



REVISTA DE GASTROENTEROLOGÍA DE MÉXICO

www.elsevier.es/rgmx



ORIGINAL ARTICLE

Comparison of the Carlsson-Dent and GERD-Q questionnaires for gastroesophageal reflux disease symptom detection in a general population[☆]



R. Contreras-Omaña^{a,*}, O. Sánchez-Reyes^b, E. Ángeles-Granados^c

^a Centro de Investigación de Enfermedades Hepáticas y Gastroenterología, Pachuca de Soto, Hidalgo, Mexico

^b Escuela de Medicina «Dr. José Sierra Flores», Área de Ciencias de la Salud, Universidad del Noreste, Tampico, Tamaulipas, Mexico

^c Instituto de Ciencias de la Salud, Área Académica de Medicina, Universidad Autónoma del Estado de Hidalgo, Pachuca de Soto, Hidalgo, Mexico

Received 19 February 2016; accepted 31 May 2016

Available online 10 January 2017

KEYWORDS

Gastroesophageal reflux disease;
Carlsson-Dent questionnaire;
GERDQ questionnaire

Abstract

Introduction: Gastroesophageal reflux disease (GERD) is an extremely common pathology in the general population and one of the main reasons for consultation in gastroenterology. There are different instruments for detecting its symptoms, but few studies comparing one tool with another have been conducted in Mexico.

Aims: To compare the effectiveness of the Carlsson-Dent questionnaire (CDQ) and the GERD-Q questionnaire (GQQ) in detecting GERD symptoms in a general population.

Materials and methods: A prospective, descriptive, cross-sectional study was conducted on 220 individuals in an open population within the time frame of May-June 2015. The subjects were evaluated through the self-assessment CDQ and GQQ. The positive scores from the CDQ (≥ 4) were compared with those of the GQQ (≥ 8), to determine which of the two instruments more easily detected patients with GERD symptoms.

Results: Fifty-seven percent of the patients were men and the mean patient age was 38.1 years. Fifty percent of the subjects presented with GERD symptoms with a positive score in at least one questionnaire; 45% had positive CDQ results and 23% had positive GQQ results. Fifty-seven percent of the patients with a positive CDQ score presented with overweight/obesity, as did 72% of the patients with a positive GQQ result. Finally, 20% of the individuals had positive results for reflux symptoms in both questionnaires.

[☆] Please cite this article as: Contreras-Omaña R, Sánchez-Reyes O, Ángeles-Granados E. Comparación de los cuestionarios Carlsson-Dent y GERD-Q para detección de síntomas de enfermedad por reflujo gastroesofágico en población general. Revista de Gastroenterología de México. 2017;82:19–25.

* Corresponding author. Centro de Investigación de Enfermedades Hepáticas y Gastroenterología, Boulevard Valle de San Javier No. 814-A, Fracc. Valle de San Javier CP 42086, Pachuca de Soto, Hidalgo, México. Tel.: +5217713130740.

E-mail address: centro_investigacion_ehg@hotmail.com (R. Contreras-Omaña).

PALABRAS CLAVE

Enfermedad por reflujo gastroesofágico; Cuestionario Carlsson-Dent; Cuestionario GERD-Q

Conclusions: There was a prevalence of GERD symptoms in 50% of the individuals studied from a general population. The GQQ detected a greater number of GERD symptoms in patients that presented with overweight/obesity and the CDQ was considered easier for patients to understand and answer. It is striking that there was only 20% agreement between the two questionnaires, suggesting that they may be useful for identifying GERD symptoms in different populations.

© 2016 Asociación Mexicana de Gastroenterología. Published by Masson Doyma México S.A. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Comparación de los cuestionarios Carlsson-Dent y GERD-Q para detección de síntomas de enfermedad por reflujo gastroesofágico en población general

Resumen

Introducción: La enfermedad por reflujo gastroesofágico (ERGE) es una patología altamente común en población general y una de las principales causas de consulta gastroenterológica. Existen diversos instrumentos para detectar sus síntomas, sin embargo pocos estudios en México los comparan entre sí.

Objetivos: Comparar la efectividad de los cuestionarios Carlsson-Dent (CDQ) y GERD-Q (GQQ) en la detección de síntomas de ERGE en población general.

