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RESEARCH ARTICLE

EVALUATION OF ANTIBIOTIC SENSITIVITY OF ODONTOGENIC BACTERIA IN CERVICOFACIAL CELLULITIS IN THE CITY OF SANGMELIMA, CAMEROON

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Abstract

Aim and objective: Cervicofacial cellulitis of dental origin is a polymicrobial infection characterized by inflammation of the deep spaces of the neck and face. These conditions can be life-threatening, as the bacteria can spread throughout the body, leading to descending necrotizing mediastinitis, sepsis and death. Management is greatly challenging because of microbial polymorphism, probabilistic antibiotic selection treatment sometimes being hesitant and inappropriate because of lack of consensus. The aim of this study was to evaluate the antibiotic susceptibility of odontogenic bacteria in cervicofacial infections.
Material and methods: This was a cross-sectional, descriptive study conducted from May 2019 to August 2020 in the odontostomatology and bacteriology departments of the Sangmelima District and Reference Hospitals in Cameroon. Thirty five samples were collected by swabbing or puncture. Specific culture media were used to inoculate samples. Sensitivity of isolated bacteria was assessed using the Kirby-Bauer diffusion disk method. Data analysis was performed using SPSS 23.0.
Results: Thirty samples were positive (85.7%). Bacteria isolated were *Streptococcus* (40%), *Staphylococcus* (30%), *Pseudomonas* (20%), *Escherichia coli* (6.7%) and Lactobacillus (3.3%). Sensitivity testing was performed with amoxicillin/clavulanic acid, metronidazole, gentamicin, ciprofloxacin, imipenem and clindamycin. Bacteria were more sensitive to amoxicillin/clavulanic acid, ciprofloxacin and imipenem.
Conclusion: Bacteria identified in purulent secretions from cervicofacial cellulitis are much more sensitive to amoxicillin/clavulanic acid, ciprofloxacin and imipenem.
Keywords: Antibiotic, bacteria, cervicofacial cellulitis, odontogenic, sensitivity.

INTRODUCTION

Cervicofacial cellulitis of dental origin (CFCDO) is a public health problem. It is a polymicrobial infection of the cellular adipose tissue located in the lodges surrounding the mandible and maxilla, developing from a dental infectious focus. These infections have a great tendency to spread into the deep aponeurotic spaces of the head and neck[1]. These conditions car lead to descending necrotizing mediastinitis, with a high death rate by sepsis and organic failure if not treated quickly and properly[1,2].

Odontogenic infections comprising dental caries and periodontal disease (gingivitis and periodontitis), are common with local (like tooh loss) and systemic implications. The main cause of tooth loss varies with age. Dental caries is most important before the age of 35 and periodontal disease after the age of 35. Both tooth decay and periodontal disease are important contributors to tooth loss after age 60[3,4].
The global burden of these conditions is considerable. Nearly half of the world population was found to suffer dental decay or periodontitis in the Global Burden of Disease Study in 2015[4]. Untreated dental caries in permanent teeth affected 2.5 billion people worldwide

(age-standardized prevalence rate of 34%)[4]. The rates for severe periodontitis and total tooth loss were 7 and 4%, respectively[4]. Hospital prevalence of CFCDO can reach 18% in developed countries[5]. In emerging and resource-limited countries in Africa, hospital prevalence of CFCDO varies between 3 and 33%[6-9]. In Cameroon, the hospital prevalence varies between 10 and 13%[10,11]. Amoxicillin, metronidazole, gentamicin and ceftriaxone are the commonest used antibiotics in CFCDO in Cameroon.

The severity of this pathology is an alarm bell for immediate management. Severe cervicofacial cellulitis (CFC) are emergencies, mostly of dental origin, and are frequently observed in developing countries. Their management is still challenging despite improvement of antibiotic therapy these last decades[12]. In this contest, we were interested in the sensitivity of antibiotics in CFCDO. The aim of this study was to assess the sensitivity of antibiotics on the bacterial profile of odontogenic cervicofacial cellulitis.

