ESPEN practical guideline: Home enteral nutrition

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Based on

ESPEN guideline on home enteral nutrition.

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Clin Nutr. 2020;39:5-22.

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Abstract

This ESPEN practical guideline will inform in a concise way physicians, nurses, dieticians, pharmacists, caregivers and other home enteral nutrition (HEN) providers about the indications and contraindications for HEN, and its implementation and monitoring. Home parenteral nutrition is not included but will be addressed in a separate ESPEN guideline. This guideline will also inform interested patients requiring HEN. The guideline is based on the ESPEN scientific guideline published before. It consists of 61 recommendations, which have renumerated, and associated commentaries that have been shorted compared to the scientific guideline. Evidence grades and consensus levels are indicated. The guideline was commissioned and financially supported by ESPEN and the members of the guideline group were selected by ESPEN.

Keywords

home enteral nutrition, tube feeding, nutrition support team, enteral formula, monitoring

List of abbreviations

BBS, Buried bumper syndrome; EN, enteral nutrition; HEN, home enteral nutrition; HPN, home parenteral nutrition; NST, nutrition support team; PEG, percutaneous endoscopic gastrostomy; PEJ, percutaneous endoscopic jejunostomy; PRG, percutaneous radiological gastrostomy; QoL, health-related quality of life; RCT, randomized controlled trial; RIG, radiologically inserted gastrostomy

Introduction

Since its introduction in the 1970s, HEN has been established as a reliable and effective nutritional intervention, particularly relevant due to the increasing reliance on ambulatory care. Usually HEN is started during a hospital stay and continued as a long-term home therapy. Typically, there are only minor differences in the indication for HEN and for in-hospital enteral nutrition (EN). In HEN, additional criteria need to be considered carefully such as prognosis, health-related quality of life (QoL) and any ethical aspect of the treatments. In order to initiate HEN, the principle should be followed that without EN there is an expectation of significant deterioration of the patient's nutritional state, affecting prognosis and QoL, which is a complex decision, if there is no effective treatment for the underlying medical condition.

Enteral nutrition support is a medical treatment but the decisions on route, content, and management of nutritional support are best made by multidisciplinary nutrition teams.

This guideline provides evidenced-based information on the use of HEN. There are numerous and often complex diseases that lead to the need for HEN, a description of which is not part of the present guideline, but they include:

- Swallowing disorders because of neurological diseases,
- Obstructions because of malignancies,
- Cachexia because of cancer,
- Chronic obstructive pulmonary disease,
- Heart disease,
- Chronic infections, and
- Malabsorption/maldigestion because of liver, pancreas, or intestinal diseases.

The specific nutritional requirements for these diseases are described in detail in other recently published ESPEN guidelines (see ESPEN website and Clinical Nutrition journal). The present guideline is focused on the methodology and clinical practice of HEN, the related monitoring, and strategies to avoid complications.

Methodology

This practical guideline consists of 61 recommendations and is based on the ESPEN guideline on home enteral nutrition (ref). The original guideline was shortened by restricting the commentaries to the gathered evidences and literature on which the recommendations are based on. The recommendations were not changed, but the presentation of the content was transformed into a graphical presentation consisting of decision-making flow charts wherever possible. The original guideline was developed according to the ESPEN methodology (1). This SOP is oriented on the methodology of the Scottish Intercollegiate Guidelines Network (SIGN). Literature was searched and graded into 1-4 according to evidence, and recommendations were created and graded into four classes (A/B/0/GPP). In brackets, the original recommendation numbers (R1, R2, …) and the grading is indicated. The working group included physicians, a pharmacist, a nurse, and dietitians, as well as a patient representative. The guideline process was funded exclusively by the ESPEN society. The shortened guideline and dissemination were funded in part by the UEG society, and also by the ESPEN society. For further details on methodology, see the full version of the ESPEN guideline (ref), and the ESPEN SOP (1).

Recommendations

This practical guideline covers 61 recommendations structured in five main chapters and diverse subchapters (Fig. 1).

1. Indication and contraindication for HEN (Fig. 2)

1.1 What are the indications for HEN?

1) HEN should be offered to patients at nutritional risk or malnourished who cannot meet their nutrient requirements by normal dietary intake, who have a functioning gastrointestinal tract, who are able to receive therapy outside of an acute care setting, and who agree and are able to comply with HEN therapy with the goal of improving body weight, functional status or QoL.

(R1, Grade GPP, strong consensus 97%)

Commentary

HEN is indicated in patients who are at high nutritional risk or malnourished, who are unable to meet nutritional requirements by the oral route, and who exhibit a functional gastrointestinal tract (5). Thus, HEN can be defined as a life-sustaining therapy and should be considered if a patient's nutritional intake is likely to be qualitatively or quantitatively insufficient for a week or more.

An inadequate nutritional state is confirmed if patients cannot eat for a week or if the energy intake is less than 60% of estimated requirements for 1-2 weeks (usually less than 10 kcal/kg/d or a lack of 600-800 kcal/d) (6-9). Poor nutritional intake is presumed when normal food ingestion covering individual requirements cannot be met despite the most skilled dietetic treatment and medical management. In this situation, initiation of EN should be within the week. Significant impairment of the nutritional state has to be assumed if the patient has lost >5% of bodyweight in 1-3 month (10). The nutritional state may deteriorate if food absorption is less than 75% of the daily requirements (11, 12), or if there has been previous weight loss or concomitant catabolic processes or if chemotherapy is concurrent (13).

A multi-center randomized controlled trial (RCT) evaluating patients undergoing esophagectomy or total gastrectomy demonstrated that HEN by jejunostomy as a usual practice was feasible, safe and acceptable to patients and their caregivers. Furthermore, the authors showed a substantial increase in anthropometric and functional parameters as well as cost efficiency at a six-month follow-up (14). The effectiveness of HEN on clinical outcomes was shown in two studies that included cancer and Crohn's patients (15, 16).

2) Prior to discharge from hospital of patients at risk of malnutrition (e.g. patients with neurological disease, head injury, head and neck cancer, gastrointestinal and other malignancies, non-neoplastic gastrointestinal disease including malabsorptive syndromes), either oral nutritional supplements or HEN should be considered.

(R2, Grade B, strong consensus 96%)

Commentary

In epidemiological data collected from 3246 Italian patients over an 11-year period, a progressive annual increase in HEN therapy could be observed (20). The mean incidence was 406±58 patients/million inhabitants/year for patients living at home and 319±44 for patients living in nursing homes (mean prevalence rate ± SD: 464±129 cases/million inhabitants at home compared to 478±164 in nursing homes) (20).

According to several epidemiological studies and European national registries, the most frequent indications for HEN in adults are neurological diseases (neurovascular and -degenerative), head and neck cancer, gastrointestinal cancer, and other cancers, cerebral palsy, non-neoplastic gastrointestinal disease (e.g., fistulae, esophageal stenosis, inflammatory bowel disease), head injury, malabsorptive syndromes (e.g., short bowel syndrome), severe intestinal motility disorders, inherited metabolic diseases, and cystic fibrosis (5, 15, 19-27) ***relevant literature: 21, 23, and 26***..

A retrospective Italian study found a median duration of HEN is about 196 days (25). Broken down by pathology, duration was 261 days for neurovascular disease, 251.5 days for neurodegenerative disease, 118 days for head and neck cancer, 82.5 days for abdominal cancer, 788 days for head injuries, and 387 days for congenital pathologies. Only 7.9% of the patients resumed oral nutrition, and the median survival rate was 9.1 months (25).

1.2 When is HEN not to be recommended? (Contraindication)

3) If life expectancy is estimated to be less than one month, HEN usually shall not be initiated.

(R3, Grade GPP, consensus 78%)

Commentary

This recommendation is based on a previous recommendation of the German Society for clinical nutrition (2). An effort should be made to estimate life expectancy to ensure optimal care (28). For further recommendations regarding HEN, the ESPEN guideline on ethical aspects of artificial nutrition and hydration (29) and the ESPEN guideline on Clinical Nutrition in Neurology (30) should be considered.

4) HEN shall not be performed in patients with contraindications such as severe functional disturbances of the bowel, gastrointestinal obstruction, gastrointestinal tract bleeding, severe malabsorption or severe metabolic imbalances.

(R4, Grade GPP, consensus 84%)

Commentary

This recommendation is based on good clinical practice and not specific to HEN. It applies similarly to EN in general.

5) If patient and/or their legal carers do not to agree to a HEN program or are unlikely to comply with and/or if there are organizational/logistic problems which cannot be overcome, HEN should not be offered.

(R5, Grade GPP, strong consensus 97%)

Commentary

This recommendation has been adopted from the German guideline "Artificial Nutrition in the outpatient area" (2) and fits to the "ESPEN ethical guideline" (29).

2. Access devices for HEN (Fig. 3)

2.1. Access devices (Fig. 4)

2.1.1 Short-term HEN (< 6 weeks)

6) HEN can be delivered through a nasal feeding tube in patients who need HEN only for a short period of time (up to 4-6 weeks).

(R6, Grade 0, consensus 90%)

Commentary

The most appropriate route for outpatient nutritional support depends on the functioning, accessibility and digestive and/or absorptive capacity of the gastrointestinal tract. There should be a careful consideration (incorporating contra-indications) when selecting the route for administration. If HEN is needed for a limited time (usually meaning up to six weeks), nasogastric tube feeding can be used. Even longer periods are possible, certainly with fine-bore nasogastric feeding tubes, when long term percutaneous endoscopic gastrostomy (PEG) or radiologically inserted gastrostomy (RIG) options are not suitable (**25**, 31). If there is already a device in situ that could be used for the provision of EN the use of that device should be considered.

2.1.2 Long-term HEN (> 6 weeks)

7) A PEG or, if indicated, a percutaneous endoscopic jejunostomy (PEJ) is the preferred access device and should be placed when long-term HEN is required.

(R7, Grade B, strong consensus 93%)

Commentary

The recommendation to use a PEG or a PEJ for long-term HEN is based on a RCT (**32**) cited in the ESPEN Cancer guideline (6), in which PEG and nasogastric tubes were compared in head and neck cancer patients, three systematic reviews on the same topic (**33-35**), and a systematic review comparing PEG with nasogastric tubes in dysphagic patients (**36**). Body weight may be maintained similarly by both PEG and nasogastric feeding (**35**) whilst the risk of tube dislodgement is lower (**35, 36**) and QoL is possibly better (**32**), although nasogastric tubes were associated with less dysphagia (**35**) and earlier weaning after completion of radiotherapy (**33, 35**). The latter advantages limit the clear recommendation for the PEG suggested by the prior studies and lead to the "B" rather than "A" grade of recommendation. A systematic review including eleven RCT reported fewer intervention failure and better improvement in nutritional status in the PEG group compared to the nasogastric tube group (**36**). Also, QoL (e.g. inconvenience, discomfort, altered body image and social activities) was in favor of PEG. There was no significant difference in mortality rates and aspiration pneumonia between the two groups. Another systematic review could not draw firm conclusions as to whether or not PEG feeding was beneficial over nasogastric tube feeding in older non-stroke dysphagia patients (**38**). In elderly hospitalized people, PEG use was associated with improved survival, was better tolerated and was associated with a lower incidence of aspiration (**40**) compared to

nasogastric feeding. Using a PEJ or PEG/J (PEG with a jejunal extension) tube for HEN may be a suitable approach in case of gastroduodenal motility disorders, gastric outlet stenosis or high risk of aspiration. (41, 42).

8) If a PEG if not suitable for long-term HEN a percutaneous laparoscopic assisted gastrostomy (PLAG) may be a safe alternative.

(R9, Grade 0, strong consensus 93%)

Commentary

There is widespread acceptance of PEG as the insertion technique of choice over a conventional surgical gastrostomy due to its lower cost, simplicity, operating time and lower complications (**43-45**). However, there are patients that are not appropriate candidates for PEG or in whom there are failed attempts at PEG placement (46). A systematic review and meta-analysis could only demonstrate fewer complications with PEG compared to surgical gastrostomy in the randomized studies included in the analysis (**43**). A large observational study comparing PLAG, PEG, percutaneous radiological gastrostomy (PRG) and conventional surgical gastrostomy demonstrated the lowest complication rate in the PLAG group (**47**).

In a systematic review from Yuan et al. (**48**) both PEG and PRG were effective for long-term EN support in selected individuals although another review indicated PEG to be associated with a lower probability of 30-day mortality compared to RIG, suggesting that PEG should be considered as the first choice for long-term EN (**49**). Finally, a retrospective review revealed that the rates of tube dislodgement were significantly higher in the RIG group compared to the PEG group (50).

