WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 6.805
Volume 5, Issue 4, 898-906. Research Article ISSN 2277– 7105

ANTIBIOGRAM OF BACTERIA CAUSING DENTOALVEOLAR ABSCESS

Poonam B. Chauhan* and Pratibha B. Desai

Dept. of Microbiology, K.B.S Commerce & Nataraj Professional Sciences college, Vapi – 396195 (Gujarat), India

Dept. of Microbiology, Shree Ramkrishna Institution of Applied Sciences, Athwalines, Surat - 395001 (Gujarat), India.

Article Received on
21 Jan 2016,
Revised on 12 Feb 2016,
Accepted on 04 Mar 2016
DOI: 10.20959/wjpr20164-5869

***Correspondence for Author**
Poonam B. Chauhan
Dept. of Microbiology, K.B.S Commerce & Nataraj Professional Sciences college, Vapi – 396195 (Gujarat), India.

ABSTRACT

The aim of this study was to investigate the bacterial species from dental abscess and evaluate their susceptibility to antibiotics. Of a population of 119 patients, 37% of the patient showed the clinical case of acute odontogenic infections with 72.7% showing symptoms of only tooth abscess and 27.3% associated with other infections with 69.8% of the tested patients being male and 30.2% female patient. A total of 101bacterial isolates were isolated and identified, the predominant bacteria found was *Staphylococcus aureus* (47%), followed by *Klebsiella* species, *Fusobacterium nucleatum* and *Porphyromonas gingivalis.* The Gram negative anaerobic bacteria were highly resistant to penicillin (95.6%), followed by erythromycin (94.4%), clindamycin (91.7%), cefuroxime (85.6%) and cefotaxime (80.8%). In case of Gram positive anaerobic bacteria the resistivity was observed in order – penicillin (100%), clarithromycin (93.75%), erythromycin and ampicillin (81.25%). Gram negative aerobic bacteria also showed high resistivity to erythromycin (98.90%), penicillin (98.20%), clarithromycin (89.10%), roxythromycin (89.10%) and clindamycin (88%). Gram positive aerobic bacteria were resistant to penicillins, macrolide and lincosamide group of antibiotics. The bacterial isolates were found to be highly sensitive to tetracycline group of antibiotic. In conclusion tetracycline and metronidazole are suitable antibiotics for treatment of dental abscess.

KEYWORDS: Dental abscess, antibiotic susceptibility, Gram negative anaerobes, Gram positive anaerobes, Gram negative aerobes, Gram positive aerobes.

INTRODUCTION

Dental or dentoalveolar abscess is a denomination used to describe localized collection of pus in the alveolar bone at the root apex of the tooth. It generally occurs secondary to dental caries, trauma, deep fillings or failed root canal treatment. The providence of infectious process widely depends on the virulence of the bacteria, host resistance factors and regional anatomy.[1] The spread of dental abscesses can lead to serious consequences in terms of its morbidity and mortality making it an important public health problem.

The etiology of dental abscess is usually heterogeneous and likely to be polymicrobial in nature.[2] The most common cause of acute dental infections is oral streptococci and obligate anaerobic bacteria especially *Prevotella* and *Fusobacterium* species.[3,4] The treatment of dental abscess is usually done by surgery along with antibiotics [5], otherwise it can lead to serious complications like brain abscess, septicaemia, shock and occasionally even death.[6,7,8,9]

Inspite of the advent in antibiotic therapy and improvement in the socioeconomic status, many cases of odontogenic infections have been reported [10,11], possibly because of high consumption, overprescribing and irrational use of antibiotics resulting in resistant microorganisms.[3,12,13,14,15] For this reason antibiotic needs to be reevaluated periodically.[16,17] It has been noted on reviewing the available literature that the use of antibiotics and the resistance pattern is not same around the world.[13,18] Thus it is sagacious to observe the changes in the resistance behaviour of the microbes and to avail an appropriate choice of antibiotics for treatment purpose.

