ORIGINAL ARTICLE

# RISK FACTORS LEADING TO DEVELOPMENTAL COMPLICATIONS AFTER OPEN REDUCTION IN DEVELOPMENTAL DYSPLASIA OF HIP

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**Background:** The developmental dysplasia of the hip (DDH) is regarded as one of the commonest congenital deformities. Its incidence has been estimated to be one in 60 live births according to some estimates. Different forms of treatment modalities have been suggested and their success depends on the age of the patient. The study was done with the objectives to observe the post-operative complications of open reduction in patients with DDH and to determine the possible risk factors associated with these complications. **Methods**: A total of 60 patients were enrolled with DDH in this descriptive cross-sectional study from August 2013 to November 2015. After obtaining an informed consent, the patients underwent open reduction and in some cases, subsequent osteotomy. The patients were followed-up at three months intervals for at least 9 months to look for development of complications, if any. **Results**: The mean age of the patients was 31.32±2.52 months. Majority 45 (75%) of the study population was female. The most common complication observed was osteonecrosis (5 patients; 8.33%) followed by residual dysplasia and re-dislocation in 3 (5%) patients each. Infection was identified as a complication in 2 (3.33%) patients. When stratified with complications of open reduction, female sex and bilateral hip involvement were found to have a significant association with the development of complications. **Conclusion**: Female sex and bilateral hip involvement confer a greater risk of developing a complication following open reduction for DDH.

**Keywords**: Developmental Dysplasia of Hip, Open reduction, Osteotomy, osteonecrosis, re-dislocation.

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## INTRODUCTION

The developmental dysplasia of hip (DDH) is also known as congenital dislocation of hip. The earliest accounts of DDH in the literature date back to the era of Hippocrates[1], who described DDH in the following words, "There are persons who, from birth or from disease, have dislocations outward of both the thighs; in them, then, the bones are affected in like manner, but the fleshy parts in their case lose their strength less; the legs, too, are plump and fleshy, except that there is some little deficiency at the inside, and they are plump because they have the equal use of both their legs, for in walking they totter equally to this side that.[2] More often than not, conflicting terms have been used for this order, making discussions of this disorder more difficult.[3]

However, DDH is usually used in context of the instability of the hip joint, dislocation of the acetabulum or dysplasia of the acetabulum.[3] Although the aetiology of this condition is still unclear despite recent advances in its management, a number of associated factors have been identified.[4] These include female sex[5], breech presentation in utero[6], being female and born in breech position[7], being a Laplander or Native American[8,9]. Other risk factors include oligohydramnios[10], torticollis[10], metatarsus adductus[11] and the cultural practice of swaddling[12].

The incidence of DDH has been reported to be as high as 1 in 60 newborns.[13] There are different approaches the management of DDH and these depend on the age of the patient as well as the likelihood of success of a particular approach.3 Patients up-to the age of 6 months are treated with Pavlik's harness, patients aged 6–24 are best managed by closed reduction and patients with DDH older than 24 months are usually treated by open reduction and/or femoral shortening and/or pelvic osteotomy.[13]

As is the case with other procedures, there are certain complications of open reduction of DDH and these include, among others, re-dislocation, osteonecrosis of proximal femur and residual dysplasia.14,15 The aim of this study was to observe the post-operative complications of open reduction in patients with DDH and to determine the possible risk factors associated with these complications.

## MATERIAL AND METHODS

This descriptive cross-sectional study was conducted in the department of orthopaedics, Ayub

Teaching Hospital Abbottabad from August 2013 to November 2015.All these patients had been admitted to the hospital for open reduction of DDH. An informed consent was obtained from the patients before surgical procedure which consisted of open reduction in most cases. In some cases, open reduction was followed by osteotomy. Hip joint was accessed using anterior approach in which employed percutaneous tenotomy to release the adductor longus muscle, and intramuscular tenotomy to release the iliopsoas muscle at the pelvic brim. The hip joint was exposed as a result of an incision made parallel to the acetabular margin. Space for reduction was created after transection of transverse ligament and the soft-tissue blocking the intra-articular space was removed. After reduction of the femoral head, interrupted sutures were used to repair the joint margin to secure open reduction. In some patients, osteotomy was required in addition to the above process.

After surgery, bilateral spica cast was applied to the patients for six weeks. The hips of the patients were maintained in flexion at 30 degrees and 45 degrees in abduction. Patients were followed up at 3 months interval for 9 months. At each follow up visit, pain at the hip joint, the presence of limping and the range of motion at the hip joint were noted. In addition to the presence of re-dislocation, other complications that were noted were Presence of infections, avascular necrosis of the hip and residual dysplasia. Involvements of the right side of the hip as well as bilateral hip involvement were considered as risk factors for development of complications of open reduction for DDH.

