Manchester Cancer

Central Manchester University Hospitals NHS
NHS Foundation Trust

Greater Manchester and Cheshire HPB Unit Guidelines for the Assessment & Management of Hepatobiliary and Pancreatic Disease

Chapter 15

Contents

15. General perioperative management ____ *169*

15.1. HPB WHO Checklist ____ 170

15.2. ERAS Protocol for management of liver resection ____ 174

15.3. ERAS Protocol for perioperative management of Pancreatoduodenectomy ____ 176

15.4. Algorithm for reducing the risk of venous thromboembolism ____ 178

15.5. Algorithm for IV fluid therapy ____ 180

15.6. Acute Kidney Injury ____ 181

15.7. Composition of commonly used crystalloids ____ 182

15.8. Composition of common fluid losses ____ 183

15.9. Malnutrition Universal Screening Tool (MUST) ____ 184

15.10. Indications for nutrition support ____ 185

15.11. Nutritional Support and Refeeding syndrome ____ 186

15.12. Protocol for nutritional, anthropometric and clinical monitoring of nutrition support ____ 188

15.13. Protocol for laboratory monitoring of nutrition support ____ 191

15.14. HPB Quality Improvement Programme (QIP) ____ 193

15. General perioperative management

15.1. ***HPB WHO Checklist***

HPB WHO CHECKLIST

Date:	**Theatre No.:**
Time:	
Surgeon:	Anaesthetist:
Grade of most senior surgeon present:	Grade of most senior anaesthetist present:
Number of cases:	
Operations:	
1.	**4.**
2.	**5.**
3.	**6.**

Team Briefing – Before starting the first patient

Are all team members present? Yes ☐ No ☐
If NO please enter name of individual not present:

Are all team members known to each other by name and role?
Yes ☐ No ☐

Are there any list change? Yes ☐ No ☐

If YES please enter details:

Is the anaesthetic equipment check completed? Yes ☐ No ☐
If No please check now.

Is a difficult intubation anticipated? Yes ☐ No ☐

Is all equipment required for the case available and working?

Case	1	2	3	4	5	6
Laparoscopic stack	☐	☐	☐	☐	☐	☐
CUSA	☐	☐	☐	☐	☐	☐
Argon	☐	☐	☐	☐	☐	☐
IOUS	☐	☐	☐	☐	☐	☐
Harmonic	☐	☐	☐	☐	☐	☐
Haemostatic agents	☐	☐	☐	☐	☐	☐
Staplers	☐	☐	☐	☐	☐	☐

Other equipment/instrument issues:

Other patient related issues (e.g. high-risk, co-morbidity)

Is a HDU bed required and available?

Case	1	2	3	4	5	6
Yes	☐	☐	☐	☐	☐	☐
No	☐	☐	☐	☐	☐	☐

Does the patient have a valid Group and Save?

Case	1	2	3	4	5	6
Yes	☐	☐	☐	☐	☐	☐
No	☐	☐	☐	☐	☐	☐
High risk of major haemorrhage:	☐	☐	☐	☐	☐	☐

Are any blood products required and if so available?

Are antibiotics required? Yes ☐ No ☐
If YES which antibiotics?
Case 1 ☐ Case 3 ☐ Case 5 ☐
Case 2 ☐ Case 4 ☐ Case 6 ☐

Are somoatostatin analogues required? Yes No

Case	1	2	3	4	5	6
Yes	☐	☐	☐	☐	☐	☐
No	☐	☐	☐	☐	☐	☐

Is a frozen section likely to be required and if so has pathology been informed?
Yes ☐ No ☐

Is radiology assistance required and if so has it been arranged?
Yes ☐ No ☐

Events during the list	**Team De-Briefing**
Concerns in briefing: (patient specific issues; equipment etc)	Opportunities for improvement:
	During the session were there any incidents to: Missing instruments or swabs Yes ☐ No ☐ Wrong site surgery Yes ☐ No ☐ Difficult/failed intubation Yes ☐ No ☐ Cancelled operation due to Equipment/instrument Yes ☐ No ☐ Missing or wrong labelled specimens Yes ☐ No ☐
Escalation to if not resolved:	Action taken:
	Number of patients scheduled to list:
	Number of patients cancelled:
	Signature: Date

Individual Patient's Surgical Safety Checklist

Date	Time	Theatre no.
Before induction of anaesthesia	**Before skin incision**	**Before patient leaves theatre**
Sign in	Time Out	Sign Out
Confirm patient has the correct details **Identification** Pre-operative checklist completed ☐ Name, DOB, Hospital no ☐ Procedure confirmation ☐ (Consent form, operating list, medical notes, patient's marking correct site surgery form) Verbal confirmation, visual surgical marking confirmation ☐ **Patient information** Known allergy ☐ High airway or aspiration risk ☐ Specialised equipment available ☐ Risk of blood loss ☐ Essential imaging available ☐	Confirmation that all team members have been introduced by name and role Yes ☐ No ☐ Confirm patient details **Patient identification** ☐ (Name, DOB, Hospital number) **Procedure identification** Consent form (site, side and procedure) ☐ Surgeon's verbal confirmation (site, side and procedure) ☐ Visual confirmation (site marking, procedure from correct site surgery form) ☐	Team verbal confirmation of: Correct swab, needle, instrument count was correct ☐ Confirmation of procedure completed ☐ The correct labelling of the specimen in the specimen pots ☐ Correct documentation of the above ☐ Opportunities for improvement: Handover to recovery confirmed:
Confirmation of briefing information.	Confirm essential information Essential imaging available ☐ VTE prophylaxis used ☐ Antibiotics administered ☐ SSAs administered ☐	Addressograph label:

15.2. *ERAS Protocol for management of liver resection*

Pre-operative:

- Appropriate referrals for smoking cessation and alcohol abstention (for alcohol abusers)
- Perioperative protocol and explanation given to patient.
- Measure BMI. Supplemental enteral nutrition for significantly malnourished patients.
- Baseline bloods to include tumour markers and CRP.
- See also: Consent, Cardiopulmonary Exercise Testing Protocol

On admission:

- DVT prophylaxis: subcutaneous LMWH (Clexane/Enoxiparin) given 12 hours before the procedure.
- Intake of clear fluids up to 2 hours before anaesthesia and solids up to 6 hours allowed.
- Oral carbohydrate drink to all patients without diabetes 2 hours before anaesthesia.
- Antibiotics: Co-amoxiclav should be given 1 hour before incision. Repeat doses given at 4 hours intra-operatively. Post-operative doses not required.

