The diagnosis of this disorder is possible with a thorough history, determination of defecation pattern, detailed clinical evaluation and determination of anorectal physiology.

Anorectal manometry (AM) remains the most widely used anorectal physiology investigative tool. Several different anorectal physiology recording systems are available.[4] Anorectal manometry can evaluate sphincter pressure while the patient is resting, squeezing, and attempting to defecate.

When the patient is in the left lateral decubitus position or lithotomy, the manometry catheter is introduced into the rectum and pulled back through the anal canal with measurements taken at intervals to determine the rest, squeeze, and push pressures of the anal sphincter. Normal ranges differing in age and gender and patients should be compared to matched normal individuals.[1]

At present, AM is extensively used to identify the pathophysiological mechanisms of anorectal obstruction in constipated patients, but its clinical usefulness is debated.[5, 6]

First described by Barnes, the balloon expulsion test (BET) is another tool available to assess rectoanal coordination during defecation. The inability of a subject to expel the balloon suggests an outlet obstruction and should trigger further anorectal testing (anorectal manometry, defecography and electromyography).

The BET is a valuable test in which patients are asked to expel balloons filled with water or air from the rectum. It is a simple test, easy to perform, inexpensive, and easily reproducible.

Rao *et al.*[7] have underlined that the inability to expel a balloon or stool-like device such as a fecom within 1 minute is one of the physiologic criteria to diagnose dyssynergic defecation.

Recently, it has been defined as one of the diagnostic criteria for the definition of functional defecation disorders by the Rome III group.[8] This test has high specificity and negative predictive value for identifying constipated patients without dyssynergic defecation.[9]

The diagnostic workup of patients with obstructed defecation includes morphologic techniques, such as defecography and magnetic resonance imaging (MRI), to evaluate anatomical abnormalities the anorectum and pelvis during evacuation.[10]

Characteristic findings of defecography include a lack of pelvic of floor descent and paradoxical contraction of the puborectalis muscle. Another less specific feature is an aberrantly deep impression of the puborectalis sling on the posterior rectal wall at rest. This is caused by the presence of a hypertonic puborectalis muscle. However, this finding can be found in some normal individuals.[11]

The aim of our study was to compare the results of balloon expulsion test with the manometry and defecography findings to exclude DD in patients with functional constipation.

Materials and methods

From January 2005 to December 2011, 127 patients with symptoms reminding of functional constipation according to the Rome Criteria III were recruited retrospectively from the General Surgery Department of the Clinic University Hospital of Palermo. The patients were screened for participation in this study after signing an informed consent. Institutional Ethics Committee (Comitato Bioetico A.O.U.P.) approval was also obtained.

The patients were divided into three groups according to defecography results: group DD (dyssynergic defecation) consisted of 24 patients (20 females, 4 males; mean age 50.16±18.52 years; range: 19-79 years) affected with paradoxical contraction of the puborectalis muscle; group PDS consisted of 54 patients (46 females, 8 males; mean age 51.39±11.54 years; range: 22-72 years) affected with descending perineum syndrome; group without DD/PDS consisted of 49 patients (43 females, 6 males; mean age 52.78±13.13 years; range: 23-75 years) who were not affected by DD/PDS.

We established the following inclusion criteria: both gender, age >18 and <80 years, history of chronic constipation at least 5 years, functional constipation with normal transit.

We established the following exclusion criteria: history of malignancy, previous anal-

Gazzetta Medica Italiana - Archivio per le Scienze Mediche 2016 March;175(3):59-67
The online version of this article is located at http://www.minervamedica.it

ORIGINAL ARTICLE

Can the balloon expulsion test be used to exclude the diagnosis of "dyssynergic defecation"?

Angela INVIATI [1] *, Gregorio SCERRINO [1], Domenico SCHIFANO [1], Silvia DI GIOVANNI [1], Vito LO GRECO [2], Sebastiano BONVENTRE [1]

[1]Department of Surgical and Oncological Sciences, University of Palermo, Palermo, Italy; [2]Service of Radiology, Department of Biopathology and Forensic Biotechnologies, University of Palermo, Palermo, Italy

*Corresponding author: Angela Inviati, Department of Surgical and Oncological Sciences, University of Palermo, via L. Giuffrè 5, 90127 Palermo, Italy. E-mail: surgeryangela@hotmail.it

ABSTRACT

BACKGROUND: Functional constipation (FC) is a common disorder, particularly frequent in women. The aim of our study was to compare the results of balloon expulsion test with the manometry and defecography findings to exclude dyssynergic defecation (DD) in patients with chronic constipation.