Materiales y métodos: Estudio prospectivo, descriptivo, transversal; durante el periodo de mayo a junio del 2015; 220 individuos de población abierta se evaluaron a través de CDQ y GQQ autoaplicables. Se compararon los resultados positivos del CDQ (≥ 4) con los del GQQ (≥ 8), para establecer cuál detecta con mayor facilidad pacientes con síntomas de ERGE.

Resultados: El 57% de los pacientes fueron del género masculino y la media de 38.1 años. El 50% presentaron síntomas de ERGE con al menos un cuestionario positivo; el 45% de ellos fueron positivos con CDQ y el 23% con GQQ. El 57% con CDQ positivo presentaron sobrepeso/obesidad en comparación con el 72% con GQQ positivo. Finalmente, el 20% presentó positividad para síntomas de reflujo en ambos cuestionarios simultáneamente.

Conclusiones: Hubo una prevalencia del 50% con síntomas de ERGE en población general. El GQQ detectó un mayor número de síntomas de ERGE en pacientes con obesidad/sobrepeso. El CDQ fue calificado como más fácil de comprender y contestar por los pacientes. Es importante mencionar que solo hubo una concordancia del 20% entre ambos cuestionarios, lo que indica que tal vez sean de utilidad para identificar síntomas de ERGE en poblaciones distintas.

© 2016 Asociación Mexicana de Gastroenterología. Publicado por Masson Doyma México S.A. Este es un artículo Open Access bajo la licencia CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Gastroesophageal reflux disease (GERD) is defined as the ascent of gastric or gastroduodenal content above the gastroesophageal junction, causing symptoms and/or structural damage and affecting the well-being and quality of life of the individuals that present with it. Symptoms and quality of life are the 2 most sensitive aspects in all the phenotypical varieties,¹ making them common objectives for its diagnosis and treatment. Heartburn and regurgitation are considered typical symptoms,¹⁻³ whereas cough, laryngitis, asthma, dental erosions, and chest pain of presumed esophageal origin are considered atypical or extra-esophageal symptoms.^{1,3} Current diagnostic methods have been developed that can be classified into: noninvasive (clinical attention, questionnaires, PPI test response) and invasive (endoscopy, barium esophagogram, 24-h pH study, multichannel intraluminal impedance study,

biopsy when eosinophilic esophagitis or Barrett's esophagus are suspected). Some of the invasive methods can be costly and often are not available,² and none of them alone is considered a "gold standard".^{2,4} The worldwide prevalence of GERD is varied. In Mexico the most frequent variant is nonerosive reflux disease² according to the Montreal Classification.⁵ However, the exact prevalence figure for patients with GERD is unknown. Therefore, the initial use of noninvasive methods in primary care is recommended, especially the application of sensitive questionnaires as diagnostic aids.⁶⁻¹¹ The Carlsson-Dent questionnaire⁸ (CDQ) and the GERD-Q questionnaire¹⁰ (GQQ) are currently the most widely used. They have been validated and possess the majority of the characteristics required.^{4,12}

The aim of the present study was to compare the value and diagnostic efficacy of the CDQ and GQQ in detecting positive GERD symptoms in a general population in Mexico.

Materials and methods

A randomized, prospective, descriptive, cross-sectional study was conducted within the time frame of May to June 2015 at the *Hospital General de Zona y Medicina Familiar 1 "Dr. Alfonso Mejía Schroeder"* in Pachuca de Soto, Hidalgo, Mexico. Individuals from an open population were selected that met the following inclusion criteria: 18 years and older, male or female, with positive symptoms for reflux disease (heartburn or regurgitation) within the last 3 months, no previous GERD diagnosis, and no current GERD treatment. The nature of the study was explained and the individuals signed statements of informed consent. The two questionnaires were handed out and instructions of how to complete them were given. The Spanish version of the GQQ¹³ was employed and it consists of 6 multiple choice questions and a cut-off point ≥ 8 as a positive result. The questionnaire evaluates the symptoms associated with GERD, their frequency in days, and their repercussions on wellbeing and quality of life (Figure 1). The Spanish version of the CDQ¹⁴ includes 7 multiple choice questions and its cut-off point for a positive result is ≥ 4 . This questionnaire qualitatively evaluates symptoms associated with GERD and their triggering factors such as diet, posture, and medications used (Figure 2). The two instruments are self-assessment questionnaires, with medical personnel providing assistance only if the subject has a question about an item or has doubts about how to answer it, or is unable to read. The variables of sex, age, height and weight measurements to determine the presence of overweight or obesity ($BMI \geq 25$), and the scores from the two questionnaires were obtained. The patients

