Clinical Implications of Diverticular Disease of the Appendix. Experience Over the Past 10 Years

Alberto A. Marcacuzco,* Alejandro Manrique, Jorge Calvo, Carmelo Loinaz, Iago Justo, Oscar Caso, Felix Cambra, Naim Fakih, Rebeca Sanabria, Luis C. Jimenez-Romero

Servicio de Cirugía General «C» y Trasplante de Órganos Abdominales, Hospital Universitario 12 de Octubre, Madrid, Spain

Article history:
Received 26 February 2014
Accepted 11 May 2014
Available online 6 January 2016

Keywords:
Appendicular diverticulum
Appendicitis
Diverticulitis
Vermiform appendix

Background: Diverticular disease of the appendix is an uncommon condition, with an incidence from 0.004% to 2.1%. It usually occurs between the fourth or fifth decades of life, does not present gastrointestinal symptoms but only insidious abdominal pain. Patients usually delay consultation, leading to increased morbidity and mortality. The aim of this study was to determine the clinical features of diverticular disease of the appendix.

Methods: A retrospective study of all patients undergoing appendectomy in a tertiary hospital between September 2003 and September 2013 was performed.

Results: During this period, 7044 appendectomies were performed, and 42 cases of diverticular disease of the appendix were found, which represents an incidence of 0.59%. A total of 27 patients were male. The mean age was 46.6 ± 21 years. The average hospital stay was 4.5 days. A perforated appendix was identified in 46% of patients. In 80% of the cases, a complementary imaging test was performed. The incidence of neoplastic disease with diverticulum of the appendix was 7.1%.

Conclusions: Diverticular disease of the appendix is an incidental finding. In its acute phase, it presents as an acute appendicitis. The treatment of choice is appendectomy. It presents a higher risk of developing neoplastic disease of the appendix.

© 2014 Published by Elsevier España, S.L.U. on behalf of AEC.

Implicaciones clínicas de la enfermedad diverticular del apéndice. Experiencia en los últimos 10 años

Introducción: La enfermedad diverticular del apéndice es infrecuente, con una incidencia que varía desde 0,004 a 2,1%. Suele presentarse entre la cuarta o quinta década de vida, con ausencia de síntomas gastrointestinales y dolor abdominal insidioso. Los pacientes...
Diverticulitis
Apéndice vermiforme

habitualmente consultan de forma tardía, con el consiguiente aumento de morbilidad. El objetivo de este estudio fue determinar las características clínicas de la enfermedad diverticular del apéndice.

Métodos: Se realizó un estudio retrospectivo de todos los pacientes operados de apendicectomía en un hospital terciario desde septiembre de 2003 hasta septiembre de 2013. Resultados: Durante este periodo se realizaron 7.044 apendicectomías, encontrándose 42 casos de enfermedad diverticular del apéndice, que representa una incidencia de 0.59%. De ellos, 27 pacientes fueron de sexo masculino. La edad media fue de 46.6 ± 21 años. El promedio de la estancia hospitalaria fue de 4.5 días. El 46% de los casos presentaban perforación del apéndice. En el 80% de los casos se realizó una prueba de imagen complementaria. La incidencia de neoplasia asociada a enfermedad diverticular fue de 7.1%.


1 2014 Publicado por Elsevier España, S.L.U. en nombre de AEC.
According to their histopathological characteristics, Lipton et al. (2008) in their series, there are no reports of Schwann cell proliferation in appendiceal diverticulitis. In our study, we observed that the age of appendiceal perforation and hospital stay were also greater in type I. Moreover, there were more cases of diverticulitis in type I. Fever, the incidence of appendiceal perforation and abdominal pain were also greater in type I.

The incidence of neoplasms associated with diverticular disease was 7.1% (Table 4).

### Discussion

Diverticular disease of the vermiform appendix was reported in 1893 by Kelynack. According to their histopathological characteristics, appendiceal diverticula are classified as congenital or true diverticula and acquired or pseudo-diverticula. Congenital diverticula are unique and located on the antimesenteric border of the appendix; they have been associated with other diseases like trisomy D (13–15) or Patau syndrome. Acquired diverticula lack a muscularis propria layer in the wall, and are more frequently located in the distal third of the appendix on the mesenteric edge and are usually small in size (2–5 mm). These latter type are more prevalent and therefore not associated with colonic diverticula. In our series, all the patients presented acquired or pseudo-diverticula.

In 1989, Lipton et al. reported the morphological classification of diverticular disease of the caecal appendix. There are 4 different types, and type I (classical) is the most frequent, with a prevalence of around 40–50%. In our study, we observed that types I (33.3%) and II (33.3%) were most frequent.

Certain risk factors have been described for this pathology, such as: age over 30, male sex, history of cystic fibrosis and Hirschsprung disease. The disease can present in 2 types: one that is acute, resulting from an inflammatory process similar to acute appendicitis, and another of recurring chronic pain. In our study, 14.3% of patients presented a history of chronic abdominal pain. The main complication is perforation, with an incidence of up to 66%, which entails a higher mortality rate when compared with acute appendicitis. In our series, perforation was seen in 46% of cases.

