

Original Article

Management of jaw fractures in oral surgery in public and private practice: a retrospective study from 2006 to 2017

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Abstract – Introduction: To date, no epidemiological studies on jaw fracture have examined its characteristics according to hospital status (public vs private). The aim of this study was to examine their differences in terms of patient- and injury-related variables. **Methods:** A retrospective study was conducted using patients' medical records in 2 types of hospital located in the northern area of Brittany (France). All patients hospitalized for jaw fracture between 2006 and 2017 were eligible. Comparisons between centres according to age, gender, anatomic location of fracture, mechanism of injury, and length of stay were undertaken using χ^2 , Fisher exact test, *t*-test, and Cochran-Armitage trend test. **Results:** A total of 142 patients were included: 45.1% in the public and 54.9% in the private hospitals. Of them, 84.5% were men and the mean age was 32.0. Main causes of fractures were assault (56.3%), fall (30.3%) and road traffic accident (10%). A small number of patients had polytrauma (4.2%). The mean duration of stay was less than 2 days. Compared to patients who were admitted in private hospital, those who were likely to be admitted in public hospital were those: who had a jaw fracture in context of road traffic accident (18.8% vs 2.6%), with polytrauma (9.4% vs 0.0%) and maxilla fracture (9.4% vs 1.3%), and who had a longer stay (2.2 vs 1.1 days). **Conclusion:** This study showed that differences observed in characteristics of jaw fractures between public and private hospitals may be due to recruitment process: more severely affected patients are likely to be admitted in the public hospital.

Introduction

Jaw fractures include fractures of mandible and maxilla which can occur as a result of blunt trauma such as being punched or hit with an object or when the front of the face smashes against an immovable object as occurs in a road traffic accident or in a fall from a height. These fractures are generally never left unnoticed because they are painful, worsening with mastication and speech movements and if left untreated may cause facial asymmetry [1-4].

These fractures are treated by oral, maxillofacial, or ENT (ear, nose and throat) surgeons. Their treatment consists in restoring correct occlusion and facial appearance. There are several descriptive studies on characteristics [5-17], management [17-20] and outcomes [3,4,6,8] following such fractures which have been published.

To the best of our knowledge, no studies have examined characteristics of jaw fracture according to hospital status (public vs private). Therefore, the aim of this study was to describe epidemiological data on jaw fractures in 2 French

hospitals, one public and other private, located in the northern area of Brittany in France; to examine differences between these centres in terms of patient- and injury-related variables, including age, gender, anatomic location of fracture, mechanism of injury, and length of stay.

Methods

A retrospective study was conducted between 2006 and 2017 in the department of oral surgery in two hospitals (public and private) which altogether offer health services in a catchment area of population of 150,000 living in a Northern area of Brittany in France. All patients who were hospitalised for a maxillary or mandibular fracture were included. Patients with following conditions were not included: (1) fractures of the midface which includes the area from the superior orbital rim to the maxillary teeth as they are usually taken care of in the department of otorhinolaryngology (in France, jaw fractures are usually managed by maxillofacial surgeons or oral surgeons) and (2) severe multiple trauma with life-threatening conditions as they were immediately transferred to university hospitals located in Brittany.

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Confirmation and description of fractures were undertaken based on traditional computed tomography (CT) scanner when patients were hospitalised in public hospital and on cone beam CT scanner when they were hospitalised in private hospital. CT scanner was associated with a panoramic dental x-ray for all patients at the time of hospital admission. A second panoramic dental x-ray was performed to examine the result of treatment before discharging patients. A third one was required at the time of post treatment consultation with oral surgeons at 4 weeks from the hospital discharge to check that the fracture was not displaced.

Fractures were treated by osteosynthesis using mini-plate and mini-screws. Intermaxillary fixation was undertaken either using arch bars with stainless steel wires or elastic bands or applying 4 miniscrews for anchorage and stainless steel wires [18,19].

