

Nutritional support and percutaneous endoscopic gastrostomy



Definition of nutritional support

- The provision of enteral or parenteral nutrients to treat or prevent malnutrition.
- Nutrition Support Therapy can include oral, enteral, and parenteral nutrition to maintain or restore optimal nutrition status and health.

Type of nutritional support

- Enteral nutrition
 - Oral nutritional supplements
 - Tube feeding
- Parenteral nutrition
 - Intravenous administration of nutrition
 - Total parenteral nutrition (TPN)
 - Peripheral parenteral nutrition (PPN)

Parenteral nutrition (PN)

	TPN	PPN
적응증	사용기간이 적어도 2주 이상 소화기관을 이용할 수 없을 때 수술 전 영양결핍이 심한 환자 Short bowel syndrome	5~7일간 경구섭취 불가 TPN이 필요하나 사용할 수 없는 경우 (혈액응고질환, 정맥 혈전)
합병증	Catheter 관련 합병증 (기흉, 혈흉) 패혈증, 혈전증 대사 합병증 (hyperosmolarity, hyperglycemia, hypoglycemia..) 담석증, Cholecystitis	말초 정맥염
금기	위장관 기능이 정상일 때 사용기간이 5일 이내일 때	
삼투압	1,200~1,500 mOsm/L	600 ~ 900 mOsm/L > 900 mOsm/L 에서는 혈전 정맥염 발생

Nutritional requirements

	Critically ill patients	Stable patients
Protein	1.2~1.5 g/kg/day	0.8 ~1.0 g/kg/day
Carbohydrate	< 4mg/kg/min	< 7 mg/kg/min
Lipid	1 g/kg/day	1 g/kg/day
Total calories	20~25 kcal/kg/day	30~35 kcal/kg/day
Fluid	적절한 영양지원을 위한 최소량	30~40 mL/kg/day

Selection of PN

- Low osmolarity (<850mOsmol/L)의 PN 제제를 사용할 경우에는 Peripheral access
- Low osmolarity PN만으로 환자의 요구량을 만족하지 못하는 경우, 2주이상 장기간 PN이 필요한 경우는 Central access
- 환자 상태, 영양 요구량에 맞는 상품형 PN을 사용
- 다음의 경우 NST에 의뢰하여 약제부에서 조제한 PN을 투여
 - 특별한 질환을 동반한 경우
 - 전해질 불균형이 발생한 경우
 - 영양 요구량이 상품형 PN과 맞지 않는 경우

Commercial peripheral PN

약품코드	XOLIM-P	XOMAPP7	XSKABP	XWINP20
상품명	Peri Olimel N4E 1000 ml(말초정맥용)	Omapone Peri 724ml (말초정맥용)	SmofKabiven Periphe ral 1500 1448ml (말 초)	Winuf peri 2020ml(말 초정맥용)
투여경로	Peripheral	Peripheral	Peripheral	Peripheral
Total Volume (ml/bag)	1000	724	1448	2020
비고/분류				
Glucose (g/bag)	75	51	103	142.87
Lipid (g/bag)	30	20.4	40.8	57.1
Lipid 세부조성	Olive oil 24 g Soybean oil 6 g	Soybean oil 6.12 g MCT 6.12 g Olive oil 5.10 g Fish oil 3.06 g	Soybean oil 12.3 g MCT 12.3 g Olive oil 10.1 g Fish oil 6.1 g	Soybean oil 17.1 g Coconut oil 14.3 g Olive oil 14.3 g Fish oil 11.4 g
Amino Acid (g/bag)	25.3	22.81	45.63	63.65
Electrolytes				
Na+ (mEq/bag)	21	18	36	50.6
K+ (mEq/bag)	16	14	28	38.6
Mg2+ (mEq/bag)	4.4	2.3	9.2	12.68
Ca2+ (mEq/bag)	4	1.15	4.6	6.32
Cl- (mmol/bag)	24	16	32	45
Acetate (mmol/bag)	27	48	96	133
Sulfate (mmol/bag)	-	2.3	4.6	6.47
Phosphate (mmol/ba g)	8.5	5.95	11.9	16.7
Zinc (mg/bag)	-	1.14	2.34	3.41
pH	6.4	5.6	5.6	6
Osmolarity (mOsmol/L)	760	850	850	850
Non protein Calorie (Kcal/bag)	600	410	822	1141.2
Total Calorie (Kcal/bag)	700	501	1006	1396

