Original Article

Undiagnosed mandibular condylar fractures causing temporomandibular joint ankylosis: A problem in northern India

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ABSTRACT

Background. Temporomandibular joint (TMJ) ankylosis due to undiagnosed condylar fractures has a high incidence in India compared to western countries. We evaluated the demographics, injury pattern, hospital reporting and referral pattern of undiagnosed condylar fractures complicating TMJ ankylosis in northern India.

Methods. We did a retrospective analysis by retrieving medical records of patients with post-traumatic TMJ ankylosis reporting to the Department of Oral and Maxillofacial Surgery, All India Institute of Medical Sciences between 1 July 2012 and 30 June 2013.

Results. Of 90 patients with post-traumatic TMJ ankylosis, 74 (82.2%) resided in rural areas. Sixty-three (70%) patients were from the states of Uttar Pradesh, Bihar and Jharkhand. Only 8.8% had higher education and 10% had an annual income of more than ` 2 lakh. In 69 (84.4%) patients, fall was the aetiological factor. Primary health centres (42%) and private clinics (20.5%) received the major share of patients immediately following injury. Few patients (19.3%) had some radiographic examination done and only 17% were referred by the primary healthcare provider. Of those referred only 3 were examined by a dental practitioner. Only 10% of all were diagnosed with condylar fractures.

Conclusion. Patients with TMJ ankylosis presenting to us have poor literacy and income levels. A missed diagnosis of condylar fractures by rural healthcare providers contributes to its high incidence in India. Improving awareness of clinicians and improved rural healthcare infrastructure can help prevent this complication.

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INTRODUCTION

The term 'ankylosis of the temporomandibular joint' (TMJ) refers to bony or fibrous adhesion of the anatomical components of the joint and their ensuing loss of function.[1] The immobilized joint causes functional limitation such as inability to eat a normal diet with difficulty in speech. Facial growth is affected resulting in mandibular asymmetry and severe mandibular retrognathia when the condition is bilateral. Maintenance of oral hygiene becomes difficult with an increased incidence of dental caries and periodontitis. The extensive facial deformity and functional limitation has considerable psychological effects, which hamper the quality of life of the individual.

The aetiology of TMJ ankylosis broadly includes trauma and infection. Isolated mandibular fractures represent the most common type of paediatric maxillofacial fractures,[2–5] with the condyle being the most common site to be fractured.[4,6–8] Despite this it is one of the least diagnosed sites of trauma in the head and neck region.[7–9] The condylar head in children differs anatomically from that of an adult. It has a thin cortex with a broad neck and high osteogenic potential. An impact on the chin as a result of a fall or injury by a heavy object transmits forces along the mandible fracturing the condylar head.[10] If not diagnosed and treated, such injuries frequently lead to TMJ ankylosis.

The incidence of TMJ ankylosis is high in developing countries compared to the West.[11–13] Trauma is the major cause of ankylosis in India while a high percentage of congenital TMJ skeletal disorders are reported from the West.[13] The incidence of TMJ ankylosis is rising in India.[11] We evaluated the demographics, injury pattern, hospital reporting and referral pattern of patients with undiagnosed condylar fracture leading to TMJ ankylosis in northern India.

METHODS

We did a retrospective study of the medical records of patients with post-traumatic TMJ ankylosis reporting to the Department of Oral and Maxillofacial Surgery, Centre for Dental Education and Research, All India Institute of Medical Sciences, New Delhi, between 1 July 2012 and 30 June 2013. We collected information on demographic details, annual income and educational status of the patient and/or their parents, primary healthcare provider after initial trauma, referral pattern, diagnosis of injury, time taken for diagnosis, time when ankylosis was noticed by the patient/patients' parents and average mouth opening at the time of presentation.

The educational status was classified as illiterate, primary education (up to class IV), secondary education (class IV to X) and

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higher (class XI and higher). In children the highest educational status of either parent was considered. Annual income levels were divided into three categories: <₹1 lakh, ₹1–2 lakh and >₹2 lakh. The primary healthcare provider for the patients after initial trauma was divided into public and private set-up. A public healthcare facility was classified as government run: primary health centres (including subcentres) (PHCs), secondary health centres (community health centres; SHCs) and tertiary health centres (THCs). A private healthcare facility was classified as: private clinics, nursing homes and hospitals. Data were analysed using STATA version 11 (Statacorp, College Station, TX, USA) and are presented as mean (SD).

