

## Original Research Article

# Pattern and presentation of panfacial fractures at a tertiary reference center based in Central Kerala, South India

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**Abstract – Aim:** We aimed to describe the pattern and clinical presentation of panfacial fractures and to analyze if the panfacial fractures differ from other maxillofacial injuries concerning the time of intervention and duration of hospital stay, thereby evaluating if panfacial fractures place a burden on our hospital which is a tertiary reference center in South India. **Materials and methods:** This was a prospective study conducted for a duration of two years from January 2018 to January 2020 among 28 patients who reported with panfacial fractures. Descriptive data were entered and chi-square test was done to find out the association between categorical variables. **Results:** Patients who reported with panfacial fractures were young adults ( $n = 17$ , 60.7%), males (92.8%) predominantly. Among those with a history of Road Traffic Accidents ( $n = 23$ , 82%), 91% ( $n = 21$ ) did not use any protective devices. **Conclusions:** Males, young adults, use of two-wheelers, consumption of alcohol before driving, and avoidance of protective devices were most commonly associated with panfacial fractures ( $p < 0.05$ ). Based on the study, panfacial fractures place a burden on the hospital in terms of the need for special care and prolonged stay period and operating time compared to other maxillofacial injuries ( $p < 0.05$ ).

## Introduction

When facial bone fractures were studied decades ago, the prevalence of high energy accidents producing panfacial fractures was not common. Due to increased transportation and speed at which the world moves, development in terms of communication and mobility lead to not only increased and faster connectivity, but also to unavoidable mishaps such as road traffic accidents (RTAs). Panfacial trauma is one such, which involves de-construction of the facial aesthetics and function involving both the hard and soft tissues.

Panfacial fractures are facial fractures that simultaneously involve the upper, middle, and lower thirds of the face, usually caused by high-velocity injuries [1,2]. They are often accompanied by head, cervical, and long bone injuries at the time of presentation. Dilapidation to the bony framework along with the damages to the soft tissue may produce aesthetic problems like alterations in vertical facial height, transverse or anteroposterior projection, and functional disturbances like derangement of occlusion, diplopia, or trismus making reconstitution of original facial architecture

a challenge even to an experienced surgeon because of the severe degree of fragmentation and loss of anatomy that guides in the reconstruction of facial harmony [3].

Taking into consideration the complexity in the management and the presence of concomitant injuries warranting the need for emergency intervention in panfacial trauma, our study aimed to analyze the pattern, etiology, concomitant injuries, emergency intervention, clinical presentation, and management strategies of panfacial fractures reporting to our tertiary reference center in South India. The study is unique in the sense that there is no reported literature on the elaborate study of panfacial fractures in South India. We also intended to analyze the difference between panfacial fractures and other maxillofacial fractures in terms of duration of hospital stay required, length of surgical procedure in the operation theater, and the need for special care, thereby observing if they place a burden to the hospital.

## Materials and methods

### Study population and criteria

This was a prospective study conducted at a Tertiary Reference Centre in Kerala, South India. Patients sustaining fractures of the upper, middle, and lower third of the face

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**Table I.** Distribution of patients according to etiology of fracture.

Etiology	<i>n</i> = frequency	Percentage
Road Traffic Accident (RTA)	23	82
Fall	2	7.2
Inter Personal Violence (IPV)	1	3.6
Occupational	2	7.2
Sports Related	0	0
Others	0	0

simultaneously during the study period from January 2018 to January 2020 were included in this study, whereas those with isolated fractures of the upper third or middle third or lower third of the face, medically compromised patients and those who did not consent to participate were excluded.

### Procedure

Emergency intervention was done to stabilize the patient and primarily address conditions like pneumothorax, blunt abdominal trauma, and head injury whenever present, at the Emergency Department (ED) by an emergency physician. Complete physical examination of the patient was then carried out by a general surgeon and a maxillofacial surgeon to evaluate sites of fracture, associated head or cervical injuries and confirmed by plain or specialized imaging. Plain postero-anterior view of skull, paranasal sinus view (PNS), orthopantomograph (OPG), computed tomography (CT) and cone beam CT (CBCT) were the radiographs commonly advised. Closed treatment (conservative) or open surgical approach by Open Reduction and Internal Fixation (ORIF) was carried out in indicated patients.