Commercial central PN

약품코드	XNUT12	XSKAB20	XWIN14	XWINUF
상품명	Nutriflex Lipid Special 1250ml(중심정맥용)	SmofKabiven 2000 1970ml(중심정맥용)	Winuf 1435ml(중심정맥용)	Winuf 1085ml(중심정맥용)
투여경로	Central	Central	Central	Central
Total Volume (ml/bag)	1250	1970	1435	1085
비고/분류				
Glucose (g/bag)	180	250	182	138.32
Lipid (g/bag)	50	75.1	54.7	41.2
Lipid 세부조성	MCT 25 g LCT 25 g	Soybean oil 22.5 g MCT 22.5 g Olive oil 18.8 g Fish oil 11.3 g	Soybean oil 16.4 g Coconut oil 13.7 g Olive oil 13.7 g Fish oil 10.9 g	Soybean oil 12.4 g Coconut oil 10.3 g Olive oil 10.3 g Fish oil 8.2 g
Amino Acid (g/bag)	70.07	100.1	72.9	55
Electrolytes				
Na+ (mEq/bag)	67	80	58	43.9
K+ (mEq/bag)	47	60	44.3	33.5
Mg2+ (mEq/bag)	10.6	20	14.54	11
Ca2+ (mEq/bag)	10.6	10	7.24	5.48
Cl- (mmol/bag)	60	70	51	39
Acetate (mmol/bag)	60	209	153	115
Sulfate (mmol/bag)	-	10	7	5.3
Phosphate (mmol/bag)	20	25	18.3	13.8
Zinc (mg/bag)	2.615	5.2	3.87	2.92
pH	5.5	5.6	6	6
Osmolarity (mOsmol/L)	1545	1500	1440	1440
Non protein Calorie (Kcal/bag)	1168	1754	1274.4	964
Total Calorie (Kcal/bag)	1455.36	2154	1566	1184

Compounded PN in SMC

TPN조성처방(성인)

2016-10-04
火

환자번호
36603267

환자명
박귀석

초기조성참조
NST Reply

전처방(2016-09-29)입니다.

Total Calories
1522.0 kcal/day (24.2 kcal/kg/day)

투여경로

☒ Central
☐ Peripheral

Volume (L)

