

## Cross-sectional and descriptive study of centrofacial fractures at the Cocody University Hospital Center from 2016 to 2020

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### Ethics Committee Approval

The study was approved by comité national d'éthique des sciences de la vie et de la santé (CNESVS), National Ethics Committee for Health and Life Sciences (CNESVS) (January 26, 2022, 0019-22/MSHPCMU/CNESVS-km).

All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

### Conflict of Interest

No conflict of interest was declared by the authors.

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### Abstract

**Background/Aim:** Centrofacial fractures resulting from high-impact violence can be considered mild traumatic brain injuries. Given the complexities and associated risks, a comprehensive examination of these fractures is warranted. These fractures are increasingly prevalent among young adult patients and are commonly associated with road traffic accidents. In the literature, only a few studies have focused on this particular type of facial bone lesion. In Ivory Coast, no studies have been conducted on these fractures, which highlights the importance of our research aimed at describing the epidemiological and anatomical-clinical characteristics of centrofacial fractures in the stomatology and maxillofacial surgery department of the Cocody Teaching Hospital.

**Methods:** This descriptive cross-sectional study was conducted in the Stomatology and Maxillofacial Surgery Department of the Cocody University Hospital Center from January 2016 to December 2020.

**Results:** The prevalence of these fractures was 24.20%, with a predominance of male subjects. The age group most affected was 20 to 40 years old, accounting for 70.96% of cases, and most patients resided in Abidjan (59%). All socio-economic categories were represented, with a higher proportion of individuals in liberal professions (91.4%). Road traffic accidents involving two-wheeled vehicles were the primary cause of these fractures (76.8%), with the most common injury site being the naso-ethmoido-maxillo-fronto-orbital complex (NEMFOC) (32.5%).

**Conclusion:** The epidemiological characteristics of centrofacial fractures associated with two-wheeled vehicles in the Abidjan metropolis of Côte d'Ivoire suggest the need for increased accountability among motor vehicle drivers and stricter enforcement of traffic laws.

**Keywords:** fracture, centrofacial, NEMFOC, motor vehicle

## Introduction

Facial trauma is a common occurrence in urban areas due to population growth and increased transportation options. Its prevalence remains high in Africa, particularly in underserved communities, resulting in many clinical injuries [1].

Centrofacial fractures refer to discontinuities in the central part of the face. While they were once rare, they have become more frequent and often result from violent incidents. These fractures can be severe as they are often associated with fractures of the anterior part of the skull base. Therefore, meticulous radioclinical exploration is necessary. Failure to recognize these fractures can lead to infectious complications (such as post-traumatic meningitis, which is particularly concerning), functional complications (such as anosmia or blindness), and aesthetic complications [2,3].

In the existing literature, very few studies have focused on this specific type of facial bone injury. Moreover, in Côte d'Ivoire, no studies have been conducted on these fractures. This motivated us to initiate this research project to describe the epidemiological and anatomical-clinical aspects of these fractures.

## Materials and methods

This descriptive cross-sectional study was conducted at the Stomatology and Maxillofacial Surgery Department of the Cocody University Hospital Center from January 2016 to December 2020. The study included patients of all ages who were admitted to the department with a central facial fracture.

Patients with maxillofacial trauma who underwent a complete clinical examination and radiological assessment revealing a central facial bone lesion were included. Patients with incomplete exploration were excluded from the study.

The following variables were examined: epidemiological [gender, age categorized in 20-year intervals, profession of the traumatized individual (student, worker, professional, middle manager, executive, unemployed), date and location of the occurrence, cause of the trauma (road accident, work accident, assault, domestic accident, altercation), role of the injured person at the time of the trauma (driver of wheeled vehicles, motorcyclist, pedestrian), and compliance or non-compliance with safety measures (wearing a helmet or seat belt)] and clinical and paraclinical [observed clinical signs (including nosebleeds, cerebrospinal fluid rhinorrhea, telecanthus, nasal pyramid flattening, tearing, enophthalmos, diplopia, anosmia, and others), centrofacial skeletal lesions (including naso-ethmoidal-maxillo-front-orbital (NEMFO) complex, maxillary, nasal, and naso-ethmoidal fractures), and associations with other facial and extra-facial fractures (including mandible, zygomatic bone, anterior floor, skull, lower and upper limbs, pelvis, and spine)].

### Sampling methodology

A non-probabilistic sampling method was used to select patients admitted to the stomatology and maxillofacial surgery department during the study period.

