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Global CTEV treatment challenges and adjustments during Covid-19 pandemic: A systematic review

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Abstract

Background: Congenital Talipes Equino Varus (CTEV) is a common congenital condition that could lead to lifelong disability. Early intervention using the Ponseti method, a low-cost, highly effective treatment, is essential. However, in the 2020 emerged Covid-19 global pandemic which could impacted on CTEV treatments.

Purpose: This study explores the Covid-19 pandemic impact on CTEV treatment and the adaptations developed to ensure continued patient care.

Method: A systematic review was conducted according to PRISMA guidelines. Database searches were carried out through screening articles from 2019 to 2023.

Results: Out of 23 initial studies, 12 met the inclusion criteria. Covid-19 has caused delays in CTEV treatment globally, reducing access to surgeries, tenotomies, and consultations. Patients faced challenges such as travel restrictions, lack of public transportation, financial strain, and increased travel distances. Healthcare providers dealt with limited resources, clinic closures, and redirected efforts toward Covid-19 care, impacting the availability and frequency of CTEV treatment. These challenges were overcome through telemedicine, "barrier casting", and clinic-based tenotomies under local anaesthesia.

Conclusion: The Covid-19 pandemic emphasized the need for robust contingency plans in healthcare, especially for conditions requiring timely interventions like CTEV. The adaptive approaches developed offer valuable insights for future healthcare crises.

Keywords: Covid-19 Pandemic; CTEV Treatment Adjustments; CTEV Treatment Challenges.

INTRODUCTION

The World Health Organization (WHO) has identified congenital abnormalities as a significant contributor to the overall global disease burden. It's important to note that early surgical intervention has the potential to prevent more than half of the disability-adjusted life years (DALYs) that are lost each year due to congenital abnormalities (Debas, Donkor, Gawande, Jamison, Kruk, & Mock, 2015). Among these conditions, there are some, such as clubfoot, for which accessible and cost-effective treatments are readily available. It's noteworthy that approximately 100,000 newborns worldwide are born with club feet each year, according to WHO (2023). The prevalence

of clubfoot, also known as Congenital Talipes Equino Varus (CTEV), can range from 0.51 to 2.03 cases per 1000 live births on a global scale (Smythe, Kuper, Macleod, Foster, & Lavy, 2017). Clubfoot is a congenital foot abnormality characterized by one or both feet turning inward, leading to the child walking on their ankles. If left untreated, this condition can have a profound and lasting impact on an individual's quality of life, causing significant impairment that persists throughout their lifetime. It is particularly concerning that a substantial 80% of untreated clubfoot cases occur in developing countries. However, it is crucial to emphasize that this condition

can be effectively corrected through physical realignment of the child's foot, often involving a combination of treatments like casting, bracing, and, in some instances, surgery (Regasa, Zemedkun, Neme, Aweke, Tadese, Getachew, Alemu, & Hailu, 2022).

The early detection and timely treatment of Congenital Talipes Equino Varus (CTEV), commonly known as clubfoot, are crucial factors that can significantly impact a child's life. The Ponseti method has gained recognition as the gold standard for addressing CTEV, as affirmed by Gelfer et al. in their 2020 study. This method is noteworthy for being non-invasive and cost-effective, with a remarkable success rate of 98%, as reported by the World Health Organization (2023). The Ponseti method involves a series of weekly plaster casts and a minimally invasive procedure known as percutaneous Achilles tenotomy. However, one key determinant of the treatment's success is the age of the child when therapy commences. Initiating treatment at a younger age leads to more favorable outcomes (Ayana & Klungsoy, 2014; Harmer & Rhatigan, 2014). As a child grows older, the number of casts required for correction increases, and the treatment's effectiveness gradually diminishes (Ahmed, Moosa, Muhammad, Ifikhar, Khan, Chinoy, & Samad, 2022).

It is essential to highlight the potential consequences of delaying treatment. If intervention is postponed, it may eventually necessitate more invasive surgical procedures. These surgeries often come with an elevated risk of complications, higher financial costs, and reduced effectiveness (Morcuende, Dolan, Dietz, & Ponseti 2004). Importantly, untreated clubfoot can result in a range of life-altering consequences. It can lead to disability, chronic pain, limited mobility, and decreased overall productivity. These effects can extend into adulthood, significantly affecting an individual's quality of life (Adhikari, Meng, Wu, Mao, Ye, Wang, Sun, Sylvia, Rozelle, Raat, & Zhou, 2020; Ciotti, Angeletti, Minieri, Giovannetti, Benvenuto, Pascarella, Sagnelli, Bianchi, Bernardini, & Ciccozzi, 2019; Cui, Li, & Shi, 2019).

