醫院管理局 HOSPITAL AUTHORITY

醫院管理局進修學院 Hospital Authority Institute of Health Care

Institute of Advanced Nursing Studies 護理深造學院

Nurse performed ultrasonography in confirming the position of nasogastric tube in the Emergency Department

A prospective single group diagnostic test study

Study team members:

Tai Pak Hong, Lau Wing Sze (RN/QEH)
Lam Yuen Cheung, Mak Hoi Ting,
Mak Yuen Ting, Mandy (RN/TKOH)
Chan Pui Yin, Ng Shuk Yee (RN/YCH)

Medical advisors:

Dr. Wong Chi Keung (COS/QEH)
Dr. Tsoi Chun Hing (SMO/TKOH)
Dr. Chung Chi Sum (SMO/YCH)

Nursing supervisors:

Ms. Yau Ching Ying (WM/QEH)
Mr. Wong Chi Yip (APN/QEH)
Mr. Leung Chun Pong (WM/TKOH)
Ms. Cheng Kwai Fa (NO/TKOH)
Ms. Yuen Yuk Yin (APN /YCH)
Mr. Yau Tai Loi (APN/YCH)

Background

Nurses' responsibility in verifying correct NG tube placement

NEWS • HONG KONG • MEDICAL

Elderly woman dies in Hong Kong hospital after feeding tube is mistakenly inserted into her lung

apologises and launches investigation

PUBLISHED : Friday, 05 September, 2014, 1:25pm
UPDATED : Saturday, 06 September, 2014, 3:46am

A spokesman for expressed regret for the woman's death.

SHARE

388 9

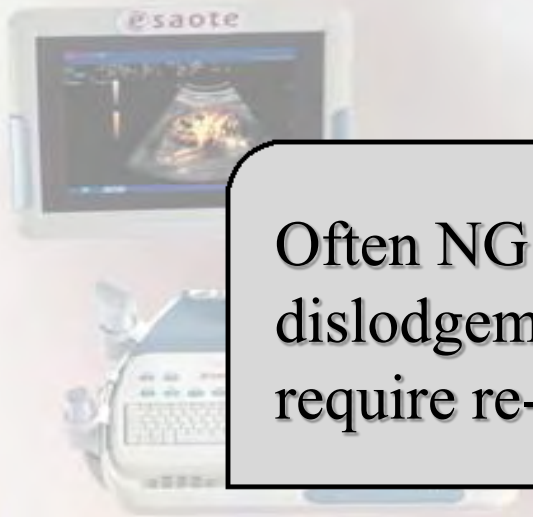
13

Background

Nurses' responsibility in verifying correct NG tube placement

- After insertion
- Right before feeding
- Suspected malposition

In AED



Often NG tube dislodgements require re-insertion.

Long stay require feeding

Present SOB with Hx of choking during feeding

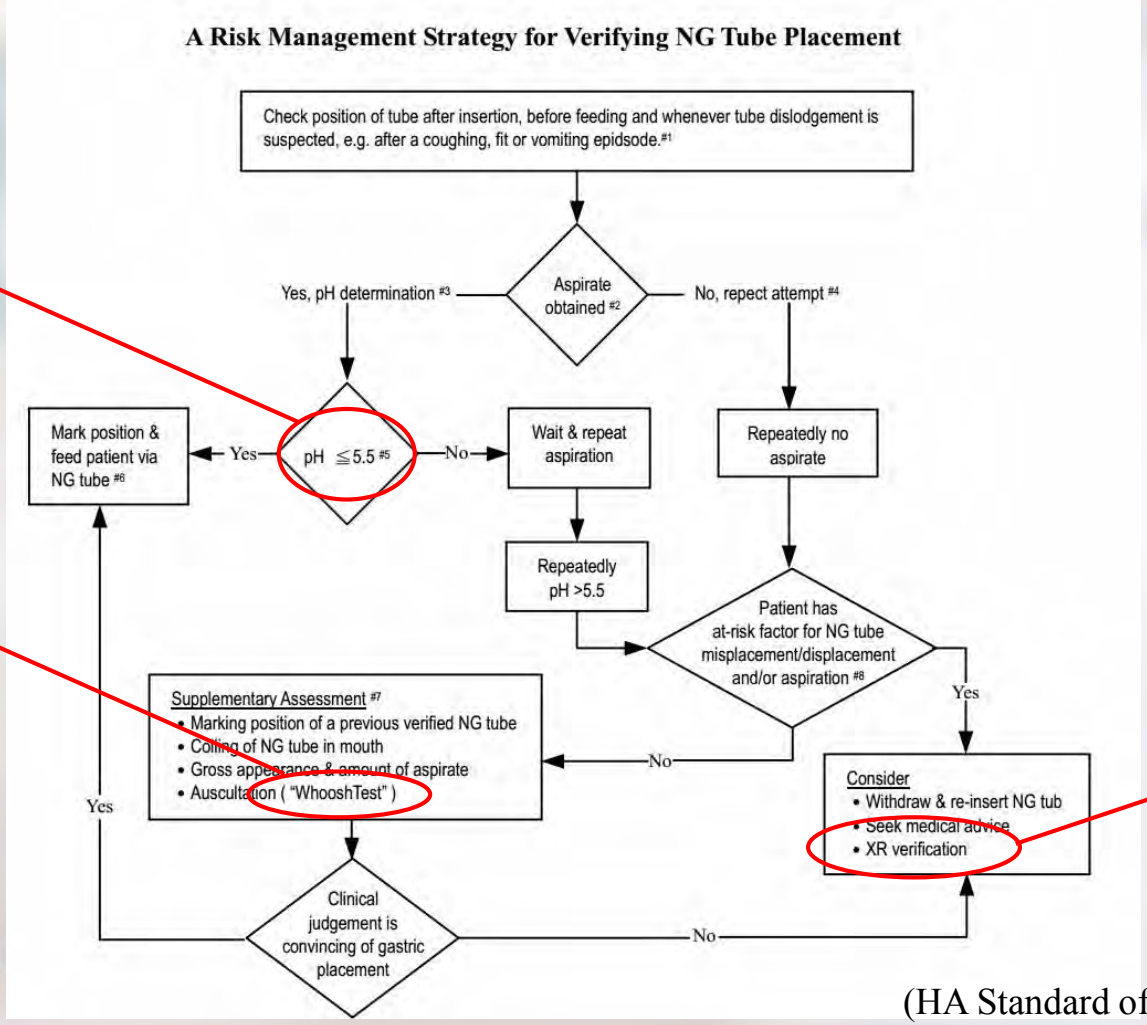
Background

Limitation of conventional methods

pH test of aspirates

Auscultation Test

X-Ray verification



(HA Standard of practice, 2006)

Background

Limitation of pH test – Low sensitivity

- **Acid-lowering medication (e.g.H2 blockers)**
- **Recently ingested food**
- **Alkali poisoned**

→ **False Negative**

Fail to aspirate gastric content for pH test

21.3% patients whose gastric content were not able to be aspirated (Kim et al., 2012).

Background

Limitation of Auscultation test – not have sufficient specificity

- **Small-bore NG tube** may not allow sufficient passage of the air
- **Air-bubbling in the pleura, lung or esophagus** (kim et al., 2012).

False Positive

Background

Limitation of X-Ray determination

Routine use of X-Ray is not practical

- Exposure to radiation
- Time and cost consumed
- Transporting manpower consumed

Any other option in verifying NG tube placement?

