Routine anti-reflux surgery combined with gastrostomy in children: is it really necessary? Our single-center experience

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ABSTRACT

Objective. To study gastroesophageal reflux (GER) in children undergoing gastrostomy in a single pediatric institution.

Materials and methods. A retrospective study of patients undergoing gastrostomy from 2000 to 2017 was carried out. Demographic data, clinical data, progression, and complications were recorded. GER was considered positive in patients with clinical signs requiring antisecretory treatment, prokinetic treatment, or anti-reflux surgery to control symptoms.

Results. 207 patients with a median age of 2 years [R: 0.25-18] were included. Neurological impairment was the most frequent underlying condition (74%). Swallowing difficulty and undernourishment were the main surgical indications for gastrostomy. Prior to gastrostomy, 96 out of 207 patients (46%) showed GER symptoms. Combined fundoplication and gastrostomy was performed in 41 (43%) patients with preexisting GER, 6 of whom showed GER worsening (4 required redo fundoplication). 5 complications following fundoplication were noted – gastric perforation, sustained Dumping syndrome, and gastroesophageal stenosis. 55 out of 96 (57%) patients with preexisting GER underwent gastrostomy alone. Clinical signs disappeared in 16 of them (29%) and improved or stabilized in 19 (35%). GER worsening occurred in 20 patients (36%), with subsequent fundoplication being required in 10 cases. In patients with no previous clinical signs (111 out of 207), GER symptoms occurred following gastrostomy in just 18 cases (16%), and only 2 patients required fundoplication.

Conclusions. In our experience, routine anti-reflux surgery combined with gastrostomy is not justified. Individualized fundoplication should be considered in case of medical treatment failure. Further studies with an adequate design are required to establish which patients could really benefit from this procedure.

KEY WORDS: Gastroesophageal Reflux; Gastrostomy; Fundoplication.

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This work was presented at the 58th congress of the Spanish Pediatric Surgery Society held in Vigo on May 23-25, 2019.

Date of submission: August 2020 *Date of acceptance:* November 2020

¿ES REALMENTE NECESARIO ASOCIAR UNA TÉCNICA ANTIRREFLUJO A LA GASTROSTOMÍA DE FORMA RUTINARIA? EXPERIENCIA EN NUESTRO CENTRO

RESUMEN

Objetivos. Estudio del reflujo gastroesofágico (RGE) en los pacientes en los que se ha realizado una gastrostomía en nuestro centro.

Material y métodos. Revisión de los pacientes intervenidos de gastrostomía en el periodo 2000-2017. Registro de datos demográficos, clínicos, evolución y complicaciones. Definimos RGE como la presencia de clínica compatible en pacientes que requirieron tratamiento médico o quirúrgico antirreflujo.

Resultados. Incluimos 207 pacientes con una mediana de edad de 2 años [r:0,25-18]. La patología subyacente más frecuente fue déficit neurológico (74%). Las indicaciones quirúrgicas fueron trastornos deglutorios y/o desnutrición. Previamente a la gastrostomía, 96/207 pacientes (46%) presentaban clínica de RGE. Se realizó funduplicatura asociada a gastrostomía en 41/96 (43%) de los pacientes con RGE previo. En 6/41 pacientes (15%) el RGE empeoró, requiriendo 4 de ellos una segunda funduplicatura. Se registraron 5 complicaciones tras funduplicatura (perforaciones gástricas, síndromes de Dumping prolongados y estenosis esofagogástrica). En 55/96 pacientes con RGE previo a la gastrostomía no se asoció funduplicatura. La clínica desapareció en 16/55 (29%), y mejoró o se estabilizó en 19/55 pacientes (35%). En 20/55 (36%) la sintomatología empeoró, y 10 de ellos precisaron una funduplicatura posterior. De los pacientes sin clínica previa de RGE (111/207), presentaron síntomas de RGE tras la gastrostomía 18/111 (16%), y solo 2 pacientes requirieron funduplicatura.

Conclusiones. Según nuestra experiencia, la funduplicatura de rutina asociada a la gastrostomía no está justificada. En caso de fracaso del tratamiento médico del RGE, una técnica antirreflujo debe plantearse de forma individualizada. Son necesarios estudios adecuadamente diseñados para definir qué pacientes realmente se beneficiarían de este procedimiento.

