the internal leNGth of a nasogastric tube

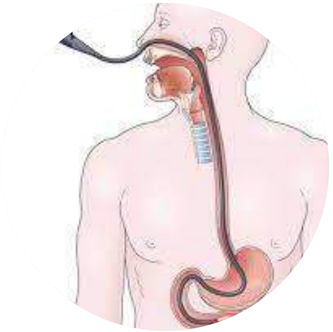
成人鼻胃管置入長度正確性之評估

引言人:張　平

護理長:許怡苹

營養途徑比較

NG
Bedside
直接放置



ND
胃鏡室放置
吸收、消化問題

PEG
手術室放置

TPN
增加血流感染

背景資料

- 據衛生福利部中央健康保險署（2022）統計資料顯示，2021年置放NG的病人總數196,244人，佔住院人數比率為10.7%。
- 長期NG灌食的長者吸入性肺炎的發生率為43%~60%（Huang et al., 2017），死亡風險為17%~62%（Gomes et al., 2003）。
- 鼻胃管位置錯誤，鼻胃管放置長度過長或過短造成食物逆流，灌食姿勢及灌食速度不適當或胃殘餘量過多造成嘔吐，常是引起吸入性肺炎的原因（吳尚蓉，2022）。

鼻胃管放置

目的

- 病人困難進食、易嗆，給予營養、藥物
- 胃減壓

風險

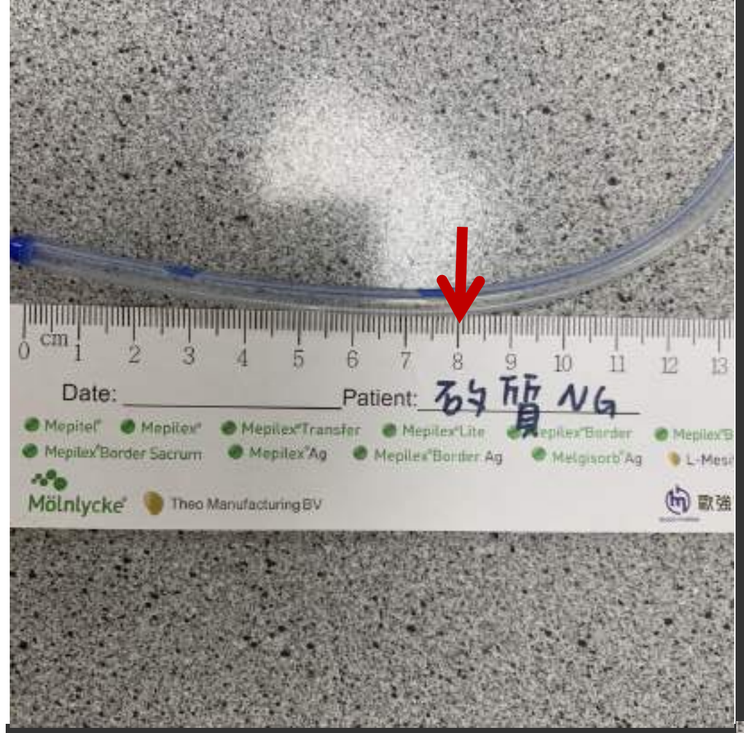
- 放置位置錯誤，
- 如:肺內、食道內，
- 造成灌食時吸入性肺炎。

目前流程

- 直接放置，測量方式NEX[1]
- 聽診器確認位置
- 放置後不會照CXR

1. NEX：nose–earlobe–xiphoid distance ，鼻尖-耳垂-劍突距離

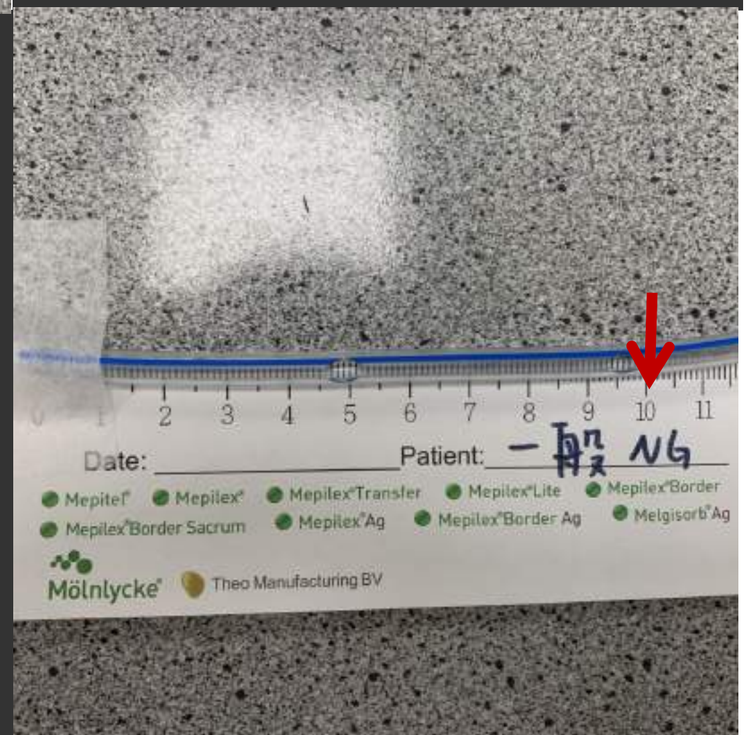
臨床問題



臨床醫師於胃鏡檢查發現部分病人鼻胃管末端孔洞沒有全在賁門以下。

不同鼻胃管末端孔洞長度差異。

兩截式鼻胃管是否適合所有病人?



臨床資料

床號	材質	身高	NEX (目前院內規範)	臨床實際放置長度
101	矽質(8cm)	148	46	60
102	矽質(8cm)	157.2	52	65
161	矽質(8cm)	172	56	60
171	矽質(8cm)	145	45	55
202	一般(10cm)	150	48	60
205	一般(10cm)	142	47	55

PICO

P **Population/ Problem**
放置鼻胃管的成人

I **Intervention**
新測量鼻胃管放置長度方式

C **Comparison**
傳統測量鼻胃管放置長度方式（NEX）

O **Outcomes**
於胃內長度正確性

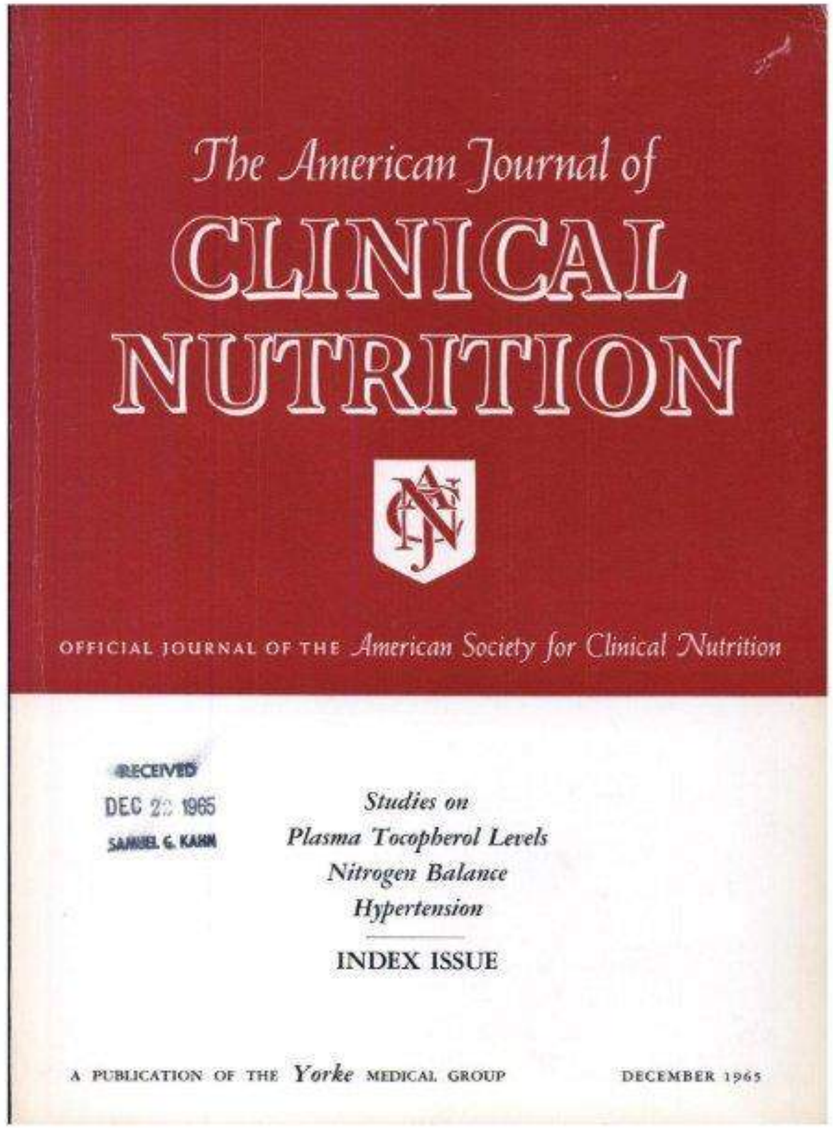
找出最佳證據

關鍵字
Adult
Gastrointestinal intubation
Nasogastric intubation

Embase®

PubMed

Cochrane Library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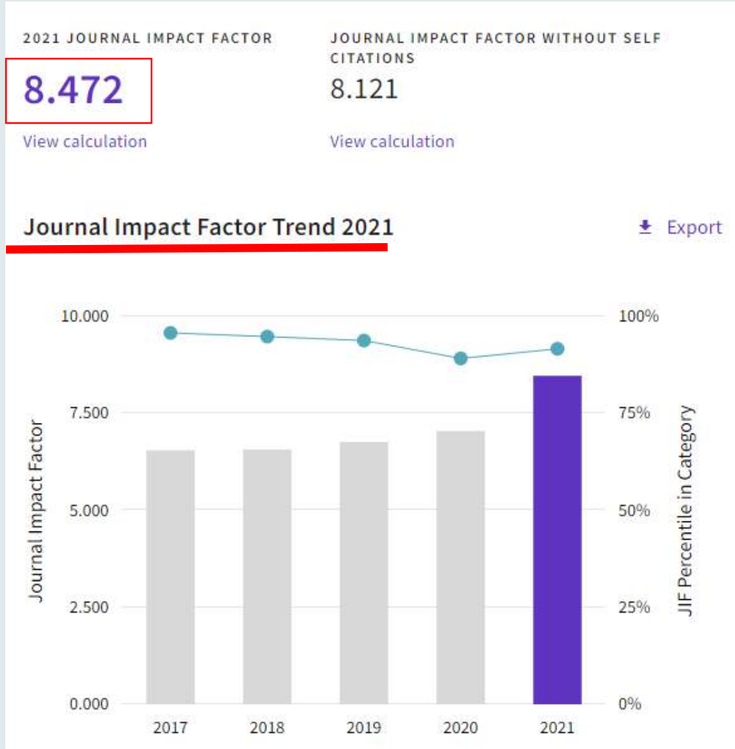
Studies on
Plasma Tocopherol Levels
Nitrogen Balance
Hypertension
INDEX ISSUE
A PUBLICATION OF THE Yorke MEDICAL GROUP
DECEMBER 1965


