

REVIEW ARTICLE

Epidemiological pattern and outcomes of surgical acute abdomen in Ethiopia: A meta-analysis

Atalel Fentahun Awedew¹, Tesfaneh Shimels²

¹Department of Surgery, School of Medicine, College of Health Sciences, Addis Ababa University, Ethiopia

²Department of Social and Public Health, School of Medicine, College of Health Sciences, Debre Tabor University, Debre Tabor, Ethiopia

Correspondence: Dr Atalel Fentahun Awedew (fentahunatalel27@gmail.com)

© 2021 Atalel F.A. & Tesfaneh S. This open access article is licensed under a Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.



East Cent Afr J Surg. 2021;26(3):135-142
<https://doi.org/10.4314/ecajs.v26i3.6>

Abstract

Background

Acute abdomen is the sudden onset of nontraumatic abdominal pain, occurring over a maximum duration of 5 days. Globally, acute abdomen accounts for approximately 10% of emergency department presentations.

Methods

We conducted a meta-analysis to evaluate the burden and patient outcomes of nongynaecologic surgical acute abdomen in Ethiopia. We searched MEDLINE (via PubMed), African Journals Online (AJOL), and Google Scholar for articles published between 1 January 2007 and 31 December 2018. Additional articles were identified from the grey literature and via the reference lists of articles identified in the database search. Two reviewers independently screened candidate articles using the following inclusion and exclusion criteria: (1) published in English, (2) published from 1 January 2007 through 31 December 2018, (3) study conducted in Ethiopia, (4) study investigated human subjects, and (5) not a case report or systematic review. We employed fixed-effects modelling to estimate the pooled prevalence of surgical acute abdomen and acute abdomen-associated mortality among patients presenting for emergency care. Underlying causes of surgical acute abdomen were also evaluated, along with heterogeneity between the studies (via I^2 statistic calculations and sensitivity analysis). This review was conducted using a protocol registered in the International Prospective Register of Systematic Reviews (PROSPERO; [CRD42019133645](https://doi.org/10.4314/ecajs.v26i3.6)).

Results

The pooled prevalence of surgical acute abdomen was 41.3% (95% confidence interval [CI], 39.7%-42.9%). Most patients (1515 of 2053, 73.8%) were male. The main causes were acute appendicitis (42.1%; 95% CI, 40.0%-44.2%), bowel obstruction (35.9%; 95% CI, 33.8%-37.9%), and perforated peptic ulcers (4.5%; 95% CI, 3.5%-5.5%). Complications occurred in 19.8% of cases (95% CI, 18.1%-21.5%); the mortality rate was 5.1% (95% CI, 4.2%-6.0%). I^2 values between 71% and 100% indicated significant heterogeneity across the studies in terms of all analyzed variables; sensitivity analysis yielded no findings contradicting the primary I^2 analysis.