In March 2020, WHO declares the Covid-19 outbreak a global pandemic. It is important to break the transmission chain in the pandemic situation by applying lockdown, social distancing, and mask wearing measures (Aquino, Silveira, Pescarini,

Aquino, Souza-Filho, Rocha, Ferreira, Victor, Teixeira, Machado, & Paixão, 2020; Sardar, Abdul-Khaliq, Ingar, Amaidia, & Mansour, 2020; Tirachini & Cats, 2020; Zhang, Zhao, & Hu, 2020; Layton, Mont, Puli, Calvo, Shae, Tebbutt, Hill, Callaway, Hiscock, Manlapaz, & Groenewegen, 2021). The Covid-19 and its measures may impact on CTEV treatment globally. This research aims to understand the challenges faced by the Clubfoot Treatment and Education Program (CTEV) worldwide during the Covid-19 pandemic and explore adjustments made to address these challenges.

RESEARCH METHOD

This systematic review follows the guidelines set out in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. The systematic review specifications use the following Population: CTEV patients; Intervention: CTEV treatment; Comparison: during the pandemic, and Outcomes: any measurable effects, innovations, and recommendations.

An extensive search was conducted in various databases known to collect relevant articles. These databases included PubMed, MEDLINE, ProQuest, CINAHL, Scopus, Gale OneFile, and Embase. In addition to searching these databases, additional studies were identified through Google Scholar and Ulrichweb. The database search was conducted from July 17, 2023, using the keywords: "Congenital Talipes Equinovarus," "CTEV," "Clubfoot," "Covid-19," "SARS-CoV-2," "challenge," "barrier," "strategies," and "treatment." Article screening will use a three-stage approach: title, abstract, and full text. The publication date was limited to 2019 when the Covid-19 outbreak occurred worldwide.

After collecting the studies, they were organized and managed. The initial step involved removing duplicate studies. Each remaining study then underwent comprehensive eligibility screening based on predetermined inclusion and exclusion criteria. Articles that did not meet these criteria, as determined through evaluation of their titles and abstracts, were excluded from the review. The next stage involved a full-text review of the remaining articles, with further exclusions made according to the same inclusion and exclusion criteria.

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Studies were included in the review if they met the specified inclusion criteria, namely: Peer-reviewed articles, Mentioning the treatment of clubfoot during the Covid-19 pandemic, published in English, and conducted or published during the Covid-19 period (2019-2023). On the other hand, studies were excluded from the review if they met the following exclusion criteria: Did not mention clubfoot treatment during the Covid-19 pandemic, Published in a language other than English, and Grey literature.

Data from each included article were extracted and presented in a Table. The extracted information included details such as authorship, publication date, study location, subjects, study design, conclusions, recommendations, and limitations.

A total of 23 papers were initially considered in the inquiry and underwent screening based on their titles and abstracts. After this screening, 16 papers remained for a comprehensive full-text assessment. Out of these, 12 papers ultimately met the final inclusion criteria, as illustrated in Figure 1, and were deemed suitable for inclusion in the review. The 12 papers that adhered to the inclusion criteria and were considered eligible for the review. The earliest study among them was published in 2020, while the most recent was published in 2023. The 12 articles were from developed and developing countries in which 1 from Turkey, 3 from the United Kingdom, 6 from India, and 2 from Canada.