Background

Study purpose

Related foreign studies conducted in emergency center, ICU and prehospital settings (Kim et al, 2012, Chenaitia et al., 2012, Vigneau et al., 2005)

→ **Ultrasonography is useful for verifying gastric tube placement.**

ORIGINAL RESEARCH Open Access

The effectiveness of ultrasonography in verifying the placement of a nasogastric tube in patients with low consciousness at an emergency center

Hyung Min Kim[1], Byung Hak So[1], Won Jung Jeong[1], Se Min Choi[2] and Kyu Nam Park[3*]

Intensive Care Med (2005) 31:1570–1572
DOI 10.1007/s00134-005-2791-1

BRIEF REPORT

Cécile Vigneau
Jean-Luc Baudel
Bertrand Guidet
Georges Offenstadt
Eric Maury

Sonography as an alternative to radiography for nasogastric feeding tube location

Ultrasound to confirm gastric tube placement in prehospital management☆

Hichem Chenaitia[a,*], Pierre-Marie Brun[b], Emgan Querellou[b], Jérome Leyral[c], Jacques Bessereau[d], Christine Aimé[e], Renaud Bouaziz[e], Arnaud Georges[f], Fabrice Louis[f], WINFOCUS (World Interactive Network Focused On Critical Ultrasound) Group France

Background

Nurses performed ultrasound in emergency unit

Validation of nurse-performed FAST ultrasound

Justin Bowra [a,b,*], Sally Forrest-Horder [a], Erica Caldwell [a], Michelle Cox [a], Scott K. D'Amours [a,b]

[a] Departments of Emergency Medicine and Trauma, Liverpool Hospital, Sydney, NSW 2170, Australia
[b] Conjoint Senior Lecturer, University of New South Wales, Australia

ARTICLE INFO

Article history:
Accepted 10 August 2009

Keywords:
Nurse
Ultrasound
FAST
Trauma

ABSTRACT

Background: Patients presenting to Eme
FAST (Focused Assessment with Sonogr
credentialed in FAST; therefore occasi
Hence, the aim of this study was to d
alternative where suitably trained doc
Methods: This was a prospective study
whom abdominal injury was clinically s
FAST scans for each patient. Accuracy
with computerised tomography (CT) s
Results: 242 indicated nurse-performe
demonstrated sensitivity of 84.4% (95%
predictive value (PPV) of 94.2% (CI 83.1–

The ability of emergency nurses to detect simulated long bone fractures with portable ultrasound

Jason D. Heiner MD (Physician) *, Aaron M. Proffitt MD (Physician), Todd J. McArthur MD (Physician)

Department of Emergency Medicine, Madigan Army Medical Center, Tacoma, WA, United States

; accepted 27 August 2010

ency department (ED) diagnosis. Ultrasound is a useful tool to
ng bone fractures and can be performed by minimally trained
ility of ED nurses to sonographically detect long bone fractures
ing model. The fracture model consisted of a turkey long bone
ergency nurses examined five fracture models with a portable

Emergency Nurses' Utilization of Ultrasound Guidance for Placement of Peripheral Intravenous Lines in Difficult-access Patients

Larry Brannam, MD, RDMS, Michael Blaivas, MD, RDMS, Matthew Lyon, MD, RDMS, Michael Flake, RN

Abstract

Objectives: Emergency nurses (ENs) typically place peripheral intravenous (IV) lines, but if repeated attempts fail, emergency physicians have to obtain peripheral or central access. The authors describe the patient population for which ultrasound (US)-guided peripheral IVs are used and evaluate the success rates for such lines by ENs. **Methods:** This was a prospective observational study of ENs in a Level

collected in a five-month period no ENs declined to participate. There were 280 (87%) successful attempts. Twelve (29%) of the 41 failure patients required central lines, 9 (22%) received external jugular IVs, and 20 (49%) had peripheral IV access placed under US guidance by another nurse or physician. Twenty-eight percent (90) of all patients were obese, 18% (57) had sickle cell anemia, 10%

Background

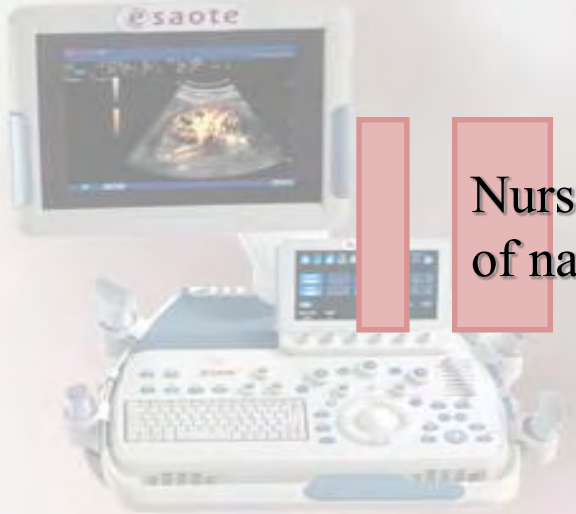
Potential Benefit to patient, department & nursing

Background

knowledge gap

Scanty data in local AED

Lack of validation of nurse performed ultrasonography in Hong Kong



Nurse performed ultrasonography in confirming the position of nasogastric tube in the Emergency Department

Research Design

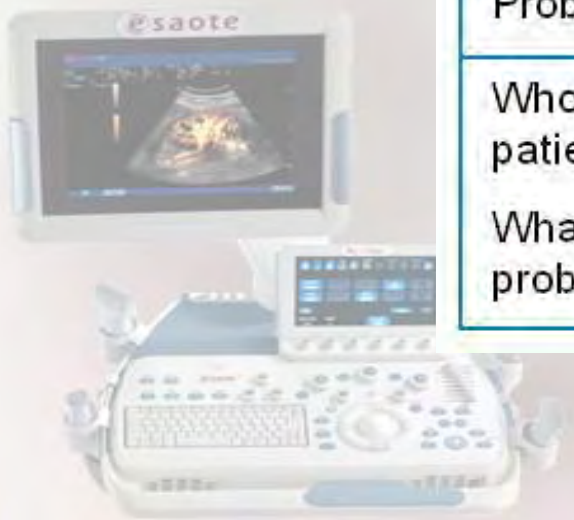
- Quantitative
- Prospective
- Cross-sectional
- Single Group Diagnostic test
  - One specific group of subjects: Patients with nasogastric tube.
- Single - blinded
  - Investigators are “blinded” from the position of the nasogastric tube

Research Strategy

PICO

- A framework for formulating research question
- A strategy for choosing research methodology

P	I	C	O
Population Patient Problem	Intervention Or Exposure	Comparison	Outcome
Who are the patients? What is the problem?	What do we do to them? What are they exposed to?	What do we compare the intervention with?	What happens? What is the outcome?



(Sackett et al, 1997)

Research Strategy

PICO

Patient

- **Inclusion criteria:**
  - ✓ Age ≥ 18
  - ✓ Patient / Legal Guardian able to read Chinese / English
  - ✓ **Patients with nasogastric tube** and require Chest x-ray / Abdominal x-ray or
  - ✓ **Patients require Chest / Abdominal x-ray** after insertion of nasogastric tube
  - ✓ Recruited from the AED of three local hospitals (QEH, TKOH, YCH)
  - ✓ Consecutive convenience sampling (Subjects were recruited when investigators on duty)

Research Strategy

PICO

Patient

- **Exclusion criteria:**
  - Patient with **unstable hemodynamic status**
  - Known history of nasopharyngeal carcinoma
  - Known history of fracture base of skull
  - Known history of surgical problems of the pharynx, larynx, trachea, esophagus or stomach
  - Patients with tracheostomy
  - Patients with Aortic Aneurysm
  - Pregnancy

Research Strategy

PICO

Intervention

- Nurse performed bedside ultrasonography scan to confirm the position of nasogastric tube