Conclusions

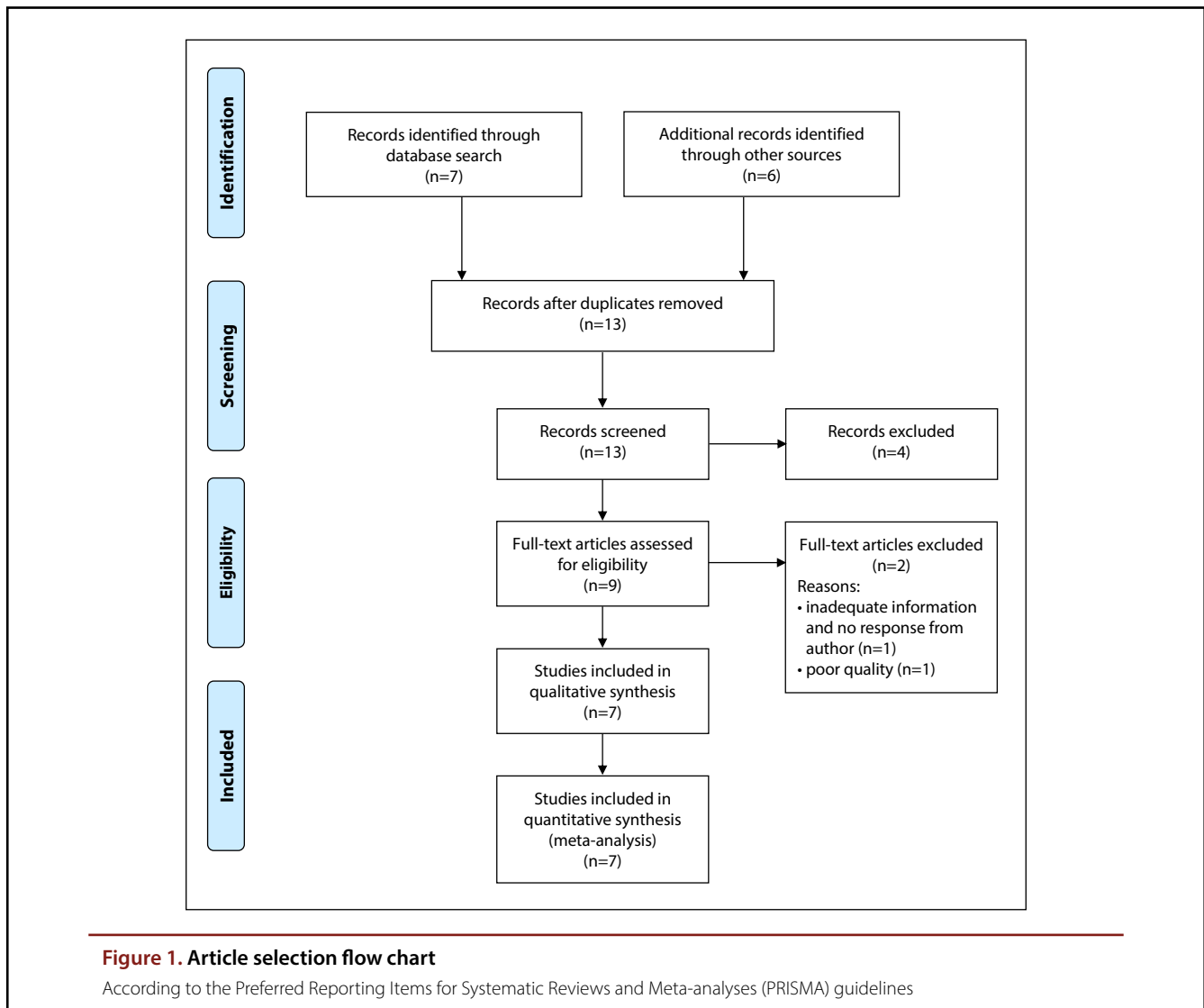
The main causes of surgical acute abdomen in Ethiopia were acute appendicitis and bowel obstruction. Further high-quality research is required to confirm these findings and provide more detailed evidence regarding surgical acute abdomen in Ethiopia.

Keywords: acute abdomen, mortality, morbidity, Ethiopia

Introduction

Acute abdomen is the sudden onset of nontraumatic abdominal pain with a maximum symptom duration of 5 days.^[1] Acute abdomen encompasses a broad range of self-limiting to life-threatening surgical, medical, and gynaecological conditions.^{[1],[2]} Surgical acute abdomen is any abnormal condition within the abdominal cavity that presents with signs and symptoms of abdominal visceral or peritoneal irritation requiring emergency evaluation for possible surgi-

cal intervention.^{[2],[3]} Acute abdominal pain accounts for approximately 10% of emergency department presentations globally.^[1] While acute abdomen accounts for a substantial burden of morbidity, mortality, and health costs globally, data regarding the burden and causes of surgical acute abdomen in Ethiopia are lacking. To address this knowledge gap, we conducted a meta-analysis of published literature to estimate the burden, causes, and patient outcomes of nongynaecological surgical acute abdomen in Ethiopia from 2007 through 2018.