### Analysis of data

Complete history, demography, concurrent injuries, emergency interventions done, and the method of treatment were recorded. The amount of time taken for operating a panfacial fracture, the time when they were attended after the primary interventions were addressed by the concerned specialties, and duration of hospital stay were recorded. Data were entered in Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS version 21.0, IBM, Chicago, IL). Chi-square test was done to find out the association between categorical variables and a *p*-value of  $\leq 0.05$  was considered statistically significant.

### Results

A total number of 28 patients with panfacial fractures who fulfilled the inclusion criteria were selected and treated as a part of this study. Three patients were excluded due to extreme illness (*n* = 2) and not consenting to be a part of the study (*n* = 1). In our study, most of the patients who had panfacial

fractures belonged to the age group of 18–40 years who contributed almost 2/3rds (*n* = 17, 60.7%) of the study population. Irrespective of the etiology of fracture, 26 of 28 cases were males (92.8%), 18(64%) patients with panfacial trauma were below the poverty line and ten (36%) patients were above the poverty line. The distribution of patients according to the etiology of fracture is shown in [Table I](#). Those involved in Road traffic accidents (RTA) (*n* = 23, 82%) were either riding motorbikes (*n* = 17, 74%) or four wheelers (*n* = 5, 22%), or a pedestrian (*n* = 1) who collided with any of these vehicles. Usage of protective devices like helmets for two-wheelers and seat belts for four-wheelers were analyzed in our study. Among the 22 patients who were driving during the accident, around 91% (*n* = 21) did not use any of these protective devices. Irrespective of the etiology of panfacial fracture, consumption of alcohol before the accident was analyzed in our study. At the ED, 18 patients (64%) were either found positive for the smell of alcohol at the time of reporting or reported in an inebriated state or were elicited from the ones who accompanied them.

The various findings of clinical importance in panfacial trauma are listed in [Table II](#). Among the 28 patients with panfacial trauma reporting to the ED, six (21%) patients required invasive methods of airway stabilization, 14 (50%) patients required non-invasive methods, and the remaining eight (29%) did not require any intervention ([Tab. III](#)). The clinical features of panfacial fractures are depicted in [Figures 1 and 2](#). The method of delivery of general anesthesia in patients who required ORIF is shown in [Figure 3](#).

Management of panfacial trauma was either closed treatment or ORIF under general anesthesia. Two patients with panfacial trauma expired at the ED due to severe concomitant injuries. Hence, among the remaining 26 patients, two patients (8%) were managed with closed reduction because of the risk of quadriplegia owing to the presence of cervical spine fractures, and the remaining patients were managed by ORIF. Among the patients treated by ORIF, 16(67%) underwent the bottom to top approach and the rest eight (33%) underwent the top to down approach. These patients who were treated surgically by any of the two sequencing methods were followed up at regular intervals of the first week, first, and third month ([Fig. 4](#)). Facial deformity including post-operative edema was the most common feature seen in follow-up. Two patients had post traumatic deformity after three months of follow up.

**Table II.** Observatory findings and associated injuries in Panfacial fractures.

Observation	Yes	No	Percentage
Usage of protective devices	02	20	9
(+) For smell of alcohol	18	10	64
C-spine injury	12	16	43
Long bone fracture	07	21	25
Head injury	15	13	54
CSF rhinorrhoea	04	22	14
CSF otorrhoea	01	25	4
Pneumothorax	10	18	36
Rib fracture	09	19	32
Abdominal trauma	06	20	23
Facial nerve palsy	01	25	4
Traumatic optic neuropathy	03	23	12
Mean GCS Score at the time of presentation	10		

**Table III.** Distribution of patients according to the emergency airway required.

Emergency airway intervention	n = Frequency
Oropharyngeal airway	2
Nasopharyngeal airway	1
Oral intubation	11
Nasal intubation	0
Tracheostomy	6
Nil	8



**Fig. 1.** (a) Raccoon eyes in a case of panfacial trauma. (b) Clinical features of panfacial trauma (peri-orbital edema, gross facial edema) with emergency intervention (oral intubation) for stabilizing airway and anterior nasal packing for arresting hemorrhage.

