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Enteral feeding methods for nutritional management in patients with head and neck cancers being treated with radiotherapy and/or chemotherapy (Review)

Nugent B, Lewis S, O'Sullivan JM

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[Intervention Review]

Enteral feeding methods for nutritional management in patients with head and neck cancers being treated with radiotherapy and/or chemotherapy

Brenda Nugent¹, Sian Lewis², Joe M O'Sullivan³

¹Department of Nutrition and Dietetics, Belfast Health and Social Care Trust, Northern Ireland Cancer Centre, Belfast, UK. ²Department of Nutrition and Dietetics, Velindre Cancer Centre, Cardiff, UK. ³Centre for Cancer Research and Cell Biology, Queen's University of Belfast and the Northern Ireland Cancer Centre, Belfast, UK

Contact address: Brenda Nugent, Department of Nutrition and Dietetics, Belfast Health and Social Care Trust, Northern Ireland Cancer Centre, Belfast City Hospital, Lisburn Road, Belfast, Northern Ireland, BT9 7AB, UK. Brenda.nugent@belfasttrust.hscni.net.

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ABSTRACT

Background

This is an update of a Cochrane review first published in *The Cochrane Library* in Issue 3, 2010.

For many patients with head and neck cancer, oral nutrition will not provide adequate nourishment during treatment with radiotherapy or chemoradiotherapy due to the acute toxicity of treatment, obstruction caused by the tumour, or both. The optimal method of enteral feeding for this patient group has yet to be established.

Objectives

To compare the effectiveness of different enteral feeding methods used in the nutritional management of patients with head and neck cancer receiving radiotherapy or chemoradiotherapy using the clinical outcomes, nutritional status, quality of life and rates of complications.

Search methods

Our extensive search included the Cochrane ENT Group Trials Register, CENTRAL, PubMed, EMBASE, CINAHL, AMED and ISI Web of Science. The date of the most recent search was 13 February 2012.

Selection criteria

Randomised controlled trials comparing one method of enteral feeding with another, e.g. nasogastric (NG) or percutaneous endoscopic gastrostomy (PEG) feeding, for adult patients with a diagnosis of head and neck cancer receiving radiotherapy and/or chemoradiotherapy.

Data collection and analysis

Two authors independently assessed trial quality and extracted data using standardised forms. We contacted study authors for additional information.

Main results

One randomised controlled trial met the criteria for inclusion in this review. No further studies were identified when we updated the searches in 2012.

Patients diagnosed with head and neck cancer, being treated with chemoradiotherapy, were randomised to PEG or NG feeding. In total only 33 patients were eligible for analysis as the trial was terminated early due to poor accrual. A high degree of bias was identified in the study.

Weight loss was greater for the NG group at six weeks post-treatment than for the PEG group ($P = 0.001$). At six months post-treatment, however, there was no significant difference in weight loss between the two groups. Anthropometric measurements recorded six weeks post-treatment demonstrated lower triceps skin fold thickness for the NG group compared to the PEG group ($P = 0.03$). No statistically significant difference was found between the two different enteral feeding techniques in relation to complication rates or patient satisfaction. The duration of PEG feeding was significantly longer than for the NG group ($P = 0.0006$). In addition, the study calculated the cost of PEG feeding to be 10 times greater than that of NG, though this was not found to be significant. There was no difference in the treatment received by the two groups. However, four PEG fed patients and two NG fed patients required unscheduled treatment breaks of a median of two and six days respectively.

We identified no studies of enteral feeding involving any form of radiologically inserted gastrostomy (RIG) feeding or comparing prophylactic PEG versus PEG for inclusion in the review.

Authors' conclusions

There is not sufficient evidence to determine the optimal method of enteral feeding for patients with head and neck cancer receiving radiotherapy and/or chemoradiotherapy. Further trials of the two methods of enteral feeding, incorporating larger sample sizes, are required.

PLAIN LANGUAGE SUMMARY

Artificial tube feeding methods for use with patients with head and neck cancer who are receiving treatment with radiotherapy, chemotherapy or both

Patients with cancer of the head and neck are at risk of malnutrition during radiotherapy treatment due to the side effects of this treatment and they may need tube feeding to meet their nutritional needs.

Tube feeding can either be delivered via a nasogastric feeding tube, which is a fine tube inserted through the nose into the stomach, or a gastrostomy tube which is inserted through the skin of the abdomen directly into the stomach. Both of these methods allow the delivery of nutrients directly into the stomach.

Tube feeding is essential to meet the nutritional needs of head and neck cancer patients as malnutrition can lead to a poorer prognosis for this patient group. There is debate over which method of tube feeding provides the most benefit to the patient for outcomes such as nutritional benefit and quality of life, as well as avoiding delays in radiotherapy treatment.

Following our analysis of the available literature, only one clinical trial was eligible to be included in this review. The authors of this review found no evidence to support the use of any one method of tube feeding over another.

BACKGROUND

Description of the condition

This is an update of a Cochrane review first published in *The Cochrane Library* in Issue 3, 2010.

