

Congenital Clubfoot in Children After Walking Age: Management and Evaluation of 41 Feet with the Dimeglio Score

ZOLTAN DERZSI¹, HOREA GOZAR², SIMONA GURZU³, RADU PRISCA⁴, ORS NAGY⁵

ABSTRACT

Introduction: Congenital Clubfoot (CC) is one of the most frequent orthopedic lesions in patients younger than 10-15 years. The surgical correction is more difficult in children over 1.5 years, compared to newborns, due to advanced osteoarticular development and higher rigidity of the foot. The aim of this study was to report the results of our experience regarding the combined orthopedic-surgical treatment of CC and the follow-up prognostic value of Dimeglio score in children aged between 1.5 to 12 years.

Material and Methods: From June 2009 and May 2012, 31 consecutive patients with CC, aged between 1.5 to 12 years, underwent surgical treatment. To assess the results, pre-operative and post-operative Dimeglio scores, at 6 months after surgery, were

compared in each of the cases. An adapted Ponseti-Mitchelle orthosis-bar was used for aftercare.

Results: The mean age of patients enrolled in this study was 4.32 ± 2.04 years old. From the 31 patients, 10 had bilateral deformity; surgical intervention was performed for a total of 41 feet. Independently by the age of patients, between pre-operative and post-operative evaluation, the Dimeglio score regressed from a mean of 11.70 ± 7.43 (ranged between 4 and 18) to 3.80 ± 0.96 (ranged between 0 and 12). Unfavorable outcome was observed in 5 feet; the success correction rate was 85.37%.

Conclusion: This study reveals that CC can also be treated in older children by using a proper orthopedic, surgical and post-operative management. The Dimeglio score is useful, easy to use and relevant also in children over 1.5 years.

Keywords: Dimeglio score, clubfoot, surgery, Ponseti-Mitchelle orthosis-bar

INTRODUCTION

Congenital Clubfoot (CC) is a malformation characterized by the varus position of the foot, and equine adducted forefoot, which can be fixed or rigid of varying degrees [1-3]. The most reliable treatment should be initiated within the first week of life, but there are some patients who present at hospital in a later stage or neglect treatment at a point. This special category also comprises children with recurrent clubfoot previously treated whose parents did not cooperate properly during aftercare. The difficulty of the treatment in this group of patients is due to stiffness, ossification and mature age of the joints [4-6].

The aim of this study was to present our experience in management of CC in children after walking age. Although CAP (Clubfoot Assessment Protocol) and other classification systems as Piranni or Mannes were reported to be relevant [7-9], we chose to perform the follow-up by using the Dimeglio score [8].

MATERIAL AND METHODS

Selection criteria

We conducted a cross-sectional study at the Clinic of Paediatric Surgery, Târgu- Mureș, Romania, during January 2009 and May 2012. Processing of the cases was approved by the Ethical Committee of Clinical County Hospital of Targu-Mures, Romania. Written informed consent was obtained from each patient prior to began any research. The study group comprised all consecutive patients with CC, corrected by the same surgical team, who were diagnosed with congenital varus equinus CC, who at their first presentation were ≥ 1.5 years old. Patients who did not accept the proposed treatment or quit treatment before its completion were excluded from the study. Children with associated neurological abnormalities were also excluded. Thus, in the study 31 patients aged between 1.5 and 12 years old were included. Bilateral CC was diagnosed in 10 of the cases; a total of 41 feet were treated.

Management protocol

The study protocol includes the following steps: pre-operative evaluation of the patient using Dimeglio score, orthopedic correction, surgical intervention, follow-up and post-operative evaluation and 6 months post-operatively by using the same score [8]. The Dimeglio score aims four points of reducibility of the foot in different degrees from 0 to 4, the more flexible the position the lower the score. The four target positions are equinus, varus, supination and adductus. Beyond these, there are four possible scores, which are the followings: posterior crease, medial crease, cavus and deviant muscle function. Introduce these points to be awarded one point more. Thus, the maximum score is 20 and the minimum 0, the lower the score is the less the foot is affected, the score 0 representing a perfectly normal feet [8]. According to this score, patients can be classified in four groups, from benign to very severe CC [Table/ Fig-1] [8].

