

Optimal Place for Precordial Stethoscope Attachment in Nonintubated Children under Two Years of Age: An Observational Trial

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ABSTRACT

Background: The precordial stethoscope is a non-invasive monitoring method in pediatric anesthesia. We previously investigated optimal place for its attachment among intubated children under two years old. Now we also did in nonintubated children under two years old.

Methods: Twenty-five patients who underwent general anesthesia in our institution were involved in this study. Lung and heart sounds via precordial stethoscope were recorded (MP3 format) at the six places: Site A (paratracheal region), B (suprasternal notch), C (between place of the nipple and clavicle on the left midclavicular line), D (between place of the costal arch and nipple on the left midclavicular line), E (horizontal level of Site D on the left midaxillary line), and F (epigastric fossa). Two blinded evaluators scored random sorted lung and heart sounds on a 10-point scale (0: cannot hear at all and 10: can hear clearly) individually.

Results: Statistically significant differences were observed between Sites A: 10.0 (8.5–10.0), B: 9.0 (2.5–9.5), C: 8.0 (6.5–9.0) and D: 1.5 (1.0–6.5), E: 4.5 (1.5–7.0), F: 1.0 (0.0–4.5) for lung sounds and between Sites B: 9.0 (5.0–10.0), C: 9.5 (8.0–10.0), D: 9.0 (4.5–9.5) and A: 0.0 (0.0–0.0), E: 0.5 (0.0–2.5), F: 0.5 (0.0–0.5) for heart sounds.

Conclusion: Site C is the optimal place for precordial stethoscope attachment for children under two years of age during general anesthesia.

Introduction

The current study indicates the quantitative characteristics of the lung and heart sounds at different places for nonintubated pediatric patients and determined where to place the device for the most effective auscultation in children during general anesthesia, which isn't described clearly in textbooks of pediatric anesthesia [1-2].

Methods

This observational trial was approved by the Ethics Committee of our institution (Approval number: 1-12).

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We included all children under two years old for one year (2020), with parental written informed consent, and performed an elective surgical procedure under general anesthesia in our institution.

The patients underwent general anesthesia using a typical approach. Lung and heart sounds of children breathing restfully after extubation were recorded in MP3 format at the six places (Figure 1): Site A (paratracheal region), B (suprasternal notch), C (between place of the nipple and clavicle on the left midclavicular line), D (between place of the costal arch and nipple on the left midclavicular line), E (horizontal level of Site D on the left midaxillary line), and F (epigastric fossa). Two blinded evaluators scored the random sorted lung and heart sounds independently on a 10-point scale (0: cannot

hear at all and 10: can hear clearly). The medians of the two scores were compared among the six places. Clinical data, such as age, gender, height, and body weight, were collected from the anesthesia and medical records.

Data were analyzed with the GraphPad Prism software program, ver. 9.3.0 (GraphPad Software, San Diego, CA, USA). Categorical data are indicated as counts (%) and continuous data are indicated as the median (interquartile range), as appropriate. Friedman's test was used to compare the scores of lung and heart sounds (Dunn's multiple comparison test was employed as a post-hoc test). $p < 0.05$ was considered as statistical significant.

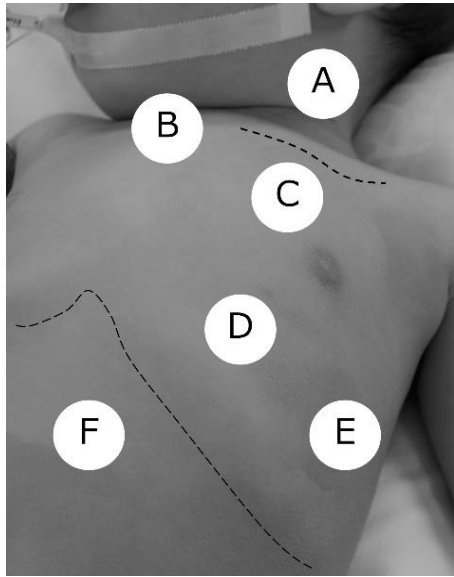


Figure 1- The six sites for recording

Results

With respect to the demographic characteristics of the 25 enrolled children, there was a median age of 1.2 (0.9–1.6) years old, height of 76.0 (67.0–79.0) cm, and weight of 9.2 (8.5–10.6) kg.

