



Changes in the Management of Clubfoot Cases During COVID-19 Pandemic—A Survey Among Orthopaedic Specialists

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Abstract

Purpose The on-going COVID-19 pandemic has curtailed the established practice norms of many ailments including clubfoot. We conducted a survey to study the changes in the clubfoot treatment practices, Achilles tenotomy methods, and the role along with the possible impact of teleconsultation during this pandemic.

Methods A web-based survey was conducted using a questionnaire prepared on Google forms. The link for this questionnaire was sent to Indian Orthopaedic specialists with a special interest in clubfoot management via a social messaging platform.

Results 127 eligible responses were analysed. Of them, 67% respondents were in practice for more than 10 years. During the study period, 30.7% of doctors did not perform any casting; 66.9% performed casting in 1–5 cases per week and only 2.4% performed casting in more than five cases per week. A statistically significant difference was noted in the number of doctors who performed casting in less than five cases per week and the doctors who performed casting in more than five cases per week, before and during the COVID-19 pandemic. 30.7% of doctors deferred doing Achilles tenotomy during the study period, and among those who performed one, a significant number of them avoided tenotomy under general anaesthesia.

Conclusion The COVID-19 pandemic has significantly impacted clubfoot treatment practices during the lockdown period in India. Significant reductions in the number of cases, and a reduction with changes in Achilles tenotomy practices were noted too. However, whether this had any adverse influence on the eventual outcome in these feet is yet to be determined.

Keywords Casting · COVID-19 · Clubfoot · Congenital talipes equinovarus · Ponseti · Tenotomy

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Introduction

The on-going novel Coronavirus disease 2019 (COVID-19) pandemic has curtailed the established practice norms of many ailments, including congenital talipes equinovarus (CTEV) correction using the Ponseti method of treatment.

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In India, the first case of COVID-19 was reported on January 30, 2020 [1]. On March 11, 2020, the World Health Organisation (WHO) declared this rapidly spreading viral disease as a global pandemic. Following this, a period of national lockdown in India was implemented from March 25, 2020. It was divided into different phases from Phase 1 to Phase 4, with some relaxation in the last two phases of the lockdown depending on the caseload in a particular zone; the lockdown was officially considered over on May 31, 2020 [2, 3]. During the lockdown period, it became difficult for the parents of children with clubfeet to bring their child to the hospital for the periodic casts. After the lockdown period, gradual reopening was resumed with some relaxations except in the containment zones during the unlock period 1.0 (from June 1 to June 30, 2020) [4].

The birth prevalence of clubfoot in India is estimated to be 1.2/1000 live births [5]. This constitutes large numbers in terms of cases, and require special treatment for its management. The Ponseti method of correction, which is the gold standard of clubfoot treatment, requires weekly corrective casts, Achilles tenotomy for correcting residual equinus in most of the cases, and maintenance of correction in Foot Abduction Orthosis (FAO). Weekly hospital visits during the correction phase and periodic hospital visits during the maintenance phase are required for satisfactory treatment of the condition. During the lockdown period of the COVID-19 pandemic, CTEV was considered a non-urgent condition, surgeons and hospitals delayed correction casting and the subsequent management. However, the delay was not uniform all across the countries and few doctors and hospitals did continue to offer clubfoot treatment. As such, the extent to which clubfoot management changed is unclear and has not been assessed yet. This survey was conceptualized to study the same.

We conducted a survey among orthopaedic specialists to assess the impact of COVID-19 pandemic on their clubfoot practices during the time of lockdown and unlock 1.0 period (March 25th to June 30th, 2020). The participation was focussed on specialists who treat CTEV, with the purpose of evaluating—(1) Whether there was any change in the practice of clubfoot management during this time? (2) Whether there was any change in Achilles tenotomy methods? (3) Evaluation of usage and impact of teleconsultation for managing these cases.

