



ARTÍCULO ORIGINAL

Agreement between surgical and histopathological findings in patients with acute appendicitis at a level III hospital in Bogotá, Colombia

Concordancia entre los hallazgos quirúrgicos e histopatológicos en pacientes con apendicitis aguda en un hospital de tercer nivel de Bogotá, Colombia

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Abstract

Introduction. Currently surgical findings dictate the post-operative treatment of patients with acute appendicitis; however, this relies only on the judgement of the surgeon during the appendectomy. This study aimed to determine the inter-rater reliability between surgeons and pathologists at a tertiary hospital.

Methods. This was a cross-sectional retrospective study conducted between October 2015 and October 2016 at the Central Military Hospital in Bogotá. Patients who underwent appendectomy due to suspected acute appendicitis and had histopathological with their respective surgical findings were included. Our aim was to determine the agreement between surgical and pathology reports.

Results. During the study period, we identified 418 patients who underwent appendectomy. Surgeons assessed 32 (7.7%) appendix as negative, 78 (18.93%) as inflamed, 110 (26.7%) as suppurative, 137 (33.25%) gangrenous and 55 (13.35%) as perforated. Highest agreement was observed in patients with suppurative appendicitis (82/110; 74.5%). Overall Kappa indicated a poor-fair agreement between the pathologist and surgeons (Kappa = 0.2950, 95% CI 0.2384-0.3517, $p < 0.0001$).

Conclusion. There is a poor concordance between surgical and pathologic findings in our study, which is similar to previous articles. As a take home message, surgeons and pathologist should revise the definition of the clinical and the histopathological criteria to better describe the findings and reach a better agreement.

Key words: appendicitis; anatomy & histology; observer variation; surgical procedures, operative; pathology, surgical.

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Resumen

Introducción. Los hallazgos quirúrgicos actuales dictan el tratamiento postoperatorio de los pacientes con apendicitis aguda; sin embargo, esto se basa únicamente en el juicio del cirujano durante la apendicectomía. Este estudio tuvo como objetivo determinar la correlación de la evaluación entre cirujanos y patólogos en un hospital de tercer nivel.

Métodos. Estudio transversal retrospectivo realizado entre octubre de 2015 y octubre de 2016 en el Hospital Militar Central de Bogotá. Se incluyeron pacientes que se sometieron a apendicectomía debido a sospecha de apendicitis aguda y tenían histopatología con sus respectivos hallazgos quirúrgicos. Nuestro objetivo fue determinar la concordancia entre el informe quirúrgico y el de patología.

Resultados. Durante el período de estudio, identificamos a 418 pacientes que se sometieron a apendicectomía. Los cirujanos evaluaron 32 (7,77%) apéndices como negativos, 78 (18,93%) como inflamados, 110 (26,7%) como supurativos, 137 (33,25%) gangrenosos y 55 (13,35%) como perforados. La mayor concordancia se observó en pacientes con apendicitis supurativa (82/110; 74,5%). En general, Kappa indicó un acuerdo poco equitativo entre el patólogo y los cirujanos (Kappa = 0.2950, IC 95% 0.2384-035.17, p <0.0001).

Conclusión. Hay una pobre concordancia entre los hallazgos quirúrgicos y patológicos en nuestro estudio, similar a los documentos médicos anteriores. Como mensaje, los cirujanos y el patólogo deben revisar la definición de los criterios clínicos e histopatológicos para describir mejor los hallazgos y llegar a un mejor acuerdo.

Palabras clave: apendicitis; anatomía & histología; variaciones dependientes del observador; procedimientos quirúrgicos operativos; patología quirúrgica.

Introduction

Inflammation of the appendix, called acute appendicitis, is a common intra-abdominal condition requiring immediate surgical intervention ^{1,2}. Despite the advanced modalities appendectomy remains the standard treatment of acute appendicitis ^{3,4}. Acute appendicitis is considered to have a high risk of occurrence ⁵, which remains close to 7 % of individuals, 23.1 % and 12 % in men and women, respectively ⁶. Removal of the appendix not only decreases the risk of presenting life-threatening complications, including perforation and sepsis, but also allows histopathological analysis, which is the gold standard for the confirmation of the diagnosis of acute appendicitis, independent of the intraoperative findings ^{6,7}. If the pathologist shows transmural inflammation of the appendix or granulocytes in the mucosa or infiltration within the epithelium, the diagnosis of acute appendicitis is made ⁸. However, open appendectomy has the disadvantage of a high rate of negative appendectomy ⁵, which refers to an appendectomy based on the

clinical diagnosis of acute appendicitis, but in which the histopathological analysis of the appendix is normal ⁸.

