

Cefotaxime prophylaxis in major non-contaminated head and neck surgery: one-day vs. seven-day therapy

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Abstract

Patients who undergo major surgery of head and neck benefit from perioperative antibiotic prophylaxis. This study was developed to determine if seven days of antibiotic administration would be more effective than one day. A prospective randomized double blind study was designed. Patients were randomly assigned to receive cefotaxime sodium for either 24 hours or seven days. In each case, the drug was administered intramuscularly, beginning one to two hours pre-operatively and continued for the prescribed period. Sixty patients were included in the trial. Of 30 patients assigned to one day of perioperative prophylaxis, wound infection developed in four (13 per cent). Of 30 patients assigned to seven days of perioperative antibiotic prophylaxis, wound infection developed in three (10 per cent) ($P>0.05$). These data suggest that no beneficial effect from administration of antibiotics for longer than 24 hours post-operatively can be achieved in patients who undergo major head and neck surgery.

Key words: Antibiotics, Surgery, head and neck.

Introduction

Considerable controversy surrounds the use of prophylactic antibiotics in major oncologic head and neck surgery. There is evidence that the use of antibiotic therapy in head and neck operative procedures will decrease the incidence of infectious complications (Johnson *et al.*, 1984a, b). Wound infection following major head and neck surgical procedures is the leading cause of post-operative morbidity and may lead to death (Johnson *et al.*, 1986a). Previous studies have indicated that the wound infection rate in patients who undergo head and neck surgery without the benefit of perioperative antibiotics is 28 per cent to 87 per cent (Becker and Parell, 1979; Piccard *et al.*, 1983). The optimal antibiotic regime, however, remains contentious (Johnson *et al.*, 1986a). To contribute to the clarification of these controversies, in a series of sequential, prospective, randomized, and double blinded trials, we compared cefotaxime (1 g) for one day and for seven days in two groups of patients, in the prevention of post-operative wound infection following major head and neck surgery.

Patients and methods

A protocol to investigate the effects of cefotaxime given for various lengths of time in the prevention of post-operative wound infections following head and neck surgery was developed at Erciyes University School of Medicine, ENT Clinic. Patients on antibiotic therapy within four days of surgery were ineligible for entry. Patients who need entry into the upper aerodigestive tract through the neck were excluded from the study. No patient was

allergic to penicillin or cephalosporins and none refused to enter the study. The following patient variables were recorded upon admission: age, height, weight, sex, drug allergy, associated medical conditions, prior radiation therapy, recent weight loss, length of pre-operative hospitalization, tumour location, size and evidence of metastases (if there is malignancy). Operative variables included: type of incision, drains, estimated blood loss and replacement, use of cautery.

Cefotaxime sodium was chosen for prophylaxis because of its known effectiveness against aerobic pathogens most commonly isolated from wound infections, anaerobic bacteria and because of its low toxicity.

Patients were randomly placed in two groups of thirty. Cefotaxime, 1 g was given intramuscularly (im) two hours prior to the planned time of skin incision and continued for either one day post-operatively (two doses) or for seven days post-operatively; cefotaxime sodium 1 g every 12 hours was used. Closed suction drainage was used in many of the cases. Wounds were graded daily by either one of authors on a scale of 0 to 4.

0 = No erythema or induration.

1+ = 1 cm erythema around the wound.

2+ = Less than 5 cm erythema and induration.

3+ = Greater than 5 cm erythema and induration.

4+ = Purulent drainage, either spontaneously by incision drainage or by needle aspiration.

Wounds were considered infected by the demonstration of pus at any time during the post-operative hospitalization; aerobic and anaerobic cultures were obtained from those wounds considered to be infected.

The surgical team also graded the viability of skin flap on the following scale.

TABLE I
TYPES OF THE OPERATIONS

Operation types	Group 1	Group 2
	1 day	7 days
Total resection of parotid gland and RND	7	3
Total resection of submandibular gland and RND	5	7
Metastatic carcinoma resection on the neck	11	12
Total resection of thyroid gland	7	8
Total	30	30

(RND: Radical neck dissection).

1+ = Normal appearance (blanches on digital pressure).

2+ = Pale (does not blanch).

3+ = Cyanotic.

4+ = Necrotic.

The types of the operations are shown in Table I.

Results

Sixty patients entered the study. There were 37 men and 23 women, age range 31 to 63 years (average 52 years). Of the 60 patients, 30 received cefotaxime for one day, 30 for seven days. The infection rate was 13 per cent (4/30) and 10 per cent (3/30) respectively, representing no statistically significant reduction in infection ($P>0.05$) Table II.

Erythema, induration, and local skin changes were noted in 68 per cent of the patients. Patients with wounds showing only diffuse erythema and induration (1+, 2+, and 3+ wounds) received no antibiotic treatment other than the one and seven days of cefotaxime received in the peri- and post-operative period. None of these progressed to wound suppuration. We believe that erythema and induration represent local skin changes due to tissue trauma and interruption of the normal venous and lymphatic drainage of the cervical skin flaps.

