International Journal of Nursing Studies 92 (2019) 73–78

Contents lists available at ScienceDirect

International Journal of Nursing Studies

journal homepage: www.elsevier.com/ijns

# Adequacy of different measurement methods in determining nasogastric tube insertion lengths: An observational study

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ARTICLE INFO

*Article history:*
Received 28 September 2018
Received in revised form 4 January 2019
Accepted 4 January 2019

*Keywords:*
Feeding
Feeding difficulty
Nursing care
Nutrition
Tube feeding

ABSTRACT

*Background:* Distance from the tip of the nose to earlobe to xiphisternum is commonly used to determine the length of nasogastric tube to be inserted. However, it is not evidence-based and frequently leads to improper positioning.
*Objectives:* This study evaluated four formulae and the distance from the tip of the nose to earlobe to xiphisternum in estimating the internal length of nasogastric tube required for optimal positioning.
*Design:* Observational Study.
*Settings:* Tertiary hospital in Singapore involving patients from the medical and surgical intensive care units and a neurosurgical ward.
*Participants:* Inclusion criteria were patients who required a nasogastric tube insertion and age >=21 years old and =<85 years old. Patients who required an orogastric tube insertion or did not require a chest x-ray post nasogastric tube insertion were excluded.
*Methods:* Upon nasogastric tube insertion, the external length of the tube was measured and the corresponding internal length calculated. Several anatomical measurements were taken as required in the formulae below:
1. ((Distance from tip of nose to earlobe to xiphisternum−50 cm)/2) + 50 cm.
2. 29.38 + 4.53*gender+0.34*distance from nose to umbilicus with head flat on bed–0.06*weight (gender = 1 for male, and 0 for female).
3. Distance from xiphisternum to earlobe to nose + 10 cm.
4. Distance from earlobe to xiphisternum to umbilicus–distance from tip of the nose to earlobe.
Post insertion chest x-rays were examined to evaluate the position of the nasogastric tube. For those with optimal positioning, the distance from tip of the nose to earlobe to xiphisternum and the four formulae were compared to determine which provided the least difference with the internal length of the nasogastric tube.
*Results:* Ninety-two participants were recruited. The average age of the cohort was 62.9 years old with 54% being male. Twenty-five had nasogastric tubes in optimal position; 13 had it too short and 54 had it too long. For nasogastric tubes in optimal position, distance from xiphisternum to earlobe to nose + 10 cm provided the best estimate of the internal length. Average difference between the distance from xiphisternum to earlobe to nose + 10 cm and internal length of the nasogastric tubes in optimal position was only 1.8 cm which was by far the least difference compared to other formulae.
*Conclusion:* This study found distance from xiphisternum to earlobe to nose + 10 cm to provide the best estimate for the internal length of nasogastric tube required. However, even this formula could result in placement that is not optimal due to anatomical differences.


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https://doi.org/10.1016/j.ijnurstu.2019.01.003
0020-7489/

**What is already known about the topic?**

- Correct placement of the nasogastric tube is an important safety requirement for enteral feeding.
- Current method of estimating the nasogastric tube length required for insertion, the distance from the tip of the nose to earlobe to xiphisternum is not evidence-based and might lead to improper positioning.

**What this paper adds**

- The researchers found that distance from xiphisternum to earlobe to nose+10cm is the most suitable formula for prediction of nasogastric tube insertion length.

## 1. Introduction

Insertion of nasogastric tubes is a common procedure in the hospital. Indications for nasogastric tube insertion include provision of enteral nutrition for the critically ill who are intubated or too drowsy for oral intake and aspiration of stomach contents for patients who suffer from intestinal obstruction.

During insertion of the nasogastric tube, it is important to have the appropriate length inserted. If the length is too short, the tip of the nasogastric tube may be in the esophagus, increasing the risk of aspiration (Santos et al., 2016). Based on reports from home caregivers in Singapore, (Lim et al., 2018) 19.2% of patients experienced aspiration pneumonia after initiation of home enteral nutrition. This could potentially be due to inadequate depth of nasogastric tube being inserted during a blind insertion in the home setting, and not detected due to unavailability of x-ray facilities.

Conversely, the nasogastric tube might be kinked, causing it to be blocked (Santos et al., 2016), or enter the duodenum if it were too long.

An incorrectly placed nasogastric tube requires adjustments resulting in additional chest x-rays to confirm its final position. This increases patient discomfort, nursing time, radiological exposure and healthcare cost (Santos et al., 2016; Taylor et al., 2014). Furthermore, it leads to delay in feeding and medication administration (Taylor et al., 2014), and potentially leads to patient harm. Hence, it is important to have a good estimate for nasogastric tube insertion length.