While patients who are found to have simple appendicitis have been shown to be discharged safely on the day of surgery without additional antibiotic management, patients with complex appendicitis have a longer course requiring hospitalization for treatment with intravenous antibiotics. According to Weis et al. ⁹, appendicitis incurs in significant costs in health care in the United States, with estimated hospital charges of \$2.4 billion annually. Therefore, the importance of knowing the relationship between the intraoperative surgical findings and the pathological result in our setting is raised.

Methods

Study design and patient eligibility

We conducted an observational, cross-sectional study to evaluate the agreement between surgical and histopathological findings of patients who

underwent an appendectomy as treatment for acute appendicitis at the central military hospital in Bogotá, Colombia. Patients of any age and sex were deemed eligible if they underwent an appendectomy between October 2015 and October 2016. We excluded patients with incomplete data (surgical records, histopathological report or both) or patients who underwent surgery in another institution.

Outcomes

Data was collected from the patient's surgical notes and were classified according to the institutional standards as negative appendix, inflamed, suppurative, gangrenous and perforated. Original histopathological reports were obtained for histological diagnosis, which were classified in the same fashion. False positive results were defined as positive surgical finding for appendicitis and a normal histopathological finding, false negative was occurred when surgeons diagnosed a normal appendix and pathology was positive for appendicitis.

Data Collection and Sample Size

Data was collected and tabulated in a Microsoft® Excel spreadsheet. We estimated a minimum sample size of 329 subjects by employing a power based approach for studies of inter-observer agreement with a multinomial outcome of five levels; alpha was set at 0.05 and a power of 0.8, with an expected kappa of 0.3 from previous studies (10). Expecting a maximum of 20 % of loss to follow-up we included 82 patients for our final sample size of 411 patients.

Statistical analysis

Descriptive statistics were used to summarize differences in demographic characteristics, surgical and histopathological findings among study subjects. For primary analyses inter-rater concordance with five categories of diagnosis was determined using weighted Cohen's Kappa statistics. Data was analyzed using SAS/STAT® university edition Copyright© 2012-2017, SAS Institute Inc., Cary, NC, USA.

Results

Patient results

A total of 418 patients we included prospectively of which 71 % (n=297) were male and 29 % (n=121) were female, with a mean age of 31.8 ± 14.72 years (range: 15-86). Data on C-reactive protein was available for 390 patients with a mean value of 6.59 ± 8.70 mg/dL, while leucocyte information was available for 412 patient. Pre-operative abdominal echography and double contrasted CT-scans was performed on 230 and 67 patients, respectively, with suggestive findings for appendicitis in 99 (26.0 %) for abdominal echography and 48 (11.9 %) for abdominal CT-scan. Full patients' demographics and other clinical details are shown in table 1.

Surgical and pathological agreement

Documentation on histopathological finding was not available in eight patients, because appendectomy for these patients was performed in another institution. Of the 410 available records, the pathologist assessed the tissue samples as 17 (4.1 %) negative, 80 (19.5 %) inflamed, 244 (59.5 %) suppurative, 68 (16.6 %) gangrenous and one (0.2 %) perforated. According to intraoperative findings, surgeons determined

Table 1. Characteristics of patients that underwent appendectomy.

Characteristics	n=418
Age (SD) years	31.8 (14.7)
Gender	
Male (%)	297 (71.5)
Female (%)	121 (28.9)
Pre-operative labs	
C-reactive protein (SD)	6.6 (8.7)
Leucocytes count (SD)	14430.6 (4865.5)
Pre-operative imaging	
CT-scan (%)	67 (16.1)
Abdominal echography (%)	230 (55.1)

32 (7.8 %) appendix as negative, 78 (18.9 %) as inflamed, 110 (26.7 %) as suppurative, 137 (33.2 %) gangrenous and 55 (13.3 %) as perforated. Using the histopathological diagnosis as the gold standard, agreement was the highest in patients with suppurative appendicitis (82/110; 74.5 %), and the lowest were with perforated appendix (0 %). The results are shown in table 2. Overall Kappa statistics for inter-rater reliability using a five diagnostic categories indicated a poor-fair agreement between the pathologist and surgeons (Kappa = 0.2950, 95%CI 0.2384-0.3517, $p < 0.0001$).