Methodology

A web-based survey was performed using a questionnaire prepared on Google forms (Google LLC, California). The study was conducted after the departmental review board approval (Reference no. DRB/Ortho/2020/149). A set of questions was prepared, reviewed and verified by all

the investigators. This questionnaire included questions about the experience of the participant, the volume of new clubfoot cases handled per year, presentation of clubfoot cases during the COVID-19 pandemic, tenotomy protocol before and during the pandemic, management of cases in the different stages of Ponseti correction, and maintenance of bracing protocol. Trial runs were internally conducted to check if the questions were well understood and to decrease the ambiguity in the options provided; this was done by circulating it among 30 consultants and residents in our institute. The data was completely wiped after this exercise before starting the collection of actual study data.

Participants were selected from among the membership of the Paediatric Orthopaedic Society of India (POSI) or Orthopaedic surgeons known to treat clubfoot cases (personal information with authors). A link of the questionnaire was sent to the participants all over India on 9th and 10th July 2020 via a popular social messaging platform (WhatsApp, Facebook Corp., CA, USA) with a participant information sheet attached. Responses were anonymous and only those who consented for the survey proceeded further. The time frame for the collection of data was 1 week, with three reminders being sent out to complete the questionnaire. The data collection was stopped one week after the third reminder. The data collected was exported in a Microsoft Excel file and was scanned for incomplete and duplicate responses. The data were then exported into SPSS version 20.0 (IBM Corp, Armonk, NY) for analysis. The categorical variables were expressed as numbers along with percentages. For comparison of categorical variables between the paired samples, McNemar's Chi-squared test was used, continuity correction of 0.5 was applied when appropriate. A '*p*' value of <0.05 was taken as significant.

Results

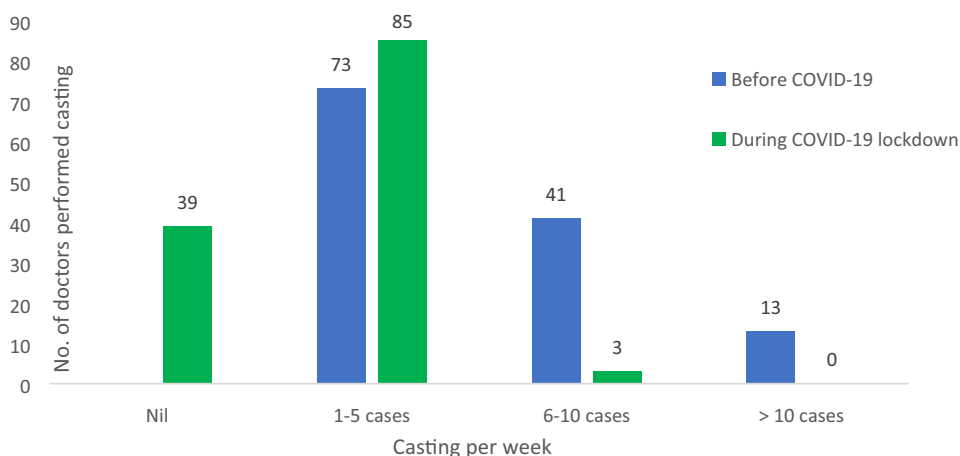
Out of the 240 Orthopaedic surgeons who were contacted, 160 doctors responded. Out these, 11 responses were found to be duplicate and 22 respondents responded that they no longer performed clubfoot casting routinely. These 33 responses were excluded from data analysis. Of 127 respondents, 67% had work experience of > 10 years. 56.7% and 33.1% of the respondents worked in teaching institutes and private clinics respectively (Table 1).