The distance from the tip of the nose to earlobe to xiphisternum is the most commonly used method to estimate the length of nasogastric tube to be inserted and is the most widely taught method in nursing schools (Chen et al., 2014; Ellett et al., 2005; Santos et al., 2016). However, Chen et al. (2014), Ellet et al. (2005), Hanson (1979) and Taylor et al. (2014) found that distance from the tip of the nose to earlobe to xiphisternum was not the best estimate for nasogastric tube insertion depth.

A review of the literature was conducted and several studies suggested formulae to estimate the length of nasogastric tube required for insertion. A summary table of the articles may be found in Table 1. The alternative formulas to calculate the length of nasogastric tube to be inserted were as follows:

1) Forumla 1= ((Distance from tip of the nose to earlobe to xiphisternum−50 cm)/2) + 50 cm (Hanson, 1979).
2) Formula 2 = 29.38 + 4.53*gender + 0.34*distance from nose to umbilicus with head flat on bed− 0.06*weight (gender = 1 for male, and 0 for female) (Ellett et al., 2005).
3) Formula 3= Distance from xiphisternum to earlobe to nose + 10 cm (Taylor et al., 2014).
4) Formula 4= Distance from earlobe to xiphisternum to umbilicus–distance from tip of the nose to earlobe (Malta et al., 2013).

There is currently no study which compared all these formulae with the distance from the tip of the nose to earlobe to xiphisternum, in terms of accuracy of predicting nasogastric tube insertion lengths. Furthermore, different studies had different standards of what is proper positioning. Hanson (1979) defined the tip of the nasogastric tube 10 cm past the gastroesophageal junction as too deep and the tip of the nasogastric tube in the esophagus as too short, while Ellet et al. (2005) defined the tip of the nasogastric tube longer than 10 cm past the gastroesophageal junction as too deep and tip of the nasogastric tube shorter than 3 cm past the gastroesophageal junction as too short. These measurements do not apply to our care setting as the brand of the nasogastric tube used, Unomedical Ryles tube, has the most proximal side hole 7 cm from the tip of the nasogastric tube. Hence this shows that the varying standards set by the different studies might be related to the different brands of nasogastric tube used. Performing a study in the local setting allowed this problem to be addressed.

Estimation of insertion length is also related to anatomical proportions which differs across ethnic groups. For instance, Afro-Brazillian subjects was found to have larger measures for the lower third of the face and for distance between the outer cantus and the left cheillion compared to white subjects (Nascimento et al., 2013). Previous studies were conducted among more homogenous populations such as patients in Taiwan (Chen et al., 2014), United States (Ellet et al., 2005; Hanson, 1979) and Brazil (Malta et al., 2013). It is likely that the Singapore population may have a different body proportion ratio as compared to those involved in previous studies.

This study aimed to evaluate four formulae and distance from tip of nose to earlobe to xiphisternum in estimating the internal length of the nasogastric tubes required for optimal positioning in the Singapore population.

## 2. Materials and methods

This was an observational study, involving patients from the medical and surgical intensive care units and a neurosurgical ward in a tertiary hospital in Singapore. Ethical approval and a waiver of consent were obtained from the Centralised Institution Review Board. Data collection took place between 5$^{th}$ December 2016 and 30$^{th}$ October 2017. Inclusion criteria were patients who required an insertion of nasogastric tube and age >=21 years old and =<85 years old. Patients who required an insertion of an orogastric tube or did not require a chest x-ray post nasogastric tube insertion were excluded from the study.

Blind insertions of nasogastric tubes were performed by nurses caring for the patients to a length of distance from nose to earlobe to xiphisternum according to the hospital protocol. Post insertion chest x-rays were performed within 24 h to confirm its placement.

Upon insertion of the nasogastric tube, the external length was measured and corresponding internal length calculated. Internal lengths of nasogastric tubes were calculated by taking its total length (125 cm), minus the external length after insertion.