### Sample size

The sample size (n) was determined using the following formula:

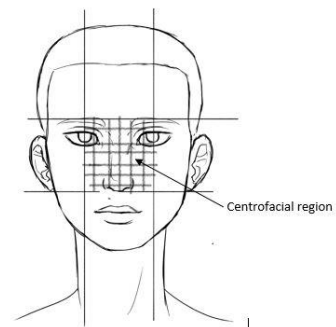
$$N = \left[ \frac{E^2 \times P \times (1-P)}{m^2} \right] / 0.052 \approx 113$$

Where N is the sample size, P is the prevalence (8%), m is the margin of error of 5%, and E is 1.96.

### Operational definitions

The operational definitions used were: centrofacial region [the middle third of the face between the horizontal line passing through the glabella (upper part) and the horizontal line passing through the nostril wings (lower part)] (Figure 1); upper frame (patients working in companies with a minimum education level of BAC+5); middle frame (patients working in companies with a maximum education level of BAC+2); and liberal profession (patients working independently, regardless of the nature of their activity).

Figure 1: Centrofacial region



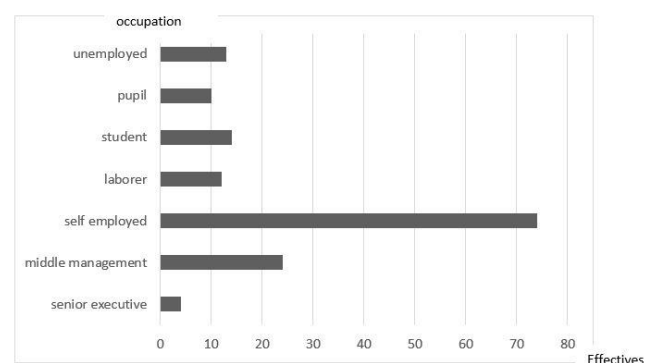
### Statistical analysis

The data was entered into Excel 2016, and tables and graphs were generated using the same software version. Descriptive statistics were calculated for quantitative variables, including mean and standard deviations. For certain variables, median values and extremes were also specified. Proportions were calculated for qualitative variables.

## Results

We identified a total of 151 patients, with centrofacial fractures accounting for 24.20% of all facial fractures. The average age of the patients was 30 (8) years, and the highest incidence was observed in the third and fourth decades of life. The male-to-female ratio was 9:1. Patients in liberal professions represented 49% (n=74) of the cases (Figure 2).

Figure 2: Distribution by occupation



Among the different municipalities, Abobo had the highest number of centrofacial fractures, accounting for 17% (n=25) of the cases (Figure 3). Road traffic accidents were the leading cause, accounting for 76.80% of cases (Table 1). Two-wheeled vehicles were involved in 44% of accidents, and in 78.44% of cases, the victims were not wearing seatbelts (Table 2). Among victims from four-wheeled vehicles, 69% were not wearing seatbelts. Nosebleeds were present in all patients, with 53% (n=80) experiencing nasal pyramid flattening and 20% (n=30) experiencing cerebrospinal fluid leakage (Figure 4).

Table 1: Distribution by causes

Causes	Number	Percentage
AVP	116	76.80%
ACC work	10	6.60%
Attack	11	7.30%
ACC domestic	6	4%
Brawl	4	2.60%
Others	4	2.60%

AVP: Road accidents, ACC work: work accidents, ACC domestic: domestic accidents

Table 2: Distribution by type of engine

Occupation of the victim	Number	Percentage
Two-wheeler driver	51	44%
Four-wheel driver	48	41%
Pedestrian	17	15%