☒ 1 L
☐ 1.5 L
☐ 2 L

아미노산 종류

☒ Standard
☐ Branched Chain AA rich
☐ Standard + Glutamine

Glutamine $\leq$ 20g
☐
Glutamine $>$ 20g
☐

TPN CODE
TPNT13

조제완료

Weight
63 kg

이전 Weight
0 kg

Nutrients
Standard
계산

Electrolytes

미량원소

Dextrose
230 g
23 %
782 kcal

Amino acid
60 g
6 %
240 kcal

Lipid
50 g
500 kcal

Dextrose : Amino acid : Lipid = 51% : 16% : 33%

NPC : N = 134% : 1

TPN infusion rate
41.7 mL/hr over 24hrs

NaCl
10 mEq

NaAC
0 mEq

Total Na = 10

KCl
45 mEq

KH₂PO₄
20 mEq

Total K = 65

Ca₂glu
2 mEq

MgSO₄
12 mEq

미량원소
0 mL

Zn
mg

Cu
mg

Mn
mg

Cr
mcg

Heparin
0 U

Multivitamins
2.5 ml

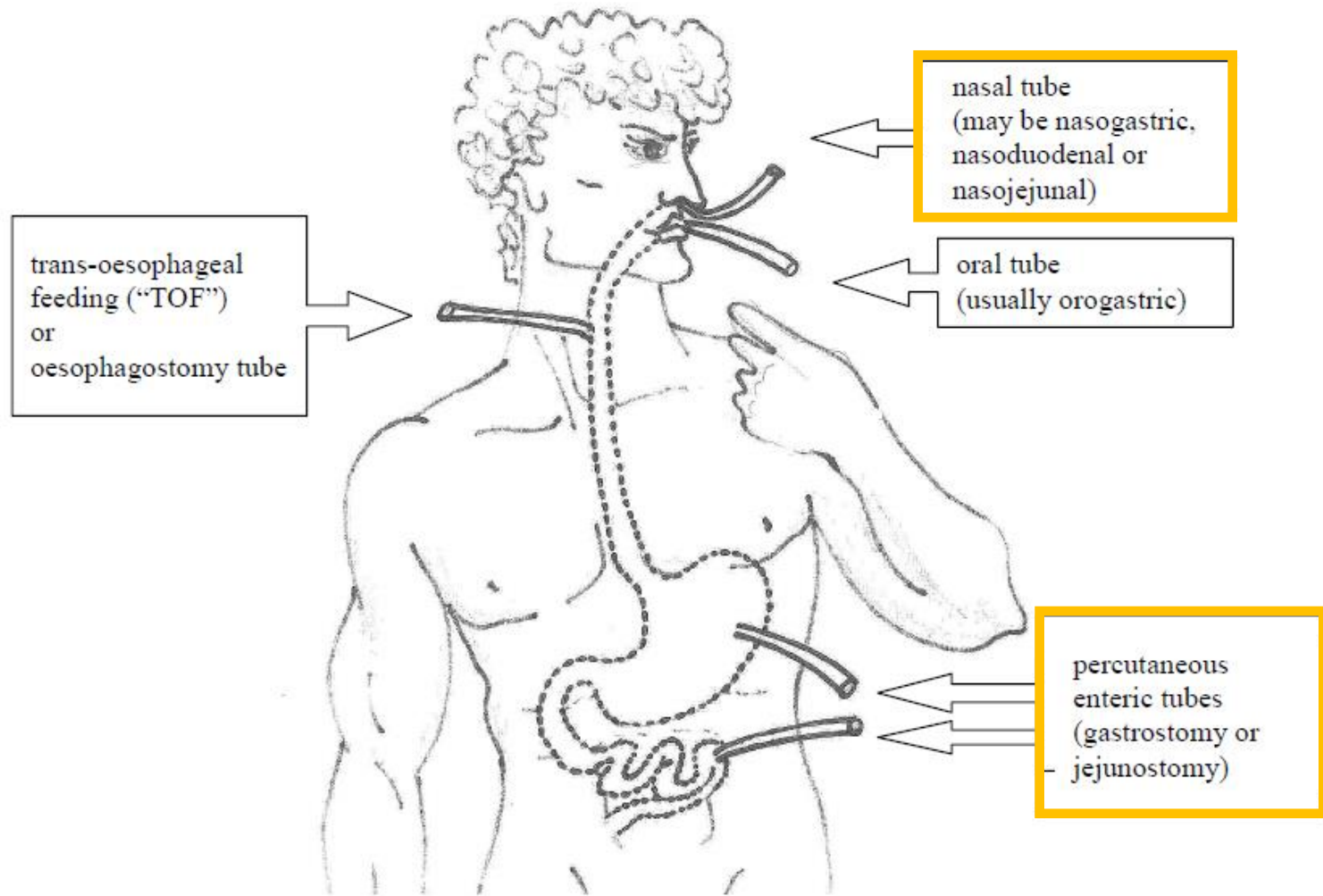
처방내림
삭제
종료 (Esc)

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정상 조회되었습니다.
2016-10-03 19:54:00:139

Type of nutritional support

- Oral nutritional supplements
 - preferred method of administration
- Tube feeding
 - unable to ingest adequate amounts of nutrition

Tube Feeding



Routes for Enteral Feeding

Site of delivery	Access	Feeding route	Placement method
Stomach	Transnasal	Nasogastric tube Nasoduodenal tube Nasojejunal tube	▪ Spontaneous passive placement ▪ Using endoscopy ▪ Using fluoroscopy
Duodenum Jejunum	Percutaneous (Gastro/ enterostomy)	Gastrostomy tube Gastroduodenal tube Gastrojejunal tube Jejunostomy	▪ Using endoscopy ▪ Using fluoroscopy ▪ Surgical access

Nasal vs. Gastro/Enterostomy tube

- Duration of tube feeding
- The level of consciousness
 - Alert patients can not tolerate more than 2 – 6 weeks

Nasal tube feeding

- First consideration for enteral nutrition supply
- **Easy** insertion & **costly effective**
- Not used more than 4 weeks

G/Enterostomy tube feeding

- Enteral tube feeding for **more than 4 weeks**

Site of nutrition delivery

SITE	ACCESS	INDICATIONS	ADVANTAGES	DISADVANTAGES
Gastric (stomach)	- Nasogastric tube (NGT) - Orogastric tube (OGT) - Trans-Oesophageal feeding tube (TOF) - Percutaneous Endoscopic Gastrostomy (PEG) - Surgical or radiologically placed gastrostomy tube	Patients with normal emptying of gastric and duodenal contents	<u>Large reservoir capacity of stomach</u> <u>Most cost effective</u> <u>Easiest to insert</u> <u>Can give bolus feeds</u>, without need for a pump	<u>Increased risk of oesophageal reflux and/or pulmonary aspiration</u>
Duodenum (small bowel)	Nasoduodenal tube (NDT)	Patients who have <u>impaired gastric emptying</u> or who are <u>at risk of oesophageal reflux</u>	- Can be used for early enteral feeding, eg: 4-6 hours after trauma - May reduce risk of oesophageal reflux and/or pulmonary aspiration	<u>Potential gastrointestinal intolerance (bloating, cramping, diarrhoea) due to lack of reservoir capacity in duodenum; likely to need pump to control feed rate</u> <u>May require fluoroscopic or fibre-optic endoscopic placement of tube</u> <u>Risk of displacement/migration back into stomach</u> <u>Unable to use tube aspirates to indicate feeding tolerance</u>
Jejunum (small bowel)	- Nasojejunal tube (NJT) - Surgical jejunostomy (JJ) - Percutaneous Endoscopic Gastrostomy with jejunal extension (PEJ)	- Patients who have <u>impaired gastric emptying</u> or who are <u>at risk of oesophageal reflux</u> <u>Patients post upper GI surgery (jejunal feeding bypasses the surgical site)</u>	- Can be used for early enteral feeding, eg: 4-6 hours after trauma - Reduces risk of oesophageal reflux and/or pulmonary aspiration	<u>Potential gastrointestinal intolerance (bloating, cramping, diarrhoea) due to lack of reservoir capacity in jejunum; likely to need pump to control feed rate</u> <u>May require fluoroscopic or fibre-optic endoscopic placement of tube</u> <u>Risk of displacement/migration back into stomach</u> <u>Unable to use tube aspirates to indicate feeding tolerance</u>