2021 JOURNAL IMPACT FACTOR
8.472
View calculation
JOURNAL IMPACT FACTOR WITHOUT SELF CITATIONS
8.121
View calculation
Journal Impact Factor Trend 2021
Export
10.000
7.500
5.000
2.500
0.000
Journal Impact Factor
100%
75%
50%
25%
0%
JIF Percentile in Category
2017
2018
2019
2020
2021

文獻介紹

- 針對成年人使用NG者
- 長度測量方式
- NG胃內長度正確性

Intervention

Outcomes

The accuracy of methods for determining the internal length of a nasogastric tube in adult patients: a systematic review

Population

Tim Torsy,[1,2] Harm HJ van Noort,[3] Stephen Taylor,[4] ... he,[2] and Dimitri Beeckman[2,5]

[1]Department of Healthcare, Odisee University of Applied Sciences, Brussels, Belgium; [2]University Centre for Nursing and Midwifery, Department of Public Health and Primary Care, Ghent University, Ghent, Belgium; [3]Centre for Complex Abdominal and Pelvic Diseases, Radboud University Medical Centre, Nijmegen, Netherlands; [4]Nutrition & Dietetics Team, Southmead Hospital, Bristol, United Kingdom; and [5]Faculty of Medicine and Health, School of Health Sciences, Örebro University, Örebro, Sweden

10種測量方式

	測量方式	文獻數量
1.	NEX[1]	8
2.	NEX + 10 cm	3
3.	GX (眉間~劍突距離)	1
4.	GU (眉間~肚臍距	
5.	GWNUF	
6.	Hanson 1 [(NEX − 50)/2] +50	4
7.	Hanson 2 [(NEX × 0.38696) + 30.37]	3
8.	Hanson 3 [(body length × 0.20239) + 17.07]	1
9.	(EX + XU) − NE (耳垂~劍突+劍突~肚臍中線) – 鼻尖~耳垂	2
10.	(NEX × 0.38696) + 30.37 + 6 cm	3

29.38 + (4.53 x 性別) + (0.34 x 平躺時鼻尖~肚臍距離) - (0.06 x 體重)
性別：男性 = 1、女性 = 0

1. NEX：nose–earlobe–xiphoid distance ，鼻尖-耳垂-劍突距離

納入文獻介紹

Table:3

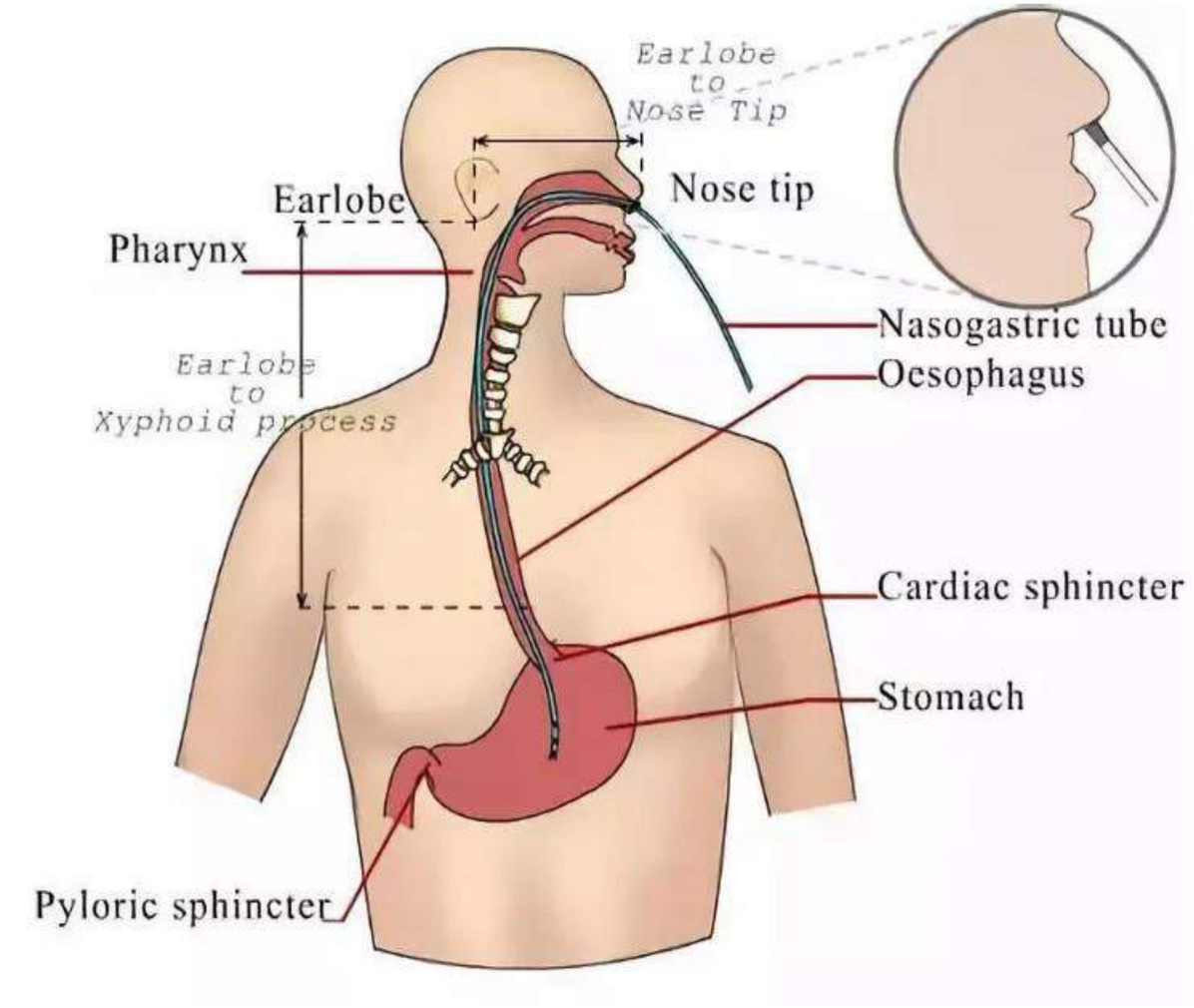


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TABLE 3 Sample and study characteristics[1]

Authors, country	Design; study setting	Participants; sample size, *n*	Sex (M–F), %; Age, range, mean ± SD or median [IQR], *y*	Evaluated methods for determining internal tube length	Verification methods for NG tube tip positioning
Hanson (18, 25), USA	Observational, cross-sectional; NR	Adult persons (either cadaver or healthy volunteer); *n* = 104 (99 cadavers, 5 volunteers)	70.2%–29.8% 17.0–92.0, 45.0	NEX -Hanson 1: [(NEX – 50)/2] + 50 -Hanson 2: (NEX × 0.38696) + 30.37;	Cadavers: palpation through the stomach wall before the beginning of the autopsy Healthy volunteers: esophageal and gastric pressure measurement, providing a continuous chart recording
Cirgin Ellett et al. (8), USA	Observational,	Adult patients scheduled ageal motility	43 17		phageal and gastric pressure measurement, providing a continuous chart recording
Malta et al. (20), Brazil		italized patients d for EGD;	57 18		D
Chen et al. (27), Taiwan (China)		nts with NG rtion, scheduled e body PET-CT;	90 33		ole body PET-CT
Taylor et al. (21), United Kingdom		patients placement of NI tube;	75 17		ctromagnetic tracking of he tube path; pH neasurement of gastric aspirate
Klos et al. (26), Netherlands	general hospital	italized patients placement of an NG tube; *n* = 108	46 72	0.38696) + 30.37[2]	measurement of gastric aspirate
Torsy et al. (22), Belgium	Observational, cross-sectional; general hospital	Adult hospitalized patients requiring placement of an NG tube; tube feeding necessary on the basis of a medical indication; *n* = 58	65.5%–34.5%[3] 27.8–92.0, 70.5 ± 13.5[3]	(NEX × 0.38696) + 30.37 + 6 cm	Chest X-ray; pH measurement of gastric aspirate

國家

- 新加坡 (1)
- 台灣 (1)
- 美國 (2)
- 巴西 (2)
- 英國 (2)
- 紐比利時 (3)
- 西蘭 (1)

確認鼻胃管位置方式

- 觸診 (n = 1)
- 食道、胃壓力測試(n = 2)
- EGD (n = 1)
- PET、CT(n = 1)
- 偵測電磁(n = 2)
- 偵測pH(n = 5)
- CXR(n = 4)

TABLE 3 *(Continued)*

Authors, country	Design; study setting	Participants; sample size, *n*	Sex (M–F), %; Age, range, mean ± SD or median [IQR], *y*	Evaluated methods for determining internal tube length	Verification methods for NG tube tip positioning
Torsy et al. (16), Belgium	RCT, parallel groups; general hospital	Adult hospitalized patients requiring placement of an NG tube; medical indication for tube feeding; $n = 183$	Control group ($n = 99$): 52.5%–47.5% 35.0–97.0,[3] 72.4 ± 12.3 Intervention group ($n = 84$): 57.1%–42.9% 19.0–90.0,[3] 70.6 ± 12.7	Control group: NEX Intervention group: -Hanson 2: (NEX × 0.38696) + 30.37	Chest X-ray; pH measurement of gastric aspirate
Fan et al. (28), Singapore	Observational, cross-sectional; tertiary hospital (medical and surgical ICUs and a neurosurgical ward)	Adult hospitalized patients requiring placement of an NG tube; $n = 92$	58.7%–41.3% 20.0–88.0, 63.0	NEX -Hanson 1: [(NEX − 50)/2] + 50 GWNUF XEN + 10 cm (EX + XU) − NE	Chest X-ray
Torsy et al. (19), Belgium	Observational, cross-sectional; general hospital (with general ICU)	Adult ICU patients requiring placement of an NG tube; medical indication for tube feeding; $n = 199$	62.8%–37.2% 26.0–92.0,[3] 69.5 ± 12.9	(NEX × 0.38696) + 30.37 + 6 cm	Chest X-ray; pH measurement of gastric aspirate
Taylor (29), United Kingdom	Observational, cross-sectional; general hospital (Department of Nutrition and Dietetics)	Adult ICU patients requiring placement of an NG tube; $n = 193$	72.0%–28.0% 53.3 [38.1–69.0]	NEX (or XEN) -Hanson 1: [(NEX − 50)/2] + 50 (NEX × 0.38696) + 30.37 + 6 cm XEN + 10 cm	Electromagnetic tracking of the tube path