9) Radiologically inserted gastrostomy (RIG) or percutaneous radiological gastrostomy (PRG) can be used as alternative techniques for the placement of a feeding tube into the stomach, if an endoscopically guided tube placement cannot be performed.

(R10, Grade 0, strong consensus 97%)

Commentary

The risk of peritonitis and mortality is lowered if the gastrostomy is placed by an endoscopic rather than radiological technique (**50-52**). Radiological techniques should be reserved for those patients in whom an endoscopic technique is not possible. However both PEG and PRG are effective for long-term EN support in selected individuals (**48**).

10) In case of inadvertent displacement or removal of the PEG more than four weeks after initial placement, direct replacement can be safely attempted before the track closes completely.

(R11, Grade GPP, strong consensus 93%)

Commentary

A mature fibrous tract is a prerequisite for replacement of a PEG after inadvertent removal, dislodgement, occlusion or breakage. Patients who are at risk for inadvertent removal (e.g. dementia, delirium) require preventive measures to protect the tube.

Adherence of the stomach to the abdominal wall normally takes place within 7 - 14 days but can be delayed in patients with impaired wound healing (53). Inadvertent removal of a recently placed percutaneous gastrostomy tube (< four weeks), is an emergency.

In the first two weeks, replacement is mostly done endoscopically or radiologically through the same site. Between two and for weeks after initial placement, besides endoscopic replacement, blind reposition can be attempted (upon medical decision) if the tube position is afterwards checked by a water-soluble contrast study (54). Replacement should be executed expeditiously to maintain patency and prevent closure of the tract (41). Balloon-type replacement tubes are mostly used for blind replacement. If a first tube change can be planned, it is recommended to perform it in a hospital, and afterwards replacement may be completed in a home care setting or nursing home by a nurse, if patients are not able to perform it (55).

If no commercially available gastrostomy tube with similar diameter is available for immediate replacement, a balloon-tipped Foley catheter of the same size can be used temporarily to keep the tract open and, if necessary, to administer EN, fluids or medications, although this is currently more difficult with universal safety connectors (e.g. "ENFit®") (55). If there is any doubt of malposition after blind replacement then endoscopic or radiologic confirmation of correct position using a water-soluble contrast should be carried out prior to use of the tube. Alternative techniques to check proper position is pH confirmation of gastric content (pH 5 or less), irrigation of the tube with 3 - 50 ml sterile water without resistance or leakage from around the stoma, assessment of external length of the tube and manipulation of the tube via rotation and in-out movement (59, 60).

11) A PEG should be preferred over a surgical gastrostomy for long-term HEN, mainly due a lower complication rate, cost-effectiveness and operating time.

(R8, Grade B, strong consensus 100%)

Commentary

See commentary to Recommendation 8.

2.2. Handling of tubes, exit sites, and consumables

2.2.1 Nursing aspects (Fig. 5)

12) Until the stoma tract is formed and the incision is healed, the PEG exit site should be daily monitored and kept clean and dry by using aseptic wound care (usually up to 5-7 days post procedure).

(R12, Grade B, strong consensus 100%)

Commentary

During the first week after insertion of PEG one aim is to prevent stoma tract infection. It is not necessary to apply traction to the freshly inserted PEG tube system for the initial 24 h to achieve better adaptation of the gastric to the abdominal wall (**56**) The PEG exit site has to be monitored on a daily basis (for signs of bleeding, pain, erythema, induration, leakage, and inflammation) and cleansed (to remove any debris) with 0.9% w/v sodium chloride, sterile water or freshly boiled and cooled water. A sterile Y dressing to compress (that does not shed fibers), placed under the external disc plate, is commonly used,

followed by a skin friendly and solvent-free breathable dressing. When the dressing is placed under the exterior bumper, tension has to be avoided (**55, 57**). Occlusive dressings should be avoided because they promote a moist wound environment and can lead to skin maceration (**56, 57**).

According to previous guidelines (61, 62) the grades of recommendation 12 has been upgraded to a "B", even though the underlying primary literature evidence rather fits to a "0". Within these guidelines, a direct comparison of "no care" versus "aseptic care" is missing, and instead only "cleansing" vs "disinfection" was examined for obvious (ethical) reasons.

13) Once the gastrostomy tract has been healed (after about one week), the tube should be rotated daily and should be moved inwards at least once a week (at least 2 cm, up to 10 cm).

(R17, Grade GPP, consensus 87%)

Commentary

Buried bumper syndrome (BBS) is a severe complication in which the internal fixation device migrates alongside the tract of the stoma outside to the stomach. The device can end up anywhere between the stomach mucosa and the surface of the skin (**62**). BBS is a usually long-term, uncommon, severe but preventable complication with adequate nursing aftercare. Alarming signals are any difficulty in mobilizing the tube, leakage around the insertion site when trying to flush the tube, frequent feeding pump alarms (that may indicate obstruction), abdominal pain, chronic site infections or resistance with administrating EN or fluids (42). The most important risk factor leading to BBS is excessive compression of tissue between the internal and external fixation device (most often with rigid or semi-rigid internal devices) (63). The distance between the two bolsters should not be too loose or too restrictive. The tube should be advanced into the stomach for a minimum of about 2-3 cm, but with small movements there is a risk of just moving the abdominal wall, so ideally it should be even up to 5-10 cm (64). This can start after approximately one week because earlier it can cause local pain and damage tract formation. A PEG can also be imbedded in the gastric mucosa even if it is still possible to rotate the PEG. This can happen when a gastric mucosa 'pocket' has grown over and round the bumper (64). When stiches/sutures are present because the stomach is fixed to the abdominal wall (gastropexy), mobilization of the tube can be delayed until the sutures have been removed (usually after two weeks). Note that the device should not be rotated (but only moved in and out) if a jejunal extension is present within the tube or if the tube is a gastrojejunostomy (57, **65**).

14) After mobilization, the tube may be returned to its initial position with some free distance (0.5 - 1 cm) between the skin and the external bolster.

(R18, Grade 0, strong consensus 93%)

Commentary

See commentary to Recommendation 13.

15) If the device is a gastrojejunostomy or gastrostomy with jejunal extension it should not be rotated (only weekly pushed in and out).

(R19, Grade GPP, strong consensus 92%)

Commentary

See commentary to Recommendation 13.

16) A glycerin hydrogel or glycogel dressing should be used as an alternative to classical aseptic wound care during the first week(s).

(R13, Grade B, strong consensus 97%)

Commentary

Two RCTs in adults investigated alternative wound dressings compared with standard wound dressings. The more recent study demonstrated a statistically significant reduction of the mean infection scores at the end of the first and second week using a glycerin hydrogel wound dressing (applied the day after placement and changed every week during four weeks) (**56, 58**). However, the other study showed no advantage of a glycogel wound dressing regarding peristomal infection after one week of usage (**59**). Both studies concluded that by omitting daily changes of regular wound dressings these adjunctive techniques or barriers can be a good cost-effective alternative. The findings were confirmed in a very recent RCT using a hydrogel in children (**60**).

According to previous guidelines (61, 62) the grades of recommendation 16 has been upgraded to a "B", even though the underlying primary literature evidence rather fits to a "0".

17) After stoma healing, dressings can be reduced to one or two times a week, and the entry site can be cleansed using soap and water of drinking quality.

(R14, Grade 0, strong consensus 90%)

Commentary

After approximately one week (or if properly healed) the stoma site can be cleansed twice a week with a clean cloth using fresh tap water and soap and afterwards the skin can be gently and thoroughly dried. With a well healed exit site also, showering, bathing and swimming (it is advisable to cover the site with a waterproof dressing when swimming in public pools) is possible after a few weeks. For some patients it may be advisable to use an additional fixation or securement to minimize traction on the stoma site (**57**). Once the patient is discharged it is important to guarantee further competent and high quality of care by means of clear and univocal verbal communication and written or visual materials for caregivers and/or patients. It should be also pointed out which department or service can be used as an (emergency) advice point (61).

18) Alternatively to recommendation 14, dressings can be omitted and the site can be left open.

(R15, Grade GPP, strong consensus 92%)

Commentary

See commentary to Recommendation 17.

19) Immediately after placement of the PEG, the external fixation plate should be subjected to very low traction, without tension.

(R16, Grade GPP, strong consensus 93%)

Commentary

See commentary to Recommendation 13.

2.2.2 Complications (Fig. 6)

2.2.2.1 Leakage

20) In case of peristomal leakage of gastric contents at the stoma site, the surrounding skin can be properly protected using zinc oxide-based skin protectants.

(R20, Grade 0, strong consensus 93%)

Commentary

A small peristomal liquid drainage in the week after placement can occur, but leakage of gastric content (very often in combination with signs of peristomal infection or gastrostomy tract enlargement) can lead to serious problems and even tube loss. Risk factors for peristomal leakage include skin infection, increased gastric acid secretion, gastroparesis, increased abdominal pressure, constipation, side torsion of the tube, increased tension between the internal and external bolster, BBS and the presence of granuloma tissue in the tract (55, 66, 67). Also, patient-related factors can hinder wound healing such as diabetes, immunosuppression and malnutrition.

In any case, to minimize skin breakdown due to leakage, a topical skin product as a powdered absorbing agent or a barrier film, paste or cream (containing zinc oxide) can be applied (69). Also, foam dressings rather than gauze can be used to reduce local skin irritation (foam lifts the drainage away from the skin, whereas gauze can contribute to more skin maceration). Local fungal skin infections may also be associated with leakage and can be treated with topical antifungal agents. It is important to verify the proper tension between the two bolsters whilst avoiding unnecessary tube movement or excessive pressure. Side torsion resulting in a too large stoma tract, can be corrected by stabilizing the tube using a clamping device or switching to a low-profile device (**53**). If a balloon retaining device is present, the volume content of the balloon has to correspond with the manufacturer's recommendations and regularly checked (e.g. once a week). In case of a button gastrostomy, one needs to ensure that the correct balloon size and tube length are being used (57). In some refractory cases it can be tried to remove the tube for 24-48 hours, which permits slight spontaneously closure of the tract aiming that the replacement tube will fit more closely (70). If all above mentioned measures fail, a new gastrostomy has to be placed at a new location.

21) Proton pomp inhibitors can be used for decreasing leakage by minimizing gastric acid secretion and – if used – needs to be reviewed regularly.

(R21, Grade 0, strong consensus 96%)

Commentary

Gastric decompression and starting proton pump inhibitors and/or prokinetics can be useful while simultaneously optimizing nutritional (e.g. with starting PN) and medical status (**68**).

2.2.2.2 Granulation

22) Excessive granulation tissue is a common problem of PEG and should be avoided or treated using appropriate methods.

(R22, Grade GPP, strong consensus 93%)

Commentary

The development of overgranulation tissue forming around the gastrostomy tube is a common complication in patients with a PEG tube. Granulation tissue is vascular, so it bleeds easily and is sometimes painful. Common causes of overgranulation include excess moisture, excess friction or movement from a poorly secured tube and critical colonization, leakage or infection (recommendations 22 and 24). A barrier film or cream may be administered to protect the surrounding skin and if the overgranulation tissue is exuding. The affected skin should be cleaned minimum once a day using an antimicrobial cleanser. Further, a wide variety of treatment options are possible such as the application of a topical antimicrobial agent under the fixation device, or a foam or silver dressing over the affected area which has to be changed only if there is evidence of significant exudate (but at least weekly). Another option is to apply cauterization by silver nitrate directly onto the overgranulation tissue. Alternatively, a topical corticosteroid cream or ointment can be administered for 7-10 days in combination with a foam dressing to provide compression to the treatment site. Finally, surgical removal and argon plasma coagulation have been described in the literature. If the above steps prove ineffective, an alternative brand or type of gastrostomy tube can be tried (42, 57, 71).

2.2.2.3 Tube defect

23) Tube replacement should be accomplished in case of tube breakage, occlusion, dislodgement or degradation.

