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REVIEW ARTICLE

Congenital convex pes valgus (congenital vertical talus) The condition and its treatment : A review of the literature

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Much discussion exists about the best operative technique to treat congenital convex pes valgus. In this article a table of surgical approaches and an algorithm, based upon literature review, are presented.
In our opinion the technique of choice in a child younger than 2 years of age is extensive release with lengthening of tendons and fixation procedures.
In a child over 2 years of age, extensive release with tendon transfer is the preferred procedure. When this procedure has failed, naviculectomy with extensive release and tendon transfer, or subtalar / triple arthrodesis must be considered.

Keywords : congenital convex pes valgus ; treatment ; algorithm ; literature review.

INTRODUCTION

Congenital convex pes valgus is a condition characterised by multiple soft-tissue, joint and osseous abnormalities which result in a severe rigid flat-foot deformity. It was described first by Rocher (*28*) in 1913 who called it "foot in piole". Since then many authors published about this deformity under various terminologies as "pied plat valgus congénital", vertical talus, reverse club foot, congenital valgus flatfoot, rocker-bottom foot and talipes convex pes valgus (*13, 18, 21*). Although the term congenital convex pes valgus, proposed by Lamy and Weissman (*19*), is currently preferred, Tachdjian (*32*) believes that "teratologic dorsolateral dislocation of the talocalcaneonavicular joint" more accurately directs attention to pathogenesis and therapeutic implications (*13*). Anatomical features of the deformity are a dislocated talonavicular joint, with the navicular bone lying dorsally on the neck of the talus. The talus itself lies in a plantar and medial position, almost vertically directed. The head of the talus produces a prominence on the medial side ; clinically the calcaneus produces a rocker bottom on the sole of the foot. The forefoot is dorsiflexed, abducted and everted at the midtarsal joint, and the hind foot is fixed in plantar flexion.

Congenital convex pes valgus should not be confused with other deformities of the foot, such as

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clubfoot (talipes equino-cavo-varus). The displacement of the talonavicular joint is indeed opposite in the two conditions : in club foot it is displaced downwards and medially, whereas in congenital convex pes valgus the navicular bone moves upwards and laterally to lie on the dorsum of the head of the talus. A further difference is that the elevated heel in congenital convex pes valgus is not fixed, as it is in clubfoot (*11*).

Although many surgical procedures have been described for the correction of congenital convex pes valgus, the best operative technique to treat this condition is often discussed (*21, 29, 35*). In this article an algorithm of surgical techniques, based upon a review of the literature is presented.

MATERIAL AND METHODS

PubMed was used to search for articles on surgical treatment of congenital convex pes valgus.

Articles found and reporting about the following were included : number of affected feet ; other abnormalities ; age at surgery ; surgical technique ; results and follow-up. Fifty articles were found, of which 22 (including 212 operated feet) could be used following the above mentioned criteria.

After studying the various surgical techniques in the articles, 6 main procedures were defined : 2 soft tissue and 4 bony procedures.

Age at operation (+/- 2 years), associated congenital abnormalities according to Hamanishi (*17*), surgical technique and its success rate are shown in tables I, II and III.

RESULTS

Most patients up to two years of age were operated by extensive release with tendon lengthening and fixation procedures. The average success rate with this technique was 71% (*8, 10, 12, 13, 16, 22, 29, 31, 33, 34*).

Extensive release with tendon transfer was the second most performed procedure in this age group. The average success rate in these patients was 74% (*3, 5, 6, 8-10, 12, 15, 16, 34*).

Table I. — Results in feet treated with 6 different operative techniques, in children from 0-24 months of age

0-24 months	*Age at surgery in months (range)*	*Number of feet*	*Follow-up in months (range)*	*Results*
ETLF*	9.6 (0.25-24)	78	59.3 (3-251)	55 good 8 fair 15 poor
ETT*	15.6 (5-24)	43	53.7 (8-184)	32 good 5 fair 6 poor
WN*	9.6 (9-11)	3	89 (72-120)	3 good 0 fair 0 poor
NE*	14.5 (5-24)	4	30 (24-36)	2 good 2 fair 0 poor
NERTT*	11.2 (3-18)	8	19.2 (12-48)	8 good 0 fair 0 poor
STA*	14.6 (3-24)	4	30 (24-41)	4 good 0 fair 0 poor

* extensive release with lengthening of tendons and fixation procedures (ETLF), extensive release with tendon transfer procedures (ETT), wedge from navicular (WN), naviculectomy (NE), naviculectomy, extensive release and tendon transfer procedures (NERTT), subtalar / triple arthrodesis (STA).

