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Ludwig's Angina in Nigeria: the disease of the poor and health inequality!

Abstract

Aim; highlight the health inequality and identify opportunities to improve the care delivered to the patients who suffer from Ludwig's angina which could have national and international clinical impact.

Materials and methods; Data was collected from three major oral and maxillofacial centers, in Nigeria including Benin, Lagos and Kano. A protocol was developed for data collection which included demographic details, socio-economic status, management of the air way, the associated morbidities and mortalities. **Results;** Forty-nine were managed in Benin, 57 in Lagos and 66 in Kano. Diabetes was the most prevalent underlying systematic condition, affecting 21% of the Ludwig's angina patients in Lagos. Poverty was a common denominator, 90% of the patients from Kano were unemployed compared to 23% and 8% from Lagos and Benin respectively. For most of the patients, the airway was monitored. Incision and drainage were carried out in most of the cases at Benin and Lagos, but it was only considered in 50% of the cases in Kano. Mortality ranged from 4% in Benin to 12% in Lagos and it was as high as 19% in Kano. **Conclusion;** poor access to oral healthcare, unemployment and low socio-economic status are important predisposing factors of Ludwig's angina.

Introduction:

Ludwig's angina is a rapidly spreading and frequently fatal gangrenous cellulitis and edema of the soft tissues of the neck and floor of the mouth.¹ Airway obstruction is the commonest complication and results from progressive swelling of the soft tissues, elevation and posterior displacement of the tongue.²

The fundamental criteria for the diagnosis of Ludwig's angina include bilateral infection involving more than one peri-mandibular facial space, the production of gangrenous, serosanguinous, putrid infiltration often associated with little or no pus formation initially.³⁻⁵

The aetiology of Ludwig's angina is mainly odontogenic, primarily resulting from infections of the second and third molars. Predisposing factors include dental caries, recent dental treatment and systemic illnesses such as diabetes mellitus, malnutrition, alcoholism, compromised immune system and organ transplantation.^{6,7}

Globally, there is no consensus on the demographic pattern of Ludwig's angina due to limited studies. Most were mainly case reports.⁸ A study by Blankson et al., 2019, on the incidence of dentofacial infection at major referral hospital in Ghana showed that Ludwig's Angina constituted 52% of the cases.⁹ A male preponderance has been reported in Nigerian and South African studies,¹⁰⁻¹¹ with values as high as 69.9% in a five-year retrospective study of 93 patients by Bortha.¹² Paediatric cases occurred sporadically.¹³ A high prevalence of Ludwig's Angina has been noted in Northern Nigeria with many of the patients in a low socioeconomic class.¹⁴

Infections may occur before or after exodontia secondary to submandibular gland sialadenitis and sialolithiasis, base of tongue lymphangioma, tongue piercing, trauma and oral malignancy.^{14,15}

The lack of information regarding the demography and morbidities associated with this serious infection in Nigeria inspired this study. Nigeria is the most populated country in Africa with the highest incidence of Ludwig's Angina. Ludwig's Angina and submandibular abscesses are the most common deep head and neck space infections.¹⁶

The aim of the study was to determine the demography and pattern of complications associated with the management of this condition. The rationale is to highlight health inequalities and identify opportunities to improve the quality of care delivery for the disadvantaged patient who suffers from Ludwig's Angina.

Patients and Method

This is a retrospective study of patients with Ludwig's Angina seen and managed between January 2015 and June 2019 in three tertiary hospitals in Nigeria. The hospitals are Central Hospital, Benin in Edo State, Southern Nigeria; Lagos State University Teaching Hospital, Ikeja, South-west Nigeria and Aminu Kano Teaching Hospital, Kano, Northwestern Nigeria. These are main referral centres in the country. The average monthly attendance of patients at the Dental Clinic of Central Hospital in Benin is 400, that of Lagos State Teaching Hospital, Ikeja is 2000 and 1850 is the average attendance of patients at the Aminu Kano Teaching Hospital, Kano.

All patients with facial cellulitis that met the diagnostic criteria as Ludwig's angina were included in this study. The inclusion criteria of Ludwig's Angina was the infection occupying bilaterally more than one space of the peri-mandibular facial space. A protocol was developed for data collection. This included age, gender, dental visits pattern and the oral hygiene status. The aetiology,

clinical state of tooth/teeth involved, airway impairment/challenge, presence of dysphagia and throat pain were recorded. Education and employment status were used to assess the socioeconomic status/deprivation index using the modification of Oyedeji social classification system.¹⁷ We also collected other information including smoking, drinking and retroviral screening. Previous antibiotics usage, history of similar disease, and intervention by quacks, traditional healers and others were recorded.