PALABRAS CLAVE: Reflujo gastroesofágico; Gastrostomía; Funduplicatura.

INTRODUCTION

Gastrostomy is the procedure of choice in patients requiring long-term enteral feeding as a result of swal-

lowing difficulty and other causes impairing oral feeding.

Many situations where gastrostomy is indicated in children are frequently associated with gastroesophageal reflux (GER). Indeed, neurological impairment, which occurs in more than 50% of patients undergoing gastrostomy, predisposes to GER as a result of esophageal dysmotility, decreased pressure of the lower esophageal sphincter, delayed gastric voiding, and increased abdominal pressure due to spasticity, convulsions, scoliosis, constipation, or abnormal postures[1].

GER is one of the complications reported following gastrostomy, with a prevalence of 13-28%[2-4]. This has led many surgeons to systematically resort to anti-reflux techniques in the same surgical procedure, and especially so in patients with neurological impairment, even in patients without evidence of GER[1,5-7]. However, this strategy has been called into question for more than 20 years, with gastrostomies being performed alone, also in GER patients[1,2,5-8]. Unfortunately, results have been inconclusive.

Based on this, the objective of this study was to assess the impact of gastrostomy on GER occurrence and progression, as well as to identify any factor that could potentially establish the need for fundoplication in these patients.

MATERIALS AND METHODS

A retrospective study of patients aged 0-18 undergoing gastrostomy at our healthcare facility from 2000 to 2017 was carried out. Clinical record data reviewed included sex, age, underlying pathology, neurological condition, possibility of oral feeding, surgical indication, preoperative diagnosis of GER, surgical technique, subsequent occurrence of GER, and progression. Undernourishment was defined as a weight/size ratio below 2 SDs of the 50th percentile according to age.

GER was defined as the presence of compatible clinical symptoms in patients undergoing medical or surgical anti-reflux treatment.

Patients were divided into 2 groups: patients with clinical signs of GER prior to gastrostomy (Group 1) and patients without clinical signs of GER prior to gastrostomy (Group 2). Group 1 patients were divided into patients undergoing gastrostomy alone (Group 1A) and patients undergoing combined gastrostomy and anti-reflux surgical technique (Group 1B).

Postoperative GER progression was defined as *improvement* (when anti-reflux medication could be reduced), *stability* (when no medication increase or changes were required), and *worsening* (when medication increase or changes were required; when clinical complications secondary to GER occurred; or when anti-reflux technique was required for symptom control purposes).

Table 1. Underlying pathology.

Underlying pathology	*N (%)*
Neurological	153 (73.9%)
Digestive	20 (9.6%)
Metabolic	10 (4.8%)
Oncologic	7 (3.4%)
ENT	7 (3.4%)
Prematurity	7 (3.4%)
Psychogenic	3 (1.5%)

N: number of patients.

Qualitative variables were expressed as frequency distribution. Quantitative variables were expressed as mean if they followed a normal distribution, or as median and interquartile range (25-75 IQR) if they did not follow a normal distribution.

Bivariate association among qualitative variables was analyzed using the χ^2 test or Fisher's exact test (when more than 25% of expected values were < 5). Multivariate association was assessed using the logistic regression test.

Quantitative variable behavior was analyzed for each of the independent variables categorized using Mann-Whitney U test if quantitative variables did not follow a normal distribution.

Statistical analysis was carried out using the STATA 14.0 software.

RESULTS

During the study period, gastrostomy was performed in 220 patients, 13 of whom were excluded due to lack of clinical data. 207 patients were reviewed, 120 of whom were male (58%) and 87 female (42%), with a median age of 2 years (25-75 IQR: 1-8).

The most frequent underlying condition was neurological pathology, which was found in 153 patients (74%), followed by digestive disorders in 20 patients (10%) (Table 1).

Prior to gastrostomy, 63% of patients (131 out of 207) had been receiving full or partial oral feeding, and 37% (76 out of 207) had been receiving nasogastric feeding only.

The most frequent surgical indications were swallowing difficulty in 149 patients (72%), undernourishment in 97 patients (47%), and both indications in 52 patients (25%).

96 patients were included in Group 1: 48 patients (50%) with digestive symptoms, 34 patients (35%) with respiratory symptoms, and 14 patients (15%) with other symptoms suggestive of GER, such as irritability or postprandial spasticity. 79 patients (82%) had neurological impairment, with GER being more prevalent (p= 0.01) than in the 17 patients (18%) without neurological impairment.

