Antibiotic prophylaxis in Oral and Maxillofacial Surgery

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ABSTRACT

Antibiotic prophylaxis in oral and maxillofacial surgery aims the prevention of the infection of the surgical wound, either due to the characteristics of the surgery or the general state of the patient. This risk increases with the contamination of the surgical operation area, making it necessary to imply a prophylactic treatment of the infection in clean-contaminated and contaminated surgeries and treatment of the infection in dirty surgeries. Moreover, a proper surgical technique helps to reduce the development of the postsurgical infection. The elective antibiotic chemotherapy ranges from penicillin-derivates with betalactamase inhibitors (amoxycillin-clavulanate, ampicilin-sulbactam) to second or third generation cephalosporins, quinolones or clindamycin. The indication for the use of these antibiotics depends on the type of surgery in oral and maxillofacial surgery, according to the degree of contamination. Thus in oral surgery and surgery of the salivary glands the literature demonstrates that there is not a better prognosis when using prophylactic antibiotherapy instead of not using it in healthy patients. In traumatology this prophylaxis is justified in compound fractures and those communicating with paranasal sinuses. In orthognatic surgery there is disagreement according to the criteria of using antibiotic prophylaxis, but short term treatment is preferred in case of using it. In oncological surgery it has been demonstrated the reduce in incidence of postsurgical infection using prophylactic peroperative antibiotherapy, mostly in those cases in which oral mucosa and cervical area contact.

Key words: *Infection, oral cavity, antibiotic, maxillofacial surgery, prophylaxis.*

RESUMEN

La profilaxis antibiótica en cirugía oral y maxilofacial tiene como fin la prevención de la infección en la herida quirúrgica, ya sea por las características de la cirugía o por el estado general del paciente. Este riesgo se incrementa cuanto más se contamine el campo quirúrgico, siendo necesario realizar tratamiento profiláctico de la infección en cirugías limpias-contaminadas y contaminadas y tratamiento de la infección en cirugías sucias. Además, una adecuada técnica quirúrgica colabora con la reducción de la aparición de infección postquirúrgica. La antibioterapia de elección varía entre derivados de la penicilina con inhibidores de las betalactamasas (amoxicilina-clavulánico, ampicilina-sulbactam), cefalosporinas de segunda o tercera generación, quinolonas o clindamicina. La indicación de su uso variará en función del tipo de cirugía en cada ámbito de la cirugía oral y maxilofacial, según el grado de contaminación de la misma. De este modo en cirugía oral y en patología de glándulas salivares la literatura parece demostrar que no hay mejor pronóstico en cuanto al uso de antibioterapia profiláctica respecto a no usarla en pacientes sanos. En traumatología se justifica en fracturas compuestas o con comunicación con senos paranasales. En cirugía ortognática hay discrepancia en cuanto al criterio de empleo de profilaxis antibiótica, si bien se prefieren ciclos cortos de tratamiento. En cuanto a la cirugía oncológica,

se ha demostrado la reducción de la incidencia de infección postquirúrgica con el uso de antibioterapia profiláctica peroperatoria, fundamentalmente en los casos en que se pone en contacto la mucosa oral con la región cervical.

Palabras clave: *Infección, cavidad oral, Antibioticos, cirugía oral, cirugía maxilofacial, profilaxis.*

INTRODUCTION

The aim in surgical antibiotic prophylaxis is to prevent the possibility of an infection in the surgical wound, creating an area of resistance to microorganisms by means of antibiotic serum concentrations that may avoid the multiplication and spread of bacteria through the surgical injury.

The prophylaxis is always indicated when there is an important risk of infection, because of either the features of the operation or the local or general conditions of the patient. Among the factors that could be the cause for this infection, the ones that should be emphasized are the type and duration of the surgery and the surgical risk of the patient (ASA risk) due to his comorbidity: diabetes, nephropathies, hepatopathies (cirrhosis), cardiopathies, inmmunosupressors (corticoids, radiotherapy, chemotherapy, previous infections undertreated or mistreated with other antibiotics). Minor surgical procedures in healthy patients may not require prophylaxis.

