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| RESEARCH ARTICLE

Characteristics of Cervical Necrotizing Fasciitis (CNF) Patient in Oral and Maxillofacial Surgery Department Rsup Dr Hasan Sadikin: 2 Years Retrospective Study

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| ABSTRACT

Cervical necrotizing fasciitis (CNF) is a life-threatening bacterial infection that runs aggressively in the subcutaneous tissue and fascia in the head and neck area with clinical presentation of extensive necrotic tissue that develops from infection of the teeth or gingiva and other supporting tissues accompanied by an endosteal or periosteal infection of the jaw. This research aims to obtain information about characteristic patients with cervical necrotizing fasciitis (CNF). This study is an observational study with a retrospective descriptive approach. Based on medical record data, the research was conducted at Hasan Sadikin General Hospital (RSHS) Bandung from March 2019 – March 2021. The data collected include age, gender, onset, nutritional status, region, clinical diagnosis, microbiology, antibiotic sensitivity resistance, length of stay, and source focal infection. In this study, 23 medical records were obtained. The most frequent characteristics of the subjects were elderly aged more than 50 years (47.8%) and males (61%). The most frequent locations were the submandible area (100%), and the most frequent source of focal infection was from mandibular posterior teeth (60.46%). From the onset to the symptoms frequently 7-14 days with the nutritional status, most patients were malnourished (58%). Regarding microbiology gram negative dominantly (66,6%), with the most bacterial that worsening the spread of CNF being Acinobacter Baumanii (26.0%), Tigecycline becomes antibiotic most sensitive (43,47%), Cefazoline is the most resistance (73.91%). Most patients were treated by surgery necrotomy debridement (95, 6 %), and most improved (76 %). The ability to diagnose quickly and take aggressive action is needed to treat patients with Cervical Necrotizing Fasciitis (CNF) because of its high progression.

| KEYWORDS

Cervical Necrotizing Fasciitis, odontogenic infection, dental infection, Necrotizing fasciitis

| ARTICLE INFORMATION

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1. Introduction

Cervical necrotizing fasciitis (CNF) is a life-threatening bacterial infection that runs aggressively on the subcutaneous tissue and fascia in the head and neck area with clinical presentation of extensive necrotic tissue. This infectious condition rarely affects the head and neck because of the high vascularity of this area. Cervical necrotizing fasciitis can be caused by an infection in the oral cavity or tonsils or trauma to the head and neck area. Cervical necrotizing fasciitis can develop from infection of the teeth or gingiva and other supporting tissues accompanied by an endosteal or periosteal infection of the jaw which is referred to as Odontogenic cervical necrotizing fasciitis (OCNF) (Ogle, 2016; Fu, 2020; Aburazzaq, 2016).

The spread of CNF can develop due to a weak immune system in the individual and is also accompanied by systemic disease. The most likely cause of the further spread of infection is loss of vascularity with microthrombosis surrounding the infection locus, accompanied by acute inflammation of the subcutaneous tissue and swelling of the surrounding tissue, with this progression

without intravascular coagulation and necrosis of the infected tissue (Emmanuel, 2018). Clinical manifestations of this infection include acute onset, accompanied by persistent and severe pain, swelling, redness, erythema, the appearance of necrotic tissue, palpation showing crepitus caused by gas gangrene, gray to blackish, foul-smelling "dishwater" exudate in severe cases cause upper airway obstruction.[5]

Cervical necrotizing fasciitis can be associated with significant morbidity and mortality due to septic shock disseminated intravascular coagulation (DIC) and the consequences of multiple organ failure. More severe cervical necrotizing fasciitis can spread to the chest and abdominal areas. Cervical necrotizing fasciitis is often polymicrobial, highly destructive, and often fatal, with a mortality rate of 7% to 20%. If the infection progresses to the chest area as mediastinitis, the mortality rate will increase dramatically (Hupp, 2019). Cervical necrotizing fasciitis is often not properly diagnosed initially and is considered a mild soft tissue infection. Proper diagnosis, broad-spectrum antibiotic therapy, and aggressive debridement surgically of the affected tissue are the keys to the treatment of this serious infection, which is often life threatening (Jose, 2016).