Before the COVID 19 pandemic related lockdown, 73 doctors (57.5%) used to perform serial casting for 1–5 cases per week, 41 (32.3%) for 6–10 cases per week, and 13 (10.2%) performed for > 10 cases per week. During the study period of the COVID-19 pandemic, 39 doctors (30.7%) did not perform any casting, 85 (66.9%) performed casting in 1–5 cases per week and only 3 (2.4%) performed casting in more than five cases per week (Fig. 1). When the number

Table 1 Demographic and practice characteristics of respondents ($n = 127$)

S. no	Demographic and practice characteristics	Numbers (%)	
1	Experience of the doctor	0–5 years	24 (18.9%)
		6–10 years	18 (14.2%)
		11–20 years	35 (27.6%)
		> 20 years	50 (39.4%)
2	Place of work*	Teaching Institute	72 (56.7%)
		Govt. non-teaching/trust hospital	14 (11%)
		Corporate multi-speciality hospital	23 (18.1%)
		Private clinic	42 (33.1%)
3	Average no. of new club foot cases seen by the responding doctors before COVID-19 pandemic	1–25 cases/year	64 (50.4%)
		26–50 cases/year	26 (20.5%)
		51–75 cases/year	24 (18.9%)
		> 75 cases/year	13 (10.2%)
4	The time interval between two successive casts change during COVID-19 pandemic	1 week	48 (37.8%)
		2 weeks	28 (22.1%)
		2–4 weeks	8 (6.3%)
		Did not change the cast	14 (11%)
		Irregular depends on patient ability to reach the clinic	29 (22.8%)

*Some doctors worked in more than one setup

Fig. 1 Clustered column graph shows the comparison of number of casting per week performed by doctors before and during COVID-19 pandemic

* Only doctors performing routine clubfoot casting before COVID-19 pandemic were included for analysis

of doctors performing casts in less than five cases per week were compared with doctors who performed casts in more than five cases per week in a before and during the COVID-19 pandemic scenario a statistically significant difference was noted (McNemar's test, " p " value < 0.001).

Among 73 doctors (57.5%) who used to perform casting for 1–5 cases per week (low-volume surgeons) before lockdown, 29 doctors (39.7%) did not perform any casting while 44 doctors (60.3%) continued to perform casting for 1–5 cases per week during COVID-19 pandemic. Among 41 doctors (32.3%) who used to perform casting

for 6–10 cases per week (medium-volume surgeons) before lockdown, six doctors (14.6%) did not perform any casting, 33 doctors (80.5%) performed casting in reduced numbers of 1–5 cases per week, while only two doctors (4.9%) continued to perform casting for 6–10 cases per week during COVID-19 pandemic. Finally, among the 13 doctors (10.2%) who used to perform casting for more than ten cases per week (high-volume surgeons) prior to the lockdown, four doctors (30.8%) did not perform any casting, eight doctors (61.5%) performed casting in markedly reduced numbers of 1–5 cases per week and 1

doctor (7.7%) performed casting in 6–10 cases per week during COVID-19 pandemic.

When the analysis was performed on the basis of place of work, 22 out of 72 doctors (30.5%) working in teaching institutes, 6 out of 23 doctors (26.1%) working in corporate multi-speciality hospitals, 10 out of 42 doctors (23.8%) working in private clinics, and 3 out of 14 doctors (21.4%) working in trust and Government non-teaching hospitals, did not perform any casting during the study period.

For new-born babies with clubfoot, 31.5% followed the same protocol as before COVID-19 pandemic but with added precautions. 36.2% changed their protocol by asking them to come on a specific day in a week by prior appointment; 20.5% did remote management by asking parents/mother to manipulate/stretch foot only and did not start casting on new-born babies. 11.8% advised parents to attend nearby clubfoot clinic/hospital (Fig. 2). Cast change practices during the pandemic time also underwent modifications; 37.8% of doctors changed casts weekly, 22.1% changed it once in two weeks and 22.8% changed it irregularly depend on the parent’s ability to bring the child to the hospital (Table 1).