were classified according to the questionnaire results and other variables. The exclusion criteria were: age under 18 years, refusal to participate in the study, GERD diagnosis during the past year with an established treatment, the presence of alarm symptoms (unintentional weight loss, severe and/or progressive dysphagia, or gastrointestinal bleeding), and a past history of GERD-related surgical procedures (open or laparoscopic treatment). Finally, the positive CDQ results were compared with the positive GQQ results to determine which instrument more easily detected the prevalence of patients with symptoms consistent with GERD.

Results

Sample total

Two hundred and twenty randomly selected individuals answered the CDQ and GQQ. Of that total, 125 (57%) were men and 95 (43%) were women and their mean age was 38.1 years (18 to 76 years). One hundred ten (50%) individuals presented with symptoms consistent with GERD, with positive results in at least one of the questionnaires applied. The patients were organized into 12-year age groups as follows: 18-29 years = 84 (38.18%), 30-41 years = 49 (22.27%), 42-53 years = 47 (21.36%), 54-65 years = 35 (15.90%), and 66-77 years = 5 (2.27%). Figure 3 shows the comparison by ages of the individuals with a positive CDQ or GQQ. One hundred fourteen (52%) patients presented with overweight or obesity ($BMI \geq 25$), whereas 106 (48%) were normal weight

Gerd Q1
Questionnaire for patients with upper gastrointestinal symptoms

Important: To answer this questionnaire, take only the last 7 days (1 week) into account and answer each question by filling in one square per question.

	Never	1 day	2 to 3 days	Between 4 and 7 days
1. In the last week, how many days have you had a burning sensation or burning pain in your chest?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. In the last week, how many days have you noticed that the contents of your stomach have come up into your throat or mouth?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. In the last week, how many days have you felt pain in the pit of your stomach?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. In the last week, how many days have you been nauseated or felt like throwing up?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. In the last week, how many nights have you had trouble sleeping well because of burning pain or because your stomach content has come into your throat or mouth?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. In the last week, how many days have you taken medication other than what your doctor prescribed (such as Almax, Fruit salts, or Rennie chewable tablets) for burning pain or because your stomach content has come into your throat or mouth?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1 Gerd-Q questionnaire, Spanish version.

Source: Pérez-Alonso et al.¹³

Carlsson-Dent Questionnaire	
1. Which of the following sentences best describes your main complaint? Mark an option.	<ul style="list-style-type: none"> +5 burning sensation or burning pain that starts in the pit of your stomach or chest and goes up into your throat (heartburn) 0 nausea or vomiting +2 pain in the middle of your chest when you eat 0 none of the above
2. Which of the following sentences best describes the time at which you have the complaint? Mark an option.	<ul style="list-style-type: none"> -2 at any time and there is no relation to eating (neither improves or worsens with meals) +3 within the first 2 hours after eating 0 always occurs at the same time of day or night and is not related to eating
3. What happens to your complaint in the following situations: does it get worse, get better, or nothing happens? Read each sentence and circle what happens to your main complaint	<ul style="list-style-type: none"> You eat a lot or more than you are accustomed to +1 -1 0 You eat fatty foods +1 -1 0 You eat spicy or very seasoned foods +1 -1 0
4. What happens to your main complaint when you take antacids? Mark an option	<ul style="list-style-type: none"> 0 nothing +3 complete relief within the first 15 minutes of having taking them 0 complete relief 15 minutes after taking them 0 I don't take antacids
5. What happens to your main complaint when you bend over or lie down? Mark an option	<ul style="list-style-type: none"> 0 nothing +1 it gets worse or the activity causes it -1 it gets better 0 I don't know
6. Which of the following options best describes the effect that carrying heavy things, straining, or doing anything strenuous has on your main complaint?	<ul style="list-style-type: none"> 0 no effect +1 it gets worse or the activity causes it -1 it gets better 0 I don't know or I don't do strenuous things
7. If you regurgitate (the food in your stomach returns to your throat), what happens to your main complaint?	<ul style="list-style-type: none"> 0 nothing +2 it gets worse or the regurgitation causes it -1 it gets better 0 I don't know or I don't regurgitate

Figure 2 Carlsson-Dent questionnaire, Spanish version.