Interventions

Ultrasonography tests

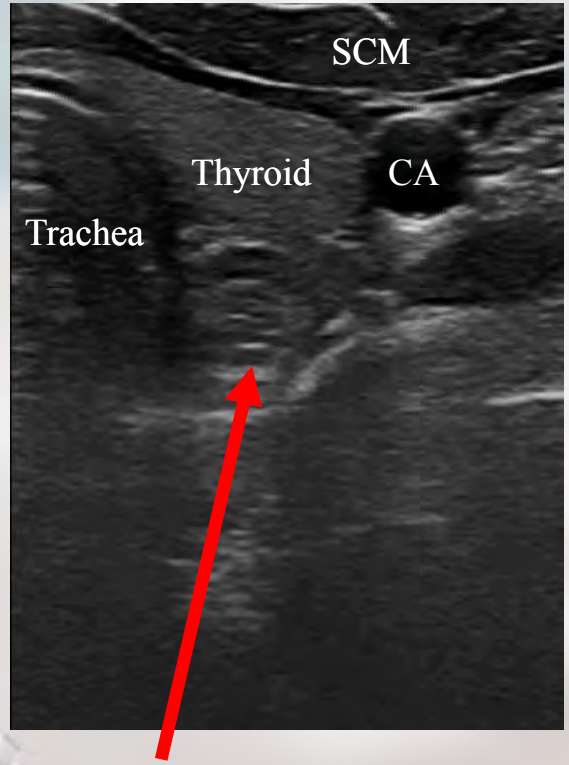
1. **Neck Scan:**
   - ✓ Acoustic Shadow over the esophagus region
2. **Epigastrium Scan:**
   - ✓ Acoustic shadow in epigastric region
3. **Air Injection test**
   - ✓ Hyperechogenic “foggng” in stomach by injecting air via the NG tube

(Kim et al., 2012)