Table II. — Results in feet treated with 6 different operative techniques, in children older than 24 months of age

>24 months	*Age at surgery in months (range)*	*Number of feet*	*Follow-up in months (range)*	*Results*
ETLF*	40.4 (25-72)	13	76 (24-207)	6 good 3 fair 4 poor
ETT*	42 (26-84)	22	67 (12-154)	16 good 3 fair 3 poor
WN*	96	1	84	1 good
NE*	37 (32-42)	4	57 (24-96)	1 good 2 fair 1 poor
NERTT*	43.6 (25-78)	15	41.7 (18-65)	11 good 1 fair 3 poor
STA*	75 (36-156)	17	78 (12-180)	12 good 3 fair 2 poor

* extensive release with lengthening of tendons and fixation procedures (ETLF), extensive release with tendon transfer procedures (ETT), wedge from navicular (WN), naviculectomy (NE), naviculectomy, extensive release and tendon transfer procedures (NERTT), subtalar / triple arthrodesis (STA).

The other four surgical procedures, all bony procedures, were hardly used in this age group (table I) (*3, 5, 10, 11, 16, 27*).

In the group of children who had surgery over 24 months of age, extensive release with tendon transfer was the most used procedure. The average success rate with this technique was 73% (*3, 6, 8, 9, 16, 25, 34*).

Extensive release with tendon lengthening and fixation procedures scored an average success rate of 46% (*8, 10, 23, 31, 33*).

Of the bony procedures, naviculectomy with release procedures and tendon transfer, and the subtalar / triple arthrodesis, were the two most used surgeries.

The average success rate of naviculectomy with release procedures and tendon transfer was 73% at a mean age of 43.6 months at surgery (*5, 20, 27*). The subtalar / triple arthrodesis scored 71% at a mean age of 75 months at surgery (*4, 10, 23, 24, 26*).

Excision of the navicular bone or excision of a wedge from the navicular was only done in five feet (table II) (*3, 10, 35*).

The results of the soft tissue procedures compared accordingly to the accompanying congenital abnormalities are listed in table III.

Bony procedures and operations performed on children beyond 2 years of age were not included in this table due to the lack of sufficient data for a reliable analysis.

The most performed procedure was extensive release with tendon lengthening and fixation procedures. Poor results were relatively more common in children with chromosomal abnormalities.

Extensive release with tendon transfer seemed to be a superior procedure in children with neural tube defects, younger than 2 years of age.

DISCUSSION

If left untreated the condition will result in a very painful and deformed foot in adolescence. Most authors agree that the disorder should be recognised at birth and treated before the age of 2. If treatment is delayed beyond 2 years of age, more aggressive procedures must be employed (*20*).

Table III. — Results of the two soft tissue techniques in feet of children with congenital abnormalities, in the classification according to Hamanishi *(17)*

	0-24 months	*Age at surgery in months (range)*	*Number of feet*	*Follow-up in months (range)*	*Results*
Neural tube defects	ETLF*	11 (3-220)	18	72 (3-220)	10 good 3 fair 5 poor
	ETT*	23 (12-24)	9	36 (12-60)	7 good 0 fair 2 poor
Neuromuscular	ETLF*	9.6 (5-18)	5	33 (12-62)	4 good 1 fair 0 poor
	ETT*	14 (8-24)	6	51.2 (12-94)	4 good 0 fair 2 poor
Chromosomal	ETLF*	8 (6-12)	5	92.6 (28-204)	2 good 1 fair 2 poor
	ETT*	5	2	16.5 (8-25)	1 good 0 fair 1 poor
Malformation	ETLF*	11.3 (1-22)	20	58.3 (14-144)	14 good 2 fair 4 poor
	ETT*	16 (11-22)	5	79.6 (24-180)	4 good 0 fair 1 poor
Idiopathic	ETLF*	9.5 (1week-24 months)	30	53.3 (18-251)	26 good 1 fair 3 poor
	ETT*	10.3 (6-24)	11	47.9 (25-184)	9 good 2 fair 0 poor

* extensive release with lengthening of tendons and fixation procedures (ETLF), extensive release with tendon transfer procedures (ETT).

