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Case Report

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Successful Percutaneous Gastrostomy Tube Insertion in Adult Prevalent Peritoneal Dialysis Patients: Case-Series and Literature Review

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Abstract

Protein-energy malnutrition (PEM) is a prevalent condition in peritoneal dialysis (PD) patients, contributing to increased morbidity and mortality. Feeding difficulties can exacerbate PEM, making adequate nutrition challenging. Percutaneous endoscopic gastrostomy (PEG) tubes offer a potential solution for patients unable to maintain oral intake. This case series presents adult prevalent six PD patients with PEM who underwent PEG tube placement by an interventional radiologist. Clinical outcomes, including complications, survival rates, and nutritional status, were evaluated. PEG tube insertion was successfully performed in all six patients without major complications. Nutritional status improved, and patients tolerated feeding well. Despite successful PEG placement, mortality rates remained high due to underlying comorbidities and complications unrelated to the PEG tube.

Percutaneous endoscopic gastrostomy tubes can be a safe and effective option for PD patients with PEM and feeding difficulties. Further research is needed to establish definitive guidelines and evaluate long-term outcomes in this population.

Keywords: Peritoneal Dialysis; End-Stage Renal Disease; Protein and Energy Malnutrition, Percutaneous Endoscopic Gastrostomy Tube

Introduction

A percutaneous endoscopic gastrostomy (PEG) tube is a feeding tube inserted into the stomach percutaneously under endoscopic guidance. This procedure is used for patients requiring long-term enteral nutrition. Before the 1980s, permanent feeding tubes were only available through open surgery until Gauderer et al. introduced the safe and minimally invasive PEG tube placement technique [1].

The scope of PEG tube placement has expanded beyond surgeons to include gastroenterologists, thoracic surgeons, and interventional radiologists. Protein-energy malnutrition (PEM) affects up to 40% of patients on peritoneal dialysis. Several factors have been identified as contributing to protein-energy malnutrition (PEM) in patients on dialysis, including inadequate protein intake due to decreased appetite, insufficient dialysis, infections, inflammation, acidosis, insulin resistance, and dialysate protein loss during peritoneal dialysis fluid (PD) [2].

Extensive research has demonstrated a strong association between protein-energy malnutrition (PEM) and inflammation with increased cardiovascular morbidity and mortality rates in the dialysis population. Despite various strategies aimed at mitigating protein-energy malnutrition (PEM) in

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peritoneal dialysis (PD) patients, progress has been limited. Actual protein intake often falls short of the recommended 1.2 g/kg body weight. The average daily loss of protein and amino acids during PD ranges from 5-15 grams of protein to 2-4 grams of amino acids [3]. Amino acid-based dialysate solutions were developed to compensate for inadequate dietary protein intake in peritoneal dialysis patients. However, their clinical effectiveness remains a subject of debate in the literature [3]. Furthermore, amino acid-based dialysate solutions can lead to metabolic acidosis and elevated serum urea levels, which may exacerbate protein-energy malnutrition (PEM). Consequently, these solutions have not gained widespread popularity in peritoneal dialysis (PD). It is crucial to administer amino acid-based solutions concurrently with caloric intake. Amino acids stimulate protein synthesis, while oral calories suppress protein degradation, thereby amplifying the positive effects of amino acid-based solutions on protein balance [3].

In patients experiencing feeding difficulties, a percutaneous endoscopic gastrostomy (PEG) tube may be the most effective way to ensure adequate nutrition, particularly considering the high mortality rate associated with protein malnutrition in the peritoneal dialysis (PD) population. However, research on the effectiveness of PEG tube feeding in PD patients is limited to the pediatric age group, and there is ongoing debate regarding the optimal approach between PEG tube and open gastrostomy (OG).

We present our unique experience of successfully treating six peritoneal dialysis (PD) patients (three cases were previously reported) with protein-energy malnutrition (PEM) secondary to feeding difficulties using percutaneous endoscopic gastrostomy (PEG) tube placement by an interventional radiologist without complications. This case series contributes to the growing body of literature on the successful treatment of PD patients with PEG tubes.

Case Section

Case 1

A 71-year-old Saudi male with a history of end-stage renal disease secondary to diabetes mellitus, hypertension, dyslipidemia, coronary artery disease post percutaneous coronary intervention (PCI), and ischemic cerebrovascular stroke, with right side residual weakness, was admitted to the intensive care unit on March 15, 2024, for status epilepticus. He had been undergoing automated peritoneal dialysis (APD) since April 2023.