解剖位置

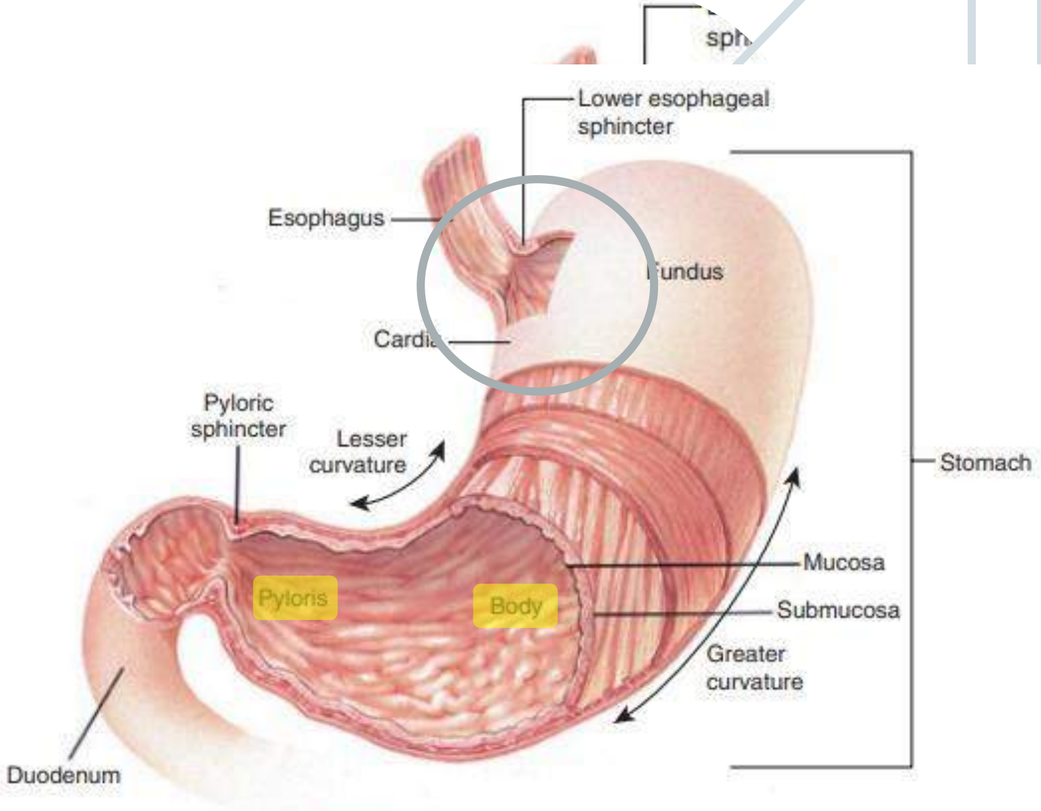


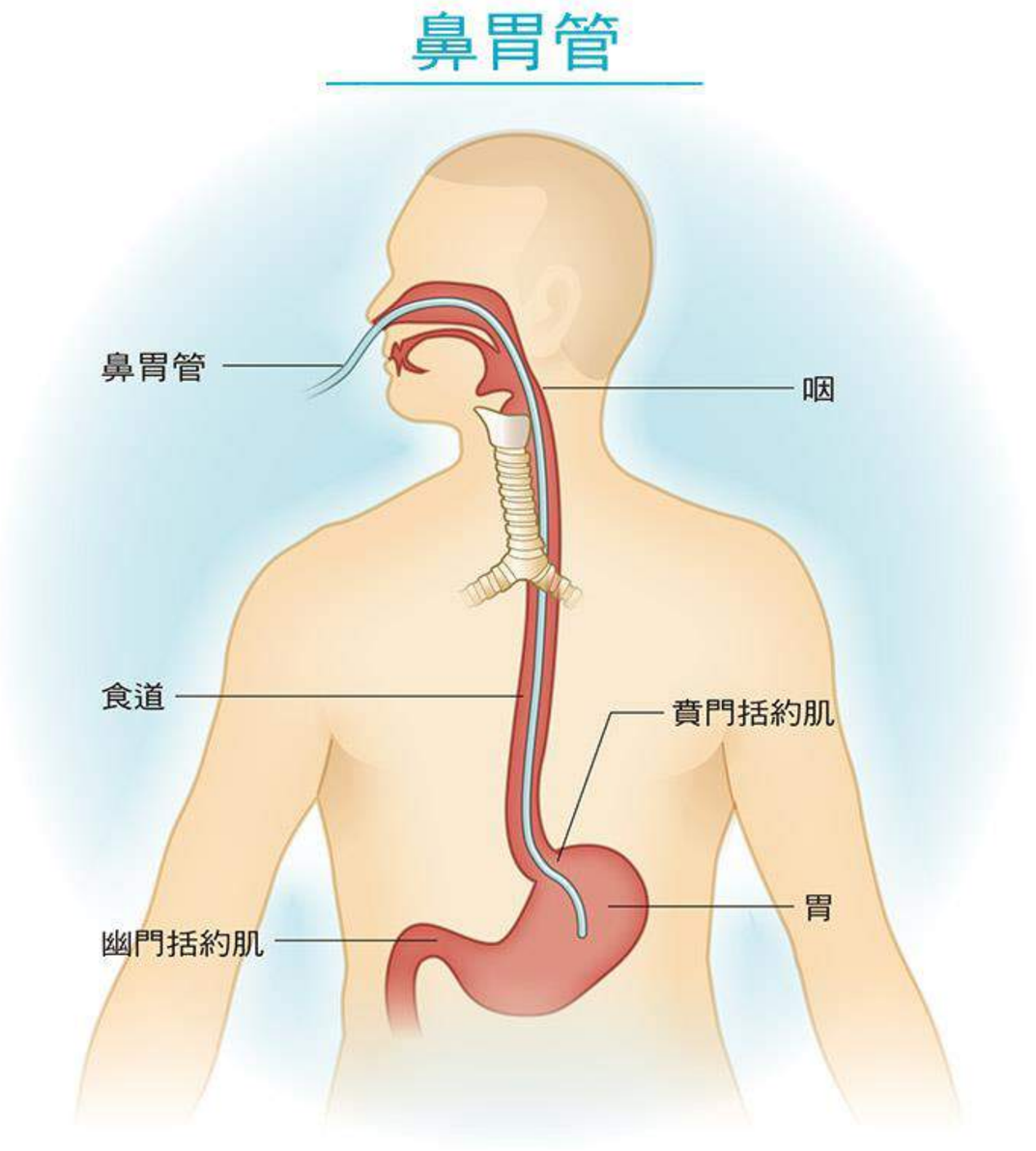
FIGURE The stomach.

LES
lower esophageal sphincter
下食道括約肌

esophageal junction
交接處

結果

Table:4



結果摘要

TABLE 4 Summaryof findings[1]

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results: Main outcomes	Results: Adverse events	Comments
Hanson (18, 25), USA	LES At distal margin of it (tip 1–10 cm below); In gastric fundus or body	1) Tip positioning		Method 1: <1 cm n = 2	- Patient in supine position; bed
Cirgin Ellett et al. (8), USA	LES At distal margin of it (tip 3–10 cm below); In gastric fundus or body				
Malta et al. (20), Brazil	GEJ - At distal margin of LES (tip 1–10 cm below).[4]	2) NR Not report	the distance as measured by EGD ($r = 0.651$, $P < 0.001$) Contr.: EGD (mean ± SD: 40.8 ± 3.16 cm)		patient in supine position; head erect and in rest position aligned to the trunk. - Internal measurement: patient in left lateral decubitus with slight vertical flexion, head aligned at the shoulders with legs slightly flexed.

(*Continued*)

