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Joint NS-BSG-BAPEN Winter Conference: Diet and Digestive Disease

BAPEN Practitioners' Session

To PEG or not to PEG that is the question

Thomas Welbank¹, Matthew Kurien^{1,2*}

¹ Department of Gastroenterology, Sheffield Teaching Hospital NHS Foundation Trust, United Kingdom, S10 2JF

² Academic Unit of Gastroenterology, Department of Infection, Immunity and Cardiovascular Disease, University of Sheffield, Sheffield, United Kingdom, S10 2RX

Shortened Title: Controversies regarding PEG feeding

Abbreviations: ETF, Enteral Tube Feeding, PN, Parenteral Nutrition, PEG, Percutaneous Endoscopic Gastrostomy, PRG, Percutaneous radiological gastrostomy

Corresponding author

Dr Matthew Kurien, Room P39, Royal Hallamshire Hospital, Sheffield Teaching Hospitals, Glossop Road, Sheffield, S10 2JF, UK.

E-mail: m.kurien@sheffield.ac.uk Telephone Number: +44 114 2261179

29 **ABSTRACT**

30 Nutrition support involves the use of oral supplements, enteral tube feeding or parenteral
31 nutrition. These interventions are considered when oral intake alone fails to meet nutritional
32 requirements. Special diets and oral supplements are usually the first approach to managing
33 malnutrition, however their role becomes limited when oral intake is restricted or if swallowing
34 is unsafe. Enteral tube feeding or parenteral nutrition are alternative means of providing
35 nutrition support for this select group of patients.

36

37 Percutaneous Endoscopic Gastrostomy (PEG) feeding was introduced into clinical practice in
38 1980. It describes a feeding tube placed directly into the stomach under endoscopic guidance.
39 It is an established means of providing enteral nutrition to those who have functionally normal
40 gastrointestinal tracts, but who cannot meet their nutritional requirements due to an inadequate
41 oral intake. The intervention is usually reserved when nutritional intake is likely to be
42 inadequate for more than 4-6 weeks. Although the benefits of PEGs have been shown for select
43 group of patients, there currently exists concerns about the increasing frequency of this
44 intervention, and also uncertainty about the long-term benefits for certain patients. The 2004
45 UK National Confidential Enquiry into Patient Outcome and Death (NCEPOD) report
46 emphasized this concern, with almost a fifth of PEGs being undertaken for futile indications
47 that negatively influenced morbidity and mortality.

48

49 This review paper discusses the indications for, controversies surrounding, and complications
50 of gastrostomy feeding and provides practical advice on optimising patient selection for this
51 intervention.

52

53 **Keywords:** Nutrition Support: Gastrostomy Feeding: Patient Selection

54

55 **Nutrition Support**

56 Nutrition support involves the provision of nutrition beyond that provided by normal food
57 intake using oral supplementation, enteral tube feeding (ETF) and parenteral nutrition (PN).⁽¹⁾

58 The goals of nutrition support are to ensure attainment of an individual's nutritional
59 requirements. Oral nutrition using special diets and supplements is usually considered the first
60 line therapy in managing malnutrition, however certain individuals may require enteral or
61 parenteral nutrition when oral intake is reduced or when swallowing is unsafe.⁽²⁾ Of these
62 modalities, enteral nutrition is usually preferred in the context of a normally functioning
63 gastrointestinal tract as it is physiological, cheaper and may help maintain gut barrier
64 function.^(3;4)

65
66 Most patients requiring nutrition support therapy have treatment for less than one month.⁽⁵⁾
67 When short-term enteral feeding is considered, nasogastric and orogastric tubes are most
68 frequently used, reflecting their ease of insertion and removal (Figure 1). Tubes range in length
69 and diameter and can be inserted either at the bedside, at endoscopy or using radiological
70 guidance. When nutritional intake is likely to be inadequate for more than 4-6 weeks then
71 enteral feeding using a gastrostomy is most frequently considered.⁽⁶⁾

72 73 **History of Gastrostomies**

74 A gastrostomy describes a feeding tube placed directly into the stomach via a small incision
75 through the abdominal wall. It can provide long term enteral nutrition to patients who have
76 functionally normal gastrointestinal tracts but who cannot meet their nutritional requirements
77 due to an inadequate oral intake.⁽⁶⁾ Infrequently, they may also be used for decompressing the
78 stomach or proximal small bowel following outflow obstruction or volvulus.

