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Feasibility and benefit of decompressive percutaneous endoscopic gastrostomy (dPEG) in advanced cancer patients with malignant bowel obstruction

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ABSTRACT

Background and study aims Bowel obstruction is a common complication in advanced cancer patients. Patients are restricted in quality of life (QOL) due to nausea, vomiting, or abdominal pain. Prospective data on the feasibility and benefit of decompressive percutaneous endoscopic gastrostomy (dPEG) are scarce.

Patients and methods Patients suffering from symptomatic bowel obstruction due to advanced cancer were included prospectively in a single-center study when other treatments to eliminate the obstruction were impossible. Patients were given a questionnaire the day before dPEG (d-1) and, if the procedure was successful, the day after (d + 1) and 14 days after the procedure (d14). Furthermore, lifetime after dPEG was assessed.

Results 53 patients were included. dPEG was technically feasible in 34 of 53 (64.2%). Significant improvement could be shown for nausea and vomiting when comparing d-1 to d + 1 (nausea (P = 0.002), vomiting (P < 0.001)) and when comparing d-1 to d14 (P = 0.021 and P = 0.003, respectively). Comparing d + 1 to d14, there was no further improvement. QOL improved significantly from 8.1 (mean) on d-1 to 5.9 (mean) on d + 1 (P < 0.001). Median survival after successful dPEG was 27 days (range 2–353).

Conclusions dPEG is an effective method for quickly relieve symptoms of malignant bowel obstruction in advanced cancer patients. However, the technical success rate is limited and needs to be improved. Prospective studies comparing endoscopic and computed tomography-guided procedures are needed to avoid unsuccessful procedures in patients with advanced cancer and limited life expectancy.

Introduction

Bowel obstruction is a frequent complication in patients with advanced cancer, especially in patients with colorectal, ovarian, gastric or pancreatic cancer [1, 2, 3, 4]. Prevalence of malignant bowel obstruction is described in 3% to 15% of patients with gastrointestinal cancers, 20% to 50% of patients with ovarian cancer, and 10% to 29% of patients with colorectal cancer [5, 6].

Symptoms are abdominal pain, inability to eat, constipation, nausea, and vomiting. This leads to a profound worsening in

quality of life (QOL) [5]. The main noninvasive tools to alleviate these symptoms are pharmacological treatments and nasogastric tubes (NGTs). NGTs are not well tolerated, restrict QOL, and may lead to complications such as sinusitis, hemorrhage, pneumothorax, or pulmonary aspiration [7]. Pharmacological treatments alone are usually not able to overcome symptoms of mechanical obstruction sufficiently [8]. When noninvasive measures are not effective and when patients are unfit for surgery or surgery is technically impossible, decompressive percutaneous endoscopic gastrostomy (dPEG) can be performed to relieve patient symptoms and to improve QOL [9].

The aim of this prospective study was to analyze the technical feasibility and the effects of dPEG regarding symptoms such as nausea and vomiting and especially regarding QOL in patients with malignant bowel obstruction.

Patients and methods

We conducted a monocentric, prospective study in the Department of Gastroenterology in the University Hospital of Augsburg, Germany. The study was approved by the Institutional Review Board of Clinical Research, Augsburg, Germany (study ID 2020–27).

All patients who were scheduled for dPEG from April 2020 to August 2023 were asked to participate in the study. Inclusion criteria were age ≥ 18 years, advanced cancer causing symptoms of mechanical bowel obstruction such as nausea, vomiting, heartburn, or thirst and informed consent of the patients. All included patients were inpatients. The indication for dPEG was when other options to eliminate the obstruction were not possible (e. g. a surgical approach or endoscopic stenting). The primary study endpoint was improvement in symptoms and QOL. Secondary endpoints were technical success rate and complications.

Questionnaire to assess symptoms and QOL

Patients were asked to answer a questionnaire regarding common symptoms of malignant bowel obstruction on the day before dPEG was scheduled (Day -1). If dPEG was successful, patients were asked to answer the same questionnaire on the first day after dPEG (Day + 1) and 14 days after the procedure (Day 14).

If patients preferred, a close relative (i. e. husband, wife, brother, sister, or children) was asked to answer in agreement with the patient. The questionnaire requested yes or no answers to questions about symptoms such as nausea and vomiting, reflux, thirst, abdominal pain, and constipation. To assess restriction in QOL. a numeric rating scale was used, rating from 1 to 10 (1 for being not restricted at all to 10 as the worst limitation in QOL).

If patients had a NGT prior to dPEG, they were also asked about the subjective burden of the tube using a numeric rating scale from 1 to 10 (1 for no burden to 10 as maximal burden).