Methods

Selection of articles

This review was conducted in accordance with a protocol registered in the International Prospective Register of Systematic Reviews (PROSPERO; [CRD42019133645](https://doi.org/10.1111/CRD4.2019133645)). We searched MEDLINE (via PubMed), African Journals Online (AJOL), and Google Scholar to identify English-language articles about surgical acute abdomen in Ethiopia that were published in scholarly journals or appeared in the grey literature between 1 January 2007 and 30 December 2018. The authors of identified articles were contacted to obtain full-text articles when none was available online. Additional articles were identified from the grey literature and via the reference lists of articles identified in the database search. We excluded research done on nonhuman subjects, case reports, and systematic reviews.

We used the following free-text queries and Medical Subject Heading (MeSH) terms to conduct our search: (*surgical procedures, operative* [MeSH terms] OR (*surgical* [all fields] AND *procedures* [all fields] AND *operative* [all fields])) OR “operative surgical procedures” [all fields] OR *surgical* [all fields] AND (*abdomen, acute* [MeSH terms] OR (*abdo-*

men [all fields] AND *acute* [all fields])) OR “acute abdomen” [all fields] OR (*acute* [all fields] AND *abdomen* [all fields])) AND (*ethiopia* [MeSH term] OR *Ethiopia* [all fields]).

Two reviewers (1 surgical resident and 1 public health officer) independently screened candidate articles by evaluating titles and abstracts using the following the inclusion and exclusion criteria: (1) published in English, (2) published from 1 January 2007 through 31 December 2018, (3) study conducted in Ethiopia, (4) study investigated human subjects, and (5) not a case report or systematic review. The full-text versions of candidate articles that passed the screening were reviewed. Discrepancies between the reviewers were resolved through discussion until consensus was reached. The reasons for exclusion were documented for all candidate articles that were not included in the meta-analysis.

Data extraction

Data from articles were extracted using a computer-based standardized form, which had been piloted to check for consistency and completeness before beginning data collection. The form included the following key variables: author, year of publication, geographic location of the study, sample size,

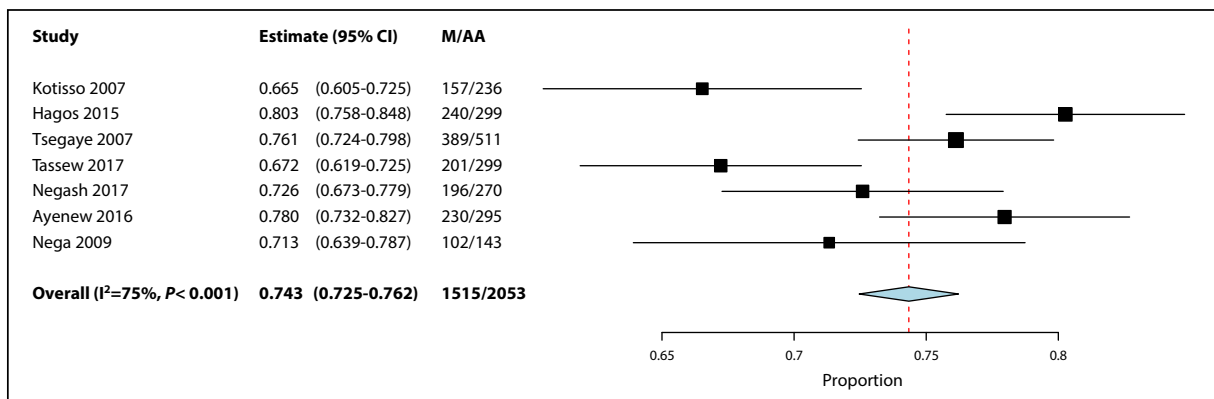


Figure 2. Forest plot depicting proportions of male patients (among acute abdomen cases) in studies conducted in Ethiopia with article publication dates between 1 January 2007 and 31 December 2018 (fixed-effects meta-analysis)