When the surgical injury comes about with in the skin wound, the main physical barrier that stops the entrance of microorganisms into the body breaks down (1). Because of this event, these microorganisms penetrate and may colonize and cause infection of deep tissues (2). According to the amount of bacteria, the possibility of infection elevates, also depending on whether it is a clean, clean-contaminated, contaminated or dirty surgery. The more contamination in the wound, the more risk of postsurgical infection.

The risk of contamination of the surgical area reduces with an appropriate surgical technique, a good health of the patient, etc (3), (4), but the one that has been considered the most important factor is antibiotic prophylaxis. Antibiotics in surgery must be used just in those cases in which is indicated and the pharmacocynetics of the drug should be appropriate as well as the spectrum of bacteria.

Measures of control of the infection in the surgical technique in order to reduce the risk of infection are clean incissions, mucoperiosteal flaps avoiding tearing the mucosa, constant irrigation to cool the surgical area and clean the debris, constant aspiration, careful haemostasis, avoid injuries with the needle of the local anesthesia, slow entrance of the anesthetic agent, drainages and surgical dressings when required… It must be underlined the importance of the entrance in the postoperative period of liquids and remains of food through the surgical wound, therefore it should be recommended to make mouthwashes after 24 hour postoperative time onwards.

A good prophylaxis happens when there are effective serum concentrations of the drug since the opening of the skin of mucosa until its closure. Due to this fact, the antibiotic should be used in the hour previous to the incision. The best moment is during the anaesthetic induction via intravenous. In case of long-lasting surgery, it could be necessary to repeat the antibiotic dose to keep therapeutic serum levels of the drug, according to the pharmacocynetics of each antibiotic. It is not well demonstrated that the use of antibiotics more than 24 hours after the surgery may reduce the risk of infection. Therefore, it is considered malpractice treating patients with these drugs over this period of time (5).

CLASSIFICATION OF SURGICAL WOUNDS ACCORDING TO THE RISK OF CONTAMINATION-INFECTION (6-10)

- Type I: clean wounds (no disruption of mucosa such as the oral cavity): infection rate 1-4%. No prophylaxis or prophylaxis no longer than 24 hours with amoxicillin-clavulanate as there is no benefit in using postoperative antibiotics.
- Type II: clean-contaminated wounds (disruption of mucosa such as the oral cavity or surgery in an inflamed area): infection rate 5-15%. Prophylaxis against gram + and anaerobic bacteria (11) (amoxicillin-clavulanate, cefazolin + anaerobicid (clindamycin or metronidazol) (12)).
  - Amoxicillin-clavulanate 2 g, repeat dose if long term surgery 1g/4h (13).
  - Allergy to betalactamics. Clindamycin 600 mg + gentamycin 120 mg), repeat dose if long term surgery every 4h.
- Type III: contaminated wounds (oncological surgery in which both oral cavity and neck contact): rate infection 16-25%. Prophylaxis against gram +, anaerobc bacteria and also gram –, which are not covered in clean and clean contaminated surgeries, using drugs such as ampicillin-sulbactam or piperacillin-tazobactam:
  - Amoxicillin-clavulanate 2 g, repeat dose if long term surgery 1 g/4h.
  - Clindamycin 600 mg + cefazolin 2 g, repeat dose of clindamycin every 6h and 1 g/8h of cefazolin if long term surgery.
- Type IV: dirty and infected wounds. Rate infection 25%. Antibiotic treatment always, not prophylaxis.

The use of antiseptics in the oral cavity reduces the amount of the bacteria in the surgical area, but has not demonstrated to be effective in the prophylaxis of the bacterial colonization.