MATERIALS AND METHODS

Samples were collected from patients having signs and symptoms of acute odontogenic infections, particularly dentoalveolar abscess from different clinics of Valsad district, Gujarat, India. The pus samples were collected in sterile transport medium and transported to the microbiological laboratory for processing. The isolation, identification and biochemical characterization of isolates were done as per standard techniques.[19]

Different isolation media like MacConkey agar, Mannitol salt agar were used for isolation of aerobic bacteria, incubated at 37^0C for 24 hours. Fusobacterium agar, Trypticase soy agar, Bacteroides bile salt agar, Phenyl alcohol agar, Actinomyces agar plates were streaked in duplicates where one set was incubated in the anaerobic jar at 37^0C for 5-6 days and other at 37^0C for 24 hours for isolation of facultative and obligate anaerobic bacteria.

Antibiotic susceptibility testing was performed by Kirby-Bauer disc diffusion technique on Muller-Hinton agar. The following commercially available antibiotic disc (Hi Media, Mumbai, India) were used Ampicillin/sulbactum ($A/S^{10/10}$), Norfloxacin (NX^{10}), Doxycycline Hydrochloride (DO^{30}), Gentamicin (GEN^{10}), Co-Trimoxazole (COT^{25}), Ampicillin (AMP^{10}), Roxythromycin (RO^{30}), Colistin (CL^{10}), Cefotaxime (CTX^{30}), Penicillin-G (P^{10}), Amoxyclav (AMC^{30}), Azithromycin (AZM^{15}), Ciprofloxacin (CIP^{5}), Amikacin (AK^{30}), Metronidazole (MT^{5}), Clarithromycin (CLR^{15}), Nalidixic Acid (NA^{30}), Tetracycline (TE^{30}), Erythromycin (E^{15}), Chloramphenicol (C^{30}), Kanamycin (K^{1000}), Streptomycin (S^{10}), Nethillin (NET^{30}), Clindamycin (CD^{2}), Ceftriaxone (CTR^{30}), Vancomycin (VA^{30}), Ceftazidime (CAZ^{30}), Trimethoprim (TR^{5}), Piperacillin (PI^{100}), Piperacillin/Tazobactam ($PIT^{100/10}$), Cefuroxime (CXM^{30}).

RESULTS AND DISCUSSION

During the study period, a total 119 samples were processed. Patient receiving antibiotic treatments either prescribed or on their own were excluded from the study. 69.8% of the tested patients were male and 30.2% were female, with a mean age of 33.8 years, which is younger as compared to other studies.[20,21,22] In the present study 37% patient showed the clinical case of acute odontogenic infections in which 72.7% was showing symptoms of only tooth abscess, 27.3% patients associated with other infections involving 68.2% molar, 20.5% premolar, 9% incisor and 2.3% canine teeth. It was found that 8 cases of dental abscess were found to be associated with periapical abscess that involved 37.5% molar, 50% premolar and 12.5% being incisor teeth and only three cases of dental abscess with the symptoms of periodontitis involving 100% of the molar teeth were found.

A total of 101 bacterial strains were isolated from 44 patients with dental abscess. Gram negative anaerobic bacteria was predominantly observed (42%) and the most frequently isolated bacteria were *Fusobacterium nucleatum* and *Porphyromonas gingivalis.* High prevalence was also recorded for *Staphylococcus aureus* amongst the Gram positive aerobic bacteria (Table 1), which is in agreement with the findings of Aditi *et al*., (2014).[23]

In the present study, different panel of antibiotics were used against the anaerobic and aerobic bacteria. According to antibiogram analysis (Table 1) 95.6% of the Gram negative anaerobic bacteria were found to be resistant to penicillin G, 94.4% showed resistance against erythromycin and 91.7% showed resistance to clindamycin, in contrast Neringa *et al*., (2010)[24] reported clindamycin to be effective in case of penicillin. Antibiotics like

clarithromycin and roxythromycin showed almost 90% resistance. Amongst the various groups of antibiotics tested, maximum resistance of gram negative anaerobic bacteria was observed against macrolide and lincosamide group of antibiotics, *Prevotella dentalis* was registered to be resistant to almost all the antibiotics used except tetracyclines and chloramphenicol. *Bacteroides fragilis* showed 100% resistance to cephalosporins, followed by *Porphyromonas* species (87.5%) (Table 2), the result is in accordance with the other studies.[23,25,26]

Table 1: Bacterial isolates from patients with dentoalveolar abscess (n = 44 patients)