鼻胃管位置 不良事件 在LES或GEJ以下。

每篇鼻胃管 隼不同，因鼻胃管差異。

1. LES/G) (18, 20, 25, 26)
2. LES以 16)
3. GEJ以
4. LES 以 22)
5. 胃本體
6. 胃本體 (n = 2) (21, 29).

- 誤放到肺
- 氣胸
- 肺炎
- 誤放到食道
- 誤放到十二指腸

結果摘要

TABLE 4 *(Continued)*

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results: Main outcomes	Results: Adverse events	Comments
Chen et al. (27), Taiwan (China)	GEJ - Tip ≥9.5 cm below; - In gastric cardia.	*1)* Tip positioning *2)* Intraesophageal placement	Method 1: NEX (mean ± SD: 51.2 ± 2.99 cm) $R^2 = 0.16$, 95% CI: −0.04, 0.35 ≥9.5 cm $n = 1$ (3.3%) Method 2: GX (mean ± SD: 40.3 ± 2.65 cm) $R^2 = 0.30$, 95% CI: 0.08, 0.52 ≥9.5 cm $n = 0$ (0%) Method 3: GU (mean ± SD: 55.9 ± 3.46 cm) $R^2 = 0.09$, 95% CI: −0.06, 0.25 ≥9.5 cm $n = 14$ (46.7%)	Method 1: <9.5 cm $n = 29$ (96.7%) ≥1 lateral hole in esophagus and stomach $n = 14$ of 29 0 lateral holes through GEJ $n = 15$ of 29 Method 2: <9.5 cm $n = 30$ (100.0%) 0 lateral holes through GEJ $n = 30$ of 30 Method 3: <9.5 cm $n = 16$ (53.3%).	- No details reported about patient position during NG tube placement procedure. - All participants ($n = 30$) were of Han Chinese race and may have had relatively shorter stature, bony structure, or less prominent facial features.
Taylor et al. (21), United Kingdom	GEJ - Tip reaching the gastric body (mid-stomach); - Tip at leftmost position (visible on anterior view when using real-time EM tracking). pH cutoff: ≤5.0	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:** Gastric body (mean ± SD: 62.3 ± 5.7 cm) Gastric antrum (mean ± SD: 73.4 ± 7.0 cm) Method 1: XEN (mean ± SD: 50.7 ± 4.0 cm) MD: −11.6 cm (95% CI: −12.9, −10.2 cm), $P < 0.001$ Method 2: XEN + 10 cm MD: −1.6 cm (95% CI: −2.9, −0.2 cm), $P = 0.02$ **Gastric aspirate:** $n = 20$ of 70 (28.6%)	**Intraesophageal placement:** = pre-GEJ (mean ± SD: 48.2 ± 3.2 cm) Method 1: XEN MD: +2.5 cm Method 2: XEN + 10 cm MD: +14.1 cm	- No details reported about patient position during NG tube placement procedure. - At completion of placement, all tubes were confirmed as having reached the stomach by ≥1 methods: X-ray (64.0%), pH ≤ 5.0 (28.6%), and subsequent intestinal EM trace (64%).
Klos et al. (26), Netherlands	LES[5] - Tip 1–10 cm below;[5] - In gastric fundus or body.[5] pH cutoff: ≤5.5	*1)* Tip positioning; gastric aspirate *2)* NR	**Tip positioning:** Method 1: NEX (mean: 54.21 cm, SD: NR) Method 2 (Hanson 2): (NEX × 0.38696) + 30.37 (mean: 51.33 cm, SD: NR) **Gastric aspirate:** Actual insertion length until gastric aspirate was obtained (mean: 56.85 cm, SD: NR) Method 2: (NEX × 0.38696) + 30.37 $n = 24$ of 108 (22.2%)		- Patient in supine position; chest at an elevation angle of 10–30°; facing forward.[5] - Obtainment of gastric aspirate within 1 h after placement.[5]

(Continued)

結果摘要

TABLE 4 Summaryof findings[1]

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results		Comments
			Main outcomes	Adverse events	
Hanson (18, 25), USA	LES At distal margin of it (tip 1–10 cm below); In gastric fundus or body	1) Tip positioning 2) Intraesophageal placement[3]	Method 1: NEX 1–10 cm $n = 75$ (72.12%) >10 cm $n = 27$ (25.96%) Method 2 (Hanson 1): [(NEX – 50)/2] + 50 1–10 cm $n = 95$ (91.35%) >10 cm $n = 6$ (5.77%) Method 3 (Hanson 2): (NEX × 0.38696) + 30.37 1–10 cm $n = 96$ (92.30%) >10 cm $n = 4$ (3.85%) Method 4 (Hanson 3): (body length × 0.20239) + 17.07 1–10 cm $n = 100$ (96.15%) >10 cm $n = 1$ (0.97%)	Method 1: <1 cm $n = 2$ (1.92%) Method 2: <1 cm $n = 3$ (2.88%) Method 3: <1 cm $n = 4$ (3.85%) Method 4: <1 cm $n = 3$ (2.88%)	- Patient in supine position; bed horizontal
Cirgin Ellett et al. (8), USA	LES At distal margin of it (tip 3–10 cm below); In gastric fundus or body	1) Tip positioning 2) Intraesophageal placement	Method 1: GWNUF $R^2 = 0.61$; 95% CI: 0.49, 0.73 3–10 cm $n = 65$ (85.5%); 95% CI: 0.75, 0.92 >10 cm $n = 5$ (6.6%) Method 2 (Hanson 1): [(NEX – 50)/2] + 50 $R^2 = 0.22$; 95% CI: 0.09, 0.43 3–10 cm $n = 57$ (75.0%); 95% CI: 0.64, 0.84 >10 cm $n = 11$ (14.5%) Method 3: NEX $R^2 = 0.22$, 95% CI: 0.09, 0.43 3–10 cm $n = 55$ (72.4%); 95% CI: 0.61, 0.82 >10 cm $n = 9$ (11.8%)	Method 1: <3 cm $n = 6$ (7.89%) Method 2: <3 cm $n = 8$ (10.5%) Method 3: <3 cm $n = 12$ (15.8%)	- Patient in supine position; bed horizontal; without pillow
Malta et al. (20), Brazil	GEJ - At distal margin of LES (tip 1–10 cm below).[4]	*1)* Tip positioning *2)* NR	Method: (EX + XU) – NE (mean ± SD: 39.5 ± 3.17 cm) Significantly positively correlated with the variance in the distance as measured by EGD ($r = 0.651$, $P < 0.001$) Contr.: EGD (mean ± SD: 40.8 ± 3.16 cm)		- External measurements: patient in supine position; head erect and in rest position aligned to the trunk. - Internal measurement: patient in left lateral decubitus with slight vertical flexion, head aligned at the shoulders with legs slightly flexed.

(Continued)

結果摘要

TABLE 4 (*Continued*)

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Taylor et al. (21), United Kingdom	GEJ - Tip reaching the gastric body (mid-stomach); - Tip at leftmost position (visible on anterior view when using real-time EM tracking). pH cutoff: ≤5.0	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:** Gastric body (mean ± SD: 62.3 ± 5.7 cm) Gastric antrum (mean ± SD: 73.4 ± 7.0 cm) Method 1: XEN (mean ± SD: 50.7 ± 4.0 cm) MD: −11.6 cm (95% CI: −12.9, −10.2 cm), $P < 0.001$ Method 2: XEN + 10 cm MD: −1.6 cm (95% CI: −2.9, −0.2 cm), $P = 0.02$ **Gastric aspirate:** $n = 20$ of 70 (28.6%)	**Intraesophageal placement:** = pre-GEJ (mean ± SD: 48.2 ± 3.2 cm) Method 1: XEN MD: +2.5 cm Method 2: XEN + 10 cm MD: +14.1 cm	- No details reported about patient position during NG tube placement procedure. - At completion of placement, all tubes were confirmed as having reached the stomach by ≥1 methods: X-ray (64.0%), pH ≤ 5.0 (28.6%), and subsequent intestinal EM trace (64%).
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(*Continued*)

結果摘要

TABLE 4 *(Continued)*

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results: Main outcomes	Results: Adverse events	Comments
Torsy et al. (22), Belgium	LES - Tip > 3 cm below. pH cutoff: ≤5.5.[6]	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:**[7] Method: (NEX × 0.38696) + 30.37 + 6 cm (mean ± SD: 56.62 ± 1.44 cm) 3–10 cm $n = 38$ (65.5%) >10 cm $n = 20$ (34.5%) **Gastric aspirate:** $n = 40$ of 58 (69.0%)	<3 cm $n = 0$ (0%).	- Patient in supine position; chest at an elevation angle of 10–30°; facing forward. - Obtainment of gastric aspirate within 1 h after placement.
Torsy et al. (16), Belgium	LES - Tip 3–10 cm below; - In gastric fundus or body. pH cutoff: ≤5.5	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:** Exp. (Hanson 2): (NEX × 0.38696) + 30.37 (mean ± SD: 50.5 ± 1.62 cm) 3–10 cm $n = 61$ of 84 (72.6%) >10 cm $n = 4$ of 84 (4.8%) Contr.: NEX (mean ± SD: 51.62 ± 3.79 cm) 3–10 cm $n = 62$ of 99 (62.6%), $P = 0.151$ >10 cm $n = 17$ of 99 (17.2%), $P = 0.009$ **Obtaining gastric aspirate:** Exp.: (NEX × 0.38696) + 30.37 $n = 47$ of 84 (56.0%) Contr.: NEX $n = 55$ of 99 (55.6%), $P = 0.938$	Exp.: <3 cm $n = 19$ of 84 (22.6%) Contr.: <3 cm $n = 20$ of 99 (20.2%), $P = 0.691$	- Patient in supine position; chest at an elevation angle of 10–30°; facing forward. - Obtainment of gastric aspirate within 1 h after placement.
Fan et al. (28), Singapore	GEJ - Tip in the middle or lower third of the stomach (= in gastric fundus or body).	*1)* Tip positioning *2)* Intraesophageal placement; intestinal placement[8]	**Tip positioning according to hospital protocol:** Mean ± SD: 61.7 ± 5.27 cm Middle/lower third $n = 25$ of 92 (27.2%) **Optimal position:** Method 1 (Hanson 1) ($n = 25$): [(NEX − 50)/2] + 50 Mean ± SD: 50.2 ± 2.16 cm MD: −11.5 cm, SD: 5.67 cm, range: −22.5 to 0.8 cm Method 2 ($n = 23$): GWNUF Mean ± SD: 46.6 ± 3.35 cm MD: −15.2 cm, SD: 6.00 cm, range: −28.5 to −4 cm Method 3 ($n = 25$): XEN + 10 cm Mean ± SD: 59.9 ± 4.58 cm MD: −1.8 cm, SD: 7.6 cm, range: −22 to 14 cm Method 4 ($n = 23$): (EX + XU) − NE Mean ± SD: 38.2 ± 4.94 cm MD: −23.6 cm, SD: 7.28 cm, range: −37 to −10.5 cm Method 5 ($n = 92$): NEX Mean ± SD: 50.4 ± 4.34 cm MD: −11.3 cm, SD: 6.79 cm, range: −22 to 4 cm ($n = 25$)	**Intraesophageal placement:** = upper one-third; at or just below GEJ According to hospital protocol: $n = 13$ Method 3: (XEN + 10 cm) Within 3-cm difference of tip positioning: according to hospital protocol $n = 7$ of 13 (53.8%) **Intestinal placement:** = into duodenum According to hospital protocol: $n = 4$ of 54 Method 3: (XEN + 10 cm) Within 3-cm difference of tip positioning: according to hospital protocol $n = 16$ of 54 (29.6%).	- The vast majority of participants (69.6%) were of Han Chinese race and may have had relatively shorter stature, bony structure, or less prominent facial features. - No details reported about patient position during NG tube placement procedure.

