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Complications of Percutaneous Endoscopic Gastrostomy

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COMPLICATIONS OF PERCUTANEOUS ENDOSCOPIC GASTROSTOMY

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RESUMO

INTRODUÇÃO: Assegurar a nutrição entérica é um processo fundamental em diversas condições. A gastrostomia percutânea endoscópica (PEG) é, hoje, um procedimento de eleição na manutenção da via entérica a longo prazo em doentes com compromisso da deglutição, tendo o número de gastrostomias endoscópicas aumentado ao longo dos últimos anos. Apesar de considerado um procedimento seguro, a PEG associa-se a complicações.

MATERIAIS E MÉTODOS: Estudo retrospectivo de doentes submetidos a PEG no Serviço de Gastrenterologia do Centro Hospitalar e Universitário de Coimbra, entre janeiro de 2009 e dezembro de 2015. A colocação das sondas de gastrostomia (20 a 24 Fr) foi realizada na unidade de endoscopia segundo o método *pull-through*. Complicações e mortalidade associadas ao procedimento foram registadas nos 12 meses de *follow-up*, sendo as complicações descritas como imediatas, a curto e a longo prazo. No tratamento dos dados utilizou-se o Statistical Package for the Social Sciences (SPSS), versão 20.0.

RESULTADOS: Foram incluídos 186 doentes, dos quais 55% pertenciam ao sexo masculino. A média etária dos doentes foi de $60,5 \pm 18,8$ anos (intervalo de 18-94 anos), sendo que 32% se encontravam institucionalizados em lares ou unidades de cuidados continuados. As principais indicações para a realização da PEG foram doenças neurodegenerativas (42%) e um total de 115 doentes (62%) apresentava outras comorbilidades. Cerca de 95% dos doentes tomava medicação crónica e cerca de 71% era previamente alimentado por sonda nasogástrica. Hemorragia no local de inserção da gastrostomia foi a complicação imediata mais frequente (9%), tendo sido registadas outras complicações como, complicações anestésicas (1%), um caso de pneumoperitoneu (0,5%) e dor no local de inserção da gastrostomia. Complicações a curto-prazo incluíram, disfunção/obstrução da gastrostomia (2%), hemorragia peristoma (2%), saída de conteúdo gástrico (0,5%), gastroparesia (0,5%) e um caso de peritonite (0,5%). Complicações a longo

prazo incluíram, disfunção/obstrução da gastrostomia (18%), deterioração do tubo de gastrostomia (84%), infecção peristoma (2%), formação de tecido de granulação (2%), gastroparesia (2%), saída de conteúdo gástrico (1%), pneumonia de aspiração (2%), um caso de peritonite (0,5%) e um caso de Buried Bumper Syndrome (BBS). Nenhuma relação estatisticamente significativa foi encontrada entre a ocorrência de hemorragia peristoma e a presença de diabetes mellitus, toma de anticoagulantes ou inibidores selectivos da recaptção da serotonina ($p < 0,005$). A taxa de mortalidade registada a um mês e a um ano da colocação da gastrostomia foi de 8% e 33%, respetivamente.

CONCLUSÃO: A realização de gastrostomia percutânea endoscópica segundo o método *pull-through* mostrou-se segura e eficaz como meio de nutrição entérica a longo prazo. Complicações associadas são frequentes e por vezes graves contudo, a maioria pode resolver-se com recurso a medidas conservadoras.

PALAVRAS-CHAVE: Nutrição entérica; Gastrostomia percutânea; Complicações.

ABSTRACT

BACKGROUND: Providing enteral nutrition is critical in multiple circumstances. Percutaneous endoscopic gastrostomy (PEG) is now the preferential route for long-term feeding in patients with swallowing disturbances and an increasing number of PEG tubes has been placed over the years. Despite being considered a safe procedure, PEG tube insertion has potential complications.

MATERIAL AND METHODS: Retrospective analysis of data from patients who underwent PEG placement between January 2009 and December 2015 at the Gastroenterology department of the Coimbra University Hospital Centre. All procedures were performed in the endoscopy unit and PEG tubes (20 or 24 Fr) were placed using the pull-through technique. Complications and mortality rate were recorded in the 12-month period following placement. Complications were described as immediate, short-term and long-term. Univariate and multivariate analysis was performed with the Statistical Package for the Social Sciences (SPSS) version 20.0.

