Int. J. Oral Maxillofac. Surg. 2016; xxx: xxx–xxx
http://dx.doi.org/10.1016/j.ijom.2016.09.005, available online at http://www.sciencedirect.com

International Journal of Oral & Maxillofacial Surgery

Clinical Paper
Orthognathic Surgery

Comparison of different hypotensive anaesthesia techniques in orthognathic surgery with regard to intraoperative blood loss, quality of the surgical field, and postoperative nausea and vomiting

S. Lin[1], C. Chen[2], C.-F. Yao [3], Y.-A. Chen[3], Y.-R. Chen[3]

[1]Department of Oral and Maxillofacial Surgery, Vanderbilt University Medical Center, Nashville, TN, USA; [2]Department of Anaesthesiology, Chang Gung Memorial Hospital, Taoyuan, Taiwan; [3]Department of Plastic and Reconstructive Surgery, Chang Gung Memorial Hospital, Taoyuan, Taiwan

S. Lin, C. Chen, C.-F. Yao Y.-A. Chen, Y.-R. Chen: Comparison of different hypotensive anaesthesia techniques in orthognathic surgery with regard to intraoperative blood loss, quality of the surgical field, and postoperative nausea and vomiting. Int. J. Oral Maxillofac. Surg. 2016; xxx: xxx–xxx. © 2016 Published by Elsevier Ltd on behalf of International Association of Oral and Maxillofacial Surgeons.

Abstract. Sixty-three consecutive patients undergoing bimaxillary surgery between June and August 2015 were included in this study. Twenty-one patients were included in each of three study groups. In group 1, sevoflurane was the sole maintenance anaesthesia agent used; in group 2, propofol was the predominant agent, in addition to a reduced amount of sevoflurane; in group 3, patients received sevoflurane until fixation was completed, at which point it was switched to propofol. The mean intraoperative blood loss (ml) was 707.14 ± 290.74 in group 1, 917.62 ± 380.30 in group 2, and 750.00 ± 331.84 in group 3; the difference between groups 1 and 2 was significant ($P = 0.047$). The mean score for the quality of surgical field assessment was 1.32 ± 0.44 in group 1, 2.04 ± 0.49 in group 2, and 1.45 ± 0.53 in group 3 ($P = 0.003$). The postoperative nausea and vomiting (PONV) rate was 28.6% in group 1, 9.5% in group 2, and 14.3% in group 3 ($P = 0.343$). The quality of the surgical field was significantly better in groups 1 and 3 than in group 2. The average blood loss in group 1 was also significantly less than in group 2. The PONV rates were lower than those reported in other studies.

Key words: hypotensive anaesthesia; orthognathic surgery; postoperative nausea and vomiting; intraoperative blood loss; quality of the surgical field.

Accepted for publication 7 September 2016

0901-5027/000001+05

In 1976, Schaberg et al. published the first study on intraoperative blood loss and hypotensive anaesthesia in orofacial corrective surgery.[1] Since then, the use of various anaesthetic agents to achieve hypotensive anaesthesia has been reported in the literature. Orthognathic surgery, especially bimaxillary osteotomies, has been associated with excessive intraoperative blood loss[2] and high rates of postoperative nausea and vomiting (PONV).[3,4] Hypotensive anaesthesia is widely accepted as a means of reducing intraoperative blood loss, thereby decreasing the need for blood transfusion.[5,6]

In a large-scale retrospective study, Silva et al. demonstrated that the PONV rate after orthognathic surgery was around 40%, with a particularly high rate of 56% after bimaxillary osteotomies.[3] Phillips et al. reported a 67% postoperative nausea rate and a 27% postoperative vomiting rate after orthognathic surgery.[4] Tabrizi et al. reported a 3.1–16.7% PONV rate after double-jaw orthognathic surgery.[7] However, this PONV rate increased dramatically to 89% when the duration of the bimaxillary surgery exceeded 165 min.[7] Although PONV is usually not a life-threatening event, it is definitely one of the most common and unpleasant post-anaesthesia events and can result in patient dissatisfaction, a prolonged hospital stay, and increased medical expenses.[8–10]

The PONV rates with the use of propofol or inhalational agents were compared in a meta-analysis conducted by Sneyd et al. in 1998.[11] Patients who received maintenance anaesthesia with propofol had a 2.7–3.7-fold reduction in the incidence of PONV in comparison with those receiving inhalational agents. In the centre at which the present study was performed, three different hypotensive anaesthesia protocols have been used during orthognathic surgery. These protocols vary in the sequence and amount of sevoflurane and propofol used during the maintenance phase of anaesthesia. Based on clinical observations, it was found that a better quality of surgical field and less intraoperative blood loss could be achieved during orthognathic surgery when an inhalational agent such as sevoflurane was used as the predominant maintenance agent compared with intravenous agents such as propofol.