The day (mean) on which patients with panfacial trauma were intervened, after being primarily addressed by concerned specialties for concomitant injuries, was on the ninth day of admission, whereas, the other maxillofacial trauma patients

were treated on their fourth day of admission ( $p < 0.05$ ). The average duration of hospital stay in panfacial fractures was 13.9 days whereas other maxillofacial fractures treated in our department simultaneously required a mean hospital admission duration of 6.9 days ( $p < 0.05$ ). The average time taken for surgery from intubation to extubation for a panfacial fracture was 4 hours and 26 minutes compared to the average of 1 hour and 42 minutes for isolated facial bone fractures ( $p < 0.05$ ).

## Discussion

Panfacial fractures not only affect the bony framework but lead to damage of soft tissues also, which may result in both aesthetic and functional retardation [3]. Therefore, stepwise and meticulous planning is necessary to optimize the outcome. This starts from the moment the patient reports to ED. Proper evaluation of the patient with prompt attention to emergency interventions must be carried out if required. High energy injuries are the most common cause of panfacial fractures and they account for 4–10% of all facial fractures with males affected frequently in 3:1 ratio compared to females [4]. Similarly, our study also had a significant amount of males between 18 and 40 years being the most commonly affected group.

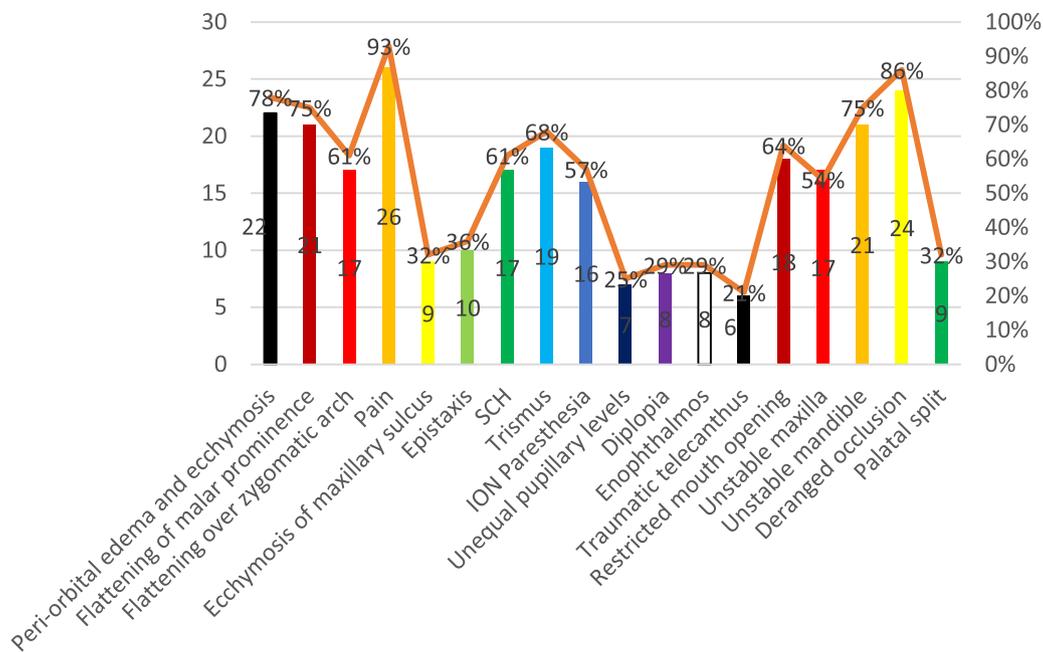


Fig. 2. Clinical features of Panfacial fractures.

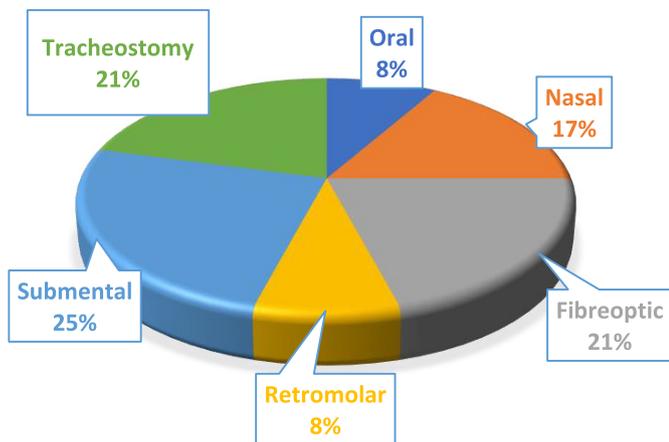


Fig. 3. Pie chart showing distribution of patients according to the method of intubation for general anaesthesia.

