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TOPIC HIGHLIGHT

2016 Gastrointestinal Endoscopy: Global view

# Buried bumper syndrome: A complication of percutaneous endoscopic gastrostomy

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## Abstract

Percutaneous endoscopic gastrostomy (PEG) is a widely used method of nutrition delivery for patients with long-term insufficiency of oral intake. The PEG complication rate varies from 0.4% to 22.5% of cases, with minor complications being three times more frequent. Buried bumper syndrome (BBS) is a severe complication of this method, in which the internal fixation device migrates alongside the tract of the stoma outside the stomach. Excessive compression of tissue between the external and internal fixation device of the gastrostomy tube is considered the main etiological factor leading to BBS. Incidence of BBS is estimated at around 1% (0.3%-2.4%). Inability to insert, loss of patency and leakage around the PEG tube are considered to be a typical symptomatic triad. Gastroscopy is indicated in all cases in which BBS is suspected. The depth of disc migration in relation to the lamina muscularis propria of the stomach is critical for further therapy and can be estimated by endoscopic or transabdominal ultrasound. BBS can be complicated by gastrointestinal bleeding, perforation, peritonitis, intra-abdominal and abdominal wall abscesses, or phlegmon, and these complications can lead to fatal outcomes. The most important preventive measure is adequate positioning of the external bolster. A conservative approach should be applied only in patients with high operative risk and dismal prognosis. Choice of the method of release is based on the type of the PEG set and depth of disc migration. A disc retained inside the stomach and completely covered by the overgrowing tissue can be released using some type of endoscopic dissection technique (needle knife, argon plasma coagulation, or papillotome through the cannula). Proper patient selection and dissection of the overgrowing tissue are the major determinants for successful endoscopic therapy. A disc localized out of the stomach (lamina muscularis propria) should be treated by a surgeon.

**Key words:** Buried bumper syndrome; Percutaneous

endoscopic gastrostomy; Endoscopy; Complication; Enteral nutrition



**Core tip:** This review summarizes current knowledge about buried bumper syndrome, with emphasis on endoscopic diagnosis and therapy. Proper patient selection and endoscopic dissection of the overgrowing tissue are the major determinants for successful endoscopic therapy.

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## INTRODUCTION

Percutaneous endoscopic gastrostomy (PEG) is a well-established method of nutrition delivery[1-3] with a high technical success rate[4]. PEG was introduced in 1980 by Gauderer and Ponsky[5] as an alternative to open surgery. More than 250000 PEGs are implanted in the United States every year. The PEG complication rate varies from 0.4% to 22.5% of cases[1]. Complications can be categorized as major and minor; some are typically early or late[6]. Minor complications are three times more frequent[4], with peristomal infection being the most common[1,6].

## DEFINITION

Buried bumper syndrome (BBS) represents a less common but major complication of PEG. The internal fixation device of the cannula (bumper) migrates alongside the stoma tract out of the stomach. The disc can end up anywhere between the stomach mucosa and the surface of the skin. The stoma channel evolves into the abscess cavity with infiltrate around the migrating disc, while it leaves a fistula towards the stomach lumen. This complication is typical for rigid or semi-rigid internal fixation devices, and cases complicating balloon fixation are rare[7,8]. The mildest form of the syndrome can be hyperplastic tissue growing over the edge of the disc or an ulcer below the disc. The other extreme is complete spontaneous dislocation of the PEG tube with the disc. Some authors limit the syndrome to cases in which the disc is completely covered during endoscopy[9-11], but less advanced cases are also relevant because they can evolve into full BBS without proper precautions.

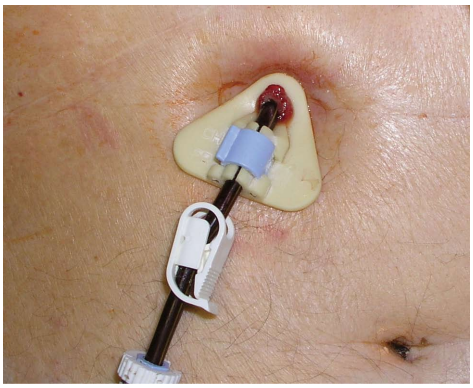

**Figure 1 Buried bumper syndrome.** External view demonstrates tight position of the external fixator with peristomal granulations.