The focus of the pre-operatively evaluation was also placed on the age of patients and the structure of their bone tissue. Because the study group comprised children over the age of 1.5 years old, first step was to decide if the rigidity of the feet allows the conservative treatment.

In some of the cases, where it was possible, a casting device was applied in the pre-treatment phase; a femoral-cruro-podal plaster device in a position of maximum correction, changed every two weeks, for minimum 3 times, was used. The orthopedic treatment was performed according to the Ponseti method [10,11].

For the subsequently surgical correction, Turco modified procedure [12] was used [Table/Fig-2]. After surgery repeated plasters were performed to maintain the correction, in normal or hypercorrection position during 6 weeks. After 2 and 4 weeks the plaster device was changed. If used the Kirschner wires, they were removed 3 months follow surgery.

In order to maintain the post-operatively correction, for minimum 2 years post-operatively, as a method of aftercare, we opted for the



[Table/Fig-1]: The surgical correction of congenital clubfoot in 12-year old boy patient, using the Turco modified procedure - pre-operative (1A), intra-operative (1B) and post-operative view (1C and 1D) **[Table/Fig-2]:** The aspect of the adapted Ponseti-Mitchelle orthosis-bar used for the aftercare protocol, in a case with congenital clubfoot. **[Table/Fig-3]:** The pre-operatively and post-operatively Dimeglio score in the study group

Dimeglio Score	4	3	2	1	0
Equinus C1	90° - 45° plantarflexion	45° - 20° plantarflexion	20° - 0° plantarflexion	0° - 20° dorsalflexion	>20° dorsalflexion
Varus C2	90° - 45° varus	45° - 20° varus	20° - 0° varus	0° - 20° Valgus	>20° valgus
Supination C3	90° - 45° supination	45° - 20° supination	20° - 0° supination	0° - 20° pronation	>20° pronation
Adductus C4	90° - 45° adduction	45° - 20° adduction	20° - 0° adduction	0° - 20° abduction	>20° abduction
Posterior Crease C5	°	°	°	present	absent
Medial Crease C6	°	°	°	present	absent
Cavus C7	°	°	°	present	absent
Deviant Muscular Function C8	°	°	°	present	absent
Dimeglio Score	0-5	6-10	11-15	16-20	
Category	I-Benign	II-Moderate	III-Severe	IV-Very severe	

[Table/Fig-4]: Criteria of the Dimeglio score, used for pre-operatively and post-operatively evaluation (adapted from Dimeglio et al., [8])

Parameters	Pre-operator average	Post-operator average	Average correction	p
Equinus C1	2.17±1.22	0.26±0.08	1.91±1.14	<0.001
Varus C2	2.24±0.96	0.43±0.16	1.81±1.05	<0.001
Supination C3	2.17±1.03	0.68±0.20	1.49±0.78	<0.001
Adductus C4	2.95±1.76	1.51±0.79	1.44±0.56	<0.001
Posterior Crease C5	0.73±0.21	0.09±0.02	0.64±0.07	<0.001
Medial Crease C6	0.53±0.11	0.12±0.05	0.41±0.20	<0.001
Cavus C7	0.60±0.15	0.39±0.13	0.21±0.05	<0.001
Deviant Muscular Function C8	0.29±0.01	0.29±0.08	0	-
Dimeglio score	11.70±7.43	3.80±0.96	7.90±3.45	<0.001

[Table/Fig-5]: Quantification of the average preoperative and postoperative Dimeglio score and its criteria

Bebax orthosis for a maximum of 13.5cm foot length, then Dennis-Browne orthosis and orthopedic shoes for walking. To improve the outcome, we use a combined orthosis, for children older than 3 years. It was about a combination of a plastic ankle-foot orthosis with a Dennis-Browne bar (adapted Ponseti-Mitchelle orthosis-bar), that was also applied for minimum 2 years post-operatively, respectively during the night, after this period [Table/Fig-3].

STATISTICAL ANALYSIS

For data analysis, descriptive elements and inferential statistics were performed, using GraphPad Prism 5 software. Central tendency comparison was performed applying Wilcoxon test for paired data. We fitted a linear regression model with age as an independent

variable and pre-operative Dimeglio score as dependent variable. The significant level of 0.05 was used.

