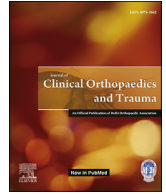




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## Original article

## Impact of COVID-19 pandemic on clubfoot program at tertiary care institute



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## ABSTRACT

**Purpose:** The COVID-19 pandemic had serious impact on health care sector. During reprioritisation of the services, elective and non-emergency procedures were suspended, with gradual resumption of services after lockdown was over. In this study we assessed the impact of pandemic on our clubfoot program at a tertiary care institute. Also, we discussed the future challenges and strategies to re-start our clubfoot program.

**Methods:** Data was collected retrospectively regarding registrations, demography and procedures done at our clubfoot centre. Study period was 25 March to 31 December 2020 and it was compared with same duration from previous years 2019 and 2018. After the data analysis, the findings were discussed on departmental committee meeting, future challenges were considered and strategies were charted out for re-establishing the clubfoot program at our Institute.

**Results:** When compared to previous year, we noted 46% decline in paediatric outpatient registrations and 60% decline in new clubfoot registrations at our centre. The clubfoot follow-up visits reduced by 30% in the pandemic year 2020. 80% of clubfoot registrations were local residents during pandemic year, which was 54%, 58% in year 2019 and 2018 respectively. The percentage of neglected cases remained stable, however, share of relapse cases increased during pandemic year. There was 80% decline in number of tenotomies and 90% decline in other clubfoot surgeries performed during pandemic year 2020 compared to year 2019.

**Conclusion:** COVID-19 pandemic had definite disruptive impact on our clubfoot program. With decreased new registrations, follow-up visits and increased relapses, we anticipate a significant increase in clubfoot cases in need of casting & treatment. To deal with pent-up demand and an anticipated wave of relapse and neglected clubfoot cases, we have proposed strategies to re-establish clubfoot program in post-pandemic new-normal. We hope these will prepare us for any adversaries we face.

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## 1. Introduction

The COVID-19 Pandemic caused by novel coronavirus SARS-CoV-2, started with epicentre being Wuhan, China in around last quarter of 2019.<sup>1,2</sup> In India, the first case of COVID-19 was reported on January 30, 2020.<sup>3</sup> On March 11, 2020, the World Health Organisation (WHO) declared this rapidly spreading viral disease a global pandemic.<sup>4</sup> In order to curb this, a period of national lockdown was implemented in India from March 25, 2020.<sup>5,6</sup> The strict

lockdown was officially considered over on May 31, 2020, with gradual “unlock” and relaxations depending on caseloads in that particular region.<sup>5–9</sup>

In the wake of the pandemic there was reprioritisation of healthcare services. This led to the suspension of elective, non-emergent and out-patient department (OPD) services thus affecting the clubfoot program of our institute.<sup>10</sup> The services were heavily affected due to lockdown regulations and reassignment of health care workers & infrastructure.<sup>11</sup>

Even during the unlock period, owing to episodic disruption of public transport and selective restrictions in containment zones, it was difficult for the parents to visit the clubfoot clinic for periodic casting.<sup>11–13</sup>

The primary objective of this study was to assess the impact of Covid-19 pandemic on clubfoot program at our tertiary care

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institute. The secondary objective were to consider future challenges, solutions & strategies for re-establishing the clubfoot program at our Institute.

## 2. Material and methods

After institutional ethical committee approval, retrospective study was conducted at department of paediatric orthopaedics of major tertiary care referral teaching hospital. To compare impact of Covid-19 pandemic on our clubfoot program, data was collected from 25 March 2020 to 31 Dec 2020. The study period corresponds to period of strict Lockdown followed by gradual unlock. This was compared with same 09 months duration from 2019 to 2018.

Data were collected related to idiopathic clubfeet from our Clubfoot clinic & associated Minor & major Operation Theater (OT) regarding new idiopathic clubfeet registration in clubfoot clinic, follow up visits, demography and any relevant procedures done (tenotomies, soft tissue releases/osteotomy etc.)