RESULTS: A total of 186 patients were included, 55% of which were male. The mean age of the patients was 60.5 ± 18.8 years-old (range 18-94) and 32% were institutionalized in a nursing home or in a long-term care facility. The most common indications for PEG placement were neurodegenerative diseases (42%) and a total of 115 patients (62%) had chronic comorbid diseases. About 95% of the patients took chronic medication and in 71% of the cases the nutritional support route before PEG placement was nasogastric tube. The most common immediate complication was bleeding at the insertion site of PEG tube (9%) and other complications as anesthetic complications (1%), symptomatic pneumoperitoneum (0.5%) and pain at the insertion site were recorded. Short-term complications included device dislodgement/blockage (2%), peristomal bleeding (2%), gastric contents leakage (0.5%), gastroparesis (0.5%) and a case of peritonitis (0.5%). Long-term complications included

dislodgement/blockage (18%), tube deterioration (4%), peristomal infection (2%), peristomal granulation tissue (2%), gastroparesis (2%), gastric contents leakage (1%), aspiration pneumonia (2%), one case of peritonitis (0.5%) and one case of Buried Bumper Syndrome (BBS). No relation between peristomal bleeding and conditions such as diabetes mellitus, anticoagulation drugs or selective serotonin reuptake inhibitors was significant ($p < 0.05$). The mortality rate one month and one year after PEG placement was 8% and 33%, respectively.

CONCLUSION: PEG by the pull-through method reveals that is a safe and effective way of providing long-term feeding. Complications are common and sometimes severe, but much of these cases can be treated with conservative measures.

KEYWORDS: Enteral nutrition; Percutaneous gastrostomy; Complications.

INTRODUCTION

Over the last 3 decades percutaneous endoscopic gastrostomy (PEG) gained popularity has the preferential route for long-term feeding in patients with swallowing disturbances. Introduced by Gauderer *et al*, in 1980¹, and originally developed for children, this technique was rapidly adopted to provide enteral nutrition in all age groups.

In many disorders, despite the motility and absorptive function of the gastrointestinal tract being preserved, the lack of oral intake leads to high prevalence of malnutrition, a major health concern with prognostic impact. Gut disuse is also associated with impairment of the immune barrier and higher risk of complications, making enteral nutrition the preferred route for artificial nutrition when compared to the parenteral access.^{2, 3} Gastrostomy tubes may be placed through endoscopy, surgery or radiologic methods. Due to lower cost, fewer risks and shorter procedure time, PEG is considered a better choice.^{4, 5} It is a minimally invasive endoscopic technique that creates a gastrocutaneous fistula, a temporary or permanent communication between the gastric cavity and the abdominal wall using a flexible tube for the passage of foods, fluids and medications.⁶ These facts explain the increasing number of PEG tubes placements over the years. From 1989 to 2000 the number of PEG procedures increased from 61,000 to 216,000 in the USA^{7, 8} and the number of PEG placement in Germany is approximately 140,000 per year.⁹ Significant differences between countries are thought to exist.¹⁰

Variations of the PEG technique have been introduced, including the push (Sachs-Vine)³, pull (Ponsky-Gauderer)³, introducer (Russell)¹¹ and Versa (T-fastener)¹¹ techniques. The most commonly performed are the push and pull methods with similar outcomes.^{11, 12}

For many years PEG and nasogastric tubes (NGT) were compared in terms of safety, efficiency, complications and mortality in order to determine the best long-term enteral feeding.¹³ Feeding by NGT is easy and inexpensive but many clinical studies favored the use PEG.¹⁴⁻¹⁹ Others studies were not able to conclude about the superiority of one method over

the other.^{13, 20-23} It became apparent that both feeding strategies have advantages and disadvantages and PEG, as a more comfortable technique, is the preferred route for feeding in patients needing enteral nutrition for more than 3-4 weeks. NGTs are a good short-term option when the duration of dysphasia is unknown.^{2, 3, 5, 24}