Head and neck cancer is the term used to describe a variety of malignant tumours which can develop in the upper aero-digestive tract, including cancers of the lip, oral cavity, tongue, salivary glands, pharynx, larynx, nasal cavity, ear and skull base (Semple 2004). It is estimated that between 80% and 90% of these tumours are squamous cell carcinomas (Devlin 2005; Semple 2004; Specht 2002).

There are approximately 372,000 new cases per year globally, accounting for 5.1% of all new cancers annually (Ferlay 2008). Most new cases predominantly occur in men, especially after 50 years of age (Ridge 2011). However, due to the recent increase in the incidence of human papillomavirus (HPV), which is associated with oral cancer, there has been a shift towards younger individuals, with both men and women being at equal risk (Fakhry 2006).

Alcohol and tobacco use are known risk factors in the development of head and neck cancers. The alcohol use commonly seen in this patient group also contributes to nutritional problems by providing 'empty calories' devoid of essential nutrients, which suppress appetite resulting in the risk of malnutrition (Beaver 1998; Hunter 1996; Kubrack 2010; Lees 1999). Cancer of the head and neck can also physically impede the intake of food and fluid through physical obstruction to swallowing, odynophagia (pain on swallowing) or trismus (inability to open the mouth normally). Malnutrition can also be caused by the effect of the cancer itself, through cancer cachexia (Cravo 2000). This patient group may receive multi-modality treatments which can include surgery, radiotherapy and chemotherapy with the aim being to cure the patient and minimise functional loss as well as manage symptoms (Ehrsson 2004; Rieger 2006), however treatment toxicity can place this patient group at a further risk of malnutrition. Patients with head and neck cancer receiving radiotherapy or chemoradiotherapy are at a considerable risk of malnutrition, with 75% to 80% of patients experiencing significant weight loss during the treatment period (Hammerlid 1998; Munshi 2003; Newman 1998; Unsal 2006) with some studies having reported weight losses in the range of 15% to 20% (Ames 2011; Kubrack 2010). Radiotherapy treatment toxicities include painful mucositis, dysgeusia (altered taste), xerostomia (dry mouth), odynophagia, thickened secretions and anorexia (Ames 2011; Backstrom 1995; Beaver 1998; Harrison 2003; Marcy 2000; Lango 2010; Larsson 2005). These usually result in worsening of an already poor nutritional status. Chemotherapy may be accompanied by mucositis, nausea and vomiting, thereby impairing nutrient intake (Beaver 1998; Beer 2005; Marcy 2000; Shafman 2006; Sheldon 1999). Treatment modalities can hence decrease oral intake by physical means as well as by decreasing a patient's motivation to eat.

For many patients with head and neck cancer, oral nutrition will not provide adequate nourishment during the course of radiotherapy or chemoradiotherapy, due to side effects of treatment or physical impediment from the tumour itself. Therefore enteral feeding (tube feeding) may be appropriate (Cheng 2006). Enteral feeding refers to the delivery of nutrients directly into the stomach via a feeding tube device, such as a nasogastric feeding tube or

a gastrostomy tube (Thomas 2007). A nasogastric feeding tube is a fine tube which is inserted transnasally into the stomach. A gastrostomy is the creation of an artificial tract between the stomach and the abdominal surface. The gastrostomy tube can be placed endoscopically in a procedure known as a percutaneous endoscopic gastrostomy (PEG), or radiologically in a procedure known as a radiologically inserted gastrostomy (RIG) (Thomas 2007). A gastrostomy tube that is placed prior to treatment in anticipation of requirement is referred to as a prophylactic PEG or a prophylactic RIG.

Description of the intervention

Enteral tube feeding is used to feed patients who cannot attain an adequate oral intake from food and/or oral nutritional supplements, or who cannot eat/drink safely (NICE 2006). It can be used to provide nutritional support to the patient with head and neck cancer during and post-treatment who cannot meet their nutritional requirements due to side effects of their treatment. The tube feeding device used may be a gastrostomy tube, percutaneous endoscopic gastrostomy (PEG), radiologically inserted gastrostomy (RIG) or a nasogastric tube (NG). The PEG or RIG can be placed prior to commencement of treatment; this allows for immediate access to enteral feeding during the treatment period when required. The gastrostomy device, PEG or RIG may also be placed during the treatment period when the patient needs to be enterally fed, but this can lead to a delay in commencement of feeding. However, as nasogastric feeding is usually considered for short-term feeding for periods less than 30 days (Cannaby 2002) the NG feeding tube is generally placed during the course of treatment as required.

How the intervention might work

Optimising nutrition is an important goal during cancer treatment. It has been known for many years that adequate nutrition can improve tolerance and response rate to radiotherapy and chemoradiation, improve immune status, increase wound healing and reduce complications (NICE 2006; Williams 1989). It is also likely that good nutritional status reduces the chance of delays or gaps in treatment which can reduce the effectiveness of radiotherapy (Beer 2005).

NG tube feeding is indicated if the requirement for enteral nutrition is likely to be less than four weeks. However, the retrospective study of Baredes 2004 has shown complications such as laryngeal irritation and persistent gastroesophageal reflux in patients fed with a NG tube. Furthermore, a prospective study identified increased patient discomfort, increased risk of tube displacement and blockage when NG feeding was compared to a PEG in patients with head and neck cancer (Lees 1997). PEG feeding may be the preferred method in patients with radiation induced oral and oesophageal mucositis (Arends 2006).