Figure 3: Distribution by location

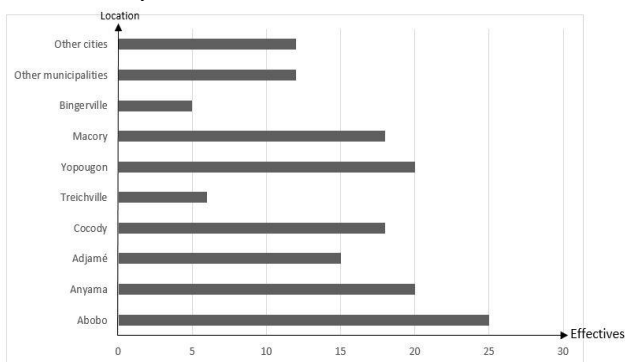
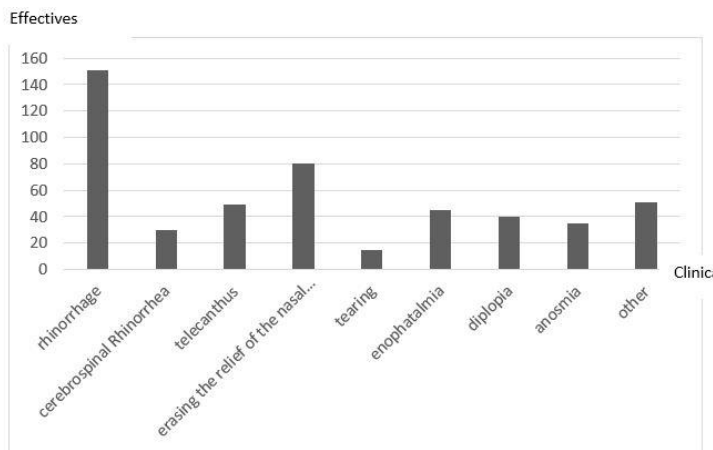


Figure 4: Distribution according to clinical signs



Regarding specific fractures, the most common form was the NEMFO complex fracture, accounting for 32.50% of cases. Additionally, 36.4% of centrofacial fractures were associated with zygomatic bone fractures (Table 3). Most of these fractures occurred in December and January, with rates of 17% (n=25) and 13% (n=19), respectively. Monday and Thursday had the highest number of cases, with 31 and 28 recorded, respectively. Most traumas occurred between 12 PM and 4 PM (Figure 5, 6, 7).

Table 3: Distribution according to maxillofacial and extra-maxillofacial fractures

Treatment of centro-facial fractures	Number	Percentage
NEMFOC	49	32.50%
Maxilla	40	26.45%
Nasal	33	21.85%
Naso ethomodal	29	19.20%
Facials fracture association		
Mandible	43	28.50%
Os zygomatic	55	36.40%
Fracture front floor	30	19.87%
No	23	15.23%
Extra-facial fracture association		
Skull	23	15.20%
Lower limb	9	6%
Senior limb	9	6%
Spine	1	7%
Basin	0	0%

NEMFOC: naso-ethmoido-maxillo-fronto-orbital complex

Figure 5: Distribution by month

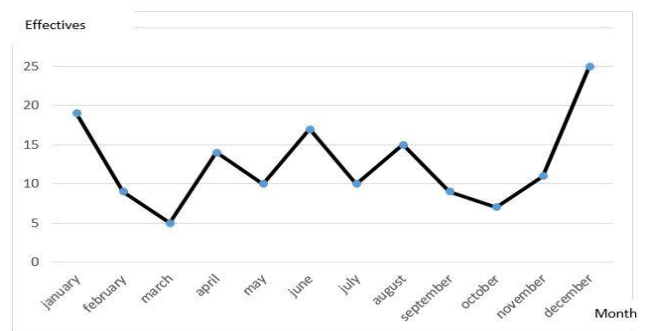


Figure 6: Distribution according to the days of the week

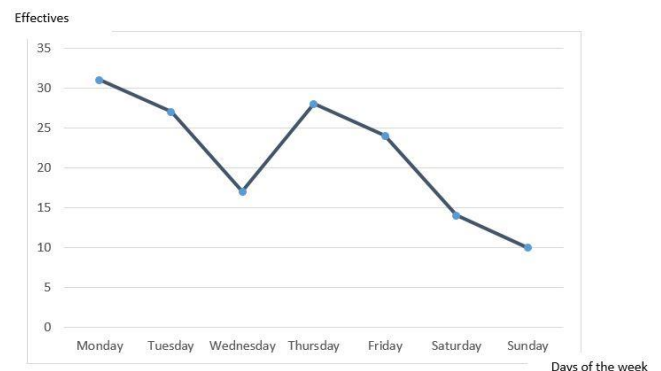
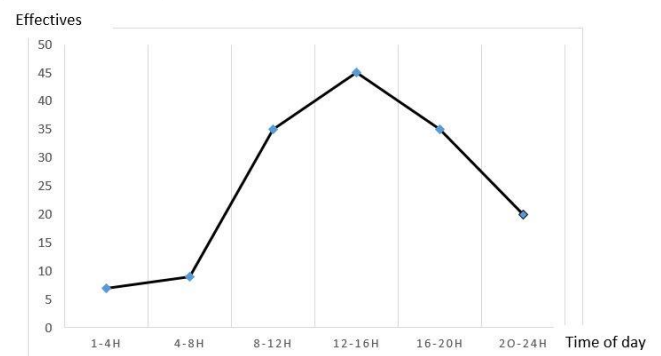


