

Outcome of one stage combined open reduction, pelvic and derotation femoral osteotomy in congenital dislocated hips of children younger than three years age

Anisuddin Bhatti, Jagdesh Kumar, Siraj Ahmed Butt

Abstract

Objective: To determine the outcome of one-stage combined operative management of congenital dislocation of hips in children aged 18-36 months.

Methods: The descriptive case series study was conducted at the Department of Orthopaedic Surgery, Jinnah Postgraduate Medical Centre, Karachi, from January 2005 to December 2011. Children aged 18-36 months suffering from congenital dislocation of hips were included. Those with Tonnis stage III and IV were managed with one-stage operative procedure without preliminary traction. The operative procedure included adductor tenotomy, open reduction, capsulorrhaphy, Salter's osteotomy and a femoral derotation osteotomy. Catterall's 'Test of Stability' was used after open reduction as an indicator for need of pelvic and femoral osteotomies. Follow-up ranged between 1 and 7 years. The patients were evaluated clinically on McKay's criteria and radiologically on Severin's criteria. Klisic's overall rating was used to know mean of the assessments.

Results: There were 38 patients with 50 congenital dislocations of hip. There were 26(68.42%) females and 12(31.57%) males with a female-to-male ratio of 2:1. Mean age at the time of operation was 24.26±7.6 months. Of the total, 12(31.57%) patients had bilateral involvement, 11(28.94%) had right-sided and 15(39.47%) had left-sided involvement. Right side to Left ratio was 1:1.2. At the time of last follow-up, 25(50%) hips behaved excellent on McKay's criteria. According to radiographic classification on Severin's criteria, 24(48%) hips were in excellent class. Avascular necrosis of femoral head was noted in 3(6%) hips, re-subluxation/re-dislocations were observed in 3(6%) hips and 1(2.6%) patient had 1cm femoral lengthening.

Conclusion: One-stage open reduction, capsulorrhaphy, Salter's osteotomy and femoral derotation osteotomy without preliminary traction to re-locate congenital dislocation of hips in late presenting children is a safe and highly effective method. It produces a low rate of complication and need for repeat surgery. It reduces the cost of treatment, minimises socio-economic burden and psychological trauma incurred by lengthy hospitalisation of treatment with traction followed by closed reduction.

Keywords: Avascular necrosis, Congenital, Dislocation, Hip, Operative treatment, Femoral osteotomy, Salter's osteotomy, Derotation, Femoral osteotomy. (JPMA 64: 1015; 2014)

Introduction

The treatment of developmental dysplasia of hip (DDH) aims at reducing and maintaining the anatomical concentric reduction. The major objective is to provide an atmosphere of mutual growth-stimulating effect of femoral head to acetabulum and to allow the effective remodelling of hip. The ultimate aim is to achieve a normal hip at adulthood. This objective can best be achieved when anatomical reduction is achieved before reaching the "Golden Period"¹ of age i.e. before 18 months. Unfortunately in our country, the early detection of DDH is merely a dream due to home deliveries, lack of screening programmes in maternity homes, and practice of "Swathering".² Dislocation is usually discovered late when the child starts to walk and shows a limp. Even if

DDH is detected before that age, it is either neglected or improperly managed by kumbhars (potters),² and also sometimes treated without standard protocol or left halfway treated. Therefore, when the parents seek treatment, it is often too late and it then needs major surgical intervention due to adaptive shortening of the extra-articular soft tissues, acetabular dysplasia, and increasing femoral anteversion. Without additional procedure of femoral or pelvic osteotomy, they rarely yield a normal hip at adulthood.³⁻⁶ The preliminary gradual abduction traction before a major surgical intervention or closed reduction has been advocated by some investigators without subsequent convincing evidence. Furthermore, a high rate of beneficial and successful results are seen in global literature when pelvic or femoral osteotomies are combined with primary open reduction.⁷⁻⁹

In our setup, where we receive a majority of children with congenital dislocation of hips (CDH) after walking age,

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Department of Orthopaedic Surgery, Jinnah Postgraduate Medical Centre, Karachi, Pakistan.