79
80 The concept of a gastrostomy was first proposed by Egeberg, a Norwegian army surgeon in
81 1837, however it was only in 1876 when Verneuil used a silver wire to oppose visceral and
82 parietal surfaces that success was achieved in inserting a surgical gastrostomy.⁽⁷⁾ Post-
83 procedural peritonitis was the most frequent limitation to previous attempts at surgical
84 insertion, with death ensuing in individuals who developed this complication. Stamm modified
85 Verneuil's surgical technique in 1894, prior to modifications being developed by Dragstedt,
86 Janeway and Witze in the 20th century.⁽⁸⁾

87

88 In 1979, Michael Gauderer and Jeffrey Ponsky revolutionised gastrostomy practice by
89 pioneering an endoscopic method of insertion in Cleveland, Ohio.⁽⁹⁾ The two paediatricians
90 performed the very first percutaneous endoscopic gastrostomy (PEG) in a 6-month old child,
91 using a 16 French DePezzar (mushroom tipped) catheter, which they replicated again in a
92 further 5 paediatric cases.⁽¹⁰⁾ Ponsky then utilised this technique in a cohort of adult patients
93 with dysphagic strokes, which heightened interest in this novel endoscopic technique.⁽¹⁰⁾ The
94 ‘pull technique’ that they pioneered is currently one of three endoscopic methods frequently
95 used today in clinical practice. When compared to previously used surgical methods,
96 endoscopic insertion was favourable, as it was minimally invasive and incurred lower
97 morbidity and mortality.

98

99 Two years later in 1981, Preshaw in Canada used fluoroscopic guidance to insert the first
100 percutaneous radiological gastrostomy (PRG).⁽¹¹⁾ Like endoscopic methods, modifications of
101 the original radiological technique have occurred since the original method was conceived.
102 However, despite these advances endoscopic techniques remain the most popular methods of
103 insertion internationally, with PRG insertion most frequently reserved for high-risk patients,
104 oropharyngeal malignancy and when endoscopic passage is technically difficult.^(12; 13)

105

106 **Indications for Gastrostomy**

107 Since the introduction of endoscopic and radiological insertion techniques for gastrostomy,
108 there has been increasing demand for this intervention, for an increasing number of clinical
109 indications. A broad list of indications for which patients are currently being referred for
110 gastrostomy is given in Table 1. Despite being widely performed the evidence base to support
111 gastrostomy feeding in certain patient groups is lacking. This is reflected in the National
112 Confidential Enquiry into Patient Outcome and Death (NCEPOD) report, which reviewed
113 mortality outcomes post-percutaneous endoscopic gastrostomy insertion between April 2002
114 and March 2003.⁽¹⁴⁾ This identified a 30-day mortality rate in a cohort of 16,648 patients of
115 6%.⁽¹⁴⁾ Subgroup analysis alarmingly showed that 43% died within one week of undergoing
116 PEG insertion, of whom in 19% the intervention was felt to have been futile. Concerningly,
117 the NCEPOD data identified a high prevalence of acute chest infections (40%) in those
118 undergoing PEG placements, which could have influenced these mortality outcomes.
119 Discussed below is the role of gastrostomy feeding in different patient subgroups, and the
120 evidence that exists to inform clinical decision-making.