RESEARCH RESULTS

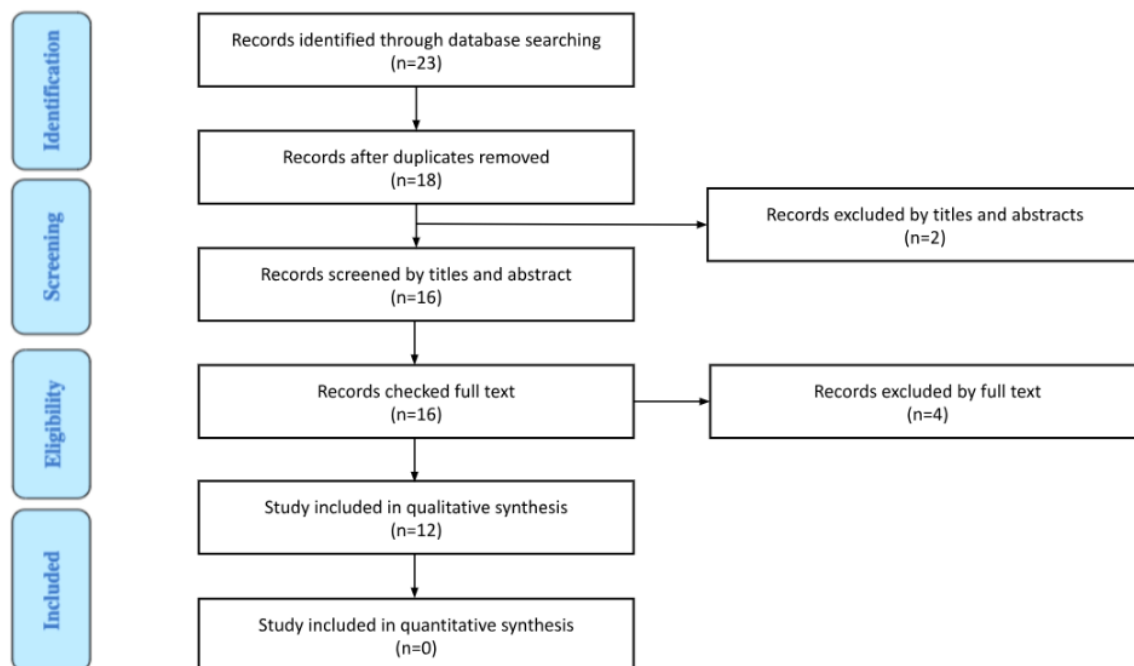


Figure PRISMA Flow Diagram for Literature Search

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Table Summary of Selected Studies

(Author, Year) (Country)	Purpose	Study Design (Subjects)	Results	Conclusion	Recommendation	Limitation
(Chand et al., 2022) India	Assess pandemic impact to clubfoot program at tertiary care institute.	Retrospective comparative study (n=3358)	Reduced paediatric outpatient registration, clubfoot registration, follow-up visits, tenotomies, and other clubfoot surgeries.	Covid-19 pandemic had negative impact on clubfoot program.	proposed re-establish clubfoot program strategies for post pandemic.	Single centre study
(Firth et al., 2022) United Kingdom	Identify the impact of Covid-19 on outpatient care for CTEV at a large tertiary hospital.	Retrospective comparative study (n=45)	Increased of CTEV registration and commuted distance.	Strict precautions have successfully provided CTEV treatment.	Through the implementation of rigorous protocols, children with CTEV can be effectively treated during pandemics, thus alleviating the future burden of providing treatment to older children post-pandemic.	Single centre study
(Rangasamy et al., 2021) India	Study the clubfoot treatment practices, Achilles tenotomy, and possible impact of teleconsultation.	Cross-sectional Web based survey (n=127)	One third doctors did not perform any casting and deferred Achilles tenotomy. Reduced weekly casting procedure.	Covid-19 pandemic had negative impact on clubfoot program.	The adverse impact of eventual outcome shall be identified further.	Online survey may cause results bias
(Özbay et al., 2021) Turkey	Investigate pandemic effect on clubfoot treatment.	Retrospective cross-sectional (n=154)	Increased clubfoot patients' admission and Achilles tenotomy.	Covid-19 measures has resulted in increased admission in rural since parents could not reach the city.	Each orthopaedic surgeon should possess the knowledge and skills to manage these cases, ensuring preparedness for unforeseen events like potential future pandemics.	Single centre study

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(Author, Year) (Country)	Purpose	Study Design (Subjects)	Results	Conclusion	Recommendation	Limitation
(Barkham et al., 2021) United Kingdom	Find out the safety, feasibility, and parents' perspective on the new procedure of tenotomies under local anaesthetic in the clinic.	Quasi experiment Prospective Study (n=25)	All patients reached ankle dorsiflexion more than 15-degree post-op. No complications. All parents reported positive experience with 99% felt less anxious with the procedure. None of patients and parents contracted with Covid-19 virus.	The new procedure was found to be safe and clinically successful.	Further research with enough control group will resulting more valid data.	Single centre study
(Baghdadi et al., 2020) India	Examine the existing literature and global practice shift, and provide guidance concerning the approach to paediatric orthopaedics amidst the Covid-19 pandemic.	Literature study (Not specified)	Extend the duration of time between cast changes to every two weeks. Tenotomies, which are minor procedures, may still be performed with the protocols.	CTEV treatment still could be performed with acceptable delays.	Telemedicine could be utilised for monitoring.	Number of literatures used is unspecified
(Aroojis et al., 2021) India	Addresses the difficulties encountered by clubfoot clinics in the midst of the Covid-19 pandemic and introduces inventive strategies for the secure implementation of Ponseti casting.	Experimental prospective study (n=43)	The techniques have shown effective, cost-efficient, and applicable in limited resource settings.	Utilizing readily available, cost-effective materials, these uncomplicated and practical tips will play a crucial role in mitigating the risk of disease transmission.	Novel methods with the capacity to minimize the risk of disease transmission have the potential to expedite the restoration of clubfoot treatment services as countries gradually reopen following extended lockdowns.	Single centre study