2. Material and Method

This research is an observational study with a retrospective descriptive approach. This research was conducted at RSHS Bandung from March 2019 - March 2021. The population and sample of this study were all medical records of a patient diagnosed with Cervical Necrotizing Fasciitis at the Oral and Maxillofacial Surgery Department RSHS. The research use inclusion and exclusion criteria. Inclusion was the patient diagnosed with cervical necrotizing fasciitis in patients receiving treatment at the Inpatient Installation of dr. Hasan Sadikin in the period March 2019 – March 2021. The exclusion criteria in this study were incomplete patient medical record data. The variables studied included age, gender, occupation, education, onset, nutritional status, therapy, active region, clinical diagnosis, microbiology, antibiotic resistance, causative teeth, and length of hospital stay. The categorical data processing was done using a computer program, and the research data were grouped and expressed in proportions. This study has received ethical approval from the Health Research Ethics Committee of Dr. Hasan Sadikin General Hospital Bandung with the ethical committee approval number: 161/UN6.KEP/EC/2022.

3. Results

The results of data collection on the Characteristics of Cervical Necrotizing Fasciitis (CNF) at KSM Oral and Maxillofacial Surgery, dr. Hasan Sadikin, for the period March 2019 – March 2021, there were 23 patients, 22 patients received debridement necrotomy treatment, and 1 patient died before surgery. The results of data collection on the characteristic of cervical necrotizing fasciitis (CNF) in patients at KSM Oral Surgery RSHS are as follows in table 1.

Table 1. Subjects Characteristics

No	Variable	Frequency N=23	%
1.	**Age**		
	0-10	1	4.3 %
	11-20	3	13.04 %
	21-30	3	13.04 %
	31-40	3	13.04 %
	41-50	1	4.3 %
	>50	12	52.17 %
2.	**Gender**		
	Male	17	61 %
	Female	6	39 %
3.	**Onset**		
	1-6 hari	4	26%
	7- 14 hari	17	52%
	14 – 21 hari	1	22%
	>21 hari	-	-

4.	**Nutritional Status**		
	Underweight	16	52%
	Normal	2	22%
	Overweight	5	26%
5.	**Therapy**		
	Necrotomy Debridement + Modern Dressing	17	73.9%
	Necrotomy Debridement + Modern Dressing+ STSG	5	21.73%
	No therapy	1	4.3 %
6.	**Region**	3	13 %
	Buccal Submandibular submental colli	23	100%
	toraks	14	61%
		13	57%
	Staging	10	43 %
7.	I		
	II	13	56.5 %
	II	5	21.7 %
		5	21.7 %
8.	**Microbiology**		
	Gram Positive	5	37.5%
	Gram Negative	16	66.6%
	Streptococcus anginosus	2	8.6%
	Streptococcus Constellatus	1	4.3%
	Staphylococcuss epidedrmidis	1	4.3%
	Staphylococcus aureus	1	4.3%
	Acinobacter baumanii	6	26.0%
	Klebsiella pneumoniae	1	4.3%
	Escherichia colli	1	4.3%
	Enterobacter clocae	1	4.3%
	Burkholderia Cepacia	1	4.3%
	Pseudomonas aerogenosa	2	8.6%
	Enterobacter Amnigenus	1	4.3%
	Tidak terdapat mikroorganisme	2	8.6%
	Candida Albicans	1	4.3%
9.	**Antibiotic Sensitivity**		
	Amikacin	12	52%
	Ampicillin	3	13,04 %
	Aztreonam	3	13,04 %
	Benzylpenicillin	3	13,04 %
	Cefazolin	1	0,23 %
	Cefepime	9	39,1 %
	Cefotaxime	3	13,04 %
	Ceftazidime	6	26,1 %
	Ceftriaxone	3	13,04 %
	Chloramphenicol	3	13.04 %
	Ciprofloxacin	5	21.73 %
	Clindamycin	3	13,04 %
	CO-trimoxasole	4	17.4 %