Gastric vs. Postpyloric Feeding

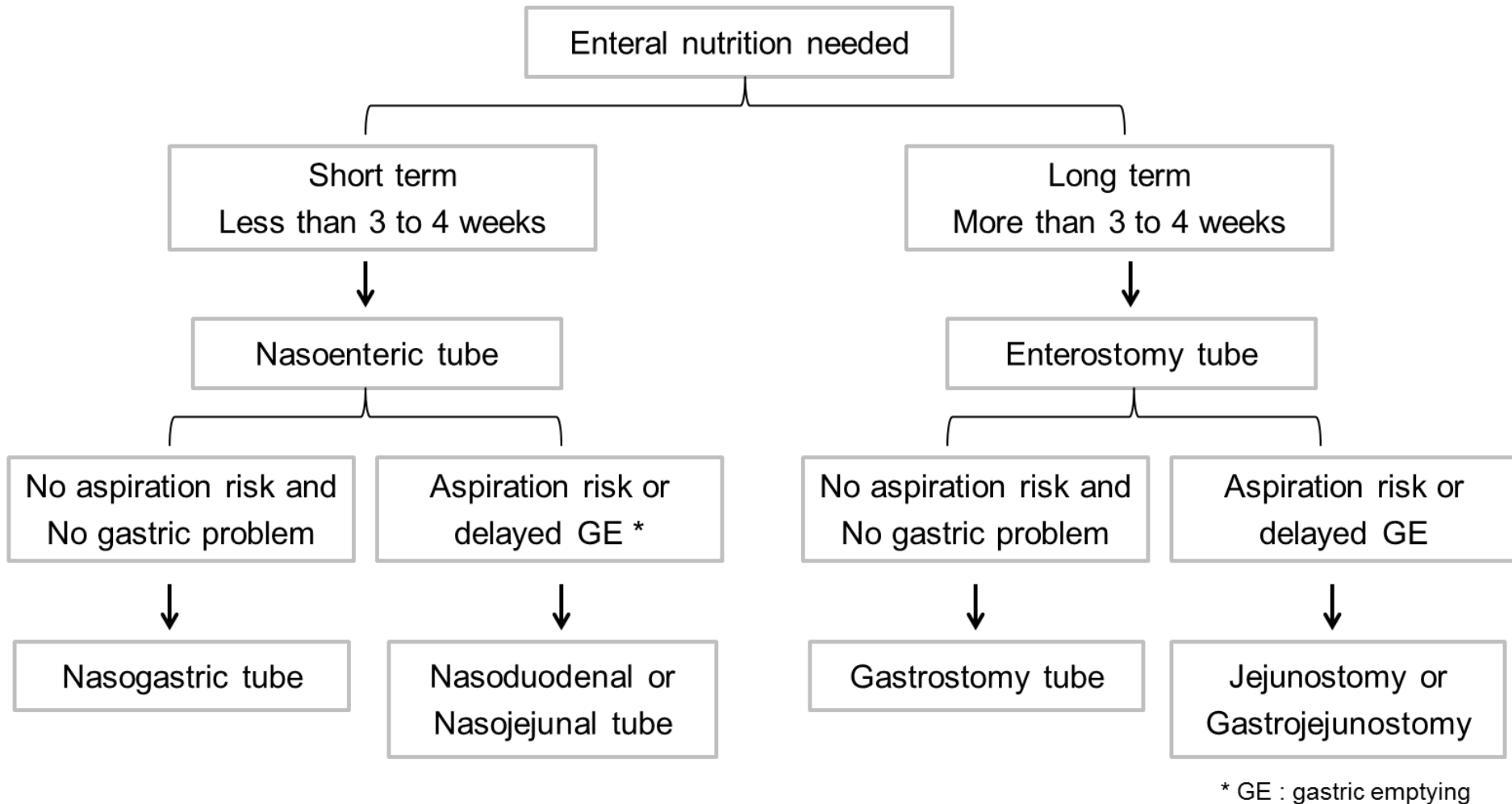
- **Consideration in the decision**

: based on gastric motility, risk of gastric aspiration, alterations in gastrointestinal anatomy (ie, postsurgical) and pre-existing medical conditions.