(R23, Grade GPP, strong consensus 93%)

Commentary

Most transorally placed bumper-type tubes can be maintained for many years. The durability of a PEG tube system is primarily linked to its careful handling. There is no need to exchange a tube system at regular intervals (56). Replacement will be required eventually because of breakage, occlusion, dislodgement or degradation (42). A percutaneous enteral access device that shows signs of fungal colonization with material deterioration and compromised structural integrity should be replaced in a non-urgent but timely manner (41). For a bumper-type tube, retrieval is performed by cutting the tube at the abdominal skin level and pushing the internal bumper into the intestinal lumen ('cut and push' technique) (72). Migration is usually uneventful even with large-caliber tubes (73). Nevertheless, endoscopic retrieval of the bumper is advocated in cases of previous bowel surgery and for patients at risk of strictures or an ileus, which could hinder spontaneous migration and elimination of the sectioned bumper (42). The replacement can be performed in many ways: endoscopically, radiologically, surgically or at bedside (depending upon the type of gastrostomy tube being replaced) (57). Balloon-

type replacement tubes are mostly used for blind replacement through the same matured tract. The balloon is inflated with sterile (no saline) water (usually 5 to 10 mL) and water volume may be checked every week to prevent spontaneous balloon deflation because of water leakage. However, because of balloon degradation, this type of tube may require replacement every three to four months (42, 74).

2.2.2.4 Infection

24) When a site infection is suspected or diagnosed, an antimicrobial agent can be topically applied to the entry site of the tube and the surrounding tissue, and – if the site infection cannot be resolved by this treatment –combined with systemic broad-spectrum antibiotics.

(R24, Grade 0, strong consensus 93%)

Commentary

A site infection is a common complication after transoral gastrostomy placement (75). Patients with diabetes, obesity, poor nutritional status and those on chronic corticosteroid therapy or other immunosuppressive therapy, are at increased risk for infection (76). Also, hyper-hydrated or inflamed skin, due to leakage, can promote growth of microorganisms (see Recommendations 20 and 21). Prevention consists of first-line aseptic wound care after placement and early detection of signs and symptoms of infection such as loss of skin integrity, erythema, purulent and/or malodorous exudate, fever and pain (**77**). One needs to ensure that the external bolster is not too tight, causing too much pressure between the internal and external bolster. The area can be swabbed for both bacterial and fungal infection. An antimicrobial ointment or a dressing with an antimicrobial agent which delivers a sustained release to the gastrostomy site can be used: these dressings typically get their antimicrobial activity from silver, iodine or polyhexamethylene biguanide and are available in different forms, e. g. foams, hydrocolloids or alginates. Be aware of allergies to any of the product components and silver dressings cannot be worn during magnetic resonance imaging procedures. Tailored systemic antibiotics or (if proven) antifungal agents can be used in combination with local therapy. Topical antibiotics should not be used.

25) If the infection cannot be resolved by the procedure described in Recommendation 24, the tube should be removed.

(R25, Grade GPP, consensus 86%)

Commentary

In case of stoma tract disruption, peristomal infection that persists despite appropriate antimicrobial treatment, skin excoriation or a fungal infection (particularly if a silicone tube is in situ) it is advisable to remove and/or replace the gastrostomy tube (57, 77).

2.3 Start of HEN (Fig. 7)

26) HEN may be started when patient is medically stable and (i) correct placement of the tube position is verified; (ii) tolerance to enteral prescription (volume and formula) is demonstrated; and (iii) the patient and/or provider have appropriate knowledge and skills to manage HEN.

(R26, Grade GPP, strong consensus 100%)

Commentary

Hospitalized patients commencing HEN should be established on a stable feeding regimen before discharge from hospital. The patient's ability to tolerate the volume and type of feed to be administered at home must be confirmed. If the patient has been admitted for a day procedure for the purpose of tube (re)placement, the gastrointestinal function needs to be ascertained before discharge to ensure safety. Commencement of HEN feeding depends on the type and position of the tube. For all tube types the correct position must be verified and if an interventional procedure has been performed e. g. gastrostomy or jejunostomy insertion, a period of observation to ensure no surgical complication is required. HEN patients and their carers, need training in managing their EN regimens by a multidisciplinary team (78). Prior to discharge they need to be able to demonstrate competency in feed administration, equipment handling and some basic trouble shooting in case of tube or equipment failure (79).

27) The patient with a nasogastric tube can start HEN immediately according to the previously established nutritional care plan once appropriate tube placement has been confirmed.

(R27, Grade GPP, strong consensus 96%)

Commentary

Once naso-gastric tube position is confirmed HEN feeding can commence or continue according to previously established nutritional care plan. There is no evidence that feeds should be diluted at the start of HEN just for dilution purposes, unless additional liquid in form of water is needed (80). Whatever tube access is used; caution should be exercised if refeeding syndrome is suspected. In such cases, appropriate guidelines should be followed to prevent metabolic complications.

28) Adults with uncomplicated gastrostomy tube placement can commence EN within 2 - 4 hours after the procedure.

(R28, Grade A, strong consensus 100%)

Commentary

Traditionally, following gastrostomy insertion, EN commenced slowly with gradual increase in water or saline followed by enteral formula. Recent meta-analysis of RCTs showed no difference in complication when feeding was commenced < 4 hours compared to delayed or next day feeding (**42**). There is no evidence to support the practice of water trials prior to commencing EN via the gastrostomy tube or device (56, 81, 82)

29) A graduated program of commencement of jejunal HEN feeds should be followed.

(R29, Grade B, strong consensus 93%)

Commentary

Studies recommend a starting infusion of 10mL/h of 0.9% w/v sodium chloride in the first 24 hours after tube insertion, followed by commencing EN at 10 mL/h for 24 hours

and then increasing the rate by 20 mL/h until nutrient target was reached usually by day 6 (**84**). A prospective randomized trial conducted by Han-Geurts in 2007 used a starter regimen of 1.0 kcal/mL continuously delivered by pump commencing at 30 mL/h on the first post-operative day and increasing to 84 mL/h on the third day as tolerated (**85**). Ninety percent of patients tolerated this feeding regimen and attained full nutritional targets.

A systematic review of routes for early feeding post esophagectomy reported that EN commenced on postoperative day 1 and gradually increased to meet nutritional requirements by day 3 was well tolerated (**86**). Though in some centers progression of feeding regimens meant that only half the patients reached target rate at day 8. Regimens for commencement of jejunal feeding where no surgical procedure has been performed are poorly defined in the literature, however provided that there is no resection of the gastrointestinal tract, and possibly less chance of ileus, starting regimens tend to be more liberal.

2.4 Administration (Fig. 8)

2.4.1 Nutrition support team

30) The method of HEN administration should be a decision of the multidisciplinary NST involved with the patient care, considering patient's disease, type of feeding tube in position, feed tolerance and patient preference.

(R30, Grade GPP, strong consensus 100%)

Commentary

Patient activity level, social environment and individual abilities should be considered when choosing delivery methods (87). In some settings, the financial costs attributable to HEN treatment needs to be considered as it might influence the choice of administration methods.

2.4.2 Need of a pump

31) Bolus or intermittent continuous or continuous infusion through a pump may be used depending on clinical need, safety and level of precision required.

(R31, Grade GPP, strong consensus 92%)

Commentary

Bolus infusion procedure requires the division of total feed volume into four to six feeds throughout the day. The infusion volume is typically between 200-400 mL of feed administered over a 15 – 60-minute period, depending on the patient's nutrient needs and tolerance. Bolus infusions are used either when a patient has a nasogastric tube *in situ* or gastrostomy tube. Feeds are administered with a 50 mL syringe with or without a plunger. Bolus feeding into the stomach is considered more physiological (88). Continuous infusion of enteral formula is usually through a pump. Enteral feeding pumps can accurately infuse solutions (89). The use of an enteral feeding pump safely allows infusion of small volume of solutions for variable periods of time (90). This is considered as an advantage in jejunal feeding as the jejunum relies on controlled delivery of isotonic substrates. High calorie feeds should be administered preferentially using a feeding pump.

Overnight pump-assisted feeding allows patients to be active during the day to carry out work/study and other social activities. Pump-assisted feeding allows patients to get uninterrupted sleep without the need to adjust flow rates during the night. Feeding pumps can be either static or mobile by placing the device in a specially designed rucksack. These can be placed on patient's back or attached e.g. to a wheelchair. Feeding pumps have evolved to be lighter and more intuitive in their operation allowing greater ease of HEN administration by patients and carers (89).

2.4.3 Water flushing

32) Routine water flushing before and after feeding can prevent tube obstruction and should be part of patient/carer education.

(R32, Grade GPP, strong consensus 100%)

Commentary

Regardless of the administration route (gastral or jejunal), feeding tubes are prone to blockages, primarily due to the chemistry of the protein rich solutions, the viscosity of the fluid and the small diameter of the tube lumen. This problem is further exacerbated the longer the feeding tube is and if medications are administered through the tube. Tubes should be flushed with at least 30 mL of water of drinking quality before starting and after completion of feeds in case of bolus administration or 4-hourly if continuous feeding (91).

2.5 Drug administration (Fig. 9)

33) An enteral tube being used for EN can also be used for drug administration if the efficacy of drug administration can be confirmed.

(R33, Grade GPP, strong consensus 92%)

Commentary

The administration of medicines through enteral feeding tubes is a widespread practice but a recent survey in the United Kingdom (92) found that over 30% of carers for patients requiring medicine administration through enteral feeding tubes received no information. Furthermore, that survey was undertaken through a national patient support group and so it could be that in a wider population even fewer carers may receive information. When using an enteral feeding tube for drug administration, it is important that the tube should not become blocked, and that those prescribing, supplying and administering the medicines are aware of their responsibility for any adverse events resulting from the use of unlicensed medicines or the off-label use of licensed medicines.

The relevant Summary of Product Characteristics should be consulted to help understand the legal position regarding individual prescriptions and dosage forms. Using a product outside the terms of the Summary of Product Characteristics carries additional responsibility that should be accepted prior to medicine prescription, supply or administration. Crushing medicines should be avoided whenever possible because of the potential risks of exposure to the drug and inaccuracies of drug dosing. The choice of dosage form for administration through an enteral feeding tube also presents practical considerations. For example, whilst it is possible that there is a generally higher incidence of tube occlusions when using solid dosage forms through nasogastric and silicone PEG tubes care still needs to be taken with liquid medicines since they may contain sorbitol which is reported to contribute to diarrhea (48% of cases of osmotic diarrhea, n = 14)(93),

or they be of an osmolality >500–600 mOsm/kg that is sufficiently high to could cause gut disturbances (77).

34) If an enteral tube is used for drug administration, adequate information should be offered to patients and carers with the involvement of a pharmacist.

(R34, Grade GPP, strong consensus 100%)

Commentary

A pharmacist is in an ideal position to advise on the administration of medicines though enteral feeding tubes and indeed the involvement of pharmacists has been recommended in national guidelines (77). The pharmacist may be able to suggest alternative medicines or alternative patient management options when asked to advise on the administration of a particular drug though an enteral feeding tube.

35) Appropriate ancillaries including syringes shall be used for drug administration through enteral tubes using connectors of a recognized standard in order to avoid misconnection errors.

(R35, Grade A, strong consensus 100%)

Commentary

See commentary to Recommendation36.

36) Measures shall be taken to ensure correct drug dosing when drugs are administered through enteral tubes, for example when using low-dose tip ENFit syringes. Shaking of a low-dose ENFit tip syringe to remove a drug moat shall not be done.

(R36, Grade GPP, strong consensus 100%)

Commentary

The recognized standard ISO 80369-3 for enteral tubes ("ENFit") has been introduced following misconnection errors, including fatal errors. This standard requires that tubing and ancillaries, including syringes, are of a specific design that cannot be connected with tubing and ancillaries intended for administration via a different route.

Due to concerns over the accuracy of drug administration using ENFit syringes, and particularly with low-dose ENFit syringes, the design of the 1 mL and 3 mL syringes was updated to incorporate a low-dose syringe tip. Whilst the low-dose tip could improve dose accuracy it could also result in a moat of drug that could inadvertently alter the quantity of drug administered. Therefore, steps should be taken to avoid inaccurate dosing when using low-dose ENFit tip syringes when administering drugs through enteral tubes. Shaking a syringe to remove a moat of drug exposes the environment and people to the drug and could affect the dose delivered, and, therefore, in the absence of evidence, it is not a recommended practice.

37) The necessity and appropriateness for a drug to be administered through an enteral tube should be confirmed, taking into account factors including any effect

of the site of drug delivery and potential drug interactions with enteral formula and enteral feeding tubes.

(R37, Grade GPP, strong consensus 100%)

Commentary

The site of an enteral tube tip and therefore the site of drug delivery is an important factor when establishing likely drug efficacy. For example, a study of trovafloxacin administered into the stomach yielded similar efficacy with or without simultaneous enteral formula, but administration through a tube directly into the duodenum rather than through a tube into the stomach led to reduced drug availability (94). Unfortunately, there was no note regarding the type or material of the nasogastric tube used in this publication.