Table 2. Complementary tests in preoperative GER assessment

	EGDTT	*pH-metry with/without impedance testing*	*Upper GI endoscopy*	*Esophageal manometry*
Not performed	142	158	191	201
Performed (–)	24	23	6	2
Performed (+)	41	26	10	4
Tests carried out	65 (31.4%)	49 (23.7%)	16 (7.8%)	6 (2.9%)

EGDTT = Esophagogastroduodenal transit test.

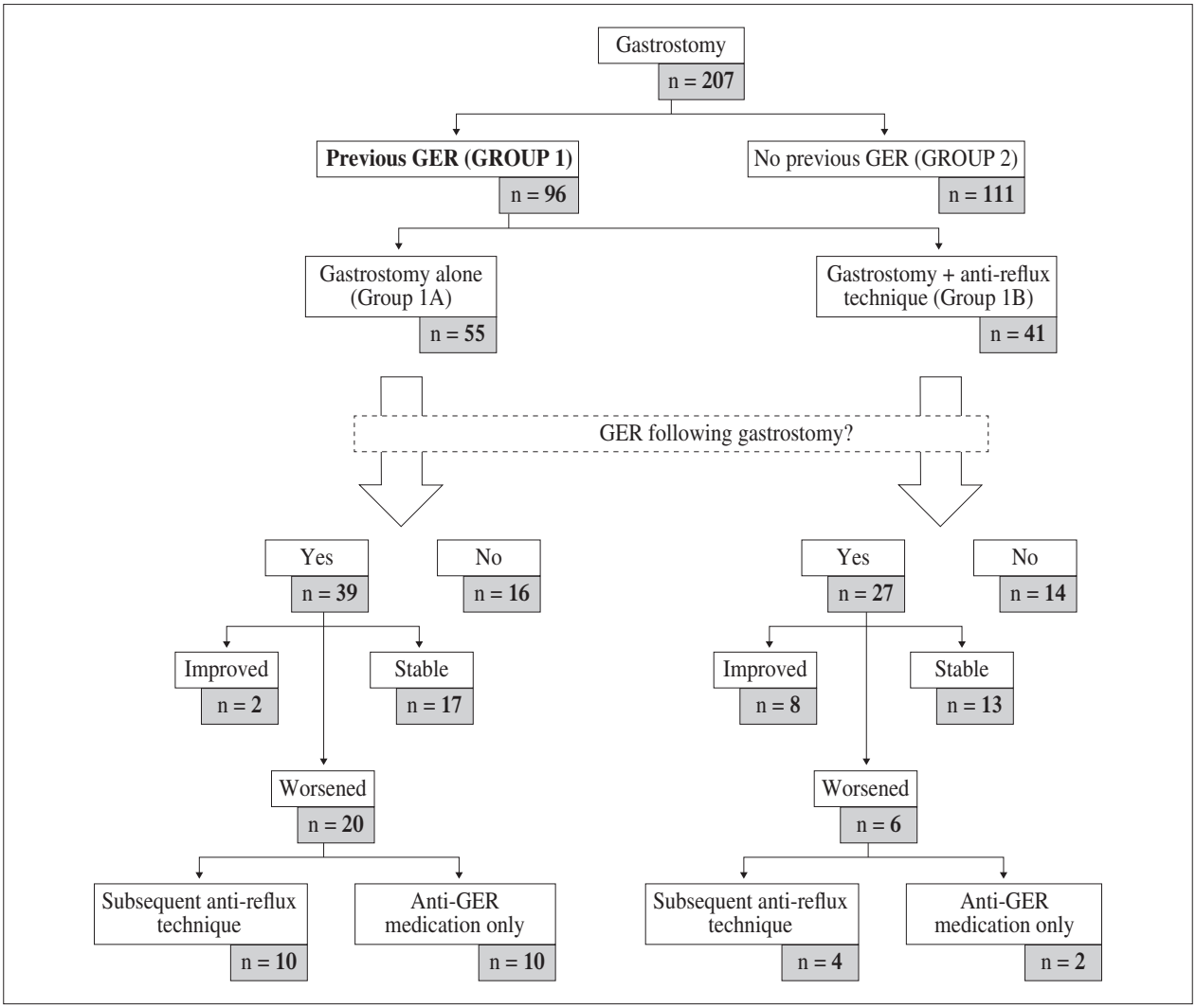

Figure 1. Study groups (n = number of patients). Patients with previous GER.