For each patient, following information were extracted from hospital medical records: age, gender, cause of injury (assault, fall, road traffic accident, other), presence of non life-threatening polytrauma (yes, no), part of jaw (mandible, maxilla), number of jaw fractures (1, >1), anatomic distribution of mandibular fracture (angle, body, condyle, symphysis, angle and body, body and condyle, symphysis and condyle, symphysis and angle, condyle and angle, body and symphysis, bicondyle, biangle, bisymphysis), length of stay (1, 2, or >2 days).

Descriptive statistics was used to summarise the data. Categorical variables were described as frequencies (percentage) and quantitative variables as mean (SD). Comparisons between types of hospital (public vs private) according to sociodemographic and fracture-related variables were using χ^2 test or Fisher's exact test as appropriate, *t*-test and Cochran-Armitage trend test. All analyses were undertaken using SAS version 9.4. Two-sided *P* values were used with an alpha=0.05 threshold for statistical significance.

This observational study using data extracted from medical records falls within the scope of the French Reference Methodology MR-004 established by the CNIL (French National Commission on Informatics and Liberties). Authors have committed to respect all obligations listed in this methodology.

Results

Between 2006 and 2017, 142 patients with jaw fractures were hospitalised in studied centres: 64 (45.1%) in the public and 78 (54.9%) in the private hospitals. Of them, 84.5% were men and the mean age was 32.0 (SD=15.9) with 75% of patients aged less than 40 years. Main causes of fractures were assault (56.3%), fall (30.3%), and road traffic accident represented 10%. A small number of patients had polytrauma (4.2%). Most jaw fractures were located in mandible (95.8%). More than half of patients (56.3%) had more than one fracture: the three mostly frequent fractures were those associated with the fracture of symphysis (angle (14.1%), body (14.1%), and condyle (8.5%)). Among patients with 1 fracture, fractures located at condyle were the most frequent (11.3%). The mean duration of stay was less than 2 days, and approximately 15% of patients stayed 3 days or more at the hospitals (Tab. I).

Table I. Description of patients' characteristics and of jaw fractures.

		Total (n = 142)
Centre, N (%)	Private hospital	78 (54.9)
	Public hospital	64 (45.1)
Age (years)	Mean (SD)	31.97 (15.87)
Age in categories (years)	<18	15 (10.6)
	18–29	65 (45.8)
	30–39	24 (16.9)
	>=40	38 (26.8)
Gender, N (%)	Women	22 (15.5)
	Men	120 (84.5)
Cause of fracture, N (%)	Assault	80 (56.3)
	Fall	43 (30.3)
	Road traffic accident	14 (9.9)
	Other	5 (3.5)
Polytrauma, N (%)	No	136 (95.8)
	Yes	6 (4.2)
Affected jaw, N (%)	Mandible	135 (95.1)
	Maxilla	7 (4.9)
Number of fractures, N (%)	1	62 (43.7)
	>1	80 (56.3)
Anatomic distribution, N (%)	Angle only	16 (11.3)
	Body only	12 (8.5)
	Condyle only	16 (11.3)
	Symphysis only	9 (6.3)
	Angle + body	11 (7.7)
	Body + condyle	3 (2.1)
	Symphysis + condyle	12 (8.5)
	Symphysis + angle	20 (14.1)
	Condyle + angle	1 (0.7)
	Body + symphysis	20 (14.1)
	Bicondyle	8 (5.6)
	Biangle	1 (0.7)
	Bisymphysis	2 (1.4)
Missing	11 (7.7)	
Length of stay (days)	Mean (SD)	1.81 (1.71)
Length of stay in categories, N (%)	0	14 (9.9)
	1	55 (38.7)
	2	44 (31.0)
	3 ou plus	21 (14.8)
	Missing	8 (5.6)

Table II. Description of patients' characteristics and of jaw fractures according to types of hospital.