The most frequent indications for PEG include patients with reduced levels of consciousness or cognition, cerebrovascular disease, chronic neurodegenerative conditions and head and neck tumors. Some indications, such as dementia, are controversial for PEG placement.^{2, 5, 24, 25}

The success rate of PEG tube placement may be as high as 99.5% and the procedure-related mortality is low, about 1%.^{12, 26, 27} Despite being considered a safe procedure, PEG tube insertion has potential complications that can be divided into minor (local wound infection, granuloma formation, peristomal leakage or tube dislodgment) or major (bleeding, aspiration pneumonia, buried bumper syndrome, perforation of bowel, metastatic seeding...).⁵ The overall complication rate has been reported to range from 13% to 40%, with the majority of these being minor complications.^{12, 26} Major complications are much less common, occurring in about 3% of PEG insertions.^{2, 8} Data suggests that short-term survival rate following PEG placement is high, 80 to 90%, and long-term survival rate is low²⁴, with a 1-year mortality rate of 40%.²⁸ The high long-term mortality rate reflects the comorbidities and severe nature of the underlying conditions of the patients with PEG.

The purpose of this retrospective study was to characterize the short and long-term complications of PEG placement by “pull-through” method and determining potential predisposing factors to their occurrence.

MATERIAL AND METHODS

Study design and data collection

We retrospectively analyzed data from patients who underwent PEG placement between January 2009 and December 2015 at the Gastroenterology department of the Coimbra University Hospital Centre. Patients less than 18 years old or with insufficient follow-up information were excluded as represented in **Figure 1**.