(Continued)

結果摘要

TABLE 4 (*Continued*)

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results: Main outcomes	Results: Adverse events	Comments
Torsy et al. (19), Belgium	LES - Tip >3 cm below. pH cutoff: ≤5.0	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:** Method: (NEX × 0.38696) + 30.37 + 6 cm (mean ± SD: 56.72 ± 1.44 cm) <3 cm $n = 0$ (0%) 3–10 cm $n = 75$ (37.7%) >10 cm $n = 124$ (62.3%) **Gastric aspirate:** $n = 155$ of 199 (77.9%) 3–10 cm $n = 56$ >10 cm $n = 99$	<3 cm $n = 0$ (0%)	- Patient in supine position; chest at an elevation angle of 10–30°; facing forward. - Obtainment of gastric aspirate within 2 h after placement/repositioning.
Taylor (29), United Kingdom	GEJ - Tip reaching gastric body flexure, not below pyloric flexure; - Tip at leftmost position (visible on anterior view when using real-time EM tracking).	*1)* Tip positioning *2)* Intraesophageal placement; intestinal placement	Method 1: NEX (or "XEN") Pre–gastric body $n = 157$ (81.3%) Between gastric body and pylorus $n = 7$ (3.6%) Method 2 (Hanson 1): [(NEX – 50)/2] + 50 Pre–gastric body flexure $n = 163$ (84.5%) Between gastric body and pylorus $n = 1$ (0.5%) Method 3: (NEX × 0.38696) + 30.37 + 6 cm Pre–gastric body flexure $n = 166$ (86.0%) Between gastric body and pylorus $n = 25$ (13.0%) Method 4: XEN + 10 cm Pre–gastric body flexure $n = 82$ (42.5%) Between gastric body and pylorus $n = 106$ (54.9%)	**Intraesophageal placement:** = pre-GEJ Method 1: $n = 29$ (15.0%) Method 2: $n = 29$ (15.0%) Method 3: $n = 1$ (0.5%) Method 4: $n = 0$ (0.0%) Intestinal placement = transpyloric Method 1: $n = 0$ (0.0%) Method 2: $n = 0$ (0.0%) Method 3: $n = 1$ (0.5%) Method 4: $n = 5$ (2.6%)	- Patient in supine position; chest at an elevation angle of 10–30°.

NG放置正確率總結—位置

方式	正確率	長度	文章
NEX	3.6%~72.4%	50.4 ~ 54.2 cm	8, 16, 18, 25, 27, 29
Hanson 1	0.5%~91.35%	Mean:50.2 cm	8, 18, 25, 28, 29
Hanson 2	72.6%~92.3%	Mean: 50.5–51.3 cm	8, 18, 25, 28, 29
Hanson 3	96.2%		8, 18, 25, 28, 29
GWNUF	85.5%	Mean: 46.6 cm	8, 28
(EX + XU) – NE	0%	M cm	20, 28
GX	0%	4	27
GU	46.7%	5	27
(NEX × 0.38696) + 30.37 + 6 cm	~~13%~100%~~ (修正後99%)	M m	19, 22, 29
NEX+ 10 cm	~~54.9%~~ (修正後97.4%)	m m	21, 28, 29

Taylor (29), 若鼻胃管位置正確標準，改為LES下3公分

Taylor (29), 鼻胃管位置正確標準: 鼻胃管在胃體與幽門之間

TABLE 3 *(Continued)*

Authors, country	Design; study setting	Participants; sample size, *n*	Sex (M–F), %; Age, range, mean ± SD or median [IQR], *y*	Evaluated methods for determining internal tube length	Verification methods for NG tube tip positioning
Torsy et al. (16), Belgium	RCT, parallel groups; general hospital	Adult hospitalized patients requiring placement of an NG tube; medical indication for tube feeding; $n = 183$	Control group ($n = 99$): 52.5%–47.5% 35.0–97.0,[3] 72.4 ± 12.3 Intervention group ($n = 84$): 57.1%–42.9% 19.0–90.0,[3] 70.6 ± 12.7	Control group: NEX Intervention group: -Hanson 2: (NEX × 0.38696) + 30.37	Chest X-ray; pH measurement of gastric aspirate
Fan et al. (28), Singapore	Observational, cross-sectional; tertiary hospital (medical and surgical ICUs and a neurosurgical ward)	Adult hospitalized patients requiring placement of an NG tube; $n = 92$	58.7%–41.3% 20.0–88.0, 63.0	NEX -Hanson 1: [(NEX − 50)/2] + 50 GWNUF XEN + 10 cm (EX + XU) − NE	Chest X-ray
Torsy et al. (19), Belgium	Observational, cross-sectional; general hospital (with general ICU)	Adult ICU patients requiring placement of an NG tube; medical indication for tube feeding; $n = 199$	62.8%–37.2% 26.0–92.0,[3] 69.5 ± 12.9	(NEX × 0.38696) + 30.37 + 6 cm	Chest X-ray; pH measurement of gastric aspirate
Taylor (29), United Kingdom	Observational, cross-sectional; general hospital (Department of Nutrition and Dietetics)	Adult ICU patients requiring placement of an NG tube; $n = 193$	72.0%–28.0% 53.3 [38.1–69.0]	NEX (or XEN) -Hanson 1: [(NEX − 50)/2] + 50 (NEX × 0.38696) + 30.37 + 6 cm XEN + 10 cm	Electromagnetic tracking of the tube path

結果摘要

TABLE 4 (*Continued*)

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results: Main outcomes	Results: Adverse events	Comments
Torsy et al. (19), Belgium	LES - Tip >3 cm below. pH cutoff: ≤5.0	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:** Method: (NEX × 0.38696) + 30.37 + 6 cm (mean ± SD: 56.72 ± 1.44 cm) <3 cm $n = 0$ (0%) 3–10 cm $n = 75$ (37.7%) >10 cm $n = 124$ (62.3%) **Gastric aspirate:** $n = 155$ of 199 (77.9%) 3–10 cm $n = 56$ >10 cm $n = 99$	<3 cm $n = 0$ (0%)	- Patient in supine position; chest at an elevation angle of 10–30°; facing forward. - Obtainment of gastric aspirate within 2 h after placement/repositioning.
Taylor (29), United Kingdom	GEJ - Tip reaching gastric body flexure, not below pyloric flexure; - Tip at leftmost position (visible on anterior view when using real-time EM tracking).	*1)* Tip positioning *2)* Intraesophageal placement; intestinal placement	Method 1: NEX (or "XEN") Pre–gastric body $n = 157$ (81.3%) Between gastric body and pylorus $n = 7$ (3.6%) Method 2 (Hanson 1): [(NEX – 50)/2] + 50 Pre–gastric body flexure $n = 163$ (84.5%) Between gastric body and pylorus $n = 1$ (0.5%) Method 3: (NEX × 0.38696) + 30.37 + 6 cm Pre–gastric body flexure $n = 166$ (86.0%) Between gastric body and pylorus $n = 25$ (13.0%) Method 4: XEN + 10 cm Pre–gastric body flexure $n = 82$ (42.5%) Between gastric body and pylorus $n = 106$ (54.9%)	**Intraesophageal placement:** = pre-GEJ Method 1: $n = 29$ (15.0%) Method 2: $n = 29$ (15.0%) Method 3: $n = 1$ (0.5%) Method 4: $n = 0$ (0.0%) Intestinal placement = transpyloric Method 1: $n = 0$ (0.0%) Method 2: $n = 0$ (0.0%) Method 3: $n = 1$ (0.5%) Method 4: $n = 5$ (2.6%)	- Patient in supine position; chest at an elevation angle of 10–30°.

不良反應總結—放置食道內

- 8 篇文章 (8, 16, 18, 19, 22, 25, 27–29)

方法	錯誤放置食道比例	
NEX	18.3%	(92/502)
Hanson 1	10.7%	(40/373)
Hanson 2	11.3%	(23/203)
Hanson 3	2.88%	
GX	100%	(30/30)
GU	53.3%	(16/30)
GWNUF	7.89%	(6/76)
(NEX × 0.38696) + 30.37 + 6 cm	0.22%	(1/450)
NEX + 10 cm	0%	

不良反應總結—放置十二指腸內

- 2 篇文章

方法	錯誤放置十二指腸比例	
NEX + 10 cm	2.6%	(5/193)
(NEX × 0.38696) + 30.37 + 6	0.5%	(1/200)

結論

Conclusion

Ten methods to determine the internal length of an NG tube before blind placement have been identified from the scientific literature. None of them, including NEX, is 100% accurate in determining the correct internal length when a correct gastric tip position is sought (i.e., all lateral holes of the distal end of the NG tube in the stomach). However, NEX + 10 cm and (NEX × 0.38696) + 30.37 + 6 cm can potentially result in >95% accuracy. Because of the longer mean internal tube length than (NEX × 0.38696) + 30.37 + 6 cm, NEX + 10 cm should be carefully considered because it increases the risk of coiling back toward the esophagus or extension of the tube beyond the pylorus into the duodenum. In addition, blind placement of an NG tube using any method to determine internal tube length without additional evaluation of tube tip position by chest radiography or pH measurement of gastric aspirate cannot be considered safe. Use of any of these 10 methods to determine internal NG tube length does not reduce the risk of pulmonary intubation.

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FAITH 系統性
文獻回顧
快速評讀

PICO搜尋

Nasogastric tube	"intubation, gastrointestinal"[MeSH Terms] OR "enteral nutrition"[MeSH Terms] OR "nasogastric tube*"[tiab] OR "ng tube*"[tiab] OR "nasogastric feeding tube*"[tiab] OR "gastric feeding tube*"[tiab] OR "tube gastric feeding"[tiab] OR "feeding tube gastric"[tiab] OR "gastrointestinal intubation*"[tiab] OR "intubation gastrointestinal"[tiab] OR "nasogastric intubat*"[tiab] OR "intubation nasogastric"[tiab] OR "gastric tube*"[tiab] OR "feeding tube*"[tiab] OR "gastric probe*"[tiab] OR "feeding probe*"[tiab] OR ("gastrointestin*"[tiab] AND ("intubated"[tiab] OR "intubation*"[tiab])) OR "stomach intubation*"[tiab] OR "gastric intubate*"[tiab] OR "stomach probe*"[tiab]
AND	
Length determination	("length*"[tiab] OR "size*"[tiab] OR "diameter*"[tiab] OR "width"[tiab] OR "depth*"[tiab]) AND ("determin*"[tiab] OR "measurability"[tiab] OR "measurable"[tiab] OR "measurably"[tiab] OR "measure*"[tiab] OR "measuring*"[tiab] OR "weights and measures"[MeSH Terms] OR "estimability"[tiab] OR "estimable"[tiab] OR "estimate*"[tiab] OR "estimating"[tiab] OR "estimation*"[tiab] OR "estimator*"[tiab])
AND	
Adults (not children)	("Adult"[Mesh] OR adult*[tiab] OR man[tiab] OR men[tiab] OR woman[tiab] OR women[tiab]) NOT ("Adolescent"[Mesh] OR "Child"[Mesh] OR "Infant"[Mesh] OR adolescen*[tiab] OR child*[tiab] OR schoolchild*[tiab] OR infant*[tiab] OR girl*[tiab] OR boy*[tiab] OR teen[tiab] OR teens[tiab] OR teenager*[tiab] OR youth*[tiab] OR pediatr*[tiab] OR paediatr*[tiab] OR puber*[tiab] OR neonat*[tiab] OR newborn*[tiab])