Correspondence: Anisuddin Bhatti. Email: dranisbhatti@gmail.com

only 2-3 specific studies are available. Therefore, we need more studies to strategise future guidelines. The study registered a series of 210 cases of DDH and CDH. Among this series study, three reports on CDH in age group 3 years to 13 years have been previously published.^{2,9,10} The report based on results in the age group 18 months to 3 years is presented here. It will help determine the outcome of one-stage operative management of CDH in children and will provide useful data to compare with other published reports of the same age group.

Patients and Methods

The prospective case series study was conducted at the Department of Orthopaedic Surgery, Jinnah Postgraduate Medical Centre (JPMC), Karachi, and those patients operated during January 2005 to December 2011 were included. During the study period, 50 hips with CDH in 38 children of age group 18-36 months were registered and the follow-up was continuing in January 2014. Children with CDH Tonnis stage III & IV¹¹ were managed with primary one-stage operative procedure without preliminary abduction traction. Children who had previously undergone a failed surgery or having paralytic, teratologic, pathological, traumatic dislocations and a follow-up duration of less than a year were excluded from the study. The study was approved by the institutional review board and informed consent was obtained from respective parents. Pre-operative clinical data along with parent's home address, phone numbers were entered in specially-designed proforma to ensure long-term follow-up.

The operative procedure which included adductor tenotomy, open reduction, capsulorrhaphy and Salter's osteotomy through iliofemoral approach was carried out in all except 4 patients who were operated without Salter's osteotomy. A distal femoral derotation osteotomy was performed in 34 cases, and proximal derotation varus osteotomy through a small lateral thigh incision was performed in 4 cases of children above 30 months of age, having tight reduction (Tonnis Stage IV). The Catteral's 'Test of Stability'¹² was used after open reduction, which was the main indicator for the need of the pelvic and femoral osteotomies. The femoral head was reduced deep in true acetabulum, fixed with transfixation K-wire (1.5mm), placing femoral neck parallel with transcondylar axis. Salter's osteotomy with wedge-shaped bone graft and distal femoral osteotomies were fixed with two 1.5mm K-wires and proximal femoral osteotomy was fixed with small fragment dynamic compression plate (DCP). A double leg Spica cast was applied for a total of 12 weeks. The first cast was changed under general anaesthesia at 5th-6th week along with the removal of all K-wires. In bilateral CDH cases, second hip was operated in the same

sitting and anaesthesia session. After the removal of cast at 3 months, children were allowed protected mobilisation, without orthosis and physiotherapy. DCP for fixation of proximal derotation femoral osteotomy was removed after 8 months.

All patients were evaluated after minimum of 12 months and for the maximum duration of seven years after surgery. The assessment was made clinically by using McKay's criteria¹³ and radiologically by using the Severin's criteria.¹⁴ Klisic's Overall rating¹⁵ by combining both clinical and radiological results was used to achieve mean of assessments. Final results were labelled as 'excellent' when both clinical and radiological gradings were excellent, 'good' when both were good, 'fair' when both were fair, and 'poor' when either clinical grading or radiological grade was poor.

Results

Of the 38 patients, 26(68.42%) were female and 12(31.57%) were male; 12(31.57%) had bilateral involvement; 11(28.94%) had right-sided and 15(39.47%) had left-sided involvement. Mean age at the time of



Figure-1A: Pre-operative AP-Xrays of 24 months aged girl with right sided CDH Tonnis stage IV and acetabular index over 40°.

Table: Clinical and Radiological Evaluation of Results with Klisic Overall Rating [Patient] %.

