Journal of Clinical Research in Pain and Anaesthesia
ISSN: 2689-6141

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Letter to Editor *Volume 5 Issue 1*

Rethinking the 'Small for Age' Assumption in Supraglottic Airway Device Selection for the Geriatric Population

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Received Date: December 18, 2024; **Published Date:** December 30, 2024

Abstract

Background: The size selection of Supraglottic Airway Devices (SAD) is usually based on body weight and gender. Occasionally the anatomical changes due to ageing process may give childlike "small appearance" to the elderly patients which may lead to selection of inappropriate size of SAD.

Case: We share the case of 102-year-old female in which small appearance misguided the Airway manager in choosing smaller size of SAD leading to inadequate ventilation. However, it was quickly identified by failed 'bubble test' and managed by upscaling the SAD size. This case highlights that although the usual criteria of correct depth of insertion may not be reliable in very old, edentulous patients, the reliability of the tests for proper SAD position & function remains unchanged.

Conclusion: A "Gender-based Adult size SAD is the appropriate choice irrespective of the external appearance/ weight of the elderly patient.

Keywords: SAD; Chest X-Ray; Mid-Forearm Amputation; Supraglottic Airway Devices; Geriatric

Abbreviations

SAD: Supraglottic Airway Device; ECG: Electrocardiogram; $ETCO_2$: End-Tidal Carbon-Dioxide; SpO_2: Oxygen Saturation; PAW: Peak Airway Pressure; UES: Upper Esophageal Sphincter; ASA-II: American Society of Anesthesiologists Class-II.

Dear Editor

Frail, underweight, tiny-looking elderly patients with otherwise normal airway can also present difficulty in supraglottic airway device (SAD) placement. We present a case that highlights this.

A 102-years American Society of Anesthesiologists Class-II (ASA-II) lady was posted for mid-forearm amputation for post-traumatic right- hand-gangrene. She was a well-controlled hypertensive and smoker (~12 pack years). On examination she was well oriented, 142cm, 29kg lady. Her respiratory and cardiovascular examination was unremarkable. Her Electrocardiogram (ECG) showed left ventricular hypertrophy and chest X-ray showed hyperinflated lung fields.

There was no significant airway related history. Airway examination revealed that she was edentulous with sunken cheeks and very thin lips. Her mouth opening was 2.8cm with Modified-Mallampatti Class-II and normal subluxation

of mandible. There was no oropharyngeal deformity or mass. Thyromental distance (6.8cm), Sternomental distance (13cm), neck thickness (28cm) and range of motion (110°) were normal.

As patient did not gave consent for peripheral nerve block and it was upper limb surgery, therefore general anesthesia was planned. Cardio-stable drugs like Injection Etomidate and Inhalational sevoflurane were used because patient had ECG changes and cardiac evaluation was not possible in emergency. After establishing standard monitoring, intravenous fentanyl 50µg was given. Following pre-oxygenation, induction was carried out with intravenous etomidate 9mg and sevoflurane 2% in O_2 and N_2O (50:50). After jaw relaxation, LMA-Proseal™ #2.5 was inserted with introducer technique and cuff was inflated with 7ml air. For size LMA-Proseal™ #2.5 the recommended inflation volume is maximum of 14ml. However, the inflation volume between 25-75% of maximum inflation volume is enough to provide good seal and an intracuff pressure of <60cmH2O. Therefore, we chose a volume of 7ml which is 50% of maximum recommended inflation volume & is a standard practice in our institution [1]. Although the bite block was more exposed than usual, the ventilation appeared adequate with good capnographic traces.

While other tests for SAD positioning and functioning were being conducted, the oxygen saturation (SpO_2) started falling and End-tidal carbon-dioxide ($ETCO_2$) started rising. At the same time, the bubble test showed bubbling through the drain tube with each positive pressure breath [2]. The depth of anesthesia was increased by intravenous etomidate 3mg and sevoflurane 4% in 100% O_2 and manoeuvres for optimal positioning of SAD were attempted (neck repositioning, jaw thrust and up & down), but ventilation was still inadequate. SAD cuff was further inflated with additional 7ml of air, but it worsened the submandibular leak. As the SpO_2 fell to 90% and $ETCO_2$ rose to 50mmHg with Peak Airway Pressure (PAW) rising to >25cm of H_2O, it was decided to change the LMA-Proseal™ to #3, which could be introduced easily by introducer technique. The ventilatory parameters soon became normal and tests also confirmed the correct placement and function of the LMA Proseal although the bite block was still almost fully out of the mouth. Further intra-operative and postoperative course was uneventful.

We share this case to highlight certain important facets regarding the use of SADs in very old, edentulous patients. In the 'old' old patients, a reduction in intervertebral disc space may lead to "loss of height" giving a childlike appearance to an elderly. In many elderly individuals like our case, undernourishment leading to loss of weight further contributes to this "child-like stature". Related to airway assessment, there is atrophy of orbicularis oris, thinning of cutis in the lips and separation of collagen fibers. This leads to smaller oral cavity and thin fragile lips. In addition, disc displacement and osteoarthritis at temporomandibular joint leads to reduced mouth opening [3,4]. These changes, along with poor intake induced weight loss, can easily misguide the airway manager in choosing a smaller size SAD, as happened in our case, who had all these features and a weight of just 29kg.

In edentulous patients alveolar bone undergoes atrophy and jaw resorption occurs over time. During post-extraction or after teeth loss, there is loss in the height of the alveolar ridge during the healing period [5]. Atrophy of medial pterygoid muscle, which is responsible for jaw protraction, may lead to receding mandible. All these changes reduce the vertical dimension of the oropharyngeal space, which can become very pronounced after many years of teeth loss. This leads to a larger length of the bite block of SAD to remain outside the mouth despite adequate placement, giving a false impression that the SAD has not been placed correctly or that the size of chosen SAD is larger, as happened in our case. Another anatomical change of relevance is the likelihood of atrophy of pharyngeal muscles with age [6]. Thus, the volume or cross-sectional area of the pharyngeal airway may be greater in elderly patients than the young [6-8]. As the cuff of an appropriately placed SAD is known to lie vertically between the tongue and the upper esophageal sphincter (UES) and horizontally between the both lateral pharyngeal walls [9], the recommended size of SAD should not change from early to very late adulthood, even if the person becomes frail, as in our case.

While a "small for age" child warrants selection of a smaller SAD, this is not true for geriatric age group. A gender based-adult size SAD is the appropriate choice irrespective of such patients' external appearance/ weight. As a part of personal history during pre-anesthetic evaluation, an information regarding the height and weight of the elderly patient as a young adult may serve as a better guide to appropriate size selection of the SAD.

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