In addition, several anatomical measurements were taken by study team members and were later utilized in the formulae as suggested in previous studies to calculate the nasogastric tube insertion length. The anatomical measurements taken were distance from tip of nose to earlobe, distance from nose to earlobe to xiphisternum, distance from xiphisternum to earlobe to nose, distance from earlobe to xiphisternum to umbilicus and distance

**Table 1**
Summary of studies comparing methods to determine insertion length of the nasogastric tube.

| Reference | Purpose | Design | Formulae explored | Methods to determine position of the tip of the nasogastric tube | Findings |
|---|---|---|---|---|---|
| Chen et al. (2014) | Evaluate the correlation between distance from tip of nose to earlobe to xiphisternum and the insertion depth of the nasogastric tube. | Descriptive | Distance from tip of nose to earlobe to xiphisternum<br>Distance from glabella to xyphisternum<br>Distance from glabella to umbilicus | Whole body positron emission tomography with computerized tomography scan | Out of 30 patients, one (3.3%) had the nasogastric tube placed with all side holes in the stomach using the distance from tip of nose to earlobe to xiphisternum to estimate insertion length.<br>Using the distance from glabella to xyphisternum to estimate insertion length, all were too short.<br>Using the distance from glabella to umbilicus method, 14 (45.2%) had sufficient depth. |
| Taylor et al. (2014) | Determine whether external body measurements can be used to estimate the required nasogastric tube length to safely reach the gastric body. | Descriptive | Distance from xiphisternum to earlobe to nose + 10 cm<br>Distance from xiphisternum to earlobe to nose | Electromagnetic trace | Mean distance from nose to pre-gastroesophageal junction was only 2.5 cm short of distance from xiphisternum to earlobe to nose.<br>Distance from xiphisternum to earlobe to nose + 10 cm or more complex measurements will reach mid-stomach in most patients, but because of wide variation, external measurements often fail to predict a safe<br>distance. |
| Malta et al. (2013) | To establish<br>an external measure that can correspond to the internal insertion length of the nasogastric tube up to the stomach. | Descriptive | Distance from earlobe to xiphisternum to umbilicus–distance from tip of the nose to earlobe<br>Distance from earlobe to xiphisternum | Esophagogastroduodenoscopy | Both are safe anatomical parameters to estimate distance to the gastroesophageal junction. |
| Ellett et al. (2005) | The purposes of this study were to develop a method for predicting nasogastric tube insertion distance, to predict a placement distance to achieve a stomach<br>placement for a tube, and to compare this new<br>rule to distance from tip of nose to earlobe to xiphisternum and Hanson's (1979) method. | Cross-sectional | GWNUF = 29.38 + 4.53*gender + 0.34*distance from nose to umbilicus with head flat on bed – 0.06*weight (Gender = 1 for male and 0 for female)<br>Distance from tip of nose to earlobe to xiphisternum ((Distance from tip of nose to earlobe to xiphisternum−50 cm)/ 2) + 50 cm | Continuous pressure recordings using a non-perfused probe connected to a transducer providing a continuous chart recording. When the tip of the probe passed through the lower esophageal sphincter, a high pressure zone was identifiable in the recordings.<br>Rather than inserting a nasogastric tube, this study measured the patient's distance from nose to the stomach with this method. | The GWNUF model did better than both distance from tip of nose to earlobe to xiphisternum<br>alone and<br>Hanson's (1979) method in predicting the correct nasogastric tube insertion distance. |
| Hanson (1979) | Find clinically applicable means for determining the appropriate length of nasogastric tube insertion. | Descriptive | ((Distance from tip of nose to earlobe to xiphisternum−50 cm)/ 2) + 50 cm<br>Distance from tip of nose to earlobe to xiphisternum | In cadevers, autopsy allowed for determination of the tip of the nasogastric tube in the stomach.<br>For healthy volunteers, measurement of esophageal and gastric pressures were used. | ((Distance from tip of nose to earlobe to xiphisternum−50 cm)/ 2) + 50 cm is stated to provide a 91% confidence level of tube tip placement in the<br>stomach between 1 and 10 cm.<br>With distance from tip of nose to earlobe to xiphisternum, 25.96% were more than 10 cm inside the stomach (determined as too deep in this study) and 1.92% were in the esophagus (too short). |

from nose to umbilicus with head flat on bed. All measurements were taken by two members and the average of the two measurements was used. Additional data on patient's gender, date of birth, height, weight, race, nasogastric tube size and any possible causes for length of nostril to stomach to be altered were recorded.

The chest x-rays were then viewed by a radiologist. The position of the tip of the nasogastric tube (whether at the upper one-third, middle one-third or lower one-third of the stomach), any upward bending of the nasogastric tube and insertion of the nasogastric tube to the duodenum were read from the chest x-rays by the radiologist.