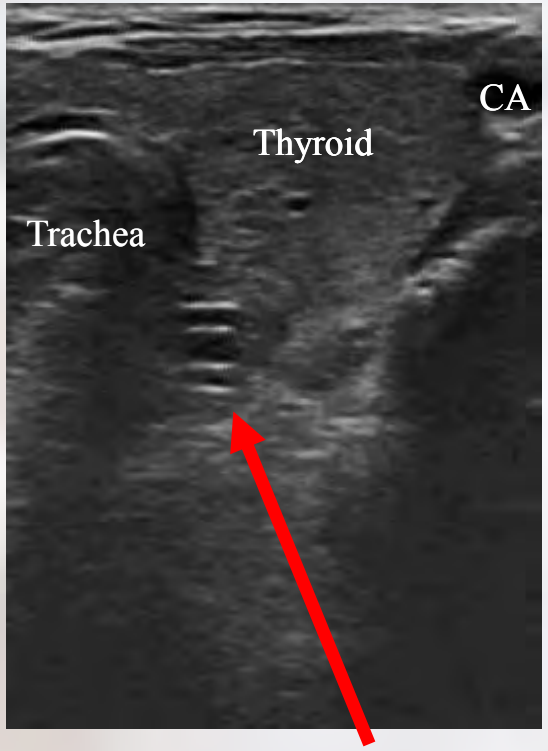
Interventions

Ultrasonography tests

- **Neck Scan – Transverse Scan:**



Normal esophagus



Esophagus with NG tube

Interventions

Ultrasonography tests

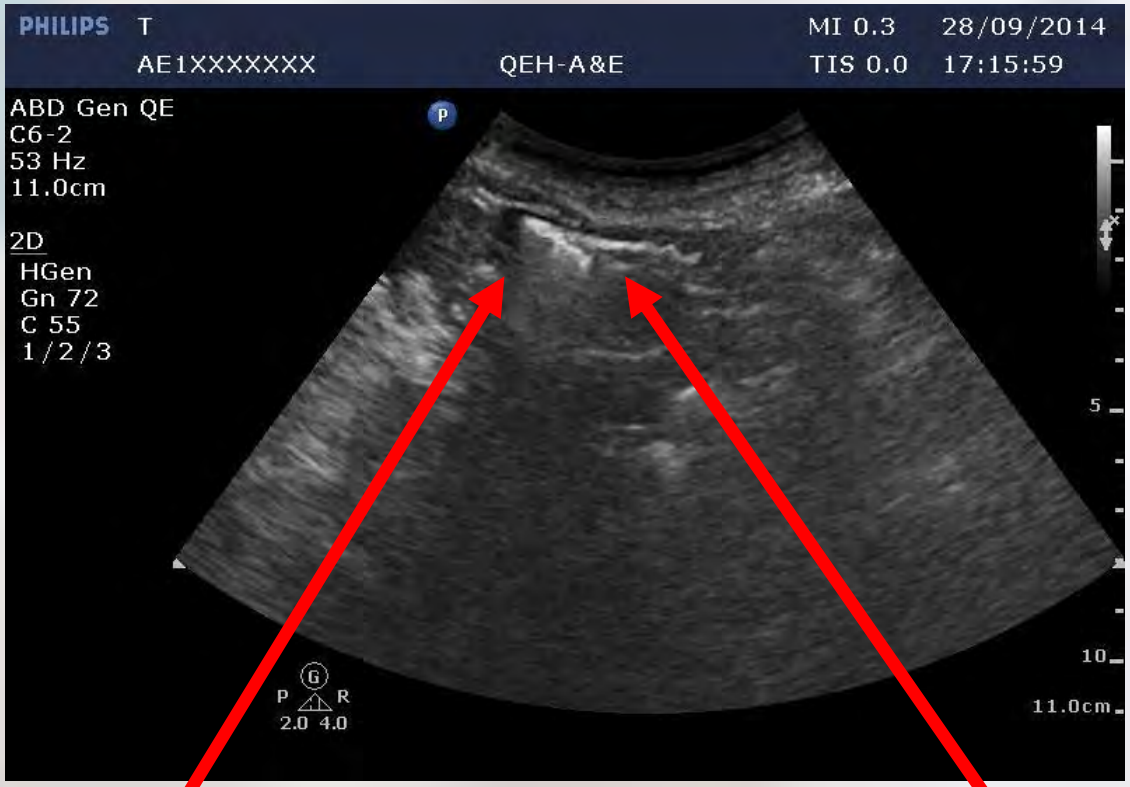
- **Neck Scan – Longitudinal Scan:**

Esophagus with NG tube

Interventions

Ultrasonography tests

- **Epigastrium Scan – Transverse Scan:**



Stomach

Acoustic shadow of NG tube

Interventions

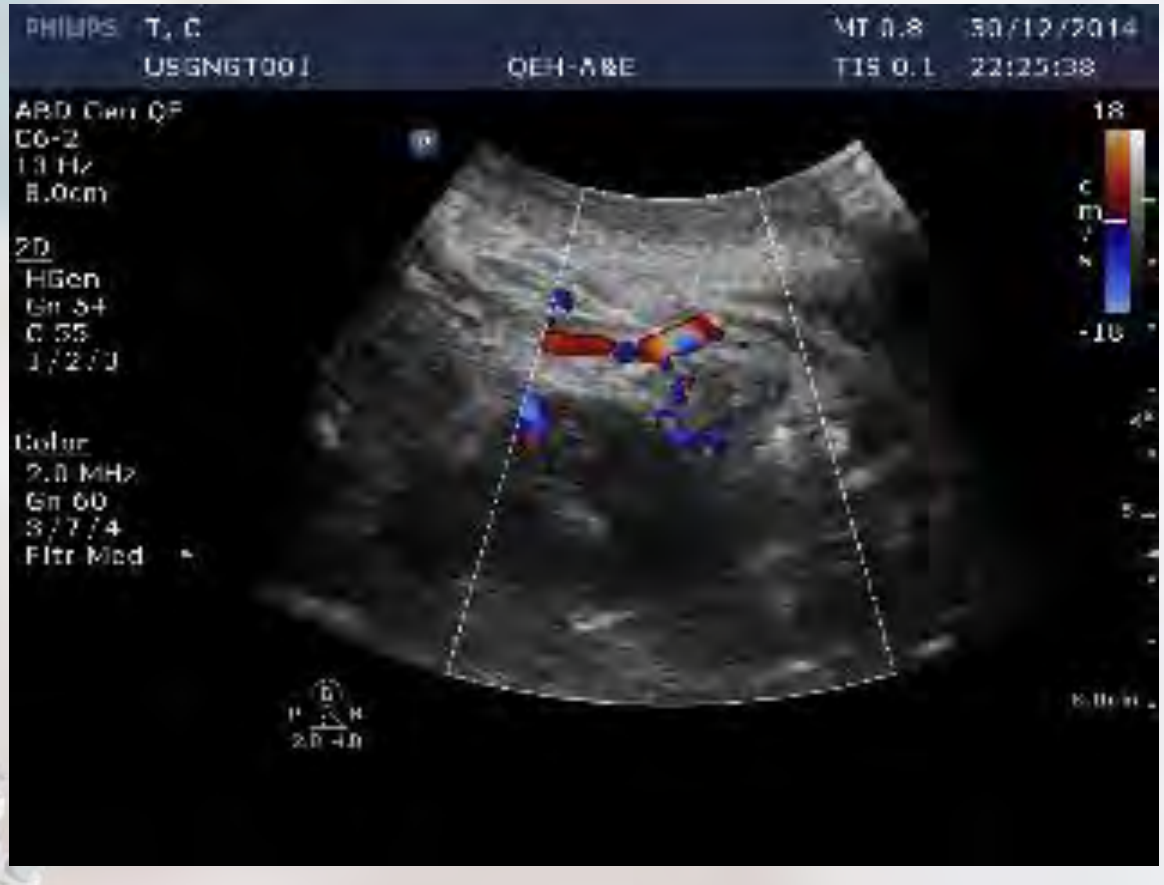
Ultrasonography tests

- Hyperechogenic “fogging”:

Interventions

Ultrasonography tests

- Colour Doppler “fogging”:



Research Strategy

PICO

Comparator

- Current Gold Standard of nasogastric tube placement confirmation:

Chest / Abdominal X-Ray

(HA Standard of practice, 2006)

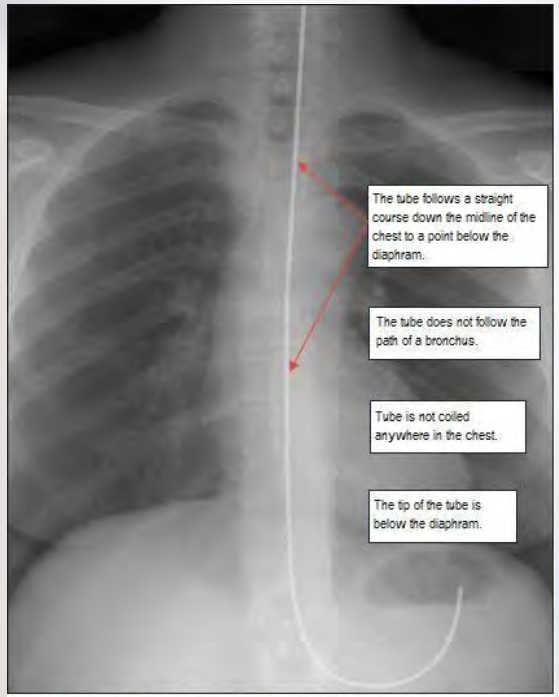


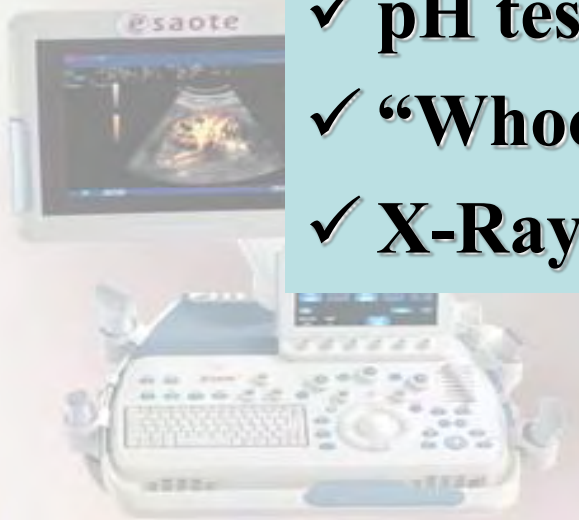
Figure 1. Chest Radiograph Representing Properly Placed Nasogastric Feeding Tube with Tip Visible

Research Strategy

PICO

Outcomes

- Dichotomous results:



- ✓ **Ultrasonography tests,**
- ✓ **pH tests of Aspirates**
- ✓ **"Whoosh" Test**
- ✓ **X-Ray Evaluation**

→ **Positive / Negative**

Sample Size Estimation

- Based on previous study (Kim, et al, 2012)
- Formula for estimate the sensitivity and specificity of single diagnostic test (Tilaki, 2014)