Evidence from both prospective and retrospective studies indicates that PEGs may have potential advantages over NG tubes through enhanced mobility, improved quality of life and permitting the use of higher energy feeds (Gibson 1992; Lees 1997; Piquet 2002). Prophylactic PEGs (P-PEGs) have been shown to reduce mean weight loss and rate of hospitalisation during radiotherapy significantly (Beaver 2001; Lee 1998; Paccagnella 2009; Wiggenraad 2007) resulting in decreased unscheduled treatment interruptions (Beer 2005). Prospective and randomised controlled trials have

demonstrated that PEGs and NGs were equally effective at maintaining body weight (Corry 2008; Lees 1997).

Complication rates from retrospective studies of the endoscopic technique of gastrostomy placement, such as site infection, leakage around gastrostomy site, local pain, gastric erosion and interperitoneal leakage, vary greatly within all studies. A Swedish study showed that fatal or severe complications of PEG placement in head and neck cancer patients occurred in 26% of cases over two years (Ehrsson 2004). Other studies have demonstrated complication rates ranging from 4% to 70% (Baredes 2004; Chaudu 2003; Dharmarajan 2004; Lloyd 2002).

Further retrospective studies have indicated that on comparing PEG feeding with NG feeding significant dysphagia proved more persistent among the PEG patients than the NG patients at three months and at six months post-treatment (Mekhail 2001).

Patients who are NG fed are more likely to have their feeding tubes removed earlier than patients who are PEG fed (Al-Othman 2003; Corry 2008; Mekhail 2001). When compared with NG tube use, PEG placement resulted in more persistent dysphagia, perhaps because there was less incentive to participate aggressively in therapy (Mekhail 2001). This is supported by the work of Baredes 2004, where PEG tubes were reported to promote a longer period of non-oral feeding secondary to the deconditioning of the muscles of deglutition. A PEG may also produce feeding tube dependence in patients with dysphagia (Chaudu 2003).

Why it is important to do this review

Enteral tube feeding is an established means of providing nutrition for the patient with head and neck cancer during chemotherapy and or radiotherapy.

This systematic review was undertaken to elucidate the optimal method of enteral feeding in the head and neck cancer patient receiving radiotherapy and/or chemotherapy.

The feeding methods were judged by their ability to maintain nutritional status and quality of life as well as by the rate of complications.

OBJECTIVES

To assess whether different enteral feeding methods used in the nutritional management of patients with head and neck cancer receiving radiotherapy or chemoradiotherapy can influence the patient's nutritional status, quality of life and rate of complications.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials.

Types of participants

Adult patients with a diagnosis of head and neck cancer receiving radiotherapy and/or chemotherapy.

Types of interventions

Trials had to compare one method of enteral feeding with another. Combination of the methods of enteral feeding was acceptable provided one of the interventions was included in both of the arms of the study. Trials which were designed to look at a treatment intervention but include feeding methods were to be included.

Intervention comparisons could include the following.

- Prophylactic percutaneous endoscopic gastrostomy (PEG) versus nasogastric tube (NG).
- Prophylactic PEG versus PEG.
- Prophylactic PEG versus radiological inserted gastrostomy (RIG).
- Prophylactic RIG versus NG.
- Prophylactic RIG versus PEG.
- Prophylactic RIG versus RIG.
- PEG versus NG.
- PEG versus RIG.
- RIG versus NG.

Types of outcome measures

Primary outcomes

- Change in or maintenance of the nutritional status of the patient, measured by percentage body weight difference and/or anthropometry measurement changes such as triceps skin fold thickness, mid arm muscle circumference or by hand grip strength difference, during and post-treatment period.

Secondary outcomes

- Complications arising from the enteral feeding device, e.g. infection, tolerance of feeding device, death.
- Time enteral feeding device placed in relation to treatment delivered.
- Quality of life, health economics, user satisfaction of feeding device.
- Number of unscheduled treatment breaks/gaps during radiotherapy, prolongation of radiotherapy, non-completion of radiotherapy.
- Length of time (in days) enteral feeding is required.
- Reason for discontinuation of enteral feeding.

Search methods for identification of studies

We conducted systematic searches for randomised controlled trials. There were no language, publication year or publication status restrictions. We contacted original authors for clarification and further data if trial reports were unclear, and we arranged translations of papers where necessary.

Electronic searches

We searched the following databases from their inception: the Cochrane Ear, Nose and Throat Disorders Group Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2012, Issue 1), PubMed, EMBASE, CINAHL, LILACS, KoreaMed, IndMed, PakMediNet, CAB Abstracts, ISI Web of Science, BIOSIS Previews, ISRCTN, ICTRP, Google Scholar and Google. The date of the last search was 13 February 2012, following a previous search in 2009.

Subject strategies for databases were modelled on the search strategy designed for CENTRAL. Where appropriate, we combined subject strategies with adaptations of the highly sensitive search strategy designed by The Cochrane Collaboration for identifying randomised controlled trials and controlled clinical trials (as described in the *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0, Box 6.4.b. ([Handbook 2011](#))). Search strategies for key databases including CENTRAL are shown in [Appendix 1](#).