The use of diagnostic imaging studies like ultrasound and CT are non-specific for the diagnosis of appendiceal diverticulitis, although they are useful to differentiate it from other causes of abdominal pain. Lee et al. state that most cases of appendiceal diverticulitis can be differentiated from acute appendicitis with CT when interpreted by experienced radiologists, as the inflamed diverticula have the appearance of small cystic protrusions in the appendix, accompanied by increased IV contrast uptake in the diverticular wall. In our study, complementary radiological tests (abdominal ultrasound and CT) were done in 81% of patients. It is interesting that all the radiological diagnoses were acute appendicitis and that none of the cases were diagnosed as diverticular disease of the appendix.

The complications of appendiceal diverticulitis vary from chronic pain, acute inflammation and perforation to the risk of developing neoplasms. In Table 2, it is curious that the age and incidence of perforation of an inflamed diverticulum are greater in type I than in the rest. 42% of low-grade mucinous neoplasms of the appendix are associated with this disease, so it is therefore recommended that all appendectomy specimens that present diverticula be thoroughly examined to exclude concomitant neoplastic disease.

Dupre et al. demonstrated a statistically significant association between the presence of diverticulosis of the vermiform appendix and neoplasms (47.8%), especially carcinoid tumours and mucinous adenomas. Moreover, there are studies, such as the article by Stockl et al., that report a 42% association between the presence of Schwann cell proliferation in the mucosa and the presence of appendiceal diverticulitis. In our series, there are no reports of Schwann cell proliferation. In addition, it has been observed that the association between diverticulosis of the appendix and neoplasms is observed in 7.1%, which is a very low percentage compared to other studies (Table 2).

The treatment of choice for appendiceal diverticulitis is the same as for appendicitis: appendectomy. Laparoscopic appendectomy is feasible in these cases. Prophylactic appendectomy is recommended when appendiceal diverticula are found.

### Table 2 – Clinical and Demographic Characteristics of Appendiceal Diverticulitis.

| Age (years) | 46.6 | 46.5 | 46.5 |
| Sex (M/F) | 27/15 | 14 | 14 |
| Symptoms (days) | 3.1 | 5 (11.9) | 4 (9.5) |
| Chronic pain (%) | 14.3 | 13.5 | 7.1 |
| T°C > 38 (%) | 42.9 | 45.8 | 45.8 |
| Nausea/vomiting (%) | 74 | 9 (21.4) | 9 (21.4) |
| Perforation (%) | 46.2 | 14 (0.59) | 14 (0.59) |
| Hospital stay (days) | 4.5 | 4.5 | 5.3 |
| Complementary radiological tests (ultrasound/CT) | 34 | 34 | 34 |

### Table 3 – Clinical Characteristics According to Type of Diverticular Disease.

<table>
<thead>
<tr>
<th>Type I (n=14)</th>
<th>Type II (n=14)</th>
<th>Type III (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>50.3</td>
<td>39.9</td>
</tr>
<tr>
<td>Leukocytes (&gt;1000/μl)</td>
<td>13.8</td>
<td>14</td>
</tr>
<tr>
<td>T°C &gt; 38 (%)</td>
<td>9 (21.4)</td>
<td>5 (11.9)</td>
</tr>
<tr>
<td>Perforation (%)</td>
<td>9 (21.4)</td>
<td>4 (9.5)</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td>5.5</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Type IV was observed in 2 patients.

### Table 4 – Diverticular Disease and Its Association With Neoplasms.

<table>
<thead>
<tr>
<th>Appendectomies</th>
<th>DA n (%)</th>
<th>DA + neoplasia n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dupre et al. (2008)</td>
<td>1361</td>
<td>23 (1.7)</td>
</tr>
<tr>
<td>Kallenbach et al. (2012)</td>
<td>4413</td>
<td>39 (0.9)</td>
</tr>
<tr>
<td>Our study (2013)</td>
<td>7044</td>
<td>42 (0.59)</td>
</tr>
</tbody>
</table>

DA: diverticula of the appendix.
during a surgical procedure in order to prevent the risk of later complications or the coexistence of neoplasms.

In conclusion, diverticular disease of the appendix is generally an incidental finding. Appendiceal diverticulitis debuts with abdominal pain in the right iliac fossa, with symptoms in the acute phase that are indistinguishable from those of acute appendicitis.

The treatment of choice is appendectomy. Furthermore, prophylactic appendectomy is recommended in all patients in whom appendiceal diverticula are identified as an intraoperative finding due to the greater risk of complications in these cases, such as perforation and associated mortality. In addition, there is a high risk of developing pseudomyxoma peritonei in some patients with appendiceal diverticula as they present a higher incidence of mucinous tumours of the appendix.

**Conflict of Interests**

The authors have no conflict of interests to declare.

**References**