		Public hospital (<i>n</i> = 64)	Private hospital (<i>n</i> = 78)	<i>P</i> -value
Age (years)	Mean (SD)	32.39 (15.38)	31.63 (16.34)	0.78 ¹
Age in categories (years)	<18	7 (10.9)	8 (10.3)	0.65 ²
	18–29	27 (42.2)	38 (48.7)	
	30–39	12 (18.8)	12 (15.4)	
	>=40	18 (28.1)	20 (25.6)	
Gender, <i>N</i> (%)	Women	12 (18.8)	10 (12.8)	0.33 ³
	Men	52 (81.3)	68 (87.2)	
Cause of fracture, <i>N</i> (%)	Assault	31 (48.4)	49 (62.8)	0.007 ⁴
	Fall	18 (28.1)	25 (32.1)	
	Road traffic accident	12 (18.8)	2 (2.6)	
	Other	3 (4.7)	2 (2.6)	
Polytrauma, <i>N</i> (%)	No	58 (90.6)	78 (100)	0.007 ⁴
	Yes	6 (9.4)	0 (0.0)	
Affected jaw, <i>N</i> (%)	Mandible	58 (90.6)	77 (98.7)	0.046 ⁴
	Maxilla	6 (9.4)	1 (1.3)	
Number of fractures, <i>N</i> (%)	1	28 (43.8)	34 (43.6)	0.98 ³
	>1	36 (56.3)	44 (56.4)	
Anatomic distribution, <i>N</i> (%)	Angle only	6 (9.4)	10 (12.8)	0.10 ⁴
	Body only	6 (9.4)	6 (7.7)	
	Condyle only	8 (12.5)	8 (10.3)	
	Symphysis only	1 (1.6)	8 (10.3)	
	Angle + body	5 (7.8)	6 (7.7)	
	Body + condyle	2 (3.1)	1 (1.3)	
	Symphysis + condyle	3 (4.7)	9 (11.5)	
	Symphysis + angle	7 (10.9)	13 (16.7)	
	Condyle + angle	0 (0.0)	1 (1.3)	
	Body + symphysis	11 (17.2)	9 (11.5)	
	Bicondyle	4 (6.3)	4 (5.1)	
	Biangle	0 (0.0)	1 (1.3)	
	Bisymphysis	2 (3.1)	0 (0.0)	
	Missing	9 (14.1)	2 (2.6)	
Length of stay (days)	Mean (SD)	2.23 (2.17)	1.47 (1.13)	0.02 ¹
Length of stay in categories, <i>N</i> (%)	0	10 (15.6)	4 (5.1)	0.01 ²
	1	12 (18.8)	43 (55.1)	
	2	21 (32.8)	23 (29.5)	
	3 ou plus	17 (26.6)	4 (5.1)	
	Missing	4 (6.3)	4 (5.1)	

¹*t*-test; ²Cochrane-Armitage trend test; ³Chi-test; ⁴Fisher test.

Description of above characteristics according to types of hospital showed that compared to patients who were admitted in private hospital those who were likely to be admitted in public hospital were: those who had a jaw fracture in context of road traffic accident (18.8% vs 2.6%, $p=0.007$), those with polytrauma (9.4% vs 0.0%, $p=0.007$) and maxilla fracture (9.4% vs 1.3%, $p=0.046$), and those who had a longer stay (2.2 vs 1.5 days, $p=0.02$) (Tab. II).

When studied characteristics were examined according to gender, only 2 significantly associated characteristics were found: main cause of fracture among women was due to fall whereas among men it was due to assault (59.1% vs 25.0% for fall and 31.8% vs 60.8% for assault, $p=0.01$); and condyle fracture was more frequent among women (36.4% vs 6.7%) whereas among men it was a fracture affecting angle (13.3% for angle only and 16.7% for angle and symphysis) ($p=0.003$) (Tab. III).

Table III. Description of patients' characteristics and of jaw fractures according to gender.