The incidence of congenital convex pes planus is < 1% of all live births *(13)*. It is more common in males than in females and frequently seen bilaterally. The deformity can be isolated or in combination with other congenital abnormalities such as cerebral palsy, myelomeningocele, arthrogryposis, scoliosis and Down's syndrome *(14,17, 21)*.

The exact aetiology of the deformity is unclear. Bohm *(2)* believes that it results from an arrest in rotational development of the foot in the second or third months of the foetal life. Stern *et al (30)* proposed transmission by an autosomal dominant trait with variable expression and incomplete penetrance. Others believe that muscle imbalance could be responsible for the condition *(9)*.

A clinical diagnosis of congenital convex pes valgus can only be confirmed radiographically. On a lateral radiograph with the foot in maximal plantar flexion, the tarsal navicular is dislocated dorsally on the neck of the talus. Forced plantar flexion

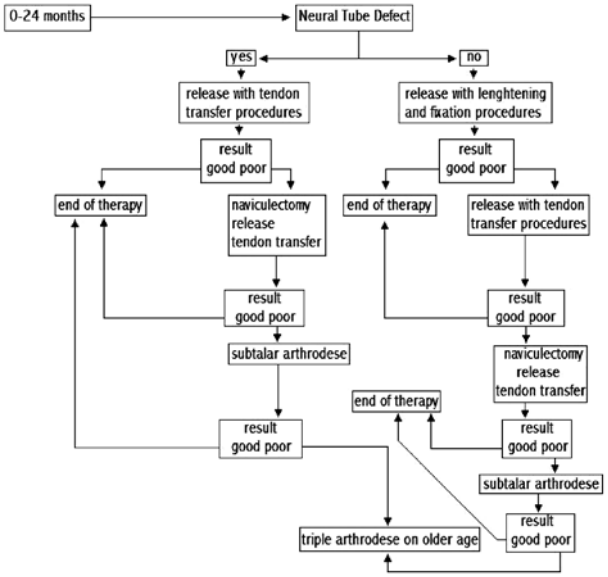

Fig. 1. — Treatment algorithm of congenital convex pes valgus in children from 0 to 24 months of age.

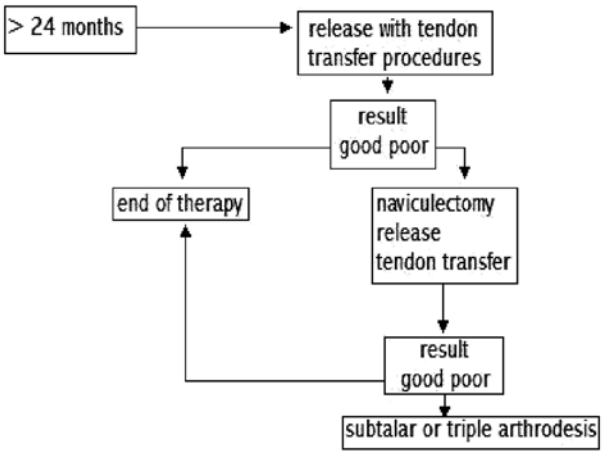

Fig. 2. — Treatment-algorithm of congenital convex pes valgus in children older than 24 months of age.

and inversion will not reduce the dislocation of the talonavicular joint and forced dorsiflexion does not bring the hindfoot out of equinus (*11, 22*).

The success rate of conservative treatment is generally poor (*1*). Many surgical procedures have been described. Most follow the principle of open reduction of the talonavicular joint with tendon lengthening and release procedures. Other procedures involve tendon transfers or total excision of the navicular or talus (*34*). As stated earlier, surgical treatment is preferred before the age of 2 years (*35*). If treatment is delayed beyond 2 years of age, more aggressive procedures must be employed. Lombardi *et al* (*20*) advocate navicular excision in patients older than 2-3 years of age. In older children procedures like subtalar or triple-arthrodesis are not uncommon.