AA, number of acute abdomen cases reported; CI, confidence interval; M, number of male patients among acute abdomen cases

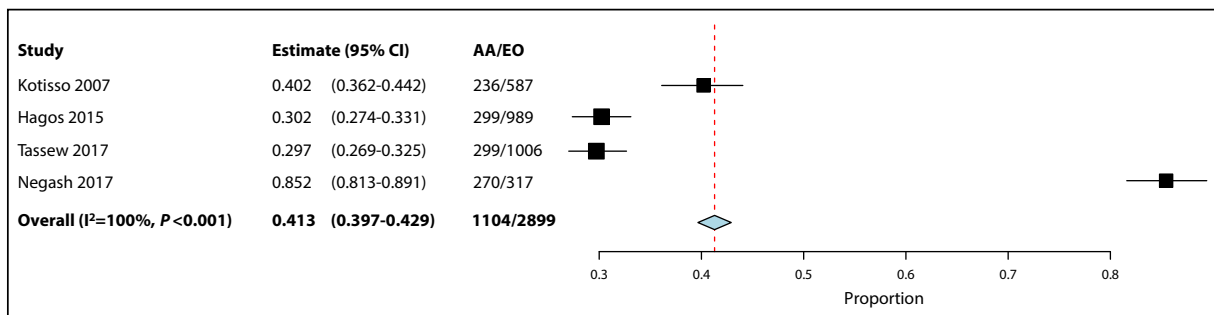


Figure 3. Forest plot depicting acute abdomen prevalence estimates according to studies conducted in Ethiopia with article publication dates between 1 January 2007 and 31 December 2018 (fixed-effects meta-analysis)

AA, number of acute abdomen cases reported; CI, confidence interval; EO, number of emergency operations reported

patient characteristics, data collection period, study design, study setting, study quality, prevalence of aetiological diagnoses, morbidity rate, and mortality rate. Study quality was evaluated using a modified version of the Joanna Briggs Institute quality appraisal tools (Supplementary File).^[4] Specifically, reviewers classified study quality—based on the risk of bias—as low, moderate, or high. Data discrepancies arising between reviewers were resolved via discussion and involving a third party.

Statistical analysis

The meta-analysis was conducted using OpenMeta[Analyst] (Center for Evidence Synthesis in Health, Brown University, Providence, RI, USA), an open-source software package. Pooled prevalence rates of study outcomes were estimated using fixed-effects modelling. We used the I^2 statistic, which represents the percentage of variability in effect estimates that is due to between-study heterogeneity, to evaluate the validity of the meta-analysis. Heterogeneity is usually classified as low, moderate, and high for I^2 values of 25%, 50%, and 75%, respectively.^[5] We conducted a sensitivity analysis to identify sources of between-study heterogeneity.

Results

Our search identified 13 candidate articles, of which 9 were deemed eligible after screening the titles and abstracts. Of these 9 articles, 7 were deemed eligible for inclusion in the meta-analysis after review of the full text. Three articles were excluded because the publication was outside the date range; 1 article was excluded because it did not report specific information regarding peritonitis as the primary cause of acute abdomen, and the author did not respond to our request for detailed information on this outcome. All 7 articles included in the final analysis reported on hospital-based, retrospective, cross-sectional studies and were published in English, which collectively included 2053 individual patients who received emergency surgical care in Ethiopia (Figure 1). Patients presenting with acute abdomen ranged in age from 5 days to 95 years (mean age, 31.2 years) (Table). Overall, 1515 of the 2053 patients (73.8%) were male (Figure 2).

