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Gastrostomy Complications in Pediatric Cancer Patients: A Retrospective Single-Institution Review

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Abstract

Background—Complications in pediatric cancer patients after a gastrostomy (GT) placement have not been widely investigated. We aimed to evaluate the complication rate and nature of complications in this specific population.

Procedure—Medical records of pediatric cancer patients having a GT placed at our institution from 1998 to 2013 were retrospectively reviewed. Variables analyzed included gender, age, diagnosis, surgical procedure, GT device, duration of GT usage, absolute neutrophil count (ANC) level at surgery, and complications.

Results—One hundred seventy-one patients (92 males, 79 females), median age of 6 years (range, 0.2–21), who underwent 181 procedures (110 open, 59 endoscopic, and 12 laparoscopic) were identified. Diagnosis included central nervous system tumor ($n = 101$), solid tumor ($n = 45$), and leukemia/lymphoma ($n = 25$). A GT tube was used in 139 procedures and a GT button in 42. Median ANC level at procedure was $3,300/\text{mm}^3$ (range, 0–38,988). Median duration of GT usage was 8 months (range, 0.2–142). One hundred seventy-seven complications occurred in 106 patients (61.9%) and were categorized as perioperative (<1 month after surgery, 20.3%) and late (>1 month after surgery, 79.7%). Major complications included 42 (23.7%) GT site infections and four (2.2%) intrabdominal complications. The most common minor complication was granulation tissue (28.8%). Younger age at procedure was associated with complications ($P = 0.048$) and an open technique was associated with GT site infection ($P = 0.003$). No statistical significance was observed between complications and gender, diagnosis, GT device, duration of GT usage, and ANC at procedure.

Conclusions—Younger patients were more likely to have complications, and GT site infections were more common after open GT procedures.

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Conflict of interest: Nothing to declare.

Keywords

complications; gastrostomy; pediatric oncology

INTRODUCTION

Poor nutritional status in children with cancer is associated with increased risk of infection, impaired cell-mediated immunity, poor wound healing, decreased tolerance of chemotherapy, and a higher incidence of relapse and decreased survival [1,2]. Malnutrition rate at diagnosis in this specific population ranges from 6% to 50% and most guidelines recommend that children with cancer be screened for nutrition risk at diagnosis and during therapy. Gastrostomy (GT) feeding has become the modality of choice for providing enteral access to pediatric cancer patients who need long-term enteral nutrition and has improved the quality of life for both the child and the parents [3]. Although GT placement is a well-established procedure, it is associated with significant morbidity [4]. Perioperative and late complications in pediatric cancer patients after a GT placement have not been widely investigated. The goals of our study were to determine the overall complication rate in this specific population and to evaluate the nature and frequency of complications according to the type of malignancy, surgical technique, and GT feeding device.

METHODS**Study Participants**

A retrospective chart review of all patients with a diagnosis of cancer at St. Jude Children's Research Hospital (SJCRH) who underwent GT placement by the Department of Surgery between January 1998 and December 2013 was performed. Institutional Review Board (IRB) approval was obtained. Patients who underwent a GT placement by the Department of Interventional Radiology were excluded from this analysis.

Variable Definitions

The prognostic variables included in the analysis were gender, age at GT placement, primary cancer diagnosis, type of surgical procedure (open GT, endoscopic GT, and laparoscopic GT), type of GT device (button vs. tube), duration of GT usage, and absolute neutrophil count (ANC) level at GT placement. The outcome variable was the occurrence of a complication. GT placements performed by interventional radiology were excluded from this analysis. Primary cancer diagnosis was divided into three categories: central nervous system (CNS) tumors, solid tumors, and leukemia/lymphoma. Surgical procedures were divided into two categories: open GT versus endoscopic/laparoscopic GT. Open GT placement was performed through a supraumbilical midline incision and a double gastric purse-string suture for GT device fixation. Endoscopic GT was performed through an upper endoscopy either by "push" or "pull" technique. Laparoscopic GT was performed with one, two, or three trocars, depending on the surgeon preferences. GT device was divided into two categories: GT tube versus GT button. According to the timing, complications were categorized as perioperative complications (<1 month after surgery) and late complications (>1 month after surgery). According to the grade, complications were categorized as major

complications (GT site infection and intrabdominal complications) and minor complications (excessive granulation tissue that required treatment, stoma irritation, peristomal leakage from the stoma site, persistent gastrocutaneous (GC) fistula after GT device removal, buried bumper syndrome, tube dislodgement, tube displacement, button balloon rupture, GT obstruction, and GT rupture). GT site infection was defined by the presence of local redness, pain and/or tenderness, increased temperature at the site, swelling, and/or pus.