SUBJECTS AND METHODS

This was a cross-sectional, descriptive study conducted from January to June 2024 at Sangmelima District and Referral Hospital in Cameroon. Inclusion criteria were any patient of any sex presenting with purulent cellulitis (Figure 1). Exclusion criteria were any patient who had taken an antibiotic 48 hours prior to consultation, and any patient who died during the study. The study population comprised 36 patients. We analyzed 35 samples at the Sangmelima Reference Hospital laboratory. One tube was excluded for non-compliance.

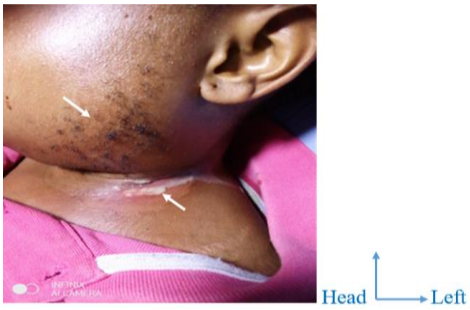

Figure 1: Cervicofacial suppurative odontogeniccellulitis (white arrows).

Ethical clearance was obtained from the Institutional Ethics Committee and Research of the FMBS of Yaounde I, and research authorizations from the hospitals. After the patients had been informed and voluntarily signed an informed consent form, a thorough examination was carried out. Intrabuccal examination was carried out using the consultation equipment. This consisted of a consultation tray, probe and mirror. This was followed by a systematic examination of all the areas of the oral cavity.

The frequency of oral lesions was assessed using the silness andloë plaque index and the CAO index. Fluid sampling was performed by two methods. The swab method, which used low-abundance purulent secretions, and the puncture method, which used high-abundance secretions. Bacteriological analysis of purulent secretions revealed some bacterial species using Mueller-Hington, Chapman and Columbia culture media (Figure 2).

Figure 2: Biplate enabling the isolation of micoorganisms on the 'Columbia blood' agar side.

The disc method, known as the Kirby-Bauer test, was used to determine antibiotic sensitivity. It is indicated for fast-growing microorganisms. It involves placing antibiotic-impregnated discs, including amoxicillin + clavulanic acid (AUG), imipenem (IMP), gentamycin (CN), Ciprofloxacin (CIP), clindamycin (CD) and metronidazole (MZ), on agar plates inoculated with the microorganism to be tested.

Statistical analysis of data

Data were entered and analyzed using SPSS version 23 and Microsoft Excel 2013.

RESULTS

Epidemiological profile of dental CFCDO in Sangmelima

The age group most affected was between 21 and 40 years (42.9%), with a median of 32 years and a sex ratio of 1.18 (Table 1).

Patient characteristics by type of sample collected

Of the 35% purulent secretions collected, 83% of samples were taken by puncture and 17% by swab.

Patient characteristics according to past medical history and some clinical data

Diabetes mellitus and HIV were the main found medical condition (Figure 2). All of patients had taken oral non-steroidal anti-inflammatory drugs (NSAIDs), mainly ibuprofen, diclofenac and indomethacin, as painkiller. Antibiotics commonly taken by 77% of our patients were amoxicillin, metronidazole and gentamicin. Patients' frequencies of consultation of a dentist are shown in Figure 3.

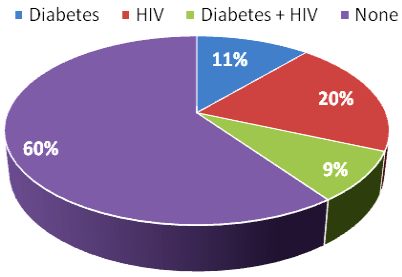

Figure 2: Comorbidities found in selected patients.

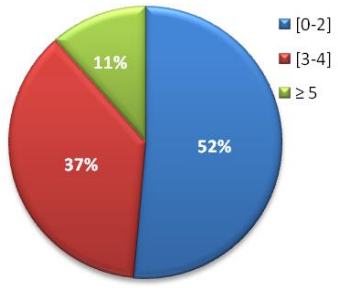

Figure 3: Patient's frequencies of consultation of a dentist.

The distribution of patients according to the site of cellulitis is shown in Figure 4.

Bacteriological characteristics of patient samples

Thirty samples (85.7%) showed a positive culture. CFC were polymicrobial. *Streptococcus* spp (isolated in 25 samples), *Staphylococcus* spp, *Pseudomonas*, *Escherichia coli* and lactobacillus were the most common bacteria found (Table 2).

