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Author/s:

McGrath, KH;Hardikar, W

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# Gastrostomy tube use in children with cancer

Kathleen H McGrath, FRACP, MBBS, BSc(Med)<sup>1,2</sup> (corresponding author)

Winita Hardikar, PhD, FRACP, MBBS<sup>1,3</sup>

<sup>1</sup>Department of Gastroenterology and Clinical Nutrition, The Royal Children's Hospital, Melbourne, Australia.

<sup>2</sup>Intestinal Failure and Clinical Nutrition Group, Murdoch Children's Research Institute, Melbourne, Australia.

<sup>3</sup>Department of Paediatrics, University of Melbourne, Australia

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## Abbreviations key:

Abbreviation	Full term or phrase
GT	Gastrostomy tube
NGT	Nasogastric tube
EN	Enteral nutrition

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**Corresponding Author:**

Dr Kathleen H McGrath, FRACP, MBBS, BSc(Med)  
Department of Gastroenterology and Clinical Nutrition  
The Royal Children's Hospital, Parkville, VIC 3052, Australia  
Email: [mcgrath.kathleen@gmail.com](mailto:mcgrath.kathleen@gmail.com)  
Phone: +44 756 324 9769

**Abstract**

Children with cancer are at risk of malnutrition which can impair critical childhood processes of growth and development and contribute to poor health outcomes. Enteral nutrition can effectively ameliorate malnutrition or weight loss in children with cancer, however published nutrition support algorithms contain minimal specific information on gastrostomy tube use and current literature is limited. Decisions about gastrostomy tube insertion in children with cancer can be challenging. Consideration of gastrostomy tube insertion is only appropriate in children with long term dependence on enteral nutrition, particularly when nasogastric tube insertion is predicted or proven to be problematic. Specific indications for patient selection are unclear and referring clinicians may be unaware of important absolute and relative contraindications. Complications are predominantly minor in nature; however reported rates are high. Morbidity must be weighed carefully against the need and anticipated duration of enteral nutrition support and further research in this area is needed.

## Introduction

All children with cancer are at risk of malnutrition, which may present at any stage from diagnosis, during treatment or into survivorship. The reported prevalence of malnutrition in children with cancer varies from 5.2 to 48%.<sup>1-4</sup> Childhood is a critical period for growth, brain development, puberty and bone formation. Malnutrition may hinder these physiological childhood processes and has been associated with poorer survival outcomes, increased morbidity, increased episodes of febrile neutropenia with bacteraemia, reduced chemotherapy tolerance and lower physical, emotional and social functioning scores for health related quality of life.<sup>3,5-9</sup> Children with malnutrition may have greater risk of long term health complications and comorbidities.<sup>10,11</sup>

Risk factors for malnutrition may be cancer-specific e.g. diagnosis of a tumour associated with high nutritional risk because of its prolonged intense treatment course, or general nutritional risk factors e.g. severe malnutrition, presence of feeding problems or poor oral intake at diagnosis, dietary restrictions or exclusions, relevant comorbid medical or behavioural problems. Identification of risk factors should prompt consideration of the need for enteral nutrition (EN). Administration of EN is a safe and effective method of reversing malnutrition and preventing further weight loss in children with cancer.<sup>12-15</sup> EN provides essential trophic factors to help maintain gastrointestinal mucosa, stimulates release of enterotrophic hormones and gastrointestinal secretions, and improves gallbladder motility.<sup>16-18</sup> EN is most commonly provided through a nasogastric tube (NGT). In some children, NGT feeding may be problematic because of mechanical obstruction, NGT intolerance / refusal, or recurrent dislodgement, and the ability to provide effective EN may

be impaired. In these children, insertion of a gastrostomy tube (GT) may have a role when long term dependence on EN is predicted or needed. Despite GT insertion being a relatively straightforward procedure, correct patient selection, detailed pre-operative assessment and consistent post-operative management is important. Implementation of a standardised clinical pathway for GT insertion has been associated with decreased utilisation of hospital resources in a general paediatric population.<sup>19</sup>

There is currently limited literature available on GT use in children with cancer and published nutrition support algorithms contain limited specific information on GT to guide clinicians with decision making.<sup>20-21</sup> This article provides a comprehensive narrative review of current literature on GT use in children with cancer and summarises key considerations for clinicians in decision-making. Improved clinician understanding of the indications, risks and management of GT can facilitate appropriate, timely selection and referral of patients and minimise further risk of malnutrition.