Panfacial fractures seldom occur alone and are often accompanied by injuries elsewhere in the body for which adequate attention has to be paid. Intra-cranial, intra-abdominal and thoracic injuries may be life-threatening and are more serious than panfacial fractures [5]. Cervical injuries pose a threat of hemiplegia or quadriplegia which are serious risks even before examination of a patient with panfacial trauma. Hence it is better to follow the dictum "All patients with maxillofacial trauma are considered to have cervical spine injuries unless proven otherwise". Cervical spine fractures, tenderness, and straightening were all included under the broad term 'cervical injuries' in our study. Two patients expired due to severe head injury and hypovolemic shock in the red

zone of ED. Hence the mortality associated with panfacial fracture in our study was 7% which cannot be solely attributed to the panfacial fracture but also the associated injuries. Oral intubation (39.2%) and tracheostomy (21.4%) were the most common emergency airway interventions done to stabilize the patients with panfacial trauma. Blind nasal intubation is never recommended for airway stabilization in panfacial fractures due to risk of encroaching the skull base in the presence of concomitant nasal and ethmoidal bone fractures [6]. This throws light on the need for the maxillofacial trainees and residents to be skilled with life-saving procedures and promptly identify the cases that require special attention.

As the maxillofacial surgeons and anesthetists share a common area, modification of the airway may be necessary for the management of panfacial fractures. In complex maxillofacial injuries, where neither orotracheal nor nasotracheal intubation is preferred, the alternate technique at hand is tracheostomy [6]. In our study, nasotracheal intubation was not preferred in cases with the presence of comminuted nasal bone fractures. As the occlusal relationship is a guiding factor intraoperatively in achieving improved function, orotracheal intubation was also not preferred generally due to its interference. Patients (n = 6) who were under tracheostomy for primary stabilisation of the airway were taken up for ORIF under GA through the same port. "Submental diversion" was the most common method used in our study for delivery of anesthesia and at the same time, to evaluate occlusion. According to Kundra *et al.*, the term "submental diversion" is the most suitable for the method of intubation where orotracheal intubation is carried out initially followed by submental diversion of the wire re-inforced endotracheal tube [7].

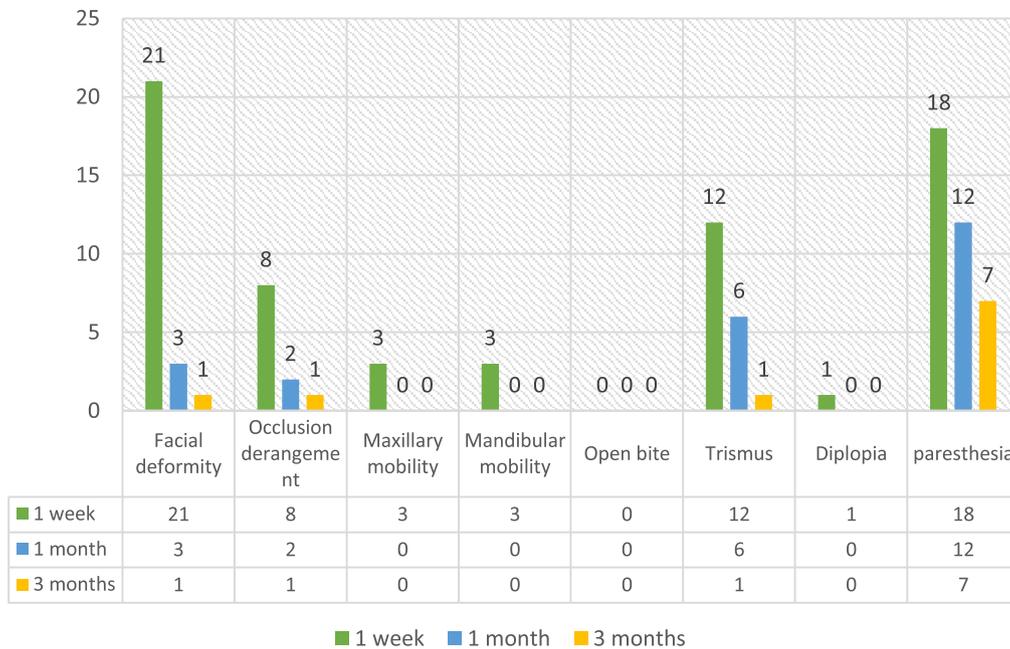


Fig. 4. Features of panfacial fractures at 1<sup>st</sup> week, 1<sup>st</sup> and 3<sup>rd</sup> month of follow up.