RESULTS

One hundred and four patients with TMJ ankylosis reported during the study period. Ninety patients (86.5%) had a previous history of trauma, 12 patients (11.5%) had a previous history of infection while the aetiology was congenital in 2 patients. The majority of patients were children and only 5 were ⩾18 years of age. The mean (SD) age was 11.6 (7.6) years with 43 men and 47 women. The most common cause (Table I) of trauma was fall from height (58.8%). Illiteracy was high among the sample (58.8%) and only 8.8% had received higher education (class XI or higher). Nine patients (10%) had an annual income of >₹2 lakh (Table II) while 47 (52.2%) had an income <₹1 lakh. Uttar Pradesh (33.3%) and Bihar (23.3%) contributed the highest number of patients while Rajasthan (2.2%) contributed the least (Table III). Seventy-four patients (82.2%) resided in rural areas while the remaining were from urban areas of Delhi (*n*=14, 15.6%) and Uttar Pradesh (*n*=2, 2.2%).

Of the 90 patients with a history of trauma, 80 reported to a healthcare professional immediately following injury while 2 patients (both children) were not taken to any healthcare facility. Of 52 patients (59%) who reported to a public healthcare facility, the majority visited PHCs (42%). Of those who reported to a private healthcare facility (*n*=36, 41%), 18 (20.5%) visited a private clinic and 16 (18.2%) a private nursing home (Table III). Fifteen (17%) patients were referred by the primary healthcare provider for further treatment (Fig. 1). On referral, 2 patients were examined by a general physician, 7 by a general surgeon, 2 by an orthopaedic surgeon, 2 by an oral and maxillofacial surgeon and 1 by a general dentist. One patient who was referred to an SHC did not report for further treatment. Only 17 (19.3%) patients had undergone some kind of facial radiographic examination at the time of initial injury. One child, though advised, did not cooperate for a radiographic examination.

Eight patients were diagnosed to have a condylar fracture at the time of injury while 1 patient was diagnosed after an interval of 2 months (Table IV). Of these 9 patients, 7 were residents of Delhi. Except 2 patients who were diagnosed at a THC, all were diagnosed at a private facility. In 2 patients, prolonged dental

TABLE I. Injury pattern of post-traumatic TMJ ankylosis patients

Cause	*n* (%)
Fall from height	53 (58.8)
Fall while playing	7 (7.7)
Fall from bed	4 (4.4)
Fall from bicycle	5 (5.5)
Hit over chin by heavy object	9 (10)
Road traffic accident	11 (12.2)
Direct hit over joint	1 (1.1)

TMJ Temporomandibular joint

TABLE II. Educational and economic status of the patients/ patient's parent*

Item	*n* (%)
Education	
Illiterate	53 (58.9)
Primary education	22 (24.4)
Secondary education	7 (7.8)
Higher education	8 (8.9)
Annual income (in ₹)	
<1 lakh	47 (52.2)
1–2 lakh	34 (37.8)
>2 lakh	9 (10)

* Parental education (highest education of either parent) and income considered for children

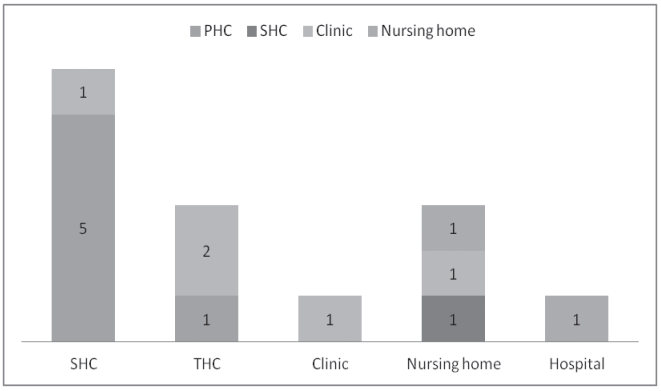

FIG 1. Referral pattern of patients after initial injury. The X-axis denotes the centre where patients were referred to; segments of the bar denote the referring centre
SHC Secondary health centre THC tertiary health centre

TABLE III. Initial healthcare providers of patients: Distribution by state

State	Total patients	Healthcare set-up						
	n (%)	Public sector			Private sector			None
		PHC	SHC	THC	Clinic	Nursing home	Hospital	
Delhi	14 (15.6)	0	0	1	6	7	0	0
Haryana	11 (12.2)	3	1	0	5	2	0	0
Bihar	21 (23.3)	11	5	2	2	1	0	0
Jharkhand	12 (13.3)	10	1	0	0	0	0	1
Uttar Pradesh	30 (33.3)	12	2	3	5	5	2	1
Rajasthan	2 (2.2)	1	0	0	0	1	0	0
Total	90	37 (42)	9 (10.2)	6 (6.8)	18 (20.5)	16 (18.2)	2 (2.3)	2 (2.3)

Values in parentheses are percentages PHC primary health centre SHC secondary health centre THC tertiary health centre

TABLE IV. Details patients diagnosed with condylar fractures but developed ankylosis of the temporomandibular joint