## HISTORY

Ponsky already warned against excessive cannula traction leading to ischemic tissue necrosis and premature release in his editorial in 1986[12]. During 1988 and 1989, several case reports were published on this topic[13-16]. Nelson[17] presented the first case of BBS extracted using endoscopic forceps. Schwartz *et al*[18] in 1989 postulated a symptom triad of BBS: blockage, leakage and inability to insert. Chung *et al*[19] in 1990 published a study identifying excessive tension between the external and internal fixation device to be a major etiological factor for BBS. Authors described the syndrome as retraction, migration, impaction or extrusion, until Klein *et al*[20] introduced the established term BBS in 1990.

## ETIOLOGY AND PATHOGENESIS

Excessive compression of tissue between the external and internal fixation device of the gastrostomy tube is considered the main etiological factor leading to BBS[21] (Figure 1). The optimum position of the external fixator thus plays a key role: excessive pressure can lead to tissue ischemia, necrosis and infection (as the most frequent PEG complication), and subsequent inflammatory and fibrous changes can cause BBS. On the other hand, sufficient interposition of tissue prevents leakage of gastric content into the peritoneal cavity and peritonitis. These two trends are somewhat conflicting: the risk of leakage is considered to be smaller[21] and limited to the first days after PEG introduction, while risk of infection is considerable and risk of BBS is long term (Figure 2). Firm apposition of the external fixator just after introduction with subsequent release within several days seems to be an optimal compromise from this aspect. Chung *et al*[19] found more complications in a cohort of patients with traction than without. Traction formed a twice as shorter stoma tract and led to complications including

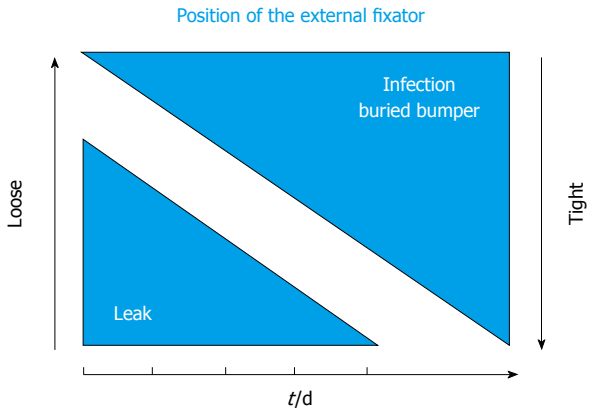


**Figure 2 This chart demonstrates conflicting influence of the position of the external fixator (loose-tight) on the risk of complications (stomal infection, buried bumper syndrome and peritoneal leakage) as a function of time.**

fatal fasciitis/myositis, bleeding and BBS, while omitting traction was not complicated by leakage. Stoma tract formation was followed in studies on dogs. Mellinger *et al*[22] found no complications in a cohort with a loose external fixator. The frequency of infectious complications and BBS correlated with tightness of the external fixator in the study performed by DeLegge *et al*[23]. Swelling of all tissues involved in the stoma tract can further increase the pressure and must be taken into account[24].

Risk factors for BBS can be classified as follows: (1) cannula (material, shape, and axis deviation); (2) procedure (point of insertion, position of the external fixator, and dressing); (3) long-term care (change of the position of the external fixator, dressing, and preventive maneuvers); and (4) patient (indication, comorbidity, medication, and abnormal manipulation with gastrostomy).

Rigidity and abrasiveness (and change of these properties in an acid gastric environment) can contribute to BBS. Small contact area[21], sharp edges and conical shape pose a risk of BBS. Improper lining, jejunal extension[16] and some types of cannula are prone to deviate the axis from perpendicular to more tangential. The risk of BBS with balloon fixation is smaller but not zero[7,8]. The distance between the external fixator and skin should be 10 mm. Some authors recommend this distance at the time of PEG insertion and without interposed dressing[1,6], others (including our group) prefer firmer apposition of the external bolster within the first 4 d to avoid peritoneal leakage[21]. Permanent interposition of a dressing or tightening of the external bolster are important risk factors relating to home care[25]. There is a higher risk of BBS in patients with malignancy, bad initial nutritional status (body mass index < 20 kg/m$^2$), with significant weight gain[8,25,26], in children[21] and uncooperative agitated patients[7,25]. Therapy with systemic corticosteroids or chemo-/radiotherapy can impair tissue healing and forming of the stoma tract.