Searching other resources

We scanned reference lists of identified publications for additional trials and contacted authors if necessary. We searched PubMed, TRIPdatabase, *The Cochrane Library* and Google to retrieve existing systematic reviews possibly relevant to this systematic review, so that we could scan their reference lists for additional trials. To ensure an extensive search we contacted dietetic associations across the UK, Ireland, Europe, America, Hong Kong, Asia, Israel and Canada to request unpublished work. We contacted companies that produce enteral feeding devices to request appropriate literature.

Data collection and analysis

Selection of studies

BN and SL independently reviewed the titles and abstracts identified through the electronic search and unpublished studies to determine whether they met the inclusion criteria. Where the title and abstract did not provide adequate information, we assessed the full study and contacted the authors of the study if additional information was required for further clarification. We used specially designed data extraction forms to collect information from the studies meeting the inclusion criteria. We recorded rejected studies in the [Characteristics of excluded studies](#) table and noted the reasons for exclusion. We resolved any discrepancy in opinion in relation to the validity of any study by consensus between the three authors.

Data extraction and management

Two authors extracted data independently (BN and SL) using specially designed data extraction forms. The authors of two studies were contacted to provide information on missing or incomplete data. All differences were resolved by discussion among the review authors. Data collected were:

- number of participants;
- gender;
- diagnosis;
- stage of disease;
- treatment delivered;
- weight loss pre-treatment;
- method of feeding;
- weight difference at the end of treatment or starting weight and completion weight;
- anthropometry changes;
- complications arising from the enteral feeding device;
- placement time of enteral feeding device (in relation to treatment delivered);

- quality of life outcomes (measured on a validated tool such as 'The Functional Assessment of Cancer Therapy - Head and Neck' questionnaire);
- number of unscheduled treatment breaks during radiotherapy;
- prolongation of radiotherapy;
- non-completion of radiotherapy;
- length of time (in days) enteral feeding required;
- reason for discontinuation of enteral feed.

Time period for weight collection had to be specified. We contacted the original study investigators in relation to missing data.

Assessment of risk of bias in included studies

BN and SL undertook independent assessment of the risk of bias of the included trials as part of the data extraction process. The following were taken into consideration, as guided by the *Cochrane Handbook for Systematic Reviews of Interventions* ([Handbook 2011](#)):

- sequence generation;
- allocation concealment;
- blinding;
- incomplete outcome data;
- selective outcome reporting; and
- other sources of bias.

We used the Cochrane 'Risk of bias' tool in RevMan 5 ([RevMan 2011](#)), which involved describing each of these domains as reported in the trial and then assigning a judgement about the adequacy of each entry. This involved answering a pre-specified question whereby a judgement of 'Yes' indicated low risk of bias, 'No' indicated high risk of bias, and 'Unclear' indicated unclear or unknown risk of bias.

Assessment of heterogeneity

Statistical heterogeneity between studies was to be tested using the I^2 statistic and subgroup analyses performed. However, this was not required as there was only one study eligible for this systematic review.

Data synthesis

A meta-analysis was to be performed on appropriate data for each of the outcomes if sufficient data were available. Continuous outcome data were to be analysed using mean difference (MD) and standard mean difference (SMD). Dichotomous outcome data were to be analysed using risk ratio (RR) together with 95% confidence intervals (CIs). A random-effects model was to be used for meta-analysis. These methods were not required as only one study was eligible for this systematic review.

Subgroup analysis and investigation of heterogeneity

Potential clinical heterogeneity (through multi-modality chemoradiation treatment or single modality radiotherapy treatment) was to be explored by conducting a subgroup analysis; this was not required as only one study was eligible for this systematic review.

Sensitivity analysis

Sensitivity analysis was to involve repeating the meta-analysis with the exclusion of low quality studies; this was not required as only one study was eligible for this systematic review.

These methods will be applied should new studies be available for future updates of this review.

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#).

Results of the search

We updated the searches for the review in February 2012. A total of 149 papers were identified from these searches. After independent screening of these papers and exclusion of non-randomised studies and surgical studies, we identified two papers as potentially eligible for inclusion. On further assessment of these two papers both were excluded ([Salas 2009](#); [Silander 2012](#)) (see [Excluded studies](#) and [Characteristics of excluded studies](#)).

From the original (May 2009) searches a total of 100 papers were identified. This search also identified two papers as potentially eligible for inclusion. One study ([Lindschinger 2000](#)) was excluded and one study ([Corry 2008](#)) was included. We identified no studies involving comparison of any combination of prophylactic RIGs or RIGs with any other form of enteral feeding, or prophylactic PEG versus PEG which met the inclusion criteria for this review.

Included studies

[Corry 2008](#) was a randomised controlled trial undertaken in Australia with patients assigned to one of two groups (PEG versus NG). Thirty-three patients aged over 18 years and undergoing radical radiotherapy/chemoradiation treatment were randomised to either PEG feeding (15) or NG tube feeding (18). There was a high percentage of male patients included in this study (72%) but the number of patients with stage III/IV disease was similar in both groups (95% NG and 86% PEG). The diagnosis of oropharynx cancer was disproportionately large for the PEG group compared to the NG group (67% versus 39%). The criteria used for insertion of a feeding tube were less than 50% of calculated daily nutritional requirements and/or 5 kg weight loss from commencement of treatment. On commencement of enteral feeding there was no significant difference in nutritional status between the two groups in relation to weight, upper arm circumference or triceps skin fold thickness.