Bacterial sensitivity to the different molecules tested

During present study, 91.7% of streptococci were sensitive to amoxicillin+clavulanic acid, but these streptococci were resistant to metronidazole, as were the other bacterial species isolated. As for anaerobic bacteria, we were able to isolate only one, lactobacillus, representing 3.3% of the bacteria isolated, and they were 100% sensitive to amoxicillin+clavulanic acid, metronidazole, ciprofloxacin and imipenem (Table 3).

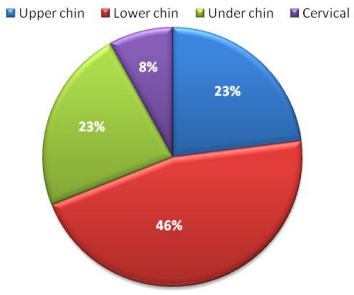

Figure 4: Distribution of patients according to the site of cellulitis.

DISCUSSION

Most of our patients were aged between 21 and 40 years (42.9%), with a median of 32 years. The highest incidence of infections of dental origin occurs between 21 and 30 years[13].The common significant medical conditions in CFCDO patients' history are diabetes, hypertension, obesity, HIV, substance abuse and other systemic disorders[14,15]. Twenty-one percent of our patients were found with no prior medical condition. CFCDO are complication of dental infection that may occur even in young and relatively healthy patients[16].

Table 1: Socio-demographic characteristics of the study population.

Variables	Modalities	Frequency (%)
Age group (years)	[0-20[	9 (25.7)
	[20-40[	15 (42.9)
	≤ 40	11 (31.4)
Gender	Male	19 (54.3)
	Female	16 (45.7)
School level	Primary	10 (28.6)
	Secondary	21 (60.0)
	University	4 (11.4)
Occupation	Housewife	5 (14.3)
	Teacher	4 (11.4)
	Hairdresser	4 (11.4)
	Farmer	6 (17.1)
	Student	10 (28.6)
	Baker	5 (14.3)
	Retired	1 (2.9)

Analysis of purulent secretions showed 40% *Streptoccocus* spp, 30% Staphylococcus spp, 20% *Pseudomonas* spp, 6.7% *E. coli* and 3.3% lactobacillus. More than 1000 distinct bacterial species have been identified worldwide. In most instances, the cultivable microflora probably represents less than 1 percent of the total existing bacterial population[17].

In the healthy periodontium, the microflora is sparse and consists mainly of gram-positive organisms, such as *Streptococcus sanguinis* and Actinomyces spp. In the presence of gingivitis, the predominant subgingival flora shifts to a greater proportion of anaerobic gram-negative bacilli, with *Prevotella intermedia* as the predominant isolate[18]. Dental caries are caused by microorganisms within the supragingival plaque, such as gram-positive facultative and microaerophilic cocci and rods. The mutans group of streptococci, particularly *S. mutans* and *S. sobrinus*, are the usual primary organisms associated with dental caries[19,20]. Periodontal disease is caused predominantly anaerobic periodontopathic subgingival plaque flora. In well-established periodontitis, the flora further increases in complexity with a preponderance of anaerobic gram-negative bacilli and motile organisms.

Table 2: Bacterial species isolated in patients' cellulitis.

Bacteria	Frequencies (%), N=30
Streptococcus spp	25 (83.3)
Staphylococcus spp	22 (73.3)
Pseudomonas	11 (36.7)
E. coli	14 (46.7)
Lactobacillus	1 (3.3)

Table 3: Sensitivity rate of isolated bacteria to tested antibiotics.

	Streptococcus n=12 (%)	*Staphylococcus* n=9 (%)	*Pseudomonas* n=6 (%)	*E. coli* n=2 (%)	*Lactobacillus* n=1 (%)
Amoxicillin + clavulanic acid	11(91.7)	7(77.7)	5(87.5)	1(50)	1(100)
Metronidazole	0(00)	0(00)	0(00)	0(00)	1(100)
Gentamicin	7(58.3)	5(55.5)	2(33.3)	2(100)	0(00)
Ciprofloxacin	8(66.7)	6(66.7)	3(50)	1(50)	1(100)
Imipenem	9(75)	8(88.9)	4(66.7)	2(100)	1(100)
Clindamycin	4(33.3)	2(22.2)	2(33.3)	0(00)	0(00)