Anaesthetic & Intra-operative:

- A multi-modal strategy to prevent PONV (e.g. TIVA, different types of antiemetic)
- Epidurals remain the gold standard; consider wound cathers or TAP block if unsuccessful.
- Normothermia: warming blankets should be used to keep patient's temperature as normal as possible throughout the perioperative period.
- Intra-operative flow guided therapy as standard.
- Consider the use of N-acetylcysteine (Parvolex) for major liver resections (or as part of a clinical trial): 10 g of Parvolex in 250 ml of 5% Dextrose infused continuously over 24 hours. This infusion is continued until the AST/ ALT begin to normalise following the initial rise in serum levels noted after a Liver resection as a result of hepatocellular damage.

Day 0

- *Postoperative analgesia:* epidural or PCA
- *Mobilization:* up to sit
- Fluid balance =0; 2 L/day Hartman's is sufficient

Day 1

- *Postoperative analgesia:* oral analgesia following NGT removal
- *NGT:* removed if drainage volume <500 ml (refer to NGT removal criteria)
- *Fluid balance:* allow free clear fluids; reduce i.v. fluids to 1 l/day if oral intake is >500 ml
- *Central line removal*
- *Arterial line removal*
- *Mobilization:* up to sit for 1 h
- *HDU:* consider discharge to ward (refer to HDU discharge criteria)
- *Nutrition:* Soft food intake, energy drinks

Day 2

- *Intra-abdominal drains:* cut and bag drains to improve mobility
- *Mobilization:* up to sit for 2 h
- *Fluid balance:* stop i.v. fluids

Day 3

- *Postoperative analgesia:* **stop** epidural
- *Urinary catheter:* **remove** urinary catheter when epidural is stopped
- *Mobilization:* sit up for 3 h and short walk around bed
- *Nutrition:* solid food intake
- *Intra-abdominal drains:* fluid bilirubin levels of drains sent to laboratory; remove drain if bilirubin is <30 U/l and drain output is <100 ml

Day 4

- *Mobilization:* walking for 20 min
- ALL lines out?

Day 5

- *Hospital discharge:* consider discharge if hospital discharge criteria are met, or prepare for discharge if social services needed.

15.3. *ERAS Protocol for perioperative management of Pancreatoduodenectomy*

Pre-operative:

1. Avoid endoscopic biliary drainage if bilirubin < 250µmol/l
2. Appropriate referrals for smoking cessation and alcohol abstention (for alcohol abusers)
3. Perioperative protocol and explanation given to patient.
4. Measure BMI. Supplemental enteral nutrition for significantly malnourished patients. Prescribe Creon 80,000 units tds, as per PEI protocol, in cases of pancreatic cancer or evidence of pancreatic duct obstruction
5. Baseline bloods to include tumour markers and CRP.

On admission:

6. DVT prophylaxis: subcutaneous LMWH (Clexane/Enoxiparin) given 12 hours before the procedure.
7. Mechanical bowel preparation should not be used.
8. Intake of clear fluids up to 2 hours before anaesthesia and solids up to 6 hours allowed.
9. Oral carbohydrate drink to all patients without diabetes 2 hours before anaesthesia.
10. Antibiotics: Taxozin should be given 1 hour before incision. Repeat doses given at 4 hours intra-operatively. Post-operative doses not required.
11. Insert a nasogastric tube if gastric outlet obstruction is present

Anaesthetic & Intra-operative:

12. A multi-modal strategy to prevent PONV (e.g. TIVA, different types of antiemetic)
13. Epidurals remain the gold standard; consider wound catheters or TAP block if unsuccessful.
14. Octreotide: 200 µg SC to be administered on induction. Continue post-operatively until normal feeding established.
15. Normothermia: warming blankets should be used to keep patient's temperature as normal as possible throughout the perioperative period.
16. Intra-operative flow guided therapy as standard.

Day 0:

17. Postoperative analgesia: epidural or PCA, wound catheter or intrathecal opiods alone or in combination
18. Fluid balance: even (near-zero) fluid balance should be aimed for all patients. UK Reference Nutrient Intake in normal adult is 70 mmol/24 hr, accompanied by 1.5 – 2.5 litres of water. 2L/day Hartman's is sufficient if haemodynamically stable and sufficient end-organ perfusion (brain and kidney)
19. Mobilization: sit up in bed

Day 1:

20. Fluid balance: allow free clear fluids; reduce i.v. fluids to 1 l/day if oral intake is >500 ml
21. NGT: removed if drainage volume <500 ml (refer to NGT removal criteria)
22. Feeding: start NJ tube feed as per protocol (attached)
23. Postoperative analgesia: oral paracetamol or IV. Caution with NSAIDs due to increased risk of anastomotic breakdown.
24. Arterial line removal: if FiO2 <40%, and BE >-0.5
25. Mobilization: to sit out for 1 h

Day 2:

26. Intra-abdominal drains: cut and bag drains to improve mobility
27. Mobilization: to sit out for 2 h
28. Fluid balance: stop i.v. fluids if oral intake is >1 L.
29. HDU: consider discharge to ward (refer to HDU discharge criteria)
30. Central line: remove central line, if peripheral access is sufficient.

Day 3:

31. Postoperative analgesia: **stop** epidural/PCA, establish oral analgesia
32. Urinary catheter: **remove** urinary catheter when epidural is stopped
33. Mobilization: sit up for 3 h and short walk
34. Nutrition: Soft food intake (soup and mashed food), energy drinks
35. Drain: fluid to be sent for amylase.

Day 4:

36. Nutrition: solid food intake
37. Mobilization: walking for 20 min
38. ALL lines out?, including peripheral IV access.