Although BBS is considered to be a chronic complication[27], migration to skin level was described as early as after 6 d[28] and 9 d[29] from insertion. Acute BBS (within 30 d from insertion) is caused by vigorous traction of the cannula by patients themselves (agitation[30,31]) or by extreme tightness of the external bolster. These cases are probably not suitable for a conservative and endoscopic approach with respect to the immature stoma tract[15,32,33].

## EPIDEMIOLOGY

Incidence of BBS is estimated at around 1%[10] (0.3%-2.4%)[1,34-36], but it increases in exceptional studies to 9%[8] and even to almost 22% in a pediatric case series[37]. A prospective study found BBS using computer tomography in 5% (3/57)[38] of gastrostomies introduced more than a year ago. Bittinger *et al*[39] described an increase in incidence from 0.8% in 1998 to 3.6% in 2004. We should take into account the variability in quality of PEG procedures and under-reporting in real life.

## SYMPTOMS

Leakage of gastric content or nutrition from the stoma is an early symptom of BBS. Erythema, purulent secretion and pain are symptoms of local infection. Fixation of the cannula impedes further insertion, while the ability to rotate can be preserved. Blockage of the tube is a late symptom, sometimes initially limited to aspiration (valve type)[40], but preserved patency does not exclude BBS. In rare cases, the internal disc can protrude from the skin or is palpable just below the skin. Inability to insert, loss of patency, and leakage around the PEG tube are considered to be a typical symptomatic triad[17,18]. BBS can be an incidental finding during gastroscopy for removal or for another indication.

## DIAGNOSIS

Gastroscopy is indicated in all cases when BBS is suspected. A pressure ulcer (Figure 3A) below the disc and tissue growing over the edge of the disc (Figure 3B) are typical early signs. The disc can disappear gradually; the involved area may be flat (Figure 3C), excavated (Figure 3D) or elevated (Figure 3E), resembling a submucosal tumor. The mucosa may be normal or edematous. The orifice of a residual fistula can be identified in the majority of cases; discharge of pus, nutrition, rinsing water (Figure 3E) or methylene blue injected to cannula[41,42] can reveal it. Localization of the fistula orifice does not always correspond with localization of the buried bumper itself[43], we can use fluoroscopic control and perform a "tubogram" (Figure 4). A guidewire pulled through the PEG and fistula to the stomach lumen can help to guide endoscopic therapy.

