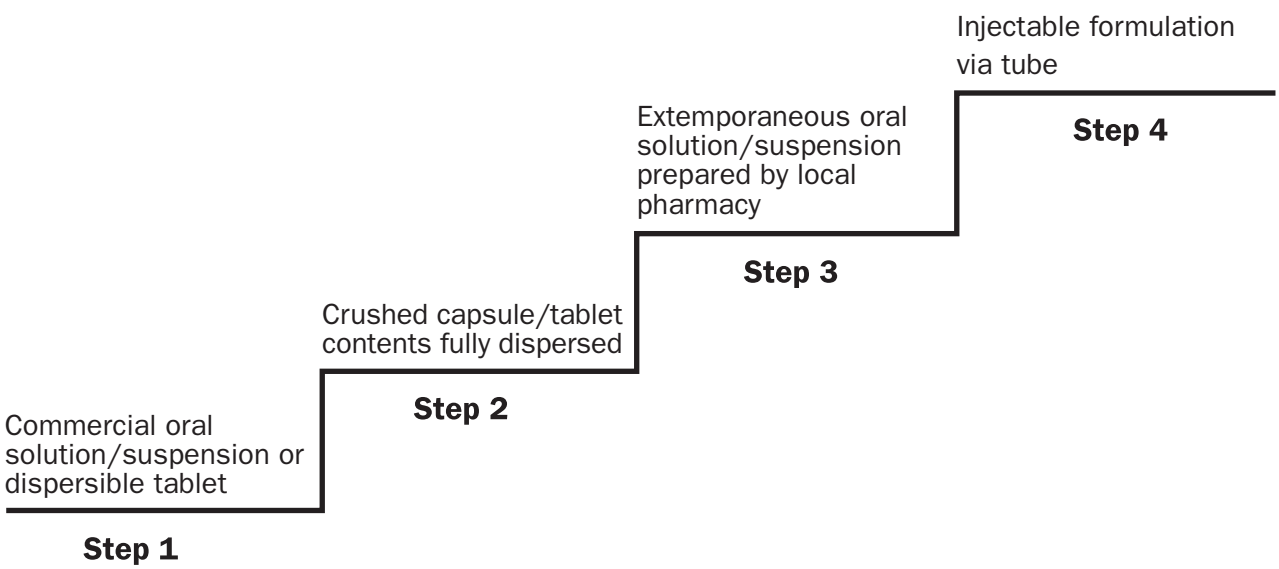
Appendix 10: Administering drugs via feeding tubes

Administering drugs via feeding tubes is generally an unlicensed activity. There is little published data and most recommendations are theoretical and/or based on local policy. An alternative licensed option may therefore be preferable, e.g. rectal or parenteral formulations. However, if given by tube, there is a range of possibilities (Figure A10.1). Guidance should be sought from a pharmacist regarding which option is feasible or most appropriate.

There are several types of feeding tubes (Box A10.A). These can be further classified according to lumen size (French gauge), number of lumens (single or multiple) and length of use (short-term, long-term/fixed).

Figure A10.1 4-step ladder for drug administration by feeding tubes[a]



a. Step 1 is the preferred option; for further explanation, see Choosing a suitable formulation.

Box A10.A Main types of feeding tubes

Nasogastric (NG), inserted into the stomach via the nose.

Nasojejunal (NJ), inserted into the jejunum via the nose.

Percutaneous endoscopic gastrostomy (PEG), inserted into the stomach via the abdominal wall.

Percutaneous endoscopic jejunostomy (PEJ), inserted into the jejunum via the abdominal wall.

Percutaneous endoscopic gastro-jejunostomy (PEGJ), inserted into the jejunum via the abdominal wall and through the stomach.