For babies with on-going casting (middle stage of casting protocol), 42.5% doctors continued to treat babies

during the study period, doing this on a specific day in a week with precautions. 26% of the doctors responded that most of the parents did not contact them or were lost to follow-up. 18.5% of doctors referred their cases to nearby clinics/hospitals for further casting and follow-up and 13% doctors asked parents (via teleconsultation) to remove cast by soaking in a bucket of water and do manipulations of the child’s foot.

Tenotomy practice underwent some changes too. Prior to COVID-19 pandemic, 54.3% of doctors performed Achilles tenotomy in the operation theatre (OT) under general anaesthesia (GA), 20.5% in OT under local anaesthesia (LA) and 25.2% performed tenotomy in the outpatient department (OPD). During the study period, this reduced to 20.5% tenotomies in the OT under GA, 16.5% in the OT under LA, and 32.3% being performed in OPDs. 30.7% of doctors deferred doing Achilles tenotomy during this period. This change in practice from OT to OPD setup, as well as deferment of the procedure, was statistically significant (“p” value < 0.001) (Table 2) and on comparing separately the change in the practice of tenotomy from GA to LA during pandemic with before was also statistically significant (“p” value = 0.006).

Fig. 2 Bar diagram shows the management protocol of new-born babies with clubfoot during the COVID-19 pandemic

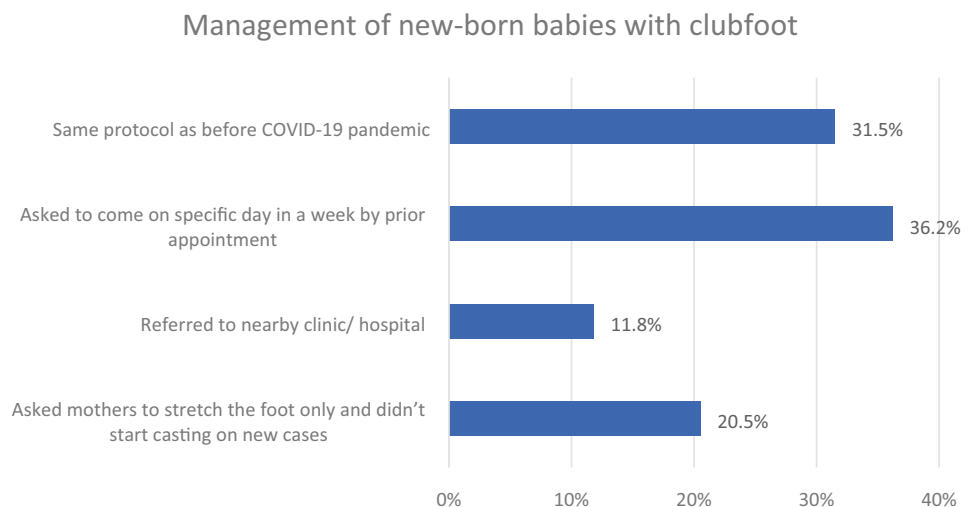


Table 2 Comparison of TA tenotomy techniques before and during COVID-19 times

Achilles tendon tenotomy	No. of doctors performing tenotomy before COVID-19	No. of doctors performing tenotomy during COVID-19	McNemar’s test [#]
In the out-patient Department (OPD)	Under local anaesthesia	25	Significant “p” value < 0.001
	Without any anaesthesia	7	
Inside Operation theatre (OT)	Under General anaesthesia	69	26
	Under local anaesthesia	26	
Deferred doing tenotomy	–	39	

[#]By making a 2×2 table of tenotomy in OPD and tenotomy in OT and compared with the number of doctors performing tenotomy before and during COVID-19

For babies who were on maintenance phase with Foot Abduction orthosis (FAO), 60.6% doctors advised parents to continue with the same FAO till lockdown opened and asked them to visit hospital later for brace change. 15% doctors referred their cases to a nearby hospital for brace change and follow-up. 24.4% gave teleconsultation (video calling) and half of them faced difficulty in home delivery of braces (Fig. 3).