Data was collected and analysed using Microsoft Excel Office 2019, comparing 2020 with same time period of previous two years (2019 & 2018). Statistical analysis was performed using SPSS for Windows 23.0 (IBM Corp., Armonk, NY, USA).

After the data analysis, the findings were discussed on departmental meeting headed by our clubfoot program chief (AS). All the members of team are involved in clubfoot care at various positions over the years. The future challenges were considered, and various possible solutions were discussed & strategies were charted out for re-establishing the clubfoot program at our Institute.

## 3. Results

In the pandemic year 2020, at our tertiary care institute, total number of registrations for pediatric orthopaedic OPD were 3358 compared to 6285 during same time in 2019 and 5032 in 2018. This shows a 46% decline in OPD footfall at our paediatric Ortho OPD during pandemic year compared to previous year. New idiopathic clubfeet registrations at our clubfoot centre, showed a sharp fall of 60% during pandemic year 2020 (as shown in Fig. 1).

Among new registrations, M: F distribution was almost constant over past 3 years, with females being 29%, 22%, and 22% in year 2020, 2019, 2018 respectively. Average age at registration and Laterality of feet affected is shown in Table 1.

After completion of cast treatment/tenotomies, all clubfoot cases in brace are kept in regular follow up (3 monthly in most cases). We noticed a 70% fall in these follow up visits in year 2020 compared to previous year (Fig. 1).

During year 2020, among new registrations, 23% were neglected idiopathic clubfoot cases as compared to 27%, 25% in year 2019 and 2018 respectively. During year 2020, we saw increase in share of relapse cases compared to previous years (relapse cases were 27%, 12% and 9% of new registrations in 2020, 2019, 2018 respectively). Although this increase was statistically not significant ( $p$ -value  $>0.05$ ).

Majority of new registrations during year 2020 were local residents, with 80% residing within 100 km of institute and none of registration was for beyond 250 km range. During previous year 2019, almost half were from non-locals, with only 54% residing within 100 km, which was 58% for year 2018.

There was 80% decline in number of tenotomies and 90% decline in other clubfoot surgeries performed during pandemic year 2020 compared to year 2019 (Both statistically significant decrease with  $p$ -value  $<0.05$ ).

## 4. Discussion

Covid-19 pandemic and subsequent response had substantial effect on health care services. All the elective and non-emergent services were put on hold during reprioritisation of resources and considering safety of citizen. The clubfoot program at our centre was also disrupted during this pandemic. Our centre is a high-volume tertiary care teaching institute and functions as referral centre for nearby districts and adjoining states. It runs a dedicated clubfoot centre at department of Paediatric Orthopaedics, with twice a week clubfoot clinic.

During pandemic, clubfoot treatment was described in non-emergency or non-urgent list.<sup>10</sup> Paediatric Orthopaedic Society of India (POSI) & Indian Orthopaedic Association (IOA) guidelines for care during Covid-19 pandemic put routine clubfoot services in priority level 3.<sup>10,11</sup> It suggested that the initial management & tenotomies can be delayed upto 3 months. Neglected & relapse cases were put on priority level 4, suggesting delaying more than 3 months.<sup>13</sup> In a survey of orthopaedic surgeons at national level, 30% did not do any casting or tenotomy during survey period amid covid-19 pandemic.<sup>14</sup> The authors concluded that pandemic had a significant impact on clubfoot services in India.

At our clubfoot center, during pandemic, we noticed a 60% decline in new registrations and a 70% fall in routine follow up visits of idiopathic clubfeet, compared to previous year. The follow up visits are important part of clubfoot treatment especially in the maintenance phase with Foot Abduction Brace (FAB). It has been established that non-compliance to brace is an important factor for relapse of clubfoot.<sup>15-17</sup> So follow up visits are essential not only to improve compliance but also to pick cases in early relapse stage and intervene.