121

122

123 *Gastrostomy feeding and Dementia*

124 Patients with dementia frequently develop feeding problems, leading to weight loss and
125 nutritional deficiencies. Up to 85% of these problems develop prior to death suggesting that
126 difficulties with feeding are an end-stage problem associated with advanced disease.⁽¹⁵⁾
127 Whether or not to use gastrostomies to feed patients with dementia is an emotive and
128 controversial issue. This controversy is further compounded by the fact that in the late stages
129 of the illness, individuals lack capacity to express their wishes. The 2010 British Artificial
130 Nutrition Survey (BANS) gives insights into the frequency of insertion for dementia,
131 highlighting that registration of home enteral tube feeding (mainly by gastrostomy) for this
132 indication declined from 7% in 2004 to 3% (48/1560).⁽¹⁶⁾ This decline is likely to reflect
133 concerns raised in the medical literature about inserting gastrostomies for this specific
134 indication.

135

136 There is currently a limited number of prospective studies examining outcomes in dementia,
137 which could help inform clinical practice.^(17; 18) In a retrospective cohort study of 361 patients,
138 mortality was found to be significantly higher in dementia patients compared to any other
139 patient group (54% 30-day mortality and 90% at 1 year).⁽¹⁹⁾ Our group replicated this finding
140 in a prospectively followed cohort (n=1023), however the number of insertions performed for
141 the indication of dementia was low (n=5).⁽²⁰⁾ These concerns have been highlighted in a
142 Cochrane systematic review, which showed no improvements in survival, quality of life,
143 nutritional status, function, behaviour or in psychiatric symptoms in patients with advanced
144 dementia receiving enteral tube feeding.⁽²¹⁾

145

146 There now exists general agreement amongst clinicians that PEG feeding does not benefit
147 people with advanced dementia. The evidence supporting this assertion has been disseminated
148 through guidelines and enhanced education, and influenced the decline in gastrostomy
149 insertions for this indication in the U.K. over recent years. Although this decline has been seen
150 within the UK, the practice of inserting gastrostomies for this indication remains widespread
151 in other countries.⁽²²⁾ The reasons for this geographical variation is uncertain but may reflect
152 how factors such as cultural, religious, family and healthcare system expectations influence
153 PEG decision making, which goes beyond clinic outcomes alone. In summary, gastrostomy
154 feeding does not derive benefits to people with advanced dementia.

155

156

157 *Gastrostomy Feeding in Stroke Patients*

158 Dysphagia is common in patients after a stroke ranging between 23-50%.⁽²³⁾ Neurological
159 recovery does occur in some patients leading to improvements in swallowing function,
160 however many remain at high risk of developing aspiration pneumonia and malnutrition.
161 Enteral nutrition is widely advocated in these individuals, however controversy exists as to the
162 optimal mode of delivery.

163

164 Historically, two small randomised, studies evaluating PEG versus nasogastric feeding
165 demonstrated improved mortality outcomes, hospital length of stay and nutritional indices in
166 patients who had a PEG, suggesting derived benefit.^(24;25) More recently, the FOOD (Feed or
167 Ordinary Diet) trial has been published and questioned the potential merits of PEG feeding.⁽²⁶⁾
168 This multi-centre study consisted of three pragmatic randomised controlled trials: Trial 1 aimed
169 to determine whether routine oral nutritional supplementation of a normal hospital diet
170 improved outcomes after stroke); Trial 2 assessed whether early tube feeding improved the
171 outcomes of dysphagic stroke patients; and Trial 3 examined whether tube feeding via a PEG
172 resulted in better outcomes than nasogastric feeding. The results from this study showed no
173 benefit of oral supplements; however, survival improved when tube feeding was commenced
174 early but at the cost of poorer functional outcomes. In Trial 3 comparing PEG feeding versus
175 nasogastric feeding, there was a significant difference between the 2 groups, with PEG fed
176 patients likely to have a higher mortality and poorer outcomes. A possible explanation for this
177 findings being the impact of dependency on long-term PEG feeding, with PEG patients still
178 requiring feed during the follow-up period when compared to patients with nasogastric
179 tubes.⁽²⁶⁾ Furthermore, survivors in the PEG group had a lower quality of life (based on EQ-
180 5D-5L, EuroQol Group), and were more likely to be living in institutions when compared to
181 nasogastric fed patients.⁽²⁶⁾ In summary, enteral nutrition support is useful in patients with
182 dysphagia following an acute stroke, however the optimal method of delivery (PEG vs.
183 nasogastric feeding) remains uncertain.