When using an enteral feeding tube for the administration of medicines, no effect of bolus compared to continuous EN on tube blockage has been reported (p=0.33) (93). Nevertheless, the choice between bolus and continuous feeding could affect the practical administration of particular medicines, such as medicines which bind to enteral formula and therefore some medicines administered through an enteral feeding tube may need to be administered apart from enteral formula. Specific drug interactions with enteral formula that reduce drug efficacy have been reported, as have drug interactions directly between medicines and enteral feeding tubes. For example, phenytoin has been reported to bind directly with enteral formula, as well as separately to polyurethane enteral feeding tubes lubricated with polyvinylpyrrolidone (with pH an important factor) (95). It has also been suggested that polyurethane PEGs are preferable to silicone PEGs when considering medicine administration through an enteral feeding tube because of higher retention of patency and subsequent ability to continue to use the tube (93).

38) Drugs may be administered individually through an enteral feeding tube, and the tube flushed before, between and after each drug, using 30 mL of water.

(R38, Grade 0, strong consensus 100%)

Commentary

It is almost universally accepted that medicines should not be mixed before administration through an enteral feeding tube due to risks including drug-drug interactions, and that adequate flushing of the tube between feed and/or medications is necessary. Using at least 30 mL of water for irrigation when giving medicines or when flushing small diameter nasogastric tubes may reduce the number of tube occlusions (**93**). A survey of 105 Belgian community pharmacists found that they had limited knowledge regarding the administration of medicines through enteral feeding tubes. For example, fewer than half knew whether or not medicines should be mixed prior to administration (**96)**. Another similar survey (98) by the same group, but this time of Belgian residential care facilities for people with intellectual disability, found fewer than 40% of staff knew whether or not medicines may be mixed prior to administration. Furthermore, it was found in the same type of facility that recommendations for medicine administration through enteral feeding tubes were not followed (99). The practice included over two thirds of the prepared medicines being mixed prior to administration, and in some cases up to eight medicines at once, despite almost half of the total medication records containing at least one drug-drug interaction (**100**). Factors such as limited time and limited knowledge were blamed for the inappropriate medicine administrations (101).

3. Products recommended for HEN (Fig. 10)

3.1 Standard situation

39) Standard commercial formula enteral tube feeds can be used, unless there is specific justification for a blended tube feed.

(R39, Grade 0, strong consensus 92%)

Commentary

There are no fundamental differences regarding the preferred nutritional products to be used to deliver HEN for patients that may have benign or malignant disease. Blended tube feeds rather than commercial tube feeds have been used frequently. Blended tube feeds have been considered to be time consuming and therefore costly to prepare, with one study finding that time and non-nutritional costs could account for >50% of the total feeding cost (104). The same study also found there to be poor standardization of blended tube feeds, and risks of microbial contamination and product instability. It is of note that four of the five authors of this particular study were affiliated to commercial EN companies. Nevertheless, others have also expressed concern regarding higher microbial contamination of blended tube feed compared to commercial tube feed (**105, 106**). In addition, when 203 Polish patients were switched from blended tube feed administered as 50-100 mL boluses between five and six times each day to commercial tube feed administered as boluses or continuous infusion under the direction of a specialist, the outcomes included fewer hospital and intensive care admissions, and less frequent pneumonia, urinary tract infection and anemia requiring hospitalization (**107**). In this study, a care package was provided to the patients in addition to the commercial tube feed which complicates the interpretation of the reported outcomes (**107**). In another study, commercial tube feed was found to be relatively more beneficial over an 8-month period for patients with head and neck cancer compared to either blended tube feed or blended diet used as a tube feed (**108**). Blended food, although without clear benefit compared to commercial food, is still occasionally used in chronic patients at home, but not in hospitals. If used at all, it should be administered via a large tube (ch 14) or a PEG to prevent from clogging.

40) For patients without diarrhea, constipation or diabetes, standard commercial tube feeds should be used according to the direction of a specialist.

(R43, Grade GPP, strong consensus 96%)

Commentary

There are more limited reports for other special situations, which include a potential role for home-prepared low iodine tube feed for preparation for scanning and management of differentiated thyroid carcinoma (117). In a study of EN in patients with Crohn's disease (which is complicated by all study participants being administered 200 mL of 10% w/v soybean lipid intravenously daily for an unknown duration), elemental formula gave benefit for disease remission as well as maintenance of remission compared to elemental formula plus drug treatment (prednisolone or sulphasalazine), drug treatment alone (and a low residue diet), or no intervention (118). A general note regarding ensuring clarity

from the prescriber of nutritional goals if using modular protein supplements has been reported due to different products not being clinically equivalent to each other for the same quantity of amino acids (119). Other reports appear to currently be less clinically relevant. Example include: standard enteral tube feed was found to be beneficial in 14 HIV positive patients with wasting, with no comparator group (120); supplementation of enteral feed with digestive enzymes had non-significant effects on total protein and albumin levels in 16 elderly residents of a nursing care facility (121); and the availability of only limited information regarding attempts to modify the gut microflora by the addition of fructo-oligosaccharides to tube feed (122).

3.2 Special situations

3.2.1 Diarrhea/Constipation

41) Fiber-containing feeds shall normally be used for patients with diarrhea.

(R40, Grade A, strong consensus 92%)

Commentary

In a crossover study investigating the effect of fiber in EN of ten medically stable residents of a chronic care facility, fiber was found to nearly double both the frequency of opening bowels and the fecal wet weight (both $p<0.05$), without diarrhea (**109**). A reduction in measured glucose and an increase in albumin and hemoglobin was found when Israeli residents in long-term care facilities were given a tube feed containing fiber rather than not over an 8-week period, although the two tube feeds differed beyond only the fiber, for example in the density of amino acids and micronutrients (**110**). Furthermore, the residents were not randomized to one or other of the tube feeds. More recently, in a systematic review and meta-analysis on the effects of fiber-containing enteral formula relevant to both acute and chronic settings, significant benefits of enteral formula containing fiber (especially fiber mixtures) were reported for patients with diarrhea as well as a trend of benefit of enteral formula containing fiber for patients with constipation (**111**).

42) Fiber-containing feeds should be used for patients with constipation.

(R41, Grade B, strong consensus 96%)

Commentary

See commentary to Recommendation 41.

3.2.2 Diabetes

43) A modified enteral formula with lower sugar content, containing slowly digestible carbohydrates and a fat content enriched in unsaturated fatty acids, especially monounsaturated fatty acids may be used for patients with diabetes.

(R42, Grade 0, majority agreement 60%)

Commentary

Specific tube feeds with a lower sugar content for patients with diabetes may be used, which are reported to be comparably tolerated to standard tube feeds (**112**). For example, improved glycemic control was found for residents with type 2 diabetes in a long-term

care facility who received an enteral tube feed with a third less energy from sugars (**113**). A limitation of this study (**113**) that has previously been raised (**112**) is that the proportion of tube feed received by each study group was not reported. In another study of diabetes specific EN there was a reduction in both insulin requirement and in HbA1c after 84 days in patients with type 2 diabetes with neurological dysphagia (**114**). One of the patients in the lower sugar tube feed group had diarrhea from the feed, and one of the patients in the standard sugar tube feed had severe hyperglycemia "possibly related to treatment". A systematic review of diabetes-specific enteral formula (defined as oral supplements or tube feeds containing a high proportion (>60%) of fat, fructose and fiber) found improved glycemic control compared to standard enteral formula (115).

For a fixed sugar content, increasing the fat and protein content of diabetes specific enteral formula may affect glycemic control. For example, in a systematic review of the effects of different macronutrients on postprandial glycaemia, it was found that more insulin was required following high fat/protein meals (116).

4. Monitoring and termination of HEN (Fig. 11)

4.1 When and how should patients on HEN be monitored? (Fig. 12)

44) HEN patients should be monitored for the efficacy and complications of HEN, which requires a good forward planning and communication between acting persons (physicians, nurses, caregivers etc.).

(R44, Grade GPP, strong consensus 96% agreement)

Commentary

Monitoring should depend upon many factors, patient-related (underlying disease, nutritional status on discharge, active treatment or palliative care), and structure-related (presence or absence of a multidisciplinary team in charge of follow-up, homecare country legislation requiring prescription renewal at given intervals).

It may involve the prescribing multidisciplinary team (physician, dietician, nurse, pharmacist), the primary care physician and nurse, the home caregivers, as well as the patient him/herself, stressing the importance of training patients and/or caregivers on caring for the tube, hygiene and safety issues and basic problem solving.

45) Monitoring of efficacy should be based primarily on body weight, body composition and hydration status, but may also include laboratory measurements, such as serum albumin or transthyretin (=prealbumin). Monitoring of complications should include tube- and EN-associated complications.

(R45, Grade GPP, consensus 83% agreement)

Commentary

Monitoring will be performed in the home setting or in the structure where the prescription originated. It may include:

- For efficacy: body weight, body composition (fat-free mass or muscle mass), hydration, muscle strength and performance, food intake, serum transthyretin (because of a much shorter half-life than albumin)

- For tolerance: tube-related complications (leakage, obstruction, displacement, local stoma complications) and respiratory and digestive tolerance

The prospective systematic follow-up of a Spanish cohort of 365 patients on HEN for various reasons showed after average 148 ± 104 (mean ± SD) days an improvement of all anthropometric (weight, arm circumference) and biochemical (albumin, transthyretin, transferrin, lymphocytes) parameters (22). In a prospective study of 150 patients aged 70 ± 8 years (mean ± SD) who had a PEG tube placement for several diseases, among the 72 surviving at least 60 days there was no significant weight or serum albumin change after four months (123). Among 80 patients who were randomized to receive supplemental HEN, HPN or nothing after major abdominal surgery and who were assessed up to one year after discharge, there was a global decrease in body weight (with however a maintained lean body mass) and an increase in serum albumin with time, with no differences between groups (124). A remote follow-up may prove useful: a prospective study of 188 HEN patients older than 65 years showed that the addition of a video consultation with the hospital team to a monthly home visit was able to reduce metabolic complications (128).

4.2 Termination (Fig. 13)

46) HEN should be terminated when the desired weight has been reached and the patient's oral intake matches his/her maintenance needs.

(R46, Grade GPP, strong consensus 92%)

Commentary

Apart from end of life care, there are several situations in which HEN will be terminated:

- Restoration of oral feeding
- Severe complication (intractable diarrhea, aspiration pneumonia), leading to a prolonged contra-indication of HEN
- Transfer to a long-term care facility
- Termination of HEN indicated for trophic indications (short bowel syndrome)

The first situation is the most frequent. Patients may evolve from total EN to complementary EN to complete oral autonomy. A cohort of 417 patients on HEN was followed for 24 to 103 months. HEN had been stopped because of death in 75.2%, weaning in 32.6% and other reasons in 6.7%; only 5.5% were still dependent on HEN (26). A Spanish cohort found in 365 HEN patients followed-up for 148 ± 104 days (mean ± SD) that as many patients had regained oral autonomy (47.2%) as those still needing EN support (47.8%) (22). Two regional cohort studies report a much more frequent return to oral autonomy in patients with digestive diseases compared to patients with cancer or neurological diseases (5, 26).

The end of life care situation has been covered by the recent ESPEN guideline on ethical aspects of artificial nutrition and hydration (29), in which it is said that "in case the feasibility or efficacy of artificial nutrition is uncertain it is advisable to administer the therapy on a trial basis. In the event of complications or if the desired success is not achieved, the attempt should be discontinued."

4.3 Management of complications (Fig. 14)

47) To reduce mechanical complications of HEN (blocking, dislodgement) percutaneous tubes should be used instead of nasal tubes for long-term needs (at least 4 - 6 weeks).

(R47, Grade B, strong consensus 98%)

Commentary

General EN complications are applicable to patients on HEN, and can be classified as mechanic, aspiration, gastrointestinal, metabolic and stoma complications. The frequency of these complications has been studied in several retrospective and prospective studies, including different type of patients and enteral accesses (**129-132**). In a Cochrane systematic review, PEG feeding demonstrated a lower probability of intervention failure (defined as feeding interruption, blocking or leakage of the tube, no adherence to treatment), suggesting the endoscopic procedure is more effective and safer than nasogastric tube feeding (**132**).