## **Methods**

A comprehensive literature review was performed in November 2018 of the following databases: Medline (Ovid) and Embase (Ovid). Thesaurus and / or keywords were used as follows: (exp 'Neoplasm' (MeSH term) AND ('Gastrostomy' (MeSH term) OR 'Intubation, Gastrointestinal' (MeSH term) OR 'Enteral Nutrition' (MeSH term))). Results were limited to English language and children 0-18 years of age. PubMed was searched using keywords only to retrieve E-publications and items not indexed in Medline. The Medline search strategy

was adapted for use in other databases. Additional items were identified through hand-searching of reference lists of relevant retrieved articles.

### **Indication and Insertion**

Most current literature on GT use in cancer comes from studies of adults with head and neck cancers.<sup>22-27</sup> The safety and efficacy of GT use in children with cancer has not been widely investigated but existing studies support it as an effective method of reversing malnutrition or preventing weight loss.<sup>28-31</sup>

Methods of initial GT insertion include endoscopic (percutaneous endoscopic gastrostomy - PEG) insertion, surgical open or laparoscopic placement and interventional radiological technique. Choice of technique is influenced by local resources, expertise and safety profiles.

Children should be screened for nutritional risk at the time of diagnosis and reviewed throughout periods of cancer treatment. The child's baseline nutritional state, previous feeding difficulties or dietary restrictions and any comorbid medical or behavioural problems should be assessed to determine presence of malnutrition and indications for nutritional support. Consideration should also be given to the underlying cancer diagnosis and anticipated duration, type and intensity of treatment to predict future nutritional risk or need for nutritional support and the anticipated duration of EN. Childhood cancers associated with a high nutritional risk, when EN is more likely to be required, include:

Osteosarcoma, Ewing sarcoma, high risk or pelvic rhabdomyosarcoma, high risk primitive neuroectodermal tumour, medulloblastoma or high risk brain tumours (e.g. diencephalic tumours), multiple relapsed or high risk leukaemia or lymphoma, patients undergoing Haematopoietic Stem Cell Transplant (HSCT), head and neck tumours, high risk Wilms tumour or Neuroblastoma.<sup>13,32</sup>

Options for nutrition support in children with predicted short-term requirement include oral nutritional supplements, EN given via NGT, or parenteral nutrition in the presence of a non-functional gastrointestinal tract. Consideration of GT insertion is usually only appropriate for children with predicted long term dependence on EN given the associated risks and healing time, as discussed in detail below. Long term EN is defined as greater than 3-months duration in our institution and other nutrition support algorithms,<sup>21</sup> however shorter periods (greater than 6 weeks) have been published as an appropriate threshold for considering GT insertion.<sup>20</sup>

When nutritional assessment predicts long term dependence on EN, alternative administration routes for EN should be discussed between nutritionist, oncologist, patient and parent / carer at an early stage, preferably soon after diagnosis. Older children and parents / carers should be provided with information or decision aids containing information on relevant differences between NGT and GT (Table 1) and involved in decision-making. In most instances, NGT will be appropriate and selected as the preferential route for EN administration. However, in certain circumstances NGT may be predicted to be problematic including potential mechanical obstruction of gastrointestinal tract from head and neck tumour, patient or parent / carer intolerance or refusal of NGT or predicted

recurrent dislodgement of NGT. Some patients may express strong preference for a GT over NGT e.g. adolescents concerned about the cosmetic impact of a NGT or parents concerned about deliberate dislodgement by the child. Further, NGT feeding may be initiated but prove problematic later in treatment because of recurrent NGT dislodgement by treatment induced emesis. This should prompt reconsideration of the predicted duration of EN and possible role for GT insertion.