Furthermore, patients were asked with yes or no questions if they felt a subjective benefit after dPEG and if they would advise patients with a similar diagnosis to undergo dPEG.

The questionnaire was completed on paper by the patients. If a patient had already been discharged from hospital on Day 14, the patient was contacted by phone and asked to complete the follow up.

dPEG procedure

Endoscopy to apply dPEG was carried out with the patient in supine position using a standard gastroscope (GIF-HQ190, or GIF-EZ1500; Olympus Medical Systems, Japan). Sedation was performed with propofol alone or in combination with midazolam. When a positive transillumination could be seen through the abdominal wall, the position was marked and dPEG was performed using the "pull" method [10]. All patients received prophylactic periinterventional parenteral single-shot antibiotics. To prevent obstruction, the dPEG was flushed with 20 mL of water three to four times a day by nurses, by the patients themselves, or by relatives who had been instructed.

Adverse events (AEs) of dPEG were defined as bleeding, perforation, cardiopulmonary complications, infections (systemic and local at the abdominal entry site of the dPEG), and death. Complications were classified according to the American Society for Gastrointestinal Endoscopy classification [11].

Statistical analysis

Variables were described as counts and percentages or mean and standard deviation. McNemar test was used to compare differences before treatment and after treatment when data were nominally scaled. Wilcoxon test was used to compare the numerically scaled data. $P < 0.05$ was considered significant. Patients who died within 14 days after dPEG were excluded from the 14-day follow- up. Statistical analysis was performed using SPSS, version 28.0.

Results

Patient characteristics

From April 2020 to August 2023, 55 consecutive patients were screened. Two patients refused to participate in the study. The remaining 53 were included in this study (23 men, 30 women; mean age 63.3 years, range 28–83). Primary cancers causing the bowel obstruction are shown in ▶ **Table 1**.

Eight patients presented with gastric cancer and another patient had infiltration of the gastric wall by a colorectal cancer. In the remaining patients with CRC and all patients with pancreatic carcinomas and cholangiocellular carcinomas, no infiltration of the gastric wall was seen. Detailed information about patients with gastric cancer is given in ▶ **Table 2**. In 41 of 53 patients (77.4%), peritoneal carcinomatosis was present. Of the patients, 90.6% (48/53) had a previous treatment with one or more of the following treatment modalities: chemotherapy in 48 of 53 (90.6%), and surgery in 27 of 53 (50.9%), radiation in four of 53 (7.5%). Five of 53 patients (9.4%) had not received previous treatment because they were too unfit for therapy (4/53; 7.5%) or refused any therapy (1/53; 1.9%). Median duration from initial cancer diagnosis to the scheduled dPEG procedure was 17 months.

25 of 34 patients (73.5%) completed follow-up on D14. Six of 34 patients (17.6%) died within 14 days after dPEG. Another three patients who were discharged from the hospital could not be reached by phone.

On Day –1 and Day + 1, all patients answered the questionnaires themselves, whereas the questionnaire on Day 14 was answered by the closest relative in 52% (13/25).

Procedure characteristics

dPEG was successfully performed in 34 of 53 patients (64.2%). In 27 patients, 20F catheters were used, whereas the remaining seven patients received 15F catheters. In patients with gastric cancer, dPEG was successful in three of eight patients (37.5%) (▶ **Table 2**).

In 19 of 53 patients (35.8%), insertion of a dPEG was technically not possible. The reason was lack of sufficient transillumination in 17 of 19 (89.5%), pulmonary aspiration during the procedure in one of 19 (5.3%), and patient condition, which was judged to be too bad to perform endoscopy under sedation, in another one (5.3%).

In nine of these patients, dPEG was successfully performed under computed tomography (CT) guidance during the further course.

The remaining 10 patients did not receive a dPEG. The reason was patient refusal in seven of 10 (70 %) and unsuccessful CT-guided attempts in the remaining three.

23 of 34 patients (67.6%) with dPEG had a NGT prior to dPEG. The mean burden caused by the NGT was described as 6.3 (range 3–10).

AEs were obstruction of drainage in 35.3% (12/34). Three patients reported a high-volume loss of fluid (8.8%). One of them had to be treated in an intensive care unit due to hyponatremia (2.9%). Another three patients developed infections (8.8%). One of them presented with bacterial peritonitis (2.9%), whereas the remaining two were treated for local infections at the abdominal entry site (5.8%). In one of these two cases, dPEG had to be removed due to the inflammation, which occurred six months after the procedure. None of the patients died from procedure-related AEs.

Median survival time of patients with successfully created dPEG was 27 days (range 2 to 353 days).

To evaluate potential risk factors for failure of dPEG insertion, we evaluated the type of cancer, presence of ascites, presence of peritoneal carcinomatosis, and previous laparotomy in patients with successful and failed procedures.