In addition to the general guidance (Box A10.B), the following should be considered when giving drugs via feeding tubes:

- *sterility with jejunal tube*, use sterile water because the acid barrier in the stomach is bypassed;[1] some centres use an aseptic technique to reduce the risk of infective diarrhoea
- *site of drug delivery with jejunal tubes*, absorption may be unpredictable because the tube may extend beyond the main site of absorption of the drug, e.g. **cefalexin**, **ketoconazole;**[2] care should also be taken with drugs that have a narrow therapeutic range, e.g. **digoxin, warfarin**, **phenytoin** and other anti-epileptics[2]
- *size of lumen*, narrow lumen tubes are more likely to block, particularly with thick oral syrups; dilute with 30–60ml water before administration; the internal diameter of equivalent French gauge tubes varies between manufacturers
- *number of lumens*, ensure the correct lumen is used with multilumen tubes; *do not use an aspiration gastric decompression port for drug administration*; some tubes have one lumen terminating in the stomach and another in the jejunum
- *function of the tube*, drugs should not be administered by tube if it is on free-drainage or suction.[3]

Box A10.B General guidelines for administration of drugs via feeding tubes

1 Drug charts should state the route of administration, e.g. NJ, and specify the lumen to be used.

2 Ensure the siting of the tube has been medically confirmed.

3 Oral syringes (i.e. a syringe to which a needle cannot be attached) should be used to prevent accidental parenteral administration.[4,5]

4 Stop the infusion of the feed when administering drugs.

5 Flush the tube slowly with at least 15ml of water, sterile if jejunal tube; use either a 30ml or 50ml oral syringe.

6 Administer each drug separately (by gravity flow) as a sediment-free liquid (Figure A10.1); flush in between and afterwards with at least 15ml of water, sterile if jejunal tube; use either a 30ml or 50ml oral syringe.

7 Document the total volume of fluid given (including flushes) on a fluid balance chart.

8 Monitor the clinical response if:
- changing from m/r to normal-release preparations
- a drug has a narrow therapeutic range
- the bio-availability of the drug differs between tablet and liquid.

9 Do not administer bulk-forming laxatives because they may block the tubes; use an enteral feed with a high fibre content instead.[3]

10 Do not add drugs to feeds; this increases the risk of incompatibility, microbial contamination, tube blockage, and underdosing or overdosing if the feed rate is altered.[6]

Choosing a suitable formulation

Guidance is given in Table A10.1 on the formulations available for many drugs used in palliative care. However, commercially available oral solutions/suspensions/syrups are not always suitable because of:

- *osmotic diarrhoea* due to high osmolality and sorbitol content; the normal osmolality of gastro-intestinal secretions is 100–400mosm/kg, whereas many liquid formulations are >1000mosm/kg);[1,2,3] reduce osmolality by diluting with as much water as is practical. Sorbitol in cumulative doses of >7.5g generally causes diarrhoea; often severe with doses of >20g
- *altered bio-availability and/or pharmacokinetics* when converting from tablets to oral solution, e.g. **digoxin**, **phenytoin**, **sodium fusidate**, or from m/r preparations to oral solution; the dose and/or frequency may need to be changed according to the clinical response
- *tube blockage/caking* caused by high viscosity preparations, e.g. **co-amoxiclav**; minimise by diluting with 30–60ml water or use suspensions rather than syrups[3]
- *clumping of the feed*, particularly if the formulation is acidic, i.e. pH<4[3]
- *bezoar formation* causing indigestible concretions, e.g. **sucralfate**
- *binding to the plastic tubing*, e.g. **carbamazepine**, **clonazepam**, **diazepam**, **phenytoin**; reduce by diluting with 30–60ml water.

Many tablets and capsule contents will disperse completely when crushed and mixed with water, even though they are not marketed as dispersible. *Do not administer crushed tablets or capsule contents which have not completely dispersed in water; sediment increases the risk of blocking the tube*[3,7] (Box A10.C). The liquid contents of some capsules can be drawn out with a syringe, but should be administered immediately in case of light sensitivity.

Before administering an injectable formulation via a feeding tube, check the osmolality. Many injections are hypertonic and therefore unsuitable. Some injections may also contain additives unsuitable for oral administration, e.g. polyethylene glycol in **amiodarone**.[3] Further, this is generally an expensive option and should be considered only short-term. All injections should be further diluted with 30–60ml water before administration.