		Men (<i>n</i> = 120)	Women (<i>n</i> = 22)	<i>P</i> -value
Centre, <i>N</i> (%)	Private hospital	68 (56.7)	10 (45.5)	0.33 ¹
	Public hospital	52 (43.3)	12 (54.5)	
Age (years)	Mean (SD)	31.14 (14.18)	36.50 (22.92)	0.30 ²
Age in categories (years)	<18	12 (10.0)	3 (13.6)	0.67 ³
	18–29	57 (47.5)	8 (36.4)	
	30–39	20 (16.7)	4 (18.2)	
	≥40	31 (25.8)	7 (31.8)	
Cause of fracture, <i>N</i> (%)	Assault	73 (60.8)	7 (31.8)	0.01 ⁴
	Fall	30 (25.0)	13 (59.1)	
	Road traffic accident	13 (10.8)	1 (4.5)	
	Other	4 (3.3)	1 (4.5)	
Polytrauma, <i>N</i> (%)	No	115 (95.8)	21 (95.5)	1.00 ⁴
	Yes	5 (4.2)	1 (4.5)	
Affected jaw, <i>N</i> (%)	Mandible	114 (95.0)	21 (95.5)	1.00 ⁴
	Maxilla	6 (5.0)	1 (4.5)	
Number of fractures, <i>N</i> (%)	1	51 (42.5)	11 (50.0)	0.51 ¹
	>1	69 (57.5)	11 (50.0)	
Anatomic distribution, <i>N</i> (%)	Angle only	16 (13.3)	0 (0.0)	0.003 ⁴
	Body only	11 (9.2)	1 (4.5)	
	Condyle only	8 (6.7)	8 (36.4)	
	Symphysis only	8 (6.7)	1 (4.5)	
	Angle + body	9 (7.5)	2 (9.1)	
	Body + condyle	3 (2.5)	0 (0.0)	
	Symphysis + condyle	10 (8.3)	2 (9.1)	
	Symphysis + angle	20 (16.7)	0 (0.0)	
	Condyle + angle	1 (0.8)	0 (0.0)	
	Body + symphysis	17 (14.2)	3 (13.6)	
	Bicondyle	4 (3.3)	4 (18.2)	
	Biangle	1 (0.8)	0 (0.0)	
	Bisymphysis	2 (1.7)	0 (0.0)	
	Missing	10 (8.3)	1 (4.5)	
	Length of stay (days)	Mean (SD)	1.79 (1.47)	
Length of stay in categories, <i>N</i> (%)	0	10 (8.3)	4 (18.2)	0.31 ³
	1	44 (36.7)	11 (50.0)	
	2	42 (35.0)	2 (9.1)	
	3 ou plus	16 (13.3)	5 (22.7)	
	Missing	8 (6.7)	0 (0.0)	

¹Chi-test; ²*t*-test; ³Cochrane-Armitage trend test; ⁴Fisher test.

Table IV. Description of patients' characteristics and of jaw fractures according to age categories.