Presence of ascites was the only parameter which was significantly associated with failure of dPEG ($P = 0.01$). Type of cancer (particularly gastric cancer) and previous laparotomies were not related to failure of dPEG (▶ **Table 3**).

Symptom characteristics and quality of life

When dPEG was successful, nausea, vomiting, and heartburn improved significantly on Day + 1 whereas no significant change was reported regarding abdominal pain, constipation or thirst. During the further course from Day + 1 to Day 14, no significant further improvement was seen in any parameters. Restrictions in QOL improved significantly from 8.13 to 5.89 ($P < 0.001$) from Day -1 to Day + 1, and to 4.60 on Day 14 ($P = 0.003$ for comparing the Day -1 vs. Day + 14).

On Day 14 after successful dPEG, 80.0% of patients reported a subjective benefit and 76.0% would recommend dPEG to other patients in a similar condition. The course of patient symptoms and QOL is described in detail in ▶ **Table 4**.

▶ **Table 1** Origin of cancer causing malignant bowel obstruction (n = 53) [n (%)].

Colorectal cancer	10 (19.0)
Ovarian cancer	10 (19.0)
Gastric cancer	8 (15.1)
Pancreatic cancer	8 (15.1)
Other cancers	5 (9.4)
Cholangiocarcinoma	4 (7.6)
Carcinoma of unknown primary	3 (5.7)
Breast cancer	3 (5.7)
Urinary bladder cancer	2 (3.8)

Discussion

We performed a prospective, single-center study of dPEG in patients suffering from symptomatic bowel obstruction due to advanced cancer. Study aims were to analyze technical feasibility and clinical effects of dPEG regarding symptoms such as nausea and vomiting and especially regarding QOL.

In our study, dPEG was successfully performed in 64.2% of cases. The main reason for failure of the procedure was a lack of transillumination (84.2%). Once the procedure succeeded, patients reported rapid significant improvement in nausea and vomiting and also a significant improvement in QOL already on the day after dPEG.

Success of endoscopic dPEG in patients suffering from intestinal obstruction is reported in up to 94% [8, 12, 13]. When placement of a dPEG is not feasible endoscopically (e. g. due to lack of transillumination), ultrasound can be helpful for determining the correct position of the dPEG and, therefore, it can increase the technical successful rate of the procedure [14, 15]. Another option is CT-guided gastrostomy [16]. In our prospective study, success of dPEG placement was lower compared with studies mentioned above, although procedures were carried out in the same way, all using the “pull” method. Campagnutta et al. used additional ultrasound, which may be one reason for the higher success rate of 94.1% [8]. Herman et al. described a high success rate of 89%. However, in this study, nonmalignant obstructions were included, making a comparison of the results difficult [13].

Once successful, dPEG reduces symptoms of nausea, vomiting, and heartburn significantly, as shown in the previously mentioned studies [17, 18]. An improvement in QOL is one of the main treatment goals for all patients, but especially for cancer patients without a curative treatment option and limited life

▶ **Table 2** Subgroup of patients with gastric cancer.

Patient	Cancer location	Laurén classification	Ulceration	Bleeding	Gastrectomy	dPEG feasibility
1	Corpus	Diffuse type	Yes	No	No	No
2	Antrum	Diffuse type	Yes	No	No	Yes
3	Antrum	Mixed type	Yes	Yes	No	Yes
4	Antrum	Mixed type	Yes	Yes	Distal gastrectomy	No
5	Antrum	Diffuse type	Yes	No	No	Yes
6	Corpus	Diffuse type	No	No	No	No
7	Antrum	Diffuse type	Yes	No	No	No
8	Fundus	Mixed type	Yes	No	No	No

dPEG, decompressive percutaneous endoscopic gastrostomy.

▶ **Table 3** Factors associated with technical success of dPEG.

	dPEG successful n = 34 (n%)	dPEG unsuccessful n = 19 (n%)	*P* value
Type of cancer			
Ovarian	5 (14.7%)	5 (26.3%)	0.465
Gastrointestinal*	19 (55.9%)	11 (57.9%)	1.000
Others	10 (29.4%)	3 (15.8%)	0.334
Cancer characteristics			
Peritoneal carcinomatosis	24 (70.6%)	17 (89.5%)	0.174
Ascites	21 (61.8%)	18 (94.7%)	0.01
Previous laparotomy†	25 (73.5%)	13 (68.4%)	0.756

*Gastric cancer, colorectal cancer, pancreatic cancer and cholangiocellular carcinoma.
†Any laparotomy, not necessarily cancer-related.
dPEG, decompressive percutaneous endoscopic gastrostomy.

expectancy. Previous studies could demonstrate an improvement in QOL after successful dPEG [19, 20, 21]. Zucchi et al. reported an improvement in global QOL after dPEG, using the Symptom Distress Scale of McCorkle and Young, which includes patient physical and psychological distress symptoms. 64 % of patients reported an improved QOL seven days after dPEG [19]. Our study confirmed these effects. Nausea and vomiting improved significantly on the day after dPEG with no significant further improvement up to Day 14 after dPEG. The rapid improvement in QOL is underscored by patient answers to the questionnaire in our study. 80 % of patients reported a subjective benefit and would recommend dPEG to other patients in similar conditions.