$$n = \frac{Z_{\frac{\alpha}{2}}^2 \widehat{P}(1-\widehat{P})}{d^2}$$

$\widehat{P}$ …….. Pre-determined value of specificity = 0.67

$Z_{\frac{\alpha}{2}}$ …….. Inserted by 1.96

d …….. Maximum marginal error of estimate = 0.07

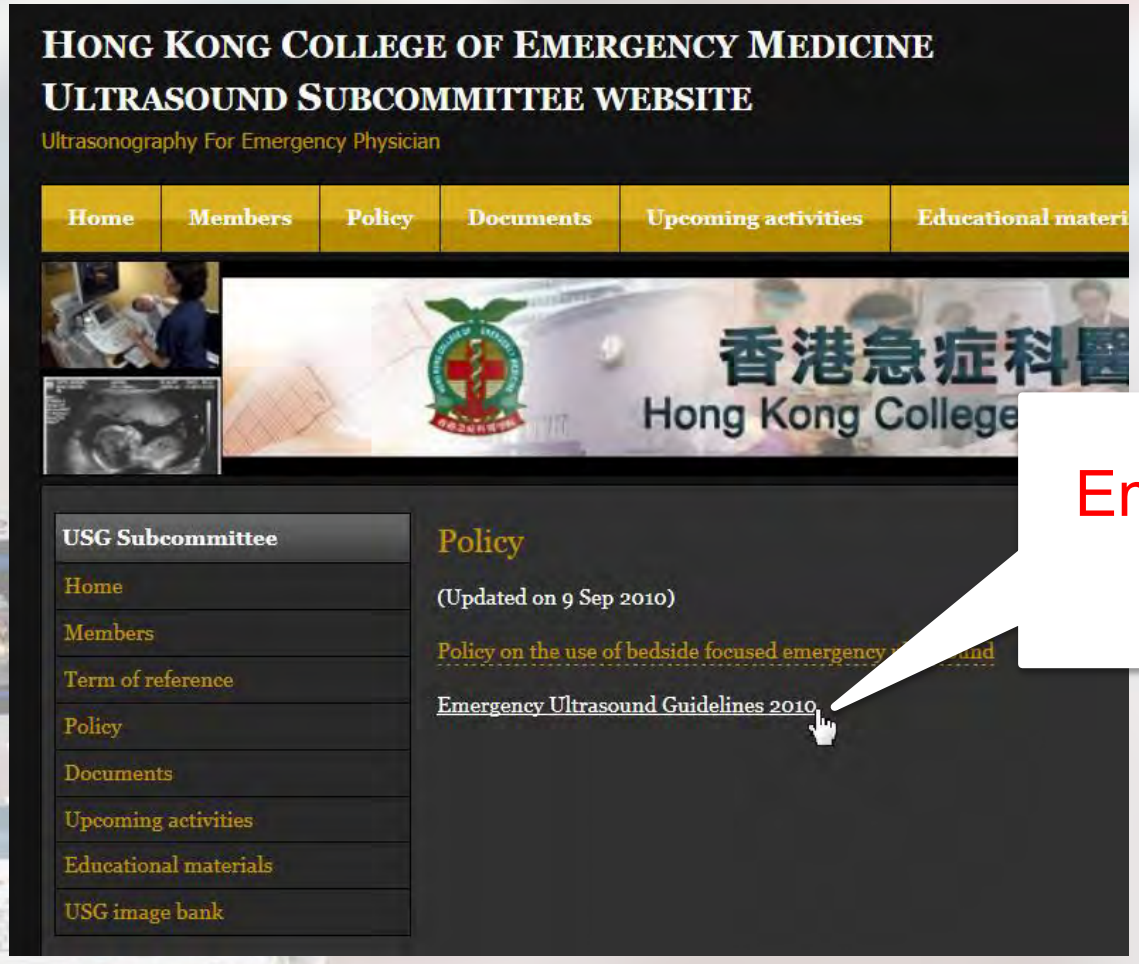
α …….. level of significance = 0.05

$(1-\beta)$ …. Power = 0.80

- **Targeted number of samples = ~173 subjects**

Data Collection

Bedside Ultrasonography Training for Investigators



Emergency Ultrasound Guidelines 2010

Data Collection

Bedside Ultrasonography Training for Investigators

Appendix 3: Training pathway & level of proficiency

EM resident or practitioner

↓

Basic USG course by HKCEM or equivalent

↓

Basic EM USG Trainee → Certificate of Attendance

↓

Scanning under supervision by EM USG independent practitioner

↓

Meet the minimal no. of scanning with log record

↓

Endorsed by Training supervisor

↓

Independent EM USG Practitioner

↓

Independent scanning for at least 6 months & nominated by training supervisor plus assessment by HKCEM USG subcom — Certificate in EM USG

(Emergency Ultrasound Guidelines 2010, HKCEM)

Data Collection

Bedside Ultrasonography Training for Investigators

- Half day workshop in QEH AED
- 23rd of Janurary, 2015
- Guest lecturer and trainer:

  Dr. Pak Chi Shing
  Associate Consultant of QEH AED
  specialized in emergency ultrasonography
- Lecture and practical sections
- PowerPoint sharing

Data Collection

Bedside Ultrasonography Training for Investigators

- Bedside practice of essential skills for data collection

Data Collection

Bedside Ultrasonography Training for Investigators

- Assessment and Evaluation of skills

Ultrasound Workshop for ENC Study: Nurse performed ultrasonography in confirming the position of nasogastric tube in the emergency department

Evaluation Form

Basic skills in using ultrasonography to confirm Nasogastric tube position

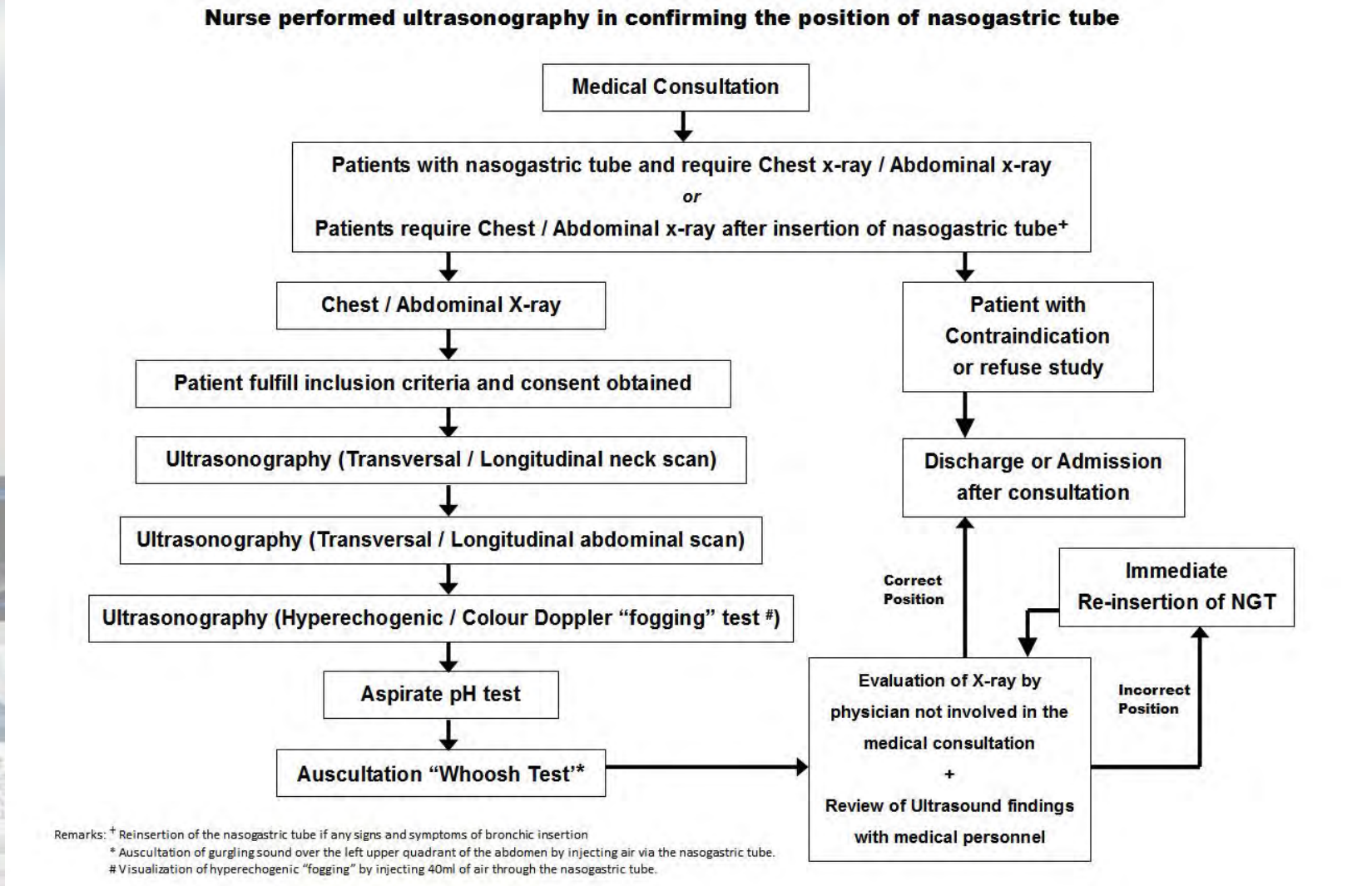
Trainee's name: Chan Pui Yin Training date: 23. 1. 2015

Transversal scan of neck :	
Appropriate probe selection ?	Pass/ Fail
Able to locate the following landmarks?	
➢ Trachea	Pass/ Fail
➢ Esophagus	Pass/ Fail
Able to identify the acoustic shadow behind the N/G tube?	Pass/ Fail
Transversal scan of stomach :	
Appropriate probe selection ?	Pass/ Fail
Able to locate the following landmarks?	
➢ Liver	Pass/ Fail
➢ Stomach	Pass/ Fail
Able to identify the N/G tube (2 parallel lines)?	Pass/ Fail*
*Is the operator able to identify the dynamic fogging on the ultrasound screen when 40ml air is injected through the N/G tube?	Pass/ Fail
Trouble shooting :	
Is the operator able to adjust settings for a better quality image?	
➢ Overall Gain	Pass/ Fail
➢ TGC (Time Gain Compensation)	Pass/ Fail
➢ Focus	Pass/ Fail

Assessor's signature:

Data Collection

Study Protocol



Data Collection

Self-developed Data Collection Sheet

Data Collection Sheet Ver.3 Dated: 11 DEC 2014

Nurse performed ultrasonography in confirming the position of nasogastric tube in the Emergency Department: A prospective single group diagnostic test study.

Data collection sheet

QEHUSGNGT 021

Sex / Age: F / 86yrs

Inclusion criteria	Yes	No
Age ≥ 18	✓	
Patients with nasogastric tube and require Chest x-ray / Abdominal x-ray or Patients require Chest / Abdominal x-ray after insertion of nasogastric tube	✓	

If all "Yes", proceed to checking for exclusion criteria.

Exclusion criteria	Yes	No
Patients with unstable haemodynamic status		✓
Known history of nasopharyngeal carcinoma		✓
Known history of fracture base of skull		✓
Known history of surgical problems of the pharynx, larynx, trachea, esophagus or stomach		✓
Patients with tracheostomy		✓
Patients with Aortic Aneurysm		✓
Pregnancy		✓

If all "No", proceed to study after patient's consent.