	Ertapenem	5	21.73 %
	Erythromycin	0	0
	Gentamycin	9	39.1 %
	Levofloxacin	3	13.04 %
	Linezolid	3	13.04 %
	Meropenem	13	56.5 %
	Piperacillin	3	13.04 %
	Tetracycline	4	17.04 %
	Tigecycline	16	69,65 %
	Ampicillin Sulbactam	4	17.4 %
10.	**Antibiotic Resistance**	1	
	Amikacin	8	4,34 %
	Ampicillin	1	18,4 %
	Aztreonam	17	4,34 %
	Cefazolin	5	73,91 %
	Cefepime	0	21,3 %
	Cefotaxime	7	0
	Ceftazidime	16	30,4 %
	Ceftriaxone	0	69,56 %
	Chloramphenicol	4	0
	Ciprofloxacin	2	17,39 %
	Clindamycin	3	8,69 %
	CO-trimoxasole	0	13.04 %
	Ertapenem	3	0
	Erythromycin	4	13,04 %
	Gentamycin	1	17,39 %
	Levofloxacin	0	4,34 %
	Linezolid	4	0
	Meropenem	3	17,39 %
	Piperacillin	11	13,04 %
	Tetracycline	0	47,8 %
	Tigecycline	8	0
	Ampicillin Sulbactam		34,7 %
11.	**Tooth as source of focal infection**		
	Upper Right posterior		
	Upper Left Posterior	3	12%
	Lower Left posterior	2	8%
	Lower Right Posterior	7	28%
		13	52%
12	**Length of stay**		
	1 – 7 hari 13 orang (52%),	13	52%
	7 – 14 hari 4 pasien (16%),	4	16%
	14 – 29 hari 6 pasien (24%), >30 hari	6	24%
	2 pasien (8%).	2	8%

There were 23 patients diagnosed with Cervical Necrotizing Fasciitis (CNF) at RSHS, divided into 17 Males (61%) and 6 Females (39%). Males predominate in patients with CNF. In table 1, the data shows that the age of majority of CNF sufferers is in the age group > 50 years, each of which is 12 patients (52.17%), and in the 0-10 year age range, the minimum age that can be affected by CNF is 1 patient (4.3%). Based on clinical examination according to the region involved in the submandibular region, submental Colli, and thorax, in areas involving 1 space, namely the submandibular area, only 4 patients, 2 patients in the right submandibular area and 2 patients in the left submandibular, involving 2 spaces There were 3 patients, 2 patients involving the right buccal and right submandibular, and 1 patient involving the left buccal and left submandibular. There were 2 patients involving 3 spaces,

namely bilateral and submental submandibular, left submandibular, left colli, and supraclavicular. In the buccal region in 3 patients (13%), the submandibular region in all 23 patients (100%), submental in 14 patients (61%), Colli in 13 patients (57%), and the thoracic area in 10 patients (43%). Submandibular region involvement was present in all patients. On the stage or staging of patients with CNF, from 23 patients, 13 patients had clinical features of stage I NF with soft palpation (expanding to the involved area), erythema, swelling, and warm to palpation, in 5 patients came with stage II NF with blisters or bullae (serous fluid), skin fluctuations, skin induration, and 5 patients with class III NF with bullae with haemorrhage, skin anaesthesia, crepitus, skin necrosis.

From the results of the examination of the causative teeth, the correct posterior teeth of RA were 3 patients (12%) and left 2 patients (8%), left posterior teeth were RB 7 patients (28%), right posterior teeth were RB as many as 13 patients (52%). From the results of the examination of the mandibular posterior teeth, the dominant cause of CNF. From monitoring the nutritional status of patients according to the calculation of BMI (Body Mass Index), there were 6 people (25%) with good nutrition, 12 patients (58%) with less nutrition, and 5 patients (17%) with excess nutrition. In diagram 4.6, most cases of CNF are found in patients with malnutrition.

According to the anamnesis, data on the onset of CNF occurred within 1-6 days in 4 patients, 7-14 days in 17 patients, 14-21 days in 1, and no more than 21 days. Most onset occurred at 7-14 days, with 52%. Cervical Necrotizing Fasciitis (CNF) cases are a combination of two types of bacteria, namely gram-positive and gram-negative. The data showed that the highest number of bacteria in cervical necrotizing fasciitis cases was gram-negative bacteria at 66.6%, followed by gram-positive bacteria at 37.5%. The table above also describes the types of bacteria cultured, which explain the bacteria in cervical necrotizing fasciitis cases dominated by Acinobacter baumanii, a gram-harmful bacteria with 26.0%.

The bacterial sensitivity data obtained in the CNF case results from a swab examination based on necrotic tissue. Antibiotic sensitivity data were obtained from the results of bacterial sensitivity cultures to the tested antibiotics. Tigecycline antibiotics gave the most sensitive results in 16 cases (43.47%) of CNF. Antibiotic resistance data were obtained from the results of bacterial resistance cultures to the tested antibiotics. The data shows the types of antibiotics resistant to CNF patients. Cefazolin antibiotics gave the most resistance results in 17 cases (73.91%) and Ceftriaxone in 16 cases (69.59%) CNF.