Mechanical complications such as dislodgement and obstruction of the tubes are more frequent in nasal tubes, especially nasojejunal tubes, than in PEG tubes (**129**). In cases of persistent obstruction, some experts, but not all, recommend infusion with cola-containing carbonated drinks or pancreatic enzymes may unclog the tube (133). However, this maneuver is not recommended for several reasons, one being the sugar content of sodas enhancing the risk of tube contamination with bacteria. Others recommend the usage of 8.4% w/v sodium bicarbonate solution to unblock the tube; however, this is also not evidence-based medicine. If necessary, a guide wire or commercially available tube declogger can be used by an expert in case of PEG tubes (42). Aspiration can occur in patients who are unable to protect their airways, especially patients with neurological problems. The incidence of aspiration has been reported to reach 20%. Various strategies to reduce aspiration have been studied. These include elevation of the head of the bed, post-pyloric feeding (by nasojejunal, percutaneous gastrojejunostomy, or PEJ), and administration of motility agents to promote gastric emptying (42, 133). Gastrointestinal complications include constipation, diarrhea, vomits and abdominal pain. These complications may be caused by the underlying disease, the drug treatment, the enteral formula and the administration method (42, 133). Metabolic complications include hyperglycemia, electrolytic disturbances, micronutrient deficiency, and refeeding syndrome (42, 133). Stoma complications are frequent in patients with gastrostomy and include excessive granulation tissue, leakage, peristomal infection and the BBS (42, 56).

48) As home-made blenderized admixtures are less effective than EN formula or commercially produced 'whole food' solutions, they should not be utilized in patients on HEN.

(R48, Grade GPP, majority agreement 63%)

Commentary

See commentary to Recommendation 49.

49) As home-made blenderized admixtures are less safe than EN formula or commercially produced 'whole food' solutions, they should not be utilized in patients on HEN.

(R49, Grade GPP, consensus 76%)

Commentary

Blenderized or homebrew tube diets are still popular in many countries due to its low cost in comparison to enteral formula. However, blenderized formulas are not standardized regarding macro and micronutrients composition and may entail a higher risk of contamination, as well as more cumbersome handling and administration (134). In an observational study, the use of EN formula and a NST in comparison to blenderized admixtures improved weight and decreased infectious complications, hospital admissions and costs, but did not have any effect on other complications (135).

See also Recommendation 39.

50) A HEN team should adequately care of nasogastric and enteral tubes, as well as follow up the patients to decrease complications and rehospitalizations.

(R50, Grade B, strong consensus 100%)

Commentary 300 words

Appropriate training of the patient/caregiver and continuity of care after discharge from the hospital are key factors for the success of HEN (136). Most of the potential long-term complications are exclusively dependent on the quality of aftercare given to the tubing system and can be effectively avoided if the proper measures are taken. In a prospective study including 108 elderly patients in Italy, followed for twelve months, the authors found a low rate of complications, most of them mild. The mortality after first month and at one year was 7.4% and 23.1%, respectively, with a mean survival of 674 days that is almost three times longer than in the literature. The authors attribute their better results regarding other series of patients to the continuity of care by the same nutrition team (137). In a quasi-experimental research in Taiwan with pre-test/post-test evaluations in 233 patients with nasogastric tube feeding, systematic nursing intervention, including comprehensive educational pamphlets and video education in comparison to routine education, significantly improved the knowledge and skills of primary caregivers and decreased the incidence of 3-months complications (**138**). In the absence of adequate gastrostomy aftercare, 6-months hospital readmission rates are as high as 23%. In a prospective study with 313 gastrostomy patients followed by a HEN team, 371 complications were encountered and most of them were resolved without hospitalization. Gastrostomy-related hospital readmissions were significantly reduced from 23 to 2% ($p<0.0001$) (**139**).

4.4 Assessment of QoL

51) During HEN treatment QoL should be measured periodically.

(R51, Grade GPP, strong consensus 92%)

Commentary

QoL is one of the patient-related outcomes necessary to evaluate the effect of the treatments. HEN has a considerable physical, social and psychological effect on the lives of patients and their caregivers. Support at the time of tube placement, and regular ongoing support, can help to minimize the impact on both, enabling them to make the most of their daily lives, sleep better, and enjoy an overall higher QoL (140).

QoL should be measured at the beginning of HEN and periodically during the treatment to evaluate the impact of this intervention. In these patients QoL has been investigated using mainly generic questionnaires, such as SF-36, SF-12, WHO QoL-BREF and EQ-5D, showing a lower value than in the general population. Among the main factors than can influence HEN patient's QoL are the underlying disease, age, gender and presence of caregiver. Also, the caregiver's evaluation can be useful to have an approximation to the patient's perception when he/she does not have the ability to communicate (145).

52) For evaluating QoL in HEN patients, validated specific questionnaires should be used.

(R52, Grade GPP, consensus 88%)

Commentary

Patient's Reported Outcomes Measures should be developed through a standardized process (146). The process of validation of these tools entails the measure of the following psychometric properties (feasibility, reliability or reproducibility, responsiveness, determination of the minimal clinically significant difference, and validity). To measure QoL in HEN patients we can use generic or specific questionnaires. Generic tools lack sensitivity to reflect patients' problems and differences in QoL between subgroups according to diseases or during the follow-up. Specific questionnaires are developed from patients' symptoms, limitations, and problems in their daily life and are more sensitive to changes. To study QoL in HEN, some authors have used specific questionnaires for different pathologies (IBDQ, head and neck cancer QOL-EF, EORTC QLQ-C30) (147, 148). There are other specific questionnaires for PEG but with some methodological limitations. A specific questionnaire to evaluate QoL in patients on HEN regardless of the underlying disease and route of administrations has been validated in a Spanish population in a multicentric study including 355 subjects. This questionnaire, NutriQoL®, consists of 17 items and evaluates QoL in two dimensions (physical performance, daily life activities, and social aspects). This questionnaire is reported to be valid, reliable and even if lowly sensitive to change it seems to be useful to measure QoL in this population (149, 150).

5. Structural requirements to perform HEN (Fig. 16)

5.1 Education and NST (Fig. 17)

53) All healthcare professionals who are directly involved in patient care should receive education and training, relevant to their duties, on the different aspects related to the safe provision of HEN and the importance of providing adequate nutrition.

(R55, Grade B, strong consensus 100%)

Commentary

The number of patients receiving HEN has increased considerably in recent years (**79**). It is now estimated that more than twice as many patients receive EN in the community compared with those in hospital (**151**). HEN is a complex therapy and should be closely monitored (**151**), otherwise serious complications can occur, like aspiration pneumonia,

dislocated tubes, gastrointestinal complications, etc.. Treatment is usually initiated in secondary care, but general practitioners can also refer patients for elective HEN with outpatient feeding tube placement. PEG tubes are the easiest feeding tubes to manage in the community. All hospitals who discharge patients with HEN should employ at least one specialist nutrition support nurse and a dietician (**152**). These hospitals should have a nutrition steering committee providing protocols for safe HEN. The composition of this team may differ according to setting and local arrangements but should consist at least a physician, a dietician, a nutrition support nurse and if possible a pharmacist and physiotherapist. Close collaboration with the home physician is important for follow up and in case of complications. Educational intervention (for example, three 1-week modular courses over six months) (136) for all healthcare professionals, in particular medical, dietetic and nursing staff, including those who work with people with dementia, is recommended. The effect on patient care like nutritional status, length of hospital stay, frequency of general practitioner visits, complications and QoL should be compared with no formal education (140). Most countries have facility companies ("home care providers") who provide patients at home with the enteral formulas, pumps and caring utensils (**153**). Reimbursement of enteral products, utensils and lease of pumps should be discussed with insurance companies or government in order to be able to provide HEN at home for all patients (**153, 154**).

54) All information related to HEN should be provided not only verbally but also in writing or pictures.

(R54, Grade B, strong consensus 100%)

There are increasing numbers of adult patients who require continuing EN support following discharge from hospital into community settings (**79, 151**). HEN refers to nutrition provided through a feeding tube directly into the gastro-intestinal tract when an individual cannot ingest, chew or swallow food but can digest and absorb nutrients in the patient's home. It allows the patient to return to a familiar environment where support can be provided by the patients itself, family, friends or professional carers (89, 90). The instruction should be given in the hospital setting or at home. Written information should be provided including contact information in case of complications and/or further clarifications needed (140, **152-155**).

55) All hospitals who discharge patients with HEN should employ at least one specialized nutrition support nurse or dietician. Ideally, these hospitals should have a NST working within the clinical governance framework.

(R57, Grade B, strong consensus 96%)

Commentary

See commentary to Recommendation 53.

56) Healthcare professionals should ensure that all people who need nutrition support receive coordinated care from a multidisciplinary NST.

(R56, Grade B, strong consensus 100%)

Commentary

See commentary to Recommendation 53.

57) For optimal management of HEN, a NST approach may comprise – in addition to a physician, a dietician/nutritionist and a nurse – other allied healthcare professionals (for example, speech and language therapists, physiotherapists and occupational therapists, and pharmacists as necessary).

(R61, Grade GPP, strong consensus 97%)

Commentary

The HEN team provides support to patients who are being fed via enteral feeding tube in the community. However, the organization of services to support the increasing number of people receiving HEN varies across regions. UK NICE guidelines outline that people receiving HEN in the community should "be supported by a coordinated multidisciplinary team" (151). It seems that a standardized care coordination model involving a multidisciplinary team could be improve outcomes and reduce health care related costs. Nevertheless, inadequate data are available to determine specifically the degree of effectiveness of any such intervention or team composition. The benefits of introducing community NSTs mainly comes from observational work that has suggested benefit (e.g. audits following the introduction of expert review for HEN) in terms of reduced costs and improve outcome. In different countries, nurses and dieticians were the most listed team members of a multidisciplinary team, whereas primary care physicians and physician specialists were included in most of the different approaches for a multidisciplinary team too. In some cases, language or speech specialists, and other healthcare workers were also included (156).

58) HEN should be standardized and coordinated by a multidisciplinary NST (physician, nurse, dietician, pharmacist) as this increases the quality of the measures, reduces the complication rates and thus makes a significant contribution to improve patients QoL and to the cost-effectiveness of the measures.

(R53, Grade B, strong consensus 96%)

Commentary

See commentary to Recommendation 54.

5.2 Infrastructure (Fig. 18)

59) The environment for patients receiving HEN should be safe in order to administer the EN without the risk of complications.

(R58, Grade B, strong consensus 100%)

Commentary

See commentary to Recommendation 53.

60) Hygiene standards should be established to prevent contamination of the home enteral product and to prevent HEN-related infections.

(R59, Grade GPP, strong consensus 100%)

Commentary

See commentary to Recommendation 53.

61) All patients receiving HEN should have access to a professional for evaluation of the procedure and, especially in case of complications or emergencies, for adequate intervention.

(R60, Grade GPP, strong consensus 100%)

Commentary

See commentary to Recommendation 53.

Conflict of interest

The expert members of the working group were accredited by the ESPEN Guidelines Group, the ESPEN Education and Clinical Practice Committee, and the ESPEN executive. All expert members have declared their individual conflicts of interest according to the rules of the International Committee of Medical Journal Editors (ICMJE). If potential conflicts were indicated, they were reviewed by the ESPEN guideline officers and, in cases of doubts, by the ESPEN executive. None of the expert panel had to be excluded from the working group or from co-authorship because of serious conflicts. The conflict of interest forms are stored at the ESPEN guideline office and can be reviewed with legitimate interest upon request to the ESPEN executive.

Funding statement

This guideline was solely financed by ESPEN, the European Society for Clinical Nutrition and Metabolism.

References (will be adapted to the shortened version!)

1. Bischoff SC, Singer P, Koller M, Barazzoni R, Cederholm T, van Gossum A. Standard operating procedures for ESPEN guidelines and consensus papers. Clin Nutr. 2015.

2. Bischoff S, Arends J, Dörje F, Engeser P, Hanke G, Köchling K, et al. S3-Leitlinie der Deutschen Gesellschaft für Ernährungsmedizin (DGEM) in Zusammenarbeit mit der GESKES und der AKE. Aktuelle Ernährungsmedizin. 2013;38:e101-e54.

3. Scottish Intercollegiate Guidelines Network (SIGN). SIGN 50: a guideline developer's handbook. Revised version. Edinburgh: SIGN; 2014.

4. Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften (AWMF) – Ständige Kommission Leitlinien. AWMF-Regelwerk „Leitlinien". 2012.

5. Cawsey SI, Soo J, Gramlich LM. Home enteral nutrition: outcomes relative to indication. Nutr Clin Pract. 2010;25:296-300.

6. Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H, Bozzetti F, et al. ESPEN guidelines on nutrition in cancer patients. Clin Nutr. 2017;36:11-48.

7. Arends J, Baracos V, Bertz H, Bozzetti F, Calder PC, Deutz NEP, et al. ESPEN expert group recommendations for action against cancer-related malnutrition. Clin Nutr. 2017;36:1187-96.

