Outcome of adductor tenotomy in children with spastic cerebral palsy at Soba University Hospital

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Abstract

Introduction: Cerebral palsy (CP) is a common neurodevelopmental condition that causes physical disability during childhood. Its spastic type accounts for 70% of cases. Adductor tenotomy, as one of the useful surgical procedures that solves many of the problems that interfere with daily activities of the patient and with personal hygiene. Moreover, the procedure reduces the tendency of lateral displacement of the femoral head and prevents subluxation and painful dislocation.

Objective: to assess the outcome of adductor tenotomy in children with spastic CP who presented to Soba University Hospital (SUH) with hip adduction deformity from 2003 to 2013.

Methods: Records of all patients of CP at SUH were reviewed, for demographic characteristics, pattern of presentation, and degree of disability. Preoperative and postoperative physical and functional status was reviewed.

Results: Forty-two (out of 224) patients with CP underwent surgery and were included in this study. Their age group ranged between 21 months and 15 years (mean age 7.73 years). Females constituted 54.8%, 23 of the 42 patients. Twenty-eight patients (66.7 %) were diaplegic. All the 42 patients underwent a standard adductor tenotomy. Four factors were found to be statistically significant in improving the postoperative physical status after the surgery; these were type of spastic CP, the preoperative physical status, Reimers Index and the mental status.

Conclusion: Adductor tenotomy is a useful operation in CP patients. It improves walking abilities; Gross Motor Function Classification System (GMFCS), Reimer's index and range of abduction.

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Introduction

Cerebral palsy(CP) is a neurodevelopmental condition that describes a group of permanent disorders of the development of movements and posture, causing activity limitation, that are attributed to non-progressive disturbances in the developing foetal or infant brain[(1)].

Prevalence of CP was estimated to range from 1.5 to more than 4 per 1,000 live births, males were reported to be more affected than females[(2)]. There is no cure for CP, thus motor disability persists throughout the life span and affects the normal development processes altering its presentation over the time[(3)].

Adduction of the hip is the most common deformity in children with CP[(4)]. It leads to adduction contractures which result in scissoring of the legs during walking, hip subluxation and dislocation. In severe cases it interferes with personal hygiene. Mild contracture is usually treated by tenotomy of the Adductor Longus, while severe contractures often require more extensive release to include the Gracilis and the anterior one half of the Adductor Brevis. Adductor Tenotomies are usually performed bilaterally to prevent a "windswept" pelvis which occurs with scoliosis and dislocated hip in these patients [(5)].

A valid and reliable method of assessment of functional limitations in children with CP uses

the Growth Motor Function Classification System (GMFS) for children up to 12 years. The GMFCS classifies functional limitations into five levels; level I: mild affection, can achieve most of the activities with only modest qualitative differences. On the other extreme, level V, includes patients who have little ability to control their head and trunk posture with severe motor impairment [6]. The main objective of this study is to evaluate the functional outcome following adductor tenotomy in Children with CP treated at Soba University Hospital.

Methods

This is a descriptive, retrospective study of children with spastic CP who presented with a hip adduction deformity at the department of paediatric orthopaedics Soba University Hospital. Children who had previous surgery at the same site and/or any other co-morbidity with the CP were excluded. Demographic characteristic of the patients, together with many factors that affect the postoperative outcome such as type of spastic CP, preoperative physical status and Reimer's Index (RI) and mental status were collected, analysed and reviewed. GMFCS was used to evaluate the outcome. It has five levels. As general headings, those in level I walk without limitations; in level II they walk with limitations; in level III, they walk using a hand-held mobility device; in level IV they have a self-mobility device with limitations with a probability of using powered mobility and in level V they are transported in a manual wheel-chair[7]. We considered level I and II as walkers, level III and IV as assisted walkers and level V as non-walkers. Mental retardation or intellectual disability is classified into mild (IQ = 50-55 to 70), moderate (IQ = 35-40 to 50-55) and severe or profound (< 35-40). This classification of mental retardation depends on educational level, adaptive skills and intensity of support required[8]. All patients underwent standard adductor tenotomy, Adductor Longus, Adductor Brivis and Gracilis.