Being a tertiary care centre, a lot of neglected clubfoot cases do visit us for treatment. In the year 2019, almost 27% of new registrations were neglected or partially treated cases. Even during pandemic year 2020, this figure was about 23%. However, with decrease in total registrations, number of neglected/walking age clubfoot decreased to one third of previous year (87, 29 in 2019 and 2020 respectively). Also, average age at registration decreased compared to previous years ( $P$ -value  $> 0.05$ ). The percentage of females among registrations remained constant over past three years.

We noticed 80% fall in the number of tenotomies done under our clubfoot program during year 2020. Three factors might have played a role in such sharp fall: firstly, total registration itself fell by 60%, secondly, no procedures were done during strict lockdown as per the regulations<sup>10,11</sup> and lastly, fewer cases were reaching to tenotomy stage due to irregular casting and also, a few cases missed the tenotomy day appointment. Özbay et al.<sup>18</sup> also reported lower rate of tenotomy during pandemic year, despite increase in registrations.

The exact effect of this disruption of clubfoot program might be visible in coming time, when we notice sharp increase in number of relapse and neglected clubfoot cases apart from expected routine yearly new registrations.<sup>10-14</sup> This may be a more real scenario, considering all supportive centres and practitioners also reprioritised their service during the pandemic.<sup>14</sup>

Although purely based on anticipation, we might witness exhaustion of resources and infrastructure due to backlog. The 46% decline in Paediatric Orthopaedic OPD footfall suggests decreased utilisation of services due to various probable reasons:

- A. During strict lockdown: Elective health services were closed.
- B. After "unlock":
  1. Clubfoot treatment on Priority level 3&4.
  2. lack of transport to reach centre

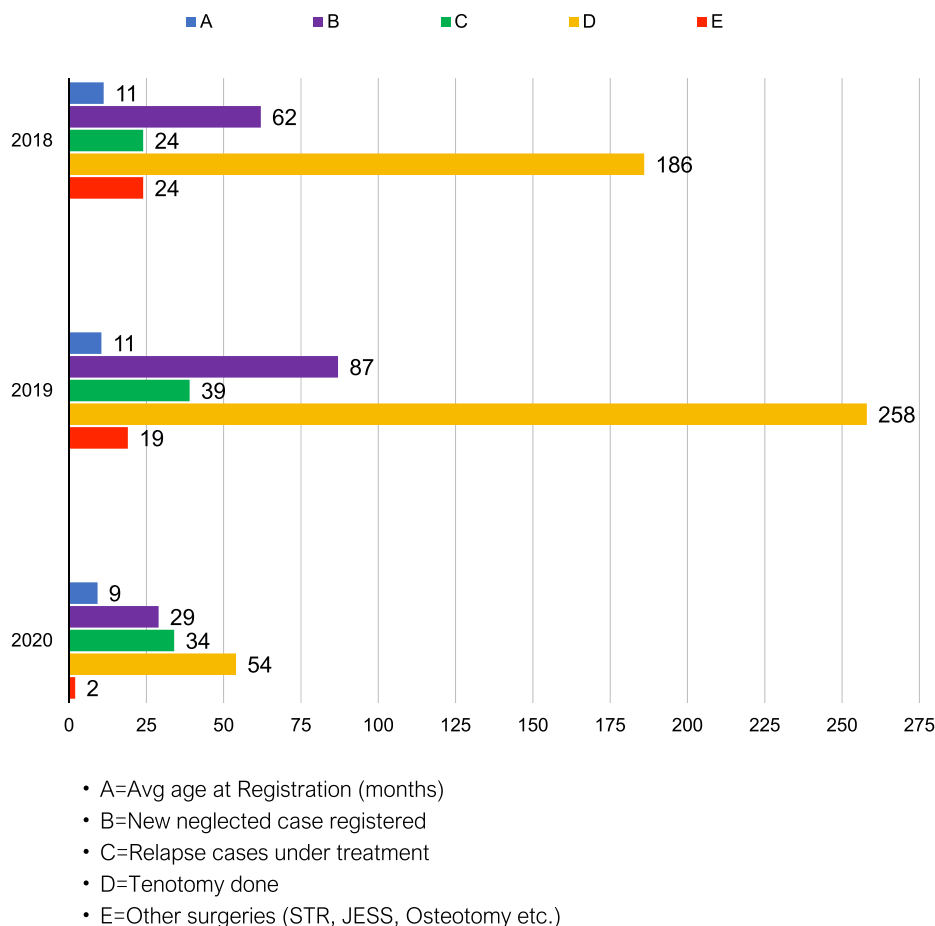


Fig. 1. Demography and other details of cases registered at our clubfoot center.

