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Comparison of Hip Spica for Duration of 12 Weeks versus 8 Weeks Post-DDH Corrective Surgery in Clinical Outcomes

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ABSTRACT

Objectives: To compare the outcomes of hip spica application for twelve versus eight weeks after performing corrective surgery for developmental dysplasia of hip. **Study design:** Quasi-experimental study. **Place and Duration of the study:** Pak-Emirates Military Hospital, Combined Military Hospital, Rawalpindi from April-2024 to February-2025. **Methodology:** A total of 64 patients who underwent corrective surgery for developmental hip dysplasia were included. Based on duration of hip spica, they were divided into Group-A (12 weeks) and Group-B (8 weeks). Outcomes were compared between groups using clinical (Bhatti & Mckay) and radiological (Severin) scoring systems. Data was analyzed using SPSS version 22. **Results:** In this study, 64 patients were included divided into two groups. Median age was 17.00 (19.00 – 13.00) months. There were 17 (26.56%) male and 47 (73.44%) female children. Amongst all patients with DDH, 43 (67.19%) had unilateral while 21 (32.81%) had bilateral deformity. There was no statistically significant difference in the clinical outcomes based on BFSS (p = 0.510) and Mckay criteria (p = 0.685) between groups. There was no statistically significant difference in the radiological outcomes based on Severin classification (p = 0.281). Frequency of AVN in Group-A (n = 32) was 12 (37.50%) while in Group-B (n = 32) it was 5 (15.62%), (p = 0.048). **Conclusion:** Hip spica application for eight weeks should be preferred after performing corrective surgery for developmental dysplasia of hip.

INTRODUCTION

Developmental dysplasia of hip (DDH), is a complex deformity of acetabulum, femur hip joint. [1] It is characterized by abnormalities of the hip joint ranging from minor hip joint instability to complete joint dislocation that results eventually in development of early osteoarthritis necessitating total replacement surgery. [2, 3] Globally, the prevalence of DDH has been reported to range from as low as 0.5% to as high as 30%. [4]

There are several risk factors that are associated with developing hip dysplasia including positive family history, female gender and breech presentation. [5] Amongst these, positive family history is the strongest one as it also increases the risk of early development and rapid progression of osteoarthritis in the affected joint. [6] Pathophysiology of DDH involves in utero interference with proper contact between femur and acetabulum that leads to chronic changes that results in further prevention of proper contact and relocation of femur head. [7] Diagnosis of DDH involves combination of clinical examination tests, ultrasonography, x-rays, modern radiological imaging and arthrography. [7]

When it comes to management of DDH, at early ages management involves use of orthosis, specifically the Pavlik harness, however, when age is more than six months hip joint corrective surgery followed by hips spica cast immobilization is performed. [7, 8] Although it is a useful method, yet ideal timing for which hip spica casting immobilization should be kept in place is not determined. In fact, currently neither the local studies have been performed in this regard nor any specific guidelines exist in this regard till date. Additionally, even at global level, such comparative studies are scarce. Therefore, to answer this important research question present study was conducted with the aim of comparing the outcomes of hip spica application for twelve versus eight weeks after performing corrective surgery for DDH.

METHODOLOGY

This two phase quasi-experimental study was conducted at Pak-Emirates Military Hospital (PEMH), Combined Military Hospital, Rawalpindi from April-2024 to February-2025 after getting approval from institutional ethical committee (Ref No: 802). Sample size was

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calculated through World Health Organization (WHO) calculator and sample size was obtained through following formula:

$$n = \frac{\left\{ z_{1-\alpha/2}\sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)} \right\}^2}{(P_1-P_2)^2}$$

Sample size calculation was performed by using level of significance 5%, power of 80% and anticipated frequency of avascular necrosis in shorter and longer duration groups of hip spica application of 15.8% and 48.3%, respectively. 9 This gave a sample size of 64 (32 in each group). Study sample was selected by using non-probability consecutive sampling technique.