METHODS: From January 2005 to December 2011, 127 patients with the diagnosis of functional constipation were recruited retrospectively. They were divided into three groups: 24 with DD, 54 with descending perineum syndrome (PDS), 49 without DD/PDS. Diagnosis of DD was established by manometric and defecographic findings according to Rome III criteria.

RESULTS: The balloon expulsion test was abnormal in 11 out of 24 patients with DD, 19 out of 54 with PDS and 13 of 49 without both. The specificity and negative predictive value of the test for excluding dyssynergic defecation were 73% and 77%, respectively. There was no statistically significant association between the balloon expulsion test and findings in defecografy (P=0.31). There was a relevant association between mean resting pressure (MRP) and balloon expulsion test (P=0.002) on anorectal manometry.

CONCLUSIONS: The balloon expulsion test is a simple and useful screening procedure to identify constipated patients who do not have DD. However, the balloon expulsion test cannot be used alone as a golden standard for the diagnosis of "dyssynergic defecation" and should be integrated with other anorectal tests mainly with anorectal manometry and secondly defecography.

(*Cite this article as:* Inviati A, Scerrino G, Schifano D, Di Giovanni S, Lo Greco V, Bonventre S. Can the balloon expulsion test be used to exclude the diagnosis of "dyssynergic defecation"? Gazz Med Ital - Arch Sci Med 2016;175:59-67)

Key words: Constipation - Defecation - Manometry - Defecography.

Functional constipation (FC) largely affects the female population and is characterized by emission of hard stools (scybala, inspissated stools often described as "pebbles"), difficulty in evacuating which requires the use of mechanical aids, digitation, excessive straining, incomplete evacuation, and excessive time needed to evacuate, less than three evacuations per week, a decreased stool weight (less than 35 g per day), prolonged or normal colonic transit time.

Functional constipation has often been linked to anatomic abnormalities of rectocele, rectoanal or rectorectal intussusception, pelvic organ prolapse, descending perineum syndrome, solitary rectal ulcer syndrome, sigmoidoceles, enteroceles and to functional abnormalities of paradoxical puborectalis contraction.[1, 2] This functional disorder includes principally dyssynergic defecation (DD), defined as paradoxical contraction or failure to relax the pelvic floor muscles during the attempts to defecate.[3]

The diagnosis of this disorder is possible with a thorough history, determination of defecation pattern, detailed clinical evaluation and determination of anorectal physiology.

Anorectal manometry (AM) remains the most widely used anorectal physiology investigative tool. Several different anorectal physiology recording systems are available.[4] Anorectal manometry can evaluate sphincter pressure while the patient is resting, squeezing, and attempting to defecate.

When the patient is in the left lateral decubitus position or lithotomy, the manometry catheter is introduced into the rectum and pulled back through the anal canal with measurements taken at intervals to determine the rest, squeeze, and push pressures of the anal sphincter. Normal ranges differing in age and gender and patients should be compared to matched normal individuals.[1]

At present, AM is extensively used to identify the pathophysiological mechanisms of anorectal obstruction in constipated patients, but its clinical usefulness is debated.[5, 6]

First described by Barnes, the balloon expulsion test (BET) is another tool available to assess rectoanal coordination during defecation. The inability of a subject to expel the balloon suggests an outlet obstruction and should trigger further anorectal testing (anorectal manometry, defecography and electromyography).

The BET is a valuable test in which patients are asked to expel balloons filled with water or air from the rectum. It is a simple test, easy to perform, inexpensive, and easily reproducible.

Rao *et al.*[7] have underlined that the inability to expel a balloon or stool-like device such as a fecom within 1 minute is one of the physiologic criteria to diagnose dyssynergic defecation.

Recently, it has been defined as one of the diagnostic criteria for the definition of functional defecation disorders by the Rome III group.[8] This test has high specificity and negative predictive value for identifying constipated patients without dyssynergic defecation.[9]

The diagnostic workup of patients with obstructed defecation includes morphologic techniques, such as defecography and magnetic resonance imaging (MRI), to evaluate anatomical abnormalities the anorectum and pelvis during evacuation.[10]

Characteristic findings of defecography include a lack of pelvic of floor descent and paradoxical contraction of the puborectalis muscle. Another less specific feature is an aberrantly deep impression of the puborectalis sling on the posterior rectal wall at rest. This is caused by the presence of a hypertonic puborectalis muscle. However, this finding can be found in some normal individuals.[11]

The aim of our study was to compare the results of balloon expulsion test with the manometry and defecography findings to exclude DD in patients with functional constipation.