IBM Statistical Package for the Social Sciences (SPSS) Statistics was used to generate descriptive statistics of the study population. Using Excel, the average difference in internal lengths of the nasogastric tube compared to distance from nose-earlobe-xiphisternum and the four formulae were calculated.

## 3. Results

A total of 92 patients were recruited for the study. Four patients had only one set of anatomical measurements taken as they were transferred out of the unit before the second research team member could take the measurements. For these four patients, the

**Table 2**
Demographic Profile of Patients.

| | Mean (range) | n(%) |
|---|---|---|
| Age (years) | 63 (20-88) | |
| Height (m) | 1.6 (1.4-1.8) | |
| Weight (kg) | 64.4 (32-160) | |
| Body Mass Index (BMI) | 24.4 (15.1-57.8) | |
| Male Sex | | 54 (58.7%) |
| Race | | 64 (69.6%) |
| Chinese | | 9 (9.8%) |
| Indian | | 11 (12%) |
| Malay | | 8 (8.7%) |
| Others | | |
| Size of nasogastric tube inserted (FG) | | 1 (1.1%) |
| 10 | | 22 (23.9%) |
| 12 | | 55 (59.8%) |
| 14 | | 14 (15.2%) |
| 16 | | |

measurements taken by the one member were utilized for data analysis. For three patients, distance from nose to umbilicus with head flat on bed and distance from earlobe to xiphisternum to umbilicus could not be measured as their umbilici were covered with a dressing. These patients were excluded from the analysis involving Formula 2 and Formula 4.

The demographic profile of the patients is as follows. The mean age was 63 years old (range = 20 to 88years old)), the mean height was 1.6 m (range = 1.4–1.8 m), the mean weight was 64.4 kg (range = 32–160 kg) and the mean body mass index (BMI) is 24.4 (range = 15.1–57.8). Fifty four of them were male (58.7%), majority (69.6%) were Chinese and most of the patients (59.8%) had size14 unomedical nasogastric tubes inserted (refer to Table 2).

From the chest x-rays images, we found that only 25 patients (27.2%) had the tip of the nasogastric tube at the optimal position. For 13 patients (14.1%), their nasogastric tubes were too short. The rest of the 54 nasogastric tubes were too long (58.7%) (Table 3).

Focusing on those nasogastric tubes which are in the optimal position, the difference between the internal length of the nasogastric tube and the length according to the four formulas were calculated. The difference between the internal length of the nasogastric tube and distance from nose to earlobe to xiphisternum was also calculated. The average difference between the internal lengths of nasogastric tube to Formula 3 (Formula 3 minus internal length of nasogastric tube) was -1.8 cm (SD 7.77, range=-22 to 14). This was by far the least difference compared to the other formulae (Table 4).

**Table 3**
Placement of nasogastric tube.

| Position | | n(%) |
|---|---|---|
| Optimal position n = 25 (27.2%) | Tip of the nasogastric tube being in the middle third of the stomach without the nasogastric tube being bent upward (towards the fundus) /bent on itself (coiled). | 15 (16.3%) |
| | Tip of the nasogastric tube being in the lower third of the stomach without the nasogastric tube being bent upward (towards the fundus) /bent on itself (coiled). | 10 (10.9%) |
| Too short n = 13 (14.1%) | Tip of nasogastric tube being in the upper one third of the stomach. | 10 (10.9%) |
| | Tip of nasogastric tube at or just beyond the GE junction. | 3 (3.2%) |
| Too long n = 54 (58.7%) | Tip of nasogastric tube inserted into the duodenum. | 4 (4.3%) |
| | Nasogastric tube bent upwards (towards the fundus) /bent on itself (coiled). | 23 (25%) |
| | Tip of nasogastric tube not seen on chest x-rays but is below the hemidiaphragm. | 27 (29.3%) |

However, for some patients had the nasogastric tubes at a position that was either too short or too deep even though the internal length of the nasogastric tube was only within 3 cm difference of Formula 3. Seven out of 13 patients (53.8%) whose nasogastric tubes were too short had the Formula 3 calculations within 3 cm difference from the internal length of the nasogastric tube and 16 out of 54 patients (29.6%) whose nasogastric tubes were too long had the Formula 3 calculations within 3 cm difference from the internal length of the nasogastric tube.