Approaches to timing of GT insertion include proactive insertion (based on predicted nutritional risk), or reactive insertion (once malnutrition occurs, usually during cancer treatment). Both approaches have been published in the literature but study numbers and size are generally small. One study retrospectively compared reactive versus proactive PEG insertion in children with bone tumours and showed prevention of weight loss and weight stabilisation but no overall impact on height variation or significant difference in PEG tolerance and complication rates between the groups.<sup>31</sup> Another recent retrospective study showed early proactive GT insertion in children with primary bone cancer was effective for administering nutritional support and better at avoiding early deterioration in nutritional status compared with NGT EN or no EN however there was no significant difference in 4-year survival between the groups.<sup>33</sup>

### **Contraindications**

Not all patients are suitable for GT insertion. Any potential contraindications identified during the process of clinical assessment should be clearly communicated within the care team (nutrition support, oncologist) (see Table 2). The safest method of insertion may vary

with the clinical circumstances. Relevant information that should be included in initial GT referrals in children with cancer to assist decision making and scheduling, includes: cancer diagnosis, previous abdominal surgery, presence of ventriculo-peritoneal (VP) shunt, bleeding risk (current parameters for platelet count and coagulation studies), infection risk, date of most recent (if applicable) and next planned chemotherapy / radiotherapy and date of next expected neutropenia. The proceduralist will then be able to identify the safest method of insertion in order to minimise unnecessary risk.

Table 2 outlines absolute contraindications to PEG tube insertion.<sup>34</sup> In the presence of relative contraindications including previous abdominal surgery, organomegaly or kyphoscoliosis, alternative methods (e.g. surgical open or laparoscopic technique) or timing of GT insertion should be considered.<sup>34</sup>

Children with a brain tumour and ventriculo-peritoneal (VP) shunt require special consideration of increased infection risk (shunt infection, peritonitis) with GT insertion. A retrospective study of 26 GT insertions (technique unspecified) in 25 children, 11 of whom also had a VP shunt showed 1 case of shunt infection that could be attributed to GT insertion.<sup>35</sup> Another retrospective study of children with CNS tumours and VP shunts found a higher rate of VP shunt infection in those children with a GT (radiologically inserted) (4/17; 23.5%) than those without a GT (3/34; 8.8%). Most of the VP shunt infections (3/4) occurred when the GT was inserted within 6 weeks of VP shunt insertion and the authors recommend delayed GT insertion until after the acute healing phase (greater than 6 weeks) for the VP shunt.<sup>36</sup>

## Complications

Reported complications rates associated with GT insertion in children with cancer are high (60-90%)<sup>33,37-41</sup> compared with rates reported in adults with cancer (predominantly head and neck cancer).<sup>24-26, 31, 42</sup> Reports of complication rates of GT insertion in children with

cancer compared with other children (predominantly with neurological impairment) are conflicting. Some studies show no significant difference overall however others support significantly higher risk of wound infection or inflammation in children with cancer.<sup>31,34,43,44</sup>

Reported rates of major complications (fatal or resulting in major patient discomfort, repeat procedure, surgical intervention or hospitalization) vary from 7-13% and are similar between children with cancer requiring a GT and those with a non-cancer diagnosis.<sup>29,31,44</sup>

Table 3 summarises minor and major complications associated with GT, including peri-operative risks and late complications. Risks should be carefully discussed with the patient and parent / carer prior to insertion including institutional specific information when available, and weighed carefully against the need and alternative options for nutrition support.