RESULTS

Clinicopathological characteristics

The median age of the 31 patients was 4.32±2.04, ranging between 1.5-12 years old. There were 11 (35.48%) girls, with the malformation present in 15 (36.58%) feet; and 20 (64.52%) male patients, with malformation present in 26 (63.42) feet. From the 41 feet comprised in the study, 34 (82.92%) were at their first presentation for orthopedic/surgical correction; the other 7 (17.08) cases were previously treated by other physicians, without success.

Dimeglio score

The average pre-operative Dimeglio score was 11.70±7.43, ranging from 4 to 18; it was not correlated with the age of patients (p=0.35; coefficient of determination r²=0.02246). From the 41 feet, only one was included in first Dimeglio category (benign), the other 40 feet (97.56%) being within categories II-IV, such as follows: 12 feet in category II (moderate), 21 feet in category III (severe) and 7 feet in category IV (very severe), respectively [Table/Fig-4]. Regarding the post-operative Dimeglio score, its average value was 3.80±0.96, ranging between 0 and 12. The average correction score was 7.90±3.45 [Table/Fig-5]. Post-operatively, the classification of CC revealed the following results: 35 feet in first category (benign), 5 feet of category II (moderate), and one foot of category III (severe), without cases included in category IV (very severe). All 6 of the feet (14.63%) with improper post-operative correction (category II/III) were pre-operatively included in the same group (category II/III).

DISCUSSION

CC is difficult to be managed, especially in children after walking age,

due to advanced ossification and maturation of the osteoarticular system [4-6]. In this group of patients the commonest therapy is the surgical correction that is difficult, lasts longer and has far more modest results compared to infants treated in their first weeks of life [11].

In our group of patients, the average correction was 7.90, in line to literature data that revealed an average correction rate from 6.5 to 11, the reported pre-operative and post-operative Dimeglio scores being also between 10.5-14.2 and 0.95-3.5, respectively [13,14]. Comparing our results obtained in children over 1.5 years with the previously published data considering the newborns, a slightly better post-operative Dimeglio score can be observed in the second category, from 3.80 to 0.6-2.4, respectively [15-17].

Although correction is usually proper and significantly improved, independently by the analyzed parameter, it seems that adductus (C4) is higher pre-operatively, compared with equinus (C1), varus (C2), or supination (C3). This is the reason why a special attention should be focused on the treatment that involves adductus correction. Deviant muscle function (C8) remains post-operatively unchanged, in older children; early diagnosis and treatment are mandatory to prevent it instead treat it. The aftercare protocol is also one of the physician-family responsibilities, essential for best correction.

STUDY LIMITATIONS

Quantification of Dimeglio score in a largest number of patients and its comparison with CAP and other classification systems such as as Piranni or Mannes could increase the study complexity. However, further researchers are necessary to evaluate the volume of leg muscles and other parameters for a longer period of time, these being some of the limitations of our study.

CONCLUSION

In children older than 1.5 years with unfavorable results following the conservative treatment, a proper correction of CC can be obtained by using the soft tissue release as surgical correction, without involving the mature bone. An adapted Ponseti-Mitchelle orthosis-bar can be successfully used post-operatively. However, intrauterine diagnosis and/or evaluation and treatment in first weeks of life are very important for the best results in the field. Dimeglio score can be successfully used for evaluation, even in children after walking age.

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PARTICULARS OF CONTRIBUTORS:

1. Department of Pediatric Surgery, University of Medicine and Pharmacy, Tirgu-Mures, Romania.
2. Department of Pediatric Surgery, University of Medicine and Pharmacy, Tirgu-Mures, Romania.
3. Department of Pathology, University of Medicine and Pharmacy, Tirgu-Mures, Romania.
4. Department of Pediatric Surgery, University of Medicine and Pharmacy, Tirgu-Mures, Romania.
5. Department of Orthopedic Surgery, University of Medicine and Pharmacy, Tirgu-Mures, Romania.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Simona Gurzu,
Associate Professor, MD, PhD, Department of Pathology, University of Medicine and Pharmacy,
38 Ghe Marinescu Street, 540139, Tirgu Mures, Romania
Phone: +40745673550; E-mail: simonagurzu@yahoo.com

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