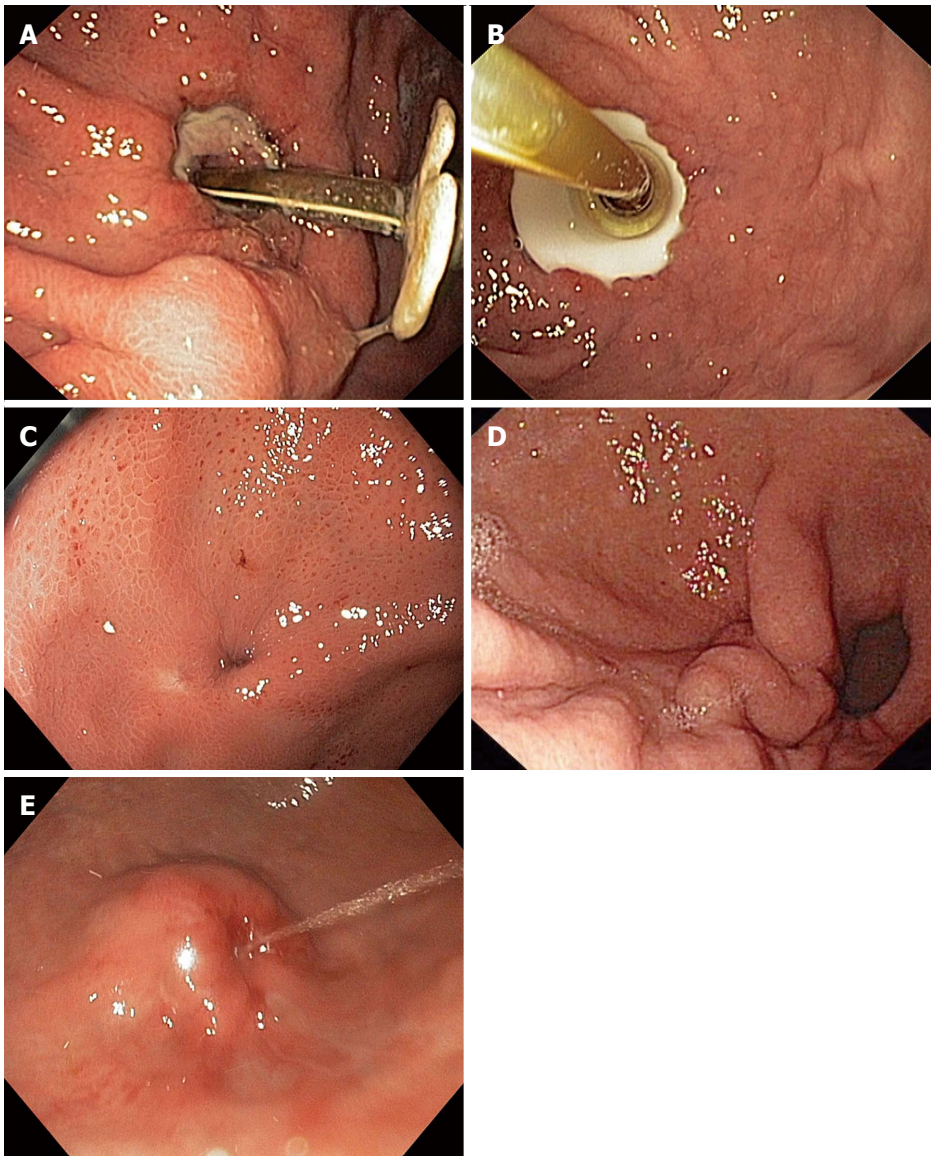


**Figure 3 Buried bumper syndrome, gastroscopy.** A: Pressure ulcer under the internal bolster repositioned to the gastric lumen; B: Hyperplastic tissue growing over the edge of the disk; C: Flat stomach wall with fistula orifice covering totally the internal bolster; D: Completely buried disc retracting the gastric mucosa; E: Internal bolster totally embedded in the stomach wall resembling a submucosal tumor. Flushing solution running from the internal orifice of the residual fistula.

**Figure 4 Buried bumper syndrome, fluoroscopy (tubogram).** Cavity around the buried bolster filled with contrast agent leaking through the fistula (arrow) to the stomach lumen.

The depth of disc migration in relation to the lamina muscularis propria of the stomach is critical for further therapy. The depth of migration can be estimated by endoscopic ultrasound (miniprobe[9] or radial[44,45]); transabdominal ultrasound was used previously by our group in a small case series[46] (Figure 5). Computed tomography (Figure 6) can also help to diagnose BBS[34] and estimate the depth of migration[47], although further methodological data are lacking.

## COMPLICATIONS

BBS can be complicated by gastrointestinal bleeding[15,32,48,49], perforation, peritonitis[15,32,50], intra-abdominal[51,52] and abdominal wall[53] abscesses, or phlegmon[54], and these complications can lead to fatal

**Figure 5 Buried bumper syndrome, abdominal ultrasound.** Internal retention disc (arrowheads) located out of the lamina muscularis propria of the stomach (arrow).

**Figure 6 Buried bumper syndrome, computed tomography.** Internal retention disc localized between the gastric and abdominal wall (courtesy of Pavel Ryska, MD, PhD, Department of radiology, University Hospital Hradec Kralove, Czech Republic).

outcomes. Bleeding can be treated endoscopically by epinephrine injection and tamponade with a balloon gastrostomy set[48], but sometimes angiography is needed[49].

## PREVENTION

The most important preventive measure is adequate positioning of the external bolster. The distance between the skin and the external fixator should be 10 mm, although there is no consensus as to whether this distance is safe at the time of insertion (without interposed lining)[1,6], or whether firmer apposition is needed (for around 4 d) with respect to risk of peritoneal leakage[21]. The length of the stoma channel (skin surface level against the scaled cannula) should be measured and recorded at the time of insertion for future reference[21]. There is also no consistent opinion about the need for endoscopic control of the internal fixator during the final PEG set assembly[1,2,21]. There is no doubt as to loose positioning of the external bolster (10 mm) in patients with a mature stoma tract (usually after 2 wk)[1]. The stoma tract lengthens with weight gain and in upright position[21,23,55] and the bolster should be properly repositioned.