Materials and methods

From January 2005 to December 2011, 127 patients with symptoms reminding of functional constipation according to the Rome Criteria III were recruited retrospectively from the General Surgery Department of the Clinic University Hospital of Palermo. The patients were screened for participation in this study after signing an informed consent. Institutional Ethics Committee (Comitato Bioetico A.O.U.P.) approval was also obtained.

The patients were divided into three groups according to defecography results: group DD (dyssynergic defecation) consisted of 24 patients (20 females, 4 males; mean age 50.16±18.52 years; range: 19-79 years) affected with paradoxical contraction of the puborectalis muscle; group PDS consisted of 54 patients (46 females, 8 males; mean age 51.39±11.54 years; range: 22-72 years) affected with descending perineum syndrome; group without DD/PDS consisted of 49 patients (43 females, 6 males; mean age 52.78±13.13 years; range: 23-75 years) who were not affected by DD/PDS.

We established the following inclusion criteria: both gender, age >18 and <80 years, history of chronic constipation at least 5 years, functional constipation with normal transit.

We established the following exclusion criteria: history of malignancy, previous anal-

rectal surgery, intestinal bowel disease, intestinal inflammatory diseases, use medications associated with constipation (iron and calcium supplements, opioids and other narcotics, anticholinergic agents, calcium channel blockers, diuretics, nonsteroidal anti-inflammatory drugs, sympathomimetic, tricyclic antidepressants), previous radiation therapy, functional constipation with slow-transit.

All patients have a negative colonoscopy for organic disease and normal colonic transit time.

The diagnosis of DD was obtained with anorectal manometry and defecography according to the Rome III criteria (diagnostic criteria for functional constipation and manometric, electromyographic, or radiologic evidence of inappropriate contraction or failure to relax the pelvic floor muscles during repeated attempts to defecate, evidence of adequate propulsive forces during attempts to defecate, and evidence of incomplete evacuation).

All patients have had two or more of these disorders in the last 3 months: straining during at least 25% of defecations, lumpy or hard stools in at least 25% of defecations, sensation of incomplete evacuation for at least 25% of defecations, sensation of anorectal obstruction/blockage for at least 25% of defecations, manual manoeuvers to facilitate at least 25% of defecations (*e.g.*, digital evacuation, support of the pelvic floor), fewer than 3 defecations per week, loose stools are rarely present without the use of laxatives, there are insufficient criteria for irritable bowel syndrome (IBS).

All of them underwent defecography to evaluate anatomical abnormalities of the anorectum and pelvis during evacuation, anorectal manometry and balloon expulsion test to evaluate motor and sensory dysfunction of the anorectum.

In the present study patients have two anatomic abnormalities, demonstrated by defecography: rectocele and rectal prolapsed; it is was often present in same patient.

Defecography and anorectal manometry findings were compared with those of the balloon expulsion test.

Balloon test

A balloon expulsion test (BET) was performed in all patients and was considered normal if a lubricated latex balloon placed in the rectum could be expelled in 60 seconds. To perform the test we placed the patients in the seated position and then, if they could not expel the balloon, in left lateral (LL) positions,[12] an empty 10-cm-long latex condom covered with lubricating jelly and tied to a catheter (external diameter, 6 mm) was introduced into the rectum. Air (60-80 mL) was instilled into the balloon through the catheter with a syringe. The total volume introduced was the minimum to induce a sustained desire to defecate, then patients were asked to expel the balloon.

Anorectal manometry

Patients were studied using a Narco Bio System MMS 200 manometer (International Biomedical Inc, Austin, Texas, USA) equipped with 8 electrodes connected to an International Biomedical Model 745-0100 (International Biomedical Inc, Austin, Texas, USA), pneumo-hydraulic capillary infusion system with 8 perfusional channels.

BEL UDMA20MZ manometric probes (Bioengineering Laboratories, Milan, Italy) were used in various combinations with an open-end tip provided with 4 helical side holes spaced 1 cm away from one another. All probes were graduated (intervals of at least 1 cm) to allow measurements of catheter depth and the length of the sphincter.

We evaluated the anal sphincter function, rectal sensation, recto-anal reflexes. With patients in the left lateral position and the hips flexed to 90°, the probe has been introduced into the rectum for 6 cm; after a manual stationary pull-trough, it has been pulled out and mean resting pressure (MRP) and squeeze pressure (SP) have been measured every cm after that the end-tip balloon has been inflated for the reflexological study of the anorectum.