Results

Out of 224 children who presented with CP to the clinic, 42(18.7%) had adduction deformity that necessitated adductor tenotomy. Twenty three (54.8%) were females and 19 (45.2%) were males. Twenty eight (66.7%) were diaplegic and 14 (33.3%) were quadriplegic. Their ages ranged between 21 months and 15 years with a mean age of 7.37 years (Table 1).

Table 1: Age distribution of patients with spastic CP (n=42)

Age group	No of patients
1 – 4 years	9(21.42%)
5 – 9 years	25(59.52%)
10 – 15 years	8(19.06%)
Total	**42(100%)**

Physical status of the 42 patients is shown in Table 2. There were 2 walkers, 12 assisted walkers and 28 non walkers before surgery. After the operation 11 became walkers, 22 became assisted walkers and 9 remained as non-walkers. (P-Value 0.000).

Regarding the effect of age on the outcome, of the nine patients who were four years or less, before the surgery seven were non-walkers and two were assisted-walkers, after the surgery, one became walker, 4 became assisted-walkers and four remained non walkers. Out of the 25 patients who were between five and nine years, before the surgery 15 were non walkers, eight were assisted walkers and two were walkers. After surgery, eight became walkers, 14 became assisted-walkers and three remained non-walkers. Of the eight patients who were between 10 and 15 years, before surgery, six were non-walkers and two were assisted-walkers. After surgery, one became walker, five became assisted-walkers and two remained non-walkers (Table 2).

Table 2. Outcome of adductor tenotomy in CP patients (n=42)

Age group	Preoperative				Postoperative			
	Non walkers	Assisted. Walkers	walkers	Total	Non walkers	Assisted. walkers	walkers	Total
0 - 4	7	2	0	9	4	4	1	9
5 - 9	15	8	2	25	3	14	8	25
10 - 15	6	2	0	8	2	5	1	8
Total	**28**	**12**	**2**	**42**	**9**	**23**	**10**	**42**

Of the 42 patients 14 were quadriplegic and 28 were diaplegic. Of the 14 quadriplegic, (Fig.1), none was walker before the tenotomy, two were assisted walkers and 12 were non-walkers. After the operation, eight became assisted walkers, six remained non walkers (p value 0.001). Of the 28 diaplegic (Fig. 2), before the operation, two were walkers, eight were assisted walkers and 18 were non walkers. After the operation 11 became walkers, 14 became assisted walkers and three remained non walkers (p value 0.001).

Postoperative outcome of physical activity in relation to mental status is shown in (Figs. 3, 4 and 5). Of the 42 patients, preoperative Reimers Index (RI) showed 14 to be normal, 12 hips were hip at risk, 12 were subluxed and 4 had dislocated hips. Postoperative status showed 37 normal hips and 5 at risk (p value 0.012) (Fig. 6).

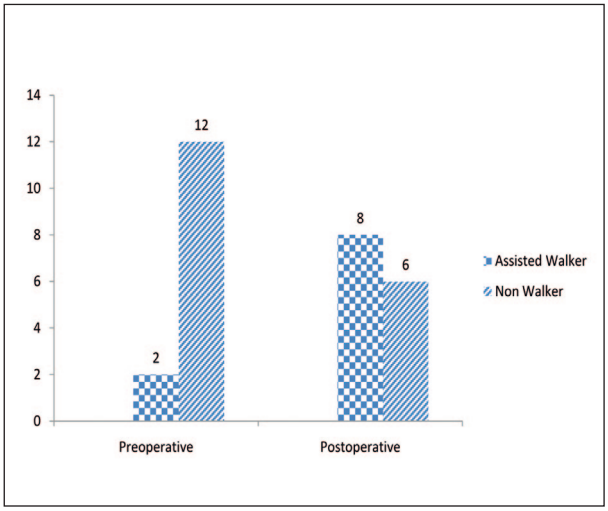

Fig.1 Preoperative and postoperative walking status of 14 quadriplegic patients. (pvalue 0.001)