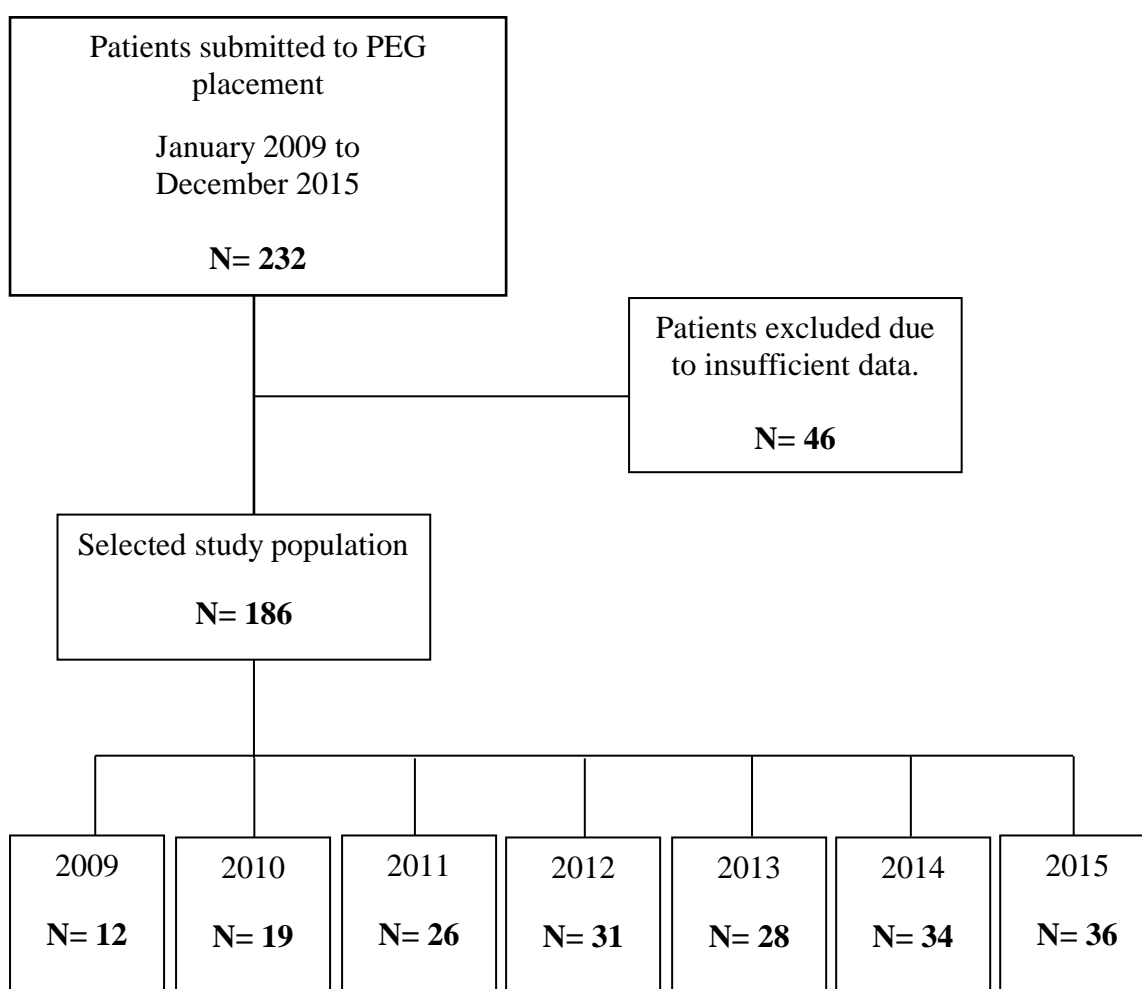


Figure 1. Flow diagram for patient's inclusion.

Data collected included gender, age, percentage of institutionalized patients, indications for PEG tube placement, presence of comorbidities [coronary heart disease/cardiac arrhythmias, hypertension, diabetes mellitus (DM), tetraparesias], chronic medications [proton pump inhibitors, selective serotonin reuptake inhibitors (SSRIs), nonsteroidal anti-

inflammatory drugs (NSAIDs), glucocorticoids, antiplatelet agents, anticoagulants and antibiotics], type of nutritional support received before the PEG placement, sedative drugs used during the PEG tube insertion procedure and length of hospital stay. Patients were followed for 12 months. Complications and mortality rate were recorded. Complications were described as immediate, short-term and long-term if it occurred in the first 24 hours, 1 month and 12 months, respectively.

PEG procedure

All procedures were performed in the endoscopy unit by experienced endoscopists or under their supervision and assisted by a specialized nurse. PEG tubes (20 or 24 Fr) were placed using the pull-through technique described by Gauderer *et al*¹.

Patients were admitted in the day of the procedure or were already in the hospital wards for other reasons. The patients were fasted for 8h to 12h before the procedure and a prophylactic antibiotic (cefazolin) was administered intravenously 60 min before the procedure. Anticoagulants and antiplatelet drugs were adjusted following the international recommendations. The patients were either sedated with midazolam administered by the endoscopist or with propofol under the surveillance of an anesthesiologist. Blood pressure, pulse rate and oxygen saturation were monitored during the procedure. The patients were admitted for at least 24 hours following the intervention and, if no major complications occur, liquid diet was started after 6 hours, with later gradual increments. Intravenous administration of 40mg of pantoprazole was given twice a day. Routine blood tests were not performed after PEG placement and the patient was discharged after 24 hours if no complications occurred.

Statistical analysis

Statistical analysis of the results was performed using chi-square test, Student's t-test and Fisher's exact test as well as binomial logistic regression for multivariate analysis. For all analysis, p values <0.05 were considered significant. The 95% confidence intervals (CIs) were calculated by normal approximation.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 20.0.

RESULTS

A total of 186 patients were included, 55% of which were male patients. The mean age of the patients was 60.5 ± 18.8 years-old (age range 18-94) and 32% were institutionalized in a nursing home or in a long-term care facility. The most common indications for PEG placement were neurodegenerative diseases (42%), such as motor neuron disease, Parkinson's disease, cerebral palsy, Alzheimer's disease, tuberous sclerosis, ataxia, Duchenne muscular dystrophy, optic neuromyelitis and Machado-Joseph disease, followed by cerebrovascular disease (26%) including stroke, hypoxic encephalopathy, and other forms of dementia. A total of 115 patients (62%) had chronic comorbid diseases and some patients had more than one condition (hypertension, tetraparesis, diabetes mellitus and coronary artery disease). Forty-one percent of the patients had hypertension, the most common comorbid disease, 23% had tetraparesis, 21% had diabetes mellitus, and 12% had coronary artery disease/arrhythmia. About 95% of the patients took chronic medication like proton pump inhibitors (53%), SSRIs (31%), NSAIDs (4%), glucocorticoids (15%), antiplatelets (15%), anticoagulants (22%) or others and about of 31% were treated with antibiotics for preexisting infection at least 1 month before and during the PEG procedure period. In the majority of the cases, the nutritional support route before PEG placement was nasogastric tube - 71%.