The survey results showed that during COVID-19 pandemic there was a significant reduction in the number of cases per week presented to the practitioners and non-uniform protocols were followed by the practitioners who managed the clubfoot cases which were in the different stages of treatment. In addition, there was a change in the protocol of Achilles tenotomy, with some deferments and many being done outside OTs.

Discussion

The COVID-19 has been spreading worldwide and in India, with the number of cases increasing exponentially (crossing 2.5 million as of 15th August 2020). The on-going pandemic has impacted healthcare systems worldwide and has forced hospitals to cancel outpatient clinics, elective surgeries, and to reroute the available resources and manpower to face the COVID-19 needs. Keshet et al. [6] categorized common paediatric orthopaedic problems during the COVID-19 pandemic into four categories based on their urgency in getting treated, and the clubfoot was categorized under semi-elective, where treatment can be delayed up to 3 months. The United Kingdom Clubfoot Consensus Group (UKCCG) considered clubfoot correction as non-urgent during phase 1 of the pandemic and suggested that casting could be delayed

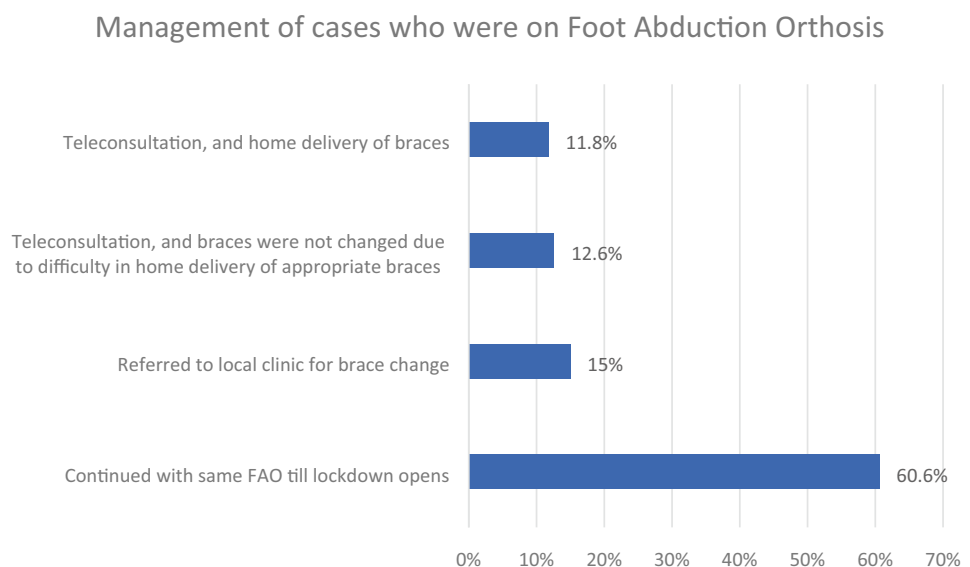
as part of the national and individual hospital policies for the duration of the outbreak [7]. A commentary by Sampath on the POSI website also suggested that during the COVID-19 pandemic, CTEV treatment (initial management including tenotomies) could be delayed by up to 3 months [8].

Our survey revealed that 30.5% of doctors from teaching institutes and 26.1% of doctors from corporate multi-speciality hospitals did not perform any casting during the study period. This is probably because many of the teaching institutes/medical colleges in India were converted into dedicated COVID-19 care centres, and manpower and resources were diverted for treating the COVID-19 cases. Likewise, corporate multi-speciality hospitals were also asked to prepare for the huge inflow of COVID-19 cases, which probably led to a reduction in the number of casting appointments. Due to a lack of public transport and travel restrictions during the lockdown, many parents probably were unable to reach the clinics, which may have contributed to the significantly lower rates of the casting during the study period.

