

The impact of the 2023 Kahramanmaraş (Turkey) earthquake on clubfoot management: A retrospective, observational study

Nevzat Gonder ¹, Oguz Kaya ², Ibrahim Halil Demir ³

¹ Department of Orthopedics and Traumatology, Gaziantep Islam Science and Technology University, School of Medicine, Gaziantep, Turkey

² Department of Orthopedics and Traumatology, Elazığ Fethi Sekin City Hospital, Elazığ, Turkey

³ Department of Orthopedics and Traumatology, Şehitkamil State Hospital, Gaziantep, Turkey

ORCID ID of the author(s)

NG: 0000-0003-0691-1289
OK: 0000-0002-6076-7057
IHD: 0000-0002-7572-7285

Corresponding Author

Nevzat Gonder

Department of Orthopedics and Traumatology, Gaziantep Islam Science and Technology University, School of Medicine, Gaziantep, Turkey

E-mail: n_gonder_02@hotmail.com

Ethics Committee Approval

The study was approved by the Gaziantep Islam Science and Technology University non-interventional clinical research ethics committee (approval date: 20.07.2023, protocol No: 2023/280, decision No: 280.27.11).

All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest

No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Clubfoot is the most common congenital foot deformity. Although the etiology and pathoanatomy of clubfoot are not fully understood, dysplasia is present in all musculoskeletal structures below the knee at varying rates. The aim of any treatment regimen is to obtain a pain-free, properly positioned foot that has functional use. The objective of this investigation was to evaluate difficulties in the follow-up and treatment of patients with clubfoot treated in our clinic after the 2023 Kahramanmaraş earthquake.

Methods: Data from patients with clubfoot treated with the Ponseti method at the Orthopedics and Traumatology Outpatient Clinic of Gaziantep Metropolitan Municipality Inayet Topcuoglu Hospital in Turkey between December 2022 and July 2023 were obtained from the hospital's electronic registry system. Patient demographics, the number of plaster casts made before the earthquake, the total number of plaster casts made, time delays in treatment due to the earthquake, and costs were all analyzed. The Dimeglio score was used for the morphological classification of clubfoot. We analyzed patient data from three time periods: the time of the initial treatment, the period before the earthquake, and the period after the earthquake.

Results: The study included 31 feet (16 left and 15 right) of 20 patients (11 males, 9 females). The mean age of the cohort was 3.5 months (standard deviation: 1.6 months). The median and minimum/maximum Dimeglio scores were 11 (9, 13), 6 (4, 8), and 9 (7, 11) at first admission, before the earthquake, and after the earthquake, respectively ($P < 0.001$). The number of casts before the earthquake was 4.32 (0.32), and the total number of casts was 9.39 (1.38). The average time delay until retreatment after the earthquake was 12 weeks (range: 8–15 weeks). There was a significant positive correlation between the duration of the delay and the Dimeglio score measured after the earthquake ($r = 0.392$, $P = 0.029$). The additional cost per patient due to the delay was calculated to be 8290.8 ± 5033.761 TRY (308.78 ± 187.43 USD).

Conclusion: The 2023 Kahramanmaraş earthquake had a significant impact on the management of clubfoot and other elective procedures. Dealing with the consequences of an unprecedented natural disaster is certainly challenging. However, by adopting carefully designed protocols and therapeutic approaches that are based on the unique characteristics of an illness, we can successfully alleviate the repercussions of such events.

Keywords: clubfoot, earthquake, casting, Ponseti method

Introduction

Clubfoot is one of the most common congenital orthopedic abnormalities; it occurs in 1–2 cases per 1000 live births worldwide [1]. Clubfoot is approximately twice as common in males than in females [2]. There are varying degrees of pathology in almost all muscle and bone tissues below the knee [1,2]. Clubfoot is a complex pathology, not just a deformity of the foot, that should be treated immediately after birth and monitored regularly. Clubfoot can be accompanied by many deformities; however, the most common type is idiopathic clubfoot (ICF). Diagnosis, follow-up, and treatment are all important because there is a race against time to obtain a fully grounded, pain-free, and functional foot before a child reaches walking age. It is very difficult to obtain a foot with a normal morphology even if there are no disruptions in the treatment process. Any disruptions can manifest as recurrent cases, which will cause additional treatment burdens and negative consequences for patients.

