Paediatric Intensive Care Unit (PICU)

Guideline on Blind Bedside Jejunal Tube Insertion

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1. Introduction

Optimal provision of nutrition support and accurate assessment of energy expenditure should be an integral component of paediatric critical care (Mehta et al, 2009a). Nutritional status has a profound effect on metabolic response to injury and strongly affects patient outcome (Mitchell et al, 1994) including length of ventilated days and PICU stay (Larsen et al, 2008).

Providing nutritional care in critically ill children is challenging since fluid restrictions, digestive intolerance and interruptions in nutritional feed delivery for diagnostic and therapeutic procedures are common (Lambe et al, 2007) and result is a failure to deliver estimated energy requirements (Cohen et al 2000 and de Neef et al, 2007). With no commonly accepted guidelines for nutritional management in PICU available (Van der Kuip et al, 2004) and a lack of systemic research and clinical trails in PICU, compiling evidence based guidelines is challenging (Mehta et al, 2009b).

Elevated gastric residual volumes (GRV) are associated with sedation and catecholamine use (Mentec et al, 2001) and in paediatric patients are often attributed to gastric paresis. Although, McClave et al (2005) state that GRVs are inherently flawed, as they have yet to be validated, current paediatric evidence suggests that a GRV > 5ml/kg can be considered to be an indicator of poor feed tolerance and delayed gastric emptying (Cobb et al, 2004 and Horn et al, 2004).

A number of studies in adult patients have advocated the use of prokinetics to aid gastric motility (Cohen et al, 2000 and McClave et al 2005) however, no studies have analysed the efficacy of prokinetics in critically ill children (Lopez-Herce, 2009). It is therefore, advocated not to delay commencement of jejunal feeding in those with delayed gastric emptying in order to trial prokinetics. This is supported by a study by Gharpure et al (2001) which concluded erythromycin did not facilitate post-pyloric tube placement.

Enteral nutrition is always the preferred route for artificial feeding in critically ill children and naso-jejunal feeding offers a safe and effective alternative to parenteral nutrition for patients, in whom gastric feeding is poorly tolerated, including post-op cardiac patients (McDermott et al, 2007 and Sachez et al, 2006). Unlike gastric feeding, jejunal feeding avoids fasting times for many procedures, including endotracheal extubation thereby, ensuring energy delivery and reducing the risk of protein energy malnutrition (Jacobs et al, 1999).

Jejunal tubes have traditionally been avoided as they have been notoriously difficult to place, often requiring endoscopic or radiological guidance (Meyer et al, 2007). However, blind placement techniques have now been shown to be up to 95% successful within the PICU population (Joffe et al, 2000, Spalding et al, 2000 and Meyer et al 2007), with associated benefits to patient outcome and financial savings for health care authorities.

2. Rationale/Purpose/Objective

- To provide a clear rationale for the blind insertion of jejunal tubes in critical care
- To provide procedural guidance on the blind bedside placement technique for jejunal feeding tubes within paediatric critical care.

This guideline should be interpreted in conjunction with the NHS GG&C PICU Guideline on Administration of Medication via Enteral Feeding Tubes (2009) and NHS GG&C PICU Guideline for Introducing and Establishing Enteral Nutrition in PICU (2009).

3. Scope

- This guideline applies to all patients in paediatric critical care (PICU/HDU) in **The Royal Hospital for Sick Children in Glasgow**. (Exclusion criteria are outlined in the procedure algorithm).

4. Roles and responsibilities

- All healthcare professionals in paediatric critical care involved in the blind insertion of jejunal feeding tubes should be familiar with this guideline.

5. PROCEDURE

ALGORITHM FOR BLIND BESIDE JEJUNAL INSERTION [Appendix 1]

6. Review

This guideline should be reviewed within 3 years from date of approval and following results of clinical audit and future scientific evidence. The Lead Manager retains responsibility for ensuring that review takes place in partnership with the Critical Care Nutrition Forum.

7. References

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[Evidence Table, Appendix 2]

A Communication and Implementation Plan

Groups informed prior to implementation:

- PICU Consultant Group
- PICU Charge Nurse Group
- PICU Critical Care Nutrition Forum
- PICU Education Team
- Clinical Effectiveness Office (Yorkhill Hospital)

Implementation Plan:

- Education and training for nursing staff
- Competency for nursing staff
- Patient care plan

