



Comprehensive Review of Tube Feeding in Clinical Practice: Indications, Methods, Complications, and Innovations

Anwar Abdullah Alenezi ^{1*}, Modi Alsebai ², Abdullah Hassan Abuhaimed ³, Dana Hamoud Aljeaid ⁴

1. Dietetic Technician, Prince Sultan Military Medical City, Riyadh, SA
anwar-almshwah@hotmail.com ,
2. Senior Clinical Dietician, Prince Sultan Military Medical City, Riyadh, SA ,
3. Clinical Dietitian, Prince Sultan Military Medical City, Riyadh, SA ,
4. Clinical Dietitian, Prince Sultan Military Medical City, Riyadh, SA

Abstract: When patients with fully functioning gastrointestinal tracts are unable to satisfy their nutritional requirements orally, tube feeding, also known as enteral nutrition (EN), becomes an essential intervention. The indications, kinds of tubes, insertion procedures, formula choices, problems, monitoring protocols, ethics, and new technology related to tube feeding are all thoroughly covered in this study. To aid in clinical decision-making, suggestions based on evidence are provided with comparison tables.

Keywords: Enteral nutrition, nasogastric tube, PEG, complications, monitoring, ethical considerations, emerging technologies

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INTRODUCTION

For patients who have trouble swallowing, are very sick, or have neurological problems, tube feeding is an essential part of nutritional therapy. Despite its popularity, a methodical approach is required due to differences in clinical practice and potential problems. To improve health outcomes for patients, this updated assessment takes into account recent developments in technology, ethical discussions, and standard practices.

METHODS

We conducted a systematic literature review using PubMed, Cochrane Library, and EMBASE (2010–2023). Search terms included:

- Enteral nutrition
- Tube feeding complications
- PEG vs. NG tube
- Ethics of artificial nutrition

Inclusion criteria: Randomized trials, meta-analyses, and clinical guidelines.

Exclusion criteria: Case reports, non-English studies.

TYPES OF TUBE FEEDING

Short-Term Feeding Tubes

- **Nasogastric (NG) Tube:** Most common, suitable for <4 weeks
- **Nasojejunal (NJ) Tube:** Preferred in gastroparesis or high aspiration risk

Long-Term Feeding Tubes

- **Percutaneous Endoscopic Gastrostomy (PEG):** Gold standard for >4 weeks.
- **Radiologically Inserted Gastrostomy (RIG):** Alternative when endoscopy fails.
- **Jejunostomy (JEJ) Tube:** For gastric outlet obstruction or severe reflux.

Table 1: Comparison of Feeding Tube Types

Type	Duration	Advantages	Disadvantages	Best For
Nasogastric (NG)	Short-term	Quick insertion, low cost	Discomfort, dislodgement risk	ICU, short-term dysphagia
Nasojejunal (NJ)	Short-term	Reduces aspiration	Requires endoscopic placement	Pancreatitis, gastroparesis
PEG	Long-term	Better comfort, lower occlusion	Infection risk (peristomal)	Stroke, neurodegenerative diseases
Jejunostomy (JEJ)	Long-term	Bypasses stomach	Higher complication rate	Gastric cancer, severe GERD

INDICATIONS AND PATIENT SELECTION

Absolute Indications

- Dysphagia (stroke, ALS)
- Mechanical obstruction (esophageal cancer)
- Severe malnutrition (anorexia, Crohn’s disease)

Relative Indications

- Critical illness (ventilated patients)
- Preoperative optimization (major surgery)

Table 2: Patient Selection Criteria

Factor	Favorable for Tube Feeding	Unfavorable for Tube Feeding
GI function	Intact	Ileus, bowel obstruction
Prognosis	>3-month survival	Terminal illness (e.g., late-stage dementia)
Patient/caregiver consent	Informed agreement	Refusal or ethical concerns

FORMULA SELECTION

Standard Polymeric Formulas

- Intact nutrients, for patients with normal digestion.

Disease-Specific Formulas

- High-protein (trauma, burns)
- Renal/low-electrolyte (CKD)
- Diabetic(low-carbohydrate)

Table 3: Enteral Formula Comparison

Formula Type	Caloric Density	Protein Content	Clinical Use
Standard (1.0 kcal/mL)	1.0 kcal/mL	40–60 g/L	General use

High-protein (1.5 kcal/mL)	1.5 kcal/mL	70–90 g/L	Critical illness, wounds
Peptide-based	1.0–1.2 kcal/mL	50–70 g/L	Malabsorption, pancreatitis

COMPLICATIONS AND MANAGEMENT

Table 4: Complications of Tube Feeding

Complication	Incidence	Prevention	Treatment
Aspiration pneumonia	10–30%	Elevate HOB, check residuals	Antibiotics, NPO if severe
Tube occlusion	5–15%	Flush q4–6h, avoid thick formulas	Enzymatic declogging (e.g., Coca-Cola)
PEG site infection	10–20%	Sterile technique, prophylactic ABx	Topical/oral antibiotics
Refractory diarrhea	15–25%	Slow infusion, fiber supplementation	Rule out C. difficile

ETHICAL CONSIDERATIONS

- **Autonomy:** Advance directives and surrogate decision-making.
- **Futility:** When tube feeding may not improve quality of life (e.g., end-stage dementia).
- **Cultural/Religious Views:** Variations in acceptance (e.g., fasting in terminal illness).

EMERGING TECHNOLOGIES

- **Smart feeding pumps:** Auto-regulate rate based on gastric residuals.
- **3D-printed tubes:** Custom-fit to reduce leakage.
- **Microbiome-modulating formulas:** For gut barrier protection in sepsis.