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(Author, Year) (Country)	Purpose	Study Design (Subjects)	Results	Conclusion	Recommendation	Limitation
(Douglas et al., 2023) The United Kingdom	Assesses the efficacy of telemedicine (TM) through live-stream videoconferencing in contrast to traditional in-person (F2F) reviews.	Retrospective case control study (n=78)	No significant difference in compliance and recurrence rate between TM and F2F group. TM connection was successful in 74% of booked appointments. The number of patients attending was similar to F2F bookings one year prior.	The use of TM for routine follow-up of Ponseti-treated clubfoot patients can be as clinically effective as F2F assessment and has potential for integration into routine follow-up care.	It is necessary to conduct prospective studies that examine the impact of multiple telemedicine (TM) reviews on compliance and the long-term outcomes over the full five-year duration of bracing.	Single centre study
(Martins et al., 2022) Canada	Assesses the efficacy of this triage system based on accuracy of the triage diagnosis (TDx) and time from referral to initial consultation (IC).	retrospective cohort clubfoot patients (n=118)	Average time of IC in CF decreased from 66 to 31 days, with p=0.08. Accuracy for TDx was high for CF sensitivity and specificity of TDx for CF were 100%.	The photo-based triage system for pediatric foot and ankle referrals proved effective in accurately identifying urgent consults and facilitating timely assessments, as evidenced by the increased accuracy of triage diagnoses and reduced referral-to-consultation times for clubfoot patients between 2019 and 2020.	Continues use of the system will optimize the system accuracy.	Single centre study
(Keshet et al., 2020) Canada	Examine acceptable timeframes for postponing the treatment of prevalent pediatric orthopedic conditions during a life-threatening pandemic	literature review and Qualitative semi structure interview (n=25)	Clubfoot as semi-elective urgency which means it could lead to potential worse outcome if delayed for more than 3 months thus it recommends to not delayed more than that. In	Clubfoot treatment could be postponed up to 3 months.	Larger number and future studies required.	Limited number of subjects

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(Author, Year) (Country)	Purpose	Study Design (Subjects)	Results	Conclusion	Recommendation	Limitation
	such as Covid-19 and put forward a classification system to tackle this issue.		details, this recommendation is applied for the newborn Ponseti initiation or recurrence or neglected clubfoot.			
(Sharma et al., 2022) India	Investigate the effectiveness of needle tenotomy for the correction of equinus in clubfoot at a minimum of one year of follow-up.	Prospective quasi experiment study (n=26)	Ankle dorsiflexion was achievable in all patients. The average Pirani score after tenotomy at final cast removal was 0.16 No patient complications	Percutaneous needle tenotomy of the Achilles tendon is a simple, safe, and effective technique for equinus correction in clubfoot	Larger subjects study required	Small subjects and single centre study
(Kumari et al., 2021) India	Explore lived experiences on use of corrective braces among parents of children diagnosed with clubfoot in Northern states of India	Qualitative in-depth interview (21 parents of clubfoot children)	Parents were facing few issues namely relapse due to non-adherence, financial burden because of lack of awareness regarding its free treatment, traveling distance, and noticeably more, which needs to be attended by health care professionals.	Several challenges faced by CTEV parents	Larger subjects study required	Small subjects and single centre study