## 4. Discussion

For the purpose of this study, we defined optimal position as being in the middle or lower third of the stomach without any upward bending or bending on itself. The researcher chose this to be the optimal position as this position would theoretically allow the nurses more ease in obtaining an aspirate from the nasogastric tube (when the patient is in a fowlers position for a feeding session) compared to if the tip were high up in the stomach. Obtaining an aspirate from the nasogastric tube is important in checking for tube placement using the recommended pH method (Cole, 2015). The nasogastric tube was considered too short if the tip of the nasogastric tube was at the upper one-third of the stomach or if the tip was at or just beyond the gastroesophageal junction, as a placement near the gastroesophageal junction would increase the risk of aspiration of feeds. On the other hand, the nasogastric tube was considered to be inserted too deep if the tip was inserted into the duodenum, if there was any upward bending of the nasogastric tube /if the nasogastric tube bent over itself or if the tip of the nasogastric tube was below the hemidiaphgram and not seen on the chest x-ray.

Focusing on the nasogastric tubes placed at the optimal position, the average difference between the internal lengths of nasogastric tube to Formula 3 (Formula 3 minus internal length of nasogastric tube) was -1.8 cm (SD 7.8, range= -22 to 14). This Formula 3, distance from xiphisternum to earlobe to nose + 10 cm, seems to yield the closest estimate of the internal length of nasogastric tube required to be inserted. Formula 1, Formula 2, Formula 4 and distance from nose to earlobe to xiphisternum are all more than 10 cm shorter than the internal length of the nasogastric tube which was placed at the optimal position. This supports the findings from earlier studies that suggest that the distance from nose to earlobe to xiphisternum is too short (Chen et al., 2014, and Taylor et al., 2014).

Chen et al. (2014) used whole body positron emission tomography with computerized tomography scan to determine the position of the tip of the nasogastric tube. This study found distance from nose to earlobe to xiphisternum to be too short. Out of 30 patients, only one (3.3%) had the nasogastric tube placed with all side holes in the stomach using the distance from nose to earlobe to xiphisternum method. Similarly, Taylor et al. (2014) studied the electromagnetic trace of the nasogastric tube path during insertion and found that the distance from xiphisternum to earlobe to nose was significantly shorter than the internal length from the nose to the gastric body (-11.6 cm, 95% confidence interval: -12.9, -10.2; $p < 0.0001$). Taylor et al. (2014) suggested using distance from xiphisternum to earlobe to nose + 10 cm in order for the nasogastric tube to reach mid stomach for most patients.

However, the results were not as clear when we focused on the group of patients whose nasogastric tube was inserted to a length that was too short or too long. Seven out of 13 patients (53.8%) whose nasogastric tubes were too short had the Formula 3 calculations within 3 cm difference from the internal length of the nasogastric tube (Formula 3 minus internal length) and 16 out of 54 patients (29.6%) whose nasogastric tubes were too long had the

**Table 4**
Difference in Actual Internal Length of the Nasogastric Tube and the Measured/Calculated Internal Length Required in Nasogastric tubes that are in the Optimal Position.

| Record ID | Internal length (cm) | Formula 1[†]-internal length (cm) | Formula 2[‡]-internal length (cm) | Formula 3[§]-internal length (cm) | Formula 4[¶]-internal length (cm) | Distance from nose to earlobe to xiphisternum -internal length (cm) |
|---|---|---|---|---|---|---|
| M5 | 58 | −10.8 | −15.3 | −4 | −23.5 | −13.5 |
| M14 | 69 | −20.5 | −28.5 | −12 | −37 | −22 |
| M26 | 62 | −10 | −12.9 | 0 | −23.8 | −8 |
| M27 | 56 | −11.1 | −15.9 | −5.8 | −30.5 | −16.3 |
| M28 | 65 | −15.9 | −17.2 | −9 | −28.3 | −16.8 |
| N6 | 65 | −13.6 | −18.5 | −3 | −26 | −12.3 |
| N21 | 66 | −16.9 | −18.2 | −6.3 | −31 | −17.8 |
| S15 | 63 | −14.8 | −14.3 | −6.5 | −23 | −16.5 |
| S23 | 58 | −5.5 | −8.2 | 7 | −15.5 | −3 |
| S24 | 63 | −9.8 | −13.2 | 3.5 | −16.5 | −6.5 |
| M1 | 60 | −8.8 | −12.7 | 2.5 | −19.3 | −7.5 |
| M8 | 60 | −10.8 | | −1.5 | | −11.5 |
| M12 | 62 | −9.3 | | 2 | | −6.5 |
| M31 | 47 | 0.8 | −5.5 | 8.3 | −14.5 | −1.5 |
| M36 | 67 | −16.4 | −19 | −5.3 | −34 | −15.8 |
| M38 | 63 | −14 | −16.8 | −4.3 | −26 | −15 |
| N1 | 73 | −22.5 | −26.6 | −22 | −36.3 | −22 |
| N11 | 67 | −18.5 | −23.3 | −10 | −29.5 | −20 |
| N15 | 59 | −9.4 | −18.7 | 2.3 | −22 | −9.8 |
| N20 | 65 | −13.4 | −15.9 | −3.8 | −16.8 | −11.8 |
| S2 | 65 | −16.5 | −15.3 | −8 | −26 | −18 |
| S6 | 57 | −6 | −10.4 | 5 | −15 | −5 |
| S14 | 62 | −10.3 | −13.4 | 1.5 | −23.5 | −8.5 |
| S19 | 56 | −3.3 | −5.7 | 9.5 | −10.5 | −0.5 |
| S27 | 55 | −0.5 | −4 | 14 | −14.5 | 4 |
| Average Difference (cm) | | −11.5 | −15.2 | −1.8 | −23.6 | −11.3 |