Table 1  
Distribution of cases in last three years at our clubfoot center

Year	Bilateral feet	Unilateral feet	M: F	Average age at registration (months)
2018	140	102	187/55	11.2
2019	173	145	244/71	10.5
2020	84	42	90/37	9.2
p-value	0.0058	0.0004	—	0.72

3. Fear of getting infected
4. Caregiver not available/sick/death
5. Poverty due to lockdown/pandemic effect/job loss.
6. Decrease in awareness and counselling programs during pandemic.

During year 2020, we noticed that almost 80% registrations were local, city residents. This may be effect of probable reasons quoted above with variable contributions.

Of all the relapses noted at our centre during 2020 (n = 34), brace issue was reported by 70% of the relapses. This included not having next appropriate size or damage to brace. In a survey of orthopaedic surgeons, 60% advised to continue with old foot abduction brace (FAB) till situation improves.<sup>14</sup> Although, it's difficult to draw a conclusion at this point, but this factor could play an important role in relapses apart from actual non-compliance during & after pandemic. This was noted with increased share of relapsed cases in year 2020 (27%) compared to 9% of new registrations in year 2018. Apart from FAB related issues, lack of regular

follow up due to various reasons could be a reason for this rise in relapse cases.

The COVID-19 pandemic affected paediatric orthopaedic services all around the world. Keshet et al. described acceptable delays in paediatric orthopaedic services in Montreal, Canada.<sup>19</sup> Newborn clubfoot was put in category 3 (appointment delayed upto 3 months) and relapse/neglected cases in category 4 (appointment delayed upto 3–12 months). Similarly, Farrell et al.,<sup>20</sup> Majid et al.<sup>21</sup> also suggested delaying clubfoot treatment by atleast 3 months.

Aroojis et al.<sup>22</sup> noted that during pandemic year 2020, new registrations decreased, especially of rural community, at their center in Mumbai, India.

In contrast, Özbay et al.<sup>18</sup> in their study from rural hospital in Turkey, reported 140% increase in clubfoot cases during pandemic year 2020 compared to previous year. Patients reporting to a rural centre rather than tertiary care centres in big cities due to covid norms was listed as possible cause of this rise by the authors. However, they reported lower tenotomy rate when compared to the literature. Patients missing out the appointments was listed as