Diagnoses

Surgical acute abdomen accounted for a mean of 41.3% of emergency operations (95% confidence interval [CI], 39.7%-

Table. Characteristics of the included articles

First author/ year	Study site	Study period	Diagnosis, n										Sex, n		Mean age±SD, years	Age range, years	Complications, n	Deaths, n	Total acute abdomen cases, n	Total emergency operations, n
			Appendicitis	Bowel obstruction	Peptic ulcer disease	Intussusception	Hernia	Cholecystitis	Typhoid perforation	Pancreatitis	Others	Male	Female							
Kotisso 2007 ⁽⁶⁾	Tikur Anbessa Specialized Hospital (Addis Ababa)	1 Jan-31 Dec 2000	122	53	21	5	4	4	4	3	3	17	157	79	30.7±14.9	14-84	60	36	236	587
Hagos 2015 ⁽⁷⁾	Mekelle Hospital	Sep 2008-Aug 2010	159	97	13	1	9	1	4	1	14	240	59	31.5	15-95	92	19	299	989	
Tsegaye 2007 ⁽⁸⁾	Gondar University Hospital	Sep 1998-Aug 2002	177	285	20	-	-	5	-	1	23	389	122	32	10-79	79	27	511	NR	
Tassew 2017 ⁽⁹⁾	Goba Referral Hospital	1 Sep 2012-30 Aug 2014	147	86	17	12	16	-	-	-	20	201	98	33.9±17.1	10-84	94	16	299	1006	
Negash 2017 ⁽¹⁰⁾	Wolaita Sodo Teaching and Referral Hospital	1 Jul 2013-30 June 2015	99	98	7	31	6	-	13	-	16	196	74	26.5	0.25-66	32	11	270	317	
Ayeneew 2016 ⁽¹¹⁾	Nekemte Referral Hospital	Jan 2011-Dec 2013	140	99	6	6	13	-	-	-	-	230	65	33.7±18.6	0.5-80	49	9	295	NR	
Nega 2009 ⁽¹²⁾	Glenn C. Olson Memorial Primary General Hospital (Butajira)	10 Oct 2004-20 Nov 2006	35	40	16	23	10	-	-	-	-	102	41	26.6±16.6	5 d-76 y	41	7	143	NR	

NR, not reported; SD, standard deviation

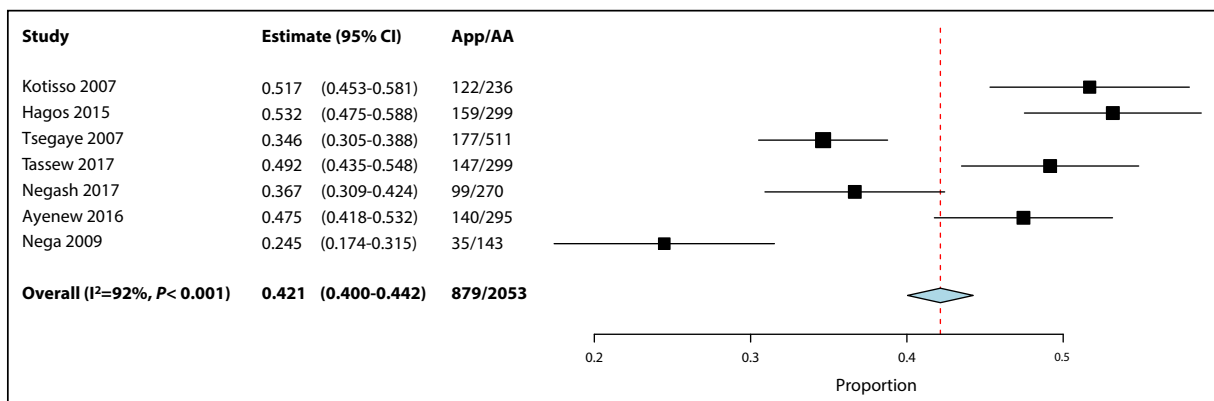


Figure 4. Forest plot depicting acute appendicitis prevalence estimates (among acute abdomen cases) according to studies conducted in Ethiopia with article publication dates between 1 January 2007 and 31 December 2018 (fixed-effects meta-analysis)