Figure 7: Distribution by time of day



## Discussion

Centrofacial fractures accounted for 24.20% of all facial fractures in our study. Our findings show a higher prevalence than Bourguila et al. [5], who reported a prevalence of 8% in Tunis. The mean age of our patients was 30 years old, with a median of 28 years old. Bourguila et al. also found similar mean and median ages of 29 and 27 years old, respectively.

A notable sex ratio of 9:1 was observed, indicating a clear male predominance, which aligns with findings from other studies. This male predominance can be attributed to factors such as engagement in risky behaviors, participation in dangerous

games, violent contact sports, and a propensity for risk-taking. In Western series, although the male predominance is less pronounced, it typically ranges around 2-3 males per female [6,7].

The peak occurrence of centrofacial fractures was between the third and fourth decades of life, a finding consistent with several other studies. The higher incidence during these decades in our study can be attributed to the fact that this age group represents the most active population and, therefore, the most exposed to potential risks. Additionally, this population may exhibit a certain carelessness and engage in dangerous practices. These fractures can have significant socio-economic impacts.

In a Japanese series, Lida et al. [8] reported the peak occurrence of centrofacial fractures between the ages of 10 and 20 years. In our study, the most affected individuals were freelancers, accounting for 74 out of 151 cases. These results are similar to those reported by Rabenandrasana et al. [9] in Antananarivo and exceed those reported by Ngaba et al. [10] in Yaoundé. Freelancers typically belong to the low-income bracket and work in the informal sector, constantly on the move and seeking subsidies.

Our series' primary cause of fractures was public road accidents, accounting for 76.8% of cases. This aligns with the findings of other African authors [11]. Several factors contribute to this trend: rapid urban population growth, leading to a younger population, increased production of faster-motorized equipment, non-compliance with or disregard for traffic regulations, poor road conditions, lack of vehicle maintenance, and the emergence of new means of transport with limited or no safety measures.

In the context of the socio-economic crisis, there has been a rise in the "moto-taxi phenomenon". These motorcycles are used for transporting people and goods, driven by young individuals who lack knowledge of traffic regulations due to a lack of driving licenses. Moreover, these individuals often use psychoactive substances while performing their activities. Furthermore, these motorcycles are frequently overloaded, sometimes carrying three or four passengers, making them unstable.

According to Bourguila [5], "this high frequency of public road accidents requires public health reflection and political efforts to improve prevention". In Western series, sports accidents account for 25.8%, followed by public road accidents at 23.1%, as reported by Lebeau [6]. The causes of maxillofacial trauma vary depending on the habits and practices of different populations.

In our series, the peak occurrence of fractures was observed in December with 25 cases, followed by January with 19 cases and June with 17 cases. This can be explained by the fact that December, corresponding to the end-of-year celebrations, involves significant population movements. During this period, vigilance tends to decrease due to the festive atmosphere. Additionally, the young population generally tends to consume alcohol and psychoactive substances during this month.

Monday had the highest number of patients, while Sunday had the least. This could be attributed to the fact that Monday marks the beginning of the workweek after the weekend

break, resulting in increased traffic density and higher accident risks.

Most accidents occurred between 12 PM and 4 PM, coinciding with the lunch break for formal sector workers. However, this period also corresponds to the peak activity hours for certain categories of self-employed workers, particularly "motorcycle deliverymen".

Clinically, all of our patients exhibited rhinorrhea, and 80 out of 151 cases showed flattening of the nasal pyramid. The clinical presentation of centrofacial fractures can vary, ranging from benign to severe deformities. The clinical examination of these fractures should be conducted meticulously and systematically to avoid overlooking any underlying serious injuries. In the presence of rhinorrhea, healthcare practitioners should be concerned about cerebrospinal fluid (CSF) leakage and actively seek its presence. CSF leakage indicates a breach in the meninges and can lead to serious complications such as post-traumatic meningitis, which is challenging to treat and can rapidly become fatal.