The aim of this study was to determine the prevalence of PONV and the effects of different hypotensive anaesthesia protocols on intraoperative blood loss and the quality of the surgical field during orthognathic surgery.

Materials and methods

This clinical study was performed in accordance with the Declaration of Helsinki on medical protocol and ethics; the regional ethics review board approved the study. Patients included in the study were males and females between the ages of 18 and 33 years with dentofacial deformities, who required bimaxillary osteotomies, with or without a genioplasty. All patients in this study were under the care of a single surgical team consisting of two operating surgeons and one supervising attending. With regard to the risk factors for PONV, patients were questioned about their smoking status and history of PONV, motion sickness, migraine, and vertigo during the pre-surgical anaesthesia evaluation. Female sex was also considered one of the risk factors for PONV.[12]

All patients were American Society of Anesthesiology (ASA) category I or II. Patients who required revision orthognathic surgery and those with a history of a bleeding disorder, renal or hepatic diseases, uncontrolled hypertension, or ischaemic heart disease were excluded from the study.

In all cases, an electrocardiogram, pulse oximeter, temperature probe, and capnography were used to monitor the patient's vital signs throughout the operation and during the recovery period. An indwelling arterial catheter was connected to the transducer to monitor the subject's mean arterial blood pressure (MAP) continuously during the operation. The target MAP was set at 50–60 mmHg for hypotensive anaesthesia.

The anaesthesia induction technique was the same for all three groups and included 40 mg of lidocaine given intravenously prior to an induction dose of propofol given at 2–2.5 mg/kg. The muscle relaxant cisatracurium was given at 0.2 mg/kg. Fentanyl (2 μg/kg) was used to suppress the intubation response. All patients received 5 mg of dexamethasone and 1 g of cefazolin immediately after induction.

A total of 63 consecutive orthognathic surgery patients, presenting between June and August 2015, were included in this study. Twenty-one patients were included in each of the three study groups. For patients in group 1, 2–2.5 minimum alveolar concentration (MAC) of sevoflurane was the main anaesthetic maintenance agent used to achieve the target MAP. For patients in group 2, propofol anaesthesia via target controlled infusion (TCI) at 3–4 μg/ml for an effective organ concentration was used in addition to a reduced dose of sevoflurane at 1.3 MAC. After fixation of the bilateral sagittal split osteotomy (BSSO) segments, sevoflurane was turned off and propofol via TCI was used until completion of the operation. In group 3, patients received sevoflurane as in group 1 until the BSSO segments were rigidly fixed. The agent was then switched to propofol via TCI until completion of the operation.

The duration between fixation of the sagittal split osteotomy segments and the end of the operation was around 60 min because roughly 55% of the patients in this study had a genioplasty following BSSO. This also accounts for the time required for closure of the intraoral incisions.

Labetalol or nicardipine was given as required to control spikes in MAP intraoperatively. Levobupivacaine 0.5% with 1:100,000 epinephrine was used for mandibular and maxillary nerve blocks and local infiltrations.

All participants underwent a Le Fort I osteotomy and BSSO with Hunsuck modification, with or without a genioplasty. Rigid fixation of the osteotomy segments was performed with plates and screws and no intermaxillary fixation was used postoperatively.

Intravenous fluid, urine output, and blood loss were measured. The amount of blood loss was measured by the circulating nurse and recorded by the surgical and anaesthesia teams. The following method for measuring intraoperative blood loss was applied uniformly in all cases: total volume in the suction canister minus the volume of saline used for irrigation throughout the procedure, plus the increase in weight of the wet sponges used. The precision of measurement was estimated to be 1 ml for the volume of irrigating fluid and 10 ml for the volume in the suction canister.

Fromme's ordinal scale for the surgical field (0–5) was utilized to assess the quality of the surgical field during incision, BSSO, Le Fort I down-fracture, genioplasty, and wound closure (Table 1).[13] The scores for each step of the operation were averaged to determine the final Fromme score for each patient. This was evaluated by the operating surgeons who were blinded to the anaesthesia technique used on the patient.

All patients received a 4-mg intravenous dose of ondansetron at the completion of the procedure to minimize the rate of PONV. Postoperative pain was managed with ibuprofen and parecoxib. The incidence of PONV was monitored and recorded by the anaesthesia nursing staff

Please cite this article in press as: Lin S, et al. Comparison of different hypotensive anaesthesia techniques in orthognathic surgery with regard to intraoperative blood loss, quality of the surgical field, and postoperative nausea and vomiting, *Int J Oral Maxillofac Surg* (2016), http://dx.doi.org/10.1016/j.ijom.2016.09.005