	Isolated bacterial strains	n	%
Anaerobic Gram negative bacterial strains 42/101	*Fusobacterium necrophorum*	5	4.9
	Fusobacterium nucleatum	6	5.9
	Fusobacterium mortiferum	5	4.9
	Bacteroides fragilis	3	3
	Bacteroides species	5	4.9
	Porphyromonas gingivalis	6	5.9
	Porphyromonas endodontalis	1	1
	Porphyromonas species	2	2
	Prevotella intermedia/nigrescens	5	4.9
	Non pigmented *Prevotella*	1	1
	Prevotella dentalis	1	1
	Veionella species	2	2
Anaerobic Gram positive bacterial strains 10/101	*Peptostreptococcus micros*	2	2
	Peptostreptococcus anaerobius	2	2
	Peptostretococcus species	2	2
	Streptococcus species	4	4
Aerobic Gram negative bacterial strains 32/101	*Pseudomonas aeruginosa*	5	4.9
	Pseudomonas pseudoalcaligenes	1	1
	Pseudomonas species	1	1
	Klebsiella species	4	4
	Klebsiella pneumoniae	8	7.9
	Proteus vulgaris	4	4
	Aeromonas salmonicida	3	3
	Brevundimonas vesicularis	2	2
	Sphingomonas paucimobilis	2	2
	Raoultella ornithinolytica	1	1
	Acinetobacter lwoffii	1	1
Aerobic Gram positive bacterial strains 17/101	*Staphylococcus aureus*	8	7.9
	Staphylococcus epidermidis	4	4
	Enterococcus faecium	5	4.9

Table 2: Antibiotic susceptibility of Gram negative anaerobic bacterial isolates from tooth abscess

Group of Antibiotics	Antibiotics	No. (%) of Resistant strains											
		F. necrophorum (n = 5)	*F. nucleatum* (n = 6)	*F. mortiferum* (n = 5)	*B. fragilis* (n=3)	*Bacteroides* species (n=5)	Non Pigmented *Prevotella* species (n=1)	*P. endodontalis* (n= 1)	*P. gingivalis* (n= 6)	*Porphyromonas* species (n=2)	*P. dentalis* (n=1)	*P. intermedia/nigrescens* (n= 5)	*Veillonella* species (n= 2)
Penicillins	P	4 (80)	6 (100)	5 (100)	3 (100)	5 (100)	1 (100)	1 (100)	4 (66.7)	2 (100)	1 (100)	5 (100)	2 (100)
	AMP	4 (80)	6 (100)	4 (80)	3 (100)	3 (60)	0 (0)	1 (100)	5 (83.3)	2 (100)	1 (100)	4 (80)	1 (50)
	AMC	3 (60)	0 (0)	1 (20)	0 (0)	1 (20)	1 (100)	1 (100)	0 (0)	2 (100)	1 (100)	3 (60)	0 (0)
	PI	1 (20)	1 (16.7)	0 (0)	2 (66.7)	1 (20)	1 (100)	0 (0)	2 (33.3)	0 (0)	1 (100)	2 (40)	0 (0)
	PIT	1 (20)	0 (0)	0 (0)	2 (66.7)	1 (20)	1 (100)	1 (100)	1 (16.7)	0 (0)	1 (100)	1 (20)	0 (0)
	A/S	5 (100)	1 (16.7)	3 (60)	0 (0)	5 (100)	1 (100)	1 (100)	2 (33.3)	2 (100)	1 (100)	3 (60)	2 (100)
Cephalosporins	CXM	4 (80)	5 (83.3)	5 (100)	3 (100)	4 (80)	1 (100)	0 (0)	5 (83.3)	2 (100)	1 (100)	5 (100)	2 (100)
	CAZ	3 (60)	5 (83.3)	3 (60)	3 (100)	2 (40)	0 (0)	1 (100)	4 (66.7)	2 (100)	0 (0)	4 (80)	1 (50)
	CTR	2 (40)	3 (50)	2 (40)	3 (100)	0 (0)	0 (0)	0 (0)	3 (50)	1 (50)	1 (100)	4 (80)	1 (50)
	CTX	4 (80)	4 (66.7)	5 (100)	3 (100)	4 (80)	0 (0)	1 (100)	5 (83.3)	2 (100)	1 (100)	3 (60)	2 (100)
Macrolide	E	5 (100)	6 (100)	5 (100)	3 (100)	5 (100)	1 (100)	1 (100)	5 (83.3)	1 (50)	1 (100)	5 (100)	2 (100)
	CLR	5 (100)	5 (83.3)	5 (100)	3 (100)	5 (100)	1 (100)	0 (0)	6 (100)	2 (100)	1 (100)	5 (100)	2 (100)
	RO	5 (100)	6 (100)	5 (100)	3 (100)	4 (80)	1 (100)	0 (0)	6 (100)	2 (100)	1 (100)	5 (100)	2 (100)
Lincosamide	CD	5 (100)	6 (100)	5 (100)	3 (100)	5 (100)	1 (100)	0 (0)	6 (100)	2 (100)	1 (100)	5 (100)	2 (100)
Aminoglycoside	AK	2 (40)	5 (83.3)	2 (40)	2 (66.7)	1 (20)	0 (0)	1 (100)	2 (33.3)	1 (50)	1 (100)	3 (60)	0 (0)
	GEN	1 (20)	3 (50)	3 (60)	0 (0)	1 (20)	1 (100)	1 (100)	2 (33.3)	2 (100)	1 (100)	2 (40)	1 (50)
	S	3 (60)	5 (83.3)	2 (40)	1 (33.3)	2 (40)	0 (0)	0 (0)	4 (66.7)	1 (50)	1 (100)	4 (80)	1 (50)
	K	3 (60)	2 (33.3)	4 (80)	1 (33.3)	4 (80)	1 (100)	0 (0)	3 (50)	0 (0)	0 (0)	2 (40)	2 (100)
	NET	0 (0)	3 (50)	1 (20)	2 (66.7)	3 (60)	1 (100)	1 (100)	3 (50)	1 (50)	1 (100)	3 (60)	0 (0)
1- Quinolone	NA	0 (0)	2 (33.3)	2 (40)	0 (0)	1 (20)	0 (0)	0 (0)	2 (33.3)	0 (0)	0 (0)	2 (40)	0 (0)