Treatment such as airway management; incision and drainage; removal of offending tooth/teeth, other forms of treatment; outcome and complications were documented.

Results

One hundred and seventy-two patients diagnosed by the surgical resident and confirmed by the duty oral & maxillofacial surgeon met the criteria for inclusion which included the bilateral involvement of the submandibular and sublingual fascial spaces. Forty-nine were managed in Benin, 57 in Lagos and 66 in Kano. Age (table 1) ranged from 7 to 85 years and the percentage of children was 9%. Male preponderance of 60% was noted at the three centres. The average monthly attendance of patients at the Dental Clinic of Central Hospital Benin is 400, that of Lagos State Teaching Hospital, Ikeja is 2000 and 1850 is the average attendance of patients at the Aminu Kano Teaching Hospital, Kano is 4,250.

Ninety percent of patients from Kano were unemployed compared to 23% and 8% from Lagos and Benin respectively. Quality of oral hygiene was assessed subjectively during the clinical examination, it varied markedly in the different study centres. It was good in over 50% of the patients in Benin and 26% of patients in Lagos, but it was poor in more than 60% of those from Kano. The highest level of tertiary education (8.8%) and secondary education of (49.1%) were found in Lagos and Kano, the highest percentage of no formal education (50%) was noted in Kano (Table 2). Unemployment was noted in 91% of the patients managed at Kano Centre and 50% had no formal education unlike 12% unemployed from Lagos and Benin hospitals.

Smoking was reported among patients in Benin and Lagos. In Benin one third drank alcohol but only 9% in Lagos; this was not a feature of the Kano group of patients (Table 3). In most of the cases the source of infection was odontogenic. Diabetes was the most prevalent underlying systematic condition in Benin and Lagos affecting 15 and 12 cases respectively. In Kano, none of Ludwig's Angina cases was diabetic. No other medical condition was predominant apart from anaemia which was only seen in Kano and reported in 25 cases with Hb < 10gm. In Benin 17 (35%) patients could not afford to pay for blood investigations, and one case of anaemia was noted among those who could afford the cost of blood test. In Lagos, anemia was detected in one case.

Ludwig's Angina was managed in outpatient clinics. At the three centres, the airway was monitored when the patients presented with early features that include raising of the floor of the mouth; difficulty in swallowing; and drooling of saliva

The protocol of monitoring respiratory distress in those groups of patients included the observation of the following signs; flaring of nares; inability to lie flat on the back; sitting and leaning forward on dental chair; presence of stridor and dyspnea

Incision and drainage (I & D) as well as removal of the source of infection were carried out in most of the cases (table 4) The procedure was carried out mostly under local anesthesia, the intravenous antibiotics and oxygen infusion. Intravenous hydrocortisone 200mg was injected perioperatively followed by 100mg 12 hourly for one day following surgery.

In some cases, spontaneous drainage of the pus occurs through the submandibular region (Figure 1) or through multiple sinuses (Figure 2). In Benin further I &D was carried out for one case due to the track of infection down to the mediastinum and in other two cases as a result of spread to the pretracheal space.

The mortality ranged from 4% in Benin to 12% in Lagos with a peak of 19% in Kano.

The most common complication was respiratory distress and mediastinitis (Table 5). In Lagos a correlation coefficient $r=0.3$ was detected between fatalities and the older age group as well as social habits including smoking and drinking, these were statistically significant $p<0.05$. In Kano, in 22 patients infection had spread to the anterior chest wall. This was related to the late presentation of the cases for treatment, in about two thirds of the cases; traditional healers and non-specialized care were the main source of providing the required surgical care. These factors contributed to the high fatality rate seen in this group of patients.

In this study some patients refused hospitalization to monitor signs of respiratory distress and for follow up after surgical intervention because they cannot afford the cost. Therefore, hospitalization was provided to only 69% of the cases. Intravenous antibiotics were provided, they were kept under observation at the outpatient clinic and were discharged back home at evening time. Patients who showed signs of toxicity, raised tongue, stridor, difficulty in swallowing saliva and other evidence of airway embarrassment were immediately admitted. However, the admission to the hospital and the duration of stay were influenced by the financial status of the patient and their ability to cover the related costs. Patients were discharged from the hospital when there were obvious signs of improvement in the airway.

None of the patients in Benin had tracheotomy, this was carried out for two patients in Kano and in only one in Lagos. He unfortunately died on the operating table.