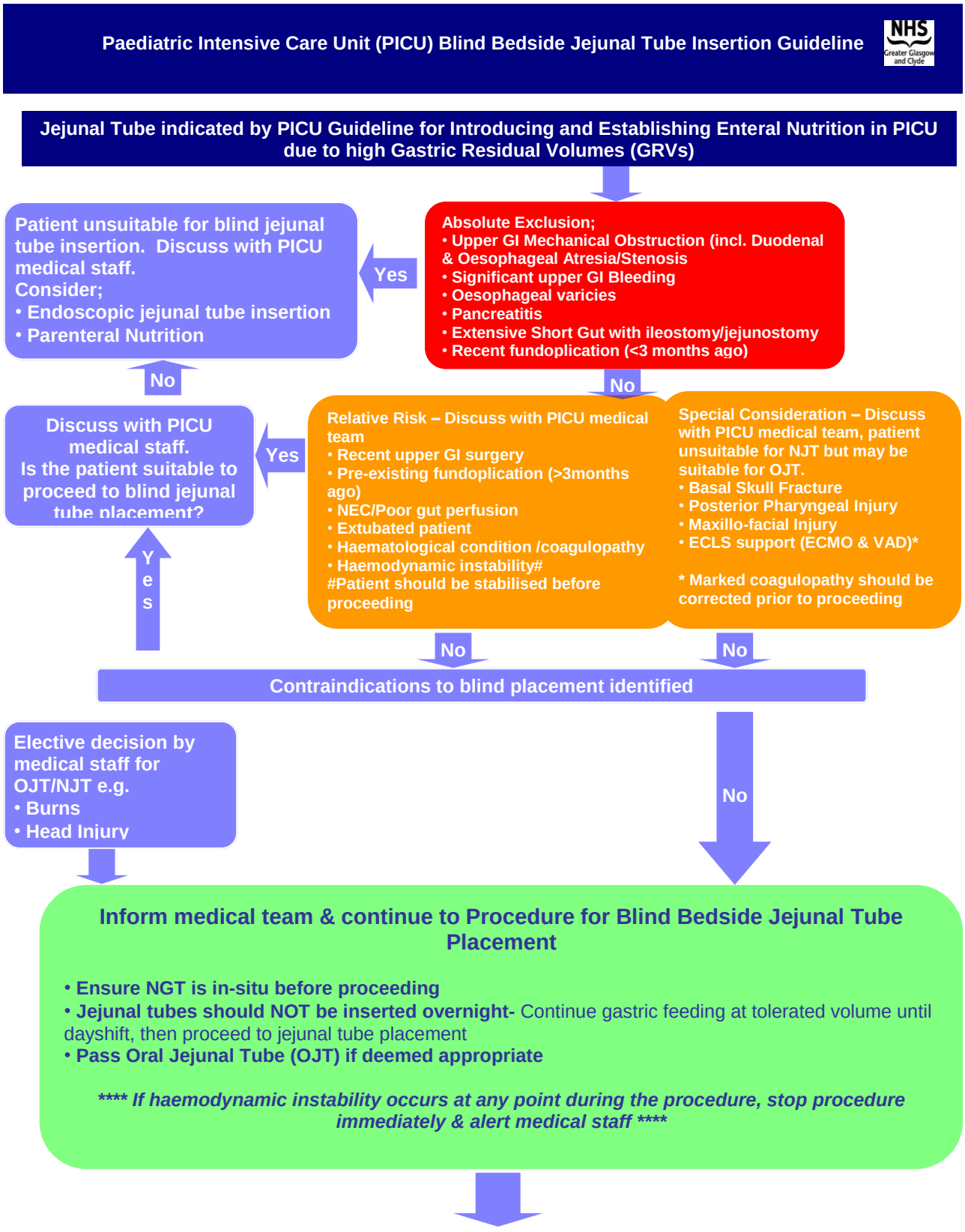
B Monitoring

In line with clinical governance, audit will be utilised to provide a means by which to assess the efficacy and impact of this guideline. Adverse events will be identified through the established local incident reporting infra-structure

C Impact Assessment

Risk assessment and EQIA were not deemed necessary for this guideline.

ALGORITHM FOR BLIND BESIDE JEJUNAL INSERTION [Appendix 1]



1) EQUIPMENT and INITIAL PROCEDURE

Using a tape measure, measure the approximate length for both gastric and jejunal position and document –ear – nose- gastrum- right lower abdomen (see guidance notes for measuring).

Choose the appropriate NJ tube (size/length), gloves, apron,pH paper, two 20ml syringes, sterile water, gauze, tape measure, hypafix tape and stethoscope.
Assess need for sedation.
Explain procedure to parents and child if appropriate.

Open the packaging and flush the tube with 10ml of sterile water via the purple port to ensure it is well lubricated.