Discussion

The ability to diagnose the degree of intraoperative appendicitis is essential as it will ultimately influence postoperative care ¹¹. According to Lamps et al and Rabah et al the diagnostic criteria remain controversial ^{12,13}. Moreover, there is no standard definition for histopathological reports, some authors argue the presence of neutrophils in the mucosa ¹⁴, while other require extension to muscularis propria ¹². This issue is evident in various studies where it has been that the intraoperative impression of the surgeon at the time of appendectomy does not always allow a correlation with the pathological diagnosis ¹⁵. One study compared the microscopic and macroscopic findings in 200 consecutive appendectomies and found that 9% of macroscopically normal appendix were found with inflammation on microscopic analysis ¹⁶. Excluding 139 patients with obvious macroscopic disease and 21 female

patients with other pathologies, this increased the incidence of false negative appendicitis to 45 %. Other study by Bliss et al over 255 children undergoing appendectomy found that 48 % of patients treated for complicated appendicitis were classified in an inconsistent manner between the surgeon and the pathologist ¹⁷. Finally, Roberts et al found that the overall accuracy in the macroscopic evaluation of the appendix during surgery was 87.3 %, with cases of gangrene, perforation or abscess diagnosed at the time of surgery, correlating well with the histopathological findings; the positive predictive value, however, was lower than 91.7 % if only inflammation was evident ¹⁸.

Concomitantly, we found that there is a poor correlation between macroscopic surgical findings by the surgeon and the histopathological findings reported by the pathologist in negative appendicitis (K = 0.2, 95%CI 0.191-0.394, $p = 0.000$), which is similar in other studies ^{19,20}. On the other hand, the inflammatory phase was mostly reported by the surgeon as the gangrenous phase (30.8 %); however, according to pathological findings, the gangrenous phase reached only 14.9 % (30.8 vs. 14.9 %). Contrary to the previous study, where there is greater concordance in the findings of uncomplicated vs. perforated appendicitis, in our study we found that the highest concordance was in early stages of appendicitis or uncomplicated appendicitis both in histopathologic vs. surgical findings.

The main limitation of our study was the lack of standardization of the surgical reports and the participation of eight different surgeons in our

Table 2. Agreement between histological and surgical findings in patients with acute appendicitis.

Surgical findings		Histopathological findings				
		Negative appendicitis	Inflamed appendix	Suppurative appendix	Gangrenous appendix	Perforated appendix
Negative appendicitis	n (%)	7 (21.8)	18 (56.2)	6 (18.7)	0 (0)	1 (3.1)
Inflamed appendix	n (%)	8 (10.3)	35 (44.9)	32 (41.0)	3 (3.9)	0 (0)
Suppurative appendix	n (%)	1 (0.91)	13 (11.8)	82 (74.5)	14(12.7)	0 (0)
Gangrenous appendix	n (%)	0 (0)	9 (6.2)	87 (63.9)	40 (29.4)	0 (0)
Perforated appendix	n (%)	1 (1.8)	5 (9.3)	37 (68.5)	11 (20.4)	0 (0)

study. These factors may have influenced the variability of the reports and influenced the lack of agreement. Nonetheless, we consider that our sample size allows us to draw special attention to the low agreement between the pathological and surgical reports.

Conclusion

Intra-operative findings dictate post-operative treatment strategies for acute appendicitis. Current debate between histological and surgical criteria may influence inter-rater agreement. There is a poor concordance between surgical and pathologic findings in our study, similar to previous published articles. It is therefore essential that surgeons and pathologist revise the clinical working definition of appendicitis as well as the histological criteria to better the agreement. This will ultimately improve the treatment of the patients.

Ethical standards

Informed consent: This is an observational, cross-sectional study to evaluate the agreement between surgical and histopathological findings and, as such, there is no need for informed consent. Permission to perform this study was granted by the Hospital Militar Central Ethical Committee.

Conflict of interest statement: None.