In all the three hospitals the diagnostic imaging was limited to plain radiographs. Three dimensional imaging facilities were not available in Benin. At Kano, CT facilities were available but none of the patients could afford the cost of the scanning. It was estimated that at least 20% of the patients would have benefited from this type of radiographic imaging. In all the three centres, Oral & maxillofacial surgeons have access to the operating theatre a full day/week. Cases which show respiratory distress were monitored in the recovery room by an anaesthetic assistant due to lack of intensive care facilities. In all the three centres, patients had to fund their own treatments including the purchase of a tracheostomy tube and antibiotics if they were not admitted to the hospital. The in-patient facilities are limited and the access to the Intensive Care Unit (ICU) is not readily available despite respiratory distress.

Discussion

Ludwig's Angina is a potentially life-threatening oro-facial infection, characterized by fever, malaise, dyspnoea, dysphagia as well as a brawny hard tender swelling of the floor of the mouth and neck.¹⁸

In this study we noted the late presentation of the cases was due to self-medication and abuse of antibiotics, ignorance, and patronage of unorthodox

medical practice. No doubt, the delay in managing these cases due to the late presentation contribute to the high complications rate and the fatality within this group of patients ^{10,14}Wang et al., 2005 confirmed the need for early surgical intervention including incision and drainage to minimize the serious complications of odontogenic infections.¹⁹ This was carried out in almost 70% of the cases that were managed in Benin and Lagos but was limited to 50% of those managed in Kano. This was positively correlated to the mortality from this Centre.

One of the main findings in this study is the lack of standardized protocol to maintain airway and avoid respiratory distress. Miller et al²⁰ stressed the importance of airway management and recommended early Contrast-Enhanced Computerized Tomographic (CECT) imaging, as clinical examination alone has a limited sensitivity of 55%. Neff et al²¹ recommended conscious fiberoptic intubation to secure the airway if computerized tomographic (CT) scan showed significant airway deviation or narrowing. Although distorted anatomy, and secretions may contribute to difficulty with fiberoptic intubation, in skilled hands, flexible fiberoptic nasal intubation is the preferred method of airway management with high rates of success.²¹ Airway management options include blind nasotracheal intubation, retrograde intubation, Glide Scope, fiberoptic intubation, and airway or tracheostomy.²²

Aggressive intravenous (IV) broad-spectrum antibiotic is the mainstay of therapy although IV steroids may help reduce the swelling and hence risk of airway compromise.²³ Surgical decompression of the fascial planes with

removal of source of infection is paramount.²⁴ Osunde, et al.,²⁵ performed all their incisions and drainage under local anesthesia to avoid obstruction of the airway.

Antibiotic abuse before hospital admission can result in sterile cultures.^{26,17} Clinical ignorance has been discovered to be a growing concern that doctors/dentists who are attempting to manage these patients with oral antibiotics before referring these patients appropriately.¹¹

Life threatening complications such as respiratory obstruction, mediastinitis, pleural empyema, pericarditis, pericardial tamponade were often associated with Ludwig's Angina. Braimah et al.,¹⁶ recorded three deaths in their series resulting from mediastinitis, severe sepsis, and laryngeal spasm.

The high complication and the mortality rate at Kano and mortality from other centres are due to late presentation, the lack of CT scanning, and financial difficulties. The patients could not afford the cost of the ICU care nor purchase of tracheostomy tubes because the admission for the close monitoring of the patients was not possible. The highest level of respiratory distress was noted among the patients treated at Kano. Two thirds of the patients have attempted pre-hospital care, involved traditional healers and non-specialized care from privately owned hospitals, 60% of the cases presented with marked fever, and respiratory distress. The diagnostic aids were limited to 2D radiographs, most of the patients could not have CT scans due to financial constraints., Ultrasonography has never been a part of our protocol for investigating Ludwig's Angina. There were no MRI facilities for imaging. In most of the

cases the odontogenic cause of infection was secondary to pericoronitis, grossly caries teeth, retained roots and septic extractions; this reflects the poor oral hygiene which was noted in almost all the patients.

This study highlighted several aspects of deficiencies which should be considered to improve the quality of care delivered to these group of patients. There was an obvious lack of a formal protocol regarding the airway management, this should be considered seriously to reduce the rate of morbidity and mortality associated with Ludwig's Angina. Monitoring of the patient should follow a strict protocol with clear measures of respiratory distress and airway obstruction, this cannot be carried out except in a hospital environment. Tracheostomy even under local anesthesia should be always considered.²⁷ Financial constraints had a significant negative impact on the quality of managing Ludwig's Angina due to the cost of clinical consumables, blood tests, imaging and medications which the patients had to pay for.