The objective of this study was to compare PEG with NG tubes in terms of nutritional outcomes, complications, patient satisfaction and cost up to six months post-treatment (see [Characteristics of included studies](#)).

Excluded studies

[Salas 2009](#) was a randomised controlled study undertaken in France with patients assigned to prophylactic percutaneous gastrostomy or non-prophylactic percutaneous gastrostomy. Thirty-nine participants were enrolled into this study. As the method of providing nutrition to all of the participants in the control group the study was not defined, this study was excluded as we were unable to compare two methods of enteral feeding (see [Characteristics of excluded studies](#)).

[Silander 2012](#) was a randomised controlled study undertaken in Sweden with patients assigned to prophylactic PEG or non

prophylactic PEG. One hundred and thirty-four participants were enrolled into this study. No distinction was made between PEG or NG feeding within the control group therefore the study was excluded as we were unable to compare two methods of enteral feeding (see [Characteristics of excluded studies](#)).

[Lindschinger 2000](#) was a randomised controlled study undertaken in Austria with patients assigned to a prophylactic PEG or oral/NG feeding. Sixty-one participants were enrolled into this study. However, no distinction was made between oral and NG feeding therefore the study was excluded as again we were unable to compare the two methods of enteral feeding (see [Characteristics of excluded studies](#)).

Risk of bias in included studies

Only one study is included in this review ([Corry 2008](#)).

Allocation

Randomisation of patients was achieved through an adaptive biased coin technique.

The allocation of patients to each group, by stage of disease and treatment delivered, was well matched.

Blinding

Blinding of patients or investigators to the method of enteral feeding was not possible due to the visibility of the device.

Incomplete outcome data

Forty-two patients were originally randomised but only 33 were included in the study. The authors feel that the missing data from nine patients have a high potential to impact on the results of this study, leading to a high risk of bias.

The nine patients excluded from this study are as follows: two patients did not require enteral feeding, one from each group; one patient had a NG tube inserted instead of a PEG in error and one patient had a PEG inserted instead of a NG tube in error. A further five patients were to receive a PEG; two refused a PEG; two were surgically unfit for a PEG and one patient required nutritional support before a PEG could be inserted. This resulted in 31.8% of PEG patients not receiving the allocated treatment and 10% of NG tube patients not receiving the allocated treatment. The greatest concern regarding bias is in relation to the five patients allocated a PEG who actually received a NG tube, due to patient refusal. The authors feel that this causes bias in favour of the PEG, as two patients refusing a PEG would influence patient satisfaction. The two patients that were unfit for a PEG and the one requiring feeding before a PEG could be inserted could potentially influence the result of this study.

Selective reporting

Anthropometric outcome measurements were taken at all designated time points throughout study except at the last time point. This outcome had been used previously to judge patients' nutritional status, therefore exclusion at the final time point has the potential to lead to selective reporting bias.

Effects of interventions

Only one study (Corry 2008) met the inclusion criteria for this systematic review; all primary and secondary outcomes relate to this study.

Primary outcome

Change in or maintenance of the nutritional status of the patient

The results of this study indicated that at six weeks post-treatment the PEG fed patients had a significant beneficial weight gain compared to the NG fed patients ($P = 0.001$). However, the NG fed patients had lower tricep skin-fold thickness suggesting that NG fed patients' loss of weight was predominantly due to loss of fat. By six months post-treatment the difference in weight was no longer statistically significant.

Secondary outcomes

Complications arising from the enteral feeding device

There was no difference in chest infection rates between the two groups (27% in PEG group and 33% in NG group). Twelve NG patients experienced feeding tube dislodgement, with no tube dislodgement in the PEG group. Four of the PEG group had site infections.

Time enteral feeding device placed

The median radiation dose received before tube insertion was 54 Gray (27 days) for NG (range 26 to 70 Gray) and 50 Gray (25 days) (range 24 to 66 Gray) for PEG tube patients.

Quality of life

Quality of life was not measured.

Health economics

The cost of PEG feeding was 10 times that of NG feeding (AUS 736 versus AUS 76).

User satisfaction of feeding device

Patient satisfaction was measured using a questionnaire and there was no significant difference in patient satisfaction between the two groups.

Number of unscheduled treatment breaks/gaps during radiotherapy

Four (27%) PEG fed patients (range one to six days) and two (11%) NG patients (range one to 11 days) required a treatment break.

Length of time (in days) enteral feeding is required

The duration of PEG feeding (range 56 to 488 days) was significantly longer than for the NG group (range 23 to 136 days) ($P = 0.0006$).

Reason for discontinuation of enteral feeding

Not recorded.