Day 5:

39. Intra-abdominal drains: remove drain if day 3 fluid amylase is <330 U/l and drain output is <100 ml
40. Stop Octreotide

Day 6:

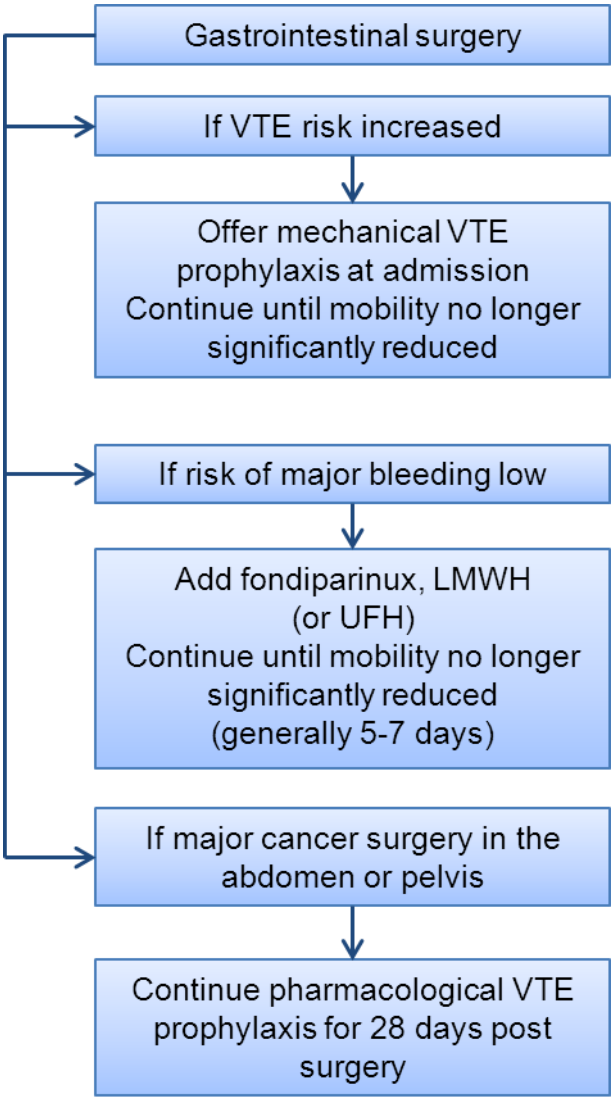
41. Hospital discharge: consider discharge if hospital discharge criteria are met, or prepare for discharge if social services needed.

Additional Notes

42. Daily blood includes: FBC, U, Cr, Na, K, Mg, Phosphate, LFTs, Clotting,
43. ABGs on day 1 and 2 (while they are in HDU)
44. Drain amylase day 3.
45. All complications to be graded (ISGPS definitions) and discussed in HPB QIP weekly meeting.

15.4. *Algorithm for reducing the risk of venous thromboembolism*

Based on NICE clinical guideline 92



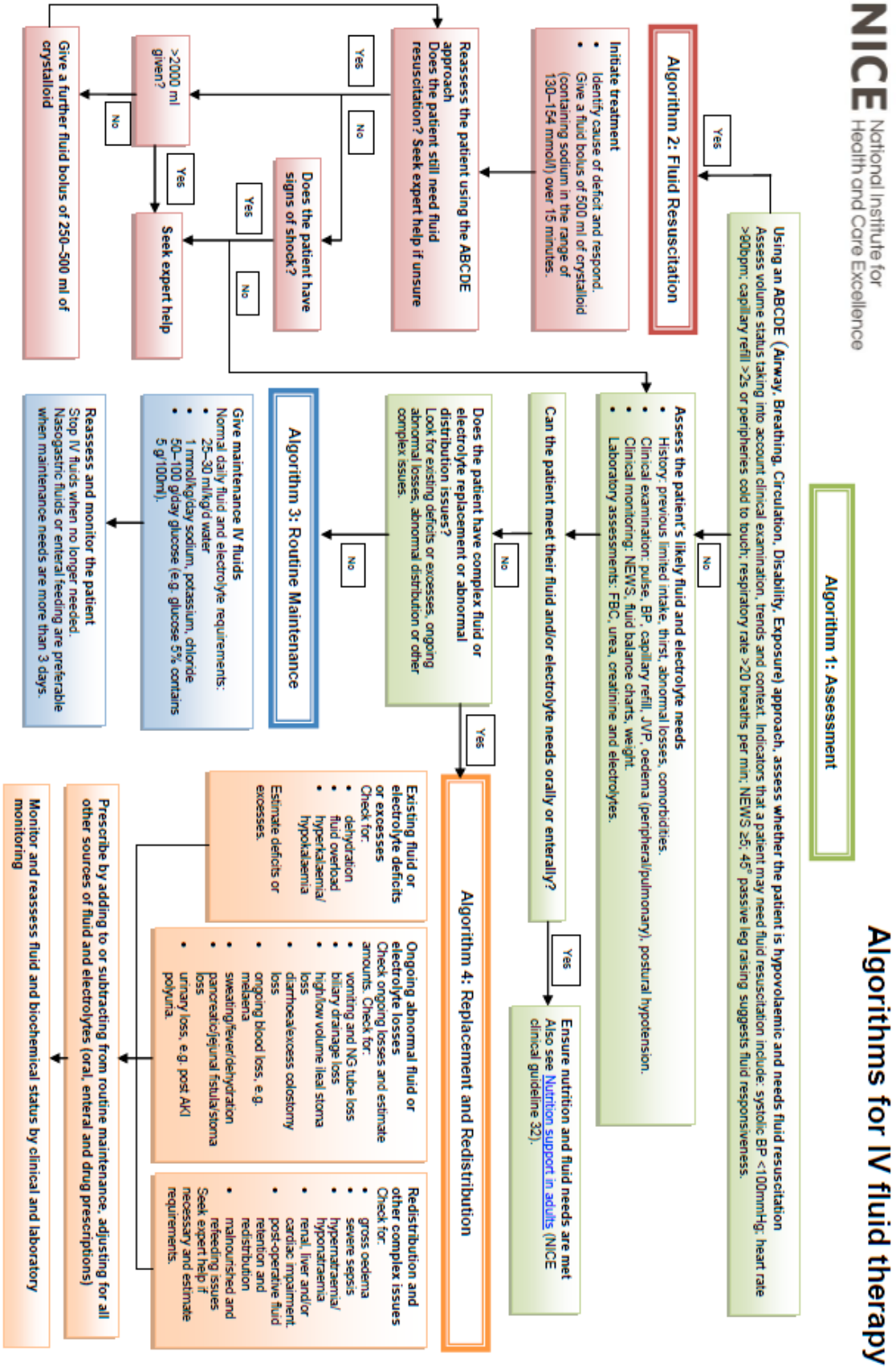
Box 1 Risk factors for VTE

- Active cancer or cancer treatment
- Age over 60 years
- Critical care admission
- Dehydration
- Known thrombophilias
- Obesity (body mass index [BMI] over 30 kg/m^2)
- One or more significant medical comorbidities (for example: heart disease; metabolic, endocrine or respiratory pathologies; acute infectious diseases; inflammatory conditions)
- Personal history or first-degree relative with a history of VTE
- Use of hormone replacement therapy
- Use of oestrogen-containing contraceptive therapy
- Varicose veins with phlebitis