Elevate bed slightly to 15-30* and position patient (if clinical condition allows), in a right lateral oblique position (left side up)

2) PROCEDURE- GASTRIC PLACEMENT

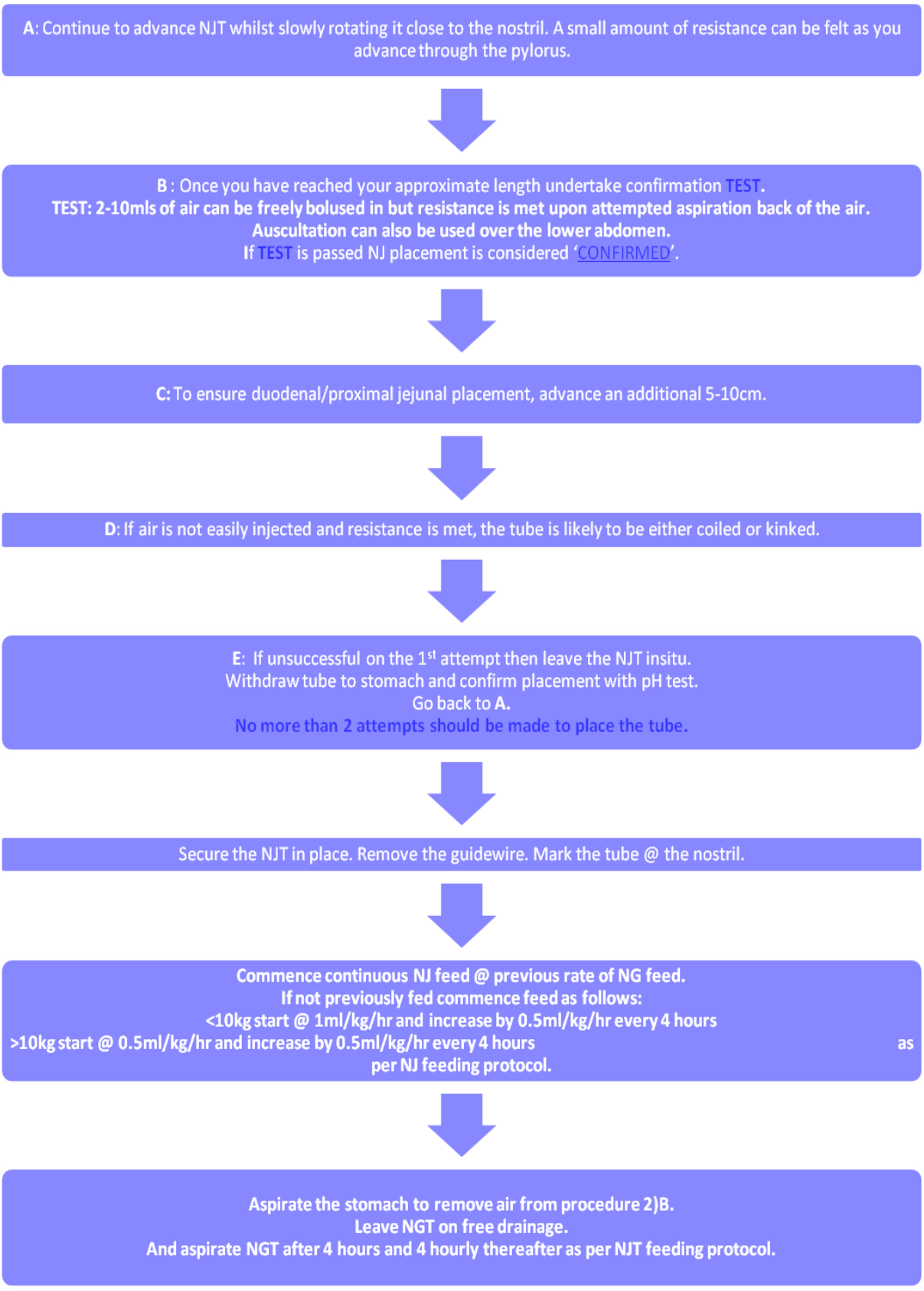
Empty and decompress stomach with nasogastric tube already insitu.

A : Lubricate the tip of the tube with water and insert preferably via the nostril with existing NG tube until in the stomach.