On February 6th, 2023, a pair of earthquakes occurred in the Pazarcık and Elbistan districts of Kahramanmaraş, Turkey 9 hours apart. The temblors had magnitudes of 7.9 and 7.6, respectively, and incurred irreparable material losses in Kahramanmaraş and the surrounding provinces. Over 50,000 people died as a result and more than 120,000 were seriously injured [3]. The earthquake affected residents living in 11 provinces spread over an area of 110,000 square kilometers. As a result of the shaking, roads were blocked, public transport ceased, medical facilities were damaged, and there were significant delays in delivering technical equipment and personnel. Furthermore, there were difficulties delivering patients to medical institutions, and even medical procedures themselves were interrupted. Musculoskeletal and systemic injuries that required urgent treatment during the earthquake were treated in field hospitals that could be established in the nearby provinces and regions [4,5]. Because Turkey had not faced such a disaster in modern times, there were no protocols in place to continue to treat diseases and conditions that required regular and continuous treatment. There is information in the literature regarding how orthopedic pathologies were treated in Turkey during the COVID-19 pandemic, but there are no guidelines as to what to do with semi-elective orthopedic procedures during natural disasters [6]. Patients who could be moved were either sent to unaffected surrounding provinces for treatment, or their treatment processes were interrupted.

It is morally unethical to deliberately delay clubfoot treatment and to conduct an observational study of the consequences. However, the treatment disruption caused by the recent earthquake in Turkey enables such an investigation. Our goal was to evaluate the delay in the treatment of patients with clubfoot who continued their treatment in a hospital in the earthquake zone and the clinical consequences of that situation.

Materials and methods

We assessed disruptions in the ICF treatment process due to the 2023 Kahramanmaraş earthquake by collecting data of ICF patients treated with the Ponseti method in the Orthopedics and Traumatology Outpatient Clinic at Gaziantep Metropolitan

Municipality Inayet Topcuoglu Hospital from December 2022 to July 2023.

Study design

After receiving approval from the Gaziantep Islam Science and Technology University non-interventional clinical research ethics committee (approval date: 20.07.2023, protocol No: 2023/280, decision No: 280.27.11), the study was retrospectively collected data from 31 legs of 20 patients. The study included patients who had not previously been treated with ICF at another center, had no additional congenital anomalies, and continued all treatment at the clinic. The study excluded cases of relapse, patients whose first treatment was started after the earthquake, and patients whose completed treatment with the Ponseti method and then underwent abduction foot orthosis before the earthquake.

Patient demographics, the number of plaster casts made before the earthquake, the total number of plaster casts made, delay durations, and costs of treatment were analyzed. The Dimeglio score was used for the morphological classification of clubfoot. The Dimeglio scoring system is based on the severity of four different foot pathologies: 1) equinus deformity in the sagittal plane, 2) varus deviation in the frontal plane, 3) derotation of the calcaneo-pedal block in the horizontal plane, and 4) adduction of the forefoot in the horizontal plane. Each parameter is given a score from 0–4, and weakness in the medial fold, cavus, and cruris muscles is recorded as an additional score [7,8]. The higher the Dimeglio score, the more severe the deformity; the highest possible score is 20 (Table 1).

Table 1: Classification of the severity of clubfoot according to Dimeglio score

Severity level	Type	Total score	Reducibility
I	Benign	< 5	Mild-mild correctable
II	Moderate	5 to < 10	Mild-hard, fixable, partially resistant
III	Severe	10 to <15	Hard-soft, resistant, partially correctable
IV	Very severe	15 to 20	Hard-hard, resistant

Statistical analysis

Descriptive analysis was performed using the median and interquartile range for non-normally distributed variables. The normality of the data was examined using the Kolmogorov-Smirnov/Shapiro-Wilk tests. The Dimeglio score variable was evaluated using the Freidman test. The correlation analyses were performed using the Spearman correlation test. We used SPSS 22.0 (IBM SPSS Corp.; Armonk, NY, USA) software. *P*-values smaller than 0.05 were considered to indicate statistical significance.

Results

The study included 31 feet (16 left and 15 right) of 20 patients (11 males, 9 females) with a mean age of 3.5 months (standard deviation: 1.6 months). The median and minimum/maximum Dimeglio scores were 11 (9, 13), 6 (4, 8), and 9 (7, 11) at first admission, before the earthquake, and after the earthquake, respectively ($P<0.001$) (Table 2). The Dimeglio score of all patients decreased significantly from the first measurement to the second measurement, and a significant increase was observed in all patients at the time of the third measurement performed after the earthquake ($P<0.001$ and $P<0.001$, respectively). The mean number of casts applied before the earthquake was 4.32 (0.32) and the total number of casts was 9.39 (1.38). The delay before retreatment after the earthquake was, on average, 12 weeks (range: 8–15 weeks). There was a

Table 2: Classes of disease severity at the time of first arrival, before and after the earthquake according to Dimeglio

	n	Mean	SD	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
First arrival Dimeglio classification	31	11.29	1.131	9	13	10.00	11.00	12.00
Pre-earthquake Dimeglio classification	31	5.61	1.054	4	8	5.00	6.00	6.00
Post-earthquake Dimeglio classification	31	9.03	1.278	7	11	8.00	9.00	10.00

SD: standard deviation

significant positive correlation between the duration of the delay and the Dimeglio score measured after the earthquake ($r=0.392$, $P=0.029$). The additional cost per patient due to this delay was calculated to be 8290.8 ± 5033.761 TRY (308.78 ± 187.43 USD).