[†] Formula 1= ((distance from nose to earlobe to xiphisternum −50 cm)/2) + 50 cm.
[‡] Formula 2 = 29.38 + 4.53*gender + 0.34*distance from nose to umbilicus with head flat on bed − 0.06*weight (gender = 1 for male, and 0 for female).
[§] Formula 3= Distance from xiphisternum to earlobe to nose + 10 cm.
[¶] Formula 4= Distance from earlobe to xiphisternum to umbilicus − distance from tip of the nose to earlobe.

Formula 3 calculations within 3 cm difference from the internal length of the nasogastric tube (Formula 3 minus internal length). One reason for this is that the position of the tip of the nasogastric tube in the stomach could appear to be at differing locations depending on how distended the stomach is during the time of chest x-ray. Furthermore, anatomical differences may contribute to this (Taylor et al., 2014). These reasons could have contributed to the variations in the results.

Although the researchers did not intend to study the trend of nasogastric tube insertion among nurses, the results showed a majority of nasogastric tubes (58.7%) being inserted too deep (the tip of the nasogastric tube are in the duodenum, the nasogastric tube is upward bending or the tip of the nasogastric tube is below the hemidiaphragm but not seen in the chest x-ray). For this group with nasogastric tubes inserted too deep, the mean difference between the distance from the nose to earlobe to xiphisternum and the internal length (distance from nose to earlobe to xiphisternum-internal length) was -15.9 cm (SD 6.7, range -37 to -3.5). This suggests that the nurses may not be using distance from nose to earlobe to xiphisternum as a method to estimate the length of nasogastric tube insertion in the first place. Possible reasons for this could be because they are aware from experience that distance from nose to earlobe to xiphisternum may not be long enough or they may feel more secure if the nasogastric tube is too deep rather than too high. However, it should be noted that upward bending of the nasogastric tube may potentially be dangerous if the tip ends up close to the gastroesophageal junction as it may increase the risk of aspiration of feeds into the lungs.

A limitation of this study is that the chest x-rays were not performed immediately after nasogastric tube insertion. Chest x-rays up to 24 h after nasogastric tube insertion were allowed for this study. As mentioned above, the distention of the stomach can lead to the nasogastric tube appearing at different locations in the stomach. For example, a nasogastric tube that appears to be at the optimal position in a decompressed stomach may appear to be in the upper one third of the stomach if the stomach were to be distended. Therefore, as the chest x-rays was not performed immediately after nasogastric tube insertion and decompression of the stomach, some limitations in the results may be found. Despite this, we can still say that Formula 3, distance from xiphisternum to earlobe to nose + 10 cm, gives a relatively good estimate for the tip of the nasogastric tube to end up inside the stomach.

## 5. Conclusion

In conclusion, distance from xiphisternum to earlobe to nose + 10 cm provided the best estimate of the internal length of nasogastric tube required to be at an optimal position for feeding. However, even this formula could result in placement that is not optimal due to differences in anatomical proportions and medical conditions of the patient (such as those who had underwent partial gastrectomy). Therefore, apart from having a good estimate of nasogastric tube insertion length, it is still necessary to have other placement confirmation methods such as checking the pH of the nasogastric tube aspirates and/or chest x-rays.

## Funding

This study did not receive funding from any organization.

## Conflict of interest

The authors declare that they have no conflict of interest.

## Acknowledgement

This study would not have been possible without the support of the Division of Nursing, Singapore General Hospital.

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