Box 2 Risk factors for bleeding

- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with international normalised ratio [INR] higher than 2)
- Lumbar puncture/epidural/spinal anaesthesia expected within the next 12 hours
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours
- Acute stroke
- Thrombocytopenia (platelets less than 75 x 10^9/l)
- Uncontrolled systolic hypertension (230/120 mmHg or higher)
- Untreated inherited bleeding disorders (such as haemophilia and von Willebrand's disease)

15.5. *Algorithm for IV fluid therapy*



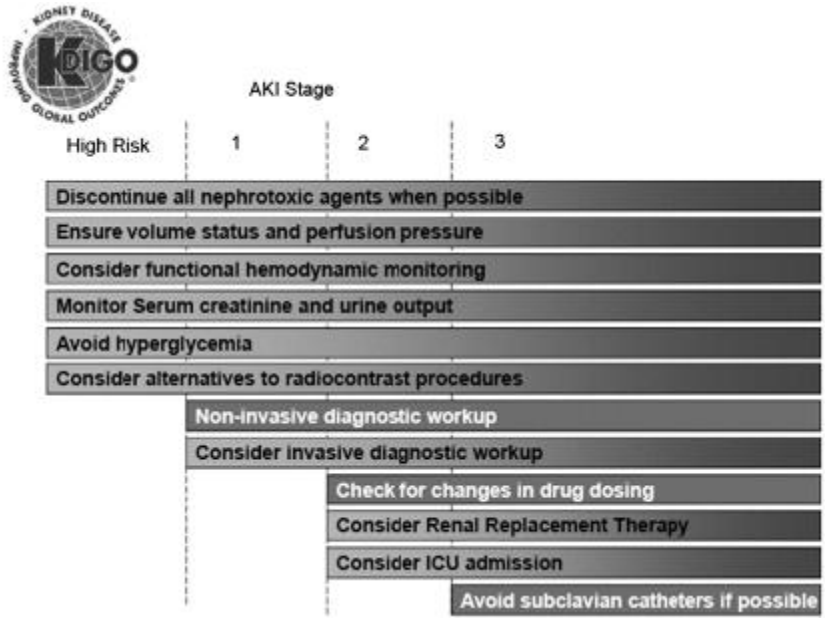
15.6. *Acute Kidney Injury*

KDIGO AKI Work Group: KDIGO clinical practice guideline for acute kidney injury. *Kidney Int Suppl* 2012, 2:1-138

Definition of AKI

Stage	Serum creatinine	Urine output
1	1.5–1.9 times baseline OR ⩾0.3 mg/dl (⩾26.5 µmol/l) increase	<0.5 ml/kg/h for 6–12 hours
2	2.0–2.9 times baseline	<0.5 ml/kg/h for ⩾12 hours
3	3.0 times baseline OR Increase in serum creatinine to ⩾4.0 mg/dl (⩾353.6 µmol/l) OR Initiation of renal replacement therapy OR, In patients <18 years, decrease in eGFR to <35 ml/min per 1.73 m^2	<0.3 ml/kg/h for ⩾24 hours OR Anuria for ⩾12 hours

Managing acute kidney injury



15.7. *Composition of commonly used crystalloids*

Content	Plasma	Sodium chloride 0.9%*	Sodium chloride 0.18%/ 4% glucose[a]	0.45% NaCl/ 4% glucose[a]	5% glucose[a]	Hartmann's	Lactated Ringer's (USP)	Ringer's acetate	Alternative balanced solutions for resuscitation**	Alternative balanced solutions for maintenance**
Na^+ (mmol/l)	135–145	154	31	77	0	131	130	130	140	40
Cl^- (mmol/l)	95–105	154	31	77	0	111	109	112	98	40
$[Na^+]:[Cl^-]$ ratio	1.28–1.45:1	1:1	1:1	1:1	-	1.18:1	1.19:1	1.16:1	1.43:1	1:1
K^+ (mmol/l)	3.5–5.3	*	*	*	*	5	4	5	5	13
HCO_3^- / Bicarbonate	24–32	0	0	0	0	29 (lactate)	28 (lactate)	27 (acetate)	27 (acetate) 23 (gluconate)	16 (acetate)
Ca^{++} (mmol/l)	2.2–2.6	0	0	0	0	2	1.4	1	0	0
Mg^{++} (mmol/l)	0.8–1.2	0		0		0	0	1	1.5	1.5
Glucose (mmol/ l)	3.5–5.5	0	222 (40 g)	0	278 (50 g)	0	0	0	0	0
pH	7.35–7.45	4.5–7.0	4.5		3.5–5.5	5.0–7.0	6–7.5	6–8	4.0–8.0	4.5–7.0
Osmolarity (mOsm/l)	275–295	308	284		278	278	273	276	295	389

*These solutions are available with differing quantities of potassium already added, and the potassium-containing versions are usually more appropriate for meeting maintenance needs.

