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Postoperative Wound Infection in Major Head and Neck Oncological Surgery: Does Antibiotic Prophylaxis Have an Influence?

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Abstract

Background: Patients undergoing head and neck oncological surgery are at great risk of developing complications following surgery, especially postoperative wound infection.

The purpose of this study was to analyse the type and degree of infection and evaluate the results of the prophylactic administration of antibiotics.

Methods: All complications were recorded in the medical records from 2010 to 2017. All the patients who developed postoperative wound infection received initially empiric antibiotics which were modified following results of culture and sensitivity of the samples. Bacteriology data from wound swabs of patients were collected. This included date of specimen sampling, organism isolated and results of antimicrobial susceptibility testing.

Results: A total of 14 of the 90 patients (16%) developed a postoperative wound infection after major oncological head and neck surgery during the study period. Of these patients, all developed pharyngocutaneous fistulas (PCF). All the patients received initially empiric antibiotics which were modified following results of culture and sensitivity of the samples. The time to infection post-operatively ranged from 2 days to 21 days. The most common organism isolated from clinical specimens was methicillin-resistant *Staphylococcus aureus*.

Co-morbidities factors were statistically associated with an increase of wound infection ($p = 0.0018$).

Conclusions: Patients undergoing head and neck oncological surgery are at great risk of developing complications, especially postoperative wound infection. Antibiotherapy seems to have efficacy when administered prophylactic in head and neck surgical procedures. Co-morbidities was the main risk factor in the development of postoperative wound infections.

Keywords

Head and neck surgery, Antibiotic prophylaxis, Surgical-site infection, Fistula, Reconstruction

Background

Patients undergoing head and neck oncological surgery are at great risk of developing complications, especially postoperative wound infection. The incidence of wound infections has been reported to be as high as 87% [1]. Wound infection can result in wound breakdown and the formation of mucocutaneous fistulae, leading to increased morbidity, prolonged hospitalization and event death [2]. Significant surgical site infection can delay the administration of postoperative (chemo) radiotherapy which increases the risk of tumor recurrence. Prophylactic antibiotics are given at the time of surgery to reduce the incidence of postoperative surgical site infections. However, the use of antibiotics in this way (to prevent rather than cure infection) is associated with increased costs, risks of adverse reactions and may

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lead to the development of antibiotic resistant organisms [3]. The emergence of resistance is a major public health problem and the unnecessary use of antibiotics must be eliminated. Prophylaxis should be given only if there is a good evidence that it does indeed reduce infection rates.

The purpose of this study was to analyse the surgical site infection rates of patients undergoing major oncological head and neck surgery, determine the type and degree of infection, identify the causative agents, and evaluate the results of the antibiotic protocol.

Methods

A retrospective review of all consecutive patients who underwent major oncological head and neck surgery at our unit between 2010 and 2017 was carried out.

The patients received antibiotic prophylaxis according to the standard prophylactic antibiotic policy. This involved giving intravenous amoxicillin-clavulanate 1000 mg at induction and then three further doses over the following 24 hours, during a period of 10 days.

All complications were recorded in the medical records.

Postoperative wound infection was defined as purulent drainage or mucocutaneous fistula formation, or both. Bacteriology data from wound swabs of patients were collected. This included date of specimen sampling, organism isolated and results of antimicrobial susceptibility testing.

Among the data, we collected TNM stage, American Society of Anesthesiologist (ASA) score, body mass index, co-morbidities and habits, history of radio- and chemoradiotherapy, method of reconstruction and the placement of intraoperative trachea-oesophageal as main variables. Secondary variables included pre-surgical treatments, length of inpatient stay, isolated microbiological agents.

Risk factors for complications were evaluated using chi-square and univariate logistic regression analysis.

Results

The mean age of the cohort was 62 years with the great majority being male. All the patients smoked tobacco (more than 25 cigarettes per day) and were heavy alcohol drinkers (more than three drinks per day). 43/90 (48%) of the patients had cT3 or cT4 tumors while 22/90 (24%) of the patients had cN0 tumor. Oral squamous cell carcinoma were diagnosed in 24/90 (27%) of the patients and (pharyngo)laryngeal carcinoma in 66/90 (73%) of the patients.

In our study, patients were treated by buccopharyngectomy or total (pharyngo)laryngectomy. 8 patients (9%) had preoperative (chemo)radiotherapy. 29/90 (32%) had a pectoralis pedicle flap reconstruction and 10/90 (11%) a free flap reconstruction. 31/90 had a trachea-oesophageal puncture.