Upon admission, the patient was intubated and continued on APD (15 liters of 2.27% dialysate over 12 hours each fill 1.9 liters with an average ultrafiltration of 1.2-1.6 liters per day). The patient has been receiving nutrition through a nasogastric tube (NGT) since admission. Despite multiple attempts to transition him to oral feeding, he has been unable to wean off the NGT. After discussing feeding options with the family, it was decided that a percutaneous endoscopic gastrostomy (PEG) tube would be the most appropriate method for providing nutrition. On April 1, 2024, a 10 French gastrostomy tube was inserted by a skilled interventional radiologist. The tube's position was verified using a contrast agent.

The patient's peritoneal dialysis (PD) was temporarily withheld for four days, including one day before, to keep the abdomen dry, and three days after a surgical procedure. Despite this, the patient remained stable with normal vital signs and metabolic markers. Prophylactic antibiotics (Ceftriaxone 1 g IP and Vancomycin 1g IP) and fluconazole 150mg IV were administered daily for three weeks, beginning on the day of surgery, to prevent infection.

PD was resumed four days post-PEG tube placement with a lower fill volume of 1 liter and gradually increased to 1.9 liters over four weeks with no leak or other complications. On May 21, 2024, the patient experienced an episode of pseudomonas peritonitis. This infection was treated with a combination of intravenous and intraperitoneal antibiotics (meropenem 500 mg IV and 500 mg IP) and IV ceftazidime 1.5 gm daily, along with fluconazole 150 mg IV for three weeks. The patient made a full recovery. Regular PD fluid gram stains and cultures were performed and remained negative.

The patient began receiving nutrition through the PEG tube four days after surgery, starting at a rate of 10 ml/hr while in a semi-sitting position. The feeding rate gradually increased to 40 ml/hr without complications. However, in week 20, the patient developed refractory ventricular tachycardia and ultimately passed away due to this condition.

Case 2

An 80-year-old lady with a history of diabetes, hypertension, multiple strokes, dry gangrene of the right foot, a dorsal ulcer on the left foot, recurrent urinary tract infections, and end-stage renal disease (ESRD) on incremental peritoneal dialysis (4 times per a week since January 2024 presented with altered mental status, decreased level of consciousness, and a vegetative state. This condition was secondary to community-acquired pneumonia.

In April 2024, a gastrostomy tube was inserted. A 10 French Pig tube was placed due to unsuccessful attempts to discontinue the nasogastric tube. Automated peritoneal dialysis (APD) was withheld for three days following the gastrostomy tube insertion. All previous preventive measures taken in the first patient, including gradual feeding and escalation of the dialysis prescription, were implemented. Regular peritoneal dialysis (PD) fluid and exit site swaps and cultures were performed and found to be negative.

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The patient tolerated feeding without complications. The peritoneal dialysis remained smooth and uneventful for 16 weeks. However, the patient's condition worsened due to the development of hospital-acquired pneumonia, ultimately leading to death.

Case 3

A 68-year-old woman with end-stage renal disease on automated peritoneal dialysis (APD) for 16 months was hospitalized due to an acute ischemic stroke associated with decreased level of consciousness. Subsequently, a nasogastric tube was inserted for feeding.

Despite multiple attempts to wean her from the nasogastric tube, the patient was unable to tolerate oral feeding. A percutaneous endoscopic gastrostomy tube was successfully inserted without complications similar to the previous cases. However, the patient developed urosepsis and died ten weeks after the PEG tube placement.

Case 4

A 68-year-old Saudi woman with a history of type 2 diabetes, dyslipidemia, bipolar disorder, a stroke with residual weakness, atrial fibrillation, and end-stage renal disease on peritoneal dialysis for 9 years was admitted on March 15, 2020, with urosepsis, altered mental status, and poor oral intake.

A nasogastric tube was inserted for feeding upon admission, but multiple attempts to wean the patient from the tube were unsuccessful. After discussing feeding options with the family, it was decided that a percutaneous endoscopic gastrostomy tube would be the most suitable option in her current situation. On June 21, 2020. A percutaneous endoscopic gastrostomy tube was successfully inserted without complications similar to the previous cases

The patient developed a PEG exit site infection growing Pseudomonas aeruginosa and was successfully treated with local gentamycin, and repeated cultures were negative. Additionally, multiple PD fluid analysis and cultures were tested after the PEG tube insertion and found to be negative for bacteria. However, the patient suffered a massive myocardial infarction in the 16th week following the procedure and died two weeks after being admitted to the Intensive Care Unit.