Statistical Analyses

Descriptive summary statistics such as mean (standard error)/median (range) for continuous variables and frequency/percentage for categorical variables were used for the preliminary and descriptive analyses. Univariate and multivariable logistic regression was conducted to study the association between complication/infection and prognostic variables.

RESULTS

Patient Demographics

Patient characteristics and outcomes are summarized in Table I. One hundred seventy-one patients, 92 males (53.8%) and 79 females (46.2%), had a GT placement at SJCRH between 1998 and 2013. The median age was 6.0 years (range, 0.2–21.0; SD 5.5 years). Primary cancer diagnosis was divided into three categories: CNS tumors (n = 101, 59%), solid tumors (n = 45, 6.3%), and leukemia/lymphoma (n = 25, 14.6%). Eighty-seven patients who underwent a GT placement by the department of interventional radiology were excluded from this analysis, which represent 33% of all GT placed at our institution in the same period of time.

Surgical Techniques and Devices

A total number of 181 gastrostomies were performed (110 open GT, 59 endoscopic GT, and 12 laparoscopic GT). A GT tube was placed in 139 procedures and a GT button in 42. Median ANC level at the time of GT placement was 3,300.0/mm³ (range, 0–38,988.0; SD 5,280/mm³). Median duration of GT usage was 8.0 months (range, 0.2–142.0; SD 17.5 months).

Complications

Table II summarizes the complications distribution. One or more complications were observed in 106 patients (61.9%) with no complications in 65 patients (38.1%). Complications were seen in 63% of the patients with CNS tumors (n = 64), 60% of the patients with solid tumors (n = 27), and 60% of the patients with leukemia/lymphoma (n = 15). A total number of 177 complications in 106 patients were recorded. According to the timing, there were 36 (20.3%) perioperative complications and 141 (79.7%) late complications. According to the grade, there were 46 (25.9%) major complications and 131 (74.1%) minor complications. GT site infection was the most common major complication observed in both periods, perioperative and late, although it was most commonly seen in late period (n = 31, 73.8%) with only 11 cases in the perioperative period. Forty-two GT site infections were recorded; 31 patients required intravenous antibiotics, seven topical antibiotics, and four oral antibiotics. Three patients required incision and drainage of

perigastrostomy site abscess and one of them had the GT tube replaced. Two of these abscesses were seen in the perioperative period and one in the late period. At the time of infection, 10 of 42 patients had ANC<500 (six late infections and four perioperative). Two intrabdominal complications (liver laceration and detachment of stomach) were observed in the open GT group, one (gastrojejunal fistula) in the endoscopic GT group and one (detachment of stomach) in the laparoscopic GT group. Median age in these four patients was 6.2 years (range, 0.9–16) and all of them required an exploratory laparotomy and surgical repair. The most common minor late complication was granulation tissue (28.8%) followed by GT site leakage (21.4%). According to the surgical technique, our study is markedly divided into two periods, open and endoscopic/laparoscopic procedures, with the latter being the most common technique (more than 70% of procedures) in the past years. In relation to the type of GT device, more complications were observed in the GT button group (64.2%) compared to the GT tube group (52.3%), with no statistical significance. Only six of our 171 patients had neutropenia (ANC < 500) at the time of the GT placement and none of them had complications.

Univariate/multiple logistic regression analyses were conducted to study the association between complications/infection and prognostic variables. The age at GT placement was a significant variable found in both univariate and multiple logistic regression analyses ($P=0.048$). Younger patients were more likely than older to have complications. No statistical significance was observed between complications, gender, and primary cancer diagnosis. The type of surgical procedure was the only significant variable associated with infection ($P=0.003$). Patients in the open GT group were more likely than patients in the endoscopic/laparoscopic GT groups to have infections. After excluding the younger patients, age was not statistically associated with infection and the type of surgical procedure. No statistical significance was observed between complications, type of device, duration of GT usage, and ANC at time of placement.