In the literature study, the treatment was considered to be successful when postoperatively the patient had no pain on walking and the foot had a good clinical and radiographic appearance. Complications such as postoperative necrosis or the necessity of re-operation were interpreted as poor results.

Several authors reported that good results in a one-stage procedure can be obtained and that there is no need for a two-stage procedure (*22, 29*). Therefore, and because the principles of both procedures are similar, we decided not to make a difference based upon a one- or two-stage procedure.

Because congenital convex pes valgus is a rare condition, the number of patients per group are too small for a statistical analysis and are therefore hard to compare.

Nevertheless, the tables contain almost all information that can be found in the literature and used in this context.

Based on the results, the best chances for successful surgical treatment of congenital convex pes valgus can be obtained with the following treatment modalities :

In a child younger than 2 years : Extensive release with lengthening of tendons and fixation procedures. The technique has reasonable follow-up and good results. It is less invasive than the other techniques because no tendon transfers or bony procedures are needed. This could be explained by the greater adaptability of the cartilaginous structures.

In a child with a neural tube defect, younger than 2 years of age : Extensive release with tendon transfer procedures seems to be the treatment of choice. Drennan and Sharrad (*7*) suggested that neuromuscular imbalance between a weak tibialis posterior tendon and strong evertor of the foot

could be responsible for the condition. Good results can be predicted from an operation which aims to correct this imbalance by tendon transfer (*8*).

In a child older than 2 years of age : Extensive release with tendon transfer procedures is preferred. Most feet in this category were operated with this technique. The technique has reasonable follow-up and the best results. We agree with Seimon (*29*), that surgical correction becomes increasingly difficult in a child older than 2 years of age because of secondary changes of the bone. We believe as, Duncan and Fixsen (*9*), that in children whose walking and standing potential has been established, this procedure produces the best results.

We believe that bony procedures should only be considered when the former procedures have failed. There are good results reported in children of 4 years and older with these procedures.

In the even older child, or when naviculectomy with extensive release and tendon transfer procedures have failed, a subtalar or triple arthrodesis should be considered.

An algorithm based upon this literature review is presented in figures 1 and 2.

