 cases were operated by bony decompression alone with no duraplasty and were grouped as group A and group B respectively. Some complications known are leakage of cerebrospinal fluid, meningitis, pseudomeningocele etc.[14]

Complications seen in our series were CSF leak seen in 5 patients of Group A and surgical site infection seen in one patient of group B. Although, there were more complications in the duraplasty group statistical analysis showed this was not significant. Krishna V et al, stated that the rate of complication is low but recurrence rates are high.[15]

In present series, a one year follow up of the patients showed an overall clinical improvement of 83.33% in the duraplasty group compared to a lower overall clinical improvement rate of 55.55% in the no duraplasty group. This difference was noted to be statistically significant (p value). With the above data we are able to conclude that although higher complication rate is seen in patients undergoing duraplasty, the overall clinical improvement of patients is better when compared to non-duraplasty group. This notion is also supported by Zhao JL et al, who did a meta-analysis of 18 articles which included a total of 1242 patients.[12] However, there is a subset of patients who showed clinical improvement in the non duraplasty group as well. This was seen particularly in symptoms like neck pain (80% of the patients showed improvement).

Therefore, the technique of bony decompression alone cannot be completely ruled out especially considering the fact that present study conclusions are made from a very small series of patients of whom majority were retrospectively analyzed. Thus, further larger series of prospective randomized control studies are necessary before we come to a final conclusion is this aspect.

CONCLUSION

Foramen magnum decompression with duraplasty is superior to foramen magnum decompression without duraplasty although slightly higher rate of complication is seen with duraplasty. Selected patients do have a benefit with foramen magnum decompression alone and further prospective randomized control studies are needed for better understanding.

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