Aggregatibacter (*Actinobacillus*) *actinomycete mco-mitans* (a HACEK infection), *Porphyromonas gingivalis*, *Prevotella intermedia*, *Treponema denticola*, and *Tannerella forsythia* are the predominant isolates[21,22]. Isolation of causative bacteria remain a challenge even in developed countries. In USA for example, organisms are identified in only15% of cellulitis cases, mostly β-hemolytic *Streptococcus* and *S. aureus*[23]. Isolation of causative bacteria mayrequire more specific culture media. More specific and more advanced methods exist, such as 16S-rRNA gene analysis detecting significantly more bacteria than conventional methods[24]. Molecular methods should become a part of routine diagnostics in medical microbiology.

All of our patients had taken non-steroidal anti-inflammatory drugs as pain killers. There is a strong correlation between use of non-steroidal anti-inflammatory drugs (NSAIDs) and evolution of head and neck infections toward CFC, including necrotic CFC extending to the mediastinum, which can be fatal[25]. The role of corticosteroids in the management of cervicofacial infections continues to cause controversy. The role of corticosteroids in the management of cervicofacial infections continues to cause controversy. Systemic anti-inflammatory and immunomodulatory effects that reduce swelling and improve symptoms in the head and neck may make these agents an effective addition to the antibiotics used and to surgical management, although this same effect may dull the physiological response to infection, and allow infections to progress[26].

The evidence suggests that the use of adjunctive, short-term, high-dose corticosteroids in cervicofacial infections may be safe and effective[26]. Control and balance of comorbidities such as diabetes, HIV and others, are crucial for efficient management. Sensitivity testing was carried out on bacteria found in purulent secretions. The results showed that streptococci were most sensitive to amoxicillin + clavulanic acid at 91.7%, then to imipenem at 75%, followed by ciprofloxacin at 66.7%, gentamicin at 58.3% and clindamycin at 33.3%. *Staphylococci* were most sensitive to imipenem at 88.9%, then to amoxicillin + clavulanic acid at 77.7%, followed by ciprofloxacin at 66.7% and gentamicin at 55.5%, and finally clindamycin at 22.2%. *Pseudomonas* spp, were most sensitive to amoxicillin + clavulanic acid at 87.5%, then to imipenem at 66.7%, then to ciprofloxacin at 50%, gentamicin at 33.3%, finally clindamycin at 33.33%. *E. coli* were more sensitive to gentamicin and imipenem at 100%, then to amoxicillin + clavulanic acid and ciprofloxacin at 50%, and, finally resistant to gentamicin and clindamycin.

Antibiotic susceptibility shows regional variations depending on epidemiological contexts. In Cameroon as in poor countries, self-medication and alternative medicine enormously favor the selection of resistant mutants. In this study we tested the sensitivity of antibiotics commonly used in these infections. The sensitivity spectrum could be wider.

Limitations of the study

The unavailability of certain agars and materials suitable for the isolation of anaerobic bacteria

CONCLUSIONS

Cervico-facial cellulitis of dental originiscaused by multiple bacteria, mainly streptococci and staphylococci. These germs are much more sensitive to amoxicillin + clavulanic acid, imipenem and ciprofloxacin. However, *E. coli* is more sensitive to imipenem andgentamycin. Lactobacilliare more sensitive to amoxicillin + clavulanic acid, metronidazole, ciprofloxacin and imipenem. Probabilistic antibiotic treatment of odontogenic cervicofacialcellulitis in Cameroon should include amoxicillin + clavulanic acid, metronidazole, ciprofloxacin and imipenem.

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AUTHOR'S CONTRIBUTION

Nibeye YC: conceived the idea and directed the work. **Kopong OF:** conceptualization and methodology. **Ngogang MP:** analyzed purulent secretions. **Zeh HZ:** recruited participants, performed physical examinations and collected samples. **Lyonga E:** data analysis, manuscript drafting. **Charles BM:** data analysis, manuscript drafting. All authors reviewed the manuscript.

DATA AVAILABILITY

Data will be available or not to anyone on request with corresponding author.

CONFLICT OF INTEREST

None to declare.

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