Movement of the upper limbs in uncooperative patients might be managed[31] using special gloves or using a low-profile device (feeding button). Simple wrapping of the PEG can lead to deviation of the tube axis and can initiate BBS.

"PEG twirl sign"[27] is an important preventive measure. Once the stoma channel has matured (usually after 2 wk), the external bolster should be unfastened once weekly (some authors recommend daily) and a PEG tube inserted several centimeters inside and turned 360° around its long axis. The external fixator should be fastened back to the proper (loose) position. This maneuver is not suitable for balloon catheters and for PEG with jejunal extension.

Communication among all involved subjects is the key issue in PEG care: patients, relatives, nurses, home-care facilities, nursing home staff, the digestive endoscopist, nutritional specialist, biomedical companies[56] and others. At least basic written information is advisable. Some authors recommend systematic follow-up of all the patients with PEG by a nutritional team[10].

## THERAPY

Nutritional support must be maintained either using an enteral tube inserted through the buried PEG set and through the residual fistula to the stomach (if they are still patent)[11], or by placement of a new gastrostomy set if there are no signs of severe inflammatory complication such as abscess or phlegmon[52]. Secondly, the buried gastrostomy system should be figured out.

### *Conservative approach*

The "cut and leave it" strategy was considered relatively safe by Kejariwal *et al*[11]. Their opinion was based on observation of seven patients with BBS for a median of 18 mo without related mortality.

Chong[57] recommended this attitude only for persons with a high operative risk and dismal prognosis. Two BBS cases were treated conservatively in a series by Horbach *et al*[58]. Both were complicated by subcutaneous infection; other BBS cases were complicated by peritonitis[15,32,50] or abscesses[51-53]. A buried disc can sometimes continue to migrate spontaneously and can be released subsequently by skin incision[16] or migration could be stimulated by increased traction[59].

### *Endoscopic therapy*

**Extraction:** Systems equipped with soft or ballooned internal retention devices can be simply extracted[8,25,43,60-62], and there are no complications observed apart from slight bleeding. Fay *et al*[63] and Venu *et al*[36] extracted a buried cannula simultaneously with pulling through of a new system (Figure 7A); the buried disc was either located subcutaneously or an additional incision and preparation were needed. Excessive traction can sometimes separate a disc