Age/ gender	Education	Annual income (₹)	Injury	Resi-dence	Primary healthcare provider	Referral to	Examined on referral by	Initial radio-graphic examination	Clinician informed about ankylosis	Time for diagnosis	Probable reason for ankylosis
7/F	Primary education	<1 lakh	Fall from height	Delhi	Nursing home	Private hospital	General dentist	Yes	No	2 months	Late diagnosis
16/M	Illiterate	1–2 lakh	Hit over chin	Delhi	Private clinic			Yes	No	immediate	Prolonged MMF, uncooperative
9/M	Primary education	<1 lakh	Fall from height	Delhi	Nursing home			Yes	No	immediate	Uncooperative
8/M	Primary education	<1 lakh	RTA	Delhi	Private clinic			Yes	No	immediate	Uncooperative
14/M	Illiterate	<1 lakh	Fall from height	Delhi	Nursing home			Yes	No	immediate	Uncooperative
13/F	Illiterate	<1 lakh	Fall from height	Bihar	THC			Yes	No	immediate	Prolonged MMF, uncooperative
51/F	Higher education	>2 lakh	RTA	Haryana	Private clinic	Private clinic	OMFS	Yes	No	immediate	Uncooperative
8/F	Illiterate	1–2 lakh	Fall from height	Delhi	Private clinic	THC	OMFS	No	Yes	immediate	Uncooperative
12/F	Higher education	<1 lakh	Fall from height	Delhi	THC			Yes	Yes	immediate	Uncooperative

RTA road traffic accident THC tertiary health centre OMFS oral and maxillofacial surgeon MMF maxillo-mandibular fixation

wiring (maxillomandibular fixation >6 weeks) was deemed as the probable reason for ankylosis. Six patients said that they did not follow the physiotherapy regimen advised following the injury. The average time after injury when decreased mouth opening was noticed was 12.8 (5.4) months. Radiographs of all patients showed complete bony ankylosis and the average mouth opening at the time of presentation was 0.7 (1.7) mm.

DISCUSSION

Similar to other studies,[11,14–16] the patient population reporting with TMJ ankylosis at our centre was mainly children. The majority of our patients were from Uttar Pradesh, Bihar and Jharkhand (70%). The higher incidence could be due to the relatively poor rural healthcare system in these states. A 2009 report showed that Uttar Pradesh and Bihar fared poorly with respect to patient satisfaction with primary healthcare.[17] Delhi with its better health facilities and better overall development also had a considerable share of patients (15.6%). Our data show that 50% of those diagnosed were also from Delhi and ankylosis developed due to poor compliance of the patients.

The majority of patients had reported to a public healthcare facility or a local private clinic immediately following injury. PHCs and rural private clinics are usually manned by a medical practitioner who is inadequately trained to diagnose condylar fractures, which is even more difficult to do in the absence of adequate radiographic facilities. Fall over chin, which was the most common aetiology, similar to other studies,[2,5] usually leads to soft tissue injury (lacerations, haematoma, abrasions) over the area of direct impact. The associated soft tissue injury also distracts the clinician as well as the patient's parents from the actual site of fracture. The relatively little pain, little clinical evidence and minimal reaction from the child to alert the adult also contributes to the missed diagnosis.[7] In the absence of major dental injury and the poor literacy levels among our patient population, it is not surprising that patients did not report to a dental practitioner after the initial trauma. However, <20% of India's PHCs have the services of a dental practitioner.[18] The dentist:population ratio is 1:10 000 in urban areas whereas it is as low as 1:150 000 in rural areas.[19]

Diagnosing condylar fractures requires radiographs. A radiographic investigation was done in only 8 patients with undiagnosed fractures in our sample which contributed to the missed diagnosis. Also diagnosing such fractures requires an orthopantomogram or a computerized tomographic scan. Such investigations are possible only with specialized equipment which is unlikely to be present in a rural set-up. The National Rural Health Mission, the country's flagship programme under which rural healthcare is delivered, provides for community health centres (CHCs) where medical specialists as well as radiographic facilities are available.[20] Resources are limited at the PHCs and patients are referred to a CHC if a specialist opinion or radiographic investigation is required. Only 17% of our patients were referred to a higher centre by the primary healthcare provider. The low referral rate could be due to seemingly mild injury, inadequate knowledge of medical practitioners regarding condylar fractures, the child's inability to communicate the exact site of injury and an inefficient referral system in rural area with respect to maxillofacial injuries. Of those who were referred, only 3 were examined by a dental or a maxillofacial surgeon. The diagnosis was missed by specialists from other fields. None of the patients who were undiagnosed were examined by a dental practitioner. Referral of these patients with undiagnosed injuries to a dentist or oral and maxillofacial surgeon would have prevented the complication of TMJ ankylosis.