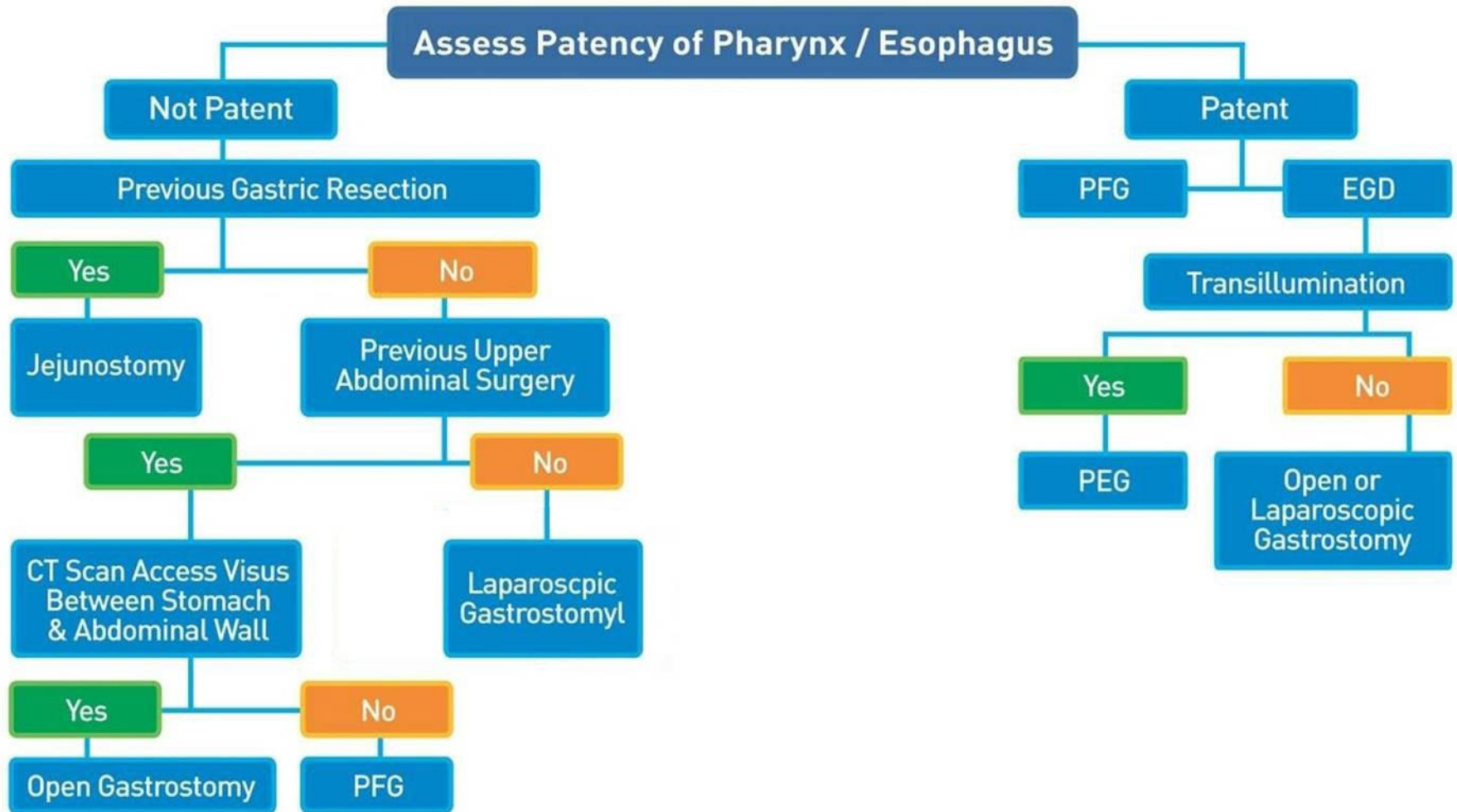
- **Small bowel feedings are the preferred choice**

: gastric outlet obstruction, gastroparesis, increased risk of aspiration, and pancreatitis.

