

Outcome analysis of congenital dislocation of knee treated with serial casting

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Abstract

Background: Congenital Dislocation of the Knee (CDK) is a rare birth abnormality. It may be associated with conditions like Arthrogyrosis, spinal dysraphism, Larsen's, Beal's or Ehler Danlos' syndromes & with other deformities like developmental dysplasia of the hip or clubfoot. There are several differences of opinion regarding the management of this condition. Serial casting is a primary line of management for this condition which if started early can give good results & might avoid surgical intervention.

Objective: This study aims to study the functional outcome of Congenital Dislocation of the Knee treated with serial casting.

Materials and Methods: This was a prospective study of 3 Newborn babies with Congenital dislocation of knee at a Tertiary Care Hospital. All 3 children were treated with serial casting with above knee cast with increasing degree of knee flexion. Regular follow up was done. Investigations were done to rule out syndromic associations. Initial conservative management was planned.

Results: Mean follow up was 16 months. All 3 babies showed >90 degree of knee flexion with stable knee & 5/5 Quadriceps strength & thus had Excellent results. No surgical intervention was required.

Conclusion: Congenital Dislocation of the knee is a rare abnormality, for which primary line of treatment is serial casting & follow up. If failed or with poor results, surgical intervention can be planned. Early detection of other abnormalities & syndromic associations is of utmost importance.

Keywords: Knee dislocation, genu recurvatum, knee hyperextension, serial casting

Introduction

Congenital dislocation of the knee (CDK) is a rare birth abnormality with incidence of 1/1,00,000. It is thought to be a result of abnormal fetal positioning ^[1]. Unilateral CDK may occur as an isolated condition or may be associated with neurologic conditions like Arthrogyrosis or spinal dysraphism or cerebral palsy. Bilateral CDK is almost always

syndromic¹ & maybe associated with laxity syndromes like Beal's, Larsen's, Down's, Ehler Danlos' syndromes. It may be associated with other musculoskeletal anomalies like Developmental Dysplasia of the Hip (DDH) or clubfoot^[2, 3, 4].

The underlying pathology may include Quadriceps fibrosis & shortening^[2, 5], tight anterior capsule, insufficient or absent cruciate ligaments^[6], anterior subluxation of posteromedial & posterolateral structures including hamstring tendons & Iliotibial band, atrophy of suprapatellar pouch & adhesions.

The diagnosis can be done immediately after birth by the position of the knee which is in hyperextension with the foot presenting at the mouth or shoulder of the infant¹ with variable restriction of flexion of the knee. It can be confirmed by radiographs^[2].

CDK has been classified into 3 grades¹ as given in Table 1:

Table 1: Grading of CDK

Grade 1	Congenital Hyperextension of the knee	- Knee flexes & reduces with gentle stretching of the quadriceps
Grade 2	Congenital Subluxation of the knee	Knee doesn't flex beyond neutral ('flexible' variant) Femoral & tibial epiphyses are in contact & do not subluxate with attempted flexion
Grade 3	True Congenital Dislocation of the knee	- Knee flexion not possible Tibia is anteriorly translated in resting position & displaces laterally over the femur with attempted vigorous flexion

The primary line of management for patients presenting early after birth is conservative with manipulation & serial plaster cast application. Femoral nerve block with local anaesthetic or quadriceps block with Botulinum toxin type A may allow correction of deformity in severe quadriceps contracture that prevents reduction^[1].

In cases where nonoperative management fails or is insufficient, late presentation, or syndromic associations operative management can be considered. The commonly performed surgeries include V-Y Quadricepsplasty as described by Curtis & Fischer^[2] or Percutaneous Quadriceps Release as described by Roy & Crawford⁷. These surgeries can be done as early as 6 months. Some cases with Anterior Cruciate Ligament (ACL) insufficiency or absence may require an additional ACL reconstruction which can be done by antegrade IT band transfer as described by Insall^[8].

The present study aims to study the outcome of early serial casting in CDK.

Objectives

This study aims to study the functional outcome of Congenital dislocation of the knee treated with serial casting.

Materials and Methods

This was a prospective study done at a tertiary care hospital. 3 cases of Congenital Dislocation of the knee were included in the study. The children when presented were thoroughly examined. The degree of hyperextension & degree of active & passive flexion of the knee was noted. Any Spinal dysraphism, associated hip dislocations, club foot, ligamentous laxity or any other syndromic associations were looked for. Radiographs were taken. The cases were clinically classified into 3 grades as described above & initial serial casting with above knee cast with increasing degree of flexion was planned.