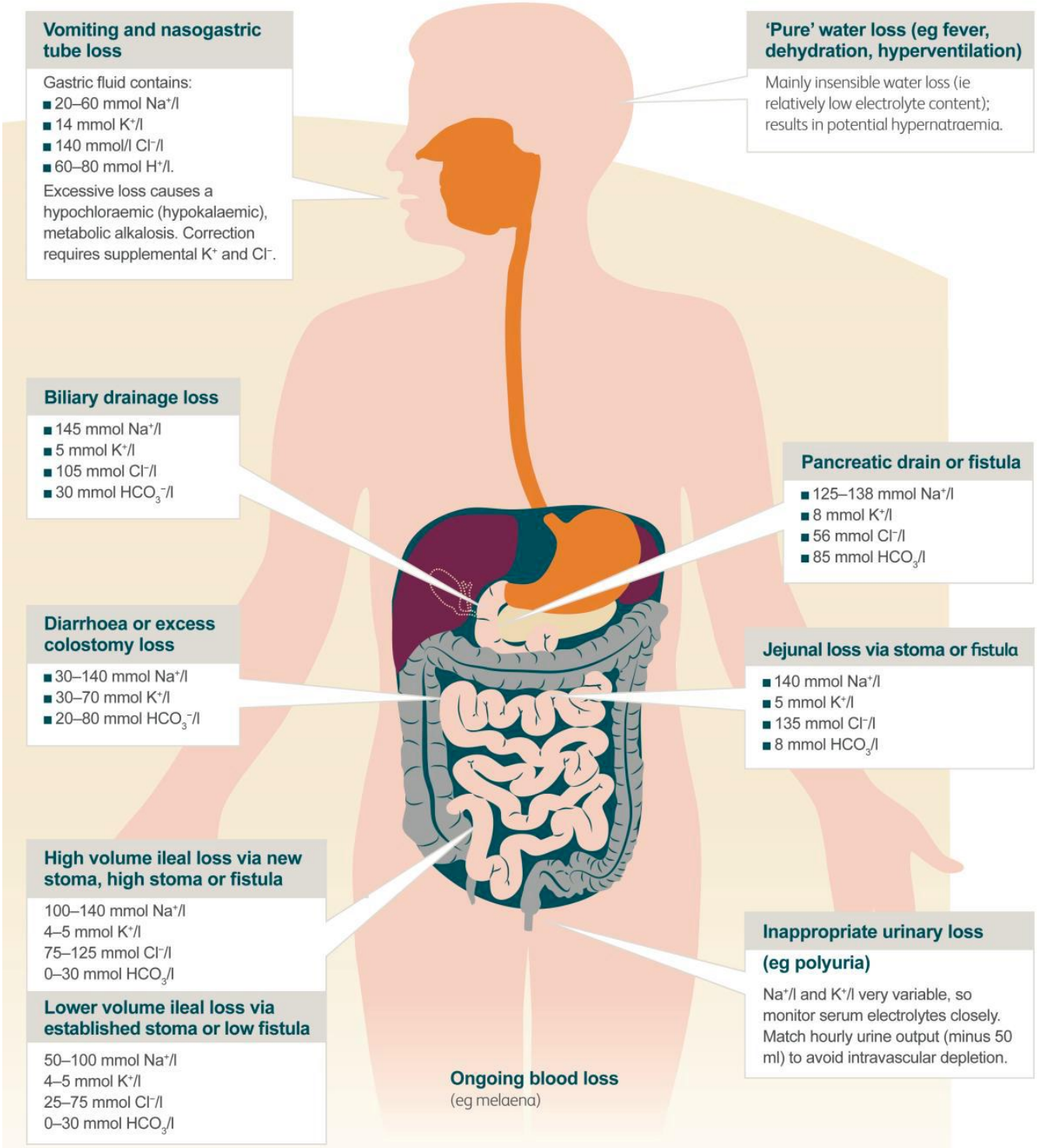
**Alternative balanced solutions are available commercially under different brand names and composition may vary by preparation.

[a]The term dextrose refers to the dextro-rotatory isomer of glucose that can be metabolised and is the only form used in IV fluids. However IV fluid bags are often labelled as glucose so only this term should be used. Traditionally hospitals bought a small range of fluids combining saline (0.18-0.9%) with glucose but several recent NICE/NPSA documents have recommended specific combinations, which are now purchased to enable guidelines to be followed. Glucose–saline combinations now come in 5 different concentrations, and the addition of variable potassium content expands the pre-mixed range to 13 different products. Prescribers must therefore specify the concentration of each component; the term dextrose-saline (or abbreviation D/S) is meaningless without these details. What is specified also impacts significantly on the cost of the product.

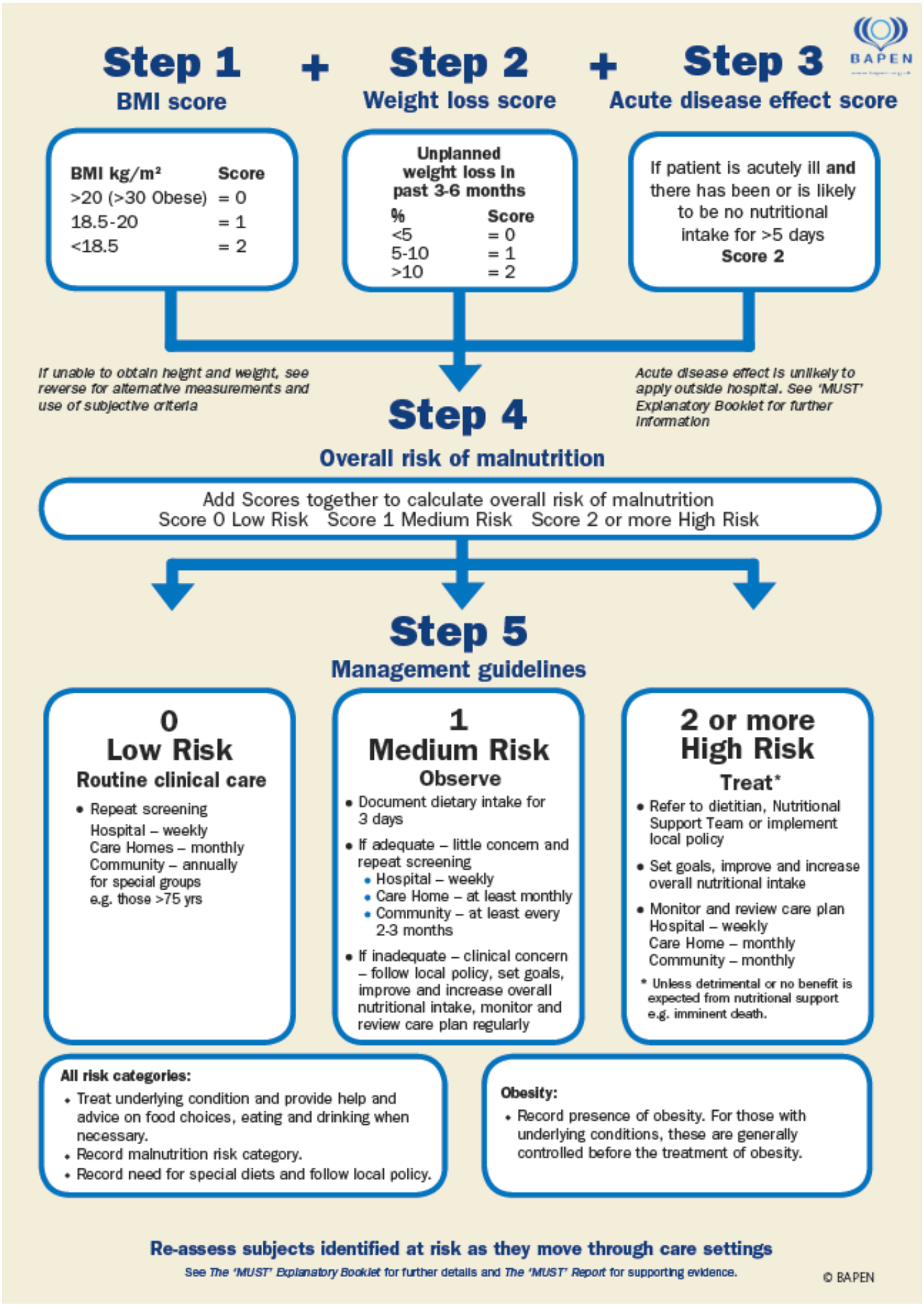
Source: This table was drafted based on the consensus decision of the members of the Guideline Development Group.