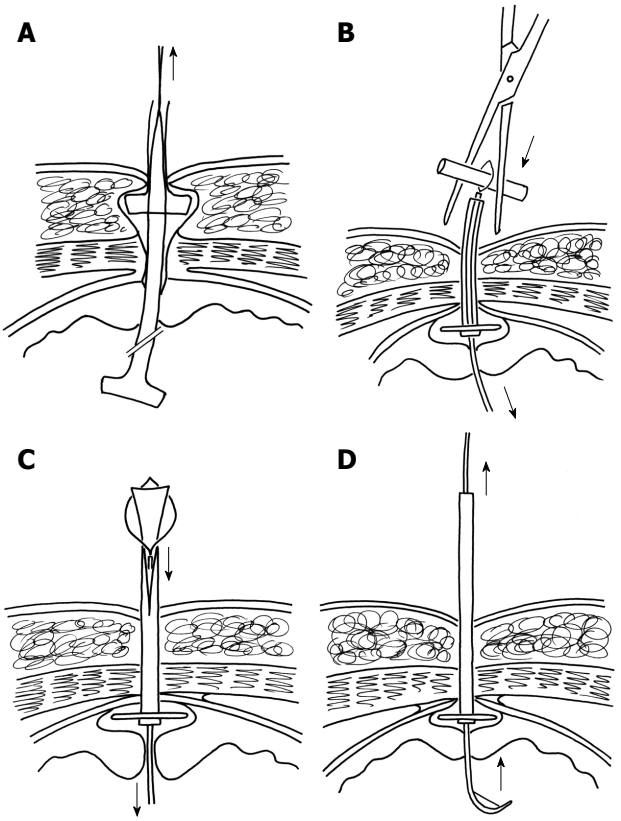


**Figure 7 Treatment methods of buried bumper syndrome.** A: Extraction of the buried gastrostomy tube with simultaneous pull through of the new one (adapted from[36,63]); B: "Push-pull T technique". Endoscopist pulls the buried gastrostomy tube by a polypectomy snare anchored using a "T-arm", while the system is stabilized and pushed inside using a clamp (adapted from[27,72]); C: A polypectomy snare entraps the buried cannula as close to the skin as possible (thanks to splitting) (adapted from[75]); D: Papillotome introduced through a shortened cannula cuts the overgrowing tissue (adapted from[78-81]).

from a gastrostomy tube and the disc thus can be retained[39,42,58,63,64].

**Push and pull inside:** A buried gastrostomy system can be stiffened and pushed inside the stomach using a Savary dilator[20,65,66] or similar special stiffeners[40,67] or other devices like the "quill" technique[68].

Dilation balloons can be introduced either externally through the buried tube[69] or endoscopically[9,70,71]. While inflated partially inside the cannula and in the gastric lumen, the balloon can help to release the buried bumper into the stomach by stiffening the system and simultaneous dilation of the overgrowing tissue.

A variety of instruments like polypectomy snares and endoscopic forceps can be used[9].

Boyd *et al*[27] developed the "push-pull T-technique" using simultaneous traction with a polypectomy snare and support using a surgical clamp (Figure 7B). The technique has been used by other authors[26,72]. Some endoscopists prefer a simpler "pull T-technique" (without external support)[58,73] or some modifications of snare use[74], like Turner *et al*[75] (Figure 7C).

**Endoscopic discussion:** Ma *et al*[30] used a needle knife for discission of the overgrowing tissue for the first time. Two of five patients experienced complications with serious bleeding. Dell'Abate *et al*[24] and Lin *et al*[76] used the same technique in treatment of a partially covered disc. Orsi *et al*[26] used a needle knife in combination with a push-pull T-technique in six cases, complicated either by severe bleeding or by perforation with fatal consequences. Braden *et al*[9] used this technique in eight cases selected by endosonography. No significant complications apart from slight bleeding were observed. Bittinger[39] succeeded with this technique in only half of 27 unselected BBS cases; six of them complicated by bleeding. Horbach *et al*[58] used a needle knife in combination with a pull T-technique in 18 patients. A third of cases needed three or more sessions and therapy was complicated by pneumoperitoneum twice. A needle knife was used also by Rieder *et al*[66] (seven patients), El *et al*[10] (six patients) and Köhler *et al*[40] in two pediatric patients. A needle knife dissects radially from the anticipated center of the buried disc (a guidewire pulled through the PEG tube is recommended for proper orientation), and a side-viewing endoscope is sometimes needed[10]. Similarly, instruments for endoscopic submucosal dissection (ESD) like HybridKnife[77] can be used for dissection.

The technique of the papillotome introduced *via* a stump of the PEG tube was described by Müller-Gerbes *et al*[78] in 2009 (nine patients), by our group in an English literature publication in 2012 (5 patients)[79] (Figure 7D), and it was subsequently used by other authors[80,81]. The papillotome is inserted over the wire from outside into the stomach through a shortened PEG tube. While bending and pulling the papillotome slightly from the outside, the cutting wire dissects the tissue growing over the button; usually in several radial cuts aimed at the most prominent bulging.

Argon plasma coagulation can be also used for destruction of the overgrowing tissue[45].

Novel techniques of NOTES (natural orifice transluminal endoscopic surgery) are also described in the treatment of BBS[82].

### *Radiological therapy*

Crowley *et al*[83] used an angioplasty catheter under fluoroscopic control in six pediatric patients, either introduced through a cannula or orally. Inflation of the balloon at the level of the buried bumper helped to stiffen the system, dilate overgrowing tissue, and push the PEG tube to the gastric lumen, similarly to endoscopic balloons.

