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[Diagnostic Test Accuracy Review]

# Ultrasonography for confirmation of gastric tube placement

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## ABSTRACT

### Background

Gastric tubes are commonly used for the administration of drugs and tube feeding for people who are unable to swallow. Feeding via a tube misplaced in the trachea can result in severe pneumonia. Therefore, the confirmation of tube placement in the stomach after tube insertion is important. Recent studies have reported that ultrasonography provides good diagnostic accuracy estimates in the confirmation of appropriate tube placement. Hence, ultrasound could provide a promising alternative to X-rays in the confirmation of tube placement, especially in settings where X-ray facilities are unavailable or difficult to access.

### Objectives

To assess the diagnostic accuracy of ultrasound for gastric tube placement confirmation.

### Search methods

We searched the Cochrane Library (2016, Issue 3), MEDLINE (to March 2016), Embase (to March 2016), National Institute for Health Research (NIHR) PROSPERO Register (to May 2016), Aggressive Research Intelligence Facility Databases (to May 2016), ClinicalTrials.gov (to May 2016), ISRCTN registry (May 2016), World Health Organization International Clinical Trials Registry Platform (to May 2016) and reference lists of articles, and contacted study authors.

### Selection criteria

We included studies that evaluated the diagnostic accuracy of naso- and orogastric tube placement confirmed by ultrasound visualization using X-ray visualization as the reference standard. We included cross-sectional studies, and case-control studies. We excluded case series or case reports. Studies were excluded if X-ray visualization was not the reference standard or if the tube being placed was a gastrostomy or enteric tube.

### Data collection and analysis

Two review authors independently assessed the risk of bias and extracted data from each of the included studies. We contacted authors of the included studies to obtain missing data.

### Main results

We identified 10 studies (545 participants and 560 tube insertions) which met our inclusion criteria.

No study was assigned low risk of bias or low concern in every QUADAS-2 domain. We judged only three (30%) studies to have low risk of bias in the participant selection domain because they performed ultrasound after they confirmed correct position by other methods.

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Few data (43 participants) were available for misplacement detection (specificity) due to the low incidence of misplacement. We did not perform a meta-analysis because of considerable heterogeneity of the index test such as the difference of echo window, the combination of ultrasound with other confirmation methods (e.g. saline flush visualization by ultrasound) and ultrasound during the insertion of the tube. For all settings, sensitivity estimates for individual studies ranged from 0.50 to 1.00 and specificity estimates from 0.17 to 1.00. For settings where X-ray was not readily available and participants underwent gastric tube insertion for drainage (four studies, 305 participants), sensitivity estimates of ultrasound in combination with other confirmatory tests ranged from 0.86 to 0.98 and specificity estimates of 1.00 with wide confidence intervals.

For the studies using ultrasound alone (four studies, 314 participants), sensitivity estimates ranged from 0.91 to 0.98 and specificity estimates from 0.67 to 1.00.

### Authors' conclusions

Of 10 studies that assessed the diagnostic accuracy of gastric tube placement, few studies had a low risk of bias. Based on limited evidence, ultrasound does not have sufficient accuracy as a single test to confirm gastric tube placement. However, in settings where X-ray is not readily available, ultrasound may be useful to detect misplaced gastric tubes. Larger studies are needed to determine the possibility of adverse events when ultrasound is used to confirm tube placement.

## PLAIN LANGUAGE SUMMARY

### Ultrasound scan for confirmation of gastric tube placement

#### Background

Each year approximately one million people receive a tube feeding (gastric tube) in the US. Gastric tubes are commonly used for giving drugs and nutrition directly into the gastrointestinal tract (tube that digests food) for people who are unable to swallow. Feeding via a tube that is misplaced in the trachea (wind pipe) can result in severe pneumonia (infection of the lungs). Therefore, confirmation of tube placement in the stomach after tube insertion is important. Gastric tubes are also used to reduce the pressure of the stomach after providing breathing assistance through masks, which is mainly used in resuscitation. Medical ultrasound is one of the diagnostic imaging techniques using sound waves to create images of the inside of the body. Recent studies suggest that ultrasound provides good diagnostic accuracy in the confirmation of appropriate tube placement. Hence, ultrasound could provide a promising alternative to X-rays in confirming tube placement, especially where X-ray facilities are unavailable or difficult to access.

#### Study characteristics

Studies included in this review are current to March 2016. We included 10 studies involving 545 participants for evaluation of the diagnostic accuracy of ultrasound for confirmation of gastric tube placement.

#### Key results

Most studies showed good performance for correct placement of the tube. However, few data were available for incorrect placement of the tube and the possible complications of a misplaced tube. Among the included studies, only 43 participants had a misplaced tube. None of the studies reported complications during ultrasound use. Three methods of ultrasound were reported: neck approach, upper abdominal (tummy) approach and a combination of both. No included studies indicated that ultrasound had sufficient accuracy as a single test for the confirmation of gastric tube placement for feeding. In contrast, ultrasound combined with other tests (e.g. saline flush visualization (pushing salt solution through the tube and seeing it inside the stomach by ultrasound)) might be useful for the confirmation of tubes used for gastric drainage.

#### Limitations of the review

Generally, the studies were of low or unclear methodological quality. We considered only three (30%) of the 10 included studies to be representative of patients in practice because they performed ultrasound after they confirmed correct position by other methods. The studies reported a variety of results for incorrect tube placement.

#### Future research

Larger studies are needed to investigate whether ultrasound could replace X-rays for confirming gastric tube placement, as well as whether ultrasound could decrease severe complications, such as pneumonia, from a misplaced tube.