Despite the lockdown (and contrary to the recommendations from UKCCG and POSI), two-thirds of the respondents were still providing casting treatment to new clubfoot cases. The reason may be that the first cast was applied while the baby was in the hospital during the immediate postnatal period or that the parents were sufficiently anxious about the early correction of the deformed feet and accessed treatment at the nearby clinic/hospitals. However, only 37.8% of doctors were able to change casts weekly, signifying that parents did experience difficulty in reaching the hospital during the lockdown period.

There was a shift from doing TA tenotomy under GA in the OT to an outpatient setting, as a significant number

Fig. 3 Bar diagram shows the management of children who were on FAO during COVID-19 pandemic



of tenotomies during the COVID-19 period were done under LA and outside OT. The global recommendation is to perform Achilles tenotomy in the outpatient clinic [9–11] under local anaesthesia. Yet in India, it is interesting to note that in pre-COVID times, 75% of doctors were performing this procedure in the OT under local or general anaesthesia. During this on-going COVID-19 pandemic, it is recommended that aerosol-generating procedures like intubation be avoided to protect operation room staff and doctors. Thus, the shift towards the outpatient setting is a welcome collateral effect of the pandemic and should be encouraged even post-pandemic to reduce costs and unnecessary OT utilization, besides being safer for young babies who may not tolerate GA [12, 13].

There is a surge in teleconsultation practice following COVID-19 pandemic all over the world and the Government of India allowed registered medical practitioners to use this platform with specific guidelines [14, 15]. During COVID-19, video consultation did play a role in the follow-up treatment of children with clubfoot, but with some limitations. For clubfoot cases, teleconsultation has a potential role in prenatal counselling for the neonatal diagnosis of CTEV, and during maintenance phase on FAO, tele-video-consultations allow evaluation of maintenance of correction and suggestions for periodic brace change. This can be supplemented by educational videos that can help parents to learn how to manipulate the feet of newborn babies in their homes. Apart from these, there is not much role, as clubfoot correction needs physical contact to manipulate and apply casts.

Regarding FAOs, the first brace usually should be applied in the hospital/clinic after post-tenotomy cast removal to assess the degree of deformity correction and teach parents how to use the brace properly [7]. Subsequent follow-up bracing visits may be curtailed during the pandemic, by implementing innovative solutions such as home delivery of braces by the orthotist/local suppliers, thus reducing the need for parents to visit the hospital for brace change.

There are some limitations of the study; being a retrospective questionnaire-based survey, recall bias is inherent, and the study period involves different phases of lockdown and unlock 1.0 period, where the restrictions implemented were gradually relaxed towards later phase and the presentation of cases also differ accordingly. Nevertheless, it does give some insight into practice changes during these trying times.

Conclusion

In conclusion, this survey reveals that the nation-wide lockdown due to the COVID-19 pandemic has significantly impacted the clubfoot management practices in India. While

the eventual impact on the outcomes of the feet of children being managed during this time period cannot be predicted at present. These children need to be meticulously followed up to determine the same.

Author Contributions KR: concept and design of work, data analysis and drafting manuscript. RM: supervision, data collection and critical revision of manuscript. NRG: data acquisition and interpretation. AA: data acquisition and critical revision of manuscript. PB: helps in framing questionnaire, analysis and interpretation of data. MSD: supervision and critical revision of manuscript.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest statement.

Ethical standard statement Approved by Departmental review board, Department of Orthopaedics, PGIMER, Chandigarh, India. [Reference no. DRB/Ortho/2020/149]. All the authors read the final manuscript and approved it for the submission. As no patient data were involved in this survey, approval by Institutional Ethics committee was deemed unnecessary.

Informed consent Consent for participating in the survey was obtained.