Cast application was started within 2 weeks of age. Weekly follow up was done during which the cast was removed, limb examined. Range of motion was noted. Initially the range of flexion was increased by about 10 – 20 degrees & another cast was applied. After 2 to 3 casts,

the cast was applied while keeping the knee in a maximum passive flexion that was possible. Once 90 degree flexion was achieved, 1 or 2 casts were applied after which a removable splint was used for 3 months.

After a follow up of about 1 year, the results were evaluated using the scoring system for knee function described by Ferris & Aichroth^[9] with addition of quadriceps power evaluation according to Medical Research Council (MRC) grading as described by Ahmed Omar^[10]. It is as described in the Table 2:

Table 2: Evaluation of results of treatment of CDK

Grade	Range of flexion	Stability/Pain	Quadriceps power
Excellent	Full range	Stable Pain free	5/5
Good	>90 degree	Slight instability or pain	≥3/5
Fair	Between 45 & 90 degree	Mild instability or pain	≤2/5
Poor	<45 degree	Gross instability or pain	≤2/5

Results

The patient demographics & outcomes were as shown in the Table 3.

Among the 3 cases 2 were females & 1 was a male child. All 3 were Left sided deformities. 1 case was grade 3 dislocation while 2 were grade 2 dislocations. 1 case presented within 2 days of birth. Other 2 children presented within 1 week after birth. 2 cases were born by full term vaginal delivery with cephalic presentation, while 1 child was full term child delivered by caesarean section done due to breech presentation & pre-eclampsia in the mother. Cast application was started within 2 weeks in all 3 cases. The cases required an average of 5.6 casts (range 5 to 6). Weekly follow up was done till the period of cast application, followed by monthly follow up till 6 months & 3 monthly follow up thereafter. The mean follow up was 16 months (Range 15 to 18 months).

Manipulation & plaster cast application was successful in all the 3 cases. It required about 4 to 5 casts to achieve flexion more than 90 degree. The mean arc of Range of Movements attained was about 125 degree (Range 120 to 130 degree). All the 3 knees were stable. The quadriceps strength was 5/5 in all 3 cases. Thus, all the 3 cases showed Excellent results.

No other musculoskeletal deformities, other anomalies or any syndromic associations were found in any of the 3 cases. None of the cases had any extensor lag. All the 3 cases had achieved developmental milestones appropriate for the age.

All the 3 children were standing & walking without support or brace.

Table 3: Showing the details of the patients

Sl. No	Age at presentation	Sex	Side	Grade	Severity	Delivery/ presentation	Associated condition	No. of casts	Follow up (months)	Functional outcome
1	2 days	F	L	3	Dislocation	FTVD/ Cephalic	-	6	18	Excellent
2	1 week	F	L	2	Subluxation	FTVD/ Cephalic	-	6	15	Excellent
3	1week	M	L	2	Subluxation	LSCS/ Breech	-	5	15	Excellent

F-Female, M-Male, L-Left, R-Right, FTVD- Full Term Vaginal Delivery, LSCS -Lower Segment Caesarean Section



Fig 1a



Fig 1b



Fig 1c



Fig 1d



Fig 1e

Fig 1 (a, b, c, d & e): Initial presentation (clinical & Radiological)



Fig 2a



Fig 2b

Fig 2 (a, b): Serial casting: 2 & 4 week follow up



Fig 3a



Fig 3b

Fig 3(a & b): 3 month follow up showing >90 degree flexion



Fig 4a

Fig 4b

Fig 4c

Fig 4 (a,b & c): 1 year follow up

Discussion

Congenital Dislocation of the Knee is a rare condition. Early detection & early initiation of treatment is important. Prenatal diagnosis with ultrasonography is also possible [11]. It may be associated with conditions like DDH, clubfoot, Larsen's, Down's, Beal's, Ehler Danlos' syndromes, arthrogyriposis, spinal dysraphism etc. Evaluation of other systems should also be done.

The primary line of management is conservative, with manipulation & serial plaster cast application. Forceful flexion of the knee should not be done due to the chances of causing iatrogenic fractures, physal injury or circulatory disturbance. The success rate of conservative management has been variable with different authors reporting different success rates [12, 13, 14].

The common indications for surgical management have been failure of conservative management. The reasons for failure may be late presentations, multiple joint involvement, syndromic associations etc.

Many surgical techniques have been described. Curtis & Fischer [2], in 1969, described V-Y Quadricepsplasty & anterior capsulotomy with an anterolateral approach. Roy & Crawford [7] described a method of percutaneous quadriceps release with stab incisions. In 2015 Shah [15] described a percutaneous needle tenotomy of the quadriceps tendon in cases of 'flexible' variant i.e., grade 2 CDK. It was done at the mean age of 14.5 days of birth. In cases with ACL insufficiency, Insall [8] described a technique of ACL reconstruction by antegrade transfer of the Iliotibial band.