Discussion

While many patients' traumatic injuries were treated immediately in Turkey after the 2023 Kahramanmaras earthquake, that accomplishment was possible only thanks to the significant efforts of medical personnel [4,5]. In addition to the loss of life inflicted by the earthquake, the natural disaster also inflicted a pronounced socio-economic burden on the Turkish economy [9,10]. We experienced a similar situation in healthcare as persisted during the COVID-19 pandemic; however, we had no advance warning [11,12]. Many planned medical procedures were postponed as a result of the earthquake [13]. In this study, we evaluated how ICF treatment, which is a semi-elective treatment, was affected by the 2023 Kahramanmaras earthquake.

Pediatric orthopedic deformities are inherently difficult to track and treat over time, and delays, neglect, and relapses can lead to prolongation of the final treatment and a decrease in clinical satisfaction [14,15]. There were difficulties in accessing health care facilities during the COVID-19 pandemic; a similar situation persisted in the aftermath of the 2023 Kahramanmaras earthquake in Turkey. Following this natural disaster, orthopedic procedures were divided into four categories according to their urgency. Patients with clubfoot admitted for treatment for the first time were included in category 3, which corresponded to semi-elective procedures [16]. It was concluded that a treatment delay of up to 3 months, measured from the time of first admission, would not adversely affect patient outcomes [16]. During the pandemic, Chand et al. [11] showed that the number of new admissions decreased by 60%, follow-up visits decreased by 70%, tenotomies decreased by 80% and other clubfoot surgeries decreased by 90%; relapse rates increased by 27% over the pre-pandemic period. Another study demonstrated that there is variation in achilotomy practices among orthopedic surgeons at the pandemic period [17]. All of the patients in our study experienced some sort of delay in treatment that persisted for anywhere from 8–15 weeks). This delay may have been caused by healthcare facilities being damaged, a lack of medical personnel, or personal situations faced by families due to the earthquake. Some authors suggested trying to at least reduce relapse with simple physical therapy methods enacted via telemedicine [6,18].

Even though the literature shows that treatment of clubfoot with the Ponseti method is effective in patients under 10 years old, follow-up with plastering, surgery, and orthosis becomes more difficult as a patient gets older and treatment is delayed [19,20]. Under normal circumstances, ICF cases are expected to reach the tenotomy stage in an average of 4.8 casts

(range: 4–6 casts) with the Ponseti method [21]. In our study, the deformity was almost restored in most patients due to the delay; therefore, the average total number of casts made was 9.39 (standard deviation: 1.38). The cost of treating clubfoot varies by country and can range from \$170 to \$30,000 [22]. As the total number of plaster casts increases, the cost also increases [21]. Costs are also associated with patients' missed work and transport [23]. The additional cost per patient due to earthquake-induced delays was calculated to be 8290.8 ± 5033.761 TRY (308.78 ± 187.43 USD). Direct and indirect cost increases manifest as financial burdens on the state in countries like Turkey where medical interventions are covered for citizens.

Limitations

Our study has several limitations. First of all, this investigation was designed retrospectively. It is a study without a control group, because under normal circumstances patient-induced delays are rare and often not recorded in hospital records. Furthermore, we did not collect any data from the patients' parents. Additionally, our study was based on records from a single center. Because a prospective study cannot be ethically performed by delaying clubfoot treatment, follow-up analysis can only be performed on larger groups of patients if an event such as a natural disaster or pandemic occurs in the future.

Conclusion

Despite the occurrence of natural calamities and pandemics, individuals born with clubfoot will continue to require medical intervention. In the context of Turkey, political figures and the Ministry of Health possess the capacity to formulate meticulously devised treatment protocols that are tailored to specific diseases, with the aim of mitigating the adverse consequences following occurrences of natural disasters. For example, it is possible to arrange parent education programs focused on clubfoot, develop smartphone applications for this purpose, establish a national clubfoot follow-up system under the supervision of the Ministry of Health to document and track patient data throughout the treatment process. By utilizing recorded data and information, patients can receive appropriate treatment or be referred to alternative centers as necessary. From an orthopedic perspective, it is crucial to provide comprehensive training in the management of clubfoot to both pediatric orthopedic experts and all orthopedists. This training should encompass the necessary knowledge and abilities required to effectively carry out basic dynamic surveillance and treatment for this condition.

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