184

185 *Gastrostomy Feeding in Oropharyngeal Malignancy*

186 Patients with oropharyngeal malignancy are at risk of malnutrition due to direct effects from
187 the tumour (e.g. reduced appetite, host response, problems ingesting food due to tumour size)
188 and also from the anticancer therapies themselves (e.g. radiation induced mucositis). PEGs and
189 nasogastric tubes insertions are widely performed in this patient group as a prophylactic

190 measure (prior to radiotherapy and chemotherapy), but also when swallowing problems occur
191 directly because of the malignancy itself. Despite the potential merits of enteral feeding in this
192 patient group, there had been limited research evaluating gastrostomy feeding in comparison
193 to other enteral feeding methods.⁽²⁷⁾ This led to a Cochrane review in 2010 concluding that
194 there was insufficient evidence to determine the optimal method of enteral feeding in patients
195 with head and neck cancer receiving radiotherapy and/or chemoradiotherapy.⁽²⁸⁾

196

197 More recently a prospective comparative cohort study from Australia compared no PEG (n=61)
198 vs prophylactic PEG (n=69) in patients with head and neck cancer receiving chemotherapy.
199 Over a two year period, prophylactic gastrostomy significantly improved nutritional outcomes
200 and reduced unplanned hospital admissions.⁽²⁹⁾ A randomised controlled trial funded by the
201 National Institute for Health Research (NIHR) Health Technology Assessment programme had
202 planned to compare gastrostomy and nasogastric feeding in this cohort of patients and advance
203 knowledge in this area, however poor recruitment limited trial progression.⁽³⁰⁾ In summary,
204 further work is needed to establish when and which enteral feeding routes are most appropriate
205 for this particular group of patients.

206

207 *Gastrostomy Feeding in Neurodegenerative Disorders*

208 Gastrostomies are increasingly being used in the treatment of patients with neurogenic
209 dysphagia.⁽³¹⁾ Whilst the exact aetiology of the neurogenic dysphagia is frequently unknown,
210 it is commonly encountered in patients with motor neurone disease (MND), Huntington's
211 chorea, Multiple sclerosis and in patients with Parkinson's disease. When bulbar weakness
212 develops leading to dysarthria and dysphagia, gastrostomies are frequently considered to aid
213 nutrition, reduce choking episodes and to minimise the risk of aspiration pneumonia.

214

215 PEG feeding is recommended for people with MND and dysphagia in both European and
216 American guidelines.^(32; 33) Despite patients potentially fulfilling criteria for insertion, it is
217 recognised that patients' and caregivers perceptions about PEG has an influence on both the
218 timing and proportion that actually receive the intervention.⁽³⁴⁾ This variability has been subject
219 to a meta-analysis and survey of clinical practice, which highlighted the dearth of high quality
220 evidence regarding the optimal timing and method of gastrostomy insertion.⁽³⁵⁾ This provided
221 the rationale for the recent ProGas study, which was a large, multicentre, longitudinal cohort
222 study.⁽³⁶⁾ This study compared the different methods of gastrostomy and explored the optimal
223 timing for insertion. Findings showed no differences between procedural methods for inserting

224 gastrostomies, and limited benefits in those who at the time of gastrostomy had had more than
225 10% loss of their diagnosis weight. These findings have helped to inform both patients and
226 relevant clinicians about the optimal timing of PEGs for people with MND. Further work is
227 now needed to established the benefits derived to people with other neurodegenerative
228 conditions.