The mean operative time was mostly longer than 6 hours. The majority of patients had ASA classification more than 2. Mean body mass index was 22.48 kg/m^2.

A total of 14 of the 90 patients (16%) developed a postoperative infection after major oncological head and neck surgery during the study period. Among these, the majority of patients presented with deep incisional infections (n = 10). These patients developed pharyngocutaneous fistulas. The time to infection post-operatively ranged from 2 days to 21 days.

Bacteriological culture results were available all the 14 patients who developed wound infections. The most common organism isolated from clinical specimens was methicillin-resistant *Staphylococccus aureus* in six patients, followed by *Pseudomonas aeruginosa* in 3 patients, *Proteus mirabilis* and *Enterobacter cloacae* each occurring in two patients.

Although the incidence of wound infection was higher in patient who received preoperative radiotherapy, in patients with advanced stage disease, and in those who required flap reconstruction, co-morbidities factors were statistically associated with an increase of wound infection ($p = 0.0018$).

Moreover, the definitive model with logistic regression analysis showed pharyngocutaneous fistulas (PCF) involved twofold increase in the risk of prolonged hospital stay.

Discussion

Postoperative infection rates in oncological head and neck surgery, remain high, especially in series considering salvage surgery, the only curative option for patients in which the original treatment ((chemo)radiotherapy) failed. Scotton, et al. [1] found a local wound infection rates of 58%, in their series, compared to 16% in our study. In a study carried out by the VA Laryngeal Cancer Study Group, Weber, et al. [2] analyzing data from the Radiation therapy Oncology Group trial 91-11, found overall wound complication rates in 59% of patients. Moreover, in a lot of other studies excluding patients treated by salvage surgery, infection rates have ranged from 22 to 87% [2-7].

Postoperative infection rates are associated with a wide range of described risk factors, including preoperative (chemo)radiation, co-morbidities, poor performance status, advanced age, tobacco and alcohol history, tumor size, size and stage, intraoperative flap reconstruc-

tions, tracheoesophageal puncture. However, not all of these risks factors have been found significant in all studies and therefore needed to be interpreted with caution.

In their study, Scotton, et al. [1] confirmed that factors as advanced age, low BMI, history of previous and persistent smoking and heavy alcohol intake have an adverse impact in the development of these infections. In their series, the mean age of their patients was 61 years, with an average BMI of 23; 90% were male and smokers, and 80% were heavy alcohol drinkers with an average weekly intake of 46 units.

In our study, although the incidence of wound infection was higher in patient who received preoperative radiotherapy, in patients with advanced stage disease, and in those who required flap reconstruction, the only preoperative factor that significantly increase the rate of wound infection was the presence of co-morbidities ($p = 0.018$).

In order to evaluate the influence of other factors affecting wound infection rates in head and neck surgery, Coskun, et al. evaluated the effect of factors such as neck dissection, localization and stage of tumor, type of surgery, history of prior radiotherapy, tracheotomy, and diabetes mellitus on postoperative wound infections rates [3] but found no risk factors associated statistically for wound infections.

In their study, Lofti, et al. included 258 patients submitted to a major clean-contaminated head and neck oncologic surgery. In conclusion, the high risk patients for surgical site infections in head and neck oncologic surgery were those with cancer at advanced stages, those who were smokers, those presenting comorbidities, those who needed major reconstruction of the surgical wound, or those who were submitted to inadequate antibiotic prophylaxis.

In our study, the patients diagnosed with surgical site infections were smokers with a pack year history of 33, had cancer at advanced stage necessitated a pharyngolaryngectomy with major reconstruction and presented comorbidities (diabetes mellitus in 70% of the cases).

Similarly, Penel, et al. [5], in their study, found, after univariate analysis, five variables significantly related to the likelihood of wound infections and associated to the tumor: Tumor stage ($p = 0.044$), previous chemotherapy ($p = 0.008$), duration of preoperative hospital stay ($p = 0.022$), permanent tracheostomy ($p = 0.0008$), and hypopharyngeal and laryngeal caners ($p = 0.008$).

Moreover, Sepehr, et al. [6], in their study, found that diabetes was not a risk factor for infection. The charts of 407 patients undergoing clean-contaminated head and neck surgery were reviewed. Three intrinsic patient risk factors for infection (malnutrition, diabetes mellitus, and tracheotomy) were evaluated. Only malnutrition and tracheotomy were associated with a higher infection rate. The incidence of infection was 18% in malnourished patients and 3% in well-nourished patients ($p < 0.0001$). The incidence of infection was 14% in patients with tracheotomy compared with 5% in patients without tracheotomy.

