



BEAUMONT HOSPITAL'S INTENSIVE CARE UNITS

Multidisciplinary Nutrition Support Guidelines: Adults

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1.0 **Aim:** These guidelines should promote the safe provision of enteral feeding to ICU patients. They should aid, not replace clinical judgement.

2.0 **Scope:** These guidelines apply to the multidisciplinary team involved in providing nutritional support to ICU patients.

3.0 **Definitions:**

Enteral feeding involves the non-volitional delivery of nutrients by tube into the gastrointestinal tract. A ‘decanted feed’ refers to a feed that needs to be poured into a feeding container before being hung at the bedside. Ready-to-hang feeds can be connected directly to the feeding system at the patient’s bedside.

Parenteral nutrition is the intravenous aseptic delivery of sufficient nutrients including protein, carbohydrate, lipids and essential fatty acids, electrolytes, vitamins, trace elements and water via a dedicated central line, where sufficient nutrition via the alimentary tract is not possible.

4.0 **Abbreviations:**

CRRT	continuous renal replacement therapy	ASPEN	American Society for Parenteral and Enteral Nutrition
CVC	Central venous catheter	ESPEN	European Society for Clinical Nutrition and Metabolism
GCS	glasgow coma scale	PENG	Parenteral and Enteral Nutrition Group of the British Dietetic Association
ICU	Intensive care unit	CPG	Canadian Clinical Practice Guidelines
NG	nasogastric	ACCP	American College of Chest Physicians
ND	nasoduodenal	PN	Parenteral nutrition
NJ	nasojejunal	EN	Enteral nutrition
PEG	percutaneous endoscopic gastrostomy	RIJ	radiologically inserted jejunostomy
PEJ	percutaneous endoscopic jejunostomy	TG	triglyceride
RIG	radiologically inserted gastrostomy		

5.0 **References:**

Guideline references:

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Article references:

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- Powell-Tuck J, Jamieson CP, Bettany GEA, et al. A double blind, randomised, controlled trial of glutamine supplementation in parenteral nutrition. *Gut* 1999;45:82-88.
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Nutritional Requirements

Where possible, all patients should be nutritionally assessed and their requirements estimated prior to commencing artificial nutrition support. Otherwise all patients are given nutrition support as soon as is indicated. Consider energy provision from medical therapies, such as propofol or dextrose infusions, when forming nutritional care plan.

Macronutrient requirement recommendations:

Nutrient	Recommendation <i>(per kg recommendations infer per kg per 24 hr.)</i>	Guideline Source
Energy	Individualise. Use validated equations, in the absence of indirect calorimetry.	PENG 2004
	20-30kcal/kg.	ESPEN 2006, ASPEN 2009, ACCP 1997
	20-25kcal/kg in acute phase of critical illness. 25-30kcal/kg in recovery phase.	ESPEN 2006
	Consider hypocaloric feeding in critically ill obese (BMI >30kg/m ²) eg. 60-70% of target energy requirements or 11-14kcal/kg actual body weight or 22-25kcal/kg ideal body weight.	ASPEN 2009
Protein	1.2-1.5g protein/kg for many critically ill.	ACCP 1997
	0.17-0.3g nitrogen/kg.	PENG 2004
	1.2-2.0g protein/kg if BMI<30kg/m ² . 2g/kg ideal body weight if BMI 30-40kg/m ² . 2.5g/kg ideal body weight if BMI >40kg/m ² .	ASPEN 2009
	Caution with excess nitrogen in severely ill.	NICE 2006
Glucose	3-5 mg/kg/minute/24hr.	ESPEN 2006
	3-5 (maximum 7) g/kg.	ESPEN 2006
	30-70% of total kcal.	ACCP 1997
Fat/lipid	1-1.5g/kg for non-septic patients.	PENG 2004
	0.8-1g/kg in sepsis/SIRS.	PENG 2004

Enteral Tube Feeding

Enteral feeding is the preferred route of feeding for critically ill patients. *Where possible*, all patients should be nutritionally assessed and their requirements estimated prior to commencing tube feeding. Otherwise all patients are given enteral nutrition as soon as is indicated. Only radio-opaque nasogastric/orogastric tubes should be used for feeding Intensive Care patients.