Complications are predominantly minor in nature and may be early (within 30 days of insertion) or late (beyond 30 days of insertion). Higher complication rates have been described in younger patients.<sup>38</sup> Gastrostomy site skin infection or inflammation are the most frequently reported minor complication but the retrospective nature of studies can limit the ability to distinguish between these two entities from medical record documentation alone which can also be a challenge encountered in clinical practice.<sup>29,37,38,41,45,46</sup> Correlation between gastrostomy skin site infection or inflammation

and administration of cytostatic drugs / neutropenia is conflicting despite frequent concerns about this in clinical practice. Study numbers are frequently small, limiting ability for statistical analysis and further large cohort prospective studies are needed.<sup>31,37,43</sup> Stoma site infections have been significantly associated with malnutrition.<sup>41</sup> Antibiotic prophylaxis at insertion with classic 'pull technique' has been shown to reduce incidence of wound infection and post-operative inflammatory complications in adults.<sup>34</sup>

A recent systematic review of all paediatric populations showed a significantly higher risk of major complications in PEG compared with laparoscopically placed GT however most included studies were retrospective.<sup>47</sup> Data specific to children with cancer is limited and must be interpreted with caution. One retrospective study showed a higher rate of post-operative complications in PEG tubes (n=28) compared with openly placed GT (n=84) in children with cancer.<sup>39</sup> Another retrospective study reported a significantly higher infection rate in GT placed by open surgical technique compared with those placed endoscopically or laparoscopically.<sup>38</sup>

Button GT are not commonly used at initial insertion and there is limited evidence on their use in children with cancer. A small feasibility study of radiologically placed primary button GT in 11 children and young adults with cancer (3-20 years old) showed no major complications or short to medium term infections and minor complications in only two patients.<sup>48</sup> However, another study showed much higher rates of local infection with button GT use compared with initial GT highlighting the need for further research.<sup>40</sup>

The incidence of persistent gastrocutaneous fistula after GT removal has been reported as high as 45% in general paediatric populations, with duration since initial insertion the only reported significant predictive factor.<sup>38</sup> There are no documented rates specific to children with cancer, however the effects of malnutrition, immunosuppression and chemotherapy may all play a role in wound healing and further specific studies are needed in this population.

## Discussion

Successful administration of nutrition support therapy relies on access to multidisciplinary team support and adequate resources to engage patients, their parents / carers and reinforce understanding of the potential benefits.<sup>49,50</sup> Enteral tube feeding is commonly initiated as a reactive measure to weight loss or malnutrition, however proactive enteral tube feeding has been shown to be feasible and associated with improved nutritional outcomes,<sup>51,52</sup> reduced non-leukopenic infections in the subsequent period<sup>53</sup> and improved EN tolerance following HSCT.<sup>54</sup> There is currently inadequate evidence to conclude whether one approach is superior to the other in children with cancer and further research is needed.

Standardisation of post-operative care for GT through common clinical pathways may improve outcomes (although institutional variation in resources and preferred insertion techniques will influence local decision making).<sup>19</sup> Early post-operative education should include care of the GT, stoma and surrounding skin, need for regular GT flushes after bolus feeds or medication administration and an action plan for accidental dislodgement. Pump

training should be provided to the parent / carer if the child has not already been on NGT feeds at home and arrangements made for formula provision and equipment supplies. Administration of medications via the GT should be explained. Appropriate follow up should be scheduled with staff trained in gastrostomy care to assess for complications such as granulation tissue, local inflammation or infection. The position of the external GT flange should be closely monitored. Children with cancer may have rapid weight gain in the weeks to months following GT insertion and their stomal length may increase. When the GT appears tight, the external GT flange should be carefully loosened by trained staff to avoid excessive pressure on the skin and associated discomfort, as well as minimise tension on the internal GT flange which may be a risk factor for migration of the internal GT flange out of the stomach, a complication commonly referred to as a 'buried bumper'.