'Intravenous fluid therapy in adults in hospital', NICE clinical guideline 174 (December 2013)

15.8. *Composition of common fluid losses*



15.9. *Malnutrition Universal Screening Tool (MUST)*



The 'Malnutrition Universal Screening Tool' ('MUST') is reproduced here with the kind permission of BAPEN (British Association for Parenteral and Enteral Nutrition). For further information on 'MUST' see www.bapen.org.uk.

15.10. *Indications for nutrition support*

(Based on NICE CG032)

Healthcare professionals should consider using oral, enteral or parenteral nutrition support, alone or in combination, for people who are either malnourished or at risk of malnutrition, as defined below. Potential swallowing problems should be taken into account.

Nutrition support should be considered in people who are malnourished, as defined by any of the following:

- BMI less than 18.5 kg/m^2
- unintentional weight loss greater than 10% within the last 3–6 months
- BMI less than 20 kg/m^2 and unintentional weight loss greater than 5% within the last 3–6 months.

Nutrition support should be considered in people at risk of malnutrition, as defined by any of the following:

- eaten little or nothing for more than 5 days and/or are likely to eat little or nothing for the next 5 days or longer
- poor absorptive capacity, and/or have high nutrient losses and/or have increased nutritional needs from causes such as catabolism

15.11. *Nutritional Support and Refeeding syndrome*

(Based on NICE CG032)

For people who are not severely ill or injured, nor at risk of refeeding syndrome, the suggested nutritional prescription for total intake4 should provide all of the following:

- 25–35 kcal/kg/day total energy (including that derived from protein9,10)
- 0.8–1.5 g protein (0.13–0.24 g nitrogen)/kg/day
- 30–35 ml fluid/kg (with allowance for extra losses from drains and fistulae, for example, and extra input from other sources – for example, intravenous drugs)

Nutrition support should be cautiously introduced in seriously ill or injured people requiring enteral tube feeding or parenteral nutrition. It should be started at no more than 50% of the estimated target energy and protein needs. It should be built up to meet full needs over the first 24–48 hours according to metabolic and gastrointestinal tolerance. Full requirements of fluid, electrolytes, vitamins and minerals should be provided from the outset of feeding.

People who have eaten little or nothing for more than 5 days should have nutrition support introduced at no more than 50% of requirements for the first 2 days, before increasing feed rates to meet full needs if clinical and biochemical monitoring reveals no refeeding problems

People who meet the criteria in Table 15-1 should be considered to be at high risk of developing refeeding problems.

Table 15-1 Criteria for determining people at high risk of developing refeeding problems

Patient has one or more of the following:
• BMI less than 16 kg/m^2
• unintentional weight loss greater than 15% within the last 3–6 months
• little or no nutritional intake for more than 10 days
• low levels of potassium, phosphate or magnesium prior to feeding.

Or patient has two or more of the following:

- BMI less than 18.5 kg/m^2
- unintentional weight loss greater than 10% within the last 3–6 months
- little or no nutritional intake for more than 5 days
- a history of alcohol abuse or drugs including insulin, chemotherapy, antacids or diuretics.

The prescription for people at high risk of developing refeeding problems should consider:

- starting nutrition support at a maximum of 10 kcal/kg/day, increasing levels slowly to meet or exceed full needs by 4–7 days
- using only 5 kcal/kg/day in extreme cases (for example, BMI less than 14 kg/m2 or negligible intake for more than 15 days) and monitoring cardiac rhythm continually in these people and any others who already have or develop any cardiac arrythmias
- restoring circulatory volume and monitoring fluid balance and overall clinical status closely
- providing immediately before and during the first 10 days of feeding: oral thiamin 200–300 mg daily, vitamin B co strong 1 or 2 tablets, three times a day (or full dose daily intravenous vitamin B preparation, if necessary) and a balanced multivitamin/trace element supplement once daily
- providing oral, enteral or intravenous supplements of potassium (likely requirement 2–4 mmol/kg/day), phosphate (likely requirement 0.3–0.6 mmol/kg/day) and magnesium (likely requirement 0.2 mmol/kg/day intravenous, 0.4 mmol/kg/day oral) unless pre-feeding plasma levels are high. Pre-feeding correction of low plasma levels is unnecessary.

15.12. *Protocol for nutritional, anthropometric and clinical monitoring of nutrition support*

(Based on NICE CG032)

Parameter	Frequency	Rationale
Nutritional		
Nutrient intake from oral, enteral or parenteral nutrition (including any change in conditions that are affecting food intake)	Daily initially, reducing to twice weekly when stable	To ensure that patient is receiving nutrients to meet requirements and that current method of feeding is still the most appropriate. To allow alteration of intake as indicated
Actual volume of feed delivered*	Daily initially, reducing to twice weekly when stable	To ensure that patient is receiving correct volume of feed. To allow troubleshooting
Fluid balance charts (enteral and parenteral)	Daily initially, reducing to twice weekly when stable	To ensure patient is not becoming over/under hydrated
Anthropometric		
Weight*	Daily if concerns regarding fluid balance, otherwise weekly reducing to monthly	To assess ongoing nutritional status, determine whether nutritional goals are being achieved and take into account both body fat and muscle
BMI*	Start of feeding and then monthly	
Mid-arm circumference*	Monthly, if weight cannot be obtained or is difficult to interpret	
Triceps skinfold thickness	Monthly, if weight cannot be obtained or is difficult to interpret	
GI function		
Nausea/vomiting*	Daily initially, reducing to twice weekly	To ensure tolerance of feed

Diarrhoea*	Daily initially, reducing to twice weekly	To rule out any other causes of diarrhoea and then assess tolerance of feeds
Constipation*	Daily initially, reducing to twice weekly	To rule out other causes of constipation and then assess tolerance of feeds
Abdominal distension	As necessary	Assess tolerance of feed
Enteral tube – nasally inserted		
Gastric tube position (pH less than or equal to 5.5 using pH paper – or noting position of markers on tube once initial position has been confirmed)	Before each feed begins	To ensure tube in correct position
Nasal erosion	Daily	To ensure tolerance of tube
Fixation (is it secure?)	Daily	To help prevent tube becoming dislodged
Is tube in working order (all pieces intact, tube not blocked/kinked)?	Daily	To ensure tube is in working order
Gastrostomy or jejunostomy		
Stoma site	Daily	To ensure site not infected/red, no signs of gastric leakage
Tube position (length at external fixation)	Daily	To ensure tube has not migrated from/into stomach and external over granulation
Tube insertion and rotation (gastrostomy without jejunal extension only)	Weekly	Prevent internal overgranulation/prevention of buried bumper syndrome
Balloon water volume (balloon retained gastrostomies only)	Weekly	To prevent tube falling out
Jejunostomy tube position by noting position of external markers	Daily	Confirmation of position