Complementary tests used for GER diagnosis are featured in Table 2. In 87 patients (42%), at least one complementary test was carried out, but none of them underwent the 4 tests described. Of the 26 patients with GER history whose condition worsened following surgery, 18 underwent preoperative pH-metry, half of which (9 out of 18) were normal.

Endoscopic percutaneous gastrostomy was performed in 158 patients (76%), and Stamm technique was carried out in 49 patients (24%).

Mean follow-up time was 40.6 months, with a median of 27 months (R: 0.25-146).

In the group with previous GER (Group 1) (Fig, 1), gastrostomy alone (Group 1A) was performed in 55 out of

Table 3. Variables potentially associated with GER worsening.

Variable	*Association with GER worsening (bivariate analysis)*
Neurological impairment	p = 0.14
Oral feeding	p = 0.03*
Undernourishment	p = 0.21
Swallowing difficulty	p = 0.76
Underlying pathology	p = 0.33
Sex	p = 0.36
Age	p = 0.02*

*GER = Gastroesophageal reflux. *Statistically significant.*

96 patients (57%), while fundoplication (Group 1B) was carried out in 41 out of 96 patients – 20% of all patients undergoing gastrostomy. Nissen fundoplication was conducted in 39 out of 41 cases.

Regarding progression, 39 out of 55 patients from Group 1A had persistent GER symptoms following gastrostomy, with worsening being observed in 20 patients, stabilization in 17 patients, and improvement in 2 patients. Median time from gastrostomy to worsening was 2.25 months (25-75 IQR: 1-7.75). Half of them (10 out of 20) required fundoplication.

In Group 1B, 27 cases had persistent GER symptoms in spite of fundoplication: 6 of them worsened (4 required redo fundoplication), 13 remained stable, and 8 improved. Median time from surgery to worsening was 3 months.

Of the 26 out of 96 patients with previous GER history whose condition worsened following surgery, 20 had neurological impairment (77%).

Bivariate analysis showed a statistically significant relationship between GER worsening and combined fundoplication and gastrostomy (p= 0.018). In the logistic regression study, anti-reflux technique emerged as a risk factor for GER worsening (OR= 3.68).

The study of variables potentially associated with postoperative GER worsening is featured in Table 3. Results confirmed a positive association with oral feeding (p= 0.03) and age (p= 0.02) both for worsening patients (median: 1 year; IQR: 0.75-3), and stable and improving patients (median: 2.5 years; IQR: 1-11).

111 out of 207 patients had no GER prior to gastrostomy (Group 2), and none of them underwent anti-reflux technique (Fig, 2). In 18 of them (16%), postoperative GER symptoms occurred following a median of 4 months since gastrostomy (25-75 IQR: 2-13). Only 2 out of 18 patients required fundoplication.

Median time from gastrostomy to subsequent fundoplication was 10.5 months (25-75 IQR: 5.5-26.5 months).

Following the 57 fundoplications carried out (including 4 redo fundoplications), 5 complications were recorded: 2 gastric perforations, 1 gastroesophageal junction stenosis requiring endoscopic dilatation, and 2 sustained Dumping syndromes.

In 40 out of 207 patients, follow-up was completed after gastrostomy closure. 40 out of 207 patients died as a result of baseline pathology.

At present, 67 out of 207 patients (32%) remain under follow-up at our healthcare facility, and 60 out of 207 (29%) are under follow-up at their original institution.