- 文獻檢索：Web of Science
- 翻閱會議記錄、研討會紀錄

F - 研究是否找到 (Find) 所有相關證據？

搜尋文獻納入標準

- 原始研究文獻
- 研究參與者≥ 18歲
- 使用語言:英文、德文、法文
- 結果有列出鼻胃管放置正確率、放置長度比較

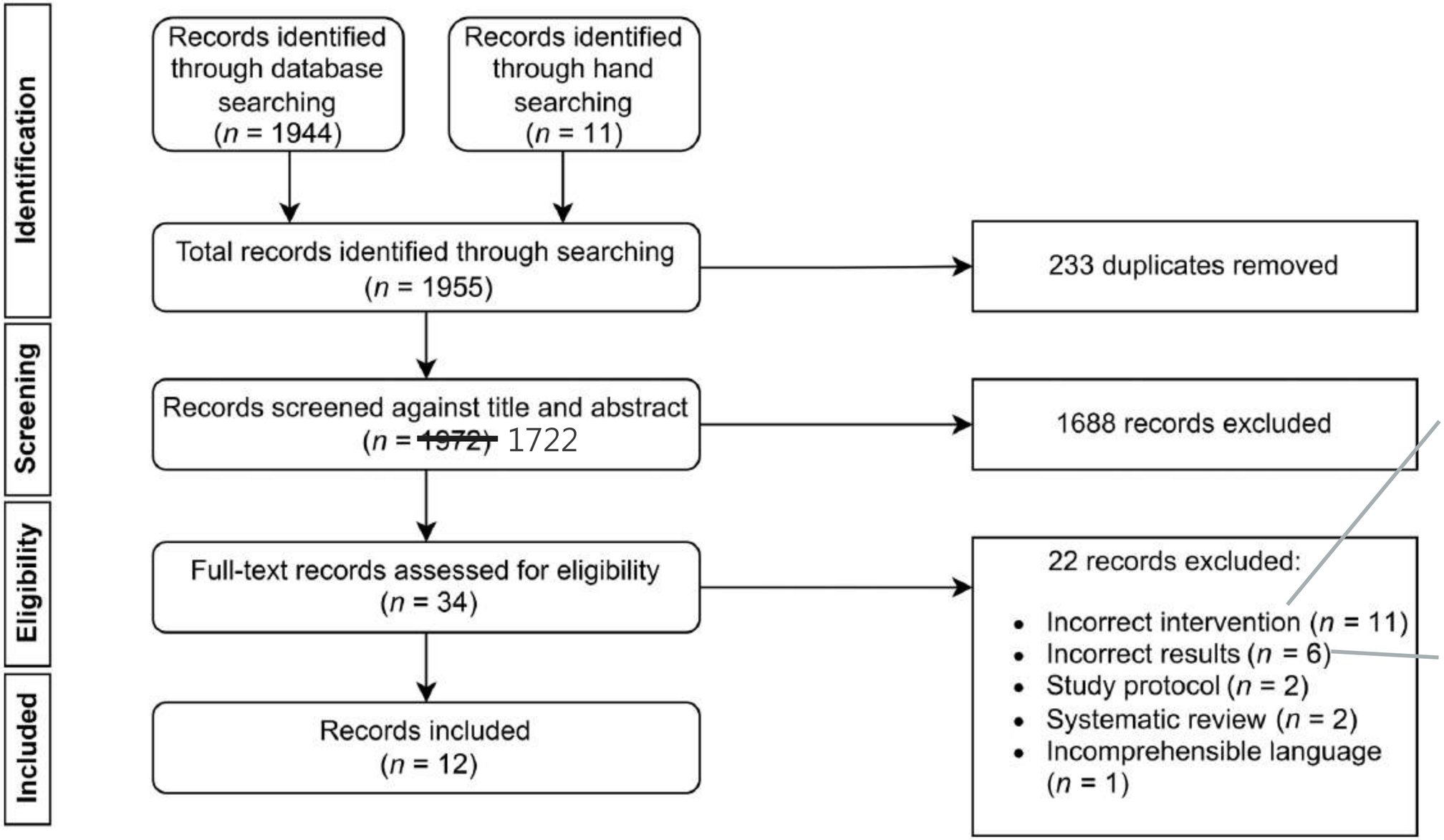
搜尋文獻排除標準

- Systematic reviews
- 參與者包含小孩、嬰兒
- 沒有充足的結果，包含鼻胃管正確放置率、放置長度比較

檢索流程

看標題 → 看摘要 → 看整篇、參考文獻

看參考文獻，找出潛在文獻



沒有呈現
鼻胃管放置長度
測量方式

沒有呈現
鼻胃管
正確放置率

FIGURE 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart of the different phases of the study selection.

F -
研究是否
找到 (Find)
所有相關證據？

評讀結果：☑是　☐否　☐不清楚

A - 文獻是否經過嚴格評讀 (Appraisal) ?

SEARCH

使用version 2 of the Cochrane risk-of-bias tool (RoB 2)

TABLE 2 Risk-of-bias quality assessment of the included randomized controlled trials[1]

Cochrane risk-of-bias tool	Bias arising from randomization process	Bias due to deviations from intended intervention	Bias due to missing outcome data	Bias in measurement of the outcome	Bias in selection of the reported result
Torsy et al. (16)	Low	Low	Low	Low	Low

使用Cross Sectional Studies：JBI[1] Critical Appraisal Checklist

TABLE 1 Risk-of-bias quality assessment of the included observational studies[1]

JBI critical appraisal checklist for cross-sectional studies	Inclusion criteria clearly defined?	Study subjects and setting described in detail?	Exposure measured in a valid and reliable way?	Objective, standard criteria used for measurement of the condition?	Confounding factors identified?	Strategies to deal with confounding factors stated?	Outcomes measured in a valid and reliable way?	Appropriate statistical analysis used?
Hanson (18)	N	N	Y	Y	Y	Y	Y	Y
Hanson (25)	N	N	Y	Y	N	N	Y	U
Cirgin Ellett et al. (8)	Y	Y	Y	Y	Y	Y	Y	Y
Malta et al. (20)	Y	Y	Y	Y	Y	Y	Y	Y
Chen et al. (27)	Y	Y	Y	Y	Y	Y	Y	Y
Taylor et al. (21)	U	Y	Y	Y	Y	Y	U	Y
Klos et al. (26)	N	N	U	U	N	N	Y	Y
Torsy et al. (22)	N	N	Y	Y	N	N	Y	U
Fan et al. (28)	Y	Y	Y	Y	N	N	Y	Y
Torsy et al. (19)	Y	Y	Y	Y	Y	Y	Y	Y
Taylor (29)	Y	Y	Y	Y	Y	Y	U	Y

1. JBI：Joanna Briggs Institute

評讀流程

兩位審查者

各別評讀

討論

意見分歧，
討論是否可以取得共識

納入第三意見

無法取得共識時，
尋求第三者審查

A - 文獻是否經過嚴格評讀(Appraisal)？

評讀結果：☑是　☐否　☐不清楚

I -
是否只納入
(Included)
良好效度的文章？

使用version 2 of the Cochrane risk-of-bias tool (RoB 2)

整體bias
=bias最差的類別分級

TABLE 2 Risk-of-bias quality assessment of the included randomized controlled trials[1]

Cochrane risk-of-bias tool	Bias arising from randomization process	Bias due to deviations from intended intervention	Bias due to missing outcome data	Bias in measurement of the outcome	Bias in selection of the reported result	Overall risk of bias[2]	JBI level of evidence
Torsy et al. (16)	Low	Low	Low	Low	Low	Low	1.c

RCT

Score, % Y	Risk of bias
≤49%	High
50% ~ 69%	Moderate
>70%	Low

3篇high risk
8篇low risk

Score, % Y	Risk of bias[2]	JBI level of evidence
75.0	Low	3.e
37.5	High	3.e
100.0	Low	3.e
100.0	Low	3.e
100.0	Low	3.e
75.0	Low	3.e
25.0	High	3.e
37.5	High	3.e
75.0	Low	3.e
100.0	Low	3.e
87.5	Low	3.e

ational study
a control group

兩審查者類別項目評分一致性：中等

整體κ = 0.61
95% CI: 0.25, 0.97
P = 0.002

Interpretation of Cohen's kappa.

Value of Kappa	Level of Agreement	% of Data that are Reliable
0–.20	None	0–4%
.21–.39	Minimal	4–15%
.40–.59	Weak	15–35%
.60–.79	Moderate	35–63%
.80–.90	Strong	64–81%
Above.90	Almost Perfect	82–100%

McHugh M. L. (2012). Interrater reliability: the kappa statistic. *Biochemia medica*, *22*(3), 276 – 282.

