Journal of Clinical Neuroscience 39 (2017) 124–129

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Case study

Airway adverse events following posterior occipito-cervical spinal fusion

Veena Sheshadri [a], Rebecca Moga [a], Pirjo Manninen [a], Christina L. Goldstein [b], Yoga Raja Rampersaud [c], Eric M. Massicotte [d,e], Michael G. Fehlings [d,e], Lashmi Venkatraghavan [a,*]

[a] Department of Anesthesia, Toronto Western Hospital, University of Toronto, Canada
[b] Department of Orthopedic Surgery, Columbia, Missouri, United States
[c] Department of Surgery, Divisions of Orthopedic and Neurosurgery, Toronto Western Hospital, University of Toronto, Canada
[d] Department of Surgery, Division of Neurosurgery, Toronto Western Hospital, University of Toronto, Canada
[e] Spine Program, McEwen Centre for Regenerative Medicine, Toronto Western Hospital, University Health Network, Canada

ARTICLE INFO

Article history:
Received 18 October 2016
Accepted 27 December 2016

Keywords:
Airway management
Airway adverse events
Occipito-cervical complex
Occipito-cervical fusion
Occipito-cervical angle

ABSTRACT

Management of the airway may be challenging in patients undergoing occipito-cervical spine fusions (OCF). Changes in the occipito-cervical angle (dOC2A) of fusion after surgery may result in acute airway obstruction, dyspnea and/or dysphagia. Objectives of the study were to review the airway management of patients during posterior OCF, determine the incidence, nature and risk factors for postoperative airway adverse events (AEs), and to determine the relationship between airway AEs and the change in dOC2A. In this retrospective cohort of 59 patients, following extubation in the operating room (OR), there were no complications in 43 (73%) patients (Group 1). Sixteen (27%) patients (Group 2) had airway complications; 4 requiring reintubation and 12 having delayed extubation. The number of vertebral levels fused (>6), presence of difficult intubation and duration of surgery (>5 h) were significantly associated with AEs. There was no significant difference in the dOC2A between the groups (−1.070 ± 5.527 versus −4.375 ± 10.788, $p = 0.127$). Airway management in patients undergoing OCF poses a challenge for the anesthesiology and surgical teams. The incidence of AEs was 27%. The decision to extubate immediately after surgery needs to be individualized. Factors such as difficult intubation, number of vertebral levels fused and duration of surgery have to be considered. A significant correlation between dOC2A and postoperative AEs could not be established. Risk factors for postoperative AEs are multifactorial and prospective evaluation of these factors is indicated.

1. Introduction

The occipito-cervical (OC) complex, consisting of occiput, atlas and axis plays a significant role in rotation, flexion and extension of the head and neck. Instability of this joint may result from various pathologies such as rheumatoid arthritis, trauma, infection, tumor, congenital deformity and degenerative processes [1]. Surgical treatment of a symptomatic and progressively unstable OC complex involves stabilization of the junction by instrumentation, and occipito-cervical fusion (OCF). Because of the underlying complex anatomic and biomechanical properties of the OC complex and possible spinal cord compression, the anesthetic and surgical management of OC pathology carries unique perioperative risks and technical challenges. Typically, these patients are at increased risk for possible life threatening airway issues that require a high degree of awareness and vigilance in the perioperative period.

The change in the angle of the OC complex (dOC2A), which is the difference between the postoperative and preoperative angle, has been proposed to be a possible cause of acute upper airway obstruction. This may be due to reduction of the cross sectional area of the oropharyngeal space. There is limited information regarding the incidence, severity, mechanism, and identifiable risk factors for postoperative airway complications after posterior OCF [2–6]. The aim of our study was to review the airway management of patients during posterior OCF, and to determine the incidence, nature, and risk factors for postoperative airway adverse events (AEs). The secondary objective was to determine the relationship between airway AEs and the dOC2A.

* Corresponding author at: Department of Anesthesia, Toronto Western Hospital 399, Bathurst Street, MCL 2-405, Toronto, Ontario M5T 2S8, Canada. Fax: +1 416 603 6494.
E-mail addresses: drveena_4u@yahoo.co.in (V. Sheshadri), Rebecca.Moga@uhn.ca (R. Moga), Pirjo.Manninen@uhn.ca (P. Manninen), goldsteincl@health.missouri.edu (C.L. Goldstein), Raja.Rampersaud@uhn.ca (Y.R. Rampersaud), Eric.Massicotte@uhn.on.ca (E.M. Massicotte), Michael.Fehlings@uhn.ca (M.G. Fehlings), Lashmi.Venkatraghavan@uhn.ca (L. Venkatraghavan).

http://dx.doi.org/10.1016/j.jocn.2016.12.036
0967-5868/

2. Methods

After research ethics board approval, we retrospectively reviewed the charts of all patients who underwent OCF at the Toronto Western Hospital between 2005 and 2013. There were no funding sources or study specific conflict of interest. We excluded patients who had combined anterior/posterior or revision surgeries and patients already intubated or with tracheostomy prior to surgery. Data collected included patient demographics, airway management, anesthesia and surgical data, and postoperative complications. The dOC2A of fusion was calculated from preoperative and postoperative computed tomography (CT) scans or lateral cervical radiographs. The OC2A was defined as the angle between McGregor's line (line drawn from the postero-superior aspect of the hard palate to the most caudal point on the midline occipital curve) and the inferior endplate line of C2 (Fig. 1). The difference in the OC2A (dOC2A) was defined as: dOC2A = postoperative OC2A-preoperative OC2A. The angles for each patient were measured by one of the investigators (RM).