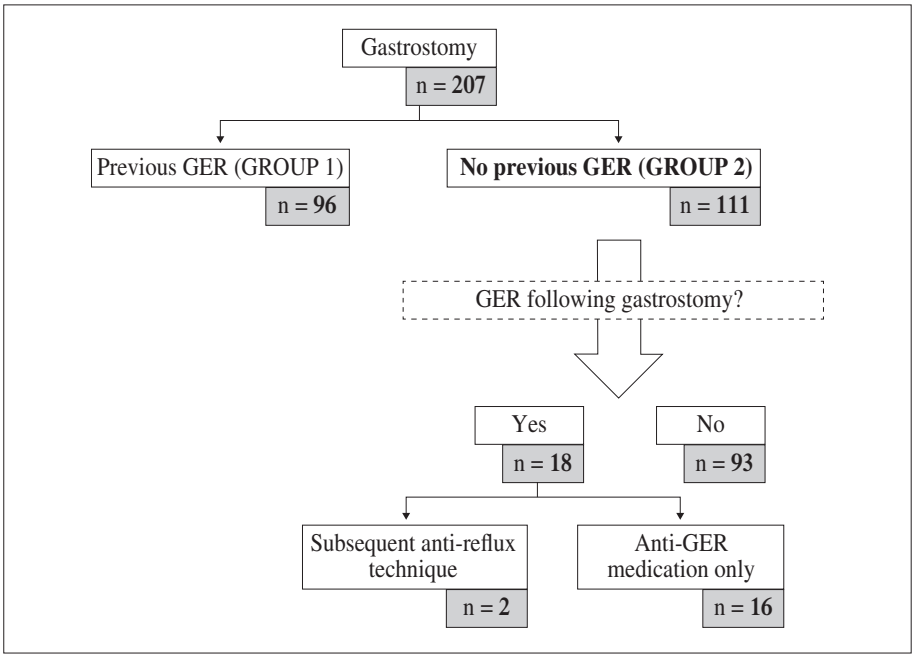

Figure 2. Study groups (n = number of patients). Patients without previous GER.

DISCUSSION

Various factors contribute to GER occurrence or worsening following gastrostomy – severity of baseline pathology, increase in transdiaphragmatic pressure in patients with lung disease, location of the gastrostomy tube, and type of feeding. In adults, quick gastric distension as a result of discontinuous feeding or bolus feeding – contrarily to continuous feeding – has been demonstrated to reduce lower esophageal sphincter pressure, which favors GER[1]. Gastrostomy position is another important factor as the gastric pouch is found at an altered location, which probably interferes with stomach motility. Therefore, antrum location seems less favorable than corpus location[9].

On the other hand, most children requiring gastrostomy have severe pathologies that prevent complementary tests from being carried out to assess GER severity, which leads to inadequate pre-gastrostomy GER assessment. Apart from these limitations, GER symptoms in more complex patients are often atypical or subtle, which means they can be mistaken for baseline pathology symptoms. Consequently, the study of GER severity may prove uneasy and raise doubts as to whether fundoplication is indicated or not.

Apart from the fact GER assessment in children scheduled for gastrostomy has not been standardized yet, diagnostic tests have limitations in the pediatric population[1]. Esophagogastroduodenal transit test (EGDTT) may prove useful to rule out anatomical abnormalities, but diagnostic usefulness in GER is unclear[10,11]. Although pH-metry is considered the gold standard for GER study, it has a <50% sensitivity in pediatric patients, since clinical signs are most likely correlated with results[9,12]. Combined multichannel intraesophageal impedance and pH testing (MIIpH) improves performance, but there are no normality values available for pediatric patients. Upper GI endoscopy does not always reveal pathological findings of esophagitis in children that may validate it for GER diagnosis[2,13]. Last, high-resolution esophageal manometry could be a useful tool, but it is available in very few institutions[12].

Consistent with other series published[5,14], the study of GER at our healthcare facility was not homogeneously conducted in all patients, with GER and GER severity diagnosis being primarily clinical. EGDTT was the most frequent test (31%), followed by pH-metry (23.7%). Upper GI endoscopy was carried out in 7.8% of patients only. 58% of patients underwent no test.

Based on this, predicting which patients will benefit from fundoplication is uneasy, and indication criteria are largely variable[1-4,14]. Comprehensive clinical assessment may help establish the importance and repercussion of GER in these children[1,8].

There are contradictory data in the literature regarding the relationship between GER and gastrostomy. Some studies have concluded that gastrostomy does not cause GER worsening as measured by preoperative and postoperative pH-metry[4,9,15,16]. However, according to others, it does increase reflux episodes, even though pH-metry worsening is not correlated with symptom worsening[17,18]. Other studies assessing clinical data report digestive and respiratory symptom improvement following gastrostomy in GER patients as measured by preoperative pH-metry[8,19].

In our study, symptoms disappeared in 29% (16 out of 55) of patients with GER symptoms prior to gastrostomy alone. Less than half of the cases from this group (36%) had clinical worsening. In the group of patients without GER symptoms prior to gastrostomy alone, only 16% (18 out of 111) had symptoms following gastrostomy. This favorable progression could be explained by gastrostomy-related feeding improvement. Some studies have demonstrated a significant decrease in the number of GER episodes at pH-metry, a decline in esophagitis frequency, and even full vomit remission in patients with feeding improvement following gastrostomy[8,20,21].