Assessment Record

Part 1. pH test of Aspirates	Positive	Negative
	✓	

pH of the aspirate: 2.0

Part 2. "Whoosh Test"	Positive	Negative
	✓	

Auscultation of the epigastrium by injecting air through the nasogastric tube

Data Collection Sheet Ver.3 Dated: 11 DEC 2014

Part 3(a). Ultrasonography – Neck Scan	Positive	Negative
Transversal scan	✓	
Longitudinal scan	✓	

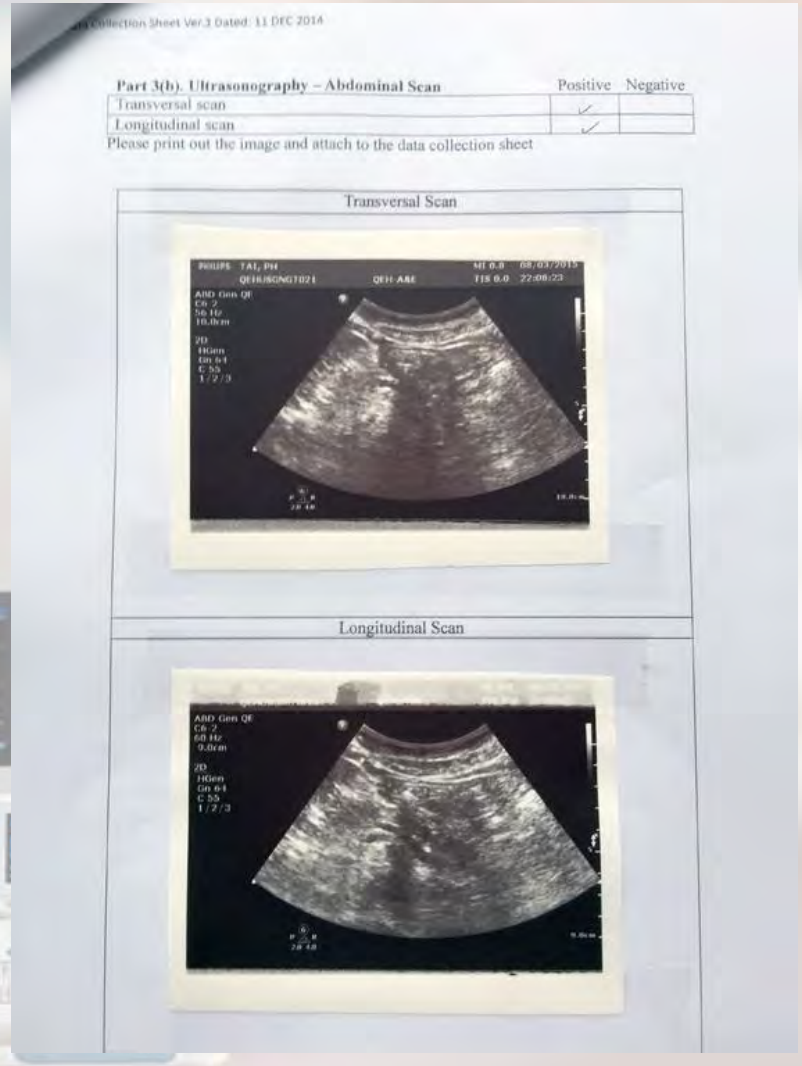
Please print out the image and attach to the data collection sheet

Transversal Scan

Longitudinal Scan

Data Collection

Self-developed Data Collection Sheet



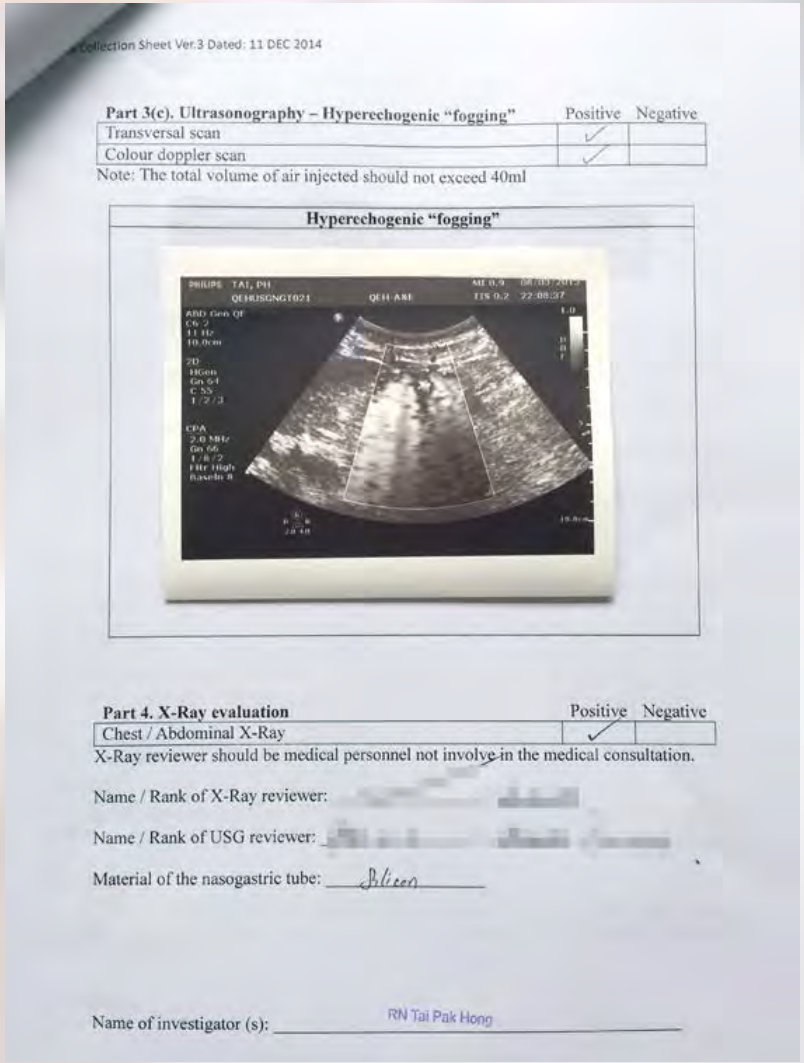
Collection Sheet Ver.3 Dated: 11 DEC 2014

Part 3(b). Ultrasonography – Abdominal Scan	Positive	Negative
Transversal scan	✓	
Longitudinal scan	✓	

Please print out the image and attach to the data collection sheet

Transversal Scan

Longitudinal Scan



Collection Sheet Ver.3 Dated: 11 DEC 2014

Part 3(c). Ultrasonography – Hyperechogenic "fogging"	Positive	Negative
Transversal scan	✓	
Colour doppler scan	✓	

Note: The total volume of air injected should not exceed 40ml

Hyperechogenic "fogging"

Part 4. X-Ray evaluation	Positive	Negative
Chest / Abdominal X-Ray	✓	

X-Ray reviewer should be medical personnel not involve in the medical consultation.