Decision Tree for Enteral Feeding Tube



Guidelines for Placing a Gastrostomy



Transnasal Access: Nasogastric tube

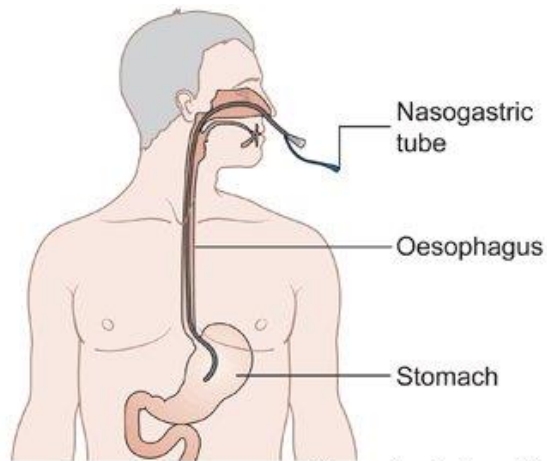


Diagram showing the position of a nasogastric tube
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- Small bore : 12, 10, 8, 6, 5 Fr (8-12 Fr)
 - Poly-urethane or silicone
 - Confirming appropriate placement
 - Aspiration of content
 - Simple plain film of the abdomen
- cf. Air insufflation: can be misleading

COMPARISON OF TUBE INTERNAL DIAMETER VERSUS OUTER DIAMETER BY FRENCH SIZE

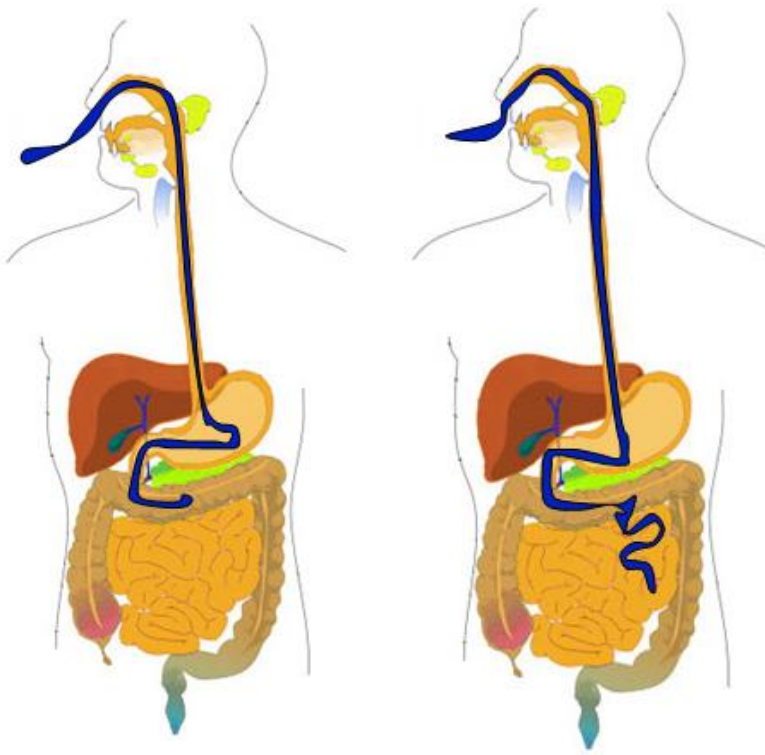
	URETHANE	POLYVINYLCHLORIDE	SILICONE	LATEX
I.D./O.D./ RATIO				

CORPAK MedSystems URETHANE 10 FR.	I.D. (mm)	2.54	O.D. (mm)	3.56
COMPETITIVE URETHANE 12 FR.		2.71		4.06
SILICONE 14.6 FR.		2.64		4.88

CORPAK MedSystems URETHANE 8 FR.	I.D. (mm)	1.96	O.D. (mm)	2.87
COMPETITIVE SILICONE 9.6 FR.		1.98		3.18

Transnasal Access: Post-pyloric feeding

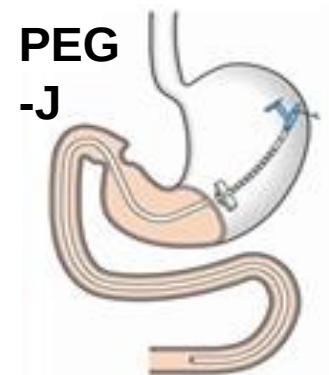
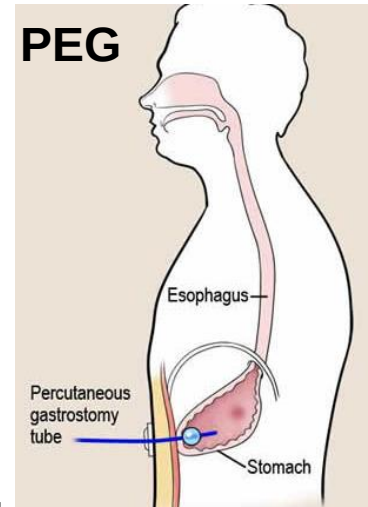
Nasoduodenal/ Nasojejunal tube