DISCUSSION

This systematic review summarises the available evidence in relation to the comparison of enteral feeding devices for patients with a diagnosis of head and neck cancer receiving radiotherapy

or chemoradiotherapy. After an extensive literature search one randomised controlled trial was located. Interpretation of the findings from this study was limited due to the small recruitment number of patients (33 patients recruited; study planned to recruit 150 to give 80% power at a significance level of 5%) and bias was established through missing data. Additionally, no consideration was given to the fact that the distribution of tumour sites was different in each of the two groups which may impact on the interpretation of the results, especially in relation to the duration of enteral feeding.

Due to the bias identified within the included study no recommendations can be provided on the routine use of one method of enteral feeding device over another method.

Despite the fact that percutaneous endoscopic gastrostomy (PEG) tubes have been in use for patients with a diagnosis of head and neck cancer since the early 1990s, there is only one randomised controlled trial included in this systematic review. However, many non-randomised studies have been published, perhaps indicating difficulties in randomising this group of patients. One issue which reduced recruitment, identified by Corry 2008, was that most patients were resistant to placement of a feeding tube prior to the development of treatment side effects. This review highlights the need for proactive education of patients and carers on enteral nutrition and feeding devices. Doing so may enable quality studies to be undertaken which can produce answers to the questions around enteral feeding.

We identified no randomised controlled studies comparing prophylactic gastrostomy feeding with nasogastric (NG) feeding or prophylactic gastrostomy feeding with gastrostomy feeding.

Overall completeness and applicability of evidence

As only one study (Corry 2008) has been identified for inclusion in this review there is insufficient evidence to make recommendations for current practice.

Quality of the evidence

The evidence in this review was obtained from one study (Corry 2008) and due to incomplete outcome data and selective reporting this study has been given a low quality rating.

Potential biases in the review process

Every effort was made to identify relevant studies, including contacting Dietetic Associations worldwide and companies that produce enteral feeding devices for unpublished work. Although no non-English studies were excluded due to language, bias may have occurred through Dietetic Associations not having translated our original requests for information and hence members of their association may not have been aware of our request for unpublished work.

AUTHORS' CONCLUSIONS

Implications for practice

For patients with a diagnosis of head and neck cancer receiving radiotherapy and/or chemoradiotherapy there is no conclusive evidence on which to base recommendations for the optimal method of enteral feeding during treatment and in the post-treatment period. More research is required in this field.

Implications for research

This systematic review emphasises the need for continuing research in the area of enteral feeding of the patient with head and neck cancer receiving radiotherapy and/or chemotherapy. However, recruitment of these patients into randomised trials may remain an issue, as demonstrated by [Corry 2008](#), as most patients are resistant to the idea of a feeding tube in general, particularly before they develop nutritional problems.

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CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Corry 2008

Methods	Randomised controlled trial with patients assigned to 1 of 2 groups (PEG versus NG)
Participants	33 participants (15 received a PEG and 18 a NG); 24 male; all participants aged > 18 years
Interventions	PEG feeding during treatment or NG feeding during treatment; both devices placed during treatment period
Outcomes	<ul style="list-style-type: none"> Change in nutritional status determined by weight change and anthropometric changes Complications from feeding device, mortality, chest infection and tube dislodgement Health economics Patient satisfaction with feeding device

Corry 2008 (Continued)

- Unscheduled treatment breaks
- Length of time enteral feeding required

Notes

—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Adaptive biased coin technique
Allocation concealment (selection bias)	Low risk	Adaptive biased coin technique
Blinding (performance bias and detection bias) Self reported outcomes	High risk	Unable to blind as intervention visible
Blinding (performance bias and detection bias) Objective outcomes	High risk	Unable to blind as intervention visible
Incomplete outcome data (attrition bias) All outcomes	High risk	Originally 42 patients were randomised, but only 33 patients were reported on in this study
Selective reporting (reporting bias)	High risk	At 6 weeks post-treatment the tricep skin-fold thickness was used to determine nutritional status, yet was not considered at 6 months post-treatment. Time points for measuring outcomes were at 6 weeks and 6 months post-treatment, yet the initial starting point was at initiation of enteral feeding. This means that the time scale/time period over which the outcomes are collected will all vary. Quality of life/patient satisfaction form completed over varying time scale for each individual, e.g. when enteral tube removed or at 6 weeks but not at 6 months post-treatment.
Other bias	Unclear risk	—

NG: nasogastric tube

PEG: percutaneous endoscopic gastrostomy

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Lindschinger 2000	<p>ALLOCATION: Patients were prospectively randomised to prophylactic PEG - no detail given on allocation</p> <p>PARTICIPANTS: 47 participants with a diagnosis of cancer of the larynx and pharynx (26 received a prophylactic PEG and 21 were placed into the non-PEG group). Gender and age of patients in this study was not detailed.</p> <p>INTERVENTIONS: 1. One arm of study prophylactic PEG 2. Other arm of study did not distinguish between oral and NG feeding</p>