Odontogenic infection was the main cause of Ludwig's Angina in our study which was reported in about 95% of cases. Three of the patients in our study were immunocompromised due to HIV, the others were HIV free, but poor oral hygiene and dental neglect was the characteristic feature in most of the cases. We believe a significant proportion of odontogenic infection is preventable by implementing routine oral hygiene, raising the awareness of dental care, providing free oral hygiene measures, conducting regular dental

check-up appointments and application of the necessary dental treatment in an aseptic environment.

Assessment of severe infections should include MRI, it has been shown to be superior to CT for the evaluation of deep space infection but may not be practical in an emergency setting. Laboratory tests which would include a full blood count, serum glucose, electrolytes, coagulation screen, blood cultures, routine culture and sensitivity tests and an arterial blood gas are also necessary.²⁸ Therefore, it is important for local health authorities to provide the necessary funding to provide CT imaging facilities for the decision-making process regarding the need and the extent of the surgical intervention to drain the involved facial spaces crucial in the management for these cases.

Recommendations and conclusions:

This study highlighted the need for improvement in the access of patients with dental infection to local dentists in Nigeria prior to referral to the Oral and Maxillofacial Surgeons. A comprehensive educational programme should be designed and implemented to train local dentists and general medical practitioners on the signs and symptoms of spreading dental infection. Governmental funding should be available to carry out routine blood tests, diagnostic imaging. The need for CT scanning facilities cannot be overemphasized. These measures are essential to reduce the morbidities and mortalities associated with Ludwig's Angina

Legends of the figures:

Figure 1: Perforation of the skin and spontaneous drainage of pus in a classic case of Ludwig's Angina

Figure 2: Multiple draining sinuses of the left cheek and the left submandibular region of case of Ludwig's Angina.

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Table 1. The age of the cases included in the study and their relative percentages at each centre.

Age Range (years)	Benin Number (%)	Kano Number (%)	Lagos Number (%)
0-10	1 (2)	3 (7)	2 (3)
11-20	2 (4)	4 (6)	5 (9)
21-30	9 (18)	18 (27)	5 (9)
31-40	7 (14)	15 (22)	13 (23)
41-50	5 (10)	13 (20)	9 (15)
51-60	11(22)	5 (7)	9 (15)
61-70	5 (10)	5 (8)	5 (9)
71-80	7 (14)	2 (2)	8 (13)
81-90	2 (6)	1 (1)	1 (4)

Table 2. The distribution of the educational attainment of the patients and their relative percentages at each of the three centres.

Class	Educational Attainment	Benin Number (%)	Kano Number (%)	Lagos Number (%)
I	Tertiary	2 (4.1)	5 (7.6)	5 (8.8)
II	Secondary	27 (55.1)	8 (12.1)	28 (49.1)
III	Primary	9 (18.4)	20 (30.3)	21 (36.8)
IV	No formal education	11 (22.4)	33 (50)	3 (5.3)

Table 3. The social history of the patents seen at the three centres of the study

Social habits	Benin Number (%)	Kano Number (%)	Lagos Number (%)

Smoking & drinking	9(18)	30 (44)	5 (9)
Drinking only	14(29)	0 (0)	11 (19)
HIV status (Non-reactive)	49(100)	64(97)	56 (98)
Sexual orientation(heterosexual)	49 (100)	66 (100)	57 (100)

Table 4 The definitive treatment of the Ludwig's Angina cases.

Treatment	Benin No.(%)	Kano No.(%)	Lagos No.(%)
Incision & Drainage (I&D), exodontia and dressing	41 (84)	66 (100)	56 (97)
Spontaneous discharge of pus on floor of mouth	2(4)	0 (0)	0 (0)
Immobilization of fracture with I&D	1(2)	0 (0)	1 (1)
Excision of sialolith with drainage	2(4)	0 (0)	0 (0)
Patients that refused treatment	3(6)	0 (0)	0 (0)

Table 5. Complications associated with Ludwig's Angina

Complications	Benin Number (%)	Kano Number (%)	Lagos Number (%)
Persistent drainage of pus	1(2)	2 (3)	1 (1.3)
Friable ulcerated skin	3(6)	2 (3)	4 (7.0)
Sinus on facial skin	1(2)	2 (3)	0 (0)
Necrotic fascial tissue	1(2)	6 (9)	1 (1)
Spread of infection to buccal space	1(2)	0 (0)	0 (0)
Spread of infection to peritracheal space	2(4)	7 (10)	3 (5)
Chronic osteomyelitis	1(2)	0 (0)	1 (1.3)
Hypovolemic shock	2(4)	3 (5)	0 (0)
Respiratory distress & Mediastinitis	4(8)	18 (27)	3 (6.)
Died	2(4)	13 (20)	7 (12)