Demographic data of the 186 patients who underwent PEG placement by the pull-through method over the 7-year study period is presented in **Table 1**.

Procedure-related complications

The most common immediate complication was minor bleeding at the insertion site of PEG tube (17 cases - 9%). Generally, bleeding was self-limited or controlled with external compression (10 cases). Five cases underwent endoscopic hemostasis and in the remaining 2 cases the bleeding was controlled through suture. No blood transfusions were required in these cases. The relation between the immediate minor bleeding and conditions such as diabetes mellitus, anticoagulation drugs or SSRIs was non-significant, X^2 (1, N=186), $p=0.502$, $p=0.531$, $p=0.575$ respectively.

One patient developed a symptomatic pneumoperitoneum with fever and abdominal pain after PEG placement. No surgery was required and the patient was treated successfully with conservative measures.

Anesthetic complications included a case of laryngospasm and a case of cardiorespiratory arrest. In the first case, the procedure was interrupted and methylprednisolone was administered. The patient recovered quickly and the PEG tube placed without further complications. The patient with cardiorespiratory arrest recovered through advanced life support and PEG placement was successfully performed.

A thorough description of all complications is provided in **Table 2**.

Complications 1 month after PEG insertion

Short-term complications in the first month following PEG insertion included device dislodgement/blockage, peristomal bleeding, gastric contents leakage, gastroparesis and a case of peritonitis (**Table 2**). All cases of peristomal bleeding were self-limited except one

that needed endoscopic hemostasis for bleeding control. The relation between peristomal bleeding 1 month after PEG insertion and conditions such as diabetes mellitus, anticoagulation drugs or SSRIs was non-significant, X^2 (1, N=186), $p=0.112$, $p=0.498$, $p=0.669$, respectively.

One patient with esophageal cancer developed a purulent peritonitis requiring laparotomy due to dislocation of PEG tube and drainage of gastric contents between the stomach and the abdominal wall. The patient's clinical condition slowly worsened and death occurred ten days after the procedure.

Infectious events such as respiratory tract infections (8 cases) and a urinary tract infection (UTI) were also reported. These infectious events were all treated with conservative measures with no associated mortality. A total of 15 patients, 8% of our population, died within 30 days of PEG tube placement due to underlying diseases.

Complications 1 year after PEG insertion

The long-term minor complications that were registered included device dislodgement/blockage, which was the most common complication (18%), gastric contents leakage, peristomal infection, peristomal granulation tissue, gastroparesis and tube deterioration. Major complications included 4 cases of aspiration pneumonia, one case of peritonitis and one case of Buried Bumper Syndrome (BBS) – see **Table 2**.

The patient with pneumoperitoneum had signs of peritonitis and required an exploratory laparotomy. The patient fully recovered from surgery. The patient with BBS was submitted to an endoscopy that showed the migration of the internal bumper through the gastric wall. The PEG tube was removed through surgery and after 2 days another PEG tube was placed by the pull-through method without any other complications.

Other systemic complications such as respiratory infections (28 cases), UTIs (12 cases), respiratory failure (2 cases), and a case of systemic inflammatory response syndrome (SIRS) after an UTI were noted. The PEG tube was changed in 24 patients (13%) due to tube dislodgment/blockage or tube deterioration. Definitive removal of the PEG tube due to complications or recovery of the oral route did not occur. The mortality rate after one year of follow-up was 33%.

The immediate, short-term and long-term complications of PEG tube placement are summarized in **Table 2**. The percentage of patients with complications per year is described in **Figure 2**.