Inclusion criteria: Male and female patients, aged 12 month or more who underwent anterior approach open reduction corrective surgery at hip joint for DDH were included.

Exclusion criteria: Patients with congenital structural anomaly of the spine or brain, congenital neurological anomalies and previously operated at hip joint and previous history of hip bracing were excluded.

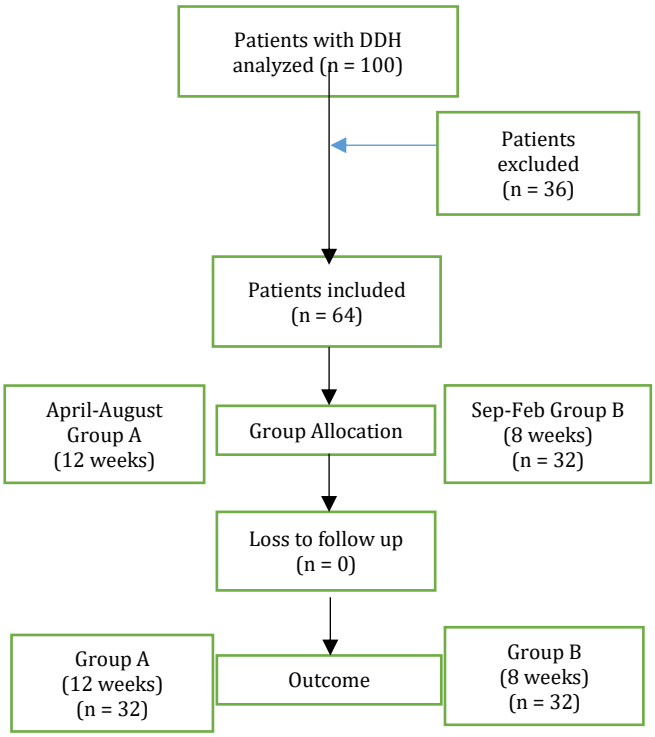
Before being included in the current research, a written consent form was signed by the parent of every patient and they were educated about the procedure. After that baseline characteristics including age, gender and laterality of DDH were documented. Group allocation was performed based on the phase of study. During the first phase extending from April-2024 to August-2024, patients were managed through longer duration of hip spica application protocol and were allocated in Group-A. During the second phase from September-2024 to February-2025, patients were managed through shorter duration of hip spica application protocol and were allocated in Group-B.

In Group-A (n = 32), hip spica immobilization was retained for a period of 12 weeks and at the end of this period, it was removed altogether under general anesthesia without performing any additional bracing of the hip joint. In Group-B (n = 32), hip spica immobilization was retained for a period of 8 weeks and was removed under general anesthesia. After its removal, an abduction brace was applied for a total period of six months. In the first month, brace application was performed for 14-18 hours in a day and from then onwards it was applied for at least 8-10 hours in a day for remaining period.

Both the groups were assessed for clinical and radiological outcomes. Clinical outcomes were assessed using Bhatti's Functional Scoring System (BFSS) and Mckay criteria. Based on BFSS, outcomes were labeled as excellent, good, fair and poor by using standard BFSS as given in a study conducted by Bhatti et al. 10 Similarly, based on Mckay criteria, outcomes were labeled as excellent, good, fair and poor by examining patients based on set criteria. 11 Finally, the radiological outcomes were determined based on Severin classification and was labeled as favorable if Severin class-I/II was achieved on post-spica removal assessment of the patient. 11 In addition, patients in both the groups were assessed for development of avascular necrosis of hip joint by MRI of the joint.

Figure 1

CONSORT Patient Flow Diagram



To statistically analyze the collected data, Statistical Package for Social Sciences (SPSS) software version 22 was used. Quantitative variable (age) was presented as median interquartile range (IQR) after checking normality of data by Shapiro-Wilk test which showed that it was not distributed normally. Qualitative variables (gender, laterality, outcome and occurrence of AVN) were presented as frequency and percentages. Outcomes and occurrence of AVN were compared between longer and shorter duration groups using Chi-square test. A p-value of ≤ 0.05 was considered as statistically significant.