REFERENCES

1. **Becker-Anderson H, Reiman I.** Congenital vertical talus. Re-evaluation of early manipulative treatment. *Acta Orthop Scand* 1974 ; 45 : 130-144.
2. **Bohm M.** Der foetale Fuss. Beitrag zur Entstehung des pes valgus und plano valgus. *Z Orthop Chir* 1932 ; 57 : 562.
3. **Clark MW, D'Ambrosia RD, Ferguson AB.** Congenital vertical talus : Treatment by open reduction and navicular excision. *J Bone Joint Surg* 1977 ; 59-A : 816-824.
4. **Coleman SS, Stelling FH, Jerett J.** Pathomechanics and treatment of congenital vertical talus. *Clin Orthop* 1970 ; 70 : 62-72.
5. **Colton CL.** The surgical management of congenital vertical talus. *J Bone Joint Surg* 1973 ; 55-B : 566-574.
6. **Derosa GP, Ahlfeld SK.** Congenital vertical talus : The Riley experience. *Foot Ankle* 1984 ; 5 : 118-124.
7. **Drennan JC, Sharrad WJ.** The pathological anatomy of convex pes valgus. *J Bone Joint Surg* 1971 ; 53-B : 455-461.
8. **Duckworth T, Smith TWD.** The treatment of paralytic convex pes valgus. *J Bone Joint Surg* 1972 ; 56-B : 305-313.
9. **Duncan RD, Fixsen JA.** Congenital convex pes valgus. *J Bone Joint Surg* 1999 ; 81-B : 250-254.
10. **Ellis JN, Scheer GE.** Congenital convex pes valgus. *Clin Orthop* 1974 ; 99 : 168-174.
11. **Eyre-Brook AL.** Congenital vertical talus. *J Bone Joint Surg* 1967 ; 49-B : 618-627.
12. **Fitton JM, Nevelös AB.** The treatment of congenital vertical talus. *J Bone Joint Surg* 1979 ; 61-B : 481-483.
13. **Griffin DW, Daly N, Karlin JM.** Clinical presentation of congenital convex pes valgus. *Foot Ankle Surg* 1995 ; 34 : 146-152.
14. **Guidera KJ, Drennan JC.** Foot and ankle deformities in arthrogryposis multiplex congenita. *Clin Orthop* 1985 ; 194 : 93-98.
15. **Jacobs M.** Congenital Vertical Talus. *Tex Med* 1963 ; 59 : 864-867.
16. **Jacobsen ST, Crawford AH.** Congenital vertical talus. *J Pediatric Orthop* 1983 ; 3 : 306-310.
17. **Hamanishi C.** Congenital vertical talus : Classification with 69 cases and new measurement system. *J Pediatr Orthop* 1984 ; 4 : 318-326.
18. **Henken R.** Contribution à l'étude des formes osseuses du pied plat valgus congénital. Thèse de Lyon, 1914.
19. **Lamy L, Weissman L.** Congenital convex pes valgus. *J Bone Joint Surg* 1939 ; 21 : 79-91.
20. **Lombardi CM, Silver LM, Silhanek AD *et al.*** Treatment of congenital convex pes valgus with navicular excision and subtalar arthroereisis : a case study. *J Foot Ankle Surg* 2001 ; 40 : 166-171.
21. **Marcinko DE, Azzolini TJ, Mariash SA.** Enigma of Pediatric Vertical Talus Deformity. *Foot Surg* 1990 ; 29 : 452-458.
22. **Marcinko DE, Schwartz NH.** Congenital convex pes plano valgus deformity. In : McGlamry. *Comprehensive Textbook of Foot Surgery* volume 1. Williams & Wilkins ; Baltimore 1987 : pp 466-482.
23. **Napiontek M.** Congenital vertical Talus : A retrospective and critical review of 32 feet operated on by peritalar reduction. *J Pediatric Orthop B* 1995 ; 4 : 179-187.
24. **Ogata K, Schoenecker PL, Sheridan J.** Congenital Vertical Talus and its familial occurrence : an analysis of 36 patients. *Clin Orthop* 1979 ; 139 : 128-132.
25. **Osmund-clark H.** Congenital Vertical Talus. *J Bone Joint Surg* 1956 ; 38-B : 334-341.
26. **Outland T, Sherk HH.** Congenital Vertical Talus. *Clinical Orthop* 1960 ; 16 : 214-218.
27. **Robbins H.** Naviculectomy for Congenital Vertical Talus. *Bull Hosp Joint Dis* 1976 ; 37 : 77-97.
28. **Rocher HL.** Les raideurs articulaires congénitales multiples. *I Med Bordeaux* 1913 ; 84 : 722.
29. **Seimon LP.** Surgical correction of congenital vertical talus under the age of 2 years. *J Pediatr Orthop* 1987 ; 7 : 405-411.
30. **Stern HJ, Clark RD, Stroberg AJ, Shohat M.** Autosomal dominant transmission of isolated congenital vertical talus. *Clin Genet* 1989 ; 36 : 427-430.

31. Striker SJ, Rosen E. Early Reconstruction of Congenital Vertical Talus. *Foot Ankle* 1997 ; 18 : 535-543.

32. Tachdjian MO. *Pediatric Orthopedics*, 2nd ed., pp. 2557-2578, W. B. Saunders, Philadelphia, 1990.

33. Walker AP, Ghali NN, Silk FF. Congenital Vertical Talus. The results of staged operative reduction. *J Bone Joint Surg* 1985 ; 67-B : 117-121.

34. Wirth T, Schuler P, Griss P. Early surgical treatment for congenital vertical talus. *Arch Orthop Trauma Surg* 1994 ; 113 : 258-253.

35. Yen CC, Huang SC. Surgical treatment of Congenital Convex Pes Valgus. *J Formos Med Assoc* 1997 ; 96 : 424-428.