This examination has been always able to evaluate some parameters, taken into consideration in our study, such as mean resting

TABLE I.—*Demographic, defecographic, and manometric parameters, and BET results.*

		DD Group	PDS Group	Without DD/PDS	P value
Demographics					
Age (years)	Range	19-79	22-72	23-75	
	Mean	50.16±18.52	51.39±11.54	52.78±13.13	
Gender	Female	20	46	43	
	Male	4	8	6	
Defecographic results					
Rectocele <3 cm		10	7	18	P=0.002
Rectocele >3 cm		7	44	24	
No rectocele		3	3	8	
Rectal prolapse		15	51	47	P=0.003
No prolapse		8	3	3	
Manometric results					
MRP (normal: 44-72 mmHg)	Range	44-115	10-110	30-130	P=0.22
	Mean	79.5±19.61	75.40±19.75	70.90±22.28	
SP (normal: MRP + 40 mmHg)	Range	80-200	30-215	50-230	P=0.59
	Mean	145.4±34.14	140.4±37.53	135.8±41.92	
EDU	Range	100-180	100-20	60-250	P=0.12
	Mean	127.4±21.45	136.67±23.73	127.2±29.34	
CDU	Range	120-250	150-300	100-250	P=0.002
	Mean	188.04±28.11	198.15±29.11	177.4±32.18	
MVT	Range	150-350	180-420	120-400	P=0.004
	Mean	262.17±57.82	288.9±56	244.3±56.93	
RAIR	Range	45-60	48-62	44-59	P=0.3
	Mean	52±5	55±8	50±5	
BET	Normal	13	35	37	P=0.31
	Abnormal	10	19	13	

MRP: mean resting pressure; SP: squeeze pressure; EDU: early defecatory urgency; CDU: constant defecatory urgency; MVT: maximum tolerable volume; RAIR: recto-anal inhibitory reflex; BET: balloon expulsion test.

rectocele was usually >3 cm. The balloon test results were abnormal in 10/35 patients with rectocele <3 cm, in 26/75 with rectocele >3 cm, and in 6/17 patients without rectocele (Figure 2). There was no association between BET and the patients with/without rectocele (>3 and <3 cm) (P=0.6). However, there was an association statistically relevant between the size rectocele and defecography findings, or the rectocele <3 cm is more frequent in DD

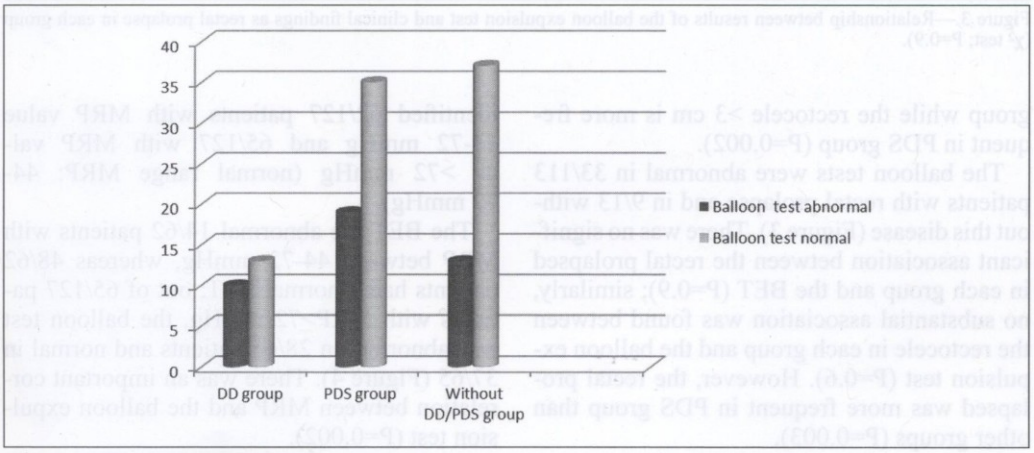

Figure 1.—Relationship between results of the balloon expulsion test and the defecography results (χ^2 test, P=0.31).

pressure (MRP), squeeze pressure (SP) during attempted defecation, recto-anal inhibitory reflex (RAIR), rectal sensation and rectal compliance, such as early defecatory urgency (EDU), costant defecatory urgency (CDU), maximum tolerable volume (MTV).

Defecography

All defecography tests and assessment measurements were carried out by a single experienced radiologist (V.L.G.) in a single setting, thus obviating the need to identify potential interobserver reliability.

All patients underwent defecography. Each of them received an oral solution of 400 mL of barium (60% Prontobario pv) to obtain opacification of the pelvic loops of the small bowel at the time of examination. At the beginning of the examination, about 250 to 300 mL of thick barium paste at high density was injected into the rectum.

They were then seated on a portable plastic toilet that contained a water-filled rubber doughnut under it. Examinations were performed on a conventional X-ray (General Electric Prestilix 1600X, Milwaukee, WI, USA), and images were taken in lateral view under fluoroscopic control. Patients were requested to start defecation, and fluoroscopy during evacuation was recorded on a video.