RESULTS

In this study, 64 patients were included. Median age was 17.00 (19.00 – 13.00) months. There were 17 (26.56%) male and 47 (73.44%) female children. Amongst all patients with DDH, 43 (67.19%) had unilateral while 21 (32.81%) had bilateral deformity. These patient demographics are compared in Table 1.

Table 1

Comparison of Patient Demographics between Groups (n=64)

Parameter	Group-A: 12 weeks (n = 32)	Group-B: 8 weeks (n = 32)	p-value
Median age	17.00 (19.00–13.00) months	17.00 (19.00–13.00) months	0.962
Gender Male Female	 7 (21.88%) 25 (78.12%)	 10 (31.25%) 22 (68.75%)	0.396
Laterality Unilateral Bilateral	 10 (31.25%) 22 (68.75%)	 21 (65.63%) 11 (34.37%)	0.790

Based on BFSS, in longer duration group (Group-A), clinical outcome was excellent in 25 (78.12%), good in 5 (15.63%) and fair in 2 (6.25%) patients while in shorter duration group (Group-B), clinical outcome was excellent

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in 21 (65.63%), good in 7 (21.87%) and fair in 4 (12.50%) patients, (p = 0.510). Clinical outcomes based on BFSS are compared between groups in Table 2

Table 2

Comparison of Clinical Outcomes between Groups Based on BFSS (n = 64)

Outcome	Group-A: 12 weeks (n = 32)	Group-B: 8 weeks (n = 32)	p-value
Excellent	25 (78.12%)	21 (65.63%)	0.510
Good	5 (15.63%)	7 (21.87%)	
Fair	2 (6.25%)	4 (12.50%)	

Based on McKay's criteria, in longer duration group (Group-A), clinical outcome was excellent in 23 (71.88%), good in 7 (21.67%) and fair in 2 (6.25%) patients while in shorter duration group (Group-B), clinical outcome was excellent in 21 (65.63%), good in 7 (21.87%) and fair in 4 (12.50%) patients, (p = 0.685). Clinical outcomes based on McKay's criteria are compared between groups in Table 3:

Table 3

Comparison of Clinical Outcomes between Groups Based on McKay's Criteria (n = 64)

Outcome	Group-A: 12 weeks (n = 32)	Group-B: 8 weeks (n = 32)	p-value
Excellent	23 (71.88%)	21 (65.63%)	0.685
Good	7 (21.67%)	7 (21.87%)	
Fair	2 (6.25%)	4 (12.50%)	

Based on Severin classification, in longer duration group (Group-A), favorable radiological outcome was achieved in 29 (90.62%) patients while in shorter duration group (Group-B), it was achieved in 26 (81.25%) patients, (p = 0.281). Radiological outcome is compared between groups in Table 4

Table 4

Comparison of Radiological Outcome between Groups Based on Severin Classification (n = 64)

Favorable outcome	Group-A: 12 weeks (n = 32)	Group-B: 8 weeks (n = 32)	p-value
Yes	29 (90.62%)	26 (81.25%)	0.281
No	3 (9.38%)	6 (18.75%)	

Frequency of AVN in Group-A was 12 (37.50%) while in Group-B it was 5 (15.62%), (p = 0.048). Frequency of AVN between groups is compared in Table 5:

Table 5

Comparison of Frequency of AVN between Groups (n = 64)

AVN*	Group-A: 12 weeks (n = 32)	Group-B: 8 weeks (n = 32)	p-value
Yes	12 (37.50%)	5 (15.62%)	0.048
No	3 (62.50%)	27 (84.38%)	

* Avascular necrosis

DISCUSSION

DDH is a congenital abnormality in the structure of the hip joint that can be corrected easily if managed in the earlier part of life but a success rate ranging as high as 87%, however, it becomes increasingly difficult to manage once the child grows older. [12, 13] In such cases, surgical correction and hip spica immobilization becomes a necessity for effective management of this condition. [14, 15] Present study focused on on one of the very important aspect of this procedure i.e., the duration for which hip spica is retained in place.