Parenteral nutrition		
Catheter entry site*	Daily	Signs of infection/inflammation
Skin over position of catheter tip (peripherally fed people)*	Daily	Signs of thrombophlebitis
Clinical condition		
General condition*	Daily	To ensure that patient is tolerating feed and that feeding and route continue to be appropriate
Temperature/blood pressure	Daily initially, then as needed	Sign of infection/fluid balance
Drug therapy*	Daily initially, reducing to monthly when stable	Appropriate preparation of drug (to reduce incidence of tube blockage). To prevent/reduce drug nutrient interactions
Long-/short-term goals		
Are goals being met?*	Daily initially, reducing to twice weekly and then progressively to 3–6 monthly, unless clinical condition changes	To ensure that feeding is appropriate to overall care of patient
Are goals still appropriate?*	Daily initially, reducing to twice weekly and then progressively to 3–6 monthly, unless clinical condition changes	To ensure that feeding is appropriate to overall care of patient
People at home having parenteral nutrition should be monitored using observations marked *.		

15.13. *Protocol for laboratory monitoring of nutrition support*

(Based on NICE CG032)

Parameter	Frequency	Rationale	Interpretation
Sodium, potassium, urea, creatinine	Baseline Daily until stable Then 1 or 2 times a week	Assessment of renal function, fluid status, and Na and K status	Interpret with knowledge of fluid balance and medication Urinary sodium may be helpful in complex cases with gastrointestinal fluid loss
Glucose	Baseline 1 or 2 times a day (or more if needed) until stable Then weekly	Glucose intolerance is common	Good glycaemic control is necessary
Magnesium, phosphate	Baseline Daily if risk of refeeding syndrome Three times a week until stable Then weekly	Depletion is common and under recognised	Low concentrations indicate poor status
Liver function tests including International Normalised Ratio (INR)	Baseline Twice weekly until stable Then weekly	Abnormalities common during parenteral nutrition	Complex. May be due to sepsis, other disease or nutritional intake
Calcium, albumin	Baseline Then weekly	Hypocalcaemia or hypercalcaemia may occur	Correct measured serum calcium concentration for albumin Hypocalcaemia may be secondary to Mg deficiency Low albumin reflects disease not protein status
C-reactive protein	Baseline Then 2 or 3 times a week until stable	Assists interpretation of protein, trace element and vitamin results	To assess the presence of an acute phase reaction (APR). The trend of results is important
Zinc, copper	Baseline Then every 2–4 weeks, depending on results	Deficiency common, especially when increased losses	People most at risk when anabolic APR causes Zn ↓ and Cu ↑

Parameter	Frequency	Rationale	Interpretation
Selenium[a]	Baseline if risk of depletion Further testing dependent on baseline	Se deficiency likely in severe illness and sepsis, or long-term nutrition support	APR causes Se ↓ Long-term status better assessed by glutathione peroxidase
Full blood count and MCV	Baseline 1 or 2 times a week until stable Then weekly	Anaemia due to iron or folate deficiency is common	Effects of sepsis may be important
Iron, ferritin	Baseline Then every 3–6 months	Iron deficiency common in long-term parenteral nutrition	Iron status difficult if APR (Fe ↓, ferritin ↑)
Folate, B12	Baseline Then every 2–4 weeks	Iron deficiency is common	Serum folate/B12 sufficient, with full blood count
Manganese[b]	Every 3–6 months if on home parenteral nutrition	Excess provision to be avoided, more likely if liver disease	Red blood cell or whole blood better measure of excess than plasma
25-OH Vit D[b]	6 monthly if on long-term support	Low if housebound	Requires normal kidney function for effect
Bone densitometry[b]	On starting home parenteral nutrition Then every 2 years	Metabolic bone disease diagnosis	Together with lab tests for metabolic bone disease
[a] These tests are needed primarily for people having parenteral nutrition in the community. [b] These tests are rarely needed for people having enteral tube feeding (in hospital or in the community), unless there is cause for concern.			

15.14. *HPB Quality Improvement Programme (QIP)*

Patient Demographics:

Name	
Unit Number	
DOB	
Consultant	

Operative Details:

Operation	
Date Time	
Operating surgeon	
Elective / Emergency	

Complication Codes: (Please note date diagnosis made if applicable)

Code	Complication	Grade	Justified	Error	Action Plan
A	**Pancreatic fistula**				
B	**Delayed gastric emptying**				
C	**Post pancreatectomy Haemorrhage**				
D	**Bile leak**				
E	**Liver failure**				
F	**Post hepatectomy haemorrhage**				
G	**Cardiac**				
H	**Pulmonary**				
I	**DVT/PE**				
J	**Wound**				
K	**Other**				
L	**Readmission within 30 days**				
M	**Death**				
N	**Unplanned return to theatre**				

A: Pancreatic fistula (ISGPF)

ISGPF Definition: "Output *via* an operatively placed drain (or a subsequently placed percutaneous drain) of any measurable volume of drain fluid on or after postoperative d 3, with an amylase content greater than 3 times the upper normal serum value"

Grade A "Transient fistula"	No clinical impact	No peri-pancreatic collections on CT scan; little/no change in management High drain amylase but nil else needed	Clinically well; no sepsis; no prolongation of hospital stay; slow removal of operatively placed drains
Grade B	Clinical impact	Peri-pancreatic drains in place or repositioned to drain collections; Change in management is required	Clinically fairly well; degree of infection requiring specific treatment; prolongation of hospital stay; patients often discharged with drains in situ and observed in outpatient setting
Grade C	Severe clinical impact	Worrisome peri-pancreatic collections that require percutaneous drains; major change in management usually in ICU setting; possible re-surgery to salvage a difficult situation (completion pancreatectomy *etc*)	Clinically unwell; associated sepsis requiring aggressive antibiotics, octreotide and other intensive care support; major prolongation of hospital stay; associated complications