Beyond symptom relief, a further positive effect of dPEG is the fact that a NGT can be avoided. NGTs are commonly not well tolerated and can lead to complications over the long term [8, 22]. Restriction in QOL by NGTs was also confirmed by our patients. Most patients had a NGT prior to dPEG and reported a significant burden caused by the tube.

AEs were obstruction of the catheter (35.3%), high-volume loss of fluids (8.8%), and infections (8.8%).

The frequency of AEs associated with dPEG in our study is in line with previous studies. Obstruction of the catheter, parastomal leakage, and infections were shown to be the most frequent AEs [13, 17, 18, 19, 23]. The total number of AEs in our study is comparable to a rate up to 15% reported by Holm et al. in a large review [22]. One reason for the low peristomal infection rate might be the short median survival of 27 days in our study. Other studies had reported a median survival from 1 to 3 months [24]. Moderate to severe AEs occurred in three cases in our study (peritonitis requiring antibiotics, high-volume fluid loss with consecutive hyponatremia requiring treatment on an intensive care unit, and infection of the dPEG channel requiring removal of the catheter). No procedure-related mortality was seen.

▶ **Table 4** Course of patient symptoms and quality of life after dPEG.

Parameter	Day -1 n = 34 (n%)	Day + 1 n = 34 (n%)	Day 14 n = 25 (n%)	*P* value (Day -1 versus Day + 1)	*P* value (Day + 1 versus Day 14)
Ability to eat solid food (n; %)	6 (17.6%)	4 (11.8%)	1 (4.0%)	1	0.25
Nausea (n; %)	18 (52.9%)	5 (14.7%)	4 (16.0%)	0.002	1
Vomiting (n; %)	21 (61.8%)	3 (8.8%)	3 (12.0%)	< 0.001	1
Heartburn (n; %)	12 (35.3%)	3 (8.8%)	0	0.016	0.5
Abdominal pain (n; %)	17 (50.0%)	18 (52.9%)	4 (16.0%)	0.727	0.07
Constipation (n; %)	18 (52.9%)	11 (32.4%)	7 (28.0%)	1	1
Thirst (n; %)	16 (47.1%)	12 (35.3%)	4 (16.0%)	0.508	1
Quality of life (1–10)* (mean, range)	8.13 (1–10)	5.89 (1–10)	4.60 (1–10)	< 0.001	0.059
Subjective benefit of dPEG (n; %)	n.a.	21 (61.8%)	20 (80.0%)	n.a.	n.a.
Patients who would recommend dPEG to other patients in similar conditions (n; %)	n.a.	21 (67.6%)	19 (76.0%)	n.a.	n.a.

*Quality of life according to a numerous rating scale from 1 to 10 (1 for being not restricted at all to 10 as the worst limitation in QOL).
dPEG, decompressive percutaneous endoscopic gastrostomy.

Our study has several limitations. One is the small number of patients. Another limitation is the fact that the Day 14-follow-up data had to be obtained by relatives in 52% of the patients because the patients' conditions had worsened. Antiemetic medication was not included in our analysis. It would be desirable to know whether a decrease in antiemetic or analgetic medication can be achieved after dPEG.

Conclusions

In conclusion, dPEG is an effective treatment option for patients with bowel obstruction caused by advanced cancer. It is able to relieve symptoms and to improve QOL rapidly.

However, the technical success rate of dPEG is limited and needs to be improved. Canaz et al. reported a high success rate of 81% when decompressive gastrostomies were inserted under CT guidance. The study was small (31 patients), retrospective, and included patients with ovarian cancer exclusively. 87 % of the patients had previously undergone unsuccessful endoscopic attempts. In this subgroup, the success rate for CT-guided procedures was 76% [25]. Regarding these data, it seems unclear whether an endoscopic approach or a CT-guided approach should be the method of choice for dPEG. A randomized trial to compare dPEG vs. CT- guided gastrostomy would be desirable to avoid unsuccessful procedures in patients in poor condition and who have limited life expectancy.

Conflict of Interest

The authors declare that they have no conflict of interest.

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