8. Arends J, Bodoky G, Bozzetti F, Fearon K, Muscaritoli M, Selga G, et al. ESPEN Guidelines on Enteral Nutrition: Non-surgical oncology. Clin Nutr. 2006;25:245-59.

9. Bozzetti F, Arends J, Lundholm K, Micklewright A, Zurcher G, Muscaritoli M. ESPEN Guidelines on Parenteral Nutrition: non-surgical oncology. Clin Nutr. 2009;28:445-54.

10. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr. 2003;22:321-36.

11. Gomes F, Schuetz P, Bounoure L, Austin P, Ballesteros-Pomar M, Cederholm T, et al. ESPEN guidelines on nutritional support for polymorbid internal medicine patients. Clin Nutr. 2018;37:336-53.

12. Kondrup J, Bak L, Hansen BS, Ipsen B, Ronneby H. Outcome from nutritional support using hospital food. Nutrition. 1998;14:319-21.

13. Jensen GL, Mirtallo J, Compher C, Dhaliwal R, Forbes A, Grijalba RF, et al. Adult starvation and disease-related malnutrition: a proposal for etiology-based diagnosis in the clinical practice setting from the International Consensus Guideline Committee. Clin Nutr. 2010;29:151-3.

14. Bowrey DJ, Baker M, Halliday V, Thomas AL, Pulikottil-Jacob R, Smith K, et al. A randomised controlled trial of six weeks of home enteral nutrition versus standard care after oesophagectomy or total gastrectomy for cancer: report on a pilot and feasibility study. Trials. 2015;16:531.

15. Howard L. Home parenteral and enteral nutrition in cancer patients. Cancer. 1993;72:3531-41.

16. Takagi S, Utsunomiya K, Kuriyama S, Yokoyama H, Takahashi S, Iwabuchi M, et al. Effectiveness of an 'half elemental diet' as maintenance therapy for Crohn's disease: A randomized-controlled trial. Aliment Pharmacol Ther. 2006;24:1333-40.

17. Wu Z, Wu M, Wang Q, Zhan T, Wang L, Pan S, et al. Home enteral nutrition after minimally invasive esophagectomy can improve quality of life and reduce the risk of malnutrition. Asia Pac J Clin Nutr. 2018;27:129.

18. Yu F-J, Shih H-Y, Wu C-Y, Chuang Y-S, Lee J-Y, Li H-P, et al. Enteral nutrition and quality of life in patients undergoing chemoradiotherapy for esophageal carcinoma: a comparison of nasogastric tube, esophageal stent, and ostomy tube feeding. Gastrointest Endosc. 2018;88:21-31. e4.

19. Klek S, Pawlowska D, Dziwiszek G, Komoń H, Compala P, Nawojski M. The evolution of home enteral nutrition (HEN) in Poland during five years after implementation: a multicentre stud. Nutr Hosp. 2015;32:196-201.

20. Paccagnella A, Marcon ML, Baruffi C, Giometto M, Mauri A, Vigo C, et al. Enteral nutrition at home and in nursing homes: an 11-year (2002-2012) epidemiological analysis. Minerva Gastroenterol Dietol. 2016;62:1-10.

21. de Luis DA, Aller R, de Luis J, Izaola O, Romero E, Terroba MC, et al. Clinical and biochemical characteristics of patients with home enteral nutrition in an area of Spain. Eur J Clin Nutr. 2003;57:612-5.

22. de Luis DA, Aller R, Izaola O, Terroba MC, Cabezas G, Cuellar LA. Experience of 6 years with home enteral nutrition in an area of Spain. Eur J Clin Nutr. 2006;60:553-7.

23. De Luis DA, Izaola O, Cuellar LA, Terroba MC, Cabezas G, De La Fuente B. Experience over 12 years with home enteral nutrition in a healthcare area of Spain. J Hum Nutr Diet. 2013;26 Suppl 1:39-44.

24. Gaggiotti G, Ambrosi S, Spazzafumo L, Sgattoni C, Orlandoni P, Rosati S. Two-year outcome data from the Italian Home Enteral Nutrition (IHEN) Register. Clin Nutr. 1995;14 Suppl 1:2-5.

25. Paccagnella A, Baruffi C, Pizzolato D, Favaro V, Marcon ML, Morello M, et al. Home enteral nutrition in adults: a five-year (2001-2005) epidemiological analysis. Clin Nutr. 2008;27:378-85.

26. Schneider SM, Raina C, Pugliese P, Pouget I, Rampal P, Hebuterne X. Outcome of patients treated with home enteral nutrition. JPEN J Parenter Enteral Nutr. 2001;25:203-9.

27. Wanden-Berghe C, Luengo LM, Alvarez J, Burgos R, Cuerda C, Matia P, et al. Spanish home enteral nutrition registry of the year 2014 and 2015 from the NADYA-SENPE Group. Nutr Hosp. 2017;34:15-8.

28. Gripp S, Moeller S, Bolke E, Schmitt G, Matuschek C, Asgari S, et al. Survival prediction in terminally ill cancer patients by clinical estimates, laboratory tests, and self-rated anxiety and depression. J Clin Oncol. 2007;25:3313-20.

29. Druml C, Ballmer PE, Druml W, Oehmichen F, Shenkin A, Singer P, et al. ESPEN guideline on ethical aspects of artificial nutrition and hydration. Clin Nutr. 2016;35:545-56.

30. Burgos R, Breton I, Cereda E, Desport JC, Dziewas R, Genton L, et al. ESPEN guideline clinical nutrition in neurology. Clin Nutr. 2018;37:354-96.

31. Williams T. Nasogastric tube feeding: a safe option for patients? Br J Community Nurs. 2016;Suppl Nutrition:S28-31.

32. Corry J, Poon W, McPhee N, Milner AD, Cruickshank D, Porceddu SV, et al. Prospective study of percutaneous endoscopic gastrostomy tubes versus nasogastric tubes for enteral feeding in patients with head and neck cancer undergoing (chemo)radiation. Head Neck. 2009;31:867-76.

33. Nugent B, Lewis S, O'Sullivan JM. Enteral feeding methods for nutritional management in patients with head and neck cancers being treated with radiotherapy and/or chemotherapy. Cochrane Database Syst Rev. 2013:Cd007904.

34. Paleri V, Roe JW, Strojan P, Corry J, Gregoire V, Hamoir M, et al. Strategies to reduce long-term postchemoradiation dysphagia in patients with head and neck cancer: an evidence-based review. Head Neck. 2014;36:431-43.

35. Wang J, Liu M, Liu C, Ye Y, Huang G. Percutaneous endoscopic gastrostomy versus nasogastric tube feeding for patients with head and neck cancer: a systematic review. J Radiat Res. 2014;55:559-67.

36. Gomes CA, Jr., Andriolo RB, Bennett C, Lustosa SA, Matos D, Waisberg DR, et al. Percutaneous endoscopic gastrostomy versus nasogastric tube feeding for adults with swallowing disturbances. Cochrane Database Syst Rev. 2015:Cd008096.

37. Tabrizi R, Hosseinpour S, Taghizadeh F. Feeding in Oral Cancer Patients After Massive Ablative Surgery: Percutaneous Endoscopic Gastrostomy or Nasogastric Tube. J Craniofac Surg. 2016;27:1010-1.

38. Jaafar MH, Mahadeva S, Morgan K, Tan MP. Percutaneous endoscopic gastrostomy versus nasogastric feeding in older individuals with non-stroke dysphagia: a systematic review. J Nutr Health Aging. 2015;19:190-7.

39. Fay DE, Poplausky M, Gruber M, Lance P. Long-term enteral feeding: a retrospective comparison of delivery via percutaneous endoscopic gastrostomy and nasoenteric tubes. Am J Gastroenterol. 1991;86:1604-9.

40. Dwolatzky T, Berezovski S, Friedmann R, Paz J, Clarfield AM, Stessman J, et al. A prospective comparison of the use of nasogastric and percutaneous endoscopic gastrostomy tubes for long-term enteral feeding in older people. Clin Nutr. 2001;20:535-40.

41. McClave SA, DiBaise JK, Mullin GE, Martindale RG. ACG Clinical Guideline: Nutrition Therapy in the Adult Hospitalized Patient. Am J Gastroenterol. 2016;111:315-34.

42. Toussaint E, Van Gossum A, Ballarin A, Arvanitakis M. Enteral access in adults. Clin Nutr. 2015;34:350-8.

43. Bravo JG, Ide E, Kondo A, de Moura DT, de Moura ET, Sakai P, et al. Percutaneous endoscopic versus surgical gastrostomy in patients with benign and malignant diseases: a systematic review and meta-analysis. Clinics (Sao Paulo, Brazil). 2016;71:169-78.

44. Ljungdahl M, Sundbom M. Complication rate lower after percutaneous endoscopic gastrostomy than after surgical gastrostomy: a prospective, randomized trial. Surg Endosc. 2006;20:1248-51.

45. Rustom IK, Jebreel A, Tayyab M, England RJ, Stafford ND. Percutaneous endoscopic, radiological and surgical gastrostomy tubes: a comparison study in head and neck cancer patients. J Laryngol Otol. 2006;120:463-6.

46. Croshaw RL, Nottingham JM. Laparoscopic-assisted percutaneous endoscopic gastrostomy: its role in providing enteric access when percutaneous endoscopic gastrostomy is not possible. Am Surg. 2006;72:1222-4.

47. Serrano Aguayo P, Gros Herguido N, Parejo Campos J, Barranco Moreno A, Tous Romero MDC, Pereira Cunill JL, et al. New laparoscopic assisted percutaneous gastrostomy. Description and comparison with others gastrostomy types. Clin Nutr ESPEN. 2016;16:24-9.

48. Yuan Y, Zhao Y, Xie T, Hu Y. Percutaneous endoscopic gastrostomy versus percutaneous radiological gastrostomy for swallowing disturbances. Cochrane Database Syst Rev. 2016;2:Cd009198.

49. Lim JH, Choi SH, Lee C, Seo JY, Kang HY, Yang JI, et al. Thirty-day mortality after percutaneous gastrostomy by endoscopic versus radiologic placement: a systematic review and meta-analysis. Intest Res. 2016;14:333-42.

50. Vidhya C, Phoebe D, Dhina C, Jayne S, Robert F. Percutaneous endoscopic gastrostomy (PEG) versus radiologically inserted gastrostomy (RIG): A comparison of outcomes at an Australian teaching hospital. Clin Nutr ESPEN. 2018;23:136-40.

51. Burkitt P, Carter LM, Smith AB, Kanatas A. Outcomes of percutaneous endoscopic gastrostomy and radiologically inserted gastrostomy in patients with head and neck cancer: a systematic review. Br J Oral Maxillofac Surg. 2011;49:516-20.

52. Odedra D, Nasirzadeh R, Menard A. Safety of Outpatient vs Inpatient Percutaneous Radiological Gastrostomy Tubes in Patients with Head and Neck Cancers. Can Assoc Radiol J. 2016;67:416-9.

53. Itkin M, DeLegge MH, Fang JC, McClave SA, Kundu S, d'Othee BJ, et al. Multidisciplinary practical guidelines for gastrointestinal access for enteral nutrition and decompression from the Society of Interventional Radiology and American Gastroenterological Association (AGA) Institute, with endorsement by Canadian Interventional Radiological Association (CIRA) and Cardiovascular and Interventional Radiological Society of Europe (CIRSE). Gastroenterology. 2011;141:742-65.

54. Miller KR, McClave SA, Kiraly LN, Martindale RG, Benns MV. A tutorial on enteral access in adult patients in the hospitalized setting. JPEN J Parenter Enteral Nutr. 2014;38:282-95.

55. Roveron G, Antonini M, Barbierato M, Calandrino V, Canese G, Chiurazzi LF, et al. Clinical Practice Guidelines for the Nursing Management of Percutaneous Endoscopic Gastrostomy and Jejunostomy (PEG/PEJ) in Adult Patients: An Executive Summary. Journal of Wound Ostomy & Continence Nursing. 2018;45:326-34.

56. Löser C, Aschl G, Hebuterne X, Mathus-Vliegen EM, Muscaritoli M, Niv Y, et al. ESPEN guidelines on artificial enteral nutrition--percutaneous endoscopic gastrostomy (PEG). Clin Nutr. 2005;24:848-61.