DISCUSSION

Our study has evaluated the complication rate and nature of complications in pediatric cancer patients, showing that more than half of the pediatric cancer patients (61.9%) who underwent GT placement at our institution had complications, although most of them were minor complications (74.1%). Different pediatric studies have reported a minor complications rate between 22% and 90% in children after a GT placement.[5,6] Minor complications include wound infection, granulation tissue, stoma irritation, tube dislodgement, tube splitting, leakage from the stoma site, and balloon rupture. In many reports, infection at the GT site has been included in the minor complications group, but our special population of immunocompromised patients allow us to consider it as a major event. A prior publication of 33 pediatric cancer patients from our institution showed that one or more complications occurred in 30 patients and no significant associations between insertion technique and type of complications were found.[7] Most of these complications were considered minor complications. Schmitt et al. [3] compared type and incidence of complications in 74 pediatric cancer patients and a control group of 57 patients with neurological impairment who underwent percutaneous endoscopic gastrostomy (PEG) placement. Complication rate for both groups was similar (74% vs. 72%) and most

commonly associated with GT peritubal wound-healing problems. They reported a GT site infection rate of 8% in the oncology group, which is lower than our 23.7% total infection rate. That may be related to the fact that most of our procedures were performed by an open approach (60.7%) and we found the type of surgical procedure to be the only statistically significant variable associated with infection. If we only consider our 59 patients who underwent a PEG placement, our infection rate is 13.5%. On the other hand, they reported a 13% intrabdominal complications rate (pneumoperitoneum, gastrocolic fistula, leak of gastric content), which is higher than our 2.2%. If we consider both complications, GT site infections and intrabdominal adverse events, major complication rate falls in a range of 21–25.9% in both studies.

Interestingly, we found that an increase in age at GT placement was associated with reduced likelihood of developing a complication; therefore, younger patients in our study were more likely than older to have complications. Naiditch et al. [8] reported the postoperative complications after a laparoscopic GT placement in 159 pediatric patients and found that the age at GT placement was not predictive of complications. Our finding might be explained by the fact that younger patients with cancer may be more sensitive to the cancer therapy side effects. Since immunocompromise is a common medical condition among our pediatric cancer patients, preventive strategies to avoid complications such as waiting until the ANC is normal at the time of GT placement are usually required at our institution.

A similar complication rate (between 60% and 63%) was observed in children with CNS tumors, solid tumors, and leukemia/lymphoma, and no statistical significance was observed between complications and primary cancer diagnosis.

Incidence of persistent GC fistula after a GT tube removal in children has been reported as high as 45%. Gordon et al. [9] found that the GT insertion technique and steroid use were not associated with the development of GC fistula. The only significant predictive factor was the length of time the tube was in place before its removal. They concluded that almost all sites closed when tubes were removed within 8 months of placement. Other authors have found similar results with different time frames.[10,11] El-Rifai et al. [12] reported a persistent GC fistula rate of 25% in 44 pediatric patients with a mean duration of GT placement in this series significantly longer in patients who went on to develop a GC fistula than in patients who did not develop a fistula (39 ± 19 months vs. 22 ± 23 months, respectively, $P < 0.03$). This specific issue has not been described in pediatric cancer patients, although several factors including immunocompromise and chemotherapy may play a role for GC fistula persistence. Only three patients in our study had a GC fistula that required surgical closure and this may be due to a nonprolonged median duration of GT usage in our group of patients (8 months). It is not uncommon for pediatric cancer patients to require a temporary GT to improve or maintain their nutritional status for a limited period of time during head/neck and chest radiation therapy or intensive phases of chemotherapy.

There are limitations that should be considered when evaluating our results. First, this is a cross-sectional retrospective analysis. Second, surgical techniques for GT placement have changed over the past decades. Our study encompasses a 15-year time frame and it is markedly divided in two periods, open and endoscopic/laparoscopic procedures; an open GT

was more commonly used in the first half of the time frame, while more than 70% of patients underwent an endoscopic/laparoscopic procedure in the second half. Third, 33% of GT placements at our institution were performed by the Department of Interventional Radiology in the same period of time; success rate and associated complications in this cohort of patients were not included in our study.