Spot radiographs are obtained in the lateral position with the patient responding to requests to rest, squeeze, strain and defecation. Finally, post-evacuation spot radiograph is also obtained after full evacuation.

The parameters of the evaluation defecography are: the anorectal angle (ARA) and level of the anorectal junction during straining. Rectoceles, sigmoidoceles, enteroceles, rectoanal intussusception and rectal prolapse are all anatomic abnormalities that can be detected on defecography. The functional abnormalities found on defecography was the imprint of the puborectalis muscles (pelvic floor dyssynergia).

Statistical analysis

Manometric characteristics are shown as means and standard deviation for continuous data, and data number and percentage for categorical data. Differences in the means were evaluated by ANOVA for multiple comparisons. A χ^2 test was applied to categorical variables; a P value lower than 0.05 was considered statistically significant. All statistical analyses were done with XLSTAT v.7.5 (Addinsoft, Paris, France).

Results

The demographic, defecographic and manometric characteristics are reported in Table I. The balloon expulsion test (BET) was abnormal in 11 of 24 patients with DD, 13 of 49 without DD/PDS (sensitivity of 46% and positive predictive value of 46% for diagnosis dyssynergic defecation).

The BET are normal in 13/24 patients of DD group, 36/49 without DD/PDS group (the specificity of 73% and negative predictive value of 77% for excluding the diagnosis of DD). Therefore, an abnormal BET has a low specificity and sensitivity for the diagnosis of DD, while a normal BET has a good sensitivity and specificity to rule out a DD.

The balloon expulsion test (BET) was abnormal in 19 of 54 patients with DD, 13 of 49 without DD/PDS (sensitivity of 33% and positive predictive value of 58% for diagnosis PDS).

The BET are normal in 35/54 patients of PDS group, 36/49 without DD/PDS group (the specificity of 73% and negative predictive value of 50% for excluding the diagnosis of PDS).

Thus, there was no statistically significant correlation between the BET and findings in defecography (groups DD, PDS and without PDS/DD, P=0.31) according to Bordeianou *et al.*[13] (Figure 1).

In this study those patients affected by rectocele (110/127) and by rectal prolapsed (113/127) were also examined and we discovered that in 35/110 patients the rectocele size was <3 cm, whereas in the remaining 75 it was >3 cm.

Most patients had both rectocele and rectal prolapse, and when both were present the

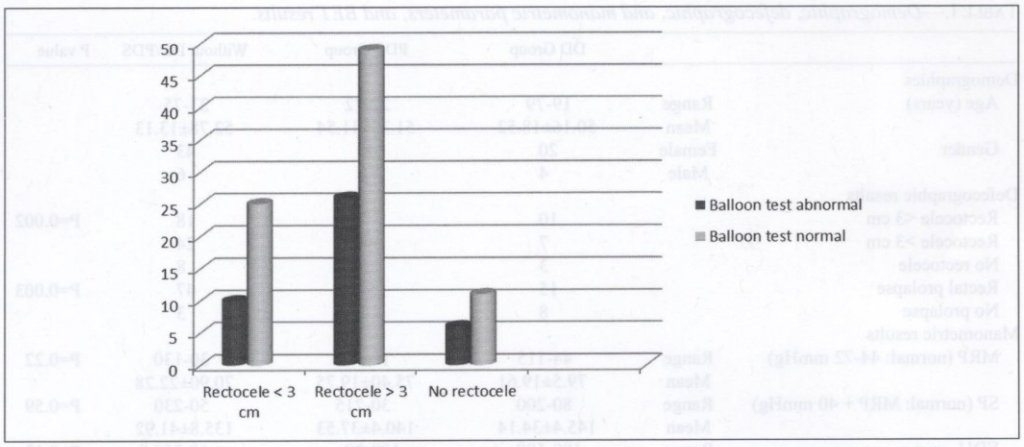

Figure 2.—Relationship between results of the balloon expulsion test and clinical findings as to rectocele (χ^2 test; P=0.6).