Table1. Base-line characteristics of the study population

Gender, n (%)	
Male	103 (55)
Female	83 (45)
Age, mean \pm S.D, years	60 \pm 19 (range 18-94)
Institutionalized patients, n (%)	60 (32)
Indications for PEG placement, n (%)	
Neurodegenerative diseases	78 (42)
Cerebrovascular disease	48 (26)
Cranial trauma	29 (16)
Head and neck cancer	23 (12)
Others	8 (4)
Clinical ward location, n (%)	
Neurology	100 (53)
Neurosurgery	28 (15)
Internal Medicine	23 (12)
Intensive care Medicine	9 (5)
Maxillofacial surgery	9 (5)
Otorhinolaryngology	7 (4)
Others	10 (6)
Major comorbid diseases, n (%)	
Hypertension	75 (41)
Diabetes mellitus	39 (21)
Coronary artery disease/arrhythmia	21 (12)
Tetraparesis	42 (23)
Concurrent medications, n (%)	
Proton pump inhibitors	98 (53)
SSRIs	57 (31)
NSAIDs	8 (4)
Glucocorticoids	27 (15)
Antiplatelets	28 (15)
Anticoagulants	40 (22)
Antibiotics for preexisting infection	57 (31)
Others	170 (91)
Nutritional support route before PEG placement, n (%)	
Nasogastric tube	132 (71)
Oral feeding	54 (29)
Length of hospital stay, mean \pm S.D, days	
Elective hospital stay for PEG placement	2 \pm 2 (range 1-8)
Hospitalization due to underlying disease	55 \pm 55 (range 9-283)

Table 2. Complications of PEG tube placement

Procedure- related complications, n (%)	
Major	
Peristomal bleeding	7 (4)
Submucosal hematoma	2 (1)
Anesthetic complications	2 (1)
Minor	
Minor fistule bleeding	10 (5)
Pain at the insertion site	1 (0.5)
Symptomatic pneumoperitoneum	1 (0.5)
Complications 1 month after PEG insertion, n (%)	
Major	
Peristomal bleeding	3 (2)
Peritonitis	1 (0.5)
Minor	
Device dislodgement/blockage	4 (2)
Gastric contents leakage	1 (0.5)
Gastroparesis	1 (0.5)
Others	9 (5)
Complications 1 year after PEG insertion, n (%)	
Major	
Aspiration pneumonia	4 (2)
Peritonitis	1 (0.5)
Buried Bumper Syndrome	1 (0.5)
Minor	
Device dislodgement/blockage	33 (18)
Tube deterioration	7 (4)
Gastroparesis	4 (2)
Peristomal granulation tissue	4 (2)
Peristomal infection	3 (2)
Gastric contents leakage	2 (1)
Others	44 (24)
Overall complications rate, n (%)	
Major complications	21 (11)
Minor complications	71 (38)
Mortality, n (%)	
1-month mortality	15 (8)
1-year mortality	71 (38)