I - 是否只納入 (Included) 良好效度的文章？

評讀結果：☐是　☑否　☐不清楚

T -
作者是否以表格和
圖表「總結」
(Total up)
試驗結果？

結果摘要

TABLE 4 Summaryof findings[1]

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results		Comments
			Main outcomes	Adverse events	
Hanson (18, 25), USA	LES At distal margin of it (tip 1–10 cm below); In gastric fundus or body	1) Tip positioning 2) Intraesophageal placement[3]	Method 1: NEX 1–10 cm $n = 75$ (72.12%) >10 cm $n = 27$ (25.96%) Method 2 (Hanson 1): [(NEX − 50)/2] + 50 1–10 cm $n = 95$ (91.35%) >10 cm $n = 6$ (5.77%) Method 3 (Hanson 2): (NEX × 0.38696) + 30.37 1–10 cm $n = 96$ (92.30%) >10 cm $n = 4$ (3.85%) Method 4 (Hanson 3): (body length × 0.20239) + 17.07 1–10 cm $n = 100$ (96.15%) >10 cm $n = 1$ (0.97%)	Method 1: <1 cm $n = 2$ (1.92%) Method 2: <1 cm $n = 3$ (2.88%) Method 3: <1 cm $n = 4$ (3.85%) Method 4: <1 cm $n = 3$ (2.88%)	- Patient in supine position; bed horizontal
Cirgin Ellett et al. (8), USA	LES At distal margin of it (tip 3–10 cm below); In gastric fundus or body	1) Tip positioning 2) Intraesophageal placement	Method 1: GWNUF $R^2 = 0.61$; 95% CI: 0.49, 0.73 3–10 cm $n = 65$ (85.5%); 95% CI: 0.75, 0.92 >10 cm $n = 5$ (6.6%) Method 2 (Hanson 1): [(NEX − 50)/2] + 50 $R^2 = 0.22$; 95% CI: 0.09, 0.43 3–10 cm $n = 57$ (75.0%); 95% CI: 0.64, 0.84 >10 cm $n = 11$ (14.5%) Method 3: NEX $R^2 = 0.22$, 95% CI: 0.09, 0.43 3–10 cm $n = 55$ (72.4%); 95% CI: 0.61, 0.82 >10 cm $n = 9$ (11.8%)	Method 1: <3 cm $n = 6$ (7.89%) Method 2: <3 cm $n = 8$ (10.5%) Method 3: <3 cm $n = 12$ (15.8%)	- Patient in supine position; bed horizontal; without pillow
Malta et al. (20), Brazil	GEJ - At distal margin of LES (tip 1–10 cm below).[4]	*1*) Tip positioning *2*) NR Not report	Method: (EX + XU) − NE (mean ± SD: 39.5 ± 3.17 cm) Significantly positively correlated with the variance in the distance as measured by EGD ($r = 0.651$, $P < 0.001$) Contr.: EGD (mean ± SD: 40.8 ± 3.16 cm)		- External measurements: patient in supine position; head erect and in rest position aligned to the trunk. - Internal measurement: patient in left lateral decubitus with slight vertical flexion, head aligned at the shoulders with legs slightly flexed.

(*Continued*)

結果摘要

TABLE 4 *(Continued)*

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results: Main outcomes	Results: Adverse events	Comments
Chen et al. (27), Taiwan (China)	GEJ - Tip ≥9.5 cm below; - In gastric cardia.	*1)* Tip positioning *2)* Intraesophageal placement	Method 1: NEX (mean ± SD: 51.2 ± 2.99 cm) $R^2 = 0.16$, 95% CI: −0.04, 0.35 ≥9.5 cm $n = 1$ (3.3%) Method 2: GX (mean ± SD: 40.3 ± 2.65 cm) $R^2 = 0.30$, 95% CI: 0.08, 0.52 ≥9.5 cm $n = 0$ (0%) Method 3: GU (mean ± SD: 55.9 ± 3.46 cm) $R^2 = 0.09$, 95% CI: −0.06, 0.25 ≥9.5 cm $n = 14$ (46.7%)	Method 1: <9.5 cm $n = 29$ (96.7%) ≥1 lateral hole in esophagus and stomach $n = 14$ of 29 0 lateral holes through GEJ $n = 15$ of 29 Method 2: <9.5 cm $n = 30$ (100.0%) 0 lateral holes through GEJ $n = 30$ of 30 Method 3: <9.5 cm $n = 16$ (53.3%).	- No details reported about patient position during NG tube placement procedure. - All participants ($n = 30$) were of Han Chinese race and may have had relatively shorter stature, bony structure, or less prominent facial features.
Taylor et al. (21), United Kingdom	GEJ - Tip reaching the gastric body (mid-stomach); - Tip at leftmost position (visible on anterior view when using real-time EM tracking). pH cutoff: ≤5.0	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:** Gastric body (mean ± SD: 62.3 ± 5.7 cm) Gastric antrum (mean ± SD: 73.4 ± 7.0 cm) Method 1: XEN (mean ± SD: 50.7 ± 4.0 cm) MD: −11.6 cm (95% CI: −12.9, −10.2 cm), $P < 0.001$ Method 2: XEN + 10 cm MD: −1.6 cm (95% CI: −2.9, −0.2 cm), $P = 0.02$ **Gastric aspirate:** $n = 20$ of 70 (28.6%)	**Intraesophageal placement:** = pre-GEJ (mean ± SD: 48.2 ± 3.2 cm) Method 1: XEN MD: +2.5 cm Method 2: XEN + 10 cm MD: +14.1 cm	- No details reported about patient position during NG tube placement procedure. - At completion of placement, all tubes were confirmed as having reached the stomach by ≥1 methods: X-ray (64.0%), pH ≤ 5.0 (28.6%), and subsequent intestinal EM trace (64%).
Klos et al. (26), Netherlands	LES[5] - Tip 1–10 cm below;[5] - In gastric fundus or body.[5] pH cutoff: ≤5.5	*1)* Tip positioning; gastric aspirate *2)* NR	**Tip positioning:** Method 1: NEX (mean: 54.21 cm, SD: NR) Method 2 (Hanson 2): (NEX × 0.38696) + 30.37 (mean: 51.33 cm, SD: NR) **Gastric aspirate:** Actual insertion length until gastric aspirate was obtained (mean: 56.85 cm, SD: NR) Method 2: (NEX × 0.38696) + 30.37 $n = 24$ of 108 (22.2%)		- Patient in supine position; chest at an elevation angle of 10–30°; facing forward.[5] - Obtainment of gastric aspirate within 1 h after placement.[5]

(Continued)

結果摘要

TABLE 4 Summaryof findings[1]

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results		Comments
			Main outcomes	Adverse events	
Hanson (18, 25), USA	LES At distal margin of it (tip 1–10 cm below); In gastric fundus or body	1) Tip positioning 2) Intraesophageal placement[3]	Method 1: NEX 1–10 cm $n = 75$ (72.12%) >10 cm $n = 27$ (25.96%) Method 2 (Hanson 1): [(NEX – 50)/2] + 50 1–10 cm $n = 95$ (91.35%) >10 cm $n = 6$ (5.77%) Method 3 (Hanson 2): (NEX × 0.38696) + 30.37 1–10 cm $n = 96$ (92.30%) >10 cm $n = 4$ (3.85%) Method 4 (Hanson 3): (body length × 0.20239) + 17.07 1–10 cm $n = 100$ (96.15%) >10 cm $n = 1$ (0.97%)	Method 1: <1 cm $n = 2$ (1.92%) Method 2: <1 cm $n = 3$ (2.88%) Method 3: <1 cm $n = 4$ (3.85%) Method 4: <1 cm $n = 3$ (2.88%)	- Patient in supine position; bed horizontal
Cirgin Ellett et al. (8), USA	LES At distal margin of it (tip 3–10 cm below); In gastric fundus or body	1) Tip positioning 2) Intraesophageal placement	Method 1: GWNUF $R^2 = 0.61$; 95% CI: 0.49, 0.73 3–10 cm $n = 65$ (85.5%); 95% CI: 0.75, 0.92 >10 cm $n = 5$ (6.6%) Method 2 (Hanson 1): [(NEX – 50)/2] + 50 $R^2 = 0.22$; 95% CI: 0.09, 0.43 3–10 cm $n = 57$ (75.0%); 95% CI: 0.64, 0.84 >10 cm $n = 11$ (14.5%) Method 3: NEX $R^2 = 0.22$, 95% CI: 0.09, 0.43 3–10 cm $n = 55$ (72.4%); 95% CI: 0.61, 0.82 >10 cm $n = 9$ (11.8%)	Method 1: <3 cm $n = 6$ (7.89%) Method 2: <3 cm $n = 8$ (10.5%) Method 3: <3 cm $n = 12$ (15.8%)	- Patient in supine position; bed horizontal; without pillow
Malta et al. (20), Brazil	GEJ - At distal margin of LES (tip 1–10 cm below).[4]	*1)* Tip positioning *2)* NR	Method: (EX + XU) – NE (mean ± SD: 39.5 ± 3.17 cm) Significantly positively correlated with the variance in the distance as measured by EGD ($r = 0.651$, $P < 0.001$) Contr.: EGD (mean ± SD: 40.8 ± 3.16 cm)		- External measurements: patient in supine position; head erect and in rest position aligned to the trunk. - Internal measurement: patient in left lateral decubitus with slight vertical flexion, head aligned at the shoulders with legs slightly flexed.

(Continued)

結果摘要

TABLE 4 (*Continued*)

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results: Main outcomes	Results: Adverse events	Comments
Chen et al. (27), Taiwan (China)	GEJ - Tip ≥9.5 cm below; - In gastric cardia.	*1)* Tip positioning *2)* Intraesophageal placement	Method 1: NEX (mean ± SD: 51.2 ± 2.99 cm) $R^2 = 0.16$, 95% CI: −0.04, 0.35 ≥9.5 cm $n = 1$ (3.3%) Method 2: GX (mean ± SD: 40.3 ± 2.65 cm) $R^2 = 0.30$, 95% CI: 0.08, 0.52 ≥9.5 cm $n = 0$ (0%) Method 3: GU (mean ± SD: 55.9 ± 3.46 cm) $R^2 = 0.09$, 95% CI: −0.06, 0.25 ≥9.5 cm $n = 14$ (46.7%)	Method 1: <9.5 cm $n = 29$ (96.7%) ≥1 lateral hole in esophagus and stomach $n = 14$ of 29 0 lateral holes through GEJ $n = 15$ of 29 Method 2: <9.5 cm $n = 30$ (100.0%) 0 lateral holes through GEJ $n = 30$ of 30 Method 3: <9.5 cm $n = 16$ (53.3%).	- No details reported about patient position during NG tube placement procedure. - All participants ($n = 30$) were of Han Chinese race and may have had relatively shorter stature, bony structure, or less prominent facial features.
Taylor et al. (21), United Kingdom	GEJ - Tip reaching the gastric body (mid-stomach); - Tip at leftmost position (visible on anterior view when using real-time EM tracking). pH cutoff: ≤5.0	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:** Gastric body (mean ± SD: 62.3 ± 5.7 cm) Gastric antrum (mean ± SD: 73.4 ± 7.0 cm) Method 1: XEN (mean ± SD: 50.7 ± 4.0 cm) MD: −11.6 cm (95% CI: −12.9, −10.2 cm), $P < 0.001$ Method 2: XEN + 10 cm MD: −1.6 cm (95% CI: −2.9, −0.2 cm), $P = 0.02$ **Gastric aspirate:** $n = 20$ of 70 (28.6%)	**Intraesophageal placement:** = pre-GEJ (mean ± SD: 48.2 ± 3.2 cm) Method 1: XEN MD: +2.5 cm Method 2: XEN + 10 cm MD: +14.1 cm	- No details reported about patient position during NG tube placement procedure. - At completion of placement, all tubes were confirmed as having reached the stomach by ≥1 methods: X-ray (64.0%), pH ≤ 5.0 (28.6%), and subsequent intestinal EM trace (64%).
Klos et al. (26), Netherlands	LES[5] - Tip 1–10 cm below;[5] - In gastric fundus or body.[5] pH cutoff: ≤5.5	*1)* Tip positioning; gastric aspirate *2)* NR	**Tip positioning:** Method 1: NEX (mean: 54.21 cm, SD: NR) Method 2 (Hanson 2): (NEX × 0.38696) + 30.37 (mean: 51.33 cm, SD: NR) **Gastric aspirate:** Actual insertion length until gastric aspirate was obtained (mean: 56.85 cm, SD: NR) Method 2: (NEX × 0.38696) + 30.37 $n = 24$ of 108 (22.2%)		- Patient in supine position; chest at an elevation angle of 10–30°; facing forward.[5] - Obtainment of gastric aspirate within 1 h after placement.[5]