## RESULTS

A total of 60 patients were treated for DDH using open reduction. 15 were males and rest of 45 were females. Mean age of the study participants was 31.32±2.52 months. Minimum age was 28 months while the age of the oldest patient was 36 months. The most common complication was osteo-necrosis which was found in 5 (8.33%) patients. It was followed by re-dislocation and residual dysplasia found in 3 (5%) patients each. Post-operative wound infection was found in 2 (3.33%) patients (Table-1). Right sided involvement was seen in 17 (28.33%) patients. Presence of post-operative complications was found to be significantly associated with female gender and involvement of both hips. No significant association was found between involvement of right hip involvement and presence of post-operative complications in patients with DDH. (Table-2 & 3)

**Table-1: Sex of study participants**

| Sex | Frequency | Percent |
|---|---|---|
| Male | 15 | 25.00 |
| Female | 45 | 75.00 |
| **Total** | 60 | 100.0 |

**Table-2: Frequency of different complications of open reduction**

| **Osteonecrosis** | **Frequency** | **Percent** |
|---|---|---|
| Yes | 5 | 8.33 |
| No | 55 | 91.67 |
| Total | 60 | 100.0 |
| **Re-dislocation** | **Frequency** | **Percent** |
| Yes | 3 | 5.00 |
| No | 57 | 95.00 |
| Total | 60 | 100.0 |
| **Infection** | **Frequency** | **Percent** |
| Yes | 2 | 3.33 |
| No | 58 | 96.67 |
| Total | 60 | 100.0 |
| **Residual Dysplasia** | **Frequency** | **Percent** |
| Yes | 3 | 5.00 |
| No | 57 | 95.00 |
| **Total** | 60 | 100.0 |

**Table-3: Hip involvement in study population**

| **Right Sided Involvement** | **Frequency** | **Percent** |
|---|---|---|
| Yes | 17 | 28.33 |
| No | 43 | 71.67 |
| Total | 60 | 100.0 |
| Bilateral Hip Involvement | Frequency | Percent |
| Yes | 28 | 46.67 |
| No | 32 | 53.33 |
| Total | 60 | 100.0 |

**Table-4: Association of complications with sex, and involvement of hip in study population ($p \leq 0.05$)**

| **Complications** | **Sex** | | **Total** | ***p* value** |
|---|---|---|---|---|
| | **Male** | **Female** | | |
| Yes | 7.00 | 6.00 | 13.00 | 0.01 |
| No | 8.00 | 39.00 | 47.00 | |
| Total | 15.00 | 45.00 | 60.00 | |
| **Complications** | **Right sided involvement** | | **Total** | ***p* value** |
| | **Yes** | **No** | | |
| Yes | 6.00 | 7.00 | 13.00 | 0.11 |
| No | 11.00 | 36.00 | 47.00 | |
| Total | 17.00 | 43.00 | 60.00 | |
| **Complications** | **Bilateral Involvement** | | **Total** | ***p* value** |
| | **Yes** | **No** | | |
| Yes | 11.00 | 2.00 | 13.00 | 0.002 |
| No | 17.00 | 30.00 | 47.00 | |
| Total | 28.00 | 32.00 | 60.00 | |

## DISCUSSION

The study was done to observe the post-operative complications of open reduction in patients with DDH and to determine the possible risk factors associated with these complications. At the third follow-up, good clinical and radiographic results had been observed in 80% and 82% patients respectively. These results confirmed the findings reported elsewhere that open reduction was an effective method of treatment of DDH after 24 months.[15] A vascular necrosis of hip was the most common complication, noted in 5 (8.33%) patients. It was followed by residual dysplasia and re-dislocation in 3 (5%) each. It is believed that vascular injury or added pressure over the head of the femur results in avascular necrosis of the femur.16 A number of factors have been identified that may contribute to the development of osteonecrosis or avascular necrosis of femur and these include, age of the patients, magnitude of displacement, application of inadequate traction before reduction, the status of immobilization and treatment method.[17–20] Although it has been suggested

the incidence of post-operative avascular necrosis can be reduced by application of traction before commencement of open reduction[15], we did not attempt to investigate the role of pre-procedure traction in prevention of avascular necrosis. In contrast to our results, reduced rates of osteonecrosis have been reported with the application of pre-procedure traction in a study where only 8.1% hips had shown evidence of osteonecrosis after application of a 2 weeks skin traction before open reduction and hip osteotomy.[21] We feel the need of a well-designed study that should aim to investigate the potential benefits of pre-procedure traction on the clinical outcomes of open-reduction with or without hip osteotomy.

A recently published study from India reported outcomes of open reduction of DDH in 35 children.[22] The study population comprised of 35 children with unilateral DDH who were treated for DDH using the standard approach for open reduction. After the procedure the children were followed up for at least 2 years. The researchers reported no re-dislocations in the study population. The researchers didn't also comment on the incidence of avascular necrosis or residual dysplasia in that study.[22] One of the limitations of this study was that the follow-up period was short. It is quite possible that some of these patients may develop delayed complications of the procedure with the passage of time. However, a study by Sankar and colleagues reported that re-dislocation occurred after a mean period of 124 days after initial open reduction.14 The authors went on to identify bilateral hip involvement, greater pelvic width and a right hip involvement in DDH as the main risk factors leading to re-dislocation after initial open reduction.

## CONCLUSIONS

The results of our study point to female sex and bilateral hip involvement as the risk factors for development of complications after open reduction.

## AUTHOR'S CONTRIBUTION

MNR, MY, MS: Literature search, data collection, write-up. MNR, MY: Performed surgeries, MW, MIA, write-up and data collection

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