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References

- Samelson SL, Reyes HM. Management of perforated appendicitis in children --revisited. *Arch Surg.* 1987;122:691-6. <https://doi.org/10.1001/archsurg.1987.01400180073014>
- A sound approach to the diagnosis of acute appendicitis. *Lancet.* 1987;1:198-200. [https://doi.org/10.1016/S0140-6736\(87\)90009-2](https://doi.org/10.1016/S0140-6736(87)90009-2)
- Schwartz SI, Brunicaardi F. Schwartz's Principles of surgery. Brunicaardi F, Andersen D, Billiar T, Dunn D, Hunter J, Matthews J, *et al* editors. 9th Edition. New York: McGraw Hill; 2010. p. 1075.
- Paydar S, Parsijani PJ, Akbarzadeh A, Manafi A, Ghaffarpasand F, Abbasi HR, *et al*. Short-term outcome of open appendectomy in southern iran: A single center experience. *Bull Emerg trauma.* 2013;1:123-6.
- Addiss DG, Shaffer N, Fowler BS, Tauxe R V. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiol.* 1990;132:910-25. <https://doi.org/10.1093/oxfordjournals.aje.a115734>
- Yilmaz M, Akbulut S, Kutluturk K, Sahin N, Arabaci E, Ara C, *et al*. Unusual histopathological findings in appendectomy specimens from patients with suspected acute appendicitis. *World J Gastroenterol.* 2013;19:4015-22. <https://doi.org/10.3748/wjg.v19.i25.4015>
- Riber C, Tønnesen H, Aru A, Bjerregaard B. Observer variation in the assessment of the histopathologic diagnosis of acute appendicitis. *Scand J Gastroenterol.* 1999;34:46-9. <https://doi.org/10.1080/00365529950172826>
- Marudanayagam R, Williams GT, Rees BI. Review of the pathological results of 2660 appendicectomy specimens. *J Gastroenterol.* 2006;41:745-9. <https://doi.org/10.1007/s00535-006-1855-5>
- Flum DR, Koepsell T. The clinical and economic correlates of misdiagnosed appendicitis: nationwide analysis. *Arch Surg.* 2002;137:799-804. <https://doi.org/10.1001/archsurg.137.7.799>
- Ando Y, Hamasaki T. Practical issues and lessons learned from multi-regional clinical trials via case examples: A Japanese perspective. *Pharm Stat.* 2010;9:190-200. <https://doi.org/10.1002/pst.448>
- Weiss, Audrey J. Elixhauser, Anne Andrews RM. Characteristics of operating room procedures in U.S. hospitals, 2011 - Statistical brief #170. February 2014. Fecha de consulta: Ago 8 de 2017. Disponible en: <https://www.hcup-us.ahrq.gov/reports/statbriefs/sb170-Operating-Room-Procedures-United-States-2011.jsp>
- Lamps LW. Appendicitis and infections of the appendix. *Semin Diagn Pathol.* 2004;21:86-97. <https://doi.org/10.1053/j.semdp.2004.11.003>
- Rabah R. Pathology of the appendix in children: An institutional experience and review of the literature. *Pediatr Radiol.* 2007;37:15-20. <https://doi.org/10.1007/s00247-006-0288-x>
- Butler C. Surgical pathology of acute appendicitis. *Hum Pathol.* 1981;12:870-8. [https://doi.org/10.1016/S0046-8177\(81\)80190-6](https://doi.org/10.1016/S0046-8177(81)80190-6)
- Shum CF, Lim JFY, Soo KC, Wong WK. On-table diagnostic accuracy and the clinical significance of routine exploration in open appendectomies. *Asian J Surg.* 2005;28:257-61. [https://doi.org/10.1016/S1015-9584\(09\)60356-0](https://doi.org/10.1016/S1015-9584(09)60356-0)
- Hussain A, Mahmood H, Singhal T, Balakrishnan S, El-Hasani S. What is positive appendicitis? A new

- answer to an old question. Clinical, macroscopical and microscopical findings in 200 consecutive appendectomies. *Singapore Med J.* 2009;50:1145-9.
17. Bliss D, Mckee J, Cho D, Krishnaswami S, Zallen G, Harrison M, *et al.* Discordance of the pediatric surgeon's intraoperative assessment of pediatric appendicitis with the pathologists report. *J Pediatr Surg.* 2010;45:1398-403. <https://doi.org/10.1016/j.jpedsurg.2010.02.048>
 18. Roberts JK, Behravesh M, Dmitrewski J. Macroscopic findings at appendectomy are unreliable: Implications for laparoscopy and malignant conditions of the appendix. *Int J Surg Pathol.* 2008;16:386-90. <https://doi.org/10.1177/1066896908315746>
 19. Fallon SC, Kim ME, Hallmark CA, Carpenter JL, Eldin KW, Lopez ME, *et al.* Correlating surgical and pathological diagnoses in pediatric appendicitis. *J Pediatr Surg.* 2015;50:638-41. <https://doi.org/10.1016/j.jpedsurg.2014.11.001>
 20. Segovia Lohse HA, Figueredo Thiel SJ. Concordancia quirúrgico-patológica en el diagnóstico de la apendicitis aguda. *An. Fac. Cienc. Méd.* 2012;45:35-43.