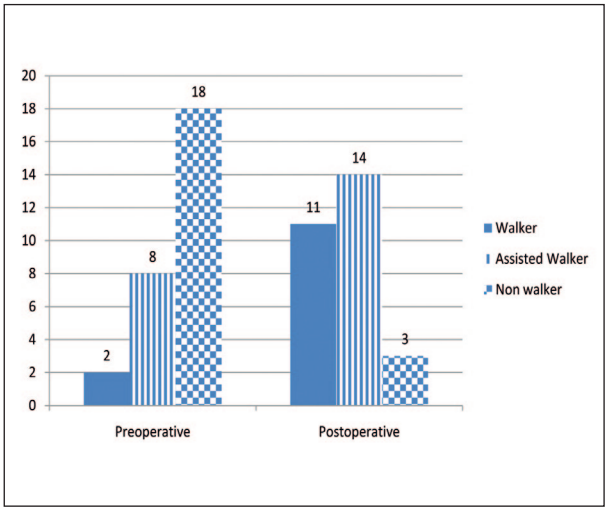

Fig 2 Preoperative and postoperative walking status of 28 diplegic patients. (p value 0.001)

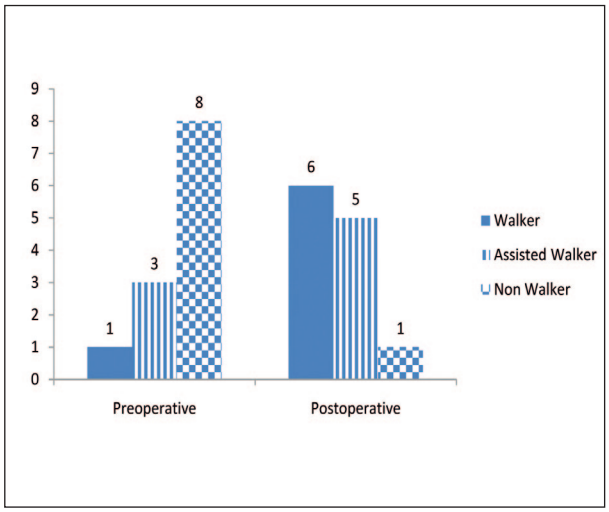

Fig 3 Preoperative and postoperative walking status of 12 patients with mild mental retardation.

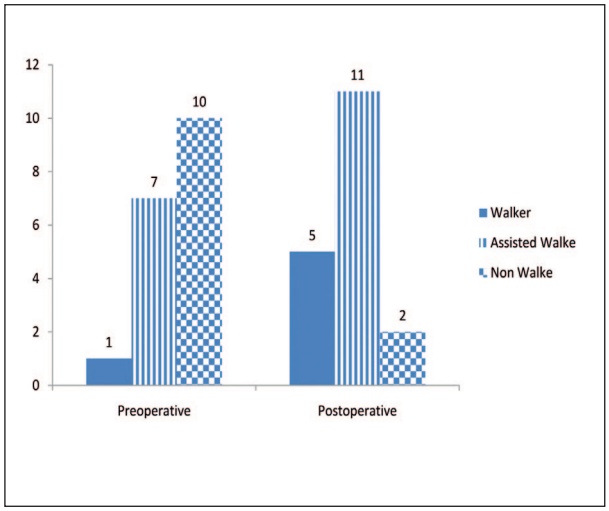

Fig. 4. Preoperative and postoperative walking status of 18 patients with moderate mental retardation.

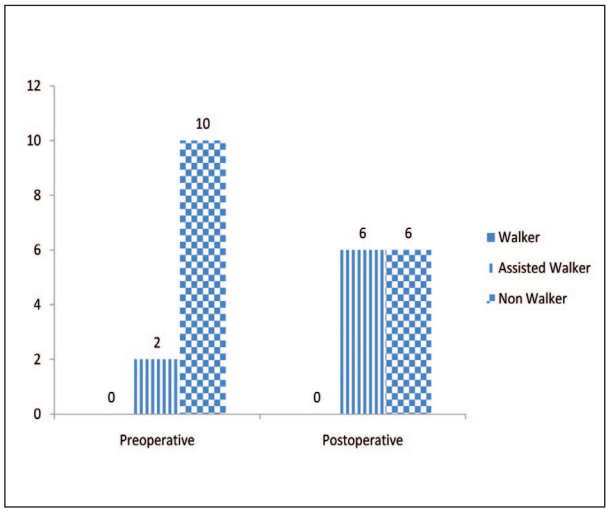

Fig 5: Preoperative and postoperative walking status of 12 patients with severe mental retardation p-value = 0.001