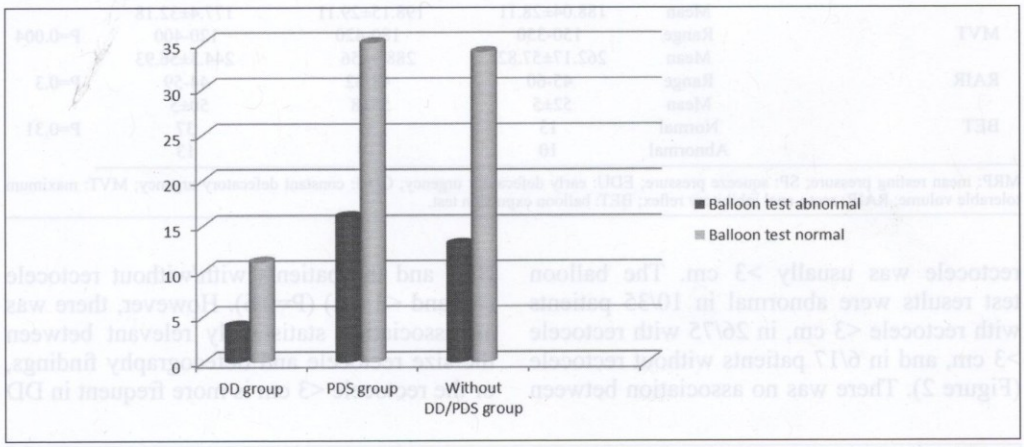

Figure 3.—Relationship between results of the balloon expulsion test and clinical findings as rectal prolapse in each group (χ^2 test; P=0.9).

group while the rectocele >3 cm is more frequent in PDS group (P=0.002).

The balloon tests were abnormal in 33/113 patients with rectal prolapse and in 9/13 without this disease (Figure 3). There was no significant association between the rectal prolapsed in each group and the BET (P=0.9); similarly, no substantial association was found between the rectocele in each group and the balloon expulsion test (P=0.6). However, the rectal prolapsed was more frequent in PDS group than other groups (P=0.003).

Through manometric examination we identified 62/127 patients with MRP value 44-72 mmHg and 65/127 with MRP value >72 mmHg (normal range MRP: 44-72 mmHg).

The BET are abnormal 14/62 patients with MRP between 44-72 mmHg, whereas 48/62 patients had a normal BET; out of 65/127 patients with MRP>72 mmHg, the balloon test was abnormal in 28/65 patients and normal in 37/65 (Figure 4). There was an important correlation between MRP and the balloon expulsion test (P=0.002).

As for manometric findings, we consid-

ommended that the inability to expel a balloon or stool-like device such as a fecom within 1 minute must be considered as one of the physiological criteria of dyssynergic defecation.[9]

Minguez *et al.*[3] evaluated the predictive value of the balloon expulsion for diagnosing pelvic floor dyssynergia. In this study, an empty 10-cm-long latex condom was filled with warm water (36 °C) until inducing a sustained desire to defecate and the test was considered normal if the balloon could be expelled within one minute.

The balloon expulsion test was found abnormal in 21 of 24 patients with pelvic floor dyssynergia and in 12 of 106 patients with functional constipation (without dyssynergia). The authors reported that the specificity and negative value of the test to exclude pelvic floor dyssynergia were 89% and 97%, respectively.

According to those results, patients with a normal expulsion test result — regardless of the frequency of symptoms — do not need other functional studies, which are more expensive and difficult to perform, to rule out obstructive defecation. This suggests that a normal test would at least exclude dyssynergia.[13]

However, this observation is rejected by other studies in which many patients with dyssynergia could expel the balloon, and this test alone was insufficient to make a diagnosis of dyssynergia.

The balloon expulsion test cannot be used as a golden rule for the diagnosis of "dyssynergic defecation" and should be integrated with other anorectal tests such as anorectal manometry, defecography and electromyography.[9-14].

Defecography is a reliable and reproducible technique, although modestly expensive, easily accessible procedure for the evaluation of defecation disorders.

Although the condition is complex due to an overlap of imaging findings between normal and symptomatic individuals, this method has the highest accuracy in diagnosing rectal intussusception, prolapse, rectocele, enterocele and functional abnormalities (dyssynergic defecation).[11]

Moreover, defecography has resulted in a less accurate survey of manometry and balloon tests in the diagnosis of dyssynergic defecation.[15] However, it cannot be considered the first-choice test in the patient with chronic constipation, it can be helpful in the study of functional disorders after manometry and BET. Anorectal manometry can provide data which can define in a better way the pathophysiological mechanisms of obstructed defecation.

This examination has been always able to evaluate some parameters taken into consideration in our study, such as mean resting pressure (MRP) and maximum tolerable volume (MTV).[10]

Our study, after evaluating the value of the balloon expulsion test to identify patients with DD, PDS and without DD/PDS, showed low values of sensitivity (46%) and positive predictive value specificity (46%) for diagnosing DD; specificity of 73% and negative predictive value of 77% for excluding the diagnosis of DD.