In present study, average age of the patients at the time of corrective surgery was 17 months. Although, there is no consensus on the ideal age for performing corrective surgery for DDH in previous literature, yet it is known that once a DDH patients is older than the age of six months, surgical correction becomes a necessity. [16] Upon analysis of distribution of this condition between the two genders, it was observed that 73.44% of the DDH sufferers were females. Compared to this, a study was conducted by Bhatti et al. [17] who reported that females are affected by this condition three times more than males and the frequency of DDH sufferers being females in their study was 72.6%. This female predominance is attributable to the female gender being a known risk factor for developing this condition. [18] However, in one study conducted by Zeb et al. [19] it was observed that there was a slight male predominance in this regard with males forming 55.8% of DDH sufferers. This difference may have occurred due to an unfortunate discrepancy of healthcare seeking practices by parents for their male and female children in Pakistan. Upon analysis of laterality of the disease, unilateral DDH was observed to be more prevalent rather than the bilateral deformity. This predominance of DDH being unilateral has been reported by Bhatti et al. [17] and Gancer et al. [20] in accordance with the findings of present study.

Upon analysis of the outcomes of longer versus shorter duration of hip spica retention after performing DDH corrective surgery, it was observed that there was no statistically significant difference in the clinical outcomes based on BFSS (p = 0.510) and Mckay criteria (p = 0.685). Similarly, frequency of achievement of Severin class-I/II was also statistically similar between groups (p = 0.281). The only difference was in frequency of AVN which was statistically higher in longer duration group compared to shorter duration group (p = 0.048). When it comes to this specific comparison, despite extensive literature search on PubMed, Google Scholar, MedLine, Scopus, Researchgate and Cochrane library, only one study was found that addressed this specific comparison. In this study which was conducted by Emara et al. [9] it was observed that, similar to the results of current study, there was no significant difference in the two different approaches of retaining hip spica immobilization in terms of Mckay criteria (p = 0.612) and Severin classification (p = 0.449) but the frequency of AVN was significantly higher in association with longer hip spica retention (p = 0.015).

In one study conducted by Yasin et al. [20], it was found that retaining hip spica in place for 12 weeks (longer duration) after DDH corrective surgery yielded favorable outcomes in 83% of the patients which was comparable to the present study. In another study conducted by Venkatadass et al. [21], success rate of the conventional approach of longer retention of hip spica for 12 weeks was only 50% which was much lower than present study but this difference can be attributed to difference in the age group of treated children with DDH. In a study conducted by Matsushita et al. [22], success rate of 8 weeks of retention of hip spica was studies and it was observed that in 83.9% of the patients Severin class-I/II was achieved which is comparable to present study. In another study, shorter duration of immobilization yielded favorable outcomes in 90% of the

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patients. [23]

Both the approaches have their own pros and cons with longer duration providing significant medical expenses reduction for not having to use hip braces and providing excellent to good functional outcomes but it does so at the cost of higher chances of developing avascular necrosis. On the other hand, shorter duration also provides equally good outcomes and reduces the chances of AVN but repeated brace application and multiple hospital visits not increases the medical expenses bit adds to the anxiety and distress of parents and their child. Based on the results of present study, however, it is evident that shorter duration of hip spica retention is an equally effective and safer approach than the conventional practice of retaining immobilization for a period of twelve weeks. It is therefore recommended that shorter duration of retention followed by hip bracing should be adopted as a preferred management protocol for DDH patients.

Limitations

Only short-term assessment of the functional outcomes and complication was performed. Additionally, patients aged more than 24 months were also not made part of this study.

CONCLUSION

In conclusion, both the approaches are equally effective in managing patients with DDH and thus traditional approach of longer retention of hip spica can be replaced by shorter retention period approach.

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