2- Quinolone	CIP	1 (20)	1 (16.7)	2 (40)	3 (100)	0 (0)	0 (0)	0 (0)	3 (50)	1 (50)	1 (100)	2 (40)	0 (0)
	NX	0 (0)	0 (0)	2 (40)	1 (33.3)	0 (0)	0 (0)	0 (0)	3 (50)	0 (0)	0 (0)	1 (20)	1 (50)
Sulfonamides	TR	5 (100)	4 (66.7)	5 (100)	3 (100)	5 (100)	1 (100)	1 (100)	2 (33.3)	1 (50)	1 (100)	5 (100)	2 (100)
	COT	3 (60)	4 (66.7)	3 (60)	1 (33.3)	3 (60)	1 (100)	1 (100)	5 (83.3)	2 (100)	1 (100)	5 (100)	1 (50)
Tetracycline	TE	1 (20)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (16.7)	0 (0)	0 (0)	1 (20)	0 (0)
	DO	1 (20)	0 (0)	0 (0)	0 (0)	1 (20)	0 (0)	0 (0)	1 (16.7)	0 (0)	0 (0)	2 (40)	0 (0)
Others	C	1 (20)	2 (33.3)	3 (60)	2 (66.7)	5 (100)	0 (0)	0 (0)	4 (66.7)	2 (100)	0 (0)	1 (20)	1 (50)
	MT	1 (20)	1 (16.7)	2 (40)	0 (0)	2 (40)	1 (100)	0 (0)	3 (50)	1 (50)	0 (0)	3 (60)	1 (50)

All the gram positive anaerobic bacteria showed 100% resistance against penicillin G, 93.75% against clarithromycin and 81.25% against ampicillin and roxythromycin. *Peptostreptococcus micros* showed highest resistance (100%) against macrolide and lincosamide, 75% resistant to cephalosporins, whereas *P. anaerobius* showed 83.3% resistance against macrolide group of antibiotics. However quinolone group of antibiotic was found to be 100% effective on *P. anaerobius*. Tetracyclines showed maximum antimicrobial effect on almost all of the isolates recovered, followed by netillin (6.25%) and metronidazole (12.5%) (Table 3).