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DISCUSSION

Covid-Pandemic Impact on CTEV treatment

In India, the Covid-19 pandemic had a noticeable impact on CTEV treatment. There was a significant decline in various crucial aspects of care, including paediatric outpatient registration, clubfoot registration, follow-up visits, tenotomies, and other clubfoot surgeries, with reductions of 46%, 60%, 30%, 80%, and 90%, respectively (Chand, Khan, Afaq, Verma, Huda, & Singh, 2022). This suggests that many children with CTEV experienced delays in treatment during the pandemic. However, it is intriguing to note that the percentage of local clubfoot registrations increased from 58% in 2018 to an impressive 80% in 2020 (Chand et al., 2022; Kuliński, Tomczyk, & Morasiewicz, 2021). This demonstrates how patients adapted by seeking treatment locally and highlights the resilience of the healthcare system in accommodating these changes. Moreover, a study in India reported healthcare providers adapted to the circumstances. It reported that 30.7% of doctors did not perform any casting during the pandemic and deferred Achilles tenotomy (Rangasamy, Mehta, Gopinathan, Aroojis, Behera, & Dhillon, 2021). Additionally, a significant portion of doctors (66.9%) reported performing casting in only 1-5 cases per week (Rangasamy et al., 2021). These statistics underline the complex clinical decisions and variations that medical professionals had to navigate during the uncertainty of the pandemic.

Converse trends occur in study based in the United Kingdom and Turkey. In the UK, there was a significant increase in the number of CTEV cases, from 11 to 23, during the pandemic (Firth, Peniston, Imediwa, Bijlsma, Walsh, & Ramachandran, 2022). However, the pandemic also had a notable impact on the management of CTEV, with a decrease in the number of referrals and surgeries. This decline could be attributed to the disruptions in healthcare services and the prioritization of Covid-19 cases. Despite these challenges, the study reported that the outcomes for children who did receive treatment during the pandemic were not significantly different from those treated before the pandemic. This underscores the adaptability and resilience of healthcare professionals in maintaining the quality of care. Furthermore, Turkey experienced a remarkable surge in the admission of clubfoot patients, recording a 140% increase, along with an astounding 1100% increase in Achilles

tenotomy procedures (Özbay, Toy, & Polat, 2021). This remarkable rise showcases Turkey's ability to adapt its healthcare system and deliver robust responses during challenging times. The dramatic increase in cases highlights the adaptability and resourcefulness of the healthcare system in managing a surge in CTEV patients.

Barriers CTEV Treatment During Covid-Pandemic from Patients Perspective

The impact of the Covid-19 pandemic on clubfoot treatment access in the UK, India and Turkey from patients' perspective has been multifaceted. In the UK, one of the significant challenges faced by clubfoot patients was the increased travel distance to access healthcare. Although not statistically significant, this issue was substantial. On average, each patient had to travel approximately 9.69 km to reach the hospital (Firth et al., 2022). The pandemic added to the burden, with families in 2020 having to cover longer distances compared to the preceding years, 2019 and 2018. The increased travel distance had a notable impact on patients and their families, making access to treatment more arduous and time-consuming.

In India, a critical factor contributing to this issue was the limited availability of public transportation and the travel restrictions imposed during pandemic-related lockdowns (Rangasamy et al., 2021). These factors not only deterred parents from reaching the clinics but also significantly contributed to the reduction in casting rates during the study period. The reliance on public transportation for medical appointments became increasingly challenging, particularly for those living in rural areas.

Moreover, another study conducted in India highlighted the emergence of multiple obstacles in the context of clubfoot treatment during the Covid-19 pandemic. These barriers encompassed various challenges such as non-compliance and financial burdens (Kumari, Kalyani, Sharma, Singh, Prashar, & Patiyal, 2021). First, patient non-compliance became a significant issue, leading to relapses and hampering the treatment's progress. Financial burdens were also prevalent, primarily due to families being unaware of the availability of free treatment. The cost of travel added to these financial challenges, as families had to travel greater distances to reach healthcare facilities. These complexities demanded the attention

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of healthcare professionals and underscored the need for more comprehensive support systems during healthcare crises.

In Turkey, the impact of the pandemic on clubfoot patients unfolded differently. Intercity travel bans and curfews, measures implemented to curb the spread of the virus, compelled parents to seek care at the nearest orthopaedic centres (Özbay et al., 2021). This included facilities in rural areas, where healthcare services may have been less commonly sought before the pandemic. This shift in patient behaviour was further influenced by a significant increase in childbirths occurring in rural hospitals. The rise in childbirths was a direct result of restrictions on travel between cities, encouraging parents to opt for local healthcare options.