The results of our study showed the usefulness of the balloon expulsion test to exclude dyssynergic defecation and descending perineum syndrome in all patients affected by chronic constipation according to Minguez.[3]

Thus, BET might be sufficient together with manometry for the diagnosis of dyssynergic defecation and thus avoid to patients, in which the test is normal, further instrumental examinations much more expensive that expose to X-rays as defecography or MRI. Our data seems to suggest that that an abnormal BET in addition with increased rectal compliance may be indicative of dyssynergic defecation or PDS, although it has not yet been demonstrated a clear association between these data according to Lee.[15]

However, a study [16] has shown that the threshold for the first sensation and the threshold for a desire to defecate may be higher in patients with obstructed defecation.

Therefore, in line with the current literature,[17, 18] the BET alone is insufficient to make a diagnosis and should be integrated with further anorectal tests such as anorectal manometry in the first time and only second time defecography.

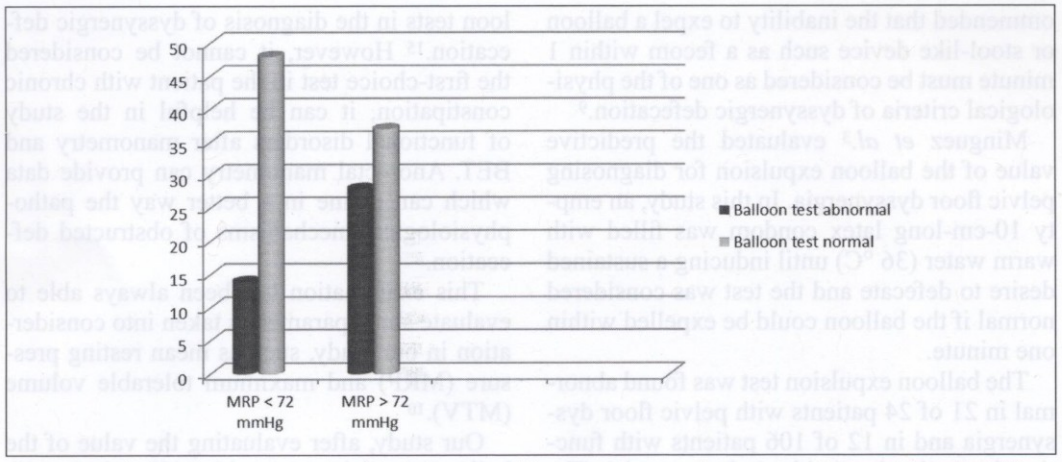

Figure 4.—Relationship between results of the balloon expulsion test and anorectal manometry findings (χ^2 test; P=0.02).

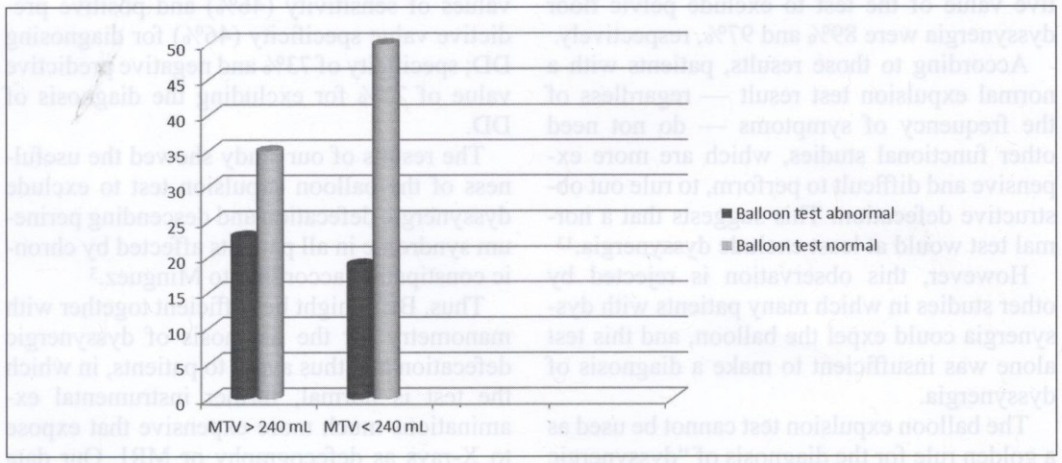

Figure 5.—Relationship between results of the balloon expulsion test and the anorectal manometry findings (χ^2 test; P=0.4).

ered the maximum tolerable volume (MTV) to be pathological for values higher than 240 mL; 58/127 patients had MTV>240 mL; among them 23/58 had an abnormal BET and 35/58 had a normal BET; 69/127 patients had MTV<240 mL, of which 19/69 patients showed an abnormal BET (Figure 5).