57. National Nurses Nutrition Group (NNNG). Exit Site Management for Gastrostomy Tubes in Adults and Children. UK2013.

58. Blumenstein I, Borger D, Loitsch S, Bott C, Tessmer A, Hartmann F, et al. A glycerin hydrogel-based wound dressing prevents peristomal infections after percutaneous endoscopic gastrostomy (PEG): a prospective, randomized study. Nutr Clin Pract. 2012;27:422-5.

59. Aschl G, Kirchgatterer A, Fleischer M, Hinterreiter M, Hubner D, Kranewitter W, et al. [The frequency of wound infections after PEG-placement and utilization of glycogel wound dressing: a randomized controlled trial]. Wien Klin Wochenschr. 2008;120:224-7.

60. Pars H, Çavusoglu H. Effects of 3 Different Methods of Care on the Peristomal Skin Integrity of Children with Percutaneous Endoscopic Gastrostomy Tubes: A Prospective Randomized Controlled Trial. Adv Skin Wound Care. 2018;31:172-81.

61. National Patient Safety Agency (NPSA). Rapid Response Report NPSA/2010/RRR010: Early detection of complications after gastrostomy. UK2010.

62. Cyrany J, Rejchrt S, Kopacova M, Bures J. Buried bumper syndrome: A complication of percutaneous endoscopic gastrostomy. World J Gastroenterol. 2016;22:618-27.

63. Schrag SP, Sharma R, Jaik NP, Seamon MJ, Lukaszczyk JJ, Martin ND, et al. Complications related to percutaneous endoscopic gastrostomy (PEG) tubes. A comprehensive clinical review. J Gastrointestin Liver Dis. 2007;16:407-18.

64. Bennell J. Buried bumper syndrome: do we have enough evidence? Br J Community Nurs. 2018;23:S28-s30.

65. McClave SA, Jafri NS. Spectrum of morbidity related to bolster placement at time of percutaneous endoscopic gastrostomy: buried bumper syndrome to leakage and peritonitis. Gastrointest Endosc Clin N Am. 2007;17:731-46.

66. McClave SA, Chang WK. Complications of enteral access. Gastrointest Endosc. 2003;58:739-51.

67. Zopf Y, Konturek P, Nuernberger A, Maiss J, Zenk J, Iro H, et al. Local infection after placement of percutaneous endoscopic gastrostomy tubes: a prospective study evaluating risk factors. Can J Gastroenterol. 2008;22:987-91.

68. Lynch CR, Fang JC. Prevention and management of complications of percutaneous endoscopic gastrostomy (PEG) tubes. Pract Gastroenterol. 2004;28:66-77.

69. Lansdown AB, Mirastschijski U, Stubbs N, Scanlon E, Ågren MS. Zinc in wound healing: theoretical, experimental, and clinical aspects. Wound Repair Regen. 2007;15:2-16.

70. Tsang TK, Eaton D, Falconio MA. Percutaneous ostomy dilation: a technique for dilating the closed percutaneous endoscopic gastrostomy sites and reinserting gastrostomies. Gastrointest Endosc. 1989;35:336-7.

71. Rahnemai-Azar AA, Rahnemaiazar AA, Naghshizadian R, Kurtz A, Farkas DT. Percutaneous endoscopic gastrostomy: indications, technique, complications and management. World J Gastroenterol. 2014;20:7739-51.

72. Pearce CB, Goggin PM, Collett J, Smith L, Duncan HD. The 'cut and push' method of percutaneous endoscopic gastrostomy tube removal. Clin Nutr. 2000;19:133-5.

73. Agha A, AlSaudi D, Furnari M, Abdulhadi Ali MM, Morched Chakik R, Alsaudi I, et al. Feasibility of the cut-and-push method for removing large-caliber soft percutaneous endoscopic gastrostomy devices. Nutr Clin Pract. 2013;28:490-2.

74. Villela EL, Sakai P, Almeida MR, Moura EG, Faintuch J. Endoscopic gastrostomy replacement tubes: long-term randomized trial with five silicone commercial models. Clin Nutr. 2014;33:221-5.

75. Hull MA, Rawlings J, Murray FE, Field J, McIntyre AS, Mahida YR, et al. Audit of outcome of long-term enteral nutrition by percutaneous endoscopic gastrostomy. Lancet. 1993;341:869-72.

76. Lee JH, Kim JJ, Kim YH, Jang JK, Son HJ, Peck KR, et al. Increased risk of peristomal wound infection after percutaneous endoscopic gastrostomy in patients with diabetes mellitus. Dig Liver Dis. 2002;34:857-61.

77. Boullata JI, Carrera AL, Harvey L, Escuro AA, Hudson L, Mays A, et al. ASPEN Safe Practices for Enteral Nutrition Therapy. Journal of Parenteral and Enteral Nutrition. 2017;41:15-103.

78. Crosby J, Duerksen DR. A prospective study of tube- and feeding-related complications in patients receiving long-term home enteral nutrition. JPEN J Parenter Enteral Nutr. 2007;31:274-7.

79. Best C, Hitchings H. Enteral tube feeding--from hospital to home. Br J Nurs. 2010;19:174, 6-9.

80. Stroud M, Duncan H, Nightingale J. Guidelines for enteral feeding in adult hospital patients. Gut. 2003;52 Suppl 7:vii1-vii12.

81. Szary NM, Arif M, Matteson ML, Choudhary A, Puli SR, Bechtold ML. Enteral feeding within three hours after percutaneous endoscopic gastrostomy placement: a meta-analysis. J Clin Gastroenterol. 2011;45:e34-8.

82. Westaby D, Young A, O'Toole P, Smith G, Sanders DS. The provision of a percutaneously placed enteral tube feeding service. Gut. 2010;59:1592-605.

83. Halliday V, Baker M, Thomas AL, Bowrey D. Patient and Family Caregivers' Experiences of Living With a Jejunostomy Feeding Tube After Surgery for Esophagogastric Cancer. JPEN J Parenter Enteral Nutr. 2017;41:837-43.

84. Abu-Hilal M, Hemandas AK, McPhail M, Jain G, Panagiotopoulou I, Scibelli T, et al. A comparative analysis of safety and efficacy of different methods of tube placement for enteral feeding following major pancreatic resection. A non-randomized study. Jop. 2010;11:8-13.

85. Han-Geurts IJ, Hop WC, Verhoef C, Tran KT, Tilanus HW. Randomized clinical trial comparing feeding jejunostomy with nasoduodenal tube placement in patients undergoing oesophagectomy. Br J Surg. 2007;94:31-5.

86. Weijs TJ, Berkelmans GH, Nieuwenhuijzen GA, Ruurda JP, van Hillegersberg R, Soeters PB, et al. Routes for early enteral nutrition after esophagectomy. A systematic review. Clin Nutr. 2015;34:1-6.

87. Stavroulakis T, McDermott CJ. Enteral feeding in neurological disorders. Pract Neurol. 2016;16:352-61.

88. Scott R, Bowling TE. Enteral tube feeding in adults. J R Coll Physicians Edinb. 2015;45:49-54.

89. White H, King L. Enteral feeding pumps: efficacy, safety, and patient acceptability. Medical devices (Auckland, NZ). 2014;7:291-8.

90. Blumenstein I, Shastri YM, Stein J. Gastroenteric tube feeding: techniques, problems and solutions. World J Gastroenterol. 2014;20:8505-24.

91. Lord LM. Enteral Access Devices: Types, Function, Care, and Challenges. Nutr Clin Pract. 2018;33:16-38.

92. Alsaeed D, Furniss D, Blandford A, Smith F, Orlu M. Carers' experiences of home enteral feeding: A survey exploring medicines administration challenges and strategies. Journal of Clinical Pharmacy & Therapeutics. 2018;19:19.

93. Phillips NM, Nay R. Nursing administration of medication via enteral tubes in adults: a systematic review. International Journal of Evidence-Based Healthcare. 2007;5:324-53.

94. Vincent J, Teng R, Pelletier SM, Willavize SA, Friedman HL. The bioavailability of nasogastric versus tablet-form oral trovafloxacin in healthy subjects. American Journal of Surgery. 1998;176:23S-6S.

95. Fleisher D, Sheth N, Kou JH. Phenytoin interaction with enteral feedings administered through nasogastric tubes. Journal of Parenteral and Enteral Nutrition. 1990;14:513-6.

96. Joos E, Verbeke S, Mehuys E, Van Bocxlaer J, Remon JP, Van Winckel M, et al. Medication administration via enteral feeding tube: a survey of pharmacists' knowledge. International Journal of Clinical Pharmacy. 2016;38:10-5.

97. Roulet L, Benoit E. Letter: Medication administration via enteral feeding tube. International Journal of Clinical Pharmacy. 2016;38:747-8.

98. Joos E, Mehuys E, Van Bocxlaer J, Remon JP, Van Winckel M, Boussery K. Knowledge of staff members of residential care facilities for individuals with intellectual disability on medication administration via enteral feeding tube. Journal of Intellectual Disability Research. 2016;60:1066-72.

99. Joos E, Mehuys E, Van Bocxlaer J, Remon JP, Van Winckel M, Boussery K. Drug administration via enteral feeding tubes in residential care facilities for individuals with intellectual disability: An observational study. Journal of Intellectual Disability Research. 2015;59:215-25.

100. Joos E, Mehuys E, Remon JP, Van Winckel M, Boussery K. Analysis of drug use in institutionalized individuals with intellectual disability and tube feeding. Acta Clinica Belgica: International Journal of Clinical and Laboratory Medicine. 2016;71:76-80.

101. Joos E, Van Tongelen I, Wijnants K, Mehuys E, Van Bocxlaer J, Remon JP, et al. Drug administration via enteral feeding tube in residential care facilities for individuals with intellectual disability: A focus group study on guideline implementation. Journal of Intellectual Disabilities. 2016;20:329-40.

102. Epp L, Lammert L, Vallumsetla N, Hurt RT, Mundi MS. Use of Blenderized Tube Feeding in Adult and Pediatric Home Enteral Nutrition Patients. Nutrition in Clinical Practice. 2017;32:201-5.

103. Hurt RT, Edakkanambeth Varayil J, Epp LM, Pattinson AK, Lammert LM, Lintz JE, et al. Blenderized Tube Feeding Use in Adult Home Enteral Nutrition Patients: A Cross-Sectional Study. Nutrition in Clinical Practice. 2015;30:824-9.

104. Borghi R, Dutra Araujo T, Airoldi Vieira RI, Theodoro de Souza T, Waitzberg DL. ILSI Task Force on enteral nutrition; estimated composition and costs of blenderized diets. Nutricion hospitalaria. 2013;28:2033-8.

105. Vieira MMC, Santos VFN, Bottoni A, Morais TB. Nutritional and microbiological quality of commercial and homemade blenderized whole food enteral diets for home-based enteral nutritional therapy in adults. Clinical Nutrition. 2016;09.

106. Anonymous. "Home brew' compared with commercial preparation for enteral feeding. British Medical Journal Clinical Research Ed. 1982;284:981-2.

107. Klek S, Szybinski P, Sierzega M, Szczepanek K, Sumlet M, Kupiec M, et al. Commercial enteral formulas and nutrition support teams improve the outcome of home enteral tube feeding. Journal of Parenteral and Enteral Nutrition. 2011;35:380-5.

108. Papakostas P, Tsaousi G, Stavrou G, Rachovitsas D, Tsiropoulos G, Rova C, et al. Percutaneous endoscopic gastrostomy feeding of locally advanced oro-pharygo-laryngeal cancer patients: Blenderized or commercial food? Oral Oncology. 2017;74:135-41.

109. Zarling EJ, Edison T, Berger S, Leya J, DeMeo M. Effect of dietary oat and soy fiber on bowel function and clinical tolerance in a tube feeding dependent population. Journal of the American College of Nutrition. 1994;13:565-8.

110. Kagansky M, Rimon E. Is there a difference in metabolic outcome between different enteral formulas? Journal of Parenteral and Enteral Nutrition. 2007;31:320-3.

111. Elia M, Engfer MB, Green CJ, Silk DBA. Systematic review and meta-analysis: The clinical and physiological effects of fibre-containing enteral formulae. Alimentary Pharmacology and Therapeutics. 2008;27:120-45.

112. Hise ME, Fuhrman MP. The effect of diabetes-specific enteral formulae on clinical and glycemic indicators. Pract Gastroenterol. 2009:20.

113. Craig LD, Nicholson S, Silverstone FA, Kennedy RD, Coble Voss A, Allison S. Use of a reduced-carbohydrate, modified-fat enteral formula for improving metabolic control and clinical outcomes in long-term care residents with type 2 diabetes: Results of a pilot trial. Nutrition. 1998;14:529-34.