Box A10.C Guidelines for administering crushed tablets and capsule contents

Administer each drug separately.[2]

Crush tablet(s) or capsule contents using a mortar and pestle; alternatively use two metal spoons to crush and a clean empty medicine bottle to mix.

Add 10ml of tap water and mix well; *use sterile water for jejunal tubes.*

Ensure the drug is completely dispersed with no sediment, then draw up using a 30ml or 50ml oral syringe and administer via the feeding tube, flushing before and after according to guidelines (Box A10.B).

Rinse the mortar with water and administer the rinsings through the tube to ensure the patient receives the whole dose.

Avoid plastic containers as the drug may adhere to the plastic.[8]

Do not crush

E/c preparations (including e/c coated capsule contents) as this will destroy the properties of the formulation, may alter bio-availability and/or block the tube.[7,9,10]

M/r preparations (including m/r coated capsule contents) as this may cause dangerous dose peaks and troughs.[3,7,10]

Cytotoxics, prostaglandin analogues, hormone antagonists or *antibiotics* as there are risks to the staff through inhalation and/or topical absorption.[3,7,10]

Buccal or sublingual preparations as their bio-availability may be dramatically reduced if absorbed via the gastro-intestinal tract.[3,7,10]

Flushing feeding tubes

Flushing tubes before and after medication reduces the risk of blocking.[11,12] A minimum of 15ml before, in between and after medications is recommended. Using 30ml or 50ml oral syringes reduces the risk of rupturing the tube.[13] Tubes should be flushed *slowly* to prevent a coating of the previous drug being left around the inside of the tube.

Drug interactions

A number of specific drug interactions can occur when drugs are administered via feeding tubes (Box A10.D). The most important clinically are with drugs with a narrow therapeutic range, e.g. **digoxin**, **phenytoin**, **warfarin**. Following the guidance in Box A10.B and Box A10.D will reduce the risk of dangerous interactions. Clinical response should be monitored, and appropriate precautionary measures taken if the feed is discontinued at any time, particularly if dose adjustments have been made.

Box A10.D Drug interactions and preventive action when giving drugs by tubes

Binding of drugs to tubes

e.g. carbamazepine, diazepam, phenytoin.[3]

Dilute the drug with at least 30–60ml of water and flush well; monitor clinical response.

Direct interaction of drug and feed causing coagulation in the tube

e.g. acidic solutions (chlorphenamine (chlorpheniramine), promethazine, thioridazine) and antacids.[6,14]

Find alternative route/preparation if possible; dilute the drug as much as possible to minimise drug-feed contact and flush with 30–60ml of water.

Documented drug/enteral feed incompatibilities affecting drug absorption

e.g. carbamazepine, ciprofloxacin, hydralazine, phenytoin, theophylline, warfarin.[3,6]

Stop the feed for 1h before and 1–2h after administering the drug (phenytoin 2h before and after);[3] dilute the drug as much as possible, and flush with 30–60ml water.

Drugs requiring administration on an empty stomach

e.g. penicillins, ketoconazole, tetracyclines.[3]

Balance the risk of reduced absorption against practicality of stopping feed for 1h before and after each dose; consider alternative route/drug; not applicable in jejunal feeding because the stomach is bypassed,[7] just ensure efficient flushing.

Drug-feed indirect interaction

e.g. warfarin and vitamin K in feed.[15]

Monitor INR and adjust anticoagulant dose if necessary.

Drug-drug direct interaction

e.g. iron or zinc and ciprofloxacin

Alter drug timings.