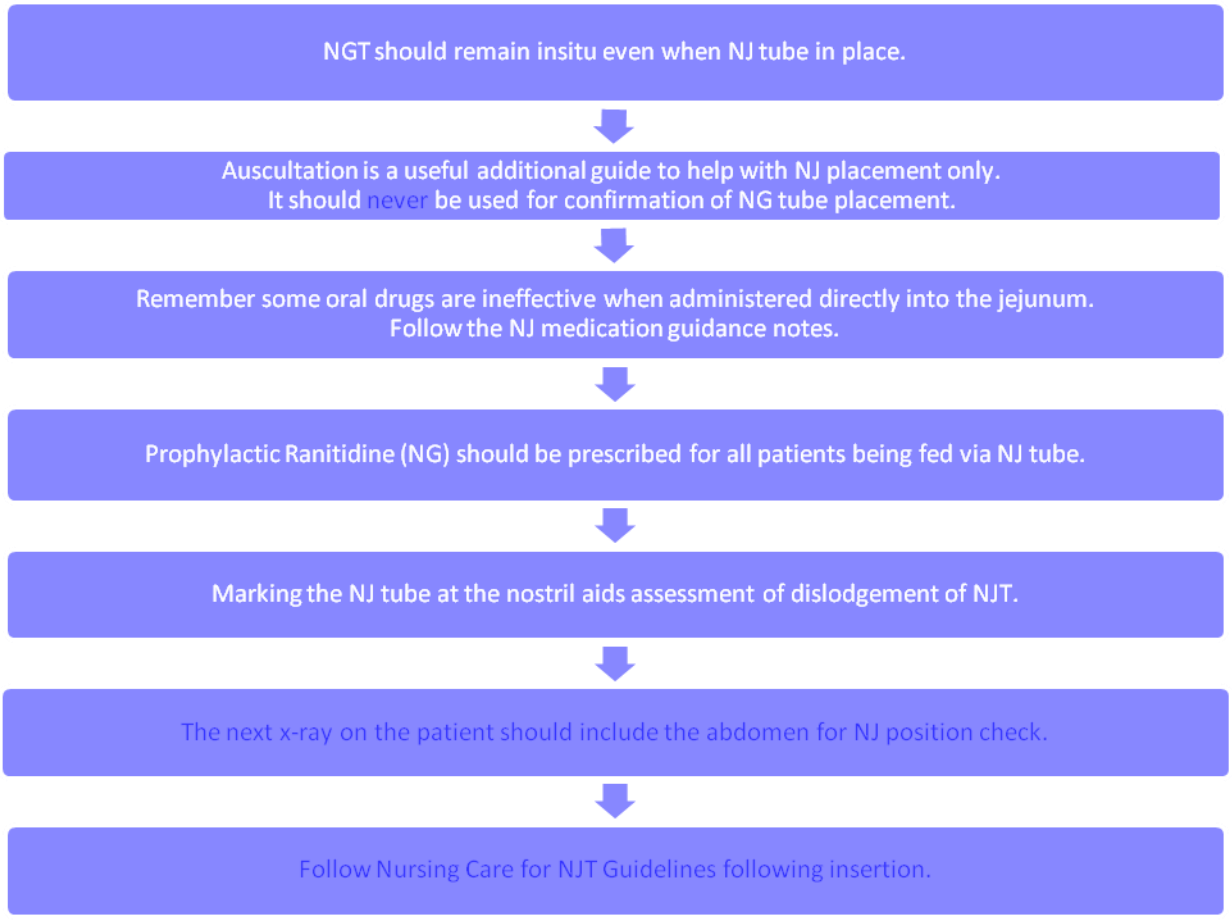
B: Confirm gastric placement as per hospital policy (Testing pH). Once position is confirmed flush **inflate the stomach with 10ml air** and proceed as **3**)

C: If there are any problems passing the tube at this stage then remove the NJT and restart from A. If position is good proceed to **3**).

3) PROCEDURE – JEJUNAL PLACEMENT



4) GENERAL NOTES



Guidance Notes for Measuring Naso-Jejunal Tube Length

Figure 1: Naso-Jejunal Tube Length Measurement – Infant (< 1 year)