Study	Reason for exclusion
Salas 2009	<p>ALLOCATION:</p> <p>Patients were prospectively randomised to prophylactic percutaneous gastrostomy - allocation was achieved via a computer-generated randomised list using a permuted block design</p> <p>PARTICIPANTS:</p> <p>39 participants with a diagnosis of squamous cell head and neck cancer (21 received prophylactic percutaneous gastrostomy and 18 were placed in the non-prophylactic percutaneous gastrostomy group). No differences in terms of clinical status or socio-demographic features were found between the 2 groups.</p> <p>INTERVENTIONS:</p> <p>1. One arm of study: prophylactic percutaneous gastrostomy</p> <p>2. Other arm of study: 13 participants had a gastrostomy placed during study and remaining 5 participants did not have a gastrostomy placed during study</p>
Silander 2012	<p>ALLOCATION:</p> <p>Patients were prospectively randomised to prophylactic PEG - allocation was achieved via a computer-based randomisation algorithm</p> <p>PARTICIPANTS:</p> <p>134 participants with a newly diagnosed untreated, pharyngeal or oral cancer, or malignant neck nodes with unknown primary of stage III or IV. 64 received prophylactic PEG and 70 were placed in the non-prophylactic PEG group. No significant differences in patient characteristics were found between the study group and the control group.</p> <p>INTERVENTIONS:</p> <p>1. One arm of study: prophylactic PEG</p> <p>2. Other arm of study: participants were enterally fed via PEG and NG plus 19 participants did not use enteral feeding</p>

NG: nasogastric tube

PEG: percutaneous endoscopic gastrostomy

APPENDICES

Appendix 1. Search strategies

CENTRAL	PubMed	EMBASE (Ovid)
#1 MeSH descriptor Head and Neck Neoplasms explode all trees #2 MeSH descriptor Otorhinolaryngologic Neoplasms explode all trees #3 ((head OR neck OR oropharyn* OR pharyn* OR laryn* OR throat OR ear OR glotti* OR nasopharyn* OR hypopharyn*) NEAR (cancer* OR carcinom* OR tumor* OR tumour* OR neoplas* OR malignan* OR metasta*))	#1 "Head and Neck Neoplasms"[Mesh] #2 "Otorhinolaryngologic Neoplasms"[Mesh] #3 ((head OR neck OR oropharyn* OR pharyn* OR laryn* OR throat OR EAR OR glotti* OR nasopharyn* OR hypopharyn*) AND (cancer* OR carcinom* OR tumor* OR tumour* OR neoplas* OR malignan* OR metasta*))	1 exp "head and neck tumor"/ 2 ((head or neck or oropharyn* or pharyn* or laryn* or throat or EAR or glotti* or nasopharyn* or hypopharyn*) and (cancer* or carcinom* or tumor* or tumour* or neoplas* or malignan* or metasta*)).tw. 3 ((head and neck and surg*) or (head and neck and operat*) or (neck

(Continued)

#4 ((head NEAR neck NEAR surg*) OR (head NEAR neck NEAR operat*) OR (neck NEAR dissect*) OR laryngectom* OR pharyngectom*)
#5 hnscc
#6 (#1 OR #2 OR #3 OR #4 OR #5)
#7 MeSH descriptor Antineoplastic Combined Chemotherapy Protocols explode all trees
#8 MeSH descriptor Chemotherapy, Cancer, Regional Perfusion explode all trees
#9 MeSH descriptor Chemotherapy, Adjuvant explode all trees
#10 MeSH descriptor Radiotherapy explode all trees
#11 MeSH descriptor Radiotherapy, Adjuvant explode all trees
#12 (chemotherap* OR chemorad* OR radiochem* OR radiotherap* OR radiation)
#13 (#7 OR #8 OR #9 OR #10 OR #11 OR #12)
#14 MeSH descriptor Enteral Nutrition explode all trees
#15 MeSH descriptor Gastrostomy explode all trees
#16 ((enter* OR nasogastric OR NG) AND (feed* OR nutrition* OR immunonutrition* OR tube*))
#17 (gastrostom* OR PEG OR RIG OR PPEG)
#18 (#14 OR #15 OR #16 OR #17)
#19 (#6 AND #13 AND #18)

#4 ((head AND neck AND surg*) OR (head AND neck AND operat*) OR (neck AND dissect*) OR laryngectom* OR pharyngectom*)
#5 hnscc
#6 #1 OR #2 OR #3 OR #4 OR #5
#7 "Antineoplastic Combined Chemotherapy Protocols"[Mesh]
#8 "Chemotherapy, Cancer, Regional Perfusion"[Mesh]
#9 "Chemotherapy, Adjuvant"[Mesh]
#10 "Radiotherapy"[Mesh]
#11 "radiotherapy"[Subheading]
#12 "Radiotherapy, High-Energy"[Mesh]
#13 "Radiotherapy, Adjuvant"[Mesh]
#14 (chemotherap* OR chemorad* OR radiochem* OR radiotherap* OR radiation)
#15 #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14
#16 "Enteral Nutrition"[Mesh]
#17 "Gastrostomy"[Mesh]
#18 ((enter* OR nasogastric OR NG) AND (feed* OR nutrition* OR immunonutrition* OR tube*))
#19 (gastrostom* OR PEG OR RIG OR PPEG)
#20 #16 OR #17 OR #18 OR #19
#21 #6 AND #15 AND #20

and dissect*) or laryngectom* or pharyngectom*).tw.
4 hnscc.tw.
5 4 or 1 or 3 or 2
6 exp chemotherapy/
7 exp Radiotherapy/
8 exp cancer radiotherapy/
9 (chemotherap* or chemoradio* or radiochem* OR radiotherap* or radiation).tw.
10 8 or 6 or 7 or 9
11 10 and 5
12 Enteric Feeding/
13 gastrostomy/ or percutaneous endoscopic gastrostomy/
14 (enter* or nasogastric or NG).tw.
15 tube feeding/
16 (feed* or nutrition* or immunonutrition* or tube*).tw.
17 16 or 15
18 17 and 14
19 (gastrostom* or PEG or RIG or PPEG).tw.
20 18 or 19 or 13 or 12
21 11 and 20

