Detection of Gas Leakage of a Supraglottic Airway Device by a Tracheal Sound Monitor: A Case Report

Fu-Shun Hsu[1], Chih-Min Liu[2], Shang-Ran Huang[1], Yi-Lin Wu[1], and Wei-Te Hung[3]

[1] Heroic Faith Medical Science Co., Ltd., Taipei, Taiwan

[2]National Taiwan University Hospital, Taipei, Taiwan

[3] Chung Shan Medical University Hospital, Taichung, Taiwan

Background

A tracheal sound monitor can display the spectrogram of breathing signals, detect the breath phases and adventitious breath sound, and play the breath sound out loud in real-time. However, in addition to normal breath sound and adventitious breath sound, the monitor can receive other sounds at the same time, some of which have significant clinical meaning. We reported a case that a supraglottic airway (SGA) device was not ideally sealed, and gas leaked out of the airway supposed to be perfectly closed. The pattern of gas leakage can be easily seen on a tracheal sound monitor and identified by the healthcare professionals.

Case Report

A male with height of 191 cm, weight of 120 kg, and BMI of 32.9 kg/m2 underwent open reduction and internal fixation surgery for ulnar proximal fracture. A tracheal sound monitor was used to monitor the patient's ventilation during the surgical procedure. The tracheal sound monitor consisted of an electronic stethoscope (AccurSound AS-101, Heroic Faith Medical Science Co., Ltd., Taipei, Taiwan) connected to a smartphone (Mi 9T pro, Xiaomi, Beijing, China) with a self-developed respiratory sound monitoring app installed. During the surgical procedure, an SGA (size number 5) device was used to maintain the airway and provide inhalation general anesthesia. However, the SGA device was not ideally sealed. The healthcare professionals noticed that the gas leaked by careful inspection, and later the ventilator gave an alarm. At the same time, acoustic pattern of leakage sound (the white square before the white dash line in Fig 1a) can be observed on the spectrogram of the tracheal sound monitor. The sound of leakage consisted of a fundamental tone and accompanied by a lot of harmonics. The leakage became worse (the white square after the white dash line in Fig 1a and the one before the white dash line in Fig 1b) as time passed. To mitigate the leakage, the anesthesiologist adjusted the patient's head and neck position. After the maneuvers, the leakage became smaller (the white square after the white dash line in Fig 1b and

the ones in Fig 1c, d) but still existed. Owing to to poor sealing, the anesthesiologist re-placed the LMA. After the readjustment, the seal of the SGA device was perfect, and the breath patterns on the spectrogram of the tracheal sound monitor return to normal (red arrows in Fig 1d).

Discussion

An SGA device is widely used to create and maintain definitive airway for pulmonary ventilation in general anesthesia. Hence, it is important to immediately know whether an SGA device is ideally sealed or not. Gas leakage can be detected by the healthcare staff and ventilator. However, the response time is varied depending on the experience of the healthcare staff and the setting of the ventilator. Besides, it is sometimes difficult for a healthcare professional to check the existence of leakage in small air leakage or under emergency. This case report shows that the sound of gas leakage exhibits a specific pattern with harmonics on the spectrogram of a tracheal sound monitor. Gas leakage can be earlier identified by observing the specific pattern on the spectrogram than the capnography.

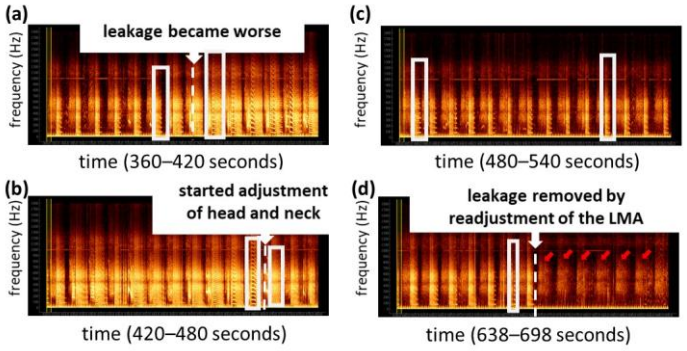

Figure 1. Spectrogram of tracheal sound. (a) the spectrogram showing the moment that the gas leakage become worse, (b) the spectrogram showing the moment that the head and neck were repositioned, (c) the leakage became smaller but it still existed and (d) the spectrogram showing the moment that the leakage was removed after readjustment of the LMA. White squares indicate the patterns of gas leakage. Not every gas leakage pattern are indicated by the squares, but one can easily identify it because of the similarity of the patterns. Red arrows indicate normal breathing patterns.