B: **Delayed gastric emptying (ISGPF)**

Grade A	Need for NGT intubation for 4 d or NGT reinsertion after postoperative day (POD) 3, or inability to tolerate a solid diet by POD 7.
Grade B	Need for NGT intubation for 8 d or NGT reinsertion after POD 7, or inability to tolerate a solid diet by POD 14.
Grade C	Need for NGT intubation for 15 d or NGT reinsertion After POD 15

C: Post Pancreatectomy haemorrhage (ISGPF)

	Onset, location, presentation and severity	**Condition**	**Diagnosis**	**Treatment**
Grade A	Early, intra or extraluminal mild	Well	Observation, blood count, USG and, if necessary CT	No
Grade B	Early, intra or extraluminal severe OR Late, intra or extraluminal, mild	Often well/intermediate Very rarely life-threatening	Observation, blood count, USG, angiography, CT endoscopy	Transfusion of fluid/blood, ICU, therapeutic embolisation relaparotomy for early PPH
Grade C	Late intra or extraluminal, severe	Severely impaired life-threatening	Angiography, CT endoscopy	Localisation of bleeding, angiography and embolisation, (endoscopy) or

				relaparotomy, ICU

D: **Bile Leak (ISGLS)**

ISGLS definition: *'Bile leakage is defined as fluid with an increased bilirubin concentration in the abdominal drain or in the intra abdominal fluid on or after post operative day 3, or as the need for radiologic intervention because of biliary collections or relaparotomy resulting from bile peritonitis. Increased bilirubin concentration in the drain is defined as at least 3 times greater than the serum bilirubin concentration measured at the same time.'*

Grade A	Bile leakage requiring no or little change in patients clinical management
Grade B	Bile leakage requiring a change in patients clinical management (eg additional diagnostic or interventional procedures) but manageable without re laparotomy or grade A lasting > 1 week
Grade C	Bile leakage requiring re laparotomy

E: **Liver failure (ISGLS)**

ISGLS definition: *'A postoperatively acquired deterioration in the ability of the liver (in patients with normal and abnormal liver function) to maintain its synthetic, excretory, and detoxifying functions, characterized by an increased INR (or need of clotting factors to maintain normal INR) and hyperbilirubinemia (according to the normal cut-off levels defined by the local laboratory) on or after postoperative day 5. If INR or serum bilirubin concentration is increased preoperatively, PHLF is defined by an increasing INR (decreasing prothrombin time) and increasing serum bilirubin concentration on or after postoperative day 5 (compared with the values of the previous day). Other obvious causes for the observed biochemical and clinical alterations such as biliary obstruction should be ruled out.'*

Grade A	PHLF resulting in abnormal laboratory parameters but requiring no change in the clinical management of the patient
Grade B	PHLF resulting in a deviation from the regular clinical management but manageable without invasive treatment
Grade C	PHLF resulting in a deviation from the regular clinical management and requiring invasive treatment

F: Post hepatectomy haemorrhage (ISGLS)

ISGLS definition: *'Post-hepatectomy haemorrhage (PHH) is defined as a drop of haemoglobin level >3 g/dl after the end of surgery compared to postoperative baseline level and/or any postoperative transfusion of PRBCs for a falling hemoglobin and/or the need for invasive re-intervention (e.g. embolization or re-laparotomy) to stop bleeding.*

To diagnose PHH (and to exclude other sources of haemorrhage) evidence of intraabdominal bleeding should be obtained such as frank blood loss via the abdominal drains if present (e.g. haemoglobin level in drain fluid >3 g/dl) or detection of an intra-abdominal haematoma or active haemorrhage by abdominal imaging (ultrasound, CT, angiography). Patients who are transfused immediately postoperatively for intra-operative blood loss by a maximum of two units of PRBCs (i.e. who do not have evidence of active haemorrhage) are not diagnosed with PHH.'

Grade A	PHH requiring transfusion of up to 2 units of RBC'S
Grade B	PHH requiring transfusion of >2 units of RBC'S but manageable without invasive intervention
Grade C	PHH requiring radiological interventional treatment (e.g. embolization) or re laparotomy

G-L: Grade as per Clavien System:

Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications Blood transfusions and total parenteral nutrition are also included
Grade III	Requiring surgical, endoscopic or radiological intervention Grade IIIa - Intervention not under general anesthesia Grade IIIb - Intervention under general anesthesia
Grade IV	Life-threatening complication (including CNS complications)* requiring IC/ICU management Grade IVa Single organ dysfunction (including dialysis) Grade IVb Multiorgan dysfunction
Grade V	Death of a patient

*Brain haemorrhage, ischemic stroke, subarrachnoidal bleeding, but excluding transient ischemic attacks.

CNS, central nervous system; IC, intermediate care; ICU, intensive care unit.

Errors:

A	Patient selection	**I**	Blood / blood product error
B	Delayed / missed diagnosis	**J**	Personnel unavailable / delayed
C	Delay to provide treatment	**K**	Inadequate patient monitoring
D	Intra operative / technical error	**L**	Inadequate documentation
E	Judgement error in patient management	**M**	Inadequate escalation of treatment
F	Equipment failure / unavailability	**N**	Failure to follow established policy
G	Drug error	**Z**	No error
H	IV Fluid error		

Justification of errors:

A	Justifiable, unavoidable, or consistent with reasonable and prudent practice given the situation or clinical data available.	**C**	Indeterminate, controversial, cannot be resolved.
B	Not justifiable, avoidable, not consistent with standards of practice or service.	**D**	No errors identified for this event

Action Plan:

A	None required – explain in comments	**E**	Modification of dept, training program
B	Tabulation and tracking of problem for further reporting	**F**	Individual counselling and discussion
C	Institution of formal Q/A audit	**G**	Educational offering
D	Formulation of new policy or procedure	**O**	Other inc. action pending review

M: Death analysis

A	**Non preventable:** Requires that: 1) To a resonable degree of medical certainty, outcome would have been the same regardless of any errors 2) No substantive errors were made and identified	**C**	**Probably Preventable:** Requires that: 1) Substantive errors made and identified 2) Errors were prospective errors 3) Death did not meet criteria for preventable 4) More likely than not, death would NOT have occurred had the identified errors been avoided
B	**Possibly preventable:** Requires that: 1) Substantive errors made and identified 2) Errors were prospective or retrospective errors 3) Death did not meet criteria for non preventable 4) More likely than not, outcome would have been the same regardless of errors made	**D**	**Preventable:** Requires that: 1) Substantive errors made and identified 2) Errors were prospective errors 3) To a reasonable degree of certainty, death would NOT have occurred had the identified errors been avoided