The most common complication after surgeries has been found to be Quadriceps weakness & extensor lag. Quadriceps tendon lengthening & prolonged immobilization of the knee in flexion might weaken the abnormal muscle resulting in extensor lag.

The treatment of other associated deformities is also important. In associated Congenital talipes equinovarus (CTEV), simultaneous correction of the deformity can be done with Ponseti [16] method of casting. If associated with developmental dysplasia of the hip, the commonly followed protocol has been to correct the deformity of the knee before the hip as the use of hip spica cast or Pavlik harness becomes more convenient if the knee can be flexed to 90 degree [17, 18].

Limitations of the study

Our study had a few limitations. CDK being a rare disease with low incidence, the sample size of our study was small. There was no comparison group. Statistically significant results could not be drawn from the study.

Conclusion

CDK is a rare abnormality, for which primary line of management is serial casting with increasing flexion. If failed or with poor results, surgical intervention can be done. Early detection of other abnormalities & syndromic associations is of utmost importance.

Abbreviations

ACL: Anterior Cruciate Ligament

CDK: Congenital Dislocation of Knee

CTEV: Congenital Talipes EquinoVarus

DDH: Developmental Dysplasia of Hip

FTVD: Full Term Vaginal Delivery

LSCS: Lower Segment Caesarean Section

MRC: Medical Research Council

References

1. Tachdjian's Pediatric Orthopaedics 5th Ed.
2. Curtis BH, Fisher RL. Congenital hyperextension with anterior subluxation of the knee. *J Bone Joint Surg (Am)*. 1969;51:255-269.
3. Johnson E, Audell R, Oppenheim WL. Congenital dislocation of the knee. *J Pediatr Orthop*. 1987;7:194-200.
4. Nogi J, MacEwen GD. Congenital dislocation of the knee. *J Pediatr Orthop*. 1982;2:509-513.
5. Laurence M. Genu recurvatum congenitum. *J Bone Joint Surg (Br)*. 1967;49:121-134
6. Katz MP, Grogono JS, Soper KC. The etiology and treatment of congenital dislocation of the knee. *J Bone Joint Surg (Br)*. 1967;49:112-120.
7. Roy DR, Crawford AH. Percutaneous quadriceps recession: a technique for management of congenital hyperextension deformities of the knee in the neonate. *J Pediatr Orthop*. 1989;9:717-719.
8. Windsor RE, Insall JN. Bone-block iliotibial band reconstruction for anterior cruciate insufficiency. Follow-up note and minimum five-year follow-up period, *Clin Orthop Relat Res*. 1990;250:197.
9. Ferris B, Aichroth P. The treatment of congenital knee dislocation. A review of nineteen knees. *Clin Orthop Relat Res*. 1987;216:135-140.
10. Ahmed Omar Youssef, MD. Limited Open Quadriceps Release for Treatment of Congenital Dislocation of the Knee. *J Pediatr Orthop*; c2017.
11. Rossig S, Lazovic D, Ruhmann O. [Ultrasound imaging of congenital knee joint dislocation. Value in diagnosis and therapy]. [Article in German]. *Ultraschall Med*. 1998;19(5):234-40.
12. Haga N, Taniguchi K, Iwaya T. Congenital dislocation of the knee reduced spontaneously or with minimal treatment. *J Pediatr Orthop*. 1997;17:59-62.
13. Laurence M. Genu recurvatum congenitum. *J Bone Joint Surg Br*. 1967;49:121-134.
14. Cheng CC, Ko JY. Early reduction for congenital dislocation of the knee within twenty-four hours of birth. *Chang Gung Med J*. 2010;33:266-273.
15. Shah NR, Limpaphayom N, Dobbs MB. A minimally invasive treatment protocol for the congenital dislocation of the knee. *J Pediatr Orthop*. 2009;29:720-725.
16. Laaveg SJ, Ponseti IV. Long-term results of treatment of congenital club foot. *J Bone Joint Surg Am*. 1980;62:23-31.
17. Iwaya T, Sakaguchi R, Tsuyama N. The treatment of congenital dislocation of the knee with the Pavlik harness. *Int Orthop*. 1983;7:25-30.
18. Naik PV. Orthopaedic challenges in Asia. Management of congenital knee dislocation. *Curr Orthop Pract*. 2013;24:43-48.