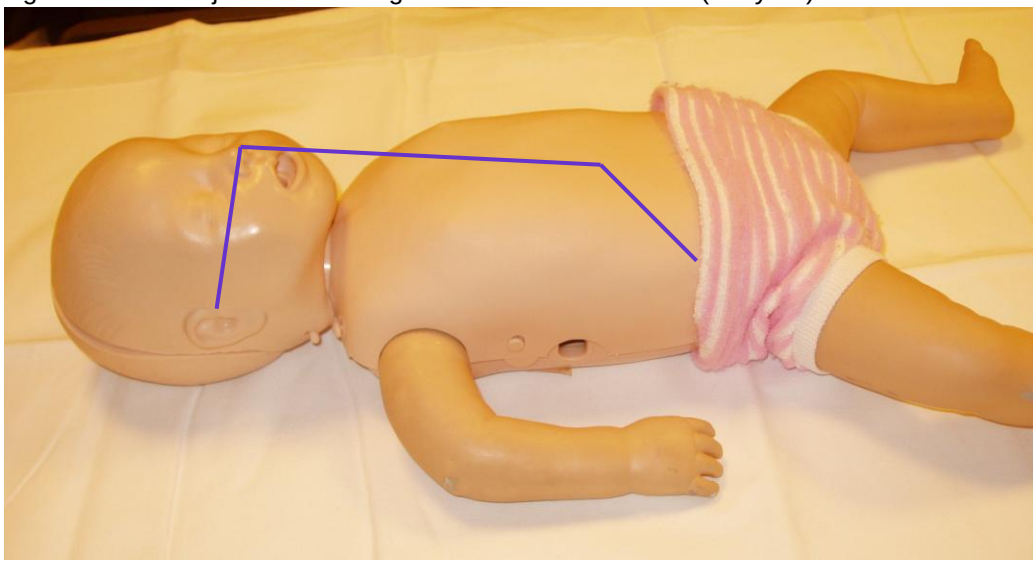
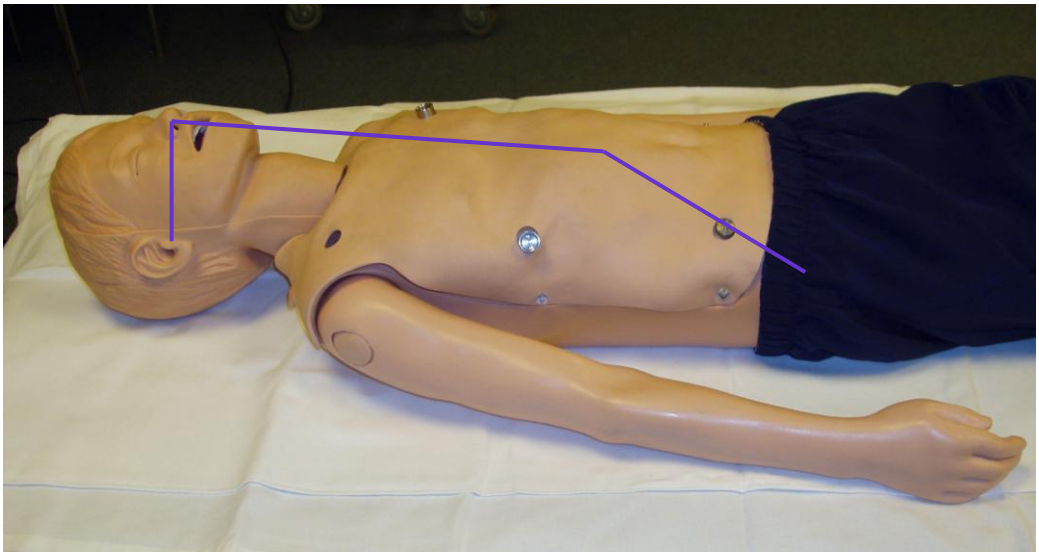


Figure 2: Naso-Jejunal Tube Length Measurement – Child (>1 year)



Notes

- Measurement should be made using a disposable tape measure
- Measure from ear – nose – gastrum (mid-point between ziphisternum and umbilicus) – right lower abdomen (right iliac crest)
- Note measurement at gastrum and right lower abdomen
- Use a Merck Corflo NJ tube with guidewire of appropriate length.
  If <8kg use 6Fr, >8Kg use 8Fr, older children may require a 10Fr.

Nursing Care Guideline
for Naso-jejunal Feeding Tube

CARE OUTCOMES

1. ***To maintain nutrition and hydration***
2. ***To prevent potential complications – tube blockage, tube misplacement, aspiration and accidental removal***

NURSING CARE	RATIONALE
1. Ensure procedure documentation is completed on CIS, including the insertion date, the size and internal length of the NJ tube.	To prevent infection To prevent displacement
2. The NJ tube can remain insitu for 4-6 weeks.	To prevent infection To prevent blockage.
3. Every 4 hours document on CIS the external length of the NJ tube and ensure tube is securely taped.	To prevent displacement
4. Every 4 hours aspirate Naso-gastric tube and test pH as per ***nasogastric feeding guideline***. If milk aspirated, it is probable that NJ tube has migrated back into the stomach, ***follow the NJ feeding guideline***. If no aspirate obtained follow naso-gastric tube feeding guideline. * **If NJ tube displacement is suspected (eg. following extubation or vomiting). The following test can be used to confirm placement:** **Instill 2-10ml air into NJ tube, if unable to aspirate the air the tube is probably in the jejunum.** **a.** If a high volume of air is aspirated (>15ml) NJ tube is likely to be in oesophagus or upper part of stomach. **b.** If a high volume of secretions (>15ml) NJ tube likely to be in stomach and test pH = 1-4. **NB. Drugs such as Ranitidine, Omprezole & Sucralfate will increase gasric pH.** **If the test is not conclusive seek medical advice. A check X-ray of chest/abdomen maybe required.**	To prevent displacement, aspiration and accidental removal. To maintain nutrition and hydration.
5. Strict hand washing is essential. Clean the feeding end with alcohol swabs	To prevent infection as the NJ tube bypasses the stomachs anti-infective acid.