229

230 *Gastrostomy Feeding in other Patient Sub-groups*

231 PEG insertion is undertaken for a number of other indications (highlighted in Table 1). The
232 evidence supporting its role in some of these differing sub-groups is highly questionable. An
233 example of this is in patients who suffer head injuries following road traffic accidents, falls,
234 violence or sport who are often considered for gastrostomy whilst on Intensive Care Units.
235 Currently, the latest Cochrane review of nutritional support in head injury patients (analysis of
236 11 trials) suggests early feeding may improve survival and disability, however this benefit may
237 be best derived from total parenteral nutrition rather than enteral nutrition methods.⁽³⁷⁾ When
238 comparing nasogastric feeding with gastrostomy feeding in this patient group, gastrostomy
239 feeding may reduce pneumonia rates but does not derive any mortality benefit.⁽³⁸⁾

240

241 Another group of patients seen in adult services with gastrostomies are patients with cerebral
242 palsy. Gastrostomy insertion is increasingly being performed in children with this condition
243 with the aim of improving weight, nutritional indices and quality of life.^(39; 40; 41) These
244 individuals are then moved into adult services as they reach adulthood. Unfortunately, like in
245 many other areas of gastrostomy feeling there is a paucity of well-designed randomised
246 controlled trials evaluating gastrostomy feeding in this patient group, leading to uncertainty
247 regarding the merits of this intervention.⁽⁴²⁾ This uncertainty is reflected in other conditions
248 (anorexia nervosa, achalasia, frailty, burns patients) and highlights the need for well-conducted
249 studies, to help better inform clinical practice.

250

251

252 **Gastrostomy Feeding and Nutritional Outcomes**

253 *Feeding via a Gastrostomy*

254 Enteral feeds can be delivered via gastrostomies using continuous, bolus or intermittent
255 infusion methods.⁽⁴³⁾ These feeds are nutritionally complete (containing protein or amino acids,
256 carbohydrate, fat, water, minerals and vitamins) and are available in fibre free and fibre
257 enriched forms. Determining the type of feed used is influenced by an individual's,

258 preferences/lifestyle, nutritional requirements, gastrointestinal absorption, motility and also
259 by their co-morbidities, such as renal or liver disease.⁽⁴⁴⁾ Continuous infusion provides patients
260 with feed over 24 hours. It is most frequently reserved for patients with high gastric residual
261 volumes on intensive care units, and those having a history of aspiration, vomiting and/or
262 reflux.⁽⁴⁵⁾ This regimen is associated with an increased risk of drug nutrient interactions and
263 may also increase intragastric pH leading to bacterial overgrowth.⁽²⁾ Bolus feeding describes
264 the delivery of 200-400 mL of feed. periodically throughout the day. It permits medications to
265 be given at times different to feeds, and also gives patients the freedom to mobilise and
266 rehabilitate without having to be continually attached to a pump . Occasionally, this method of
267 administration can lead to abdominal bloating, diarrhoea and rarely symptoms analogous to
268 those seen in the ‘dumping syndrome’ where rapid gastric emptying occurs. Intermittent
269 infusions provide feeds over a longer duration than bolus feeding using an infusion pump. They
270 are anecdotally most commonly used for ease and lifestyle reasons.

271

272 *Impact on nutritional outcomes.*

273 The nutritional benefits derived from gastrostomy feeding are not clearly established. The
274 uncertainties that exist reflect the heterogeneity in populations previously assessed, the paucity
275 of data examining long-term nutritional outcomes and confounders such as timing of
276 gastrostomy feeding that may have influenced reported outcomes. In addition, the assessment
277 of nutritional status is highly variable. In stroke patients, a frequently cited historical paper
278 showed that gastrostomy feeding was better than nasogastric feeding at improving weight gain
279 and anthropometric measurements at 6 weeks.⁽²⁴⁾ This landmark study has helped inform future
280 clinical practice, however it is to be recognised that results were derived from only 30 patients
281 from 2 UK centres. The more recent and significantly larger, multicentre FOOD trial has
282 enhanced understanding about the timing and method of enteral feeding in stroke patients,
283 however uncertainty still remains about how gastrostomies impact nutritional status in these
284 individuals.⁽²⁶⁾