In summary, GT insertion in children with cancer is an established route for providing enteral nutrition, although guidelines indicating which patient should receive a GT are not well established and decisions are frequently taken on a case-by-case basis. Although generally considered safe, a significant number of minor and major complications occur during GT placement. Awareness of these complications and the use of preventive strategies can allow the pediatric surgeon to maximize outcomes and to identify complications early. From our data, we suggest that younger pediatric cancer patients are more likely than older to have complications after a GT placement. Also, open GT is more likely than endoscopic/laparoscopic GT to have GT site infections. After excluding the younger patients, age was not statistically associated with infection and the type of surgical procedure.

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Abbreviations

ANC	absolute neutrophil count
CNS	central nervous system
GC	gastrocutaneous
GT	gastrostomy
SJCRH	St. Jude Children's Research Hospital

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TABLE I

Patient Characteristics and Procedures

No. of patients	171
No. of procedures	181
Gender (n = 171)	
Male	92 (53.8%)
Female	79 (46.2%)
Age at GT placement (years)	
Mean (SE)	7.02 (5.51)
Median (min, max)	6.0 (0.2, 21.0)
Primary diagnosis (n = 171)	
CNS tumors	101 (59%)
-Medulloblastoma	32
-Astrocytoma	20
-Rhabdoid tumor	18
-Ependymoma	15
-Pineoblastoma	5
-Glioma	4
-Spinal cord tumor	3
-CNS germ cell tumor	1
-Craniopharyngioma	1
-CNS lymphoma	1
-Choroid plexus carcinoma	1
Solid tumors	45 (26.3%)
-Nasopharyngeal carcinoma	13
-Soft-tissue sarcomas	12
-Bone tumors	7
-Renal tumors	6
-Retinoblastoma	3
-Adrenal tumors	2
-GCT	1
-Liver tumors	1
Leukemia/lymphoma	25 (14.6%)
-Acute lymphocytic leukemia	11
-Acute myelocytic leukemia	8
-Hodgkin lymphoma	3
-T-lymphoblastic lymphoma	2
-Chronic myelocytic leukemia	1
ANC level at GT placement	
Mean (SE)	4,777.6 (5,280.0)
Median (min, max)	3,300.0 (0.0, 38,988.0)
Patients with ANC <500 at GT placement	6 (3.5%)

No. of patients	171
Patients with ANC >500 at GT placement	165 (96.5%)
Duration of GT usage (months)	
Mean (SE)	12.94 (17.52)
Median (min, max)	8.0 (0.2, 142.0)
Type of GT (n = 181)	
Open	110 (60.8%)
Endoscopic	59 (32.6%)
Laparoscopic	12 (6.6%)
Device type (n = 181)	
GT tube	139 (76.8%)
GT button	42 (23.2%)

ANC, absolute neutrophil count; CNS, central nervous system; GCT, germ cell tumor; GT, gastrostomy; SE, standard error.

TABLE II

Complications Distribution

Complication	Nature of complication	Episodes	Open GT	Endoscopic GT	Laparoscopic GT	GT Tube	GT Button
Major (25.9%)	GT site infection	42	33	8	1	31	11
	Detachment of stomach	2	1		1	2	
	Liver laceration	1	1			1	
	Gastrojejunal fistula	1		1			1
Minor (74.1%)	Granulation tissue	51	38	10	3	40	11
	Peristomal leakage	38	30	4	4	29	9
	Device displacement	14	4	9	1	8	6
	Stoma irritation	10	5	4	1	7	3
	Device obstruction/malfunction	10	6	4		10	
	Cracked/ruptured device	4	1	1	2	4	
	Gastrocutaneous fistula	3	2	1		2	1
	Buried bumper syndrome	1		1		1	
		177 (100%)	121 (68.3%)	43 (24.2%)	13 (7.5%)	135 (76.2%)	42 (23.8%)
Total							

GT, gastrostomy.