Barriers CTEV Treatment During Covid-Pandemic from Health Providers Perspective

The Covid-19 pandemic not only impacting the patients but also the health providers which provide CTEV treatment. In the UK, there was increased of CTEV patient, nearly doubling when compared to the preceding years. The primary reason for this surge in patients was the closure of all local clinics in the vicinity. This means that the health providers must also be ready to treat them all. To ensure that patients with CTEV could access uninterrupted care, the facility had to adapt its standard procedures and introduce a variety of techniques (Frith et al., 2022). This adaptability was essential to guarantee the safe delivery of clubfoot treatment services.

Simultaneously, in India, the scenario at multi-specialty hospitals was quite dynamic. These facilities were under immense pressure to prepare for a substantial increase in Covid-19 cases, given the widespread impact of the pandemic. As a result, the availability of appointments for casting, a non-emergency procedure, likely decreased. Approximately 30.5% of doctors in teaching institutes, and 26.1% in corporate multi-specialty hospitals, chose not to perform casting during the study period (Rangasamy et al., 2021). This decision was influenced by the fact that some teaching institutes were repurposed as Covid-19 care centres, diverting their resources to manage the pandemic. Corporate hospitals, on the other hand, had to make provisions for Covid-19 patients, which further constrained their capacity to offer non-essential services.

In Turkey, it becomes to emphasize that orthopaedic surgeons and healthcare providers must stay informed about the notable increase in patients with congenital clubfoot during the pandemic (Özbay et al., 2021). Such awareness is vital as it equips them to broaden their knowledge and expertise in diagnosing and treating this condition effectively. The rising prevalence of congenital clubfoot patients highlights the importance of being prepared for exceptional circumstances like global health crises, ensuring that healthcare professionals are well-equipped to meet the healthcare needs of these patients. This adaptability and resilience demonstrated by the healthcare system in the face of the pandemic will undoubtedly offer valuable lessons for the future, underscoring the importance of continued education and awareness in the medical community.

Innovative Approaches of CTEV Treatment

The Covid-19 pandemic posed several challenges in the healthcare sector, particularly affecting the treatment of CTEV patients. Delays in treatment due to reduced theatre capacity prompted the introduction of a new standard operating procedure. This innovative approach involved performing tenotomies in the clinic under local anaesthesia, which was found to be safe, effective, and satisfactory (Barkham, McNally, Russell, Bridgens, & Gelfer, 2021). All patients achieved adequate ankle dorsiflexion, with no instances of Covid-19 transmission to either patients or parents. The introduction of this procedure garnered high satisfaction levels among parents, with 99% expressing reduced anxiety about tenotomies conducted in the clinic, rather than the traditional operating theatre. This approach not only improved resource allocation but also proved so successful that it is set to continue beyond the pandemic, representing a positive and lasting change in healthcare delivery.

Additionally, an inventive technique called 'barrier casting' or 'ring-fencing' was introduced to reduce the risk of infection during clubfoot casting and tenotomy procedures (Aroojis & Pragadeeswaran, 2021). This method employs a cost-effective, disposable plastic drape as a protective barrier, effectively mitigating the transmission of respiratory droplets and airborne pathogens. The approach's affordability and ease of deployment, even in resource-limited settings, make it

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a promising strategy. This approach has been implemented successfully with 43 consecutive patients and is poised to play a significant role in re-establishing clubfoot treatment services post-lockdown.

Another approach is by utilizing technology and internet for telemedicine (TM) which proven live-stream videoconferencing demonstrated a similar level of effectiveness to traditional face-to-face (F2F) reviews for regular follow-up attendance in Ponseti-treated clubfoot patients (Baghdadi, Nabian, & Baghdadi, 2020; Keshet, Bernstein, Dahan-Oliel, Ouellet, Pauyo, Rabau, & Hamdy, 2020; Douglas, Simmonds, Kedroff, & Tennant, 2023). Specifically in the UK study, compliance rates between the two cohorts showed no statistically significant difference, and there was no significant variation in the recurrence rate. Moreover, subsequent F2F reviews of the TM cohort indicated enhanced compliance for certain patients, with no instances of recurrence being overlooked. The introduction of TM did not compromise the addressing of skin issues, brace adjustments, and exercise instructions. The successful implementation of TM led to a consistent number of attending patients, with 74% of the scheduled TM appointments achieving successful connections, mirroring the F2F bookings from the previous year (Douglas et al., 2023).

Efforts were also made to reduce unnecessary hospital visits for infants by implementing a triage system based on standardized clinical photographs provided by parents. The system effectively maintained the accuracy of triage diagnoses, and the time interval from referral to consultation was reduced for clubfoot patients. In 2020, the average time to initial consultation for clubfoot patients decreased significantly, demonstrating the efficacy of the photo-based triage system in identifying urgent cases and ensuring prompt assessments (Martins, Harvey, Sadat, & Bouchard, 2022).