		Age < 30 (n = 80)	Age ≥ 30 (n = 62)	P-value
Centre, N (%)	Private hospital	46 (57.5)	32 (51.6)	0.48 ¹
	Public hospital	34 (42.5)	30 (48.4)	
Gender, N (%)	Women	11 (13.8)	11 (17.7)	0.51 ¹
	Men	69 (86.3)	51 (82.3)	
Cause of fracture, N (%)	Assault	54 (67.5)	26 (41.9)	0.01 ²
	Fall	18 (22.5)	25 (40.3)	
	Road traffic accident	7 (8.8)	7 (11.3)	
	Other	1 (1.3)	4 (6.5)	
Polytrauma, N (%)	No	78 (97.5)	58 (93.5)	0.40 ²
	Yes	2 (2.5)	4 (6.5)	
Affected jaw, N (%)	Mandible	77 (96.3)	58 (93.5)	0.70 ²
	Maxilla	3 (3.8)	4 (6.5)	
Number of fractures, N (%)	1	31 (38.8)	31 (50.0)	0.18 ¹
	>1	49 (61.3)	31 (50.0)	
Anatomic distribution, N (%)	Angle only	8 (10.0)	8 (12.9)	0.51 ²
	Body only	6 (7.5)	6 (9.7)	
	Condyle only	8 (10.0)	8 (12.9)	
	Symphysis only	5 (6.3)	4 (6.5)	
	Angle + body	7 (8.8)	4 (6.5)	
	Body + condyle	2 (2.5)	1 (1.6)	
	Symphysis + condyle	9 (11.3)	3 (4.8)	
	Symphysis + angle	10 (12.5)	10 (16.1)	
	Condyle + angle	0 (0.0)	1 (1.6)	
	Body + symphysis	13 (16.3)	7 (11.3)	
	Bicondyle	7 (8.8)	1 (1.6)	
	Biangle	0 (0.0)	1 (1.6)	
	Bisymphysis	0 (0.0)	2 (3.2)	
	Missing	5 (6.3)	6 (9.7)	
Length of stay (days)	Mean (SD)	1.78 (1.46)	1.86 (2.01)	0.80 ³
Length of stay in categories, N (%)	0	6 (7.5)	8 (12.9)	0.90 ⁴
	1	34 (42.5)	21 (33.9)	
	2	26 (32.5)	18 (29.0)	
	3 ou plus	11 (13.8)	10 (16.1)	
	Missing	3 (3.8)	5 (8.1)	

¹Chi-test; ²Fisher test; ³ t-test; ⁴Cochrane-Armitage trend test.

Moreover, only one characteristic was significantly associated with age: jaw fracture due to assault was a less frequent among those aged 30 year-old or more than those aged less than 30 year-old (41.9% vs 67.5%); however, fall was more frequent (40.3% vs 22.5%) ($p=0.01$).

Discussion

This descriptive study confirmed differences in recruitment of patients that exist between public and private hospitals in the management of jaw fractures: more severely affected

patients, i.e. those who had a road traffic accident, polytrauma, maxilla fracture, or subsequently had a longer hospital stay, were likely to be admitted in the public hospital. This may be explained by the presence of an intensive care unit in the public hospital. This is an original finding, as to date we did not find other publication focused on the differences in the management of jaw fractures according to hospital status.

Our results based on recent data (2006 to 2017) were also consistent with those from other previously published studies. Jaw fractures mostly affect young male population which usually occur during a physical assault [5–11,13,21]. Mandible

was predominantly affected part of the jaw. This is well-known in the literature and can be explained by its form (open arch), its location (lower portion of the face), and its mechanism (hyperextension and hyperflexion of the head in road traffic accidents) [22]. More than half of fractures were bifocal supporting that immediate and careful clinical and radiological examinations are necessary at the time of admission. Distribution of mandibular fracture according to anatomical locations varies across studies [8,11,13,14,17].

This is a descriptive study based on a limited number of patients. Therefore, overall distribution of patients' characteristics and fracture patterns differs from our study to others in terms of absolute values as most studies were conducted in university hospitals. Indeed, epidemiological data on jaw fractures vary according to types of recruitment: university hospitals which offer innovative technical platform and state-of-the-art equipment are more likely to admit patients with a jaw fracture but associated with a life-threatening trauma. Thus, in some studies, the percentage of road traffic accident and fall was higher than that of physical assault. In line with this, differences observed between the public and private hospitals in our study may be mostly due to the recruitment effect: more severely affected patients are likely to be managed in the public hospital. Despite some discrepancies with regards to previous studies, overall trend found in our study is similar to that observed elsewhere: jaw fracture is predominant in young men mainly due to physical assault, fall, and road traffic accident.

Conclusion

This retrospective study showed that differences observed in characteristics of jaw fractures between public and private hospitals may be due to recruitment process: more severely affected patients are likely to be admitted in the public hospital. It also confirms existing findings: jaw fracture predominantly affects young men in the context of physical assault, fall, or road traffic accident.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to this article.

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