Source: Moreno-Eloa et al.¹⁴

(Figure 4). During the application of the questionnaires, a high percentage of the patients considered the GQQ more difficult to understand and answer. In both questionnaires, the majority of the patients with reflux-consistent symptoms presented with overweight or obesity. Finally, 38 (20%) of the individuals in the sample had a positive score for reflux symptoms in both questionnaires (Figure 5).

Carlsson-Dent questionnaire

Ninety-eight (45%) of the total number of individuals that answered the questionnaires had a score equal to or greater than 4, which was consistent with gastroesophageal reflux disease, and the remaining 122 (55%) individuals had a negative score under 4. Of the 98 subjects with a positive score for GERD symptoms, 53 were men (54%) and 45 were women (46%).

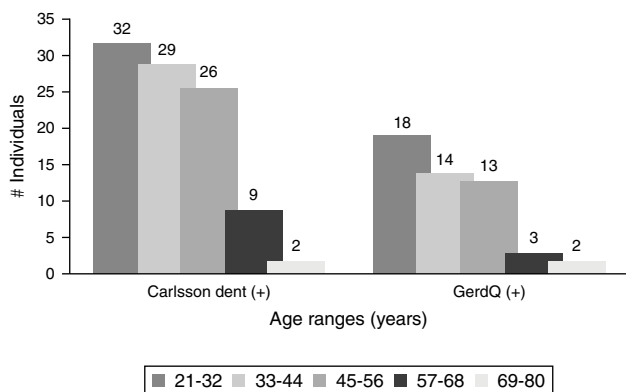


Figure 3 Comparison of age groups in individuals with positive scores in the Carlsson-Dent questionnaire and Gerd-Q questionnaire.

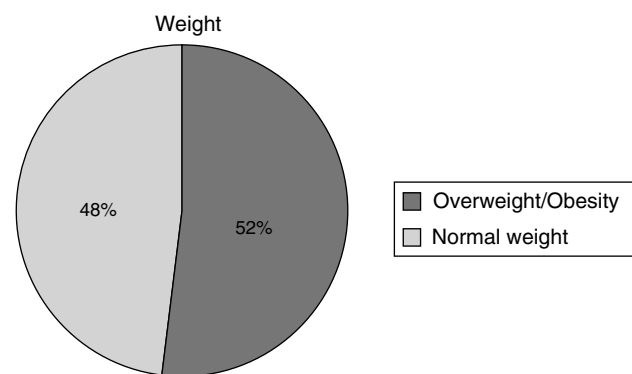


Figure 4 Normal weight/overweight-obesity relation in the individuals that answered the questionnaires.

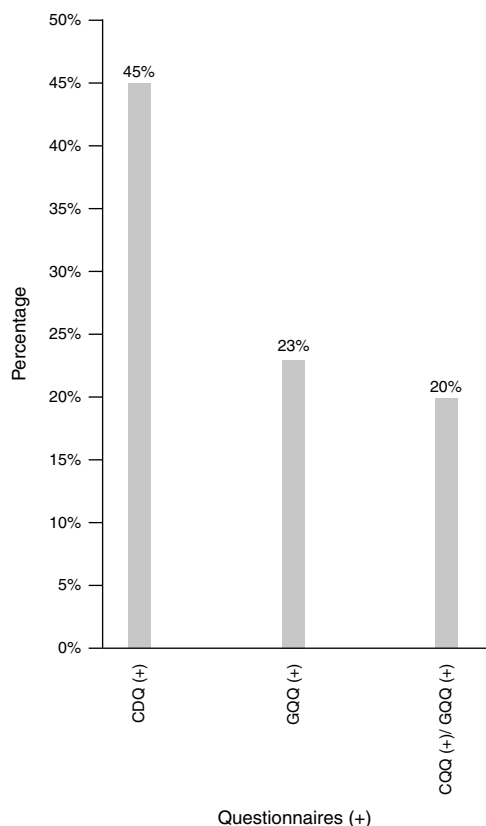


Figure 5 Relation of positive patients in the general population.