**Table 2**  
Future considerations for re-establishing clubfoot programme and suggested strategies.

Considerations/Challenges	Suggested strategies/solutions
General considerations	<ul style="list-style-type: none"> <li>• After considering the current local guidelines regarding Covid, clubfoot program to be opened in phased manner.</li> <li>• Take local authorities &amp; government bodies into confidence.</li> </ul>
Manpower/human resources	<ul style="list-style-type: none"> <li>• Appoint one person from department as nodal officers to look after clubfoot program post-pandemic.</li> <li>• If local Covid situation allows, redirect staff from covid duties back to clubfoot clinic.</li> </ul>
Logistics/supplies & Infrastructure	<ul style="list-style-type: none"> <li>• Appoint adequate doctors/residents, counsellors and support staff in team to manage increased load in clubfoot clinic.</li> <li>• Make provisions for adequate supplies of Plaster materials: - Plaster of Paris (POP), Soft cotton rolls etc.</li> <li>• More spacious plaster room/area: to accommodate more teams with proper social distancing.</li> <li>• Adequate arrangements &amp; supplies for tenotomy procedures: - dressing materials, needle &amp; syringes, surgical blade, local anaesthetic cream/injection etc.</li> <li>• Adequate number of foot abduction brace (FAB) to replace old ones and to meet anticipated increase in demand.</li> <li>• Clubfoot clinic thrice a week up from twice previously, to cater more number of children per week, with adherence to covid protocols.</li> <li>• Alloting an operation theater (OT) table for clubfoot related procedures on priority basis. When required consider day case surgeries and rapid turnover.</li> </ul>
Drop outs/lost to follow up cases	<ul style="list-style-type: none"> <li>• With the help of counsellors/Call Centre, call &amp; reach out to all drop out, missed follow ups.</li> </ul>
Infection control measure	<ul style="list-style-type: none"> <li>• Summarised in <a href="#">Table 3</a> below.</li> </ul>
Follow Up	<ul style="list-style-type: none"> <li>• Routine follow ups, especially for patients coming from out of city, can be considered on online platform.</li> <li>• Local/district centres can be identified and groomed for this telemedicine follow ups. Call patient physically only if there is any issue identified.</li> <li>• These local centres can will help in decentralising the clubfoot services.</li> </ul>
Training and Re-training	<ul style="list-style-type: none"> <li>• Practicing orthopedicians can be encouraged for training/re-training program for clubfoot management</li> <li>• Collaborate with District and state orthopaedic associations.</li> <li>• Train more nursing staff and plaster technicians.</li> </ul>
Clubfoot Awareness:	<ul style="list-style-type: none"> <li>• Use various radio, print &amp; social medial platforms to announce resumption of clubfoot services.</li> <li>• Raise awareness regarding clubfoot and its available treatment.</li> <li>• Also, re-enforce the need of regular follow up as inherent part of clubfoot treatment.</li> </ul>
Quick adaptations as & when necessary	<ul style="list-style-type: none"> <li>• Quick adaptations may be necessary in cases of non-responders, atypical or complex clubfeet.</li> <li>• Considering modified Posenti method as &amp; when necessary.</li> <li>• Program may need quick policy changes depending on pandemic situation and local guidelines.</li> </ul>
Involving Major Stakeholders	<ul style="list-style-type: none"> <li>• Ministry of Health and Family Welfare (MOHFW)</li> <li>• Local/state orthopaedic and paediatric societies</li> <li>• District hospitals/centres identifies as local clubfoot centres</li> </ul>
Financial resources	<ul style="list-style-type: none"> <li>• Utilise all stakeholders</li> <li>• Bring more Non-government Organizations (NGO's) on-board</li> <li>• Awareness and donation programs</li> </ul>

**Table 3**  
Safety protocols to reduce the risk of Covid transmission during clubfoot program services.

Prior to clubfoot clinic appointment	<ul style="list-style-type: none"> <li>• For follow up cases, give appointment only after call from counsellors or call centres, distribute appointments over the week to avoid overcrowding at clubfoot clinic.</li> <li>• For new registrations: can give appointment through online system.</li> <li>• Appointment only after confirming that child &amp; caregiver does not have active Covid symptoms or no known exposure in last 48hrs.</li> <li>• Depending upon Covid situation and local guidelines: testing for Covid before giving appointments.</li> <li>• For walk-in patients: Consider after screening with history of symptoms &amp; exposure, temperature screening.</li> <li>• Segregate appointments equally across working hours. If resources allow, consider morning &amp; afternoon shifts of appointments.</li> <li>• Cast removal: <ul style="list-style-type: none"> <li>- advised at-home removal for children coming from with-in city.</li> <li>- Advised at-clinic removal for children coming from outside city (take &gt;4 h to reach clinic).</li> </ul> </li> </ul>
Safety practices at the clubfoot clinic	<ul style="list-style-type: none"> <li>• Adequate staff to manage &amp; guide the patient flow.</li> <li>• All staff should be trained properly in infection control measures and working protocol of clinic. No staff with symptoms or suspected of Covid should attend clinic.</li> <li>• Depending upon latest covid situation and local guidelines, all staff should wear adequate protective equipments (disposable gloves, N-95 mask, face shield etc.)</li> <li>• Adequate signage and direction boards to guide caregivers and service seekers.</li> <li>• Only one caregiver should accompany each child.</li> <li>• Mask should be mandatory to all caregivers and children &gt;2year old.</li> <li>• Siting facility for all with adequate social distancing provisions.</li> <li>• Adequate sanitisation facilities with hand washing provision and touch-less hand sanitiser dispensing points.</li> <li>• Depending upon available resources, more number of doctor and counselling stations at the clinic with social distancing norms.</li> <li>• Clinic should be cleaned &amp; sanitised at recess, and at the end of day.</li> </ul>
Safety practices in plaster room & minor Operation Theater (OT) (for tenotomies)	<ul style="list-style-type: none"> <li>• Adequately spacious and ventilated plaster room.</li> <li>• Adequate space between two plastering stations/teams.</li> <li>• Routine infection control measure to be followed strictly.</li> <li>• Wear/use disposable gloves &amp; plastering gown for manipulation &amp; casting. Change gloves, gown and water used for plastering every time.</li> <li>• Can consider "ring-fence casting" technique depending of available resources and comfort of treating doctor and parents.<sup>21</sup></li> <li>• Use disposable materials as much possible during tenotomies in minor OT. Use disposable bed sheets and change after each procedure.</li> </ul>

