Journal of Hospital Infection 91 (2015) 362–366

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Short report

Reduced occurrence of ventilator-associated pneumonia after cardiac surgery using preoperative 0.2% chlorhexidine oral rinse: results from a single-centre single-blinded randomized trial

Y.J. Lin*, L. Xu, X.Z. Huang, F. Jiang, S.L. Li, F. Lin, Q.Y. Ye, M.L. Chen, J.L. Lin

Department of Cardiac Surgery, Fujian Medical University Union Hospital, Fuzhou, Fujian Province, China

ARTICLE INFO

Article history:
Received 12 April 2015
Accepted 12 August 2015
Available online 29 August 2015

Keywords:
Cardiac surgery
Chlorhexidine
Prophylaxis
Ventilator-associated pneumonia

SUMMARY

Since mechanical ventilation after cardiac surgery increases the risk of ventilator-associated pneumonia (VAP), we conducted a prospective randomized controlled trial to investigate the effect of preoperative 0.2% chlorhexidine on postoperative VAP. Ninety-four patients scheduled for heart surgery were randomized to a chlorhexidine group ($N = 47$) or control (saline) group ($N = 47$). On the day before surgery, patients gargled three times with 0.2% chlorhexidine or saline 30 min after each meal and 5 min after teeth brushing at bedtime. VAP occurred in 8.5% of the chlorhexidine group and in 23.4% of the controls. Preoperative chlorhexidine mouthwash reduced the incidence of postoperative VAP significantly.

Introduction

Patients usually require mechanical ventilation after cardiac surgery because of surgical trauma and sedation. Although mechanical ventilation reduces the incidence of respiratory failure and improves survival, it may lead to ventilator-associated pneumonia (VAP).[1,2] The incidence of VAP in patients undergoing cardiac surgery is 2.3–45.9%.[3] VAP refers to lung infection occurring after 48 h of mechanical ventilation or within 48 h after extubation.[4]

Chlorhexidine is a broad-spectrum antibacterial agent that can be used to reduce the incidence of VAP in the intensive care unit (ICU).[5–7] However, previous studies mainly focused on oral care in patients with long-term mechanical ventilation. The risk of VAP from intubation and thus VAP prevention before intubation could be as important as after intubation.

Although routine oral care may reduce VAP incidence, the preoperative use of chlorhexidine for VAP prevention is still controversial.[8–10] Therefore, this study examined the nursing intervention of a 0.2% chlorhexidine mouthwash in patients the day before major heart surgery.

* Corresponding author. Department of Cardiac Surgery, Fujian Medical University Union Hospital, No. 29, XinQuan Road, Gulou District, Fuzhou 350001, Fujian Province, China. Tel.: +86 13365910562; fax: +86 591 83344034.
E-mail address: fjxhlyj@163.com (Y.J. Lin).

http://dx.doi.org/10.1016/j.jhin.2015.08.018
0195-6701/

Methods

Subjects

Patients were selected from those scheduled for cardiac surgery between August 2013 and April 2014 at the Fujian Medical University Union Hospital, China. The inclusion criteria were: (i) conscious; (ii) aged >18 years; (iii) able to gargle in the oropharynx by themselves; and (iv) required orotracheal intubation and mechanical ventilation. The exclusion criteria were: (i) pneumonia before intubation; (ii) history of previous heart surgery and intubation; or (iii) severe brain, liver, or kidney disease.

The study was approved by the ethics committee of the Fujian Medical University Union Hospital. Written informed consent was obtained from all patients. The trial was registered at http://www.chictr.org/cn (ChiCTR-TRC-14005125).

Study design

A 1:1 randomization was performed using a computer-generated random number table and sealed envelopes prepared by a statistician. The treating physician assigned the patient to a group the day before surgery. All patients were blinded to their grouping. In the chlorhexidine group, patients were required to gargle with 0.2% chlorhexidine mouthwash (Fujian HuiZheng Pharmaceutical, Fujian, China) in the oropharynx 30 min after all meals and 5 min after brushing teeth at bedtime. Chlorhexidine mouthwash was gargled for 30 s and this was repeated three times at one-minute intervals whereas in the control group patients gargled with normal saline (Fuzhou Sea King Pharmaceutical, Fuzhou, China) according to the same schedule.

The simplified Clinical Pulmonary Infection Score (CPIS) was assessed on days 1, 3, 5, and 7 after intubation to assess the presence of VAP.

Mechanical ventilation

Patients in both groups underwent the same routine care procedures before and after cardiac surgery. VAP prevention measures were taken including handwashing before and after contact with the patients, regular turning, keeping the head at a 30–45° angle, maintaining the endotracheal intubation balloon pressure at >20 cm H_2O and regular suctioning. During intubation and mechanical ventilation, both groups underwent oral rinse with 50 mL of 0.2% chlorhexidine, four times per day. All patients gargled once with 50 mL of 0.2% chlorhexidine after extubation, and once after each meal for three days. The oral care of all patients was performed by the same two trained healthcare professionals. To reduce the possibility of bias, all procedures and data collection were performed by healthcare professionals who were blinded to the patients' grouping.

Data collection

The CPIS parameters were used to assess the presence of VAP. The total CPIS score was obtained by adding the scores for each parameter (each ranging 0–12 points). Patients with CPIS ≥6 and <6 were classified as those with and without VAP, respectively.

VAP occurring within five days was defined as early onset, whereas VAP that occurred after five days was defined as late onset.[11] Data were collected on days 1, 3, 5, and 7 after surgery. The study ended after seven days, at extubation (if it occurred before seven days), or when the patient developed VAP (CPIS ≥6).

Endpoints

The primary endpoint was the occurrence of VAP. The secondary endpoint was the CPIS score.

Statistical analysis

Based on a previous study, the estimated incidence of VAP was 30% in the placebo group and 15% in the study group, resulting in an estimated sample size of 98 patients in each arm, for a power of 80% and $\alpha = 0.05$.[12] Continuous variables are presented as mean ± standard deviation (SD). Categorical data are presented as frequencies. Continuous data were tested for normality and were compared between groups using an unpaired *t*-test. Categorical data were compared using the chi-square or Fisher's exact test, as appropriate. SPSS 17.0 (IBM, Armonk, NY, USA) was used for statistical analysis. Two-sided $P < 0.05$ was considered significant.

Results

Characteristics of the patients

A total of 309 patients were eligible. Among 94 patients who met the inclusion criteria, 47 were randomized to the chlorhexidine group and 47 to the control group.

There was no significant difference between groups for gender, age, smoking history, education degree, primary disease, surgical method, cardiopulmonary bypass time, duration of mechanical ventilation, Acute Physiology and Chronic Health Evaluation II score, duration of the operation, or blood loss (Table I).

VAP occurrence

VAP occurred in four patients (8.5%) in the chlorhexidine group and in 11 patients (23.4%) in the control group ($P = 0.049$). In the chlorhexidine group, there was one case of early onset VAP (25.0%) and three cases of late onset VAP (75.0%), whereas in the control group, there were nine cases of early onset VAP (81.8%) and two cases of late onset VAP (18.2%) ($P = 0.027$). The relative risk for VAP in the chlorhexidine group was 0.36 (8.5%/23.4%), the absolute risk reduction was 14.9% (23.4%/8.5%), and the number needed to treat was 6.7 (1/0.149).

CPIS scores

Some patients were extubated before the end of the seven-day period. On days 1, 3, 5, and 7, there were 45, 30, nine, and two patients in the chlorhexidine group and 44, 28, 10, and three patients, respectively, in the control group with