CDQ: Carlsson-Dent questionnaire

GQQ: Gerd-Q questionnaire

CDQ/GQQ: Carlsson-Dent questionnaire/GerdQ questionnaire

Fifty-six of the 98 positive cases presented with overweight or obesity (57%) and 42 had normal weight (43%) (Figure 6).

With respect to age, in the positive cases arranged into 12-year age groups from 21 to 80 years of age, there was no significant difference in the presentation of GERD symptomatology from 21 to 56 years of age, given that there

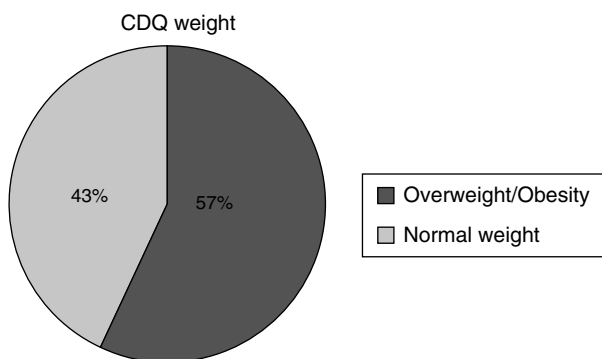


Figure 6 Normal weight/overweight-obesity relation in individuals with a positive result in the CDQ

CDQ: Carlsson-Dent questionnaire.

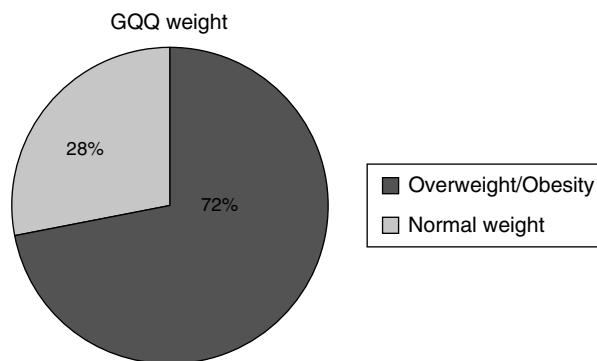


Figure 7 Overweight-obesity/normal weight relations in individuals with a positive result in the GQQ

GQQ: Gerd-Q questionnaire.

were 32, 29, and 26 positive cases in those age groups. In contrast, there were 9 positive cases in the age group of 57-68 years and 2 cases in the age group of 69-80 years (Figure 3).

Gerd-Q questionnaire

Of the 220 individuals that answered the questionnaires, 50 (23%) presented with positive results for GERD symptomatology, with a score equal to or greater than 8. One hundred seventy (77%) subjects had a score under 8 and thus were reported as negative for GERD symptomatology.

Of the 50 individuals with a positive result for GERD symptomatology, 29 were men (58%) and 21 were women (42%).

Thirty-six of the 50 positive cases presented with overweight or obesity (72%) and 14 had normal weight (28%) (Figure 7).

Likewise, we grouped the positive cases by age range, which reflected a greater incidence in the first 3 age groups, with 18, 14, and 13 individuals, respectively, whereas 3 and 2 individuals were positive in the 57-68 and 69-80 age groups, respectively (Figure 3).

Discussion

There are currently many methods for diagnosing GERD and the use of questionnaires directed at detecting the patients with positive symptomatology is a method that has gained ground due to their easy application and low cost.¹² They are mainly used in primary care centers and their sensitivity as auxiliary instruments in the Mexican population has been demonstrated.³ However, no studies have been found in the medical literature that compare one questionnaire with another to demonstrate their efficacy and usefulness in daily practice.

There are a variety of questionnaires with different characteristics and focuses. For example, some evaluate the impact of symptoms on the quality of life of the patient, rather than diagnosis, such as the GERD Impact Scale.¹¹ Likewise, Gómez-Escudero et al. state that the CDQ does not evaluate the severity or impact of symptoms on wellbeing and quality of life, but it is highly sensitive for detecting patients with positive GERD symptoms. It has a high correlation with positive endoscopy and pH study in

Mexican patients and a greater sensitivity in populations that have a high prevalence of the disease.³ In regard to the GQQ, in addition to evaluating symptom severity, it has a scale for measuring the impact on wellbeing and quality of life. Its usefulness in patient follow-up has also been demonstrated, evaluating the progression of patients that have received treatment.