Airway AEs were defined as the need for reintubation within the first hour after extubation of the patient's trachea in the operating room (i.e., immediate AE), the delay of extubation at emergence from anesthesia with transfer of the patient intubated to the intensive care unit (ICU), or failure of extubation during their stay in the ICU. There were no definite institutional protocols as to the practice of the time of extubating, whether either immediately after surgery or delaying extubation. Patients were placed into Group 1 if there were no immediate airway AEs and into Group 2 if an AE occurred. The airway AEs in patients of Group 2 were further classified into those who required reintubation immediately in the OR or after arrival in the PACU, and those who required reintubation after planned extubation during their stay in ICU. Delayed respiratory complications included pneumonia and tracheostomy.

All patients were assessed preoperatively by an anesthesiologist who determined the technique of anesthesia, airway management, and postoperative care. All procedures were performed under general anesthesia. Standard physiological monitoring (electrocardiography, invasive arterial blood pressures, pulse oximetry, end tidal CO_2, temperature, and depth of anesthesia) was performed. In addition, evoked potential monitoring with somatosensory and/or motor evoked potentials was used. Our institutional practice was to use fiberoptic bronchoscopy (FOB) as the means of intubation of the trachea in these patients. The decision whether to do an awake or asleep FOB intubation was decided on a case by case basis by the attending anesthesiologist and surgical team. Routine management of awake FOB included anti-sialogogue administration, oxygen via nasal prongs, local anesthesia, and mild sedation and/or analgesia. For asleep FOB, pre oxygenation was followed by induction of anesthesia with intravenous propofol (2–5 mg/kg), fentanyl (2–3 mcg/kg), and rocuronium (0.6 mg/kg). Minimal movement of the head and neck was maintained at all times. After the placement of skull pins for securing of the head in a fixed frame, patients were placed in the prone position on a Jackson frame. Maintenance of anesthesia was by either total intravenous anesthesia (propofol, remifentanil) or balanced inhalational anesthesia (desflurane or sevoflurane and remifentanil) and long acting opioids as needed. At the end of the surgical procedure, the decision as to when to extubate the patient's trachea was made after the considerations of preoperative factors (co-morbidities, difficulty of intubation) and the intraoperative course (duration, blood loss). The final decision was made by the attending anesthesiologist. Patients who were extubated recovered initially in the post anesthetic care unit (PACU) and patients who remained intubated or were re intubated were transferred directly to the ICU with sedation and monitoring.

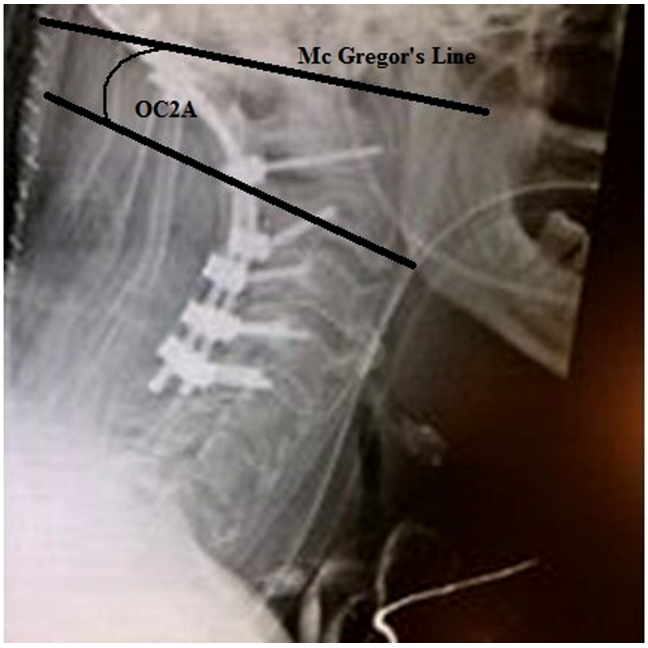

Fig. 1. Measurement of occipito-cervical angle: the OC2 angle was defined as the angle between McGregor's line and the line parallel to the inferior end plate of C2. McGregor's line is the postero-superior aspect of the hard palate to the most caudal point on the midline occipital curve. The difference in the OC2 angle (dOC2A) was defined as follows: dOC2A = postoperative OC2 angle-preoperative OC2 angle.

3. Statistical analysis

The dataset contained continuous and categorical variables. Continuous data were examined for normality of distribution using Shapiro–Wilk test. Continuous data with normal distribution were summarized as means and standard deviations and data with non-normal distributions were summarized as medians and interquartile ranges. Categorical data were summarized as proportions and percentages. Variables with normal distribution were analyzed using two-sided *t*-tests and those with non-normal distribution were analyzed using Wilcoxon rank-sum (Mann–Whitney *U*) tests. All *t*-tests were 2-sided and unpaired. For *p*-values obtained from the *t*-test, pooled values were used when there was equality of variances and Satterthwaite values were used for unequal variances. Categorical variables were analyzed using chi-square test or Fisher's exact test when 25% or more cells had expected counts of less than 5. A *p*-value of <0.05 was accepted as significant. The SAS version 9.3 (SAS Institute, Cary, NC) was used for all analyses.

4. Results

The medical records of the 59 patients who were eligible were reviewed. There were no airway AEs (Group 1) in 43 (73%) patients, whereas 16 (27%) patients (Group 2) had airway AEs. The demographics and surgical data results are shown in Table 1. The pathology of the cervical spine included degenerative disease (23.7%), rheumatoid arthritis (20.3%), metastases (17%) and fractures (15.2%). There was no significant difference between the groups in terms of pathology (Table 1).

During the preoperative evaluation, a possible difficult intubation had been documented by an anesthesiologist in 9% of Group 1 patients versus 50% of Group 2, ($p = 0.002$) (Table 1). Awake FOB intubations were performed in three Group 1 patients and in six Group 2 patients. One of these patients (Group 2) failed the