(*Continued*)

結果摘要

TABLE 4 *(Continued)*

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results: Main outcomes	Results: Adverse events	Comments
Torsy et al. (22), Belgium	LES - Tip > 3 cm below. pH cutoff: ≤5.5.[6]	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:**[7] Method: (NEX × 0.38696) + 30.37 + 6 cm (mean ± SD: 56.62 ± 1.44 cm) 3–10 cm $n = 38$ (65.5%) >10 cm $n = 20$ (34.5%) **Gastric aspirate:** $n = 40$ of 58 (69.0%)	<3 cm $n = 0$ (0%).	- Patient in supine position; chest at an elevation angle of 10–30°; facing forward. - Obtainment of gastric aspirate within 1 h after placement.
Torsy et al. (16), Belgium	LES - Tip 3–10 cm below; - In gastric fundus or body. pH cutoff: ≤5.5	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:** Exp. (Hanson 2): (NEX × 0.38696) + 30.37 (mean ± SD: 50.5 ± 1.62 cm) 3–10 cm $n = 61$ of 84 (72.6%) >10 cm $n = 4$ of 84 (4.8%) Contr.: NEX (mean ± SD: 51.62 ± 3.79 cm) 3–10 cm $n = 62$ of 99 (62.6%), $P = 0.151$ >10 cm $n = 17$ of 99 (17.2%), $P = 0.009$ **Obtaining gastric aspirate:** Exp.: (NEX × 0.38696) + 30.37 $n = 47$ of 84 (56.0%) Contr.: NEX $n = 55$ of 99 (55.6%), $P = 0.938$	Exp.: <3 cm $n = 19$ of 84 (22.6%) Contr.: <3 cm $n = 20$ of 99 (20.2%), $P = 0.691$	- Patient in supine position; chest at an elevation angle of 10–30°; facing forward. - Obtainment of gastric aspirate within 1 h after placement.
Fan et al. (28), Singapore	GEJ - Tip in the middle or lower third of the stomach (= in gastric fundus or body).	*1)* Tip positioning *2)* Intraesophageal placement; intestinal placement[8]	**Tip positioning according to hospital protocol:** Mean ± SD: 61.7 ± 5.27 cm Middle/lower third $n = 25$ of 92 (27.2%) **Optimal position:** Method 1 (Hanson 1) ($n = 25$): [(NEX − 50)/2] + 50 Mean ± SD: 50.2 ± 2.16 cm MD: −11.5 cm, SD: 5.67 cm, range: −22.5 to 0.8 cm Method 2 ($n = 23$): GWNUF Mean ± SD: 46.6 ± 3.35 cm MD: −15.2 cm, SD: 6.00 cm, range: −28.5 to −4 cm Method 3 ($n = 25$): XEN + 10 cm Mean ± SD: 59.9 ± 4.58 cm MD: −1.8 cm, SD: 7.6 cm, range: −22 to 14 cm Method 4 ($n = 23$): (EX + XU) − NE Mean ± SD: 38.2 ± 4.94 cm MD: −23.6 cm, SD: 7.28 cm, range: −37 to −10.5 cm Method 5 ($n = 92$): NEX Mean ± SD: 50.4 ± 4.34 cm MD: −11.3 cm, SD: 6.79 cm, range: −22 to 4 cm ($n = 25$)	**Intraesophageal placement:** = upper one-third; at or just below GEJ According to hospital protocol: $n = 13$ Method 3: (XEN + 10 cm) Within 3-cm difference of tip positioning: according to hospital protocol $n = 7$ of 13 (53.8%) **Intestinal placement:** = into duodenum According to hospital protocol: $n = 4$ of 54 Method 3: (XEN + 10 cm) Within 3-cm difference of tip positioning: according to hospital protocol $n = 16$ of 54 (29.6%).	- The vast majority of participants (69.6%) were of Han Chinese race and may have had relatively shorter stature, bony structure, or less prominent facial features. - No details reported about patient position during NG tube placement procedure.

(Continued)

結果摘要

TABLE 4 (*Continued*)

Authors, country	Anatomical reference point, requirements for correct NG tube tip positioning[2]	Outcomes1) Main outcomes2) Adverse events	Results: Main outcomes	Results: Adverse events	Comments
Torsy et al. (19), Belgium	LES - Tip >3 cm below. pH cutoff: ≤5.0	*1)* Tip positioning; gastric aspirate *2)* Intraesophageal placement	**Tip positioning:** Method: (NEX × 0.38696) + 30.37 + 6 cm (mean ± SD: 56.72 ± 1.44 cm) <3 cm $n = 0$ (0%) 3–10 cm $n = 75$ (37.7%) >10 cm $n = 124$ (62.3%) **Gastric aspirate:** $n = 155$ of 199 (77.9%) 3–10 cm $n = 56$ >10 cm $n = 99$	<3 cm $n = 0$ (0%)	- Patient in supine position; chest at an elevation angle of 10–30°; facing forward. - Obtainment of gastric aspirate within 2 h after placement/repositioning.
Taylor (29), United Kingdom	GEJ - Tip reaching gastric body flexure, not below pyloric flexure; - Tip at leftmost position (visible on anterior view when using real-time EM tracking).	*1)* Tip positioning *2)* Intraesophageal placement; intestinal placement	Method 1: NEX (or "XEN") Pre–gastric body $n = 157$ (81.3%) Between gastric body and pylorus $n = 7$ (3.6%) Method 2 (Hanson 1): [(NEX – 50)/2] + 50 Pre–gastric body flexure $n = 163$ (84.5%) Between gastric body and pylorus $n = 1$ (0.5%) Method 3: (NEX × 0.38696) + 30.37 + 6 cm Pre–gastric body flexure $n = 166$ (86.0%) Between gastric body and pylorus $n = 25$ (13.0%) Method 4: XEN + 10 cm Pre–gastric body flexure $n = 82$ (42.5%) Between gastric body and pylorus $n = 106$ (54.9%)	**Intraesophageal placement:** = pre-GEJ Method 1: $n = 29$ (15.0%) Method 2: $n = 29$ (15.0%) Method 3: $n = 1$ (0.5%) Method 4: $n = 0$ (0.0%) Intestinal placement = transpyloric Method 1: $n = 0$ (0.0%) Method 2: $n = 0$ (0.0%) Method 3: $n = 1$ (0.5%) Method 4: $n = 5$ (2.6%)	- Patient in supine position; chest at an elevation angle of 10–30°.

T -
作者是否以表格和圖表「總結」(Total up) 試驗結果？

評讀結果：☑是　☐否　☐不清楚

H - 試驗的結果是否相近 - 異質性

(Heterogeneity) ?

試驗的結果是否相近 - 異質性 ？

- 各篇研究設計異質性高

  (鼻胃管長度測量方式、結果測量方式)

- 研究設計異質性高，故無執行meta analysis

H - 試驗的結果是否相近 - 異質性 (Heterogeneity) ?

評讀結果：☐是　☑否　☐不清楚

評讀項目	評讀結果
F－研究是否找到 (Find)所有相關證據？	☑是　☐否　☐不清楚
A－文獻是否經過嚴格評讀 (Appraisal)？	☑是　☐否　☐不清楚
I－是否只納入 (Included)良好效度的文章？	☐是　☑否　☐不清楚
T－作者是否以表格和圖表「總結」(Total up) 試驗結果？	☑是　☐否　☐不清楚
H - 試驗的結果是否相近 - 異質性 (Heterogeneity)？	☐是　☑否　☐不清楚

限制

- 納入作者自己的研究，影響結果的客觀性。
- 缺乏正確量測鼻胃管置入長度的評估依據，以及缺乏鼻胃管在身體內正確的置入長度的依據。
- 各篇文獻的研究設計差異大，包括樣本大小、參與者、測量方式和量測的結果，影響研究結果的真實性。

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結論

方法	NG尖端位置正確率	長度	NG尖端過幽門比率
NEX	72.4%		
NEX + 10 cm	97.4%	60.7 cm	2.6%
(NEX × 0.38696) + 30.37 + 6 cm	99.0%	56.7 cm	0.5%

- NEX + 10 cm 、 (NEX × 0.38696) + 30.37 + 6 cm 正確率>95%
- 所有方法都無法減少誤差入肺部的風險

臨床應用

運用文獻中NEX+10公分測量方式，

及CXR確認鼻胃管末端方式，

探討NEX+10公分此方法於臨床應用結果如下。

床號	材質	身高	NEX (目前院內規範)	臨床實際放置長度	X ray 測量長度	正確長度	NEX +10 (文獻方法)	實際長度 - 正確長度	NEX - 正確長度	NEX+10 - 正確長度
101	矽質 (8cm)	148	46	60	14.6	53.4	[illegible]	[illegible]	-7.4	2.6
102	矽質 (8cm)	157.2	52	65	11.6	61.4	62	3.6	-9.4	0.6
161	矽質 (8cm)	172	56	60	8.8	59.2	66	0.8	-3.2	6.8
171	矽質 (8cm)	145	45	55	10.3	52.7	55	2.3	-7.7	2.3
202	一般 (10cm)	150	48	60	12.6	57.4	58	2.6	-9.4	0.6
205	一般 (10cm)	142	47	55	13.8	51.2	57	3.8	-4.2	5.8

深度太淺問題

參考資料

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放置鼻胃管時是否贊成以「NEX+10cm」的測量方式，作為鼻胃管放置長度依據?

■ 同意：27人　　■ 尚有疑慮：0人　　■ 不同意： 0人

Thank you!