Finally, during the Covid-19 surge, with limited access to operating rooms, an innovative approach was adopted for Achilles tenotomy in clubfoot patients. This involved using a 16/18-gauge needle for percutaneous tenotomy (Sharma, Kumar, Sinha, Jameel, Khan, & Kumar, 2022). The results were promising, with all patients achieving ankle dorsiflexion. At the final cast removal, patients exhibited favourable outcomes, with no complications

noted. This percutaneous needle tenotomy emerges as a straightforward, safe, and effective technique for correcting equinus in clubfoot cases. Its minimally invasive nature allows for short outpatient procedures with a low risk of complications, offering an alternative solution in challenging healthcare circumstances.

Recommendations of CTEV Treatment During Pandemic

The response to the challenges posed by the Covid-19 pandemic in the context of clubfoot treatment has been marked by innovative and adaptive measures. One noteworthy example is the experience of a major tertiary hospital in the United Kingdom. Faced with the increased demand for clubfoot treatment due to the closure of local clinics, this hospital successfully expanded its capacity to provide care to children with CTEV (Firth et al., 2022). By meticulously adhering to safety protocols, the hospital maintained the continuity of treatment even during the pandemic's initial wave. This approach is not only significant for addressing the immediate needs of CTEV patients but also for averting a potential backlog of older cases that might have arisen if treatment were delayed.

The pandemic has instigated changes in the procedures for Achilles tenotomies, with a notable transition from general anaesthesia in the operating theatre to performing these procedures on an outpatient basis under local anaesthesia (Rangasamy et al., 2021). This shift in practice underlines the adaptability of healthcare systems during the pandemic, with the need for flexibility and innovation in the face of challenges.

The adoption of teleconsultation also has gained prominence, demonstrating its potential value in various aspects of clubfoot treatment. It offers the means for prenatal counselling on neonatal CTEV diagnosis, providing parents with essential guidance even before birth (Baghdadi et al., 2020; Keshet et al., 2020; Rangasamy et al., 2021; Douglas et al., 2023). During the maintenance phase with Foot Abduction Orthosis (FAO), tele video consultations play a crucial role in evaluating and ensuring the continued correction of the child's foot. To further assist parents, educational videos are utilized to facilitate at-home manipulation. However, it is essential to recognize that certain aspects of clubfoot treatment, particularly casting and manipulations, necessitate physical

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contact and cannot be entirely replaced by telemedicine. While paediatric orthopaedic specialists typically manage paediatric conditions like clubfoot, the pandemic has highlighted the importance of preparedness among all orthopaedic surgeons (Özbay et al., 2021). Ensuring that they possess the knowledge and skills to manage these cases is vital, especially in the face of extraordinary situations such as future pandemics.

As the pandemic continues, there remains a lack of official guidelines for managing clubfoot in the context of social distancing. Consequently, it is crucial to avoid significant delays in treatment, as this could complicate the correction process. Alternative strategies have been considered, such as extending the duration that casts are worn, switching casts every two weeks, and preferring plaster and soft cast materials to minimize cast removal time (Baghdadi et al., 2020). Furthermore, minor procedures like tenotomies can be safely performed in clinical settings, provided they align with established protocols (Baghdadi et al., 2020).

Innovative techniques have also been introduced to mitigate the risk of disease transmission (Aroojis & Pragadeeswaran, 2021). For example, a "barrier casting" or "ring-fencing" approach utilizes a transparent, disposable plastic drape as a protective barrier during casting and tenotomy procedures. This method is cost-effective, easily accessible, and suitable for settings with limited resources and a high patient caseload. To address the challenges associated with limited clinical resources and restricted in-person care, a triage system based on standardized clinical photographs of the child's feet has been introduced. This system has proven effective in identifying urgent cases promptly, ultimately streamlining the referral and assessment process for clubfoot patients (Martins et al., 2022). The accuracy of triage diagnoses has been well-maintained, highlighting the potential of such innovative systems for paediatric foot and ankle referrals.

The Covid-19 pandemic also led to a change in practice where percutaneous Achilles tenotomy was performed using a needle in clubfoot patients when access to operating rooms was limited (Keshet et al., 2020). This adaptation proved effective, with patients achieving the ability to dorsiflex their ankles and no complications related to the tenotomy procedure. This

innovative approach serves as a straightforward, safe, and cost-effective technique for correcting equinus in clubfoot cases.