Once TMJ ankylosis develops, it requires an extensive surgical procedure to achieve adequate mouth opening along with correction of the facial deformity. On the other hand, management of fresh condylar injuries in children is conservative and does not require any major surgery.[21] Treatment consist of liquid diet, mouth opening exercises and long-term follow-up to monitor facial

growth and mouth opening. We found 8 patients in whom condylar fractures were diagnosed immediately but the patients still developed TMJ ankylosis. In 6 patients this was related to the patient not following the instructions with regard to mouth opening exercises while in 2 patients, prolonged treatment for concomitant symphysis or parasymphysis fracture along with inadequate mouth opening exercises resulted in ankylosis.

Another finding is the time required to develop this complication. An immediate complication is easily noticeable than a slowly developing one. At least a year passed before reduced mouth opening was noticed in our patients. TMJ ankylosis develops gradually over a long period of time and is infrequently noticed early and related to the initial injury. By the time patients reported to our centre, complete bony ankylosis had developed with a mouth opening close to nil. Missed diagnosis, no prior warning about decreased mouth opening by the primary healthcare provider and poor literacy levels probably contributed to this scenario.

The Indian healthcare system is structured in three tiers, viz. primary, secondary and tertiary wherein the primary tier consisting of PHCs and subcentres serves the large rural population while the secondary tier consisting of CHCs acts as a referral centre. However, according to the approach paper of the Twelfth Five-Year Plan, in 2010, 10% of posts of doctors at the PHCs, 63% of specialist posts at the CHCs and 25% of nursing posts at PHCs and CHCs combined were vacant.[22] Of the 660 856 doctors registered in India, only 12% are in the public sector.[23] Because of the unfunded and understaffed public healthcare set-up even the rural population uses the private set-up more frequently (Duggal R. For a new health policy: A discussion paper. Paper presented at the Study Circle organized by the MFC/FMS/ACASH. Mumbai, Aug 1994:13). However, with limited spending potential, such patients are restricted to only the more affordable unregulated private sector offering services of varying quality often by under-qualified practitioners.[23,24] Even with our limited sample of TMJ ankylosis patients, the popularity of private clinics was evident among the rural population. Unfortunately, even simple management of mouth opening exercises and follow-up for condylar fractures was unavailable at these centres. There is a need to strengthen the primary healthcare tier along with better patient education to prevent debilitating disorders such as TMJ ankylosis occurring as a result of easily manageable condylar injuries.

Our aim is to sensitize policy-makers and healthcare personnel at all levels as well as local administrators to the possibility of condylar fractures occurring in children with simple injuries over the chin. We believe well-trained and aware healthcare personnel would be able to diagnose such injuries and refer them appropriately. Paramedical staff, if trained to take care of facial injuries in children, can at least recommend that the patient be examined by a dental/maxillofacial surgeon. The management of condylar fractures in children consists of aggressive mouth opening exercises and regular follow-up to monitor mouth opening. Such a management protocol can be instituted by even a non-specialist medical officer. Even if unsure of a condylar fracture in such patients, mouth opening exercises should be advised and the patient's parents informed regarding the possibility of ankylosis and the need for follow-up with the practitioner for at least 6 months.

There are a few limitations of our study. The data presented here are from a single institution in India. However, TMJ ankylosis is also treated at other tertiary medical hospitals and the incidence of undiagnosed condylar fractures complicating TMJ ankylosis could be higher. We do not have data on the exact incidence of condylar fractures in northern India. So the number of condylar fractures complicating into TMJ ankylosis is not known. However, we are not aware of any other study reporting on the referral pattern and diagnosis of condylar fractures immediately after initial trauma in such patients.

Recommendations for preventing TMJ ankylosis

We suggest the following measures to prevent the occurrence of TMJ ankylosis:

1. Medical officers, village health nurses and other paramedical support staff of PHCs, private allopathic and non-allopathic practitioners and personnel involved with child healthcare programmes such as *Anganwadi* workers in the Integrated Child Development Scheme (ICDS), and Accredited Social Health Activists (ASHAs) who work with children should be trained regarding the possibility of condylar injuries following maxillofacial trauma, especially with direct injury to the chin.
2. Vacancies in the primary healthcare tier should be filled so as to prevent dependence of rural population on under-qualified private medical practitioners.
3. Dental surgeons who are better trained in maxillofacial trauma should be included in the primary healthcare set-up.
4. A robust referral system is necessary to refer patients with maxillofacial injuries to dental surgeons and maxillofacial surgeons in areas where dental practitioners are not available. CHCs should be equipped with dental radiographic equipment and patients with such injuries should be referred and radiographed at these centres.

In conclusion, condylar fractures though easily manageable are frequently undiagnosed and can lead to TMJ ankylosis. Chances of missed diagnosis are higher in patients with poor economic status and high illiteracy levels residing in rural areas. Clinicians in rural healthcare set-ups may not be trained to diagnose, manage and refer patient with such injuries.

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