Case 5

An 80-year-old man with a history of diabetes mellitus, hypertension, multiple strokes with residual slurred speech and right-sided weakness, ESRD on APD since 2017 was admitted with confusion, decreased level of consciousness and a vegetative state. The patient was started on nasogastric tube feeding, but with no signs of improvement, and after discussion with his family, it was decided to insert a gastrostomy tube.

A 12-French pigtail catheter was successfully inserted, and peritoneal dialysis was temporarily withheld for 3 days following the procedure. All previously implemented preventive measures were applied in this case as well, including gradual feeding and escalation of the dialysis prescription, were implemented. The patient was monitored by a dietitian daily, and he was tolerating the feeding without any complications. The peritoneal dialysis was smooth and uneventful for 10 weeks. However, the patient's condition deteriorated due to the development of hospital-acquired pneumonia, ultimately leading to his demise.

Case 6

An 88-year-old woman with ESRD on APD for six months was admitted to the hospital with acute hemorrhagic stroke associated with a decreased level of consciousness. As a result, a nasogastric tube was inserted for feeding. Despite multiple attempts to discontinue the nasogastric tube, the patient was unable to tolerate oral feeding. A PEG tube was successfully inserted without complications, following a similar procedure as in previous cases. Unfortunately, the patient developed severe urosepsis and passed away 8 weeks after the PEG tube insertion.

Table 1: Investigations conducted one week before and four weeks after catheter PEG insertion

	Case 1		Case 2		Case 3		Case 4		Case5		Case 6	
	One week before	Four weeks after	One week before	Four weeks after	One week before	Four weeks after	One week before	Four weeks after	One week before	Four weeks after	One week before	Four weeks after
Haemoglobin (g/dL)	8.4	9	7.4	9.9	8.4	9.1	9.4	8 .8	9.9	11.8	8	8.9
Albumin (g/dL)	3.1	3.2	3.2	3	3	3.2	2.4	2.6	2	1.9	1.3	2
Total protein (g/dL)	6.1	6.2	6.1	5.4	6.1	6.7	6.4	6.2	4.5	4	4.2	4.1
BUN (mg/dL)	78	55	81	55	83	55	67	60	19	32	55	66
Creatinine (mg/dL)	7.12	5.13	10	6.3	7.2	5.5	6.8	6.8	6.47	8.41	7.5	8

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Bicarbonate (mEq/L)	20	24	15	22	16	25	17	22	21	26	28	26
Calcium (mg/dL)	6.7	8.5	6.8	8	6.7	8	11.5	9.3	6.1	7.5	8.8	9
Phosphorus (mg/dL)	3	5.5	5.1	4.3	4.1	5.5	6.7	6.5	3.9	2.9	2.1	2.5
Random blood sugar (mg/dL)	71	123	200	240	122	103	395	172	133	120	95	102
Ultrafiltration (ml /24hr)	850	900	600	550	200	450	1220	579	2600	640	1300	700
Ferritin (ng/mL)	931	800	641	600	1200	1233	4882.7	3888	400	214.2	1300	1200

Table 2: Infectious and noninfectious complications

	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 5**
Exit site Infection	Negative	Negative	Negative	Pseudomonas aeruginosa	Negative	Negative
Peritonitis	Pseudomonas aeruginosa	Negative	Negative	Negative	Negative	Negative
Tunnel Infection	Negative	Negative	Negative	Negative	Negative	Negative
Migration	No	No	No	No	No	No
Leakage	No	No	No	No	No	No
Obstruction	No	No	No	No	No	No
PD duration	20 weeks	16 weeks	10 weeks	16 weeks	10 weeks	8 weeks

Discussion

Protein malnutrition is a significant risk factor for increased mortality among patients undergoing peritoneal dialysis (PD). When patients encounter feeding difficulties that compromise their nutritional intake, the insertion of a percutaneous endoscopic gastrostomy (PEG) tube may be considered as a viable strategy to maintain adequate protein intake and mitigate the associated risks of malnutrition. While the use of PEG feeding tubes has been explored in pediatric PD patients, evidence supporting their efficacy in adult PD populations remains limited. Furthermore, the optimal feeding tube placement method (PEG versus open gastrostomy [OG]) for PD patients is a subject of ongoing debate and requires further investigation.