In our study we observed a higher number of individuals with positive scores in the CDQ than in the GQQ. There could be several reasons for this. The first is that the patients with positive CDQ results could have a higher number of acid exposures in the esophagus, consistent with erosive reflux disease,³ compared with the patients with positive results in the GQQ. The latter questionnaire has shown sensitivity in detecting patients with functional heartburn or esophageal hypersensitivity with scores under 8.⁴ Another reason could be that the GQQ evaluates different parameters from the CDQ and that the quality of life in our study population was not greatly affected. However, future studies are required to corroborate or discard the abovementioned points with objective diagnostic methods such as endoscopy, 24-h pH study or pH/multichannel intraluminal impedance monitoring for atypical cases, and thus determine the sensitivity, specificity, positive predictive value, and negative predictive of these methods. Our research center is currently conducting such investigation.

It should be mentioned that despite the fact that there was a 50% prevalence of patients with GERD symptoms, these questionnaires only evaluated the typical or classic symptomatology, ignoring extra-esophageal or atypical symptoms. Therefore, the study population that presented with this type of symptomatology would remain undiagnosed. It has also been demonstrated that these instruments do not have high specificity and thus could over-diagnose patients that present with esophageal hypersensitivity or functional heartburn^{3,15} that is not strictly GERD. Nevertheless, a recent study by Zavala-González et al.⁴ demonstrated a high sensitivity in patients that presented with these 2 varieties when they had a score under 8. We hope that questionnaires focusing on these conditions will be developed in the future.

There was no difference between the sexes in the sample total, but there was a slight increase in men with positive scores in the two questionnaires. This differs from other published results that manifest a greater prevalence of positive symptomatology in women.¹⁵

Positive symptomatology was observed in both questionnaires in younger individuals, but this could be due to the fact that the sample did not have the same number of subjects in each age group. In studies conducted on a Mexican geriatric population,¹⁵ there was a high prevalence of patients with symptomatology consistent with GERD, as well as greater complications. The importance of carrying out studies on target geriatric populations is also mentioned.

In general the difference in weight in the sample total was minimal between subjects with overweight/obesity and those whose weight was within normal parameters. However, the significant increase in the percentage of overweight/obesity was striking in the patients that had a positive score in the GQQ. This could be interpreted as the GQQ being more sensitive in patients whose wellbeing

and quality of life was affected and the relation of this to overweight/obesity.^{16–18}

Finally, the low frequency of the same patient having a positive score in both questionnaires should be underlined. This can possibly be explained by the fact that each questionnaire examines different aspects of the disease that are not necessarily mutually exclusive.

This study paves the way for new ones that can compare the positive results of the two questionnaires through objective tests, such as 24-h pH study and/or endoscopy to determine the sensitivity and specificity of each one in a Mexican general population and their usefulness as follow-up tools in patients undergoing treatment.

Our study's limitations include the fact that it was a screening study on an open population. Nevertheless, it shows the prevalence of patients with positive GERD symptoms in Mexico, which is currently unknown.¹⁹ And even though our study had a sound sample size, further studies should have larger samples.

In conclusion, we observed a 50% prevalence of GERD symptoms in a general population. The GQQ detected a greater number of GERD symptoms in patients with overweight and the CDQ was rated as easier for the patients to understand and answer. It is striking that there was only 20% agreement between the two questionnaires, suggesting that they may be useful in identifying GERD symptoms in different populations.

Ethical responsibilities

Protection of persons and animals. The authors declare that the procedures followed conformed to the ethical standards of the responsible committee on human experimentation and were in accordance with the World Medical Association and the Declaration of Helsinki.

Data confidentiality. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

Financial disclosure

No financial support was received in relation to this study.

Conflict of interest

The authors declare that there is no conflict of interest.

Acknowledgements

The authors wish to thank the gastroenterologists that participated in the study.

References

1. Huerta-Iga F, Tamayo-de la Cuesta JL, Noble-Lugo A, et al. Consenso mexicano de enfermedad por reflujo gastroesofágico. Parte I. *Rev Gastroenterol Mex.* 2012;77:193–213.