Between the outcomes of the BET and the MVT, no significant correlation has been found (P=0.4).

The same manometric characteristics of each group (MRP, SP, EDU) were not statistically different (P=0.22, P=0.59 and P=0.12, respectively), while there was a statistically significant difference of each group for CDU and MVT parameters (p= 0.002 and p= 0.004 respectively). In particular, the patients of DD and PDS groups had increased rectal compliance compared to the patients without PDS/DD group (Table I).

Discussion and conclusions

The balloon expulsion test is one of the diagnostic workups of functional defecation disorders in the Rome III criteria. Rao [7] has rec-

Study limitations

This study has several limitations due to the old manometric and defecography techniques (no high-resolution manometry and MRI defecography were available) but this is a retrospective study starting in 2005 when the conventional manometry was the gold standard in the diagnosis dyssynergic defecation. Another limitation was the lack of use of electromyography in the integration of the study anorectal.

References

1. Alame AM, Bahna H. Evaluation of constipation. Clin Colon Rectal Surg 2012;25:5-11.
2. D'Hoore A, Penninckx F. Obstructed defecation. Colorectal Dis 2003;5:280-7.
3. Minguez M, Herreros B, Sanchiz V, Hernandez V, Almela P, Añon R, *et al*. Predictive value of the balloon expulsion test for excluding the diagnosis of pelvic floor dyssynergia in constipation. Gastroenterology 2004;126:57-62.
4. Andromanakos N, Skandalakis P, Troupis T, Filippou D. Constipation of anorectal outlet obstruction: pathophysiology, evaluation and management. J Gastroenterol Hepatol 2006;21:638-46.
5. Raza N, Bielefeldt K. Discriminative value of anorectal manometry in clinical practice. Dig Dis Sci 2009;54:2503-11.
6. Bharucha AE, Wald A, Enck P, Rao S. Functional anorectal disorders. Gastroenterology 2006;130:1510-8.
7. Rao SS, Tuteja AK, Vellema T, Kempf J, Stessman M. Dyssynergic defecation: demographics, symptoms, stool patterns and quality of life. J Clin Gastroenterol 2004;38:680-5.
8. Wald A, Bharucha AE, Rao SSC, *et al*. Functional anorectal disorders. In: Drossman DA, Corazziari E, Delvaux M, Spiller RC, Talley NJ, Thompson WG, *et al.*, editors. Rome III. The functional gastrointestinal disorders. Third edition. McLean, VA: Degnon Associates; 2006. p. 639-85.
9. Dedel O, Turan L, Oztürk R, Bor S. Normative values of the balloon expulsion test in healthy adults. Turk J Gastroenterol 2007;18:177-81.
10. Pucciani F, Ringressi MN. Obstructed defecation: the role of anorectal manometry. Tech Coloproctol 2012;16:67-72.
11. Kim AY. How to interpret a functional or motility test – defecography. J Neurogastroenterol Motil 2011;17:416-20.
12. Ratuaplis S, Bharucha AE, Harvey D, Zinsmeister AR. Comparison of rectal balloon expulsion test in seated and left lateral position. Neurogastroenterol Motil 2013;25:e813-20.
13. Bordeianou L, Savitt L, Dursun A. Measurements of pelvic floor dyssynergia: which test result matters? Dis Colon Rectum 2011;54:60-5.
14. Rao SS, Mudipalli RS, Stessman M, Zimmerman B. Investigation of the utility of colorectal function tests and Rome II criteria in dyssynergic defecation (anismus). Neurogastroenterol Motil 2004;16:589-96.
15. Lee TH, Lee JS, Hong SJ, Jeon SR, Kwon SH, Kim WJ, *et al*. Rectal hyposensitivity and functional anorectal outlet obstruction are common entities in patients with functional constipation but are not significantly associated. Korean J Intern Me 2013;28:54-61.
16. Gosselink MJ, Schouten WR. Rectal sensory perception in females with obstructed defecation. Dis Colon Rectum 2001;44:1337-44.
17. Bove A, Pucciani F, Bellini M, Battaglia E, Bocchini R, Altomare DF, *et al*. Consensus statement AIGO/SICCR: diagnosis and treatment of chronic constipation and obstructed defecation (Part I: diagnosis). World J Gastroenterol 2012;18:1555-64.
18. Videlock EJ, Lembo A, Cremonini F. Diagnostic testing for dyssynergic defecation in chronic constipation: meta-analysis. Neurogastroenterol Motil 2013;25:509-20.

Conflicts of interest.—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Manuscript accepted: February 26, 2015. - Manuscript received: January 9, 2016.