Unblocking tubes

Do not use a guidewire for unblocking a tube because of the danger of perforation.[13] Various agents have been used to unblock tubes (Box A10.E).[3] Their use is based on anecdote. Acidic solutions, e.g. **cranberry juice** and carbonated drinks, could make the situation worse by causing feed coagulation.[3]

Box A10.E Preparations used to unblock feeding tubes[3]

- Warm water
- Soda water
- Cola
- Pineapple juice
- Cranberry juice
- Pancreatin granules removed from capsule
- Meat tenderiser, contains papain, a mixture of proteolytic enzymes
- Clogg Zapper, a commercial powder for breaking up food formula clogs in enteral feeding devices

Table A10.1 Information on formulations available for administering drugs down feeding tubes[2,6,7,16–20]

Drug	*Oral solution/ suspension/ dispersible preparation available*	*Crushed tablet/ capsule contents disperse completely*[a]	*Oral solution/ suspension prepared by local pharmacy*	*Injection can be diluted and administered via feeding tube*	*Comments*
Amitriptyline[a]	Yes	Yes (APS®)	Yes (C)[b]		
Aminophylline					Change to theophylline or use IV route
Amoxycillin	Yes			Yes	
Antacids	Yes				Not recommended as can coagulate with feed; not needed with jejunal tube
Ascorbic acid	Yes				
Aspirin	Yes				
Baclofen	Yes	Yes (Lioresal®)Takes 5min	Yes (K)[c]		Commercial oral solution not recommended as too viscous
Carbamazepine[a]	Yes	Yes (Tegretol®)			Dilute to reduce adherence to the tube; stop feed for 1h before and 1–2h after dose. Jejunal administration not recommended because may cause plasma levels to decrease
Chlorpromazine	Yes	Yes (Largactil®) Takes 5min	Yes (K)		
Cimetidine	Yes	Yes (Dyspamet®, Tagamet®)		Yes (Tagamet® 100mg/ml)	Commercial oral solution may cause diarrhoea
Ciprofloxacin	Yes	Yes (Ciproxin®)	Yes(C)		Use sterile water not tap water (to avoid ion chelation) and dilute with 30–60ml water. Stop feed for 1h before and 1–2h after dose. Do not administer with iron or zinc
Cisapride	Yes	Yes (Prepulsid®)	Yes (K)		
Clonazepam		Yes (Rivotril®)	Yes (K)		Dilute with 30–60ml to reduce binding to the tube
Clonidine		Yes (Catapres®)	Yes (K)	Yes (Catapres®)	
Co-danthramer	Yes				No information on suitability via feeding tube
Co-danthrusate	Yes				No information on suitability via feeding tube
Codeine phosphate	Yes	Yes Takes 5min	Yes (K)		Dilute viscous commercial oral solution
Co-amoxiclav	Yes				Dilute to half-strength (to avoid caking)
Cyclizine		Yes (Valoid®) Takes 5min	Yes (C)	Yes	
Cyproterone			Yes (K)		

Table A10.1 Continued

Drug	*Oral solution/ suspension/ dispersible preparation available*	*Crushed tablet/ capsule contents disperse completely*[a]	*Oral solution/ suspension prepared by local pharmacy*	*Injection can be diluted and administered via feeding tube*	*Comments*
Dantrolene			Yes (K)		
Dexamethasone	Yes[d]	Yes (Organon®)	Yes (K)	Yes	
Diamorphine			Yes		
Diazepam	Yes	Yes	Yes (K)		Dilute with 30–60ml to reduce binding to the tube.
Diclofenac[a]	Yes				
Digoxin	Yes	Yes (Lanoxin®)			50microgram Lanoxin® oral solution = 62.5microgram tablet; commercial oral solution may cause diarrhoea
Dihydrocodeine[a]	Yes				No information on suitability via feeding tube
Docusate sodium	Yes				No information on suitability via feeding tube
Domperidone	Yes	Yes (Motilium®)	Yes (K)		
Erythromycin	Yes				No information on suitability via feeding tube
Etamsylate			Yes (K)		
Ferrous sulphate					Convert to ferrous fumarate oral syrup. Ferrous sulphate 200mg = ferrous fumarate 7ml oral syrup 140mg/5ml; no information on suitability
Flecainide		Yes (Tambocor®)	Yes (C)	Yes	Use sterile water (not tap). Do not mix injection with alkaline solutions, e.g. chlorides, phosphates, sulphates
Flucloxacillin	Yes			Yes	Stop feed for 1h before and after dose
Fluconazole	Yes		Yes (K)		
Furosemide (frusemide)	Yes	Yes (Lasix®)	Yes (K)		
Gabapentin		Yes			
Glibenclamide		Yes (Daonil®)	Yes (K)		
Gliclazide		Yes (Diamicron®) Takes 5min	Yes (K)		
Granisetron	Yes				No information on suitability via feeding tube
Haloperidol	Yes	Yes (Serenace®) Takes 5min			Commercial oral solution may cause diarrhoea
Ibuprofen[a]	Yes	Yes (Brufen®) Takes 5min			
Imipramine[a]	Yes	Yes (Tofranil®) Takes 5min	Yes (C)		