114. Pohl M, Mayr P, Mertl-Roetzer M, Lauster F, Lerch M, Eriksen J, et al. Glycaemic control in type II diabetic tube-fed patients with a new enteral formula low in carbohydrates and high in monounsaturated fatty acids: A randomised controlled trial. European Journal of Clinical Nutrition. 2005;59:1221-32.

115. Elia M, Ceriello A, Laube H, Sinclair AJ, Engfer M, Stratton RJ. Enteral nutritional support and use of diabetes-specific formulas for patients with diabetes: a systematic review and meta-analysis. Diabetes Care. 2005;28:2267-79.

116. Bell KJ, Smart CE, Steil GM, Brand-Miller JC, King B, Wolpert HA. Impact of fat, protein, and glycemic index on postprandial glucose control in type 1 diabetes: implications for intensive diabetes management in the continuous glucose monitoring era. Diabetes Care. 2015;38:1008-15.

117. Ain KB, Dewitt PA, Gardner TG, Berryman SW. Low-iodine tube-feeding diet for iodine-131 scanning and therapy. Clinical Nuclear Medicine. 1994;19:504-7.

118. Hirakawa H, Fukuda Y, Tanida N, Hosomi M, Shimoyama T. Home elemental enteral hyperalimentation (HEEH) for the maintenance of remission in patients with Crohn's disease. Gastroenterologia Japonica. 1993;28:379-84.

119. Castellanos VH, Litchford MD, Campbell WW. Modular protein supplements and their application to long-term care. Nutrition in Clinical Practice. 2006;21:485-504.

120. Suttmann U, Selberg O, Muller MJ, Schlesinger A, Gebel M, Manns MP, et al. Home enteral nutrition in patients with Acquired Immunodeficiency Syndrome. Clinical Nutrition. 1993;12:287-92.

121. Glade MJ, Kendra D, Kaminski MV, Jr. Improvement in protein utilization in nursing-home patients on tube feeding supplemented with an enzyme product derived from Aspergillus niger and bromelain. Nutrition. 2001;17:348-50.

122. Whelan K, Judd PA, Preedy VR, Taylor MA. Enteral feeding: The effect on faecal output, the faecal microflora and SCFA concentrations. Proceedings of the Nutrition Society. 2004;63:105-13.

123. Callahan CM, Haag KM, Weinberger M, Tierney WM, Buchanan NN, Stump TE, et al. Outcomes of percutaneous endoscopic gastrostomy among older adults in a community setting. J Am Geriatr Soc. 2000;48:1048-54.

124. Hyltander A, Bosaeus I, Svedlund J, Liedman B, Hugosson I, Wallengren O, et al. Supportive nutrition on recovery of metabolism, nutritional state, health-related quality of life, and exercise capacity after major surgery: a randomized study. Clin Gastroenterol Hepatol. 2005;3:466-74.

125. McWhirter JP, Hambling CE, Pennington CR. The nutritional status of patients receiving home enteral feeding. Clin Nutr. 1994;13:207-11.

126. Obara H, Tomite Y, Doi M. Serum trace elements in tube-fed neurological dysphagia patients correlate with nutritional indices but do not correlate with trace element intakes: case of patients receiving enough trace elements intake. Clin Nutr. 2008;27:587-93.

127. Alivizatos V, Gavala V, Alexopoulos P, Apostolopoulos A, Bajrucevic S. Feeding Tube-related Complications and Problems in Patients Receiving Long-term Home Enteral Nutrition. Indian J Palliat Care. 2012;18:31-3.

128. Orlandoni P, Jukic Peladic N, Spazzafumo L, Venturini C, Cola C, Sparvoli D, et al. Utility of video consultation to improve the outcomes of home enteral nutrition in a population of frail older patients. Geriatr Gerontol Int. 2016;16:762-7.

129. Ao P, Sebastianski M, Selvarajah V, Gramlich L. Comparison of complication rates, types, and average tube patency between jejunostomy tubes and percutaneous gastrostomy tubes in a regional home enteral nutrition support program. Nutr Clin Pract. 2015;30:393-7.

130. Barone M, Viggiani MT, Amoruso A, Licinio R, Iannone A, Montenegro L, et al. Influence of age and type of underlying disease on complications related to home enteral nutrition: a single Italian center experience. JPEN J Parenter Enteral Nutr. 2014;38:991-5.

131. Cuerda C, Planas M, Gomez Candela C, Luengo LM. Trends in home enteral nutrition in Spain: analysis of the NADYA registry 1992-2007. Nutr Hosp. 2009;24:347-53.

132. Gomes CA, Jr., Lustosa SA, Matos D, Andriolo RB, Waisberg DR, Waisberg J. Percutaneous endoscopic gastrostomy versus nasogastric tube feeding for adults with swallowing disturbances. Cochrane Database Syst Rev. 2012:Cd008096.

133. Arribas L, Frias L, Creus G, Parejo J, Urzola C, Ashbaugh R, et al. Document of standardization of enteral nutrition access in adults. Nutr Hosp. 2014;30:1-14.

134. Borghi R, Dutra Araujo T, Airoldi Vieira RI, Theodoro de Souza T, Waitzberg DL. ILSI Task Force on enteral nutrition; estimated composition and costs of blenderized diets. Nutr Hosp. 2013;28:2033-8.

135. Klek S, Hermanowicz A, Dziwiszek G, Matysiak K, Szczepanek K, Szybinski P, et al. Home enteral nutrition reduces complications, length of stay, and health care costs: results from a multicenter study. Am J Clin Nutr. 2014;100:609-15.

136. Howard P, Jonkers-Schuitema C, Furniss L, Kyle U, Muehlebach S, Odlund-Olin A, et al. Managing the patient journey through enteral nutritional care. Clin Nutr. 2006;25:187-95.

137. Attanasio A, Bedin M, Stocco S, Negrin V, Biancon A, Cecchetto G, et al. Clinical outcomes and complications of enteral nutrition among older adults. Minerva Med. 2009;100:159-66.

138. Chang SC, Huang CY, Lin CH, Tu SL, Chao MS, Chen MH. The effects of systematic educational interventions about nasogastric tube feeding on caregivers' knowledge and skills and the incidence of feeding complications. J Clin Nurs. 2015;24:1567-75.

139. Kurien M, White S, Simpson G, Grant J, Sanders DS, McAlindon ME. Managing patients with gastrostomy tubes in the community: can a dedicated enteral feed dietetic service reduce hospital readmissions? Eur J Clin Nutr. 2012;66:757-60.

140. Day T. Home enteral feeding and its impact on quality of life. Br J Community Nurs. 2017;22:S14-S6.

141. Schneider SM, Pouget I, Staccini P, Rampal P, Hebuterne X. Quality of life in long-term home enteral nutrition patients. Clin Nutr. 2000;19:23-8.

142. Wanden-Berghe C, Nolasco A, Sanz-Valero J, Planas M, Cuerda C. Health-related quality of life in patients with home nutritional support. J Hum Nutr Diet. 2009;22:219-25.

143. Martin L, Blomberg J, Lagergren P. Patients' perspectives of living with a percutaneous endoscopic gastrostomy (PEG). BMC Gastroenterol. 2012;12:126.

144. Faruquie SS, Parker EK, Talbot P. Evaluation of patient quality of life and satisfaction with home enteral feeding and oral nutrition support services: a cross-sectional study. Aust Health Rev. 2016;40:605-12.

145. Wanden-Berghe C, Nolasco A, Planas M, Sanz-Valero J, Rodriguez T, Cuerda C, et al. Health-related quality of life according to the main caregiver in patients with home nutritional support. Med Clin (Barc). 2008;131:281-4.

146. Fitzpatrick R, Davey C, Buxton MJ, Jones DR. Evaluating patient-based outcome measures for use in clinical trials. Health Technol Assess. 1998;2:i-iv, 1-74.

147. Guo Z, Wu R, Zhu W, Gong J, Zhang W, Li Y, et al. Effect of exclusive enteral nutrition on health-related quality of life for adults with active Crohn's disease. Nutr Clin Pract. 2013;28:499-505.

148. Stevens CS, Lemon B, Lockwood GA, Waldron JN, Bezjak A, Ringash J. The development and validation of a quality-of-life questionnaire for head and neck cancer patients with enteral feeding tubes: the QOL-EF. Support Care Cancer. 2011;19:1175-82.

149. Apezetxea A, Carrillo L, Casanueva F, Cuerda C, Cuesta F, Irles JA, et al. The NutriQoL® questionnaire for assessing health-related quality of life (HRQoL) in patients with home enteral nutrition (HEN): validation and first results. Nutr Hosp. 2016;33:1260-7.

150. Cuerda MC, Apezetxea A, Carrillo L, Casanueva F, Cuesta F, Irles JA, et al. Development and validation of a specific questionnaire to assess health-related quality of life in patients with home enteral nutrition: NutriQoL((R)) development. Patient Prefer Adherence. 2016;10:2289-96.

151. National Collaborating Centre for Acute Care (NICE). Nutrition support for adults: oral nutrition support, enteral tube feeding and parenteral nutrition. 2006.

152. Dinenage S, Gower M, Van Wyk J, Blamey A, Ashbolt K, Sutcliffe M, et al. Development and evaluation of a home enteral nutrition team. Nutrients. 2015;7:1607-17.

153. Green S, Dinenage S, Gower M, Van Wyk J. Home enteral nutrition: organisation of services. Nurs Older People. 2013;25:14-8.

154. Landeiro MJ, Peres HH, Martins TV. Evaluation of the educational technology "Caring for dependent people" by family caregivers in changes and transfers of patients and tube feeding. Rev Lat Am Enfermagem. 2016;24:e2774.

155. Morton K, Goodacre L. An exploration of the impact of home enteral tube feeding on the eating habits of the partners of adults receiving home enteral tube feeding. J Hum Nutr Diet. 2008;21:397-.

156. Majka AJ, Wang Z, Schmitz KR, Niesen CR, Larsen RA, Kinsey GC, et al. Care coordination to enhance management of long-term enteral tube feeding: a systematic review and meta-analysis. JPEN J Parenter Enteral Nutr. 2014;38:40-52.

Figure legends

Fig. 1. Main structure of the ESPEN practical guideline: Home enteral nutrition (HEN). The guideline consists of five chapters presented in Figures 2-18. For details see text.

Fig. 2. Indication and contraindication for home enteral nutrition. Abbreviations: HEN, home enteral nutrition; QoL, quality of life.

Fig. 3. Access devices for home enteral nutrition (HEN) – an overview.

Fig. 4. Access devices for short-term and long-term home enteral nutrition. Abbreviations: HEN, home enteral nutrition; PEG, percutaneous radiological gastrostomy; PEJ, percutaneous endoscopic jejunostomy; PLAG, percutaneous laparoscopic assisted gastrostomy; PRG, percutaneous radiological gastrostomy; RIG, radiologically inserted gastrostomy.

Fig. 5. Handling of tubes, exit sites, and consumables – nursing aspects. Abbreviations: see Fig. 4.

Fig. 6. Handling of tubes, exit sites, and consumables – complications. Abbreviations: see Fig. 4.

Fig. 7. Prerequisites for start and timing of home enteral nutrition. Abbreviations: EN, enteral nutrition; others see Fig. 4.

Fig. 8. Administration of home enteral nutrition. Abbreviations: NST, nutrition support team; others see Fig. 4.

Fig. 9. Drug administration via feeding tube. Abbreviations: EN, enteral nutrition; others see Fig. 4.

Fig. 10. Products recommended for home enteral nutrition (HEN).

Fig. 11. Monitoring and termination of home enteral nutrition – an overview. Abbreviations: HEN, home enteral nutrition; QoL, quality of life.

Fig. 12. Monitoring and termination of home enteral nutrition – when and how? Abbreviations: EN, enteral nutrition; HEN, home enteral nutrition.

Fig. 13. Termination of home enteral nutrition (HEN).

Fig. 14. Monitoring and termination of home enteral nutrition – Management of complications. Abbreviations: EN, enteral nutrition; HEN, home enteral nutrition.

Fig. 15. Monitoring and termination of home enteral nutrition – Assessment of QoL. Abbreviations: HEN, home enteral nutrition; QoL, quality of life.

Fig. 16. Structural requirements to perform home enteral nutrition – an overview. Abbreviations: HEN, home enteral nutrition; NST, nutrition support team.

Fig. 17. Structural requirements – Education and nutrition support team. Abbreviations: HEN, home enteral nutrition; NST, nutrition support team.

Fig. 18. Structural requirements – Infrastructure. Abbreviations: EN, enteral nutrition; HEN, home enteral nutrition).