Although the diagnostic and evaluation options evolve, the task of a surgeon remains the same, to ensure complete anatomical, functional and esthetic re-establishment of the face to its actual three-dimensional shape. Reconstructing the soft tissues taking into consideration the facial soft tissues as the fourth dimension plays a vital role [8]. Using the vertical, horizontal, and sagittal buttresses of the face, the panfacial reconstruction commences with reduction of the upper third of face followed by middle and lower thirds in top-down sequencing or vice versa in bottom-top sequencing. A combination of these sequences may sometimes be necessary for the ideal restoration of facial contour [9]. Bottom-top sequencing was the most common method followed in our study (67%) (Figs. 5 and 6). Whatever the sequence may be, the surgical approach to facial fracture management should focus on attaining proper vertical, horizontal, and transverse relationships of the facial frame along with restoration of orbital, oral and nasal cavities [10].

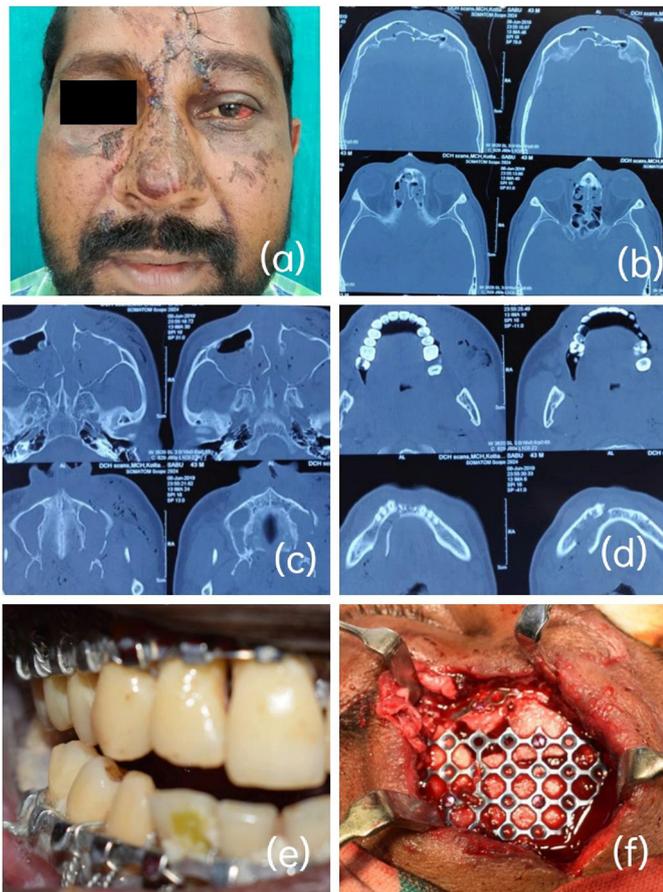
Patients who required intensive care (n = 12, 42.8%) were admitted in respective units and 14% of the patients developed psychosis in the meantime which required special attention. Therefore, panfacial trauma patients not only suffer physical injuries but also psychological problems and breakdowns for a long period as they might have disfiguring injuries to their faces [11]. Hence the psychological aspect must also be taken into account when treating these patients, thus rendering a holistic approach in panfacial fracture management. Two patients had post traumatic deformity after three months of follow up. One patient with persistent facial deformity (depressed malar prominence) was treated with osteotomy of the zygoma whereas the other patient with deranged occlusion (due to non-union) and trismus was addressed by

bilateral intraoral coronoidectomy, re-fracture of the mandible, followed by ORIF and deposition of platelet rich plasma (PRP) in the defect.