Literature specifically on the use of GT in children with cancer is limited and predominantly retrospective. The challenges of clinical research in nutrition support are inherent to this area and there is considerable variability in methodology between current studies including study population, methods of nutritional assessment, definition of malnutrition, nutritional outcomes assessed and timing and technique of GT insertion. This may limit reliability of results or capacity to apply findings to clinical practice. This review provides a summary of current literature on this topic but highlights the need for high quality studies looking at GT use in children with cancer. Future research should include prospective studies comparing outcomes (nutritional, quality of life / patient experience, cancer outcomes) in children with cancer receiving EN by GT with those receiving NGT EN. Further, different techniques of GT

insertion should be compared to enable evidence-based standardisation of care when possible.

Using the literature currently available and our experience, we have summarised key considerations for clinicians regarding GT insertion and management in children with cancer (Fig. 1). Informed understanding of the associated risks and complications by patients and their parents / carers, especially at a time where there can be 'information overload' following a new cancer diagnosis, is paramount. Future development of decision aids and written information specific for this group is important. This summary is not intended to be a strict guideline, but rather a clinical tool to highlight aspects not to be missed pre and post GT insertion in children with cancer and that may have a significant impact on safety and outcomes. It is hoped that improved understanding will assist prompt identification of suitable patients, minimise unnecessary complications / risk and facilitate timely provision of EN.

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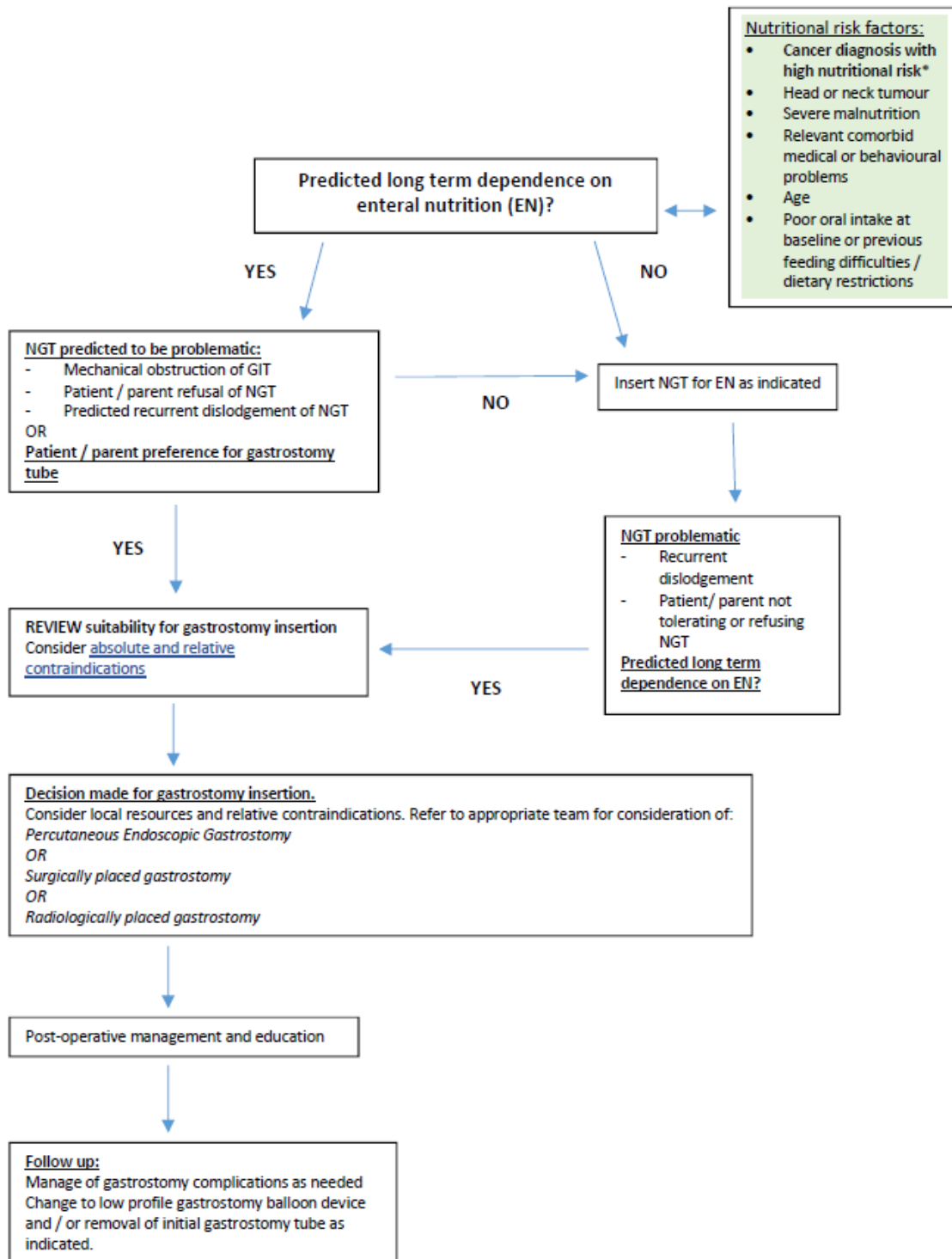
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\* Osteosarcoma, Ewing sarcoma, high risk or pelvic rhabdomyosarcoma, high risk primitive neuroectodermal tumour, medulloblastoma or high risk brain tumours, multiple relapsed or high risk leukaemia or lymphoma, patients undergoing Haematopoietic Stem Cell transplant, high risk Wilms tumour or neuroblastoma