Name / Rank of X-Ray reviewer:

Name / Rank of USG reviewer:

Material of the nasogastric tube: Silicon

Name of investigator (s): RN Tai Pak Hong

Data Collection

Self-developed Data Collection Sheet

- Assessment and Evaluation of skills (Minimum 5 positive scans)

Assessment form for Basic Emergency Ultrasound

For each scan the trainee should demonstrate the ability in (put a ✓ in ☐):

Before the scanning:

- Explaining to patient the indication & purpose of the scan (if feasible) ☑
- Proper infection control measures ☑
- Proper preparation before scanning (eg. Glove, gel and towel) ☑

During the scanning:

- Proper probe/frequency selection ☑
- Proper patient posture ☑
- Proper B mode image acquisition technique ☑
- Doppler utilization technique (if necessary) ☑
- Optimal B mode images acquired ☑
- Appropriate image interpretation ☑
- Adequate images recorded ☑
- Proper scanning speed ☑

After the scanning:

- Explanation of the scanning result and subsequent planning to patient (if feasible) ☑
- Proper documentation of scanning results and fill in the relevant forms (if necessary) ☑
- Proper communication with other specialty if necessary ☑
- Proper machine maintenance after scanning ☑
- Scanning result verified with other imaging modality/surgical procedure/clinical outcome/other relevant measures ☑

Overall assessment:

- Satisfactory (fulfill all criteria) ☑
- Acceptable (fulfill all criteria with hints) ☐
- Need further improvement ☐ Comment: _____

Scanned patient reference number: REHUSG NGT 002

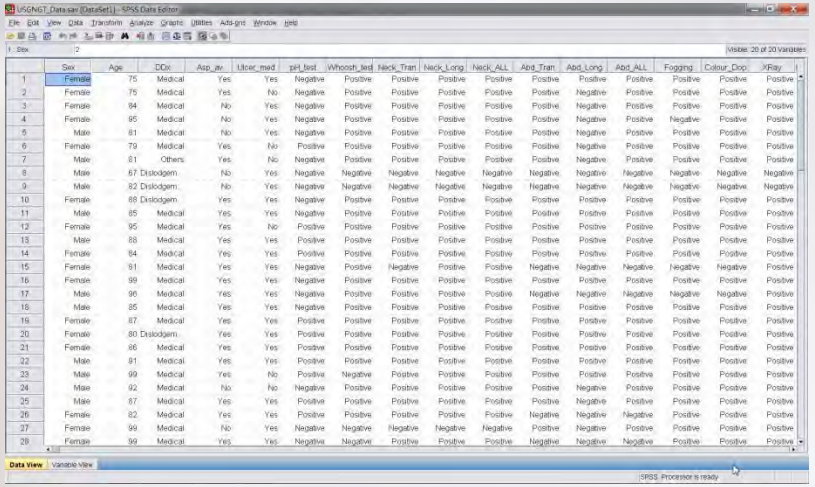
Name & signature of ultrasound trainee:

Name & signature of assessor: _____

(Emergency Ultrasound Guidelines 2010, HKCEM)

Data Analysis

- SPSS ver.16
- Descriptive statistics:
  - Describe the characteristics
  - Frequency, mean and SD
- Inferential statistics:
  - Sensitivity
  - Specificity
  - Positive Predictive Value
  - Negative Predictive Value
  - Likehood Ratios



Ethical Issues

- **Ethical Approval** from Clusters Research Ethical Committee
- **Informed written consent** (English / Chinese)
- Obtained from Patient or
- **Obtained from patient's legal guardian** if mentally incompetent
- Voluntary basis
- Not affect standard treatment
- Right to terminate participation at any point
- Contact details of the investigators
- Anonymity
- Confidentiality

REC(KC/KE)
Effective Date: Feb 2011
Revision No. 1.0

Title: REC Approval Form
Document No: KCHE
SOP031FEx
Page 1 of 2

HOSPITAL AUTHORITY

Research Ethics Committee
(Kowloon Central / Kowloon East)

c/o Queen Elizabeth Hospital
30 Gascoigne Road Kowloon

Mr TAI Pak Hong

Registered Nurse
Department of Accident and Emergency
Queen Elizabeth Hospital

30 December 2014

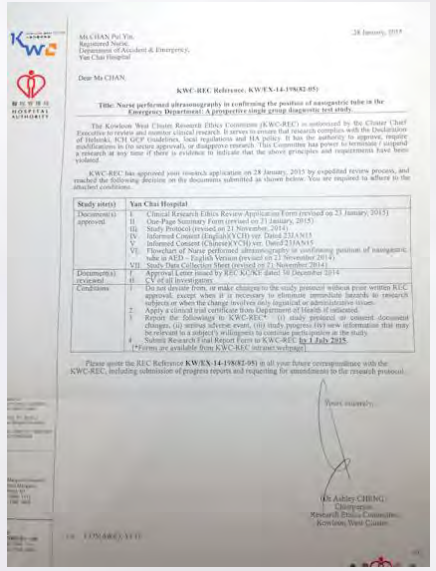
Ref: KC/KE-14-019/ER-8

Dear Mr TAI,

The REC(KC/KE) members are appointed by the Cluster Chief Executives to review and monitor clinical research independently according to the guidance of Declaration of Helsinki and ICH GCP Guidelines in order to safeguard the rights, safety and well-being of research subjects. It has the authority to approve, require modifications (to secure approval), or disapprove research. This committee has power to terminate/suspend a research at any time if there is evidence to indicate that the above principles and requirements have been violated.

The Committee has reviewed and approved your research application on 30 December 2014 by an expedited process. The approval decision was based on the documents submitted. You are required to adhere to the attached conditions:

Title of Study	Nurse performed ultrasonography in confirming the position of nasogastric tube in the Emergency Department: A prospective single group diagnostic test study
Principal Investigator	Mr TAI Pak Hong, Registered Nurse, Dept of Accident and Emergency, QEH
List of Co-investigators	Miss LAU Wing Sze, Registered Nurse, Dept of Accident and Emergency, QEH
	Mr LAM Yuen Cheung, Registered Nurse, Dept of Accident and Emergency, TKOH
	Miss MAK Hoi Ting, Registered Nurse, Dept of Accident and Emergency, TKOH
	Miss MAK Yuen Ting, Registered Nurse, Dept of Accident and Emergency, TKOH
Protocol title and version	Nurse performed ultrasonography in confirming the position of nasogastric tube in the Emergency Department: A prospective single group diagnostic test study. [Study Protocol Ver. 1 Dated 11 DEC 2014]



KWC

HOSPITAL AUTHORITY

Ms CHAN Pui Yin,
Registered Nurse,
Department of Accident & Emergency,
Yan Chai Hospital

28 January, 2015

Dear Ms CHAN,

KWC-REC Reference: KW/EX-14-198(02-05)

Title: Nurse performed ultrasonography in confirming the position of nasogastric tube in the Emergency Department: A prospective single group diagnostic test study

The Kowloon West Cluster Research Ethics Committee (KWC-REC) is authorized by the Cluster Chief Executive to review and monitor clinical research. It serves to ensure that research complies with the Declaration of Helsinki, ICH GCP Guidelines, local regulations and HA policy. It has the authority to approve, require modifications to (to secure approval), or disapprove research. This Committee has power to terminate / suspend a research at any time if there is evidence to indicate that the above principles and requirements have been violated.

KWC-REC has approved your research application on 28 January, 2015 by expedited review process, and reached the following decision on the documents submitted as shown below. You are required to adhere to the attached conditions.

Study site(s)	Yan Chai Hospital
Document(s) approved	I. Clinical Research Ethics Review Application Form (revised on 23 January, 2015) II. One-Page Summary Form (revised on 21 January, 2015) III. Study Protocol (revised on 21 November, 2014) IV. Informed Consent (English)(YCH) ver. Dated 23JAN15 V. Informed Consent (Chinese)(YCH) ver. Dated 23JAN15 VI. Flowchart of Nurse performed ultrasonography in confirming position of nasogastric tube in AED - English Version (revised on 22 November 2014) VII. Study Data Collection Sheet (revised on 21 November 2014)
Document(s) reviewed	I. Approval Letter issued by REC KC/KE dated 30 December 2014 II. CV of all investigators
Conditions	1. Do not deviate from, or make changes to the study protocol without prior written REC approval, except when it is necessary to eliminate immediate hazards to research subjects or when the change involves only logistical or administrative issues. 2. Apply a clinical trial certificate from Department of Health if enlisted. 3. Report the following to KWC-REC* : (i) study protocol or consent document changes, (ii) serious adverse event, (iii) study progress, (iv) new information that may be relevant to a subject's willingness to continue participation in the study. 4. Submit Research Final Report Form to KWC-REC by 1 July 2015. [*Forms are available from KWC-REC intranet website]

Please quote the REC Reference KW/EX-14-198(02-05) in all your future correspondence with the KWC-REC, including submission of progress reports and requesting for amendments to the research protocol.