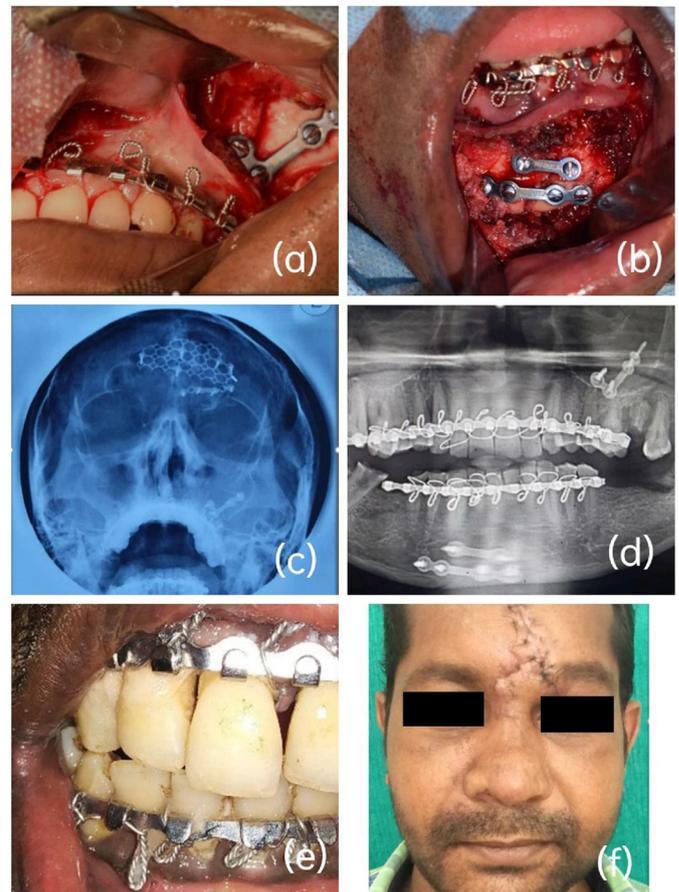
Although early intervention is best preferred, it is procured from our study that panfacial trauma patients require special attention for concurrent injuries, and hence the expert management of panfacial fractures is delayed. The panfacial fracture patients were managed by our department after the primary survey and stabilization. This led to an unavoidable delay in expert and ideal management of panfacial fractures. This delay was significant when compared to the time of intervention of other maxillofacial traumatic injuries. The problem with delayed intervention is that, if treatment is not carried out during the indicated time frame after the injury, malunion of fractures, shrinkage of soft tissues, and scarring may occur, all of which make the delayed treatment cumbersome [12]. Misdiagnosis, inadequate treatment planning, lack of adequate exposure, and failure to use bone grafts during the operation may cause post-traumatic defects secondarily such as flattening of the midface, ectropion, malocclusion, and temporal hollowing [12]. Therefore, it is conveyed from our study that the panfacial trauma patients require prolonged operating times and extended hospital stays with special care during the post-operative period and follow-up.

### Conclusion

Young inebriated males are more prone to RTAs. From our study, it is imperative that panfacial fracture management demands adequate, meticulous planning and requires long-term management usually with prolonged hospital admission



**Fig. 5.** (a) Pre operative clinical picture with gross facial edema and subconjunctival hemorrhage. (b) CT axial view showing the frontal bone fracture. (c) CT axial view showing the fracture of zygomatic buttress on left side. (d) CT axial view showing right mandibular fracture. (e) Deranged occlusion on the right side. (f) Reconstruction of outer table of frontal bone with titanium mesh.



**Fig. 6.** (a) ORIF – left zygomatic buttress. (b) ORIF - right mandible. (c) Post operative paranasal sinus view showing the hardware. (d) Post operative OPG showing adequate reduction. (e) Post operative satisfactory occlusion. (f) Post operative clinical picture of the patient after ten days.

due to the presence of concomitant injuries and in-patient care than any other maxillofacial fractures. Examination of the patient as a whole in panfacial trauma is mandatory for a surgeon to rule out any unattended emergencies. Although delayed in life-threatening injuries, early reduction and fixation are recommended for panfacial fractures.

### Ethics approval and informed consent

All the procedures performed in our study were following the ethical standards of the institutional research committee and with the 1975 Helsinki declaration and its later amendments in 2000. The questionnaire and methodology for this study were approved by the Human Research Ethics committee from Institutional Review Board, Ethics approval IEC/M/14/2017/DCK, approved in November 2017. Informed consent was obtained from all individual participants included in the study.

### Authors contributions

Anish Poorna T: Conceptualization, Methodology, Anish Poorna T, Mohan S: Writing original draft. Jayakumar N, Joshna EK: Visualization, Investigation. Jayakumar N, Mohan S: Supervision. B. Ramya Arangaraju: Writing- Reviewing and Editing. Sathikala L: Statistical Analysis.

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