Standard Feeds (Nutricia):

- Tolerated by the majority of patients.
- Composition: polymeric/whole protein, maltodextrins, vegetable fat, electrolytes and micronutrients.
- Nutrison: 1 kcal/ml & 4g protein/100ml.
- Energy: 1.5 kcal/ml & 6g protein/100ml.
- Protein Plus: 1.25 kcal/ml & 6.3g protein/100ml

Common Uses of Standard Feeds:

Nutrison (1.0 kcal/ml)	Nutrison Energy or Protein Plus
Jejunostomy and nasoenteric feeding	NG feeding
Medical patients	Post-surgery patients
Thin patients	Post-trauma patients
Light weight patients	Fluid restricted patients
Older patients	Young adult patients
Where larger volumes are needed in hypermetabolic patients	Hypermetabolic patients
	Neurosurgery patients

Specialised Feeds:

Specialised feeds should only be used when clinically indicated.

Specialised Feed	Current Indication for Use
Pulmocare & Diason (<i>Low carbohydrate/glucose feeds</i>)	Persistent hyperglycaemia. Pre-existing diabetes mellitus.
Multi Fibre & Energy Multi Fibre (<i>contains fibre - mixed</i>)	Prolonged tube feeding expected. To improve bowel problems eg. non-infection related diarrhoea, constipation.
Concentrated (<i>lower potassium/phosphate/sodium; 2kcal/ml</i>)	End stage or acute renal failure with or without haemodialysis. Not suitable for patients on CVVHDF. Liver patients with ascites.
Nepro (<i>lower potassium than Concentrated</i>)	Patients with hyperkalaemia not controlled on Concentrated.
Nutrison Low Sodium (<i>very low sodium – 1.1 mmol/100ml</i>)	Resistant hyponatraemia with serum sodium >150 mmol/litre. Often used in conjunction with sterile water enteral infusion. Liver related ascites.
Sterile Water (Nutrison)	Hyponatraemia or extra fluids needed.
Peptisorb (<i>semi-elemental</i>)	Significant malabsorption suspected. Cystic fibrosis patients where enzyme powder can be given concurrently.

Emsogen	Cystic fibrosis where enzymes cannot be administered concurrently.
Nutrison MCT	Where LCT fat restriction is needed eg. chylothorax.
Oxepa*	ARDS/ALI patients or those at high risk of ARDS/ALI

*Trials show benefits in ARDS/ALI adult patients from enteral feeds enriched with eicosapentaenoic acid (EPA), gamma-linolenic acid (GLA) and antioxidants.

See appendices 1&3 for guidelines on enteral feeding rate aims for adults & procedure.

Strategies to improve enteral feeding tolerance in adults:

For patients with inadequate feed tolerance, eg. persistently raised gastric aspirate/residual volumes:

- Consider use of prokinetics (metaclopramide +/- erythromycin), unless contraindicated. If ineffective after 24-48 hours, consider an alternative strategy. Routine use of prokinetics is not recommended unless signs of feed intolerance are present.
- Consider use of laxatives if no bowel motion, eg. for 3 days or more, where there is no contraindication.
- Reduce use of opiates where possible.
- Consider patient positioning. Elevate head of patient >30-45 degrees, where possible.
- Consider post-pyloric access for feeding.
- Control hyperglycaemia if present.
- Correct abnormal electrolytes and avoid hypokalaemia, where possible.

Enteral Glutamine supplementation:

Enteral glutamine supplementation is associated with outcome benefits in burns and trauma patients in intensive care. For trial use in General ICU: Adamin-G glutamine powder (Nutricia).

Indication for use	Trauma & burns patients in General Intensive Care Unit.
Product	Adamin-G glutamine sachets. Each sachet contains 5g of glutamine (6g protein).
Dose	At least 2 sachets twice daily, equivalent to 20g glutamine. (Ideal dose: 0.3-0.5g glutamine/kg/24hours.)
Administration	Mix 2 sachets in 100ml sterile water & give as bolus through nasogastric or orogastric tube.
Duration	While in ICU, discontinue when ready for ward transfer.

Vitamins and Trace Elements:

Where possible, and in accordance with evidenced based guidelines (ASPEN 2009, CPG 2009), all critically ill ICU patients should receive supplemental vitamins and minerals. Give centrum (crushed and mixed with sterile water) via enteral feeding tube once daily, unless contraindicated. Use liquid micronutrient preparation if more appropriate (eg through jejunostomy tubes). Flush feeding tubes with 30 to 50ml sterile water after micronutrient administration. Use water soluble vitamins for dialysis patients and patients at risk of fat soluble vitamin toxicity (eg. Orovite once daily, 5mg folic acid once daily).

