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BEDSIDE ULTRASONOGRAPHY FOR THE CONFIRMATION OF GASTRIC TUBE PLACEMENT IN THE NEONATE

Anesthesiology

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ABSTRACT

Background: Naso/Orogastric tube (NOGT) misplacement can lead to significant complications. Therefore, the assessment of tube position is essential to ensure patient safety. Although radiography is considered the gold standard for determining NOGT location, new methods may be helpful in reducing repetitive radiation exposure, especially for neonates. In this study, we sought to investigate if bedside ultrasonography (BUSG) can be used to verify NOGT placement in neonatal intensive care patients.

Materials and Methods: Infants requiring NOGT placement were enrolled. After insertion of the NOGT, the location was first identified using BUSG and then confirmed using abdominal radiography for comparison.

Results: The study cohort included 51 infants with an average gestational age of 34 ± 4.9 weeks. BUSG determined the NOGT location correctly with a sensitivity of 92.2%. The location of the NOGT could not be determined by BUSG in four neonates (7.8%). In one infant, the NOGT was positioned in the esophagus, as determined both by BUSG and radiography.

Conclusion: BUSG is a promising diagnostic tool for determining NOGT location in neonates, thereby eliminating the need for abdominal radiography.

KEYWORDS

Enteral nutrition; infant; intensive care units; nasogastric tube; ultrasonography

INTRODUCTION

The placement of a naso/orogastric tube (NOGT) is commonly performed in the neonatal intensive care unit (NICU) for enteral feeding, medication administration, and gastric decompression.[1] Misplacement of the NOGT may result in serious complications related to the location or inadvertent trauma including gastric perforation, placement within the tracheobronchial tree, aspiration, pneumothorax, and pulmonary hemorrhage.[2-4] The risk of NOGT misplacement is higher in various clinical scenarios, including patients with neurologic disabilities or sedated and critically ill newborns.[5] The incidence of misplacement has been reported to be as high as 1.3–2.4% with the most serious complications related to misplacement into the tracheobronchial tree and respiratory tract.[6] Sites of incorrect placement also include the upper esophagus and too deep into the stomach, representing 6% and 61% of cases, respectively.[7] While pneumonia, atelectasis, lung abscess, apnea, bradycardia, desaturation, and aspiration may result from inadvertent placement into the tracheobronchial tree, incorrect placement within the GI tract may result in gastroesophageal reflux, esophageal perforation, malabsorption, diarrhea, dumping syndrome, and inadequate weight gain, especially in low-birth weight neonates.[7-10] Therefore, it is essential to ensure correct placement and verify the NOGT location during placement and before use. Verification methods such as measuring the NOGT length, auscultation, capnography, observation of gastric aspirate, gastric pH testing, and radiography have specific limitations.[7] While standard radiography is accepted as the gold standard method, its use may be limited because of concerns related to repeated radiation exposure for multiple placement verifications.[4] Furthermore, abdominal radiography does not define the position of the gastroesophageal junction and the .pylorus, which are critical landmarks in ensuring the correct NOGT location and cannot be used in real time during tube placement.[11] Currently, there are no radiological standards to confirm NOGT placement, especially in neonates, and therefore, new methods for bedside confirmation of NOGT placement and ongoing verification of its location in neonates are needed.[5] Ultrasonography is being used more frequently in various clinical scenarios. Advantages of ultrasonography include its ready availability in most ICUs, lack of radiation exposure, and lower cost.[12] The efficacy of ultrasonography for the verification of the NOGT location has been reported for adult patients in various settings including prehospital management, the emergency room, and the intensive care unit.[13-15] We have previously shown that bedside ultrasonography (BUSG) can confirm NOGT location in patients in the pediatric intensive care unit when performed by a radiologist.[16] The current study prospectively evaluates the efficacy of BUSG when determining NOGT location in neonates. Since it is not always feasible to consult a radiologist to perform BUSG for the verification of the NOGT location, we also investigated whether a critical care physician could perform BUSG.

MATERIALS AND METHODS

This prospective study was performed over a 4-month period in a tertiary NICU. The local clinical research ethical committee approved the study (Ethics Committee Approval: OMU-KAEK 2016/158), and written informed consent was obtained from parents. According to the statistical power analysis (statistical power of 98% and an alpha of 5%), 51 neonates requiring NOGT insertion were included in the study. The decision to place the NOGT was made by the attending neonatologist. All NOGTs were inserted by NICU physicians. The depth of insertion was determined by measuring the distance from the tip of the patient's nose or the corner of mouth to the earlobe and then from the earlobe to the distance midway between the xiphoid process and the umbilicus (Nose-ear-mid-umbilicus (NEMU) method).[17] According to our standard NICU protocol, the NOGT position was confirmed using plain abdominal radiography before its use for enteral feeding or medications. For the purpose of this study, verification was first conducted after insertion using BUSG followed by abdominal radiography. A critical care physician who had ultrasound experience for other clinical uses (central venous catheter placement) received additional training on esophageal and gastric ultrasound from a radiologist. The gastric ultrasound was then performed by the physician and the radiologist. As part of the training, the critical care physician observed gastric ultrasound and verification of the NOGT by the radiologist in 10 neonates. Afterward this, the critical care physician performed the ultrasonography and the radiologist evaluated his performance in an additional cohort of neonates. When the technique and expertise of the NICU physician were approved by the radiologist, the critical care physician was approved to participate in the evaluation of the 51 patients that were included in this study. Ultrasonography was performed using the Toshiba Xario SSA-770A (Toshiba Medical Systems Corporation, Otawara, Japan) with a 12-MHz linear-array transducer. The ultrasound examinations included a longitudinal scan performed in the sternal region. Two parallel hyperechogenic lines in the esophageal lumen were visualized behind the heart during longitudinal scanning using a cardiac window, and the location of the NOGT was verified in the thoracic esophagus [Figure 1a]. After visualizing the NOGT in the esophagus, the NOGT was followed with a transducer through the esophagogastric (EG) junction. At the EG junction, the transducer was directed into the semi-sagittal plane and the NOGT was visualized in the stomach using a liver window [Figure 1b]. Confirmation was verified using an abdominal radiograph [Figure 2]. The location of the NOGT was then recorded using these two different methods. Feeding and/or enteral medications were administered after verification of the NOGT tip in