References

- Kakar, A., & Nundy, S. (2020). COVID-19 in India. *Journal of the Royal Society of Medicine*, 113(6), 232–233. <https://doi.org/10.1177/0141076820927668>.
- Ministry of Home Affairs. (2020). Circulars for COVID-19: Consolidated Guidelines of MHA on Lockdown measures on containment of COVID-19. https://www.mha.gov.in/sites/default/files/PR_ConsolidatedGuidelinesofMHA_28032020_0.pdf. Accessed 04 Aug 2020.
- Ministry of Home Affairs. (2020). Circulars for COVID-19: Government of India issues Orders prescribing lockdown for containment of COVID19 epidemic in the country. https://www.mha.gov.in/sites/default/files/PR_NationalLockdown_26032020_0.pdf. Accessed 04 Aug 2020.
- Ministry of Home Affairs. (2020). Circulars for COVID-19: MHA Order Dt. 30.5.2020 with guidelines on extension of lockdown in containment zones and phased reopening. No.40-3/2020-DM-I(A). https://www.mha.gov.in/sites/default/files/MHAOrderDt_30052020.pdf. Accessed 04 Aug 2020.
- Smythe, T., Kuper, H., Macleod, D., Foster, A., & Lavy, C. (2017). Birth prevalence of congenital talipes equinovarus in low- and middle-income countries: A systematic review and meta-analysis. *Tropical Medicine and International Health*, 22, 269–285. <https://doi.org/10.1111/tmi.12833>.
- Keshet, D., Bernstein, M., Dahan-Oliel, N., et al. (2020). Management of common elective paediatric orthopaedic conditions during the COVID-19 pandemic: The Montreal experience. *Journal of Children's Orthopaedics*, 14(3), 161–166. <https://doi.org/10.1302/1863-2548.14.200107>.

7. UK Clubfoot Consensus Group. (2020). Covid 19 guidance: Guidance for practitioners. <https://www.clubfootuk.net/covid-19-guidance/4594892429>. Accessed 13 July 2020.
8. Sampath JS. (2020). POSI: Commentary on current guidelines for paediatric orthopaedic surgery during Covid-19 pandemic. <https://posi.in/covid-19-pandemic.html>. Accessed 04 Aug 2020.
9. Ponseti, I. (1996). *Congenital clubfoot, fundamentals of treatment*. Oxford: Oxford University Press.
10. Willis, R. B., Al-Hunaishel, M., Guerra, L., et al. (2009). What proportion of patients need extensive surgery after failure of the Ponseti technique for clubfoot? *Clinical Orthopaedics and Related Research*, 467, 1294–1297.
11. Lebel, E., Karasik, M., Bernstein-Weyel, M., Mishukov, Y., & Peysner, A. (2012). Achilles tenotomy as an office procedure: Safety and efficacy as part of the Ponseti serial casting protocol for clubfoot. *Journal of Pediatric Orthopedics*, 32(4), 412–415. <https://doi.org/10.1097/BPO.0b013e31825611a6>.
12. Morray, J. P., Geiduschek, J. M., Ramamoorthy, C., Haberkern, C. M., Hackel, A., Caplan, R. A., et al. (2000). Anesthesia-related cardiac arrest in children: Initial findings of the Pediatric Perioperative Cardiac Arrest (POCA) registry. *Anesthesiology*, 93, 6–14. <https://doi.org/10.1097/0000542-200007000-00007>.
13. Murat, I., Constant, I., & Maud'huy, H. (2004). Perioperative anaesthetic morbidity in children: A database of 24,165 anaesthetics over a 30-month period. *Paediatric Anaesthesia*, 14, 158–166. <https://doi.org/10.1111/j.1460-9592.2004.01167.x>.
14. Mann, D. M., Chen, J., Chunara, R., Testa, P. A., & Nov, O. (2020). COVID-19 transforms health care through telemedicine: Evidence from the field. *Journal of the American Medical Informatics Association: JAMIA*, 27(7), 1132–1135. <https://doi.org/10.1093/jamia/ocaa072>.
15. Ministry of Health and Family Welfare. (2020). Telemedicine Practice guidelines. Issued 25 March 2020. <https://www.mohfw.gov.in/pdf/Telemedicine.pdf>. Accessed 05 Aug 2020

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