Table 3: Antibiotic susceptibility pattern of Gram positive aerobic bacteria isolated from tooth abscess

Group of Antibiotics	Antibiotics	No. (%) of Resistant strains		
		S. aureus **(n = 8)**	***S. epidermidis*** **(n=4)**	***E. faecium*** **(n = 5)**
Penicillins	Penicillin G (P)	7 (87.5)	4 (100)	5 (100)
	Ampicillin (AMP)	7 (87.5)	4 (100)	5 (100)
	Amoxyclav (AMC)	4 (50)	3 (75)	1 (20)
	Piperacillin (PI)	7 (87.5)	0 (0)	2 (40)
	Piperacillin/Tazobactam (PIT)	6 (75)	0 (0)	1 (20)
	Ampicillin/Sulbactam (A/S)	7 (87.5)	4 (100)	2 (40)
Cephalosporins	Cefuroxime (CXM)	6 (75)	4 (100)	3 (60)
	Ceftazidime (CAZ)	6 (75)	3 (75)	4 (80)
	Ceftriaxone (CTR)	3 (37.5)	3 (75)	3 (60)
	Cefotaxime (CTX)	8 (100)	1 (25)	2 (40)
Macrolide	Erythromycin (E)	6 (75)	3 (75)	5 (100)
	Clarithromycin (CLR)	8 (100)	3 (75)	5 (100)
	Roxythromycin (RO)	7 (87.5)	4 (100)	5 (100)
Lincosamide	Clindamycin (CD)	7 (87.5)	4 (100)	5 (100)
Aminoglycoside	Amikacin (AK)	2 (25)	2 (50)	2 (40)
	Gentamicin (GEN)	3 (37.5)	1 (25)	1 (20)
	Streptomycin (S)	6 (75)	3 (75)	4 (80)
	Kanamycin (K)	4 (50)	3 (75)	2 (40)
	Netillin (NET)	2 (25)	0 (0)	2 (40)
1- Quinolone	Nalidixic Acid (NA)	6 (75)	0 (0)	1 (20)
2- Quinolone	Ciprofloxacin (CIP)	6 (75)	2 (50)	3 (60)
	Norfloxacin (NX)	5 (62.5)	0 (0)	1 (20)
Sulfonamides	Trimethoprim (TR)	6 (75)	2 (50)	2 (40)
	Co-trimoxazole (COT)	8 (100)	4 (100)	3 (60)
Tetracycline	Tetracycline (TE)	2 (25)	0 (0)	1 (20)
	Doxycycline Hydrochloride (DO)	3 (37.5)	0 (0)	1 (20)
Others	Chloramphenicol (C)	6 (75)	0 (0)	4 (80)