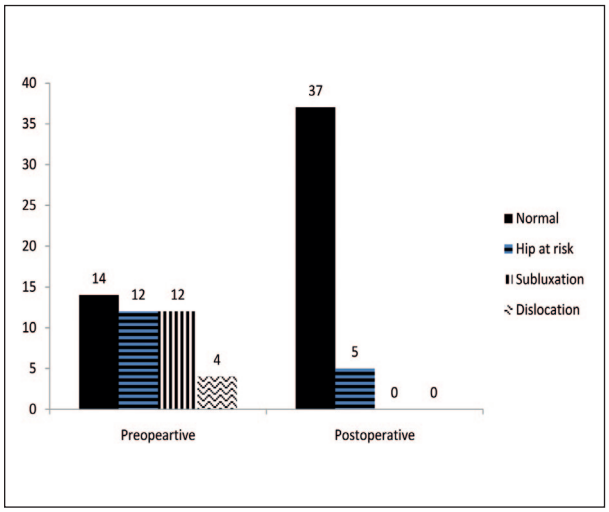

Fig. 6 Preoperative and postoperative Reimers index in 42 patients (p-value 0.012).

Before the adductor tenotomy, 29 of the 42 patients had a range of abduction from 0-10 degrees and 13 had 11-20 degrees. After surgery 19 patients had 31-40 degrees range of movement and 23 had 41-50 degrees (p-value 0.012).

Discussion

Spastic adduction of the hip joint in children with CP is a disabling deformity that interferes with functional performance and personal hygiene. In addition, it leads to hip subluxation and dislocation[1].Reports in the literature state that, adduction deformity is usually diagnosed between two and four years of age[4]. In the present series, 33 patients more than four years old were operated on, and the operative results in these were more satisfactory than the operative results in nine patients who were under four years of age. These findings contradict the finding reported by Pap[9]. However other workers stated that age had no effect on the operative outcome[10,11].

Adductor tenotomy has improved the overall outcome in this series and this agrees with many similar studies[11,12]. In this current series, we found significant difference in the outcome in relation to the type of the CP; quadriplegic or diaplegic. Only 7% of the diplegics remained non-walkers after surgery, though preoperatively 42% were non-walkers. None of the quadriplec patients became an independent walker, though some non-walker

patients became assisted walkers. A similar finding was reported by other workers[13,14]. However some workers reported that the type of CP did not affect the outcome[11]. The relationship between the severity of CP and possibility of being ambulant was reported by Shore et al[15] who stated that, with severe CP affection, when really the operation is needed, the outcome will not be favourable. Pap also found a significant effect of the preoperative physical status on the outcome[9].

The present study reports the significance of the preoperative RI in relation to both; the postoperative physical status and the postoperative RI. The paradox of hip adductor surgery for children with CP is that the children who are most severely affected and who need the surgery have the poorest results[15]. Therefore; severely affected patients with hip dislocation who underwent adductor tenotomy were reported to need further bony procedures[16-18]. Many authors emphasized the value of the preoperative RI or Migration Percentage[19] as a good predictor of the physical outcome after adductor tenotomy[19, 20].

It was reported that adductor tenotomy is indicated when abduction is less than 45 degrees, in our series the average range of abduction before the adductor tenotomy was 1٠ degrees, and improved to become 43 degrees after the operations. A comparable result was reported by Cottelorda et al[10].

Conclusion

Adductor tenotomy is a useful operation in CP patients. It improves walking abilities; GMFCS, Reimer's index and range of abduction.