Grade	Mckay's Clinical Criteria	Severin Radiological Criteria	Overall Rating
Excellent	[25] 50%	[24] 48%	24.5 (49%)
Good	[15] 30%	[14] 28%	14.5 (29%)
Fair	[8] 16%	[9] 18%	8.5 (17%)
Poor	[2] 4%	[3] 6%	2.5 (5%)
Total	[50] 100%	[50] 100%	50 (100%)

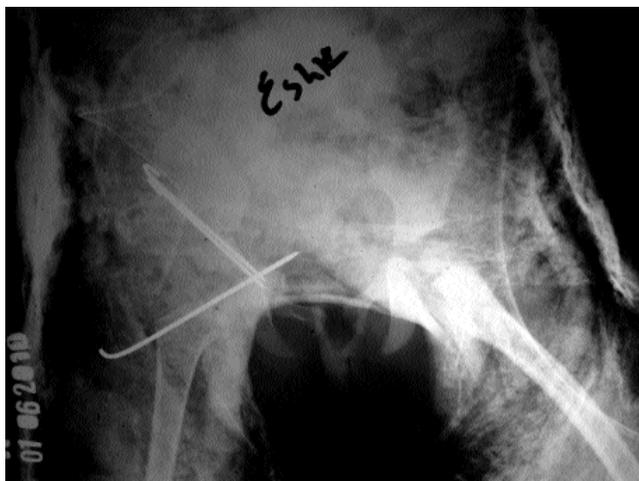


Figure-1B: Immediate Post operative AP-Xrays of 20 months aged girl with right sided CDH Tonnis stage IV, operated with Open reduction, Capsuloraphy, Salter's osteotomy & distal derotation osteotomy. Transarticular K-wire stabilization of hip and Salter's Osteotomy and good initial reduction is appreciated.



Figure-1D: Post operative Lateral -Xrays of same patient with right sided CDH Tonnis stage IV, operated with Open reduction, Capsuloraphy, Salter's osteotomy & distal derotation osteotomy. 48 months follow-up showing excellent containment of hip, acetabular index as equal to normal side and well developed hip. Clinically too she achieved an excellent score.



Figure-1C: Post operative AP-Xrays of same patient with right sided CDH Tonnis stage IV, operated with Open reduction, Capsuloraphy, Salter's osteotomy & distal derotation osteotomy. 48 months follow-up showing excellent containment of hip, acetabular index as equal to normal side and well developed hip. Clinically too she achieved an excellent score.



Figure-2 A: Pre-operative AP Xrays of 18 months aged girl with bilateral CDH Tonnis stage III, Acetabular index over 500 on both sides.

operation was 24.26 ± 7.6 months (range: 18-36 months). At the time of last follow-up (range: 1-7 years), 25(50%) hips behaved 'excellent' on McKay's criteria, 15(30%) behaved 'good' and 8(16%) 'fair'; while 2(4%) hips behaved 'poor' (Table). According to Severin classification, 24(48%) hips were in 'excellent' class, 14(28%) in 'good' and 9(18%) 'fair'; while 3(6%) hips were in 'poor' class. On Klisic's Overall rating, 24.5 (49%) hips achieved 'excellent' results, 14.5 (29%) 'good' and 8.5 (17%) 'fair', whereas 2.5

(5%) resulted 'poor'.

Figure-1 represents the height of dislocation at Tonnis level IV¹¹ and acetabular index over 40° on right side compared to 18 degrees on normal side in a two year aged patient. Figure-1B appreciates temporary trans-articular K-wire stabilization of open relocated hip, Salter's innominate osteotomy and good initial reduction. Figure-1CD appreciates the excellent containment, acetabular index 18° equal to normal side and development of the hip at four-year follow-up. Figure-2AB shows Tonnis level



Figure-2B: Pre-operative Lateral Xray of same patient with bilateral CDH Tonnis stage IV, compared to Tonnis III on AP Xray, Acetabular index over 50° on both sides.



Figure-2C: Post op Xrays of same patient with bilateral CDH Tonnis stage III, both hips operated under single anaesthesia with Open reduction, Capsuloraphy, Salter's osteotomy & distal derotation osteotomy. 30 months follow-up showing excellent containment of hip, acetabular index 17° and well developed acetabulum. Clinically too she achieved an excellent score.