6. Pre-packed feeds can be hung for 24 hours. Prepared feeds (and feeds with active ingredients) should be changed every 4 hours and all feeding sets every 24 hours using a non-touch technique	To prevent infection as the NJ tube bypasses the stomachs anti-infective acid.
7. Feeds and most drugs are given via the NJ tube. ***Follow the NJ feeding guideline*** for type of feed and build up flow rates. Continuous feeds only via NJ tube.	**Bolus feeds must not be given through the naso-jejunal tube** because the jejunum cannot hold a bolus and it causes abdominal pain, diarrhoea and dumping syndrome.
8. Most medications should be given via the NJ tube. ***Follow the guideline for NJ medication.*** NB: flushing with sterile water	To prevent blockage. To prevent reaction with feed and between drugs.
PROBLEM SOLVING	**RATIONALE**
Feed Intolerance • Follow NJ feeding guideline • Check tube position as in **section 4**. • Inform dietician and discuss feed type and regimen	Diarrhoea may be caused by feed rate being increased too quickly. Vomiting may be caused by NJ tube migrating into stomach.
Blocked Tube • If tube becomes stiff to flush or blocked, flush with 5-10ml warm sterile water, leave for 15-20 minutes and then flush with sterile water. • If unsuccessful take 10,000 units of Creon capsule, dissolve granules in 10ml Sodium Bicarbonate 8.4%. ensure granules have fully dissolved (takes 3-5min) and then flush 5-10ml into tube. Leave for 15-20mins and then flush with sterile water. • If unable to unblock arrange for NJ tube to be repassed. See **guidelines for passing naso-jejunal feeding tube.**	Warm water may dissolve fatty deposits on the tube. Pancreatic enzymes (Creon) digest the build up of feed on the internal lumen of the NJ tube. Sodium Bicarbonate dissolves the coating on the granules and activates the pancreatic enzymes. NJ tube should only be placed by a nurse trained to do so.
Displacement of Tube • If the tube is pulled partially out of the nostril, gently push the NJ tube using a slow rotating movement until advanced to the correct length. Re-tape and check position as in **section 4**. • If tube falls out or becomes damaged replace with the same type and size of NJ tube. **See guidelines for passing naso-jejunal tube**.	To reposition tube in to the correct position for use. To replace the tube. NJ tube should only be placed by a nurse trained to do so

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Evidence Table [Appendix 2]

Publication	Sample Size/Study type	Aim/Objective	Notes	Blind NJ Technique	Outcome/Comments
*Meyer et al 2007 UK	n =100 All patients ventilated > 24 hrs Audit in 2001 and 2004.	- Monitor NJ success rate and evaluate training programme in PICU	Training incl 1:1 session, algorithm and supervised insertion NJ inserted if GRV> 4 hrs feed volume	- 15-30^{o} patient tilt - Right lateral oblique (life side up) - Guidewire tube – lubricate H20 - Aspirate NGT - Confirm gastric placement (pH) and flush with 3-5ml H20 - If cyanosed/coughing pull back and retry - Continue to advance and rotate tube at nostril, resistance flet at pylorus - Once reached length, aspirate or inject air and listen, if resistance ? kinked (withdraw to stomach and retry) - Remove guidewire - Confirm position with BLUE DYE	NJT placed in 19% of pts in 2001 and 18% in 2004 Blind success rate ~95% Education and audit cycles key to success
*Harrison et al 1997 USA	n = 75 Prospective	Non-radiological assessment of blindly placed feeding tubes in PICU	89% ventilated Used UWT wired tubes 56cm or 91cm, smaller diameter in <6kg	Used blind bedside protocol -Metoclopramide iv before insertion -Supine, head midline, neck anteroflexed -15-30 degree tilt -10ml gastric air insufflated, position checked auscultation and air withdrawn -Position confirmed if <2ml air returned from 10ml instilled compared to AXR	Median time to place 10mins UWT wired tube 99% in SB, 13 in duodenum, 61 in jej Inability to aspirate insufflated air confirms transplyloric position of tube without need to AXR BLUE DYE not accurate Following study 10 tubes successfully placed by Drs

				-Further advancement 5-10cm	who had never carried out blind placement previously
*Phipps et al 2006 USA	n = 75 Prospective RCT PICU 0-18years	To compare 3 different techniques used to place NJTs in critically ill children in 12 bed PICU Technique 1: Standard Technique 2: Standard + gastric air insufflation Technique 2 : Standard _ pre-insertion iv erythromycin Position checked by AXR	Gastroparesis may develop in critical illness. Early onset of SB recovery of peristalsis compared to gastric peristalsis. Decision to pass NJ made by Dr.	- Length of tube = Nose-ear-xiphoid process-right lateral costal margin +10cm - 15-30^{o} tilt, neck anterioflexed and midline - NGT removed prior to NJ insertion - When gastric placement confirmed, turned to right lateral oblique - Tube advanced and position confirmed by air auscultation - Technique 2: Air injected 10ml/kg (max 500ml) at gastric and pylorus markers - Technique 3: 3mg/kg iv erythromycin over 60mins 30mins before procedure Some operators used 'snap-back-test' (<2ml of 10ml air aspirated when in SB.	94.6% has tubes passed into SB successfully on 1st or 2nd attempt, 88% 1st attempt. No statistical difference in methods. Greater the experience of operator higher success rate. Gastric insufflation – smaller volumes need studied
*McDermott et al 2007 UK	n = 21 patients and 27 NJTs 19 ventilated	Audit of 27 NJTs inserted under blind protocol in 21 PICU patients	Absence of clinical guidelines for NJT insertion makes procedure haphazard, often unsuccessful, delays procedure and necessitates XRs Only 1/22 PICUs (St. Marys) had guidelines Blue food dye ? mitrochondrial toxicity	-Confirm gastric position with pH, advance tube -Confirmation confirmed by higher pH or snap-back-test -XR if child not ventilated	Mean time to pass tube 16 mins Common indications for passing NJTs were feed intolerance and large GRV 58% of patients would probably have required PN if NJT unsuccessful 26/27 staff found guideline easy to follow