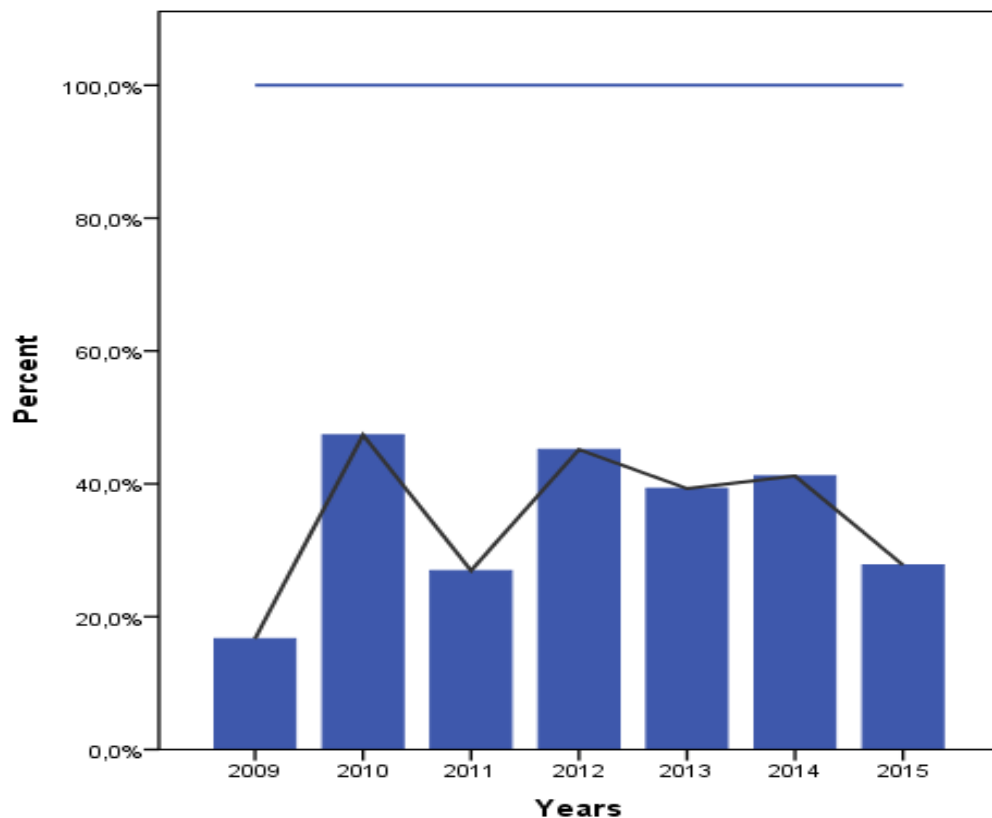


Figure 2. Percentage of patients with complications per year.

DISCUSSION

A number of retrospective and prospective studies have demonstrated that PEG placement is a safe and feasible procedure with low mortality and complications rates.⁶

In this retrospective study, the minor and major complications rates were 38% and 11%, respectively. The minor complications rate is consistent with those reported in other studies (13 to 40%) and the major complications rate was significantly higher than percentages previously described.^{12, 26, 29}

Bleeding was the most common major complication. The bleeding rate was 11%, a higher value than what was described in the literature (ranging from 2.5% to 3.8%).^{6, 12, 26, 30-32} In a retrospective study conducted at a tertiary care hospital in Turkey by Gundogan *et al.*³³, the most common acute PEG-related complication was also insertion-site bleeding but

occurred only in 4% of the study population, a lower rate than the one found in our study (9%). The high rate of bleeding observed may be influenced by the use of anticoagulation drugs (22%) and the presence of diabetes mellitus (21%) in our study population, described risk factors for increased bleeding.^{6, 12, 28} However, statistical analysis suggests that the relation between peristomal bleeding (acute or 1 month after PEG insertion) and conditions such as diabetes mellitus and anticoagulation drugs was non-significant. Gundogan *et al* showed a lower rate of bleeding with a similar percentage of patients making anticoagulation therapy and lower percentage of patients with diabetes mellitus. Richter *et al*³⁴, in a retrospective study with large cohort of patients, suggests that the use of SSRIs 24h before PEG placement was associated with an increased risk of bleeding. The therapy with SSRIs was also common in our study population (31%), which may contribute to a higher insertion-site bleeding rate, but statistical analysis suggests that the relation between peristomal bleeding (acute or 1 month after PEG insertion) and SSRI use was non-significant.

The most common complications associated with PEG procedure are peristomal wound infections, with an incidence ranging from 3% to 38%. The majority are minor infections and are easily managed but serious infections including peritonitis also occurred.^{12, 26, 32, 35} In our study the peristomal infection rate was 2%, a lower value than earlier reported, which may be due to the use of prophylactic antibiotics (cefazolin). In the retrospective study by Yuruker *et al*³⁰ peristomal infection rate was 2.3%, similar to our outcome, but no antibiotic prophylaxis was used.³⁰ Some conditions were identified as factors predisposing to infection such as size of PEG tube, PEG experience of the endoscopist, malnutrition, diabetes, cirrhosis, malignancy and radiotherapy.^{12, 30, 36} The low infection rate in our study (2%) and in the Yuruker *et al* study (2.3%) may be due to the experience of the gastroenterologists and the low prevalence of cancer in both studies, 13% and 7%, respectively.

Pneumoperitoneum is usually a temporary and self-resolving condition reported after PEG placement with an incidence around 40% but in a small percentage of cases (5%) can result in a severe complication as peritonitis.^{12, 26} In our study, there was one case of peritonitis that occurred in a patient with esophageal cancer and required a laparotomy and died 11 days after surgery.