III¹¹ dislocated hips on both sides, with an acetabular index over 50° in an 18 months aged patient. Figure-2C appreciates excellent contained hips, acetabular index 17° and a well developed hip at 30 months follow-up.

Subluxation/re-dislocation was observed in 3(6%) hips. The pelvic osteotomy was not done in these three patients, as reduction was stable at the time of open reduction. Later, after the removal of transfixation pins,

these three hips subluxated and these patients responded well to Salter's osteotomy as a secondary procedure. Avascular necrosis (AVN) of femoral head was noted in 3(6%) hips. The AVN was in fact the continuation of less developed/very small femoral head pre-operatively in 2 hips. Moreover, only one hip of bilateral CDH case developed AVN post-operatively. This patient, too, redeveloped femoral head in the next six-year follow-up, with coxa magna and minor flattening of central part of femoral head, and behaved clinically 'fair' on that side and 'excellent' on the other side.

Discussion

The successful treatment of CDH depends on concentric initial reduction, its maintenance in a stable position without interference of the blood supply, and an ultimately good remodelling of the hip.⁷ The results of CDH treatment are directly proportional to the age at the time of initial treatment.⁹ Treatment of CDH for these late-presenting children of walking age and older is a challenge, as closed or open reduction alone has not proven efficient in achieving successful results. Literature emphasises on additional procedures of femoral and pelvic osteotomy due to soft tissue contractures and structural abnormalities leading to subsequent dysplasia or subluxation. A high rate of very good results are reported with addition of pelvic or femoral osteotomies to open reduction.^{4,6,11,16,17} One study⁶ reported 86% clinical and 85% radiological excellent to good results in 23 hips in the age group from 1 year to 4 years treated with open reduction combined with femoral and/or pelvic osteotomies. One study,¹⁷ in its small series of 9 hips in 8 patients of similar age group carried out the procedure of simultaneous open reduction and Salter innominate osteotomy, which reported nearly similar 88.88% excellent results. Whereas one study¹⁸ reported little less; 77% clinical and 73% radiological good results in 33 hips of 25 older children with similar combined procedure. However, another study⁴ reported 100% clinical and 92% radiological good to excellent results in age group of 12 to 36 months. It combined Pemberton osteotomy (55%) when the anterolateral coverage of the femoral head was inadequate preoperatively, femoral derotation in 85% and femoral shortening in 4% cases. Similar one-stage combined procedures in same age groups like that study⁴ were adopted in the current study. However, our results were a little less than others,^{4,6,17} but nearly similar to some others.^{12,18,19} We have tried our best in surgery to avoid causing damage to vascularity, labrum and to reduce hip without enforcing tightness or pressure on the femoral head as has been advised in literature.¹⁹ Hence, we did not find significant AVN except in one. One study¹⁹

based on 1-55 months age group reported that spontaneous development of deep acetabulum can be achieved if the femoral head is maintained in centric reduction without abnormal pressure at any point and by avoiding frequent surgeries to construct the shelf. This, the study said, would allow the nature to play its role in the development of deep acetabulum around the 12th year of age. By this age, Morrison's epiphysis appears at the superior and posterior rim of the acetabulum.¹⁹ Our study shows the spontaneous mutual growth-stimulating effect of concentric reduction (Figure-1C). Another study¹² compared results in various age groups and indicated progressively deteriorating results with increasing age i.e. with addition of every two years at presentation. It reported in a classical review based on long term follow-up, considering age at operation as a significant prognostic factor, 94% acceptable radiological results in younger (<2 years age) children, 80% in age group 2-4 years and 71% acceptable results in children >4 years age and lower incidence of AVN and late growth disturbance in age group <2 years. We always operate bilateral CDH under single anaesthesia to minimise hospitalisation, psychological impact on patient/parents, expenditure and use of medicine (Figure-2). A transfixation K-wire 1.5mm was used to stabilise femoral head in the true acetabulum in almost every hip and a DCP to osteosynthesis proximal femoral osteotomy in children over 30 months of age. Similar to literature²⁰ we did not find any deleterious effect of K-wire as well with DCP in a single case (Figures-1, 2). The other important finding in this study was rapid development of caput femoris epiphysis which had not yet appeared at the time of surgery in the three youngest children and similar was the observation of an earlier study.²¹ The one-stage combined procedures in older age group reported earlier^{2,3,7,9,10,22} and others in younger age groups^{4,7,12,19} revealed clinically better results than radiological. It has been emphasised and concluded by these reports that what looks odd on X-ray i.e. superio-lateral acetabular irregularity (Figure-1C, D and 2C), has no significant bearing on clinical results. Till re-subluxation and AVN development, premature epiphyseal fusion, which leads to short femoral neck and partially uncovered femoral head due to less effective development of acetabulum, as seen in our two cases, have been reported previously.^{9,12} This acetabular irregularity, as noticed in our previous reports,^{9,10} has been known to disappear with well-contoured acetabulum on >10 years follow-up.¹⁹ Two hips in this study that went to re-subluxations, where one of them was associated with AVN, had no pelvic osteotomy at primary procedure. They required secondary procedure of Salter's osteotomy. This further supports the claim of