Parenteral Feeding

1. **Requirements:**

- Consider the fat content of propofol infusion when estimating requirements.
- For PN patients with open wounds healing by secondary intervention (eg open surgery wounds, burns wounds, multiple trauma wounds, etc.), consider:
 - Protein provision of 1.5 to 2g protein/kg oedema-free weight.
 - Additional ampoule of Additrac daily (for supplemental zinc).

2. **Access & Administration:**

- See Beaumont Hospital's Parenteral Nutrition Policy.
- Ideally use dedicated CVC port for PN, as per Hospital policy. Only if absolutely necessary, consider administering PN via an existing used CVC port.
- Avoid femoral lines for PN if possible.
- Braun Infusomat Space volumetric pumps are used for administering PN in General ICU.
- Braun Infusomat pumps are used for administering PN in Richmond ICU.

3. **Dressing:**

- See Beaumont Hospital's Parenteral Nutrition Policy.
- Currently in ICU, Opsite IV 3000 is the dressing of choice for catheter site.
- The dressing is changed every 4 days aseptically or if it becomes soiled, wet or loose.

4. **Changing of PN:**

- See Beaumont Hospital's Parenteral Nutrition Policy.
- In General ICU PN is generally changed daily, between 16.00 hours and 17.00 hours.
- In Richmond ICU PN is changed every 24 hours.

5. **Monitoring:**

- See Beaumont Hospital's Parenteral Nutrition Policy.
- Triglycerides (TG) should be checked on day two of PN and once weekly thereafter, or more often in the presence of a propofol infusion. If hypertriglyceridaemia is detected, alter PN prescription and check TG level more often.

6. **Glycaemic control:**

- Insulin infusion should be titrated to aim for a blood glucose level between 7 & 9 mmol/litre, with 1, 2, and 4 hourly glucometer checks, as appropriate.

7. **Glutamine (intravenous):**

Rationale	Glutamine may become conditionally essential in critically ill patients. Current standard PN regimens do not contain glutamine due to stability issues.
Indications	Critically ill patients on full PN or PN + trickle enteral feeding.
Dose & administration	Ideally should be given via a central line, but can be given peripherally. Maximum infusion rate 25ml/hour. To be charted on drugs kardex: 1x100ml bottle of Dipeptiven over 4 hours. Ideally a dose of 0.5g glutamine/kg may be needed to show benefit.
Caution	In patients with severe liver and/or renal failure (without dialysis).

Standard PN	Do not alter the PN prescription while on Dipeptiven, except for patients with significant liver and renal impairment.
Discontinue	If transitioned to full enteral tube feeding or diet. On discharge from ICU.

100ml Dipeptiven provides: 20g N(2)-L-alanyl-L-glutamine
13.46g L-glutamine
8.2g L-alanine
(3.86g Nitrogen)

8. Current standards:

Braun hold the current PN contract for Beaumont Hospital. See appendix 2 for suggested rate aims in adults starting PN 'out-of-hours'. All Beaumont Standards (Regimens A to I) contain Cernevit and Additrac.

STANDARD BEAUMONT PN REGIMENS	PROPERTIES	POSSIBLE INDICATIONS
A	Moderate energy Moderate nitrogen	• Moderate catabolism
B	High energy High nitrogen	• Hyper-catabolism • Large patient
C	Lower energy Lower nitrogen	• Light weight patient • Underweight patient • Refeeding risk
D	Renal regimen Low potassium Low phosphate Low volume	• Renal failure & no CRRT • Severe fluid restriction
E	Lower glucose	• Moderate catabolism • Hyperglycaemia • Pre-existing diabetes mellitus.
F	Lower fat Lower sodium	• Hypertriglyceridaemia • Hyponatraemia
G	Lower fat Lower glucose High nitrogen	• Morbid obesity • Hypertriglyceridaemia • Hyperglycaemia
H	Fat free Calcium free	• Significantly raised TG level • Severe hypercalcaemia
I	Lower to moderate energy Moderate nitrogen	• Avoid overfeeding. • Combine with glutamine IV.

9. Stocks in ICU:

Regimen	Number of bags
D	3
E	3
F	3

PN regimens for General ICU and Richmond ICU are stored in General ICU PN refrigerator. Stock bags are kept in the ICU PN refrigerator.

Appendix 1: Guidelines on rate aims for adults, when enteral feeding is commenced out of hours.

Only use **radio-opaque tubes** for feeding Intensive Care patients.