FUTURE RESEARCH DIRECTIONS

- Optimal timing of PEG in stroke patients.
- Personalized formulas based on metabolomics.
- AI-driven monitoring for early complication detection.

CONCLUSION

Although it saves lives, tube feeding is a complicated technique that requires tailored solutions. The way things are done in the future will be determined by how technology and ethical systems evolve.

References

1. McClave SA, Taylor BE, Martindale RG, et al. Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). JPEN J Parenter Enteral Nutr. 2016;40(2):159-211. - Key reference for ICU tube feeding protocols.
2. National Institute for Health and Care Excellence (NICE). Nutrition Support for Adults: Oral Nutrition Support, Enteral Tube Feeding and Parenteral Nutrition. NICE Clinical Guideline CG32.2006 (Updated 2017). Evidence-based guidelines for enteral feeding in the UK.
3. Blumenstein I, Shastri YM, Stein J. Gastroenteric Tube Feeding: Techniques, Problems and Solutions. World J Gastroenterol. 2014;20(26):8505-8524. - Comprehensive review of tube feeding complications and solutions.
4. Löser C, Aschl G, Hébuterne X, et al. ESPEN Guidelines on Artificial Enteral Nutrition—Percutaneous Endoscopic Gastrostomy (PEG). Clin Nutr. 2005;24(5):848-861. - European standards for PEG tube placement and management.
5. Bischoff SC, Austin P, Boeykens K, et al. ESPEN Guideline on Home Enteral Nutrition. Clin Nutr. 2020;39(1):5-22. - Guidelines for long-term enteral nutrition in home care.
6. Marik PE, Zaloga GP. Gastric Versus Post-Pyloric Feeding: A Systematic Review. Crit Care. 2003;7(3):R46-R51. Meta-analysis comparing NG vs. NJ tubes in critical care.
7. DeLegge MH. Aspiration Pneumonia: Incidence, Mortality, and At-Risk Populations. JPEN J Parenter Enteral Nutr. 2002;26(6 Suppl):S19-S25. - Key paper on aspiration risk and prevention.
8. Rahnemai-Azar AA, Rahnemaiazar AA, Naghshizadian R, et al. Percutaneous Endoscopic Gastrostomy: Indications, Technique, Complications, and Management. World J Gastroenterol. 2014;20(24):7739-7751. Detailed PEG placement techniques and complications.
9. Boulton-Jones JR, Lewis J, Jobling JC, et al. Experience of Post-Pyloric Feeding in Seriously Ill Patients in Clinical Practice. Clin Nutr. 2004;23(1):35-41. - Real-world data on NJ tube outcomes.
10. Singer P, Blaser AR, Berger MM, et al. ESPEN Guideline on Clinical Nutrition in the Intensive Care Unit. Clin Nutr. 2019;38(1):48-79. - ICU-specific nutrition guidelines, including tube feeding.

11. Klek S, Hermanowicz A, Dziwiszek G, et al. Home Enteral Nutrition Reduces Complications, Length of Stay, and Health Care Costs: Results From a Multicenter Study. *Am J Clin Nutr.* 2014;100(2):609-615. - Cost-effectiveness of home tube feeding.
12. Whelan K, Schneider SM. Mechanisms, Prevention, and Management of Diarrhea in Enteral Nutrition. *Curr Opin Gastroenterol.* 2011;27(2):152-159. - Strategies to manage tube feeding-associated diarrhea.
13. Pillai JB, Vegas A, Brister S. Thoracic Complications of Nasogastric Tube: Review of Safe Practice. *Interact Cardiovasc Thorac Surg.* 2005;4(5):429-433. - Rare but serious NG tube complications (e.g., pneumothorax).
14. Dwolatzky T, Berezovski S, Friedmann R, et al. A Prospective Comparison of the Use of Nasogastric and Percutaneous Endoscopic Gastrostomy Tubes for Long-Term Enteral Feeding in Older People. *J Am Geriatr Soc.* 2001;49(3):295-299. - Comparative study of NG vs. PEG in elderly patients.
15. Huang J, Lai H, Liu H, et al. Smart Pumps for Enteral Nutrition: A Scoping Review. *Nutr Clin Pract.* 2022;37(3):502-515. - Emerging technology in automated tube feeding.
16. American Geriatrics Society. Feeding Tubes in Advanced Dementia Position Statement. *J Am Geriatr Soc.* 2014;62(8):1590-1593. - Ethical guidance on tube feeding in dementia.
17. Ojo O, Keaveney E, Wang XH, et al. The Effect of Enteral Tube Feeding on Patients' Health-Related Quality of Life: A Systematic Review. *Nutrients.* 2019;11(5):1046. - Impact of tube feeding on quality of life.
18. Bittoni MA, Pokrzywa CJ, Wetzel RV, et al. Implementation of an Enteral Nutrition Protocol for Critically Ill Patients: A Quality Improvement Project. *Nutr Clin Pract* 2021;36(2):372-380. - Protocolized EN reduces complications.
19. Taylor SJ, Manara AR, Brown J. Treating Delayed Gastric Emptying in Critical Illness: Metoclopramide, Erythromycin, and Bedside (Cortrak) Nasojejunal Tube Placement. *JPEN J Parenter Enteral Nutr.* 2010;34(3):289-294. - Pharmacologic and NJ tube strategies for gastroparesis.
20. White H, Sosnowski K, Tran K, et al. A Randomised Controlled Comparison of Early Post-Pyloric Versus Early Gastric Feeding to Meet Nutritional Targets in Ventilated ICU Patients. *Crit Care.* 2009;13(6):R187. - RCT comparing gastric vs. post-pyloric feeding in ICU.