285

286 The ProGas study provides insights into how gastrostomy feeding influences nutritional
287 outcomes in motor neurone disease.⁽³⁶⁾ In this study the authors report outcomes of 170 patients
288 who had valid weight measurements 3 months post gastrostomy insertion. Findings showed
289 that in 84 (49%) patients, weight loss was more than 1kg compared to baseline values. These
290 findings suggest nutritional gains may be limited in this group of patients, however the timing

291 of gastrostomy insertion may be critical to achieving maximal gains. The uncertainties
292 highlighted here emphasize the need for better studies looking at nutritional outcomes in
293 gastrostomy patients. This would also help improve understanding of the efficacy of this
294 intervention in reducing malnutrition.

295
296
297

298 **Improving patient selection for Gastrostomy insertion and aftercare**

299 There has been increasing interest in improving patient selection for gastrostomy insertion.^{(46;}
300 ^{47; 48)} One method used internationally to optimise referral practice is to employ institutional
301 guidelines that use a standardised referral protocol. Use of a multidisciplinary team in
302 assessment of patients and dissemination of evidence can allow both caregivers and healthcare
303 professionals make an informed decision. This approach has been shown (in observational
304 studies) to improve the selection of patients referred for gastrostomy.^(49; 50; 51) These teams have
305 varying composition but usually include a gastroenterologist, a specialist nurse, a dietitian and
306 a speech and language therapist. Although these multidisciplinary teams have been advocated
307 in differing reports from NCEPOD⁽¹⁴⁾ and the British Society of Gastroenterology⁽⁵²⁾, it is
308 recognised that many hospitals internationally are still unable to provide this service due to
309 pressures within current healthcare systems.^(53; 54) This may be a factor influencing the negative
310 sequelae seen associated with PEG insertions.

311
312

313 A “cooling off period” is another approach that is widely adopted and can help improve patient
314 selection. This describes a gap of at least a week between assessment by the nutrition team and
315 the scheduling of the PEG insertion. This practice is based on previous published work by
316 members of our clinical team, and data from the NCEPOD report, which highlighted that of
317 those individuals that died within 30 days of PEG insertion, 43% died within the first
318 week.^{(14;(49)} This 7-day wait policy has two functions. Firstly, it serves to provide an
319 opportunity to reflect on the implications of PEG tube insertion prior to undertaking the
320 procedure (for all those involved in the decision-making process). Secondly, in some cases
321 patients may succumb during this ‘cooling off’ period, without the difficulty of having to
322 undergo a PEG procedure.⁽⁵⁵⁾

323

324 When considering whether insertion of a gastrostomy tube is merited, then consideration needs
325 to be made to an individuals' quality of life. This consideration must be done in the context of
326 the underlying diagnosis and prognosis, considering moral and ethical issues, as well as
327 respecting the patient's wishes. Guidelines exist to aid clinicians in making decisions on
328 gastrostomy feeding, however the decision to insert a feeding tube should always be made on
329 an individual basis.^(56; 57) Our recent quality of life work showed that quality of life was
330 seemingly preserved in those undergoing gastrostomy insertion, however variation occurred
331 dependent upon the indication.⁽⁵⁸⁾ The relevance of this work could again be in helping inform
332 decision making for both clinicians and patients.

333

334 Another factor that may be influencing outcomes following gastrostomy insertion is variations
335 in the organisation of aftercare services. In a UK study looking at provision of services for
336 gastrostomy, only 64% of units had a dedicated aftercare service.⁽⁵³⁾ The benefits of dedicated
337 home enteral feed teams have been shown to reduce costs and morbidity associated with
338 gastrostomy feeding.^(59; 60) Given that most complications of gastrostomy feeding occur
339 following hospital discharge, efforts need to be made to improve the delivery of aftercare
340 services for these patients.