CLASSIFICATION OF SURGICAL OPERATIONS

Surgical operations can be classified into two groups, according to the presence or absence or microorganisms in the surgical area. Some examples in maxillofacial surgery are:

1. Surgical operations with absence of microorganisms: impacted teeth, exostosis, torus, odontogenic tumors, cysts (not infected), epulis, preprosthetic and preorthodontic

surgery, closed maxillary fractures, salivary glands diseases, osteotomies, grafts, flaps…
2. Surgical operations with presence of microorganisms: third molar pericoronaritis, inflammatory cysts, teeth roots, granulomas, sialolithiasis, open fractures, traumatisms, contusions, infection inside a tumor, radionecrosis, etc.

ANTIBIOTIC PROPHYLAXIS IN DIFFERENT SURGICAL OPERATIONS IN ORAL AND MAXILLOFACIAL SURGERY

Literature data are contradictory as some issues conclude that the reduction in postoperative complications in oral and maxillofacial surgery is mostly because of the improvement in the surgical technique rather that antibiotic prophylaxis. Per and postoperative prophylaxis is recommended in those cases in which there is high risk of infection or clinical signs of infection.
The chosen antibiotic must be effective against the bacteria usually found in the oral cavity and cervicofacial skin, such as Staphylococcus, Streptococcus, enteric and anaerobic bacteria. Thus there is a good coverage using penicillin derivates combinated with betalactamase inhibitors (amoxicillin-clavulanate, ampicillin-sulbactam), though other drugs can be used such as second or third generation cephalosporins (cefazolin, cefoxitin, ceftriaxone) (14), chinolones or clindamycin.
The use of preoperative antiseptics in the oral cavity (chlorhexidine, iodine) may reduce the complications caused by the surgical trauma in the oral cavity, mostly in patients with heart valve diseases, alloplastic implants, bone grafts, immunodepression, elderly people or patients with bad oral hygiene (15).

1.- Oral surgery
Infection rate is low and because of that, in healthy patients, most of the procedures in the oral cavity need no antibiotic prophylaxis. The use will be reduced to those cases in which there is active infection, patients with comorbidity or immunodepression (16).
- Impacted third molars: different issues demonstrate that the use of postoperative antibiotics doesn´t improve the prognosis in the possibility of infection after the surgery. However other authors seem to demonstrate the benefit of using prophylaxis antibiotic amoxicilin/clavulanate for those procedures requiring osteotomy (17)
- Implantology: it has not been demonstrated that using long term antibiotherapy in postoperative implantology surgery improves the prognosis dealing with postoperative infection.

2.- Traumatology
It is widely accepted the use of antibiotic prophylaxis in compound fractures (18).
- Mandible and dentoalveolar fractures: the algorithms of antibiotic treatment are the classical ones used in cervicofacial pathology (penicillin and its derivates, third generation cephalosporins). The treatment of non complicated fractures does not seem to improve versus not using antibiotherapy, though many professionals use them to take advantage to the possibility of infection so as to reduce their incidence (19-22). Antibiotic treatment in the first 72 hours is not necessary. Antibiotic treatment of the infective complications (abscesses, pseudoarthrosis, osteomyelitis…) is where there is more consensus, although in this case we talk about antibiotic treatment and not with prophylaxis (23-25).
- Orbital wall fractures: there is no consensus on whether using antibiotics or not (some authors defend it and others don´t) (26).
Third mid and upper fractures: third generation cephalosporins are used, treating those cases with liquorrhea (27), though the majority of fractures in this region of the face are considered complex or compounded, communicating the oral mucosa with other parts such as the paranasal sinuses. In this sense, under our experience, we would rather use prophylactic antibiotics since the very beginning of these fractures.