Yours sincerely,

(Dr Ashley CHENG)
Chairperson
Research Ethics Committee
Kowloon West Cluster

Results

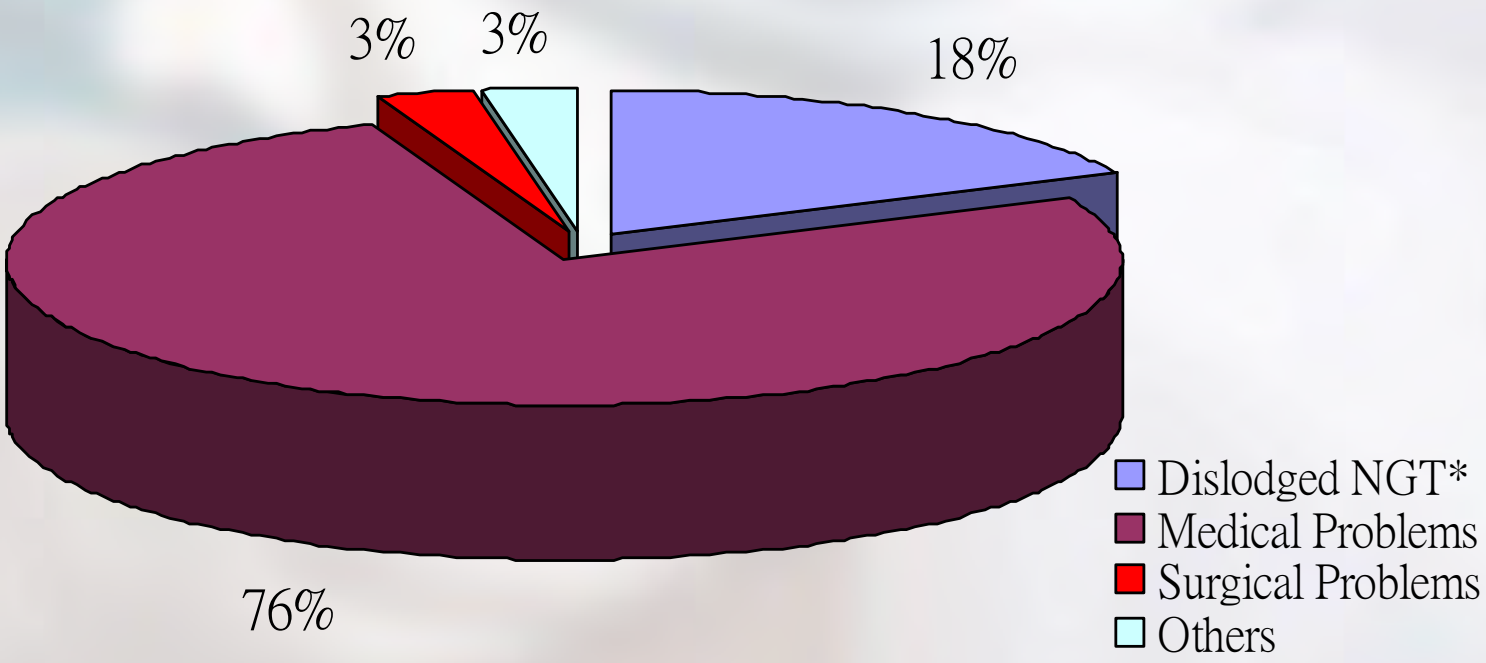
Table 1. Characteristics of the subjects

Characteristics	**n = 72**
Age (years)	min 61 / max 99
	mean 84.76 ± 8.46^
Gender (male / female)	27 (37.5)+ / 45 (62.5)+
Currently using anti-gastric ulcer medications	59 (81.9)+
Subjects with gastric aspirate NOT available	19 (26.4)+
Material of NGT* (Silicon / Latex)	60 (83.3)+ / 12 (16.7)+

^Mean ± SD, SD: Standard Deviation
+Number (%)
*Nasogastric Tube

Results

Chart 1. Reasons of AED attendance (n=72)



*Nasogastric Tube

Results

Table 2. Comparison of predictive validity

Evaluation method		Total (n=72)		Sensitivity (%)		Specificity (%)	
		correct position (n=69)	incorrect position (n=3)	Estimate	95% CI	Estimate	95% CI
Ultrasound							
Neck	(+)	66	0	**95.7**	87.8 to 99.1	**100**	29.2 to 100
	(-)	3	3				
Abdomen	(+)	36	0	52.2	39.8 to 64.4	100	29.2 to 100
	(-)	33	3				
Hyperechogenic "fogging"	(+)	61	0	**88.4**	78.4 to 94.9	**100**	29.2 to 100
	(-)	8	3				
Colour Doppler test	(+)	62	0	**89.9**	80.2 to 95.8	**100**	29.2 to 100
	(-)	7	3				
'Whoosh' test	(+)	63	0	**91.3**	82.0 to 96.7	**100**	29.2 to 100
	(-)	6	3				
pH test of aspirates	(+)	38	0	55.1	42.6 to 67.1	100	29.2 to 100
	(-)	31	3				

Results

Table 3. Comparison of predictive validity

Evaluation method	PPV (%)		NPV (%)		LR+	LR-	
	Estimate	95% CI	Estimate	95% CI	Estimate	Estimate	95% CI
Ultrasound							
Neck	100	94.6 to 100	50	11.8 to 88.2	∞	**<0.1**	0.01 to 0.13
Abdomen	100	90.3 to 100	8.3	1.8 to 22.5	∞	0.5	0.37 to 0.61
Hyperechogenic "fogging"	100	94.1 to 100	27.3	6.0 to 61.0	∞	**0.1**	0.06 to 0.22
Colour Doppler test	100	94.2 to 100	30	6.7 to 65.3	∞	**0.1**	0.05 to 0.21
'Whoosh' test	100	94.3 to 100	33.3	7.5 to 70.1	∞	**<0.1**	0.04 to 0.19
pH test of aspirates	100	90.8 to 100	8.8	1.9 to 23.7	∞	0.5	0.35 to 0.58

PPV: positive predictive value / NPV: negative predictive value / LR+: Positive likehood ratio / LR-: Negative likehood ratio

Discussion

- A **high sensitivity and specificity** of using ultrasonography in confirming the position of NGT
- Performed by emergency nurses with **specific training and practice.**
- **can be incorporated in daily practice because …**

Discussion

- **To overcome limitations of Conventional Methods**
- **Immediate bedside confirmation**

- pH test not recommended to be used alone for confirmation

"Whoosh test" & Bedside USG are recommended to be used for secondary confirmation of NGT position

Limitations

- **Limited time of data collection**
  - Limited number of subjects (Required: 173 vs Achieved: 72)
  - Subjects with in-correct NGT placement were scanty (n=3)
- **Limited number of study sites**
  - ? generalizability of the research findings
- **Accuracy of performing USG**
  - Variation in skills and experience of investigators
  - Gas interposition and involuntary movements of the patient
- **Spectrum Effect**
  - Uneven mix of study population affect prevalence of phenomenon (Correct position: 69 vs Incorrect position: 3)

Recommendations

- **Longer study period** is recommend in future studies
- **Larger scale studies** are required in the future
- **Inter-rater reliability** of nurse performed ultrasonography should be studied
- **Validation of ultrasound training for nurses** should be conducted
- **More even mix of study population** is recommended

Conclusion

- Nurse performed USG allow immediate bedside confirmation of nasogastric tube position
- Beneficial to patients, nursing and departmental operations
- Conventional tests still have their own limitations
- Bedside ultrasound provide extra evidence for clinical judgment
- Nurse performed USG can be incorporated into daily practice for confirmation of NGT position
- X-ray is still recommended if bedside USG failed to confirm the position of NGT

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END

Thank you very much!