Suggested Feed Rate Aims for Normal Weight ICU Patients:

FEED	Rate aim for normal weight men	Rate aim for normal weight women
Nutrison (1.0 kcal/ml)	80ml/hour	70ml/hour
Nutrison Energy	55ml/hour	45ml/hour
Nutrison Protein Plus	65ml/hour	55ml/hour
Nutrison Concentrated	45ml/hour	35ml/hour
Nutrison Low Sodium	80ml/hour	70ml/hour
Peptisorb	80ml/hour	70ml/hour

These rates provide approximately 1600 to 1700kcal for women, and 1900 to 2000 kcal for men, per 24 hours of feeding. This should avoid serious underfeeding or overfeeding in normal weight patients.

Suggested Feed Rate Aims for Malnourished ICU Patients:

Refeeding syndrome:

Some patients are at risk of refeeding syndrome. Giving these patients too much too soon can lead to:

- severe hypophosphataemia
- fluid balance abnormalities
- hypokalaemia
- hypomagnesaemia
- altered glucose metabolism
- vitamin deficiency

At risk patients (NICE guidelines 2006):

Any one of the following:	Any two of the following:
BMI <16 kg/m ²	BMI <18.5 kg/m ²
Unintentional weight loss of >15% within previous 3-6 months	Unintentional weight loss of >10% within previous 3-6 months
Very little or no nutrient intake for >10 days	Very little or no nutrient intake for >5 days
Low levels of K ⁺ , PO ₄ ⁼ , or Mg ⁺⁺ prior to any feeding	History of alcohol abuse
	History of some drugs, eg chemotherapy drugs, antacids*, diuretics*

*Use of magnesium or aluminium-containing antacids, and of diuretics can significantly affect serum electrolyte levels.

Suggested feeding guidelines:

- Nutrison Standard should be chosen unless contraindicated.
- Start at 10 ml per hour and increase rate every 8-12 hours by 10ml/hour, as tolerated.
- Aim for a maximum rate of 45 ml/hour until reviewed by a dietitian.
- Provide immediately before and during the first 10 days of feeding: oral thiamine 200–300 mg daily, vitamin B co strong 1 or 2 tablets, three times a day (or full dose daily intravenous vitamin B preparation, Pabrinex® 1&2 one pair daily for 3 days in most cases, or for 5 days if severe undernutrition is present) in addition to micronutrients received in enteral feeding formulae.

Appendix 2: Guidelines on rate aims for adults, when parenteral nutrition is commenced out of hours.

Suggested PN Rates for Normal Weight ICU Patients:

FEED	Rate aim for normal weight men	Rate aim for normal weight women	Possible indication for using regimen
D (renal)	62ml/hour	50ml/hour	Renal patients; patients requiring a significant fluid restriction.
E	95ml/hour	85ml/hour	Lower glucose needed; suitable for many patients with moderately raised requirements.
F	90ml/hour	75ml/hour	Low fat needed; low sodium needed.

These rates should not be used for patients at risk of refeeding syndrome.

These rates provide approximately 1600-1700 kcal per 24 hours for women, 1900-2000 kcal per 24 hours for men. This will avoid serious underfeeding or overfeeding in normal weight patients, who are not at risk of refeeding syndrome.

Suggested Rate Aims for Malnourished ICU Patients:

Refeeding syndrome:

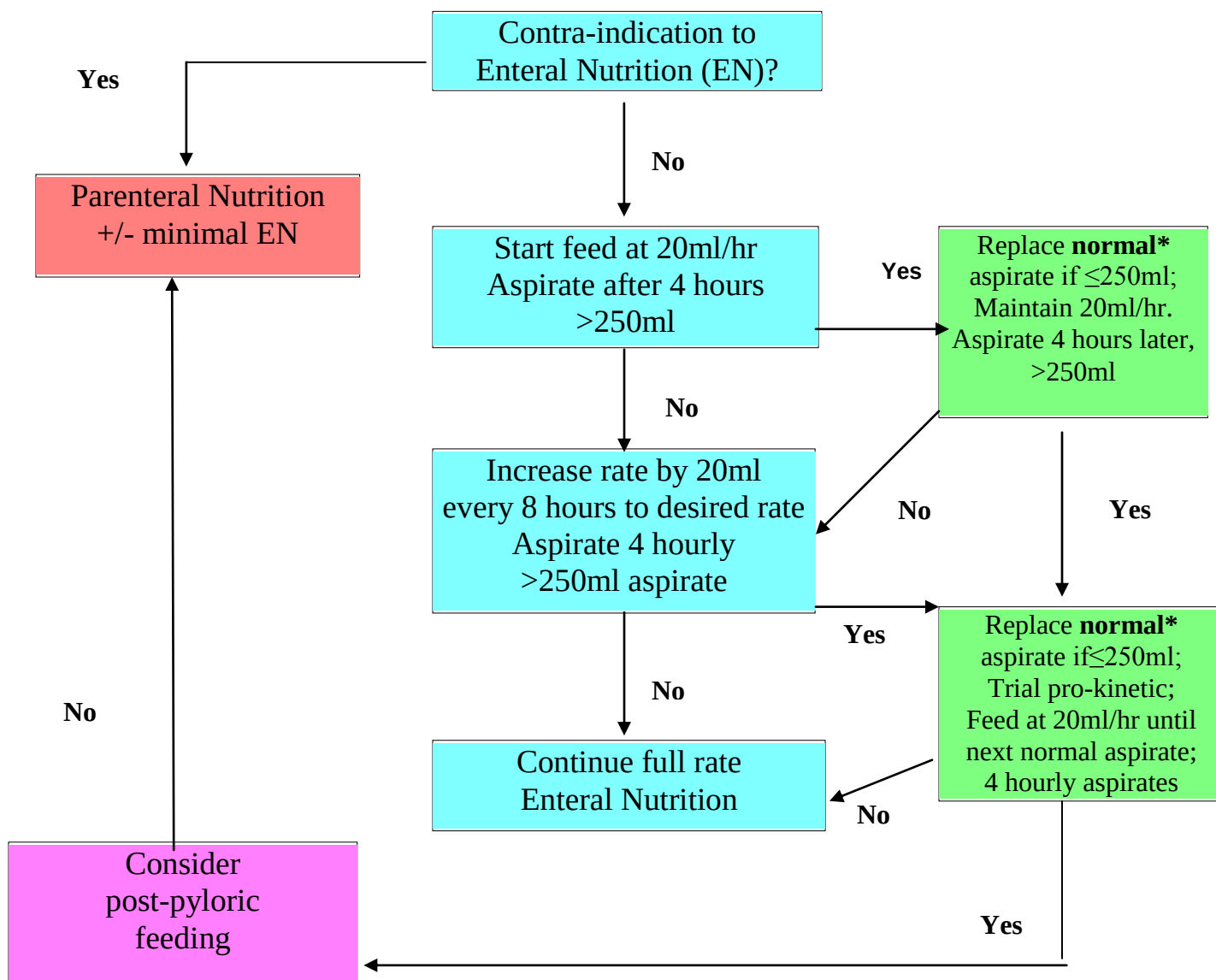
Chronically malnourished patients are at risk of refeeding syndrome. Giving these patients too much too soon can lead to potentially life-threatening abnormalities. Start on low rate PN and build up *gradually*. See below for guidelines. See appendix 1 for at risk patients.

Suggested feeding guidelines:

High refeeding risk Commence on approximately 10-15 kcal/kg/24 hours	Example: Commence a 40kg at risk patient on: - Regimen E at 20ml/hour (404 kcal per 24 hours) Until full assessment, aim for a maximum rate aim of: - Regimen E at 40ml/hour (808 kcal per 24 hours) If renal regimen D is needed: - Commence on 15ml/hour (488 kcal per 24 hours) - Maximum rate aim of 25ml/hour (813 kcal per 24 hours)
Mild to moderate refeeding risk Commence on approximately 20kcal/kg/24 hours	Example: Commence a 60kg at risk patient on: - Regimen E at 60ml/hour (1212 kcal per 24 hours), or If renal regimen D is needed: - Commence on 38ml/hour (1236 kcal per 24 hours)

- Anorexia nervosa patients may need to commence on lower rates (eg.5-10 kcal/kg/24 hours).
- Consider intravenous Pabrinex (in addition to Cernevit present in PN regimens) to provide high dose thiamine.
- Monitor for and correct hypophosphataemia, hypokalaemia and hypomagnesaemia.