3.- Ortognatic surgery and preprosthetic surgert
They are considered clean-contaminated surgeries. Some issues have demonstrated the benefit of using postoperative antibiotic prophylaxis (penicillin, cephalosporins, that in fact does not improve the prognosis and are more expensive) (28, 29). Other authors seem to demonstrate that there are no evidences in the improvement of the prognosis dealing with infection using postoperative antibiotics, specially if they are used via oral (30).
There is a higher incidence in infections in bimaxillary surgery without antibiotic treatment (31).
Some issues have used levofloxacin oral or cefazolin via intravenous in mandibular osteotomies, but in the latter is better to use amoxicillin-clavulanate due to the high amount of resistant bacteria to cefazolin (32).
The period of antibiotic prophylaxis was established in previous issues in five days, but the incidence of postoperative infection is the same comparing one day versus five days, though there is a certain improvement in the morbidity keeping the prophylaxis for five days (33).

4.- Salivary glands
In surgeries such as parotidectomy or submaxilectomy it has been clearly demonstrated that there is no effectiveness in using antibiotic prophylaxis (34).

5.- Oncological, reconstructive and cervical surgery
It has been demonstrated that the use of peroperative antibiotics reduces the incidence of postoperative infections. As in the previous examples, in cervical pathology and, overall, in oncological surgery, antibiotic prophylaxis that can be used are clindamycin combinated with cefazolin, cephalosporins, aminoglycosides, chinolones or penicillin derivates combinated with betalactamase inhibitors.

The risk of infection comes about when there is a chance to put a clean area in contact with a contaminated one such as the oral cavity, because the main source of contamination in these patients is the saliva, that carries an important amount of bacteria. Other factors that may contribute are the bad general state of the patient, immunodepression, preoperative radiotherapy or chemotherapy, reconstructive flaps or those procedures that may expose tissues to ischemia or necrosis. The sources of microorganisms in these diseases are the saliva, the skin, the teeth and the tumor itself. Therefore the chosen antibiotic must cover not only the common microorganims of saliva, such as gram + and anaerobic ones, but also gram – commonly isolated in tumor (35). Most of the references in literature don´t take into account the coverage of gram – in head and neck oncological surgery, but recent issues associate a better prognosis when there is a prophylaxis against gram – .

Prophylactic antibiotics could be gentamycin + clindamycin, that cover gram +, gram – and anaerobic microorganisms properly (cefazolin is not useful against anaerobic germs). Other alternatives are amoxicillin-clavulanate and ampicillin-sulbactam that have the same spe

The duration of the treatment is not well standarized, depending on the surgeon.

The postoperarive antibiotherapy is kept till drainages are retired, though the drug is maintained in case of infection of the surgical wound, dehiscence or fistula.

PROPHYLAXIS IN BACTERIAL ENDOCARDITIS

It must be done in patients with high risk of endocarditis cardiopathies which may undergo a procedure with bacteraemia risk in oral and maxillofacial surgery.

The elective antiobiotic is amoxicillin-clavulanate. In allergic patients, the alternative is clindamycin, clarithromicina or azytromicine.

High risk of endocarditis cardiopathies:

1. High risk: endovascular prosthesis, previous endocarditis, complex congenital cyanotic cardiopathy or surgical systemic-pulmonary fistula.
2. Moderate risk: other congenital cardiopathies, acquired valvulopathies, mitral valve prolapse with regurgitation, hypertrophyc miocardiopathy.
3. Low risk: ostium secundum interauricular communication, surgically repaired interauricular or interventricular communications, previous by-pass, mitral valve prolapse without regurgitation, pacemaker.

Those patients in high and moderate risk need prophylaxis whenever they undergo a procedure in the oral or maxillofacial area. The guidelines used recommend using the drug one hour via oral or thirty minutes via endovenous before the procedure.