The primary objective of this comprehensive review was to analyse how the Covid-19 pandemic affected the treatment of Congenital Talipes Equinovarus (CTEV), commonly referred to as clubfoot, on a global scale. The review aimed to examine various aspects, including patient enrolment in CTEV treatment programs, follow-up procedures, surgical interventions, and to identify the hurdles faced by both patients and healthcare providers during the pandemic. It also sought to uncover innovative strategies employed to overcome these challenges and provide recommendations for improving CTEV treatment during similar health crises. However, it's important to note that the number of countries conducting research and publishing findings on this topic was relatively limited.

The Covid-19 pandemic, an unprecedented global health crisis, disrupted healthcare systems and patient care across the world. It presented substantial challenges in delivering medical services while also prompting innovative adaptations to ensure that essential treatments, such as those for CTEV, could continue safely. The reviewed articles cast a light on the diverse responses to these challenges from countries with varying healthcare infrastructures. Understanding the pandemic's impact on CTEV treatment is vital as it can inform strategies to enhance healthcare system resilience and adaptability in the face of similar crises. It also provides insights into the barriers faced by both patients and healthcare providers, as well as the inventive measures taken to mitigate these obstacles, ultimately leading to improved patient care.

The research articles included in this review were primarily from developed countries which only represented by the United Kingdom, Turkey, and Canada. Meanwhile, the developing countries were only represented by articles from India. This highlights a large research gap between two groups of economic countries. Moreover, several studies used in this review are single centre study with limited number of subjects. However, there are some important information that could be drawn to provide an overview on how countries mitigate the CTEV treatment during the period of Covid-19 pandemic. While the primary focus was on the effects of the

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Covid-19 pandemic on CTEV treatment, the lessons learned from these studies have broader implications for healthcare as a whole. They underscore the significance of healthcare preparedness and adaptability, the necessity for robust contingency plans, and the value of innovative approaches in ensuring patients receive the care they require, even during challenging circumstances. This review offers an overview of the state of research and the pandemic's repercussions on CTEV treatment. It highlights both the strengths and limitations in the existing body of knowledge and emphasizes the adaptability and resilience demonstrated by healthcare systems and providers. These experiences provide valuable insights for future preparedness, especially in anticipation of potential global health crises in the years ahead.

CONCLUSION

The impact of the Covid-19 pandemic on CTEV treatment has been diverse across different regions. In India, the pandemic led to significant disruptions, with reductions in critical aspects of care, including patient registrations and surgeries. Notably, local registrations surged, demonstrating patient adaptability and the healthcare system's resilience. In the United Kingdom, CTEV cases increased, but healthcare disruptions resulted in fewer referrals and surgeries. Turkey's response was marked by a remarkable surge in clubfoot patients, showcasing the adaptability of the healthcare system. From a patient's perspective, challenges varied. In the UK, patients encountered increased travel distances, making access to care more arduous. India's issues were compounded by travel restrictions, non-compliance, and financial burdens, particularly due to reliance on public transportation. Turkey redirected patients to local healthcare centres due to travel bans, influenced by increased childbirths in rural hospitals.

Healthcare providers faced the need to adapt and innovate. In the UK, providers accommodated increased patient numbers and introduced various techniques to ensure uninterrupted care. India's multi-specialty hospitals were under pressure to prepare for Covid-19 cases, affecting casting appointments. In Turkey, healthcare providers needed to stay informed about the surge in clubfoot patients during the pandemic.

Innovative approaches emerged to mitigate pandemic-related challenges. Clinic-based tenotomies under local anaesthesia, "barrier casting" to reduce infection risk, and the effective use of telemedicine for follow-ups were notable solutions. These adaptations in practice, including percutaneous Achilles tenotomy with a needle, offered safe and cost-effective alternatives in challenging healthcare circumstances. Recommendations for managing CTEV during the pandemic emphasize the importance of preparedness among orthopaedic surgeons and the need to minimize treatment delays. Innovative techniques, such as "barrier casting," demonstrate potential for mitigating disease transmission. Triage systems and adaptations in practice ensure continuity of care during healthcare crises.

The Covid-19 pandemic has not only highlighted the resilience and adaptability of healthcare systems but also underscored the importance of education and awareness in the medical community. These innovations and adaptations provide valuable lessons for future healthcare delivery, emphasizing the need for flexibility and innovation in the face of challenges.

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