341

342 **Ethical and Legal Considerations of Gastrostomy feeding**

343 Gastrostomy feeding raises ethical and legal issues. Both the Royal College of Physicians and
344 the General Medical Council in the UK have provided guidance on oral feeding and
345 nutrition.^(61; 62) Artificial Feeding is considered a medical treatment in legal terms and requires
346 valid consent prior to commencement. For consent to be valid the person giving consent must
347 have the capacity to do so voluntarily after being given sufficient information to guide informed
348 choice. When a patient has capacity their wish to consent to or refuse treatment should be
349 upheld, even if that decision may lead to death. When a patient lacks capacity a best interests
350 meeting should be held with the multidisciplinary team, those close to that patient or an
351 independent mental capacity advocate. The multidisciplinary team caring for the patient is
352 responsible for giving, withholding or withdrawing treatment, including artificial feeding and
353 hydration and should consider any advance directives, the patient's prognosis and the likely
354 benefits of gastrostomy feeding when making decisions. A limited trial of feeding may
355 sometimes be used but strict criteria regarding what constitutes success should be determined
356 prior to starting gastrostomy feeding.⁽⁴⁴⁾ Conflicts sometimes arise between health care
357 professionals or between the professionals and those close to the patient. In such circumstances

358 it may be necessary to seek legal advice or seek resolution through a local clinical ethics
359 committee.⁽⁶³⁾ Anecdotally, such conflicts appear to be rising with increased patient and family
360 demands for intervention, which may in turn be influenced by emotion or by cultural beliefs.

361

362 The NICE dementia guidelines highlight the importance of quality of life in advanced
363 dementia and support the role of palliative care in these individuals from diagnosis until
364 death. Best practice in these patients could be to encourage eating and drinking by mouth for
365 as long as tolerated, utilising good feeding techniques, altering food consistencies and to
366 promote good mouth care. Assisting hand feeding in this way has recently been shown to be
367 of benefit in elderly patients, with volunteer assistance improving oral intake and enjoyment
368 of meals.⁽⁶⁴⁾ When disease progression is such that the patient no longer wants to eat or drink,
369 then rather than inserting a gastrostomy tube, end of life care pathways might be considered.
370 Views held by carers and medical staff may prevent progression to end of life care pathways.
371 A questionnaire survey demonstrated that allied health care professionals were more likely
372 than physicians to consider gastrostomy feeding when presented with patient scenarios
373 relating to malnutrition.⁽⁶⁵⁾

374

375 **Conclusion**

376 The provision of gastrostomy feeding remains a contentious issue. Decisions regarding
377 insertions must take into account knowledge of the underlying disease process, prognosis and
378 carefully consider the evidence regarding benefits and burdens. Patients and their caregivers
379 need to be carefully counselled on these issues to help them make an informed choice. If the
380 patient lacks capacity then those involved in the decision making should follow ethical and
381 legal principles to determine what it is the patient's best interests. Future research in
382 gastrostomy feeding should aim to better delineate those who will benefit most from this
383 intervention and when is the optimal timing for PEG insertion.

384

385

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388

389 **Conflict of Interest**

390 None declared

391

392 **Authorship**

393 TW and MK collectively wrote the manuscript. The article is a summary of an invited
394 presentation to the Joint NS-BSG-BAPEN Winter Conference 2019.

395

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554 **Table 1 – Indications where PEG feeding is considered**