### *Surgical therapy*

A disc that has migrated subcutaneously can be released by skin incisions[84]. Sauer and Staritz[85] published a technique of incision using a point scalpel alongside the cannula under external traction. Laparoscopy can serve as an alternative to digestive

**Table 1 Buried bumper syndrome severity classification (adapted from[90])**

| Grade | Finding | | | Action |
|---|---|---|---|---|
| | Clinical (cannula) | Endoscopical | Radiological | |
| 0 | Movable patent | Normal | Not needed | Prevention |
| 1 | Movable patent | Ulcer below the disc and/or marginal overgrowth[1] (less than half of the disc area covered) | Not needed | Prevention/follow-up |
| 2 | Mostly fixed mostly patent | Disc[2] components still visible[1] (more than half of the disc area covered) | Not needed | Endoscopy w/o dissection |
| 3 | Fixed might be patent | Disc[2] completely covered[1] | Disc localised inside the stomach | Endoscopy with dissection |
| 4 | Fixed mostly blocked | Disc[2] completely covered[1] | Disc localised outside the stomach | Surgery |
| 5 | Disc protrudes out of the skin or palpable just below the skin[1] | Disc[2] completely covered | Not needed | Surgery/extraction |

[1]Disc represents all the internal part of the cannula including possible central knob; [2]Critical components of the classification.

endoscopy in resolution of discs buried inside the stomach[86-88]. Other cases with a disc buried in an abscess/infiltrate between the gastric and abdominal wall requires major surgery with classical laparotomy because discission or even partial resection of the stomach wall is occasionally required together with drainage[50,89].

### *Therapeutic choice*

A conservative "cut and leave" strategy can be applied in patients with dismal prognosis without signs of local or systemic inflammation. Choice of the method of release is based on the type of the PEG set and depth of disc migration.

Systems with a balloon or other soft retention devices and discs which have migrated to the skin level can be drawn out either itself or with a new set pulled through (with a small skin incision under local anesthesia if needed). Marginal overgrowth is usually resolved by simple repositioning of the tube deeper into the stomach. There is no consistent opinion on the variety of cases between the above-mentioned extremes. Only Braden *et al*[9] evaluated the depth of migration systematically in their study using a miniprobe endoscopic ultrasound. Ulla *et al*[45] defined the lamina muscularis propria as a virtual border between endoscopic and surgical therapy. Abdominal ultrasound was used for assessment of the depth of migration in our small case series[46] and our BBS classification system[90] is based on it (Table 1). A disc retained inside the stomach and completely covered by the overgrowing tissue must be released with some type of dissection technique. A needle knife represents the conventional method of dissection, published in almost 60 patients[9,10,26,30,39,58]. There were several incidents of bleeding (including fatal[26]) and pneumoperitoneum (without peritonitis)[58] complicating this method. This method was effective in only half of the cases unselected according to the depth of migration[39] and the method appeared cumbersome in some series[58]. Papillotome introduced *via* PEG stump is a promising alternative, although only 15 cases with complete overgrowth have been referred to date[78-80].

The acute form of BBS seems to be risky for the conservative and endoscopic approach.

A disc localized out of the stomach (lamina muscularis propria) should be treated by a surgeon.

### *Secondary prevention*

A new gastrostomy set can be placed directly through the same stoma in the majority of cases[58]. Some authors prefer to implant the new PEG set beside the original stoma[9]. A "two-step approach" should be applied in the event of significant inflammatory changes (abscess or phlegmon) or the presence of a wide defect after the disc has been removed, while the patient is supplied by nasogastric/enteral/parenteral feeding and provided with antibiotics[52] with adjunctive proton pump inhibitor therapy and local therapy if indicated.

The risk of BBS relapse is low, if the patient and/or staff are properly educated, all preventive measures applied (rotation), and risk factors properly identified and eliminated. We can use a balloon type of gastrostoma set, which carries a lower risk of BBS[25] and we can follow up the patient endoscopically to detect early stages of this complication.

## CONCLUSION

PEG is a widely used method of nutrition delivery for patients with long-term insufficiency of oral intake. BBS ranks among the severe complications of this method, in which the internal fixation device migrates along the tract of the stoma outside the stomach. Despite all precautions being respected - including adequate positioning of the outer fixator - this complication does occur and early diagnosis and proper management should be offered to afflicted patients with major emphasis on ethical considerations. BBS can be managed conservatively, surgically or endoscopically in many variations. Proper patient selection and dissection of the overgrowing tissue are the major

determinants for successful endoscopic therapy.

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