CINAHL (EBSCO)	ISI Web of Science/BIOSIS Previews	CAB Abstracts (Ovid)
<p>S1 (MH "Head and Neck Neoplasms") S2 (MH "Otorhinolaryngologic Neoplasms") S3 TX (head OR neck OR oropharyn* OR pharyn* OR laryn* OR throat OR EAR OR glotti* OR nasopharyn* OR hypopharyn*) and TX (cancer* OR carcinom* OR tumor* OR tumour* OR neoplas* OR malignan* OR metasta*) S4 TX head and TX neck and TX surg* S5 TX head and TX neck and TX operat* S6 TX neck and TX dissect* S7 TX laryngec* or TX pharyngec* or TX hnscc S8 S1 or S2 or S3 or S4 or S5 or S6 or S7 S9 TX chemotherap* OR chemorad* OR radiochem* OR radiotherap* OR radiation S10 S8 and S9 S11 (MH "Enteral Nutrition") S12 (MH "Gastrostomy") S13 TX (enter* OR nasogastric OR NG) and TX (feed* OR nutrition* OR immunonutrition* OR tube*) S14 TX gastrostom* OR PEG OR RIG OR PPEG S15 S11 or S12 or S13 or S14 S16 S10 and S15</p>	<p>#1 TS=((head OR neck OR oropharyn* OR pharyn* OR laryn* OR throat OR ear OR glotti* OR nasopharyn* OR hypopharyn*) NEAR (cancer* OR carcinom* OR tumor* OR tumour* OR neoplas* OR malignan* OR metasta*)) #2 TS=((head NEAR neck NEAR surg*) OR (head NEAR neck NEAR operat*) OR (neck NEAR dissect*) OR laryngectom* OR pharyngectom*) #3 TS=hnscc #4 #3 OR #2 OR #1 #5 TS=(chemotherap* OR chemorad* OR radiochem* OR radiotherap* OR radiation) #6 #4 AND #5 #7 TS=((enter* OR nasogastric OR NG) AND (feed* OR nutrition* OR immunonutrition* OR tube*)) #8 TS=(gastrostom* OR PEG OR RIG OR PPEG) #9 #8 OR #7 #10 #9 AND #6</p>	<p>1 ((head or neck or oropharyn* or pharyn* or laryn* or throat or EAR or glotti* or nasopharyn* or hypopharyn*) and (cancer* or carcinom* or tumor* or tumour* or neoplas* or malignan* or metasta*).tw. 2 ((head and neck and surg*) or (head and neck and operat*) or (neck and dissect*) or laryngectom* or pharyngectom*).tw. 3 hnscc.tw. 4 1 or 3 or 2 5 exp chemotherapy/ 6 exp Radiotherapy/ 7 (chemotherap* or chemoradio* or radiotherap* or radiation).tw. 8 5 OR 6 OR 7 9 4 AND 8 10 (enter* or nasogastric or NG).tw. 11 tube feeding/ 12 (feed* or nutrition* or immunonutrition* or tube*).tw. 13 11 OR 12 14 10 AND 13 15 (gastrostom* or PEG or RIG or PPEG).tw. 16 14 OR 15</p>

(Continued)

17 9 AND 16

WHAT'S NEW

Date	Event	Description
3 December 2012	New citation required but conclusions have not changed	We identified no further studies which met the criteria for inclusion in the review. Two further studies were excluded, with reasons. There are no changes to the conclusions of the review.
13 February 2012	New search has been performed	New searches run.

CONTRIBUTIONS OF AUTHORS

- Co-ordination of this review was undertaken by BN.
- Draft protocol undertaken by BN and JMOS.
- Study selection was independently undertaken by BN and SL.
- Organising retrieval of papers was carried out by BN and SL.
- Writing to authors of papers for additional information, and obtaining and screening data on unpublished studies, was undertaken by BN and SL.
- Entering data into RevMan was undertaken by BN.
- Analysis and interpretation of data was undertaken by BN, SL and JMOS.
- Writing the review was undertaken by BN, SL and JMOS.
- Providing general advice on the review - BN.

DECLARATIONS OF INTEREST

None known.

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Internal sources

- No sources of support supplied

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INDEX TERMS

Medical Subject Headings (MeSH)

*Chemoradiotherapy; Enteral Nutrition [*methods]; Gastrostomy [*methods]; Head and Neck Neoplasms [*therapy]; Intubation, Gastrointestinal [*methods]; Nutritional Status; Randomized Controlled Trials as Topic

MeSH check words

Adult; Humans