Appendix 3: BEAUMONT HOSPITAL'S MULTIDISCIPLINARY ENTERAL FEEDING PROCEDURE FOR ICU (Adults)



NOTES:

- Use radio-opaque tubes for feeding Intensive Care patients.
- Orogastric tubes are preferred for patients with head or maxillo-facial injury.
- OG/NG position should be confirmed once to twice daily by checking the pH of 1ml of gastric aspirate. pH of 5.5 or less proceed to feed (refer to Beaumont Hospital's Department of Nursing Guidelines on insertion & monitoring of NG tubes & ICU Nursing Guidelines for NG feeding).
- Aspirate large bore feeding tubes 4 hourly once feeding has commenced.
- Elevate patient's head of bed to 30-45°, where possible, to reduce reflux/aspiration risk.
- If gastric residuals are recurrently >250ml reduce feed rate to 20ml/hr. Re-increase to prescribed rate once aspirate is <250ml. **Discard very large aspirates (>500ml) and inform ICU team.**
- ***Normal** aspirates are mainly feed and gastric juice. Discard faecal, curdled, bilious or coffee ground aspirates.
- Consider passing fine bore NG tube when aspirates are recurrently normal +/- patient is extubated but still requires NG feeding.
- Discard decanted feeds after 12 hours hang-time & ready-to-hang feeds after 24 hours.
- **Discontinue gastric prokinetics after 24 hours if no effect and consider post-pyloric feeding.**

Appendix 4: Jejunostomy Feeding Guidelines (Adults) (Post-upper GI Surgery)

Jejunostomy feeding tube	Vygon Nutricath jejunostomy feeding tube (reference 2300).
Placement	Surgical.
Commence feeding	Oesophagectomy: first morning post-surgery. Gastrectomy: first or second morning post-surgery – await team's instructions.
Feed instructions	Day 1 of feeding: Oesophagectomy • Commence at 20ml/hour for 8 hours. • Increase to 30ml/hour for a further 8 hours. • Increase to 40ml/hour for a further 8 hours. • Discontinue feeds and alert ICU +/- or surgical teams if intolerance, eg. abdominal distention, feed appearance in nasogastric drainage fluid, significant abdominal pain. Day 2 of feeding & onwards: Oesophagectomy • If no difficulties with feeding on day 1, increase feeds to 60ml/hour on day 2, and increase as per enteral feeding procedure above, ie 8 hourly by 20ml/hour, or as per patient specific feeding sheet, until rate aim is achieved. • If feed intolerance, do not increase feeds further and alert the ICU +/- or surgical teams. Day 1 of feeding: Gastrectomy • Commence at 20ml/hour for 24 hours. • Discontinue feeds and alert ICU +/- or surgical teams if intolerance, eg. abdominal distention, feed appearance in nasogastric drainage fluid, significant abdominal pain. Day 2 of feeding & onwards: Gastrectomy • Increase feeds to 40ml/hour for a further 24 hours. • Increase feeds to 60ml/hour for a further 24 hours. • Increase feeds to 80ml/hour or target rate (see individual patient feeding sheet) and continue. • If feed intolerance, do not increase feeds further and alert the ICU +/- or surgical teams.
Flushes	• Flush jejunostomy 4-6 hourly with 20-30ml of sterile water. • Where possible, avoid giving medications through the jejunostomy tube. Flush with 20-30ml of sterile water after administration.
Gastrogastrin swallow test	No need to hold jejunostomy feeds prior to gastrogastrin swallow test unless otherwise instructed by ICU +/- or surgical teams.

Appendix 5: Checking NG tube position in ICU adult patients

Checking position of newly placed NG tubes in ICU:

- See CXR report to confirm correct positioning of any blindly-placed tube (small or large bore). If report not available request CXR review by ICU Team.

OR

- pH testing can be used to confirm position as an alternative to CXR confirmation. A pH $\leq$ 5.0 indicates correct positioning of feeding tube.

Checking position of NG tubes (not newly placed) in ICU:

- The point of exit of a feeding tube from the body should be marked at the time of initial placement. Measure the *external* tube length (from nose to external tip of feeding tube). Observe for a change in the external tube length during feeding.
- Check pH and external tube length twice per 24 hours (once per nursing shift). Results are documented by nursing staff on the enteral feeding sheet.
- If the patient is fasting for procedure or other clinical reason, check pH during the feed break.
- Check pH more often if clinically indicated, eg. after coughing, vomiting, agitation, removal of endotracheal tube, etc.
- If pH $\leq$ 5.5 – continue feeding.
- If pH $>$ 5.5 – check external tube length, check if reason exists to suspect dislodgement of NG tube, eg. after coughing, vomiting, agitation, removal of endotracheal tube.
- If no reason found, continue feeding. If reasonable doubt about location of NG tube, stop feeds for 1 hour and recheck pH. If pH $\leq$ 5.5, restart feeding.
- **If possible dislodgement suspected**, refrain from using NG tube and request review by ICU Team, who will make a clinical decision whether to restart feeds, or whether X-ray confirmation is warranted.