Figure 1 Summary of key considerations for gastrostomy tube insertion and management in children with cancer.

TABLE 1 Differences between nasogastric tubes and gastrostomy tubes to discuss with patients and their parent / carer.

	Nasogastric tube	Gastrostomy tube
Insertion	Quick  Can be done at bedside or with sedation	Requires general anaesthetic for insertion
Cosmetic		Can be concealed under clothes
Dislodgement	Common with vomiting  Reinsertion may be delayed by bleeding / infection risk	Very uncommon
Complications	Mild discomfort  Uncommon and usually mild	Common but usually mild
Oral skill development		May encourage chance for oral skill development
Replacement	Common reasons include dislodgement / blockage.  Long term tubes require reinsertion every 1-2 months.	Requires general anaesthetic for removal (may change to low profile device if ongoing need for enteral nutrition)

TABLE 2 Absolute contraindications for Percutaneous Endoscopic Gastrostomy insertion in children with cancer and relative contraindications that may require consideration of different methods or timing of gastrostomy tube insertion.<sup>34</sup>

Absolute	Relative
<ul style="list-style-type: none"> <li>- Active peritonitis</li> <li>- Significant coagulopathy that cannot be corrected (INR &gt; 1.5, APPT &gt; 50, platelets &lt;50)</li> <li>- Clear interposition of enlarged organs</li> </ul>	<ul style="list-style-type: none"> <li>- Hepatosplenomegaly</li> <li>- History of oesophageal stricture</li> <li>- Active oral candidiasis</li> <li>- Active gastritis or peptic ulcer disease</li> <li>- History of large oesophageal or gastric varices</li> <li>- Active severe mucositis</li> <li>- Portal hypertension</li> <li>- Ascites</li> <li>- VP shunt</li> <li>- Peritoneal dialysis</li> <li>- Morbid obesity (&gt;95<sup>th</sup> centile)</li> <li>- Severe kyphoscoliosis</li> <li>- Previous abdominal surgery</li> <li>- Bleeding risk (liver disease, malabsorption, severe malnutrition, immunosuppression, coagulation factor deficiency)</li> </ul>

TABLE 3 Major and minor complications of gastrostomy tubes in children.

Complication
Major
Peritonitis
Perforation of bowel
Gastrocolic fistula
Aspiration
Buried bumper syndrome
Subcutaneous collection
Persistent gastrocutaneous fistula after PEG removal
Minor
Gastrostomy site skin infection or inflammation
Peristomal leakage
Granulation tissue
Mechanical problems e.g. tube blockage
Minor bleeding