Table 1. Antibiotic prophylaxis in bacterial endocarditis

Prophylaxis	Adults	Children
Standard	Amoxicillin 2 g vo or iv	Amoxicillin 50 mg/kg vo.
Allergy to betalactamics	Clindamycin 600 mg vo	Clindamycin 20 mg/kg vo
	Azytromicine 500 mg vo	Azytromicine 15 mg/kg vo
	Clarithromicina 500 mg vo	Clarithromicina 15 mg7kg vo
Oral intolerance	Ampicillin 600 mg im or iv	Ampicillin 50 mg/kg im or iv
	Cefazolin 1 g im or iv	Cefazolin 25 mg/kg im or iv

BIBLIOGRAFIA

1. Schuit KE, Johnson JT. Infections of the head and neck. Pediatr Clin North Am 1981;28:965-71.
2. Takai S, Kuriyama T, Yanagisawa M, Nakagawa K, Karasawa T. Incidence and bacteriology of bacteremia associated with various oral and maxillofacial surgical procedures. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005;99:292-8.
3. Coskun H, Erisen L, Basut O. factors affecting wound infection rates in head and neck surgery., Otolaryngol Head Neck Surg 2000;123:328-33.
4. Girod DA, McCulloch TM, Tsue TT, Weymuller EA, Jr. Risk factors of complications in clean-contaminated head and neck surgical procedures. Head Neck 1995;17:7-13.
5. Hotz G, Novotny-Lenhard J, Kinzig M, Soergel F. Single-dose antibiotic prophylaxis in maxillofacial surgery. Chemotherapy 1994;40:65-9.
6. Grassi RF, Pappalardo S, De Benedittis M, Petruzzi M, Giannetti L, Cappello V, Baglio OA. Drugs in oral surgery. Brief guidelines for adult patients. Minerva Stomatol 2004;53:337-44. Review.
7. Mueller SC, Henkel KO, Neumann J, Hehl EM, Gundlach KK, Drewelow B. Perioperative antibiotic prophylaxis in maxillofacial surgery: penetration of clindamycin into various tissues. J Craniomaxillofac Surg 1999;27:172-6.
8. Peterson L. Antibiotic prophylaxis against wound infections in oral and maxillofacial surgery. J Oral Maxillofac Surg 1990;48:617-20.
9. Paterson JA, Cardo VA Jr, Stratigos GT. An examination of antibiotic prophylaxis in oral and maxillofacial surgery. J Oral Surg. 1970;28:753-9
10. Weed HG. Antimicrobial prophylaxis in the surgical patient. Med Clin North Am 2003;87:59-75.
11. Finegold SM, Wexler HM. Present studies of therapy for anaerobic infections. Clin Infect Dis 1996;23:9-14.
12. Lazzarini L, Brunello M, Padula E, de Lalla F. Prophylaxis with cefazolin plus clindamycin in clean-contaminated maxillofacial surgery. J Oral Maxillofac Surg 2004;62:567-70.
13. Ball P, Geddes A, Rolinson G. Amoxycillin clavulanate: an assessment after 15 years of clinical application. J Chemother 1997;9:167-98.
14. Alfter G, Schwenzer N, Friess D, Mohrle E. Perioperative antibiotic prophylaxis with cefuroxime in oral-maxillofacial surgical procedures. J Craniomaxillofac Surg 1995;23:38-41.
15. Summers AN, Larson DL, Edmiston CE, Gosain AK, Denny AD, Radke L. Efficacy of preoperative decontamination of the oral cavity. Plast Reconstr Surg 2000;106:895-900.
16. Rikhotso E, Ferretti C. Prophylactic antibiotic use in oral surgery--a review of current concepts. SADJ 2002;57:408-13. Review.
17. Martínez lacasa J, Jímenez J, Ferràs V, García-Rey C, Bosom M, Solà-Morales Aguilar L, Garau1a J. Double Blind, Placebo-Controlled, Randomised, Comparative Phase III Clinical Trial o fPharmacokinetically Enhanced Amoxicillin/Clavulanate 2000/125, as Prophylaxis or as Treatment vs Placebo for Infectious and Inflammatory Morbidity after Third Mandibular MolarRemoval (TMR). Abstrac. 43rd Annual ICAAC Chicago. September 2003.