Fractures of the nasal-ethmoid-fronto-orbital complex were the most frequent, accounting for 32.50% of cases, followed by maxillary fractures at 26.45%. Additionally, facial fracture associations were noted, particularly involving the zygomatic bone (36.4%). Furthermore, we observed 23 cases (15.2%) of skull fracture associations on the extra-facial level. Our findings differ from those of Lebeau, who reported lower numbers. The predominance of NEMFO fractures and associated cranial vault fractures reflects the extreme violence of the impacts in our context. These fractures present significant functional, aesthetic, and life-threatening implications, highlighting the urgent public health challenge they pose in tropical regions.

### Limitations

During our literature review, we encountered insufficient data on centrofacial fractures in the African literature. Additionally, it should be noted that a significant number of medical records were unusable at the time of data collection, resulting in a reduced sample size. Despite these limitations, we could still obtain a representative population sample.

### Conclusion

Centrofacial fractures are inadequately described in the existing literature, and it is crucial for both specialists and general practitioners to be aware of them. Failure to recognize these fractures can lead to severe and potentially fatal complications. As these fractures primarily affect young adults, who are part of the most productive segment of the population, they present a significant public health concern. Authorities should address this issue through awareness campaigns, education, and training.

Further prospective studies are warranted to comprehensively assess the epidemiological, clinical, and anatomical aspects of centrofacial fractures.

### References

1. Diallo AO, Itiere Odzili FA, Keita A, Bah ML, Alloh HM, Kourouma A, et al. Traumatismes isolés de la face à Conakry: considérations épidémiologiques et prise en charge. *Health Sci Dis.* 2017;18(4):44-7.
2. Koffi KM, Kouakou KB, Assini Eyogbo S, Ory OADM, Harding-Kaba MB, Bissa HC, et al. Fractures de l'étage antérieur de la base du crane au Chu de Cocody(Abidjan): à propos de 47 cas. *Bul Med Owendo.* 2010;12(34):22-5.

3. Anzouan-Kacou E, Assouan C, Milogo M, N'Guessan N, Angoh P, Salami A, et al. Difficultés thérapeutiques des traumatismes centro-faciaux par arme à feu en période de guerre: cas de la Côte d'Ivoire. *Rev Int Ser San For Arm.* 2016;89(2):17-21.
4. Assouan C, Milogo M, Anzouan KE, N'Guessan N, Salami A, Diomande A, et al. Traumatismes maxillo-faciaux au CHU de Treichville d'Abidjan en Côte d'Ivoire. Etude épidémiologique de 1066 dossiers. *Rev Col Odonto-Stomatol Afr Chir Maxillo-fac.* 2014;21(4):31-4.
5. Bourguila J, Zairi I, Konsari RH, Jablaoui Y, Hellali M, Adouani A. Etude de la traumatologie maxillofaciale à Tunis. *Rev Stomatol Chir Maxillofac.* 2008;109:353-7.
6. Lebeau J, Kanku V, Duroure F, Morand B, Sadek H, Raphael B. Traumatisme faciaux au CHU de Grenoble. *Rev Stomatol Chir Maxillofac.* 2006;107:23-9.
7. Renier MA, Raux M, Asencio Y, Gaillard J, Ettalhaoui N, Riou B, et al. Que prédisent les valeurs de lactates d'un polytraumatisé en centre spécialisé? Congrès de la SFAR. 2011:R183
8. Lida S, Kogo M, Suguira T, Mima T, Matsuya T. Retrospective analysis of 1502 patients with facial fractures. *Int Oral Maxillo-fac Surg.* 2001;30:286-90.
9. Ranbenandrasana FV, Ndrianarivony SC, Matovoarisoa D, Razafindrade JAB, Rjoarivony AE, Rakotoarison RA. Etude épidémiologique des traumatismes maxillo-faciaux au CENHOSOA. *Revue Odonto Mal en ligne.* 2019;16:29-34.
10. Ngaba MPOMN, Youssef MD, Zing S, Bengondo MC. Fractures maxillo-faciales dues aux accidents de la circulation routière: aspects épidémiologiques et cliniques dans les trois hopitaux de la ville de Yaoundé. *Int J of innov scientific res and rev.* 2021;03(07):1529-33.
11. Rakotoarisoa AHN, Rakotoarimanana FVA, Randriamanantena T, Rasolongatovo TY, Randriamiarisoa NH, Raotoson HS, et al. Epidémiologie des fractures observées au service de chirurgie maxillo-faciale du CHU d'Antananarivo. *Rev Odonto Mal en ligne.* 2014;9:20-32.