addition of pelvis osteotomy, especially in those hips that have stable hip on Catteral's test of stability,¹² in position of flexion, abduction and internal rotation. Both the hips achieved good overall rating with recovery from AVN with coxa magna and comparable wide acetabulum on long term follow-up of 5 and 6 years. One case in this study had bilateral dislocation, Tonnis stage IV, and was operated with open reduction, capsuloraphy and Salter's osteotomy which developed re-subluxation Tonnis III stage on the left side. Five months after surgery, this patient was re-operated with capsuloraphy, Salter's osteotomy and distal derotation osteotomy at age 27 months that did not achieve the desired result. Therefore, she needed another operation with proximal derotation osteotomy and Chiari's displacement osteotomy at the age of 5 years. By this time she was diagnosed on re-evaluation to have hyperlaxity syndrome which had not been diagnosed earlier. This girl at seven years follow-up (age 9.5 years) had excellent hip on the right side, but had clinical score fair and radiological rating good on the left side. At 7.5-year follow-up she still walks with hyperlordosis, squats with support, and has developed bilateral pes-plano valgus deformity as well. However, her hips are contained well.

AVN of femoral head is one of the most serious complications in the treatment of CDH and inevitably results in deformity and late degenerative arthritis.²² The major causes of AVN of femoral head are excessive pressure on the cartilaginous femoral head due to tight reduction of high displacement of the hip and contracted soft tissues in older children.⁸ The vascular compromise of femoral head may also be caused due to excessive abduction and internal rotation during the maintenance of reduction in Spica cast or injury to circumflex artery while cutting the transverse acetabular ligament. The reported incidence of AVN following open reduction with femoral or pelvic osteotomy varies from 7% to 22%.^{12,17,19,23-25} However, we were fortunate to have AVN in only 3(6%) hips which may be due to our extra-conscious attitude of reduction at ease and maintaining hip in Spica cast at 25o abduction, neutral rotation and extension i.e. the position of weight-bearing. Two of our 38 patients had femoral shaft fracture a few weeks after the removal of cast. Two others had a minor wound infection that settled after it was treated as required, without significant bearing on ultimate results. None of our cases who reached over 3-4 year follow-up developed femoral shortening. However, one of our patients developed 1cm lengthening and that has also been reported by a few studies.^{6,7}

There were few limitations of this study that include short

period of follow-up ranging from 1 to 5 years in majority cases, lack of good record-keeping, and lack of compliance on the part of parents who failed to ensure proper rehabilitation in post-cast period.

Conclusion

One-stage open reduction, capsulorrhaphy, Salter's osteotomy and femoral derotation osteotomy without preliminary traction to re-locate CDH in late-presenting children is a safe and highly effective method. It produces a low rate of complications and reduces the cost of treatment, minimises socio-economic burden and psychological trauma incurred by lengthy hospitalisation by treatment with traction followed by closed reduction.

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