Following Fein et al.'s report of complications associated with PEG tube placement in 10 adult PD patients in 2001[4], limited case reports have emerged, primarily focusing on pediatric populations. These cases suggest that the insertion of a peritoneal dialysis catheter in patients with a pre-existing, well-healed PEG tube may be a relatively safe procedure. However, the placement of gastrostomy tubes in PD patients carries a substantial risk of complications, including leaks and potentially fatal or nonfatal peritonitis. These adverse outcomes, coupled with undesirable experiences at some centers, have contributed to a general reluctance to re-implement this procedure, particularly in settings where prior attempts have resulted in complications. As a consequence, there is a limited body of evidence regarding the safety and efficacy of PEG insertion following the initiation of PD [2].

In 2006, Warady highlighted the paucity of data on PEG tube use in adult patients with end-stage renal disease (ESRD) undergoing PD. He attributed this lack of evidence to several factors, including the limited experience and expertise of healthcare providers, concerns regarding potential complications such as fungal peritonitis and dialysate leakage, and challenges related to patient and family preferences [5]. While transitioning patients from peritoneal dialysis (PD) to hemodialysis (HD) has been proposed as a strategy to reduce the risk of peritonitis, the risk of this complication and its associated sequelae can persist for up to 6-8 weeks after PD cessation [4].

Dahlan et al. observed that withholding peritoneal dialysis, transitioning to hemodialysis, and administering prophylactic antibiotics did not effectively prevent the development of fatal peritonitis. The authors hypothesized that residual peritoneal fluid may hinder the healing process at the PEG site, leading to the leakage of gastric contents into the peritoneal cavity. The authors concluded that gastrostomy tubes should be avoided in adult patients undergoing peritoneal dialysis due to the extremely high risk of fatal peritonitis. While it remains unclear whether surgical placement with a prolonged

healing period might have yielded different results, the evidence suggests that gastrostomy tubes are associated with a significant risk of this severe complication in this patient population [6].

Von Schnakenburg et al. reported a 67% success rate in 27 pediatric patients who underwent PEG tube insertion following PD catheter placement. Peritonitis rates were 37%, with 26% of cases attributed to fungal infections. All patients received prophylactic intraperitoneal antibiotics and intravenous antifungal therapy. Peritoneal dialysis (PD) was withheld for 2-3 days following PEG tube placement without a significant difference in peritonitis rates observed before or after the procedure [2].

In our practice, we implemented a protocol for PEG tube insertion in PD patients that included several key elements: prophylactic antibiotics and antifungal therapy for three weeks following PD catheter placement, holding PD for 24 hours to allow for a dry peritoneum and subsequent healing time at the PEG site, an additional 72-hour period of PD withholding to facilitate healing, insertion by a skilled intervention radiologist using a small-gauge tube, resuming PD at a lower fill volume with a gradual increase and feeding through the PEG tube in a semi-sitting position to minimize the risk of gastric content spillage into the peritoneal cavity.

This approach aimed to optimize the safety and efficacy of PEG tube placement in PD patients, considering the challenges associated with this procedure and the potential for complications, such as peritonitis. We believe that the combination of these factors has contributed to our positive outcomes and played a significant role in preventing peritonitis in our patients undergoing PEG tube insertion while on peritoneal dialysis.

Conclusion

This case series demonstrates the successful and safe application of percutaneous endoscopic gastrostomy (PEG) tubes in peritoneal dialysis (PD) patients with protein-energy malnutrition (PEM) secondary to feeding difficulties. Despite limited literature on this topic, our experience suggests that PEG tube placement can be a valuable intervention for PD patients facing nutritional challenges.

Declarations

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Author Contributions

Hassan Al-Jassas, Moaz Abdulgalil, Nadia Al-Audah were responsible for collecting the cases and drafting the case presentation. and Professor Abdullah Alhwiesh, Khadija M. Alshehabi contributed to the manuscript's writing and review

Declaration of Conflicting Interests

The author(s) have no conflicts of interest to declare regarding the research, authorship, and/or publication of this article.

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Ethical approval

Ethical approval was obtained from the Imam Abdulrahman bin Faisal University Review Board of Medical Center, and written consent was obtained from all patients.

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