			(Van Way, 2004 & US FDA, 2003)		
*Joffe et al 2000 Canada	n = 38 patients, 71 NJTs <17years 15 patients post-op cardiac 69% ventilated Prospective interventional study		NG feeds poorly tolerated in PICU due to gastricparesis. Transpyloric feeding limited by difficulty in tube placement.	Intensivist requested NJ (without fundoplication, (pharyngeal trauma or gastric ulceration) Passed by either 1 intensivist or 1 of 3 PICU nurses. UWT polyurethane guidewired tube 6Fr, 56cm <6kg, 91cm >6kg Tube marked – gastric position and pyloric (right lateral costal margin) 15-30^{o} tilt, right lateral position, head midline and anteroflexed Sedation given and metoclopramide 0.1mg/kg iv Tube advance 1cm at a time and 2-5mls air, once at pyloric marker 5-10ml air insufflated and tested for < 2ml return. Once in this was positive tube advanced a further 5-10cm Higher pitch on auscultation over right midline, RUQ Bile coloured fluid, pH >=5 XR confirmation Standard technique + metoclopramide, right lateral position and air insufflation until< 2ml air aspirated from 5-10ml instilled	Mean age 56/12 Mean weight 17.8Kg NJT 94.4% OJT 5.6% Success rate 63/71 88.7% 36/38 95% of patients had successful placement Average time to insert 7.43mins, median 5mins, range <1-45mins Day 1 XR 15.9% in jej. Day 2: 33.3% in jej. Day 3-5 51% in jej Conclusion: Bedside placement simple, rapid, well tolerated highly successful with little training Feeling of give at pylorus (26%), change in auscultation pitch (reported in 75% but only accurate in 40%) and ability to aspirate fluid (21% and accurate in 100%) not sensitive enough confirmation tests. Inability of aspirate insufflated air predicted correct placement in

					PPV=88.7%
*Sergio et al 2002 Brasil	n = 78 (incl. 40 controls) RCT in PICU in 2 tertiary hospitals	To test air insufflation to place enteral feeding tubes and the effectiveness of using smaller insufflation volumes in paediatrics	Indication for TEN Dr's decision Dr carried out procedure Exclusion criteria: facial trauma, gastrostomy, use of prokinetics UWT Polyurethane tube (6, 8, 10fr) and guide wire	Modified procedure based on air sufflation as described by Spalding et al An additional air bolus (10ml/kg) was not utilised. Standard Insertion (control Gp): - NGT insitu -2 marks – gastric and pyloric (right lateral margin) -Elevated decubitus position at 45^{o}, neck anteroflexion -Gastric position confirmed auscultation over epigastric region -pt into right lateral decubitus and tube advanced to second mark Pt return to supine Gastric Insufflation (study Gp): - Same as standard plus - Air insufflation of 10ml/kg into stomach (max 500ml)at first marking - Pt kept in right lateral decubitus position and tube advanced to mark 2. XR confirmed position in both groups	Study Gp = 33/38 (86.8%) tubes successfully placed in 1^{st} attempt Control Gp = 18/40 (45%) ($p<0.00026$) Time to insert < 10mins in both groups. No complications Gastric insufflation: -has proved a useful tool. -Simple and feasible -Higher success rate than standard technique Rationale being that gastric distention opens pyloric outlet and stimulates gastric contraction (motility) 10ml/kg air may significantly improve success rate without increasing risks