18. Maloney PL, Lincoln RE, Coyne CP. A protocol for the management of compound mandibular fractures based on the time from injury to treatment. J Oral Maxillofac Surg 2001;59:879-84.
19. Abubaker AO, Rollert MK. Postoperative antibiotic prophylaxis in mandibular fractures: A preliminary randomized, double-blind, and placebo-controlled clinical study. J Oral Maxillofac Surg 2001;59:1415-9.
20. Andreasen JO, Andreasen FM, Mejare I, Cvek M. Healing of 400 intra-alveolar root fractures. 2. Effect of treatment factors such as treatment delay, repositioning, splinting type and period and antibiotics. Dent Traumatol 2004;20:203-11.
21. Ghazal G, Jaquiery C, Hammer B. Non-surgical treatment of mandibular fractures--survey of 28 patients. Int J Oral Maxillofac Surg. 2004;33:141-5.
22. Heit JM, Stevens MR, Jeffords K. Comparison of ceftriaxone with penicillin for antibiotic prophylaxis for compound mandible fractures. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1997;83:423-6.
23. Bruno JR, Kempers KG, Silverstein K. Treatment of traumatic mandibular nonunion. J Craniomaxillofac Trauma 1999;5:27-32.
24. Dhariwal DK, Gibbons AJ, Murphy M, Llewelyn J, Gregory MC. A two year review of the treatment and complications of mandibular angle fractures. J R Army Med Corps. 2002;148:115-7.
25. Teenier TJ, Smith BR. Management of complications associated with mandible fracture treatment. Atlas Oral Maxillofac Surg Clin North Am. 1997;5:181-209.
26. Courtney DJ, Thomas S, Whitfield PH. Isolated orbital blowout fractures: survey and review. Br J Oral Maxillofac Surg 2000;38:496-504.
27. Torrielli F, Camurati R, Cervar MF, Tel A. Fractures with loss of substance of the middle and upper third of the face: nosographic classification, surgical indications and the prevention of meningeal infections with the new antibiotic, cefuroxime. Minerva Stomatol 1980;29:163-82.
28. Baqain ZH, Hyde N, Patrikidou A, Harris M. Antibiotic prophylaxis for orthognathic surgery: a prospective, randomised clinical trial. Br J Oral Maxillofac Surg 2004;42:506-10.
29. Heit JM, Farhood VW, Edwards RC. Survey of antibiotic prophylaxis for intraoral orthognathic surgery. J Oral Maxillofac Surg 1991;49:340-2.
30. Zijderveld SA, Smeele LE, Kostense PJ, Tuinzing DB. Preoperative antibiotic prophylaxis in orthognathic surgery: a randomized, double-blind, and placebo-controlled clinical study. J Oral Maxillofac Surg 1999;57:1403-6
31. Spaey YJ, Bettens RM, Mommaerts MY, Adriaens J, Van Landuyt HW, Abeloos JV, De Clercq CA, Lamoral PR, Neyt LF. A prospective study on infectious complications in orthognathic surgery. J Craniomaxillofac Surg 2005;33:24-9.
32. Yoda T, Sakai E, Harada K, Mori M, Sakamoto I, Enomoto S. A randomized prospective study of oral versus intravenous antibiotic prophylaxis against postoperative infection after sagittal split ramus osteotomy of the mandible. Chemotherapy 2000;46:438-44.
33. Bentley KC, Head TW, Aiello GA. Antibiotic prophylaxis in orthognathic surgery: a 1-day versus 5-day regimen. J Oral Maxillofac Surg 1999;57:226-30.
34. Johnson JT, Wagner RL. Infection following uncontaminated head and neck surgery. Arch Otolaryngol Head Neck Surg 1987;113:368-9.
35. Callender DL. Antibiotic prophylaxis in head and neck oncologic surgery: the role of gram-negative coverage. Int J Antimicrob Agents 1999;12:21-5;26-7.