REFERENCES

1. Shweta and S Krishna Prakash. Dental abscess: A microbiological review. Dent Res J (Isfahan), 2013; 10(5): 585–591.
2. Tronstad L, Titterud Sunde P**:** The evolving new understanding of endodontic infections. Endod Top, 2003; 6(1): 57-77.
3. Marsh PD, Martin MV, Lewis MAO, Williams DW. Oral microbiology. 5th ed. Reed Educational and Professional Publishing: 2002.
4. Nair PN. Pathogenesis of apical periodontitis and the causes of endodontic failures. Crit Rev Oral Biol Med, 2004; 15: 348–81.
5. Peterson JL. Principles of management and prevention of odontogenic infections. In: Peterson JL, Ellis E, Hupp JR, Tucker MR, editors. Contemporary Oral and Maxillofacial Surgery. St. Louis: Mosby-year book: 1998; 392–512.
6. Corson MA, Postlethwaite KP, Seymour RA: Are dental infections a cause of brain abscess? Case report and review of the literature. Oral Diseases, 2001; 7: 61–65.
7. Robertson D, Smith AJ. The microbiology of the acute dental abscess. J. Med. Microbiol., 2009; 58: 155–162.
8. Clifton TC and Kalamch S. A case of odontogenic brain abscess arising from covert dental sepsis. Annals of the Royal College of surgeons of England, 2011; 94(1): 41-43.
9. Al Masalma M, Lonjon M, Richet H, Dufour H, Roche PH, Drancourt M, Raoult D, Fournier PE. Metagenomic analysis of brain abscesses identifies specific bacterial associations. Clin. Infect. Dis, 2012; 54: 202–210.
10. Jarboui S, Jerraya H, Moussi A, Ben Moussa M, Marrakchi M, Kaffel N, et al. Descending necrotizing mediastinitis of odontogenic origin. Tunis Med. 2009; 87: 770–5.
11. Fereydoun Pourdanesh, Nima Dehghani, Mohadese Azarsina, Zahra Malekhosein. Pattern of Odontogenic Infections at a Tertiary Hospital in Tehran, Iran: A 10-Year Retrospective Study of 310 Patients. Journal of Dentistry, Tehran University of Medical Sciences, 2013; 10(4).
12. Baumgartner JC. Antibiotics in endodontic therapy. In: Newman MG, Van Winkelhoff AJ (eds.). Antibiotics and antimicrobial use in dental practice. 2nd ed. Carol Stream, IL: Quintessence Publishing Co, Inc; 2001, pp. 143–157.
13. Monnet DL, Kristinsson KG. Turning the tide of antimicrobial resistance: Europe shows the way. Euro Surveill, 2008; 13: 19039.
14. Al-Haroni M. Bacterial resistance and the dental profesionals role to halt the problem. J Dent, 2008; 36: 95–103.

15. O¨cek Z, Sahin H, Baksi G, Apaydin S. Development of a rational antibiotic usage course for dentists. Eur J Dent Educ, 2008; 12: 41–47.
16. Martindale. The extra pharmacopoeia. 31st ed. London: Royal Pharmaceutical Society; 1996: pp. 2739.
17. Hancock RE. Peptide antibiotics. Lancet 1997; 349(9049): 418–422.
18. Van Winkelhoff AJ, Herrera D, Oteo A, et al. Antimicrobial profiles of periodontal pathogens isolated from periodontitis patients in the Netherlands and Spain. J Clin Periodont, 2005; 32: 893–8.
19. Winn WC & Koneman EW. Koneman's Color Atlas and Textbook of Diagnostic Microbiology. 6th ed. In: Elmer W. Koneman (ed.). Philadelphia: Lippincott Williams & Wilkins, 2006: pp. 1565.
20. Valdés S, Rojo-Martínez G, Soriguer F. Evolution of prevalence of type 2 diabetes in adult Spanish population. Med Clin (Barc), 2007; 129(9): 352-5. Review. Spanish. Erratum in: Med Clin (Barc), 2007; 129: 599.
21. Sato FR, Hajala FA, Freire Filho FW, Moreira RW, de Moraes M. Eight-year retrospective study of odontogenic origin infections in a postgraduation program on oral and maxillofacial surgery. J Oral Maxillofac Surg, 2009; 67:1092-7.
22. Sánchez R, Mirada E, Arias J, Paño J.R, Burgueño M. Severe odontogenic infections: Epidemiological, microbiological and therapeutic factors. Med Oral Patol Oral Cir Bucal, 2011; 16 (5): 670-6.
23. Aditi Mahalle, Revati Deshmukh, Apurv Mahalle. Evaluating the antibiotic susceptibility of bacteria isolated from the pyogenic abscess of dental origin. Journal of Dental Research and Scientific Development, 2014 1(1).
24. Neringa Skucaite, Vytaute Peciuliene, Astra Vitkauskiene, and Vita Machiulskiene. Susceptibility of Endodontic Pathogens to Antibiotics in Patients with Symptomatic Apical Periodontitis. J Endod, 2010; 1–6.
25. Kuriyama T, Nagakawa K, Karasawa T, Saiki Y, Yamamoto E, Nakamura S. Bacteriologic features and antimicrobial susceptibility in isolates from orofacial odontogenic infections. Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 2000; 90: 600-8.
26. Mahabaleshwara CH, Sripathirao BH, Sequeira J, Kotyan M. Evaluation of microbiological flora of orofacial abscess. J Oral Maxillofac Surg, 2005; 4: 1-4.