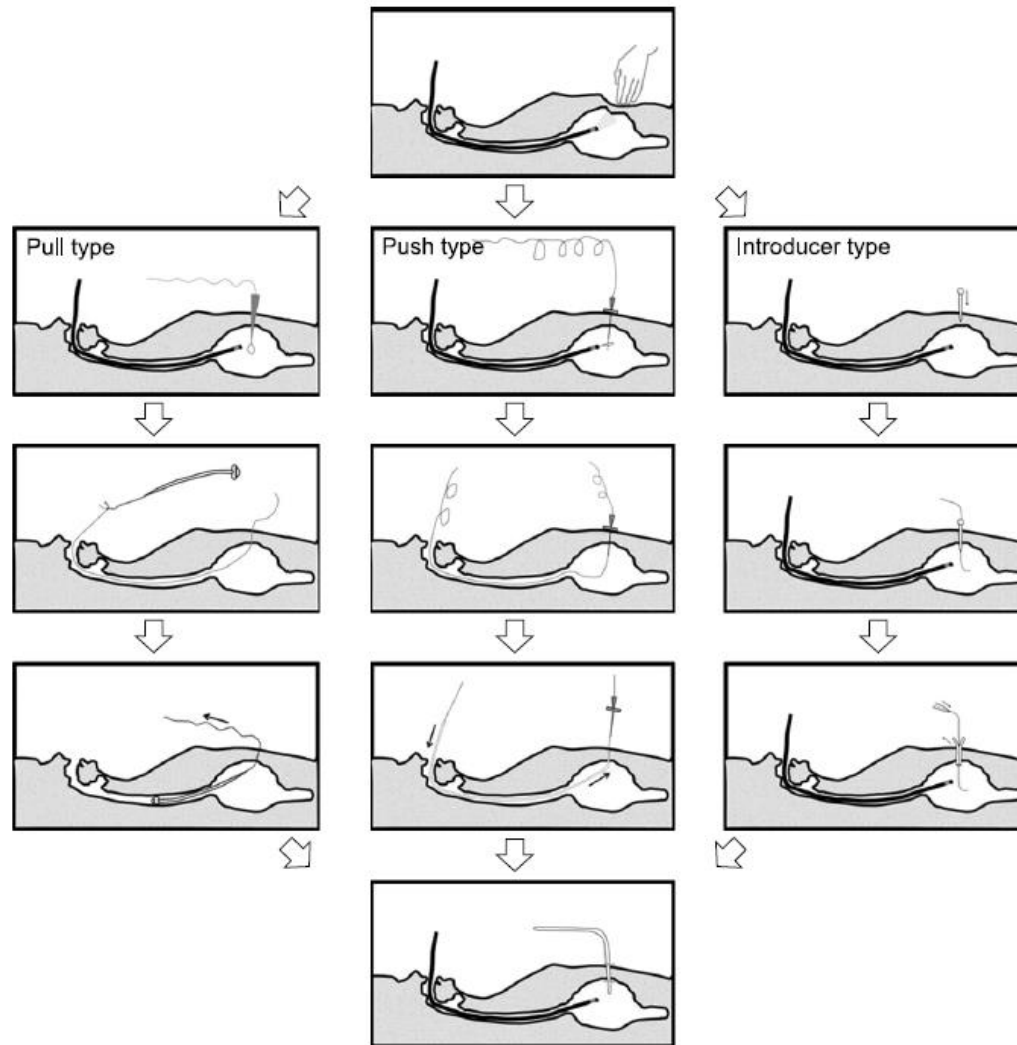
- May prevent problems associated with **reflux** of enteral nutrients and **aspiration**
- Placement
 - Spontaneous passive placement
(Right decubitus position after gastric insertion)
 - Using endoscopy or fluoroscopy
 - Motility agent

Tranendoscopic Access: PEG, PEG-J and D-PEJ

- Large bore : 12, 16, 18, 20 Fr
- PEG, PEG-J, D-PEJ
 - Percutaneous endoscopic gastrostomy (PEG)
 - PEG-jejunostomy (**PEG-J**)
 - : in patients with gastric outlet stenosis, with critical illness, or at risk of pulmonary aspiration.
 - Direct percutaneous endoscopic jejunostomy (D-PEJ)
 - : after gastric resections or if a PEG-J is dislocated
- cf. Radiologically inserted gastrostomy (RIG)



Tranendoscopic Access: PEG insertion



Tranendoscopic Access: PEG

- bumper-type (mushroom type) vs. balloon type



* Balloon retention devices should have the internal balloon checked for proper inflation every 7 to 10 days.