In their study, prolonged antibiotics were not associated with a lower infection rate. Overall, the incidence of infection was 7% in short-course antibiotics and 13% in long-course antibiotics ($p = 0.06$). In our study, the incidence of infection was 16% in patients undergoing primary head and neck surgery and salvage surgery.

Certainly, the length and type of regimens remains to be defined. For some authors (8;5) there is evidence to suggest that antibiotic regimes of 4 doses in 24 h are as effective as prolonged regimes in primary surgery regardless of the complexity of the procedures.

In their prospective, double-blind clinical trial, Skitarelic, et al. [7] randomized 189 patients with carcinoma of the upper aerodigestive tract. They received amoxicillin-clavulanate or cefazolin intravenously up to 1 h before surgery and at 8-h intervals for an additional three doses. An overall wound infection rate of 22% was observed. The infection rate in patients receiving cefazolin was 24% vs. 21% in those receiving amoxicillin-clavulanate; the difference was not statistically significant. Gram-negative bacteria were more often isolated with *Pseudomonas aeruginosa* as the dominant species. In our study, the patients received a long course amoxicillin-clavulanate. The overall wound infection was 16%. The most common organism isolated from clinical specimens was methicillin-resistant *Staphylococcus aureus* in six patients, followed by *Pseudomonas aeruginosa* in 3 patients, *Proteus mirabilis* and *Enterobacter cloacae* each occurring in two patients.

In their prospective, double-blind clinical trial, Rodrigo, et al. [8] randomized 159 patients in order to determine the optimal antibiotic regimen. The patients received amoxicillin-clavulanate, clindamycin plus gentamicin, or cefazolin intravenously up to ½ hour before surgery and at 6-hour intervals for an additional three doses. An overall wound infection rate of 23% was observed. Thirteen (22.8%) infections occurred in the amoxicillin-clavulanate-treated group, 11 (21.2%) in the clindamycin plus gentamycin-treated group, and 13 (26%) in the cefazolin-treated group, which was not statistically significant.

In addition, Strauss, et al. [9] compared, in their study, a seven-day course cephazolin and metronidazole chemoprophylaxis for clean-contaminated head and

neck oncological procedures to results with previously published antibiotic regimens. The overall wound complications rate was 28.1%, comparing favourably with previously published results.

Moreover, controversy still remains regarding which surgical procedure needed the use of antibiotic prophylaxis. Therefore, Man, et al. [10] reviewed their institution's experience with antibiotic prophylaxis in uncontaminated neck dissection. 244 patients underwent 273 uncontaminated neck dissections. Wound infections occurred after nine of the 273 procedures. All of the wound infections occurred in patients receiving intraoperative antibiotics only or intra- and postoperative antibiotics. The authors concluded that their data did not support the use of antibiotic prophylaxis in routine uncontaminated neck dissection.

In contrario, Seven, et al. [11] suggest that the use of a perioperative antibiotic for 24 hours in patients undergoing clean neck dissection results in significant reduction in the incidence of postoperative wound infection. In their prospective series, 57 patients undergoing clean neck dissections with the use of perioperative ampicillin-sulbactam for 24 hours was compared with an historical control group of 51 patients undergoing clean neck dissections with no perioperative antibiotic use. Wound infection occurred in one patient in the study group and in seven patients in the control group, the difference was statistically significant. In our study, the use of antibiotic prophylaxis was indicated in patients who undergo major surgery of the head and neck cancer with flap or without flap reconstruction.

At least, In patients who are identified as requiring major flap reconstruction after extensive ablative surgery for head and neck cancer the use of preoperative, perioperative and postoperative chemoprophylaxis for infection is mandatory. But the choice of ideal antibiotics and duration period are still under discussion. In their study, Bhathena, et al. [12] reported a series of fifty patients. Patients were assigned randomly to receive Cefoperazone sodium for either 24 hours (study group) or Cefotaxime sodium for 120 hours (control group). Their study suggest that there was no beneficial effect from administration of antibiotics for more than 24 hours postoperatively in patients who undergo major flap reconstruction for head and neck cancer after extensive radical ablation surgery.

Conclusions

Patients undergoing head and neck oncological surgery are at great risk of developing complications following surgery, especially postoperative wound infection. The use of antibiotic prophylaxis seems to reduce the frequency of postoperative wound infections. The presence of prior co-morbidities was the main risk factor in the development of postoperative wound infections.

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