Therapy data in CNF patients in diagram 4.8. Patients with CNF cases underwent necrotomy debridement in 22 patients, with continued therapy with the use of modern dressings only in 18 patients (76%), and 4 patients (24%) received follow-up care for wound reconstruction.

4. Discussion

Cervical Necrotizing Fasciitis (CNF) is a potentially life-threatening soft tissue infection characterized by excessive necrosis and gas formation in the subcutaneous tissue and fascia. These cases are rare in the head and neck, and most are of odontogenic or pharyngeal origin. The incidence of CNF based on clinical examination and microbial culture is needed to determine the characteristics that often occur in patients at KSM Oral and Maxillofacial Surgery RSHS. Based on the data collection results, it can be seen that the incidence of CNF that occurred and received treatment at the RSHS from March 2019 to March 2021 amounted to 23 patients, with the average being experienced by men aged over 50 years. Based on research conducted by Dasheka et al., it was found that the age range for CNF was men over the age of 49 years in Australia in 2017, which can increase the risk of CNF. Underlying systemic disease may predispose or be aggravating factors in patients with CNF (Oliveira, 2018).

CNF of odontogenic origin often involves the mandibular second and third molars because the apex of these teeth extends beneath the insertion of the mylohyoid muscle. The infectious process originating from this tooth easily crosses into the submandibular space. From the study's results, it was found that the left mandibular molar with a percentage value of 52% in the study as the focus of infection from CNF was following the literature mentioned by Oliviera et al. mandibular molars were the leading cause of CNF (Oliveira, 2018).

From the grouping of clinical features that have been summarized by Wong Wang et al. to the stage or clinical staging of patients with CNF, from 23 patients, 57% of them were found, with 13 patients with clinical features of stage I NF with soft palpation features (extending to the involved area).), erythema, swelling, warm to palpation, in 5 patients, with 22% presenting with stage II NF with blisters or bullae (serous fluid), skin fluctuations, skin induration, and 5 patients with 22% NF class III with bullae appearances. Hemorrhage, skin anaesthesia, crepitus, and skin necrosis (Jagdeep, 2013).

The majority of onset occurred on days 7 to 14, with 52% in this study. After the onset of CNF triggered by odontogenic infection, a dark red, ulcerated area appears 36 to 72 hours later. The lesion will display three distinct zones, including: (1) a central zone of necrosis surrounded by (2) a dark tender zone and (3) an extensive peripheral zone of erythema. By 3 or 4 days, the patient will develop skin bullae and subcutaneous emphysema. One week after onset or later, the patient will experience loss of sensation in

the involved area, which is an unfavourable sign of CNF prognosis. Subsequently, toxic shock syndrome will develop, leading to severe tissue necrosis, hypotension, shock, or multiorgan failure. According to the literature, patients with an onset of more than 7 days have a broader expansion of the necrotic area with unfavourable systemic conditions.

The distribution of the results of the culture examination based on necrotic tissue showed that Cervical Necrotizing Fasciitis was dominated by Acinobacter baumanii, a gram harmful bacteria with a percentage of 26.0%. Acinetobacter Baumannii is known to cause severe soft tissue infections in the hospital environment, and in some countries, it is known to be endemic to Acinetobacter Baumannii; the mechanism behind this severe soft tissue infection has not been established, and the involvement of polymicrobial infection predicts a poorer prognosis. Cases of deep neck soft tissue with good outcomes are sporadic.22 According to the literature from Cherrobi et al., in the data obtained from this study, patients diagnosed with CNF with the involvement of Acinetobacter Baumannii had a poor prognosis, with 8 (36.4%) patients dying after treatment. Adding polymicrobial involvement suggests a more severe spatial extension and a poorer prognosis. Microorganisms will use their toxins and enzymes that travel from the subcutaneous tissue through the superficial and deep fascia. The infection causes vascular invasion, ischemia, and thrombosis so that the spread process is faster (Kornevs, 2017).