References

1. Bax M, Goldstein M, Rosenbaum P, et al. Proposed definition and classification of cerebral palsy. *Dev Medicine Child Neuro*. 2005;47:571-6.
2. Data & Statistics for Cerebral Palsy2013. http://www.cdc.gov/ncbddd/cp/data.html. Date of access 11 March 2014.
3. Damiano DL, Alter KE, Chambers H. New clinical and research trends in lower extremity management for ambulatory children with cerebral palsy. *Physical medicine and rehabilitation clinics of North America*. 2009;20:469-91.
4. Sawyer JR. Nervous System Disorders in Children, Cerebral Palsy. In: Canale ST, Beaty JH, editors. Campbel's Operative Orthopaedics. 11th edition. Philadelphia: Mosby; 2011.p.1333 – 88.
5. Persson-Bunke M, Hagglund G, Lauge-Pedersen H. Windswept hip deformity in children with cerebral palsy. *J Pediatr Orthoped B*. 2006;15:335-8.
6. Morris C. Orthotic Management of Children with Cerebral Palsy. *J Prosthet Orthot*. 2002;14:150-8.
7. Palisano R, Rosenbaum P, Walter S, Russell D, Wood E, Galuppi B. Development and reliability of a system to classify gross motor function in children with cerebral palsy. *Dev Medicine Child Neuro*. 1997;39:214-23.
8. Zeldin, A.S. and Kao, A. Intellectual Disability. emedicine.medscape.com/article/1180709-clinical. March 2014.
9. Pap K, Kiss S, Vizkelety T, Szoke G. Open adductor tenotomy in the prevention of hip subluxation in cerebral palsy. *Int Orthop*. 2005;29:18-20.

10. Cottalorda J, Gautheron V, Metton G, Charmet E, Maatougui K, Chavrier Y. Predicting the outcome of adductor tenotomy. *Int Orthop*. 1998;22:374-9.

11. Guglielmetti, L.G.B., Santos, R.M.M., De Mendonca, R.G.M.,et al. Results of Adductors Muscles Tenotomy in Spastic Cerebral Palsy. *Rev Bras Ortop*. 2010;45:420 - 5.

12. Moreau M, Cook PC, Ashton B. Adductor and psoas release for subluxation of the hip in children with spastic cerebral palsy. *J Pediat Orthoped.* 1995;15:672-6.

13. Berker N, Yalçin S. The HELP Guide to Cerebral Palsy. 2nd Ed. Seatel, Global-Help Publications. (2010).

14. Presedo A, Oh CW, Dabney KW, Miller F. Soft-tissue releases to treat spastic hip subluxation in children with cerebral palsy. *J Bone Joint Surgery Am*. 2005;87:832-41.

15. Shore BJ, Yu X, Desai S, Selber P, Wolfe R, Graham HK. Adductor surgery to prevent hip displacement in children with cerebral palsy: the predictive role of the Gross Motor Function Classification System.*J Bone Joint Surgery Am*. 2012;94:326-34.

16. Souder C. cerebral palsy-Hip conditions. http://www.orthobullets.com/pediatrics/4084/cerebral-palsy-generalAccess date March 2014.

17. Terjesen T, Lie GD, Hyldmo AA, Knaus A. Adductor tenotomy in spastic cerebral palsy. A long-term follow-up study of 78 patients. *Acta orthopaedica*. 2005;76:128-37.

18. Rolauffs B SF, Barth S, Ochs BG, et al. [Prophylaxis and therapy for hip dislocations in patients with infantile cerebral palsy (ICP): motor functional, radiological and clinical results after subcutaneous adductor tenotomy. *Z Orthop Unfall*. 2007;145:505-10.

19. Piasek R, Snela S, Rydzak B. Effectiveness of two methods of treatment of the spastic hip in CP children. *Ortopedia, traumatologia, rehabilitacja*. 2011;13:185-9.

20. Miller F, Cardoso Dias R, Dabney KW, Lipton GE, Triana M. Soft-tissue release for spastic hip subluxation in cerebral palsy. *J Pediat Orthoped*. 1997;17:571-84.