Wound infection was invariably preceded by a collection of fluid under the skin flap. A wound was graded as 4+, if purulent drainage was seen. These wounds were either drained by incision or drained spontaneously. Specimens of the purulent drainage obtained from each of the seven patients who developed wound infection were submitted for cultural and sensitivity. Multiple organisms were identified in five of the seven patients. Aerobic bacteria were present in seven of the wounds (Table III).

Post-operative bronchitis, tracheobronchitis and pneumonia were rarely encountered. Pulmonary infection typically developed seven to 14 days into the post-operative period. Organisms resistant to the study antibiotic were not identified. These systemic infections were treated with appropriate antibiotics. No antibiotic-related complications were identified.

Discussion

The primary goal of prophylactic antibiotics for major

TABLE II
INFECTION RATE AMONG 1 DAY AND 7 DAYS GROUP

Groups	Infection					
	-	%	+	%	Total	%
1 day	26	86.7	4	13.3	30	100
7 day	27	90.0	3	10.0	30	100
Total	53	88.3	7	11.7	60	100

$\chi^2 = 0.162; P>0.05.$

head and neck surgery is the prevention of wound infection. Prophylactic antibiotics for patients who undergo surgery are maximally useful when started before the surgical contamination (Burke, 1961). Antibiotics administered one hour before, and up to six hours after, the introduction of bacteria, were tested in animals. It was concluded that there is a critical time period during which the development of bacterial infection may be suppressed by antibiotics. This effective period begins the moment bacteria gain access to the tissue (Johnson *et al.*, 1984a). Antibiotics are ineffective when administered three hours or more after bacterial contamination. Antibiotics give maximum suppression of infection if administered before bacteria gain access to the tissue. These animal experimental results have subsequently been corroborated in human studies (Polk and Lopez-Mayer, 1969; Fullen *et al.*, 1972).

Previous studies have also demonstrated that one day of perioperative antibiotic prophylaxis results in an incidence of post-operative wound infection that is not statistically different from the incidence of infection encountered when antibiotic prophylaxis is administered for more prolonged periods of time (Mombelli *et al.*, 1981; Johnson, 1986a). The efficacy of antibiotics begun pre- and continued for one day into the post-operative period has been compared with antibiotics administered for four or five days post-operatively (Piccard *et al.*, 1983; Fee *et al.*, 1984; Johnson *et al.*, 1986a). Long-term maintenance of antibiotic administration did not show a reduction in incidence of post-operative wound infection when compared with one day of antibiotic use (Johnson *et al.*, 1986a).

The results in this prospective randomized, double blind study suggest that prophylactic cefotaxime used for one day can be as effective as a seven day course in the prevention of post-operative head and neck infections.

Retrospective review of large prospective studies demonstrates that the likelihood for development of a wound infection after major head and neck surgery is less than 10 per cent when the patients are treated prophylactically, beginning before surgery and continuing for 24 hours post-operatively (Johnson *et al.*, 1984a; b; 1986a).

Major wound pathogens reported in most series, including the present one, are *Staph. aureus* and gram negative organisms. Most major aerobic pathogens and all anaerobes are relatively sensitive to cefotaxime. As the potential toxicity of cefotaxime compared to infectious morbidity is very low, it is a good prophylactic choice.

TABLE III
BACTERIA IDENTIFIED IN THE INFECTED WOUNDS

Cefotaxime 1 day	
Patient	Bacteria identified
1	— Coagulase positive <i>Staphylococcus</i> , <i>Escherichia coli</i>
2	— <i>Pseudomonas aeruginosa</i>
3	— <i>Staphylococcus aureus</i> , <i>Proteus mirabilis</i>
4	— <i>Proteus mirabilis</i> , <i>Branhamella catarrhalis</i> , <i>Staphylococcus epidermis</i>
Cefotaxime 7 days	
Patient	Bacteria identified
1	— <i>Pseudomonas aeruginosa</i>
2	— <i>Klebsiella pneumoniae</i> , <i>Haemophilus influenzae</i> , <i>Staphylococcus epidermidis</i>
3	— <i>Staphylococcus aureus</i> , <i>Branhamella catarrhalis</i> , α -haemolytic streptococcus

Research to date has demonstrated that third generation cephalosporins—such as cefoperazone sodium, moxolactam disodium, cefotaxime sodium, high-dose cefazolin, or the combination of gentamicin and clindamicin—may be equally effective in the prevention of post-operative wound infections (Johnson *et al.*, 1986b).

These data suggest that no beneficial effect is to be gained by administration of antibiotics for more than 24 hours post-operatively. These observations are in keeping with observations made in gynaecology (Gall and Hill, 1983), urology (Iversen and Madsen, 1982), general surgery (Maki and Augley, 1982), and cardiothoracic surgery (Bryan *et al.*, 1983).

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