2. Dent J, Vakil N, Jones R, et al. Accuracy of the diagnosis of GORD by questionnaire, physicians and trial of proton pump inhibitor treatment: The Diamond Study. *Gut*. 2010;59:714–21.
3. Gómez-Escudero O, Remes-Troche JM, Ruiz JC, et al. Utilidad diagnóstica del cuestionario de Carlsson-Dent en la enfermedad por reflujo gastroesofágico. *Rev Gastroenterol Mex*. 2004;69:16–23.
4. Zavala-González MA, Azamar-Jacome AA, Meixueiro-Daza A, et al. Validation and diagnostic usefulness of gastroesophageal reflux disease questionnaire in a primary care level in Mexico. *J Neurogastroenterol Motil*. 2014;20:475–82.
5. Vakil N, van Zanten S, Kahrilas P, et al. The Montreal definition and classification of gastroesophageal reflux disease: A global evidence-based consensus. *Am J Gastroenterol*. 2006;101:1900–20.
6. Locke GR, Talley NJ, Weaver AL, et al. A new questionnaire for gastroesophageal reflux disease. *Mayo Clin Proc*. 1994;69:539–47.
7. Shaw M, Talley N, Beebe T, et al. Initial validation of a diagnostic questionnaire for gastroesophageal reflux disease. *Am J Gastroenterol*. 2001;96:52–7.
8. Carlsson R, Dent J, Bolling-Sternevald E, et al. The usefulness of a structured questionnaire in the assessment of symptomatic gastroesophageal reflux disease. *Scand J Gastroenterol*. 1998;33:1023–9.
9. Wong WM, Lam KF, Lai KC, et al. A validated symptoms questionnaire (Chinese GERDQ) for the diagnosis of gastro-oesophageal reflux disease in the Chinese population. *Aliment Pharmacol Ther*. 2003;17:1407–13.
10. Jones R, Junghard O, Dent J, et al. Development of the GerdQ, a tool for the diagnosis and management of gastro-oesophageal reflux disease in primary care. *Aliment Pharmacol Ther*. 2009;30:1030–8.
11. Jones R, Coyne K, Wiklund I. The gastro-oesophageal Reflux Disease Impact Scale: A patient management tool for primary care. *Aliment Pharmacol Ther*. 2007;25:1451–9.
12. Stanghellini V, Armstrong D, Mönnikes H, et al. Systematic review: Do we need a new gastro-oesophageal reflux disease questionnaire? *Aliment Pharmacol Ther*. 2004;19:463–79.
13. Pérez-Alonso M, Regla-Dominguez A, Sánchez-Blanco J, et al. Linguistic and transcultural validation of the Gastroesophageal reflux disease questionnaire for a Spanish population [Internet] Pro Newsletter. Patient reported outcomes. 2009 [accessed 2 Ene 2016]. Available from: www.pro-newsletter.com/images/PDF_articles/gerd-final.pdf.
14. Moreno-Eloa C, Rey E, Rodríguez-Artejo F, et al. Adaptation and validation of a gastroesophageal reflux questionnaire for use on a Spanish population. *Rev Esp Enferm Dig*. 2002;94:745–58.
15. Peralta-Pedrero ML, Lagunes-Espinosa AL, Cruz-Avelar A, et al. Frecuencia de síntomas de ERGE en adultos mayores que acuden a una unidad de medicina familiar. *Rev Med Inst Mex Seguro Soc*. 2007;45:447–52.
16. El-Serag HB, Graham DY, Satia JA, et al. Obesity is an independent risk factor for GERD symptoms and erosive esophagitis. *Am J Gastroenterol*. 2005;100:1243–50.
17. Friedenberg FK, Xanthopoulos M, Foster GD, et al. The association between gastroesophageal reflux disease and obesity. *Am J Gastroenterol*. 2008;103:2111–22.
18. De Groot NL, Burgerhart JS, van de Meeberg PC, et al. Systematic review: The effects of conservative and surgical treatment for obesity on gastro-oesophageal reflux disease. *Aliment Pharmacol Ther*. 2009;30:1091–102.
19. El-Serag HB, Sweet S, Winchest CC, et al. Update on the epidemiology of gastro-oesophageal reflux disease: A systematic review. *Gut*. 2014;63:871–80.