Table A10.1 Continued

Drug	*Oral solution/ suspension/ dispersible preparation available*	*Crushed tablet/ capsule contents disperse completely*[a]	*Oral solution/ suspension prepared by local pharmacy*	*Injection can be diluted and administered via feeding tube*	*Comments*
Itraconazole	Yes				No information on suitability via feeding tube
Ketoconazole	Yes				Stop feed for 1h before and after dose. *Jejunal administration not recommended; low pH needed for absorption*
Lansoprazole	Yes	Yes (special procedure)			Commercial oral suspension not recommended as too viscous. Capsule contents may be mixed with sodium bicarbonate 8.4% and water using a specific procedure. Contact pharmacy or Lederle for full details
Levomepromazine (methotrimeprazine)		Yes (Nozinan® 25mg, 100mg)	Yes (K)		
Loperamide	Yes	Yes			Commercial oral solution may cause diarrhoea
Lorazepam		Yes (Ativan®)	Yes (K)		
Medroxyprogesterone		Yes (Provera® 5mg,10mg,100mg, Farlutal® 500mg) Takes 5min	Yes (K)	Yes	
Megestrol acetate		Yes Takes 5min	Yes (K)		
Menadiol sodium phosphate			Yes (K)		
Metformin		Yes (Glucophage®) Takes 5min	Yes (K)		
Methadone	Yes				No information on suitability via feeding tube
Metoclopramide	Yes	Yes (Maxolon®) Takes 5min			Commercial oral solution may cause diarrhoea
Metronidazole	Yes		Yes (K)	Yes	
Midazolam			Yes	Yes	
Morphine[a]	Yes				The m/r granules in Zomorph® capsules and MST Continus® suspension can be used in *larger* bore tubes; mix (do not crush) m/r granules with 30ml water to form the suspension and flush with 30–60ml. Contact Link for full details of procedure for Zomorph®. Otherwise convert to normal-release liquid

Table A10.1 Continued

Drug	*Oral solution/ suspension/ dispersible preparation available*	*Crushed tablet/ capsule contents disperse completely*[a]	*Oral solution/ suspension prepared by local pharmacy*	*Injection can be diluted and administered via feeding tube*	*Comments*
Nabilone		Yes			
Naproxen[a]	Yes	Yes (Naprosyn®, Synflex®) Takes 5min			Do not crush e/c formulations
Nifedipine[a]					Contents of liquid capsules may be drawn up using large bore needle and syringe and flushed down tube using saline (NOT water) immediately (light sensitive). May need more than one capsule to obtain the correct volume; 5mg = 0.17ml, 10mg = 0.34ml. Risk of profound hypotension particularly if converting from m/r preparation
Nitrofurantoin[a]			Yes (K)		
Olanzapine	Yes				No information on suitability via feeding tube
Omeprazole	Yes				Losec MUPS® may be dispersed in 25ml water, 15ml syrup simplex, or 5ml full-cream yoghurt, using a specific procedure specified by the company. Contact pharmacy or AstraZeneca for details. Not recommended for tubes below 7 French
Ondansetron	Yes	Yes (Zofran®) Takes 5min		Yes	
Orphenadrine	Yes	Yes (Disipal®) Takes 5min	Yes (C)		
Oxybutynin	Yes	Yes (Ditropan®) Takes 5min	Yes (K)		
Oxycodone[a]	Yes				No information on suitability via feeding tube
Paracetamol	Yes				
Phenobarbital	Yes	Yes	Yes (K)		
Phenoxymethylpenicillin (Penicillin V)	Yes				Stop feed for 1h before and after dose
Phenytoin	Yes				Phenytoin oral suspension 30mg/5ml; 90mg (15ml) = 100mg phenytoin sodium tablet/capsule. Convert to once daily dose. Stop feed for 2h before and after administration, and flush tube with 60ml water, *shake liquid well*, then dilute dose with 30–60ml water, administer and flush. May cause diarrhoea