*Spalding et al 2000 USA	n = 50 PICU Prospective RCT	To test effectiveness of gastric insufflation as an adjunct too placement of feeding tubes in small bowel	UWT	10ml/kg air insufflation and tube advanced proximal to pylorus, additional 10ml/kg injected and tube advanced to 4th part of duodenum No air injected in control group	- 23/25 successful in gastric insufflation Gp in 1st attempt - 11/25 successful in control Gp in 1st attempt (p= 0.001) - 2nd attempt 25/25 gastric insufflation and 18/25 in control gp. Gastric insufflation allows rapid placement with fewer attempts
Sanchez et al 2006 Spain	n = 212 Prospective observational study	3days – 17years old receiving transpyloric (TEN) feeding in post-op cardiac period from 1994-2002. Compared with those receiving TEN for other diagnosis	GRV > 50% feed volume x2 indicated TEN	Tubes inserted by blind or by placing patient in lateral decubitus position with air sufflation and iv metoclopramide. If failed by endoscopic guidance. Weighted tube then guidewire tube used. Position confirmed by pH> 6 and AXR.	- 350, 10.3% PICU admissions received TEN - 212, 60% post-op cardiac (177 post pump) - TEN longer to initiate in cardiacs - No association with TEN and hepatic/GI complications - Non-cardiac received pneumothorax following TEN insertion - Only 2 NEC patients
Babbit 2007 USA	n = 190 patients, 228 NJTs 148 patients ventilated Retrospective review	4 year review of transpyloric feeding in a 20 bed PICU	6Fr or 8Fr UWT Corflo tube used - Physician inserted NJT following protocol. - Pre-measurement of tube and metoclopramide		LOS 12days in PICU for those with NJTs NJT in place 9 days (3-104) Feeds held for 2.8hrs for extubation 29% feeds not stopped for extubation, 5/43 reintubated with no episodes of

			administered prior to tube insertion - Tube placed nasogastrically - Advanced through pylorus whilst slowly injecting air - XR confirmation		aspiration 96% reached full energy requirements, average time to reach this was 44 hours, when those requiring trophic feeds excluded due to systemic illness, average time 34hours Most common complication 22.6% inadvertent removal, malposition or malfunction Diarrhoea 6.8% NEC 2.1% (4 patients, 3 with cyanotic CHD) This equates to 43% (3/7) of cyanotic CHD patients developing NEC 1 patient died (CoA) due to intestinal perforation +intra-abdominal sepsis, 1 day after NJT passed.
De Lucas et al 2000 Spain	n = 240 (14.6% of PICU admissions) 90% ventilated Retrospective	Compare transplyloric enteral nutrition (TEN) and parenteral nutrition in PICU Analyse effect of TEN programme on use of PN, complications and cost.	1993 PN to all patients unable to tolerate gastric feeding, 1994 TEN programme introduced	WT 6Fr-10Fr, position confirmed by pH > 6 and XR	240 patients (14.6% PICU admissions) received PN and/or TEN PN 168 TEN 21 51 TEN + PN PN usage reduced 16% to

	descriptive comparative study over 4 years (1993-1996)				5.5%) as TEN incidence (3.2% - 10.5%) and duration increased. Hospital acquired infection (50.4%) PN 45.8%, TEN 47.6% and PN + TEN 76%HAI related to increased LOS in PICU and ventilated time Cholestasis PN 39.2% TEN 4.7%, PN + TEN 50.9% Hyperglycaemia and Hyper trigs > in PN than TEN Mortality PN 19.6%, TEN 9.5% Diarrhoea – no difference between PN & TEN Conclusion: TEN simple and less complications than PN and saves £. TEN should be 1st method if unable to tolerate gastric, using PN if TEN contraindicated or poorly tolerated.

Jacobs et al 1999 USA	n = 53 Poster abstract	Patients randomised into 2 groups, Gp 1 continued to receive TEN during weaning and extubation Gp 2 did not	Gp 2 fasted for ≥ 4 hours pre and post extubation	NA	Gp 2 received greater amount of calorie intake day of and day after extubation. Continuation of TEN is safe and results in improved nutrition during ventilator weaning and extubation
Gharpure et al 2001 USA	n = 74 Prospective RCT	Evaluate effect of erythromycin on transpyloric passage of feeding tubes and its effect on distal migration of duodenal feeding tubes.	10mg/kg iv erythromycin or saline placebo 60mins before passage of WT tube XR 4 hours later. If tube proximal to third part duodenum 2 additional doses administered 6 hrs apart. Repeat XR 14-18hours after tube insertion		Erythromycin did not facilitate transpyloric passage of feeding tubes or distal migration of duodenal tubes.
Porter et al 2005 USA	n = 69 PICU > 3.5Kg 1week – 18 years	Comparative study of success rates of weighted and unweighted transpyloric tube placement		Used modified air insufflation technique Confirmed with AXR	WT 86.5% UWT 90.6% WT need removed for MRI
Krafte-Jacobs et al 1996	n = 68 Randomised prospective	Comparison of constant pH monitoring during NJ placement			
Lazonby et al 2004 UK	Poster abstract	Brief data (possibly included in article in McDermott et al, 2007 publication)			

Stone et al 2000 USA	Bedside Placement of Postpyloric Feeding Tubes. Review article in Adults