The lung and heart sound scores are presented in (Figure 2-3). The lung sound score at Sites A–F were 10.0 (8.5–10.0), 9.0 (2.5–9.5), 8.0 (6.5–9.0), 1.5 (1.0–6.5), 4.5 (1.5–7.0), and 1.0 (0.0–4.5), respectively (Figure 2). The heart sound scores at Sites A–F were 0.0 (0.0–0.0), 9.0 (5.0–10.0), 9.5 (8.0–10.0), 9.0 (4.5–9.5), 0.5 (0.0–2.5), and 0.5 (0.0–0.5), respectively (Figure 3). Statistically significant differences were observed between Sites A–D, A–E, A–F, B–D, B–E, B–F, C–D, C–E, and C–F for lung sounds and between Sites A–B, A–C, A–D, B–E, B–F, C–E, C–F, D–E, and D–F for heart sounds.

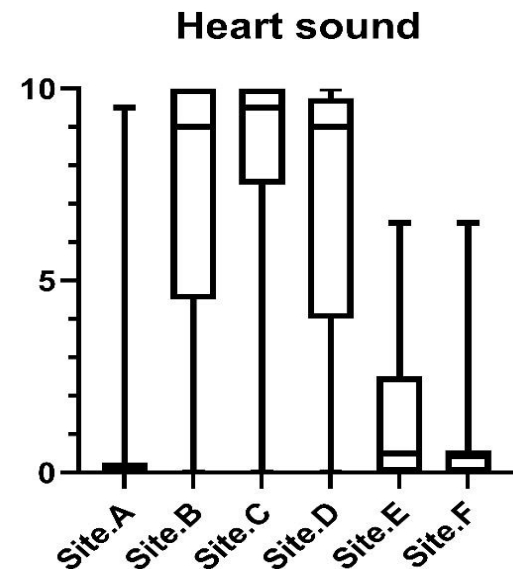
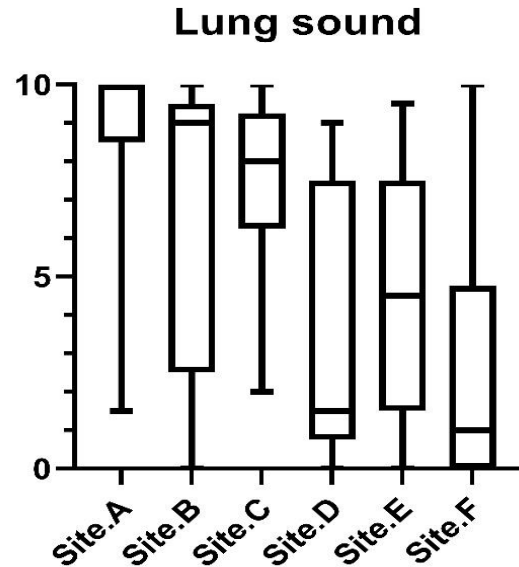


Figure 2- The quantitative analysis of lung sounds (0: cannot hear at all and 10: can hear clearly)

Figure 3- The quantitative analysis of heart sounds (0: cannot hear at all and 10: can hear clearly)

Discussion

This study provided a quantitative analysis demonstrating that Sites A, B, C and B, C, D were the most suitable for placement of the precordial stethoscope in order to monitor lung and heart sounds, respectively,

in nonintubated children under two years old. Our previous study [3], which performed in intubated children under two years old, indicated that Site C and D were the most optimal for detection of lung and heart sounds, respectively. We consider lung sounds via a precordial stethoscope is still the earliest sign of airway patency, especially before intubation and immediately after extubation, and capnography cannot detect it as early as the precordial stethoscope [4]. In addition, we also consider that heart sounds is not considerably vital as they are regularly monitored using other technologically advanced equipment, such as a pulse oximeter and electrocardiogram, that provides the patient's heart rate and arrhythmias [5]. Thus, anesthesiologists should place the precordial stethoscope on the place where they can hear lung sounds throughout the entire course of general anesthesia.

Conclusion

In conclusion, Site C is the optimal place for precordial stethoscope attachment for children under two years of age during general anesthesia.

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