Table A10.1 Continued

Drug	*Oral solution/ suspension/ dispersible preparation available*	*Crushed tablet/ capsule contents disperse completely*[a]	*Oral solution/ suspension prepared by local pharmacy*	*Injection can be diluted and administered via feeding tube*	*Comments*
Phytomenadione		Yes (Konakion®) Takes 5min		Yes (Konakion MM®)	
Pilocarpine			Yes		
Potassium supplements	Yes				Commercial oral syrup may cause diarrhoea
Prednisolone	Yes		Yes (K)	Yes	
Prochlorperazine	Yes	Yes (Stemetil®)			Commercial oral solution may cause diarrhoea
Propantheline			Yes		
Ranitidine	Yes	Yes (Zantac®) Takes 5min	Yes (K)	Yes	Commercial oral solution may cause diarrhoea
Risperidone	Yes				No information on suitability via feeding tube
Rofecoxib	Yes				No information on suitability via feeding tube
Senna	Yes	Yes (Senokot®)	Yes (K)		
Sodium fusidate	Yes				Sodium fusidate tablets 500mg = 750mg oral suspension
Sodium valproate[a]	Yes	Yes (Epilim® Crushable) Takes 5min	Yes		Commercial oral solution may cause gastrointestinal irritation. Do not crush e/c formulations
Spironolactone	Yes[d]	Yes (Aldactone®) Takes 5min	Yes (K)		
Stanozolol		Yes	Yes (K)		
Sucralfate	Yes	Yes			Not recommended due to high viscosity, bezoar formation and binding with feed; likely to block tube. Need to stop feed for 1h before and after dose; impractical for q4h schedule
Theophylline[a]	Yes				Care converting from m/r. Need to stop feed for 1h before and 1–2h after dose; impractical for q.d.s. schedule
Thioridazine	Yes	Yes (Melleril®) Takes 5min	Yes (C)		Avoid if possible as causes coagulation with feed. Dilute drug well and flush with 30–60ml water to minimise contact. Commercial oral suspensions may cause diarrhoea

Table A10.1 Continued

Drug	*Oral solution/ suspension/ dispersible preparation available*	*Crushed tablet/ capsule contents disperse completely*[a]	*Oral solution/ suspension prepared by local pharmacy*	*Injection can be diluted and administered via feeding tube*	*Comments*
Tolbutamide		Yes (Rastinon®)	Yes (K)		
Tramadol[a]	Yes	Yes		Yes	
Tranexamic acid	Yes	Yes (Cyklokapron®)	Yes (K)		
Trimethoprim	Yes		Yes (K)		
Vancomycin			Yes	Yes	
Warfarin		Yes (Marevan®)	Yes (K)		INR may be affected by the varying content of Vitamin K in feeds. Need to stop feed for 1h before and 1–2h after dose

a. Do not crush m/r preparations. Take care if converting from m/r to normal-release preparations because dose, frequency and clinical effect may be different

b. C# = Diluent C suspending agent

c. K# = Keltrol (Diluent A) suspending agent

d. Unlicensed product, available from e.g. Rosemont (see Special orders and named patient supplies).

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