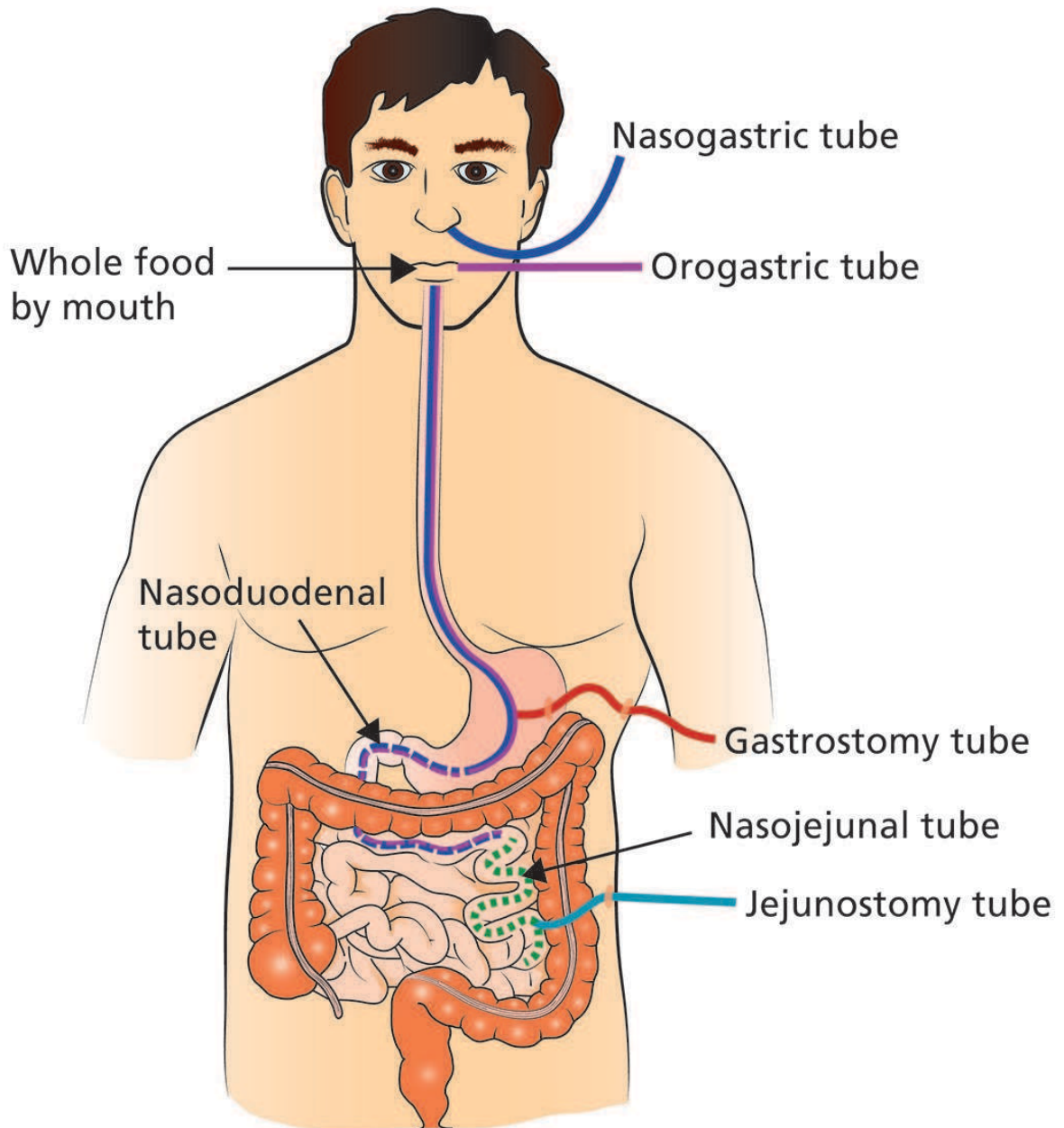
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|---|--|
| <p><i>Neurological Indications</i> Cerebrovascular Disease Motor Neurone Disease Multiple Sclerosis Muscular Dystrophy Parkinson's Disease Cerebral Palsy Dementia</p> <p><i>Reduced Conscious Level/Cognition</i> Head Injury Intensive Care Patients</p> | <p><i>Obstruction</i> Oropharyngeal Cancer Oesophageal Cancer Oesophageal Stricture</p> <p><i>Miscellaneous</i> Burns patients Fistulae Cystic Fibrosis Short Bowel Syndromes (e.g. Crohn's disease) Mental health (Anorexia/ Learning Difficulties)</p> |
|---|--|

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557 **Figure 1: Methods of Enteral feeding**

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