The indication of combined fundoplication and gastrostomy is aimed at protecting the airway from refluxed gastric content aspiration, relieving symptoms, optimizing feeding, improving patients' and caregivers' quality of life, and reducing GER-related hospital admissions[14]. However, up until now, there has been insufficient evidence on effectiveness in pediatric patients[22,23]. On the other hand, fundoplication may cause some adverse effects which are difficult to treat, such as nausea, aerophagia, intestinal transit disorder, gastric volume reduction discomfort, and abdominal pain, which may require re-intervention in up to 50% of cases[22-24]. In our study, postoperative complications were recorded in 5 out of the 53 fundoplications performed (9%), and in 4 cases (7.5%), redo fundoplication was required as a result of recurrent GER.

The need for subsequent anti-reflux technique, which involves greater technical difficulty owing to the altered anatomical position of the gastric pouch as a result of being fixated to the abdominal wall, has also been reported as a reason for systematically combining fundoplication and gastrostomy[8,19,21].

In our experience, only 7% (12 out of 166) of patients undergoing gastrostomy required subsequent anti-reflux technique, consistent with the 3%-17% rates reported in the latest series published[1,2,8,14,15,19,23].

Regarding baseline pathology, neurological impairment has been demonstrated to predispose to GER, and according to the series published, it is a risk factor in terms of need for surgical treatment[2,3]. However, there is no clear evidence as to whether fundoplication improves admission rates as a result of aspiration pneumonia, which is the most frequent cause of death in these patients[14,22,25-28]. This may be explained by the presence of other trigger factors, such as swallowing disorder, intestinal dysmotility, or ventilation disorders.

On the other hand, oral feeding has demonstrated a statistically significant relationship with GER worsening

(p= 0.03). However, few patients undergo swallowing studies that allow the cause of aspiration pneumonia and surgical indication to be established.

In our series, 79 out of 96 patients with neurological impairment (82%) had GER prior to gastrostomy, and 44 out of 53 (83%) patients requiring anti-reflux technique had neurological impairment. These results suggest combined fundoplication and gastrostomy could be indicated in these patients.

However, fundoplication has a high failure rate in neurological patients. In 25-30% of them, persistent or recurrent GER symptoms occur[12,27,29,30]. In our series, 17 out of 19 patients with stable or worsening GER symptoms following fundoplication (89%) had neurological impairment. It looks obvious that fundoplication does not prevent gastrointestinal dysmotility consequences, since GER symptoms may reoccur in the postoperative period, but can also remain the same following surgery[12].

Finally, as it is the case with other similar studies published, our study has some limitations which should be considered when interpreting results. The fact it is a retrospective study curtails conclusion assessment. Our patients could not be classified into homogeneous groups according to baseline pathology, since they were mostly neurological patients. This prevented us from performing a statistical comparison allowing GER risk groups to be determined, or surgical repair indication following gastrostomy to be established.

Patient follow-up was largely variable, and a significant percentage of patients (29%) were monitored at their original hospital, so clinical and/or postoperative progression data are heterogeneous.

In addition, the fact there were no homogeneous diagnostic studies in the study period prevented us from having objective parameters in terms of GER diagnosis and assessment.

Furthermore, various confusion factors, such as feeding regime, severity of baseline pathology, and degree of neurological impairment, could not be controlled. Patients undergoing combined fundoplication and gastrostomy had a worse GER progression than patients undergoing gastrostomy alone, with a statistically significant relationship between fundoplication and GER worsening. When interpreting this result, we should bear in mind fundoplication was indicated in the most critical patients, with a more severe GER or greater neurological impairment. Indeed, median age of patients with GER worsening was significantly lower than in other patients, probably owing to the fact the most severe cases required surgery at an earlier age.

CONCLUSIONS

In our experience, routine fundoplication in patients requiring gastrostomy is not justified. In case of medical treatment failure, individualized anti-reflux technique should be considered in order to avoid unnecessary procedures, especially in patients with neurological impairment. Multicenter prospective studies on large series and with an adequate design are required to establish which patients could really benefit from this procedure.

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