reason by authors. Firth et al.<sup>23</sup> also reported an increase in clubfoot cases in 2020 with parents commuting longer distance for treatment. Mean age at casting commencement was 52 weeks. The authors concluded that with proper safety protocols in place, continuing clubfoot care was possible.

We agree that, in our program it is a theoretical possibility that during pandemic year, patients were self-directed to local/rural doctors for clubfoot treatment. However, a national survey by Rangasamy et al.<sup>14</sup> reported that 30% did not do any casting or tenotomy during survey period and concluded that covid-19 had significant impact on clubfoot services in India.

With birth prevalence of 1 per 1000 live births, every year, about 30,000 children are born with clubfoot in India.<sup>24</sup> Due to disruption of clubfoot services, apart from backlogs, we might be looking at a wave of neglected and relapse cases. This could overwhelm the resources and infrastructure in already stressed system.

The financial burden of clubfoot treatment per child varies in each country ranging from \$ 170 to \$ 30,000. Ponseti method is a cost-effective treatment for clubfoot.<sup>25</sup> But as the number of average casts increases, the cost increases.<sup>26</sup> Hussain et al. has reported that indirect costs like transportation or job loss can be significantly higher even when treatment is provided free.<sup>27</sup> So, the direct and indirect financial cost of treating relapse and neglected clubfoot could also burden the state.

Anticipating these upcoming challenges, we plan and suggest the following considerations & strategies for re-establishing clubfoot program (Tables 2 and 3).

There are few limitations in present study. These findings are from single tertiary care center and may not be depicting exact population trend. The expected wave of relapse/neglected case is purely based on anticipation and preparedness philosophy. The patient or caregiver perspective could not be assessed in this study. Also, these recommendations are based on departmental expert committee on clubfoot management.

## 5. Conclusion

COVID-19 pandemic had definite disruptive impact on our clubfoot program. With decreased new registrations, follow-up visits and increased relapses, we anticipate a significant increase in clubfoot cases in need of casting & treatment. To deal with pent-up demand and an anticipated wave of relapse and neglected clubfoot cases, we have proposed strategies to re-establish clubfoot program in post-pandemic new-normal. We hope these will prepare us for any adversaries we face.

## Ethics approval

Approval granted by Institutional Ethical Committee.

## Consent to participate

Not applicable.

## Funding

None.

## Declaration of competing interest

The authors state that they have no conflict of interest, financial or otherwise, concerning the material or methods used in this study or the findings specified in this paper.

## Acknowledgements

The suggested strategies presented here are not truly evidence based. Some information is based on available guidelines related to Covid-19. Others are based on collective opinion of departmental expert committee with vast experience in running clubfoot program at tertiary care level.

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