Aspiration pneumonia occurred in 2 patients with cerebrovascular disease, a patient with a central nervous system tumor and a patient with head trauma. In all cases, patients were hospitalized and treated antibiotics. A much higher post-procedure rate of aspiration has been reported, ranging from 20% to 30%, with high mortality, especially in patients with cognitive impairment.^{12, 26}

BBS is a serious but rare long-term complication of PEG due to excessive traction between internal and external bumper, with a reported incidence of 0.3% to 8.8%.^{12, 26} Our rate of BBS was within that range (0.5%).

Others complications, such as respiratory and urinary infections, occurred in 28% of our patients. Probably, these infections are not associated with PEG placement but to the host immunity status and underlying conditions.²⁶

A total of 8% of the patients died within 1-month after PEG placement, whereas 33% died within 1 year. The mortality rates in our study population are consistent with the ones reported in the literature.^{24, 28, 29}

PEG involves fewer major and minor complications than open surgical gastrostomy, obviates the need for patient transfer to the operating room, avoids the risks of general anesthesia, is less costly and allows early initiation of tube feeding after placement.^{37, 38} Rustom *et al*⁴ in a comparative study between endoscopic, radiological and surgical placement of gastrostomy tubes, that included head and neck cancer patients, obtained similar rates of complications in the three groups but the short-term mortality rate associated

to surgical gastrostomy group was 10%, a higher mortality rate when compared to the other study groups and to our short-term mortality rate (8%).

For many years, PEG and nasogastric tubes (NGT) were compared to determine the best enteral feeding route. Complications of nasoenteric tubes frequently include inadvertent malposition, epistaxis, sinusitis, inadvertent tube removal, tube clogging, tube-feeding associated diarrhea, and more serious complications like aspiration pneumonia, pulmonary injury, luminal perforation and intracranial placement.^{39, 40} Aspiration or unintended inhalation of saliva, food, or secretions are described in about 90% of the NGT and consequent aspiration pneumonia occurs in 25% to 40% of the patients, with an associated mortality of 17 to 62%.³⁹ A descriptive study of complications of nasogastric tube feeding among 96 geriatric patients showed an overall complication rate of 68%, an aspiration pneumonia rate of 26% and a mortality rate of 38% in a short-term period (65 days).⁴¹ These are much higher rates than those described in our study. Tube dislodgement and blockage are very frequent events associated with NGT with unplanned dislodgement occurring in 25-50%³⁹, a higher rate than what was found in our group (18%).

Our study has some limitations. First, due to its retrospective nature, complications and other data may have been missed. Second, the PEG procedures were performed by different endoscopists. Third, a large number of patients were excluded due to data insufficiency.

Since it was first described, PEG placement by pull-type technique has replaced surgical gastrostomy as the preferential route for enteral feeding. However, new techniques were developed in order to ensure enteral feeding when the classical pull-type PEG procedure is not possible or contraindicated¹. In case of complete stenosis caused by a head and neck tumor, a conventional upper GI endoscope may not be used or the internal bumper of the PEG tube may not pass through the stenosis. Also, adverse events like tumor

seeding may occur in 0,5% to 1% of the procedures.²⁶ These limitations of the conventional pull-type PEG led to the development of new techniques like radiologic fluoroscopy-guided percutaneous gastrostomy with loop gastropexy.⁴² This technique can be used in cases of high grade stenosis since endoscopy is not needed and consequently avoids the seeding of neoplastic cells.⁴² Due to gastropexy, this technique can also be safely used in case of ascites⁴³ and avoids bowel perforation⁴². For patients with amyotrophic lateral sclerosis sedation may be hazardous. As such, fluoroscopy-guided percutaneous gastrostomy may be an option as it does not require sedation.⁴⁴

Recent literature suggests that this technique is feasible and safe, with low rates of associated complications and mortality and may be especially relevant in cases when endoscopic gastrostomy and sedation are contraindicated.^{42, 44}

CONCLUSION

Our experience with the insertion of PEG by the pull-through method reveals that this is a safe and effective way of providing long-term feeding. Complications are common and sometimes severe, but much of the cases can be treated using conservative measures, being PEG placement a minimally invasive procedure with low morbidity and mortality associated.

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