Complications Associated with Enteral Feeding Tubes

	Nasoenteric tubes	G/Enterostomy tubes
Procedure-related	▪ Epistaxis ▪ Sinusitis ▪ Misplacement	▪ Aspiration ▪ Acute bleeding ▪ Pneumoperitoneum ▪ Gastrocolocutaneous fistula
Tube-related	▪ Nasopharyngeal discomfort ▪ Tube dislodgement/ Occlusion	▪ Clogged feeding tube
Specific	▪ Aspiration	▪ Peristomal infections ▪ Leakage ▪ Buried bumper syndrome ▪ Inadvertent removal ▪ Persistent fistula following removal

Complications : G/Enterostomy tube

- **Acute bleeding (<1%)**
 - Most bleeding: disruption of superficial blood vessels arising from the tube tract
 - controlled by tightening the bumper to apply direct pressure
 - Abdominal wall and rectus sheath hematomas → usually self-limited
 - Serious cases: aortic perforation, gastric artery injury, retroperitoneal hemorrhage..
 - For prevention
 - ✓ Using a standard technique with consideration of anatomical structures
 - ✓ Correcting coagulation disorders before PEG tube insertion

Complications : G/Enterostomy tube

- **Pneumoperitoneum (8-18%)**
 - Expected complication
 - If there are no associated signs of peritonitis → observed
 - Most cases will resolve within 72 hours (If not → work up).
 - Patients with mature tubes who present with free air should undergo the same diagnostic considerations as any other patient.

Complications : G/Enterostomy tube

- **Gastrocolocutaneous fistula**

- Predisposing factors : insufficient gastric insufflation, past history of laparotomy causing adhesions and consecutive trapping of bowel loops, and improper transillumination.
- Acute presentation : local infection and peritonitis
- Chronic, indolent course : leakage of stool around the tube
- Treatment
 - ✓ Removal of a gastrostomy tube device → spontaneous closure (majority)
 - ✓ Persistence of the gastrocutaneous fistula (elapsed time between -stomy and removal) → consider surgical closure or endoscopic closure

Complications : G/Enterostomy tube

- **Clogged feeding tube (20-35%)**
 - Thick enteral feeds, bulking agents and medications
 - Prevention and treatment
 - ✓ Flushing
 - ✓ Pancreatic enzymes mixed with bicarbonate
 - Occasionally, tubes will have to be replaced. This appears to be more common with silicone tubes (due to fungal colonization) compared with polyurethane.

Complications : G/Enterostomy tube

- **Peristomal infection**

- 5% -30% (major infection < 2%)
- Predisposing factor
 - ✓ Patient-related: malnutrition, obesity, diabetes, malignancy
 - ✓ Technique-related: small incisions, lack of antibiotic prophylaxis
 - (A single IV dose of a 1st generation cephalosporin 30 minutes prior to the procedure)
 - ✓ Nursing care-related: improper wound dressing or excessive traction between the internal bumper and the stomach wall
 - (approximately 1 cm of play between the skin and external bolster)

Complications : G/Enterostomy tube

- **Leakage**

- Contributting factors

- ✓ Gastric hypersecretion, Bacterial or fungal infection, Tube displacement
 - ✓ Slowed gastric emptying, excessive gavage or residual, Enlarged gastric fistula
 - ✓ Excessive cleansing with hydroperoxide...

- Treatment

- ✓ Reduction of risk factor (PPI, treatment of infection..)
 - ✓ When leakage is related to intolerance of feeding, conversion to gastrojejunostomy.
 - ✓ the PEG tube can be removed occasionally for 24 to 48 hours, permitting the tract to close slightly,
 - ✓ Simply increasing the size of the tube almost never solves excessive leakage from a gastrostomy site.

Complications : G/Enterostomy tube

- **Buried bumper syndrome (BBS, 1.5~1.9%)**
 - The internal bolster of the PEG erodes into the gastric wall as a long-term consequence of excessive tightening of the bolsters.
 - Most common risk : excessive traction/compression between the external and internal bolsters
 - Symptoms: feeding difficulties, leakage, peristomal infection, abdominal pain..
 - Diagnosis: endoscopy or CT scan
 - Treatment: removal and replacement of the tube



Complications : G/Enterostomy tube

- **Inadvertent removal**

- Early (within 7 days) dislodgement rate: 4.1%
- Total lifetime dislodgement rate: almost 13%
- Management depends on the length of time the tube (gastrostomy tract maturation).
- Gastrostomy tract maturation: usually occurred within the first 7-10 days, but may be delayed as long as 4 weeks in the presence of malnutrition, ascites, or corticosteroid treatment.

Complications : G/Enterostomy tube

- **Persistent fistula following removal**

- Following removal, most tube sites will close spontaneously within 72 hours.
- Persistent gastric fistula: correlated with the duration of tube use,
more common in children
- Treatment
 - ✓ Formal surgical closure
 - ✓ Minimally invasive techniques
 - : gastric mucosa endoclipping, fibrin glue, and fistula tract lining disruption using electrocautery device

Gastrostomy tube change

- All tubes will require replacement as a result of occlusion, or dislodgment.
- Most transoral bumper-type gastrostomy tubes can remain in place for 1–2 years.
- Elective change at a fixed period of time (usually 3–6 months) is more common for the balloon-tip gastrostomy tubes because of the potential for balloon failure.

*Thank
you*