Treatment of CNF is aggressive surgery by evacuating necrotic tissue, taking the focus on infection, and antibacterial therapy. Surgical debridement to remove subcutaneous necrotic tissue should be performed as soon as the patient is suspected of having CNF. Delayed surgical debridement can definitely increase patient mortality. Because CNF is rapidly developing, monitoring is essential, and serial debridement can be performed within the first 24 hours after initial debridement, and follow-up debridement should always be prepared. In this study, necrotomy debridement was performed in 22 patients (95.6%), with 6 patients following serial debridement (Jagdeep, 2013).

In the treatment of NF, early administration of antibiotics and surgical debridement is necessary to save the patient. Broad-spectrum antibiotics should be chosen as the basic antibacterial therapy. Generally, multiple or triple combinations are recommended as the baseline criteria, including third-generation cephalosporins, aminoglycoside antibiotics, or metronidazole. Furthermore, such as meropenem and piperacillin-tazobactam are also recommended for the sake of greater distribution and less renal toxicity. Antibiotics should be changed as needed, according to culture results. In this study, most of the NF patients were given a third generation cephalosporin, ampicillin sulbactam, and a combination of metronidazole. In accordance with the results of a study conducted by Iwata et al., the administration of broad-spectrum antibiotics and often more than one antibiotic, including penicillinase resistant to penicillinase for streptococcal and staphylococcal bacteria and aminoglycosides for Gram-negative bacteria, clindamycin or metronidazole for anaerobic organisms may be indicated. The combination of antibiotics is the key to the success of adjuvant therapy; most patients have received empirical antimicrobial therapy before making the early diagnosis of necrotizing fasciitis. In the majority of cases, wound cultures were collected at the time of initial surgery. Unfortunately, antibiotic therapy alone has little success because tissue hypoxia and ischemia do not allow adequate administration of antibiotics to target tissues. Polymicrobial infection identified by wound culture was the dominant cause. For this reason, a combination of antibiotics is used that includes a broad spectrum of anaerobic and aerobic, gram-positive, and gram-negative organisms. For anaerobic coverage, several other combinations of antibiotics, such as metronidazole and third generation cephalosporins, are available. In this study, an antimicrobial sensitivity test was taken, with the most sensitive results being Tigecyline (69.65%), followed by Meropenem (56.5%), Amikacin (52%), Gentamicin (39.1%), and Cefepime (39.1%). In the examination of antibiotic resistance, it was found that the types of antibiotics were resistant to CNF patients, the antibiotic Cefazolin gave the most resistance to 17 cases (73.91%), Ceftriaxone to 16 cases (69.59%) of CNF (Sizer, 2021).

Another important thing in CNF treatment is to treat the wound properly and choose the right dressing according to the type of wound. Postoperative necrotizing debridement wounds require appropriate dressings to speed up healing time, prevent complications, and provide ideal wound healing. Wounds caused by necrotizing fasciitis are infected wounds and contain purulent exudate. This type of wound requires dressings that have an anti-bacterial effect and can absorb purulent exudate. In this study, it was found that 76.4% of patients with wound dressing therapy only after debridement necrotomy surgery, and 24% of patients with CNF received further reconstructive surgery therapy after debridement necrotomies and the use of wound dressings when the wound bed was good and general condition was stable (Grier, 2021).

From the data in this study, it can be seen that the length of stay of patients in the hospital is in the range of 1-7 days; there are 13 people (52%). From these data, 8 patients died after the debridement necrotomy was performed, and 1 patient died before the procedure, with 14 patients experiencing improvement (76%) and 9 patients dying (24%). Adequate intensive care is important to maintain the patient's normal metabolic processes, fluid, and electrolyte substitution. Unfortunately, in some cases, septic shock can occur, which can cause damage to multiple organs and lead to lethal outcomes (Sizer, 2021).

5. Conclusion

Cervical necrotizing fasciitis (CNF) is a life-threatening bacterial infection that runs aggressively in the subcutaneous tissue and fascia in the head and neck area with clinical presentation of extensive necrotic tissue that develops from infection of the teeth or gingiva and other supporting tissues accompanied by an endosteal or periosteal infection of the jaw. This research aims to obtain information about characteristic patients with cervical necrotizing fasciitis (CNF). This study is an observational study with a retrospective descriptive approach. The ability to diagnose quickly and take aggressive action quickly is needed to treat patients with Cervical Necrotizing Fasciitis (CNF) because of the high progression and the large number of patients who come with systemic conditions that are not good. As an oral surgeon, you must be able to collaborate with other colleagues in handling emergencies and wound care in patients with CNF.

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