AA, number of acute abdomen cases reported; App, number of acute appendicitis cases reported among acute abdomen cases; CI, confidence interval

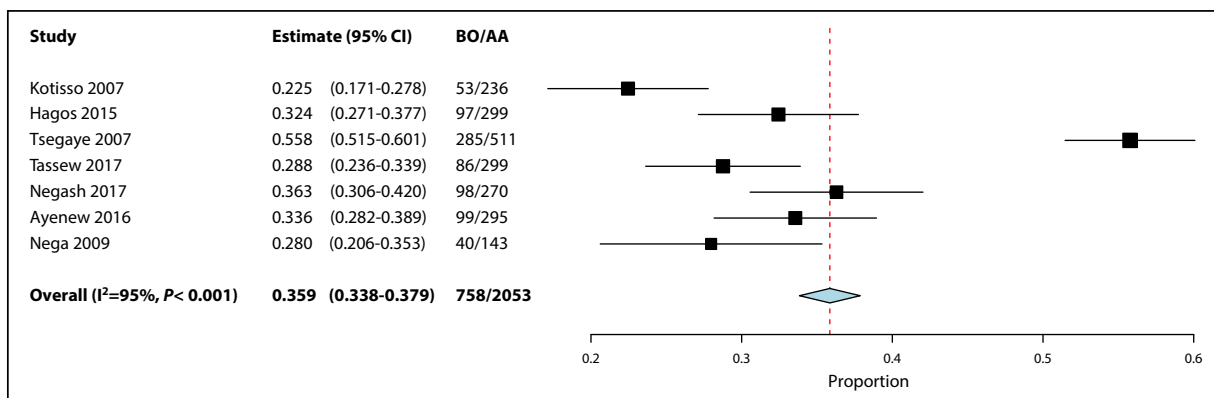


Figure 5. Forest plot depicting bowel obstruction prevalence estimates (among acute abdomen cases) according to studies conducted in Ethiopia with article publication dates between 1 January 2007 and 31 December 2018 (fixed-effects meta-analysis)

AA, number of acute abdomen cases reported; BO, number of bowel obstruction cases reported among acute abdomen cases; CI, confidence interval

42.9%) (Figure 3), with proportions reported in individual articles ranging from 29.7% to 85.2%. The main causes of surgical acute abdomen reported in the articles were acute appendicitis (42.1% of cases; 95% CI, 40.0%-44.2%) (Figure 4), bowel obstruction (35.9% of cases; 95% CI, 33.8%-37.9%) (Figure 5), and peptic ulcer perforation (4.5% of cases; 95% CI, 3.5%-5.5%) (Figure 6). The prevalences of aetiological diagnoses for surgical acute abdomen varied across the studies. Acute appendicitis was the most common diagnosis, accounting for 24.4% to 53.2% of diagnoses in individual studies. Among causes of acute abdomen, other reported prevalence ranges diagnoses included 22.4%-55.8% for bowel obstruction, 2.6%-11.2% for peptic ulcer perforation, 1.3%-4.8% for typhoid intestinal perforation, and 0.2%-1.2% for pancreatitis.

Complications and mortality

The overall pooled rate of complications associated with surgical acute abdomen was 19.8% (95% CI, 18.1%-21.5%) (Figure 7), with the complication rates reported in individual articles ranging from 11.9% to 31.4%. The most common complications reported were wound infection, anastomosis leakage, sepsis, and fistula formation. The overall pooled mortality rate following surgical acute abdomen was 5.1% (95% CI, 4.2%-6.0%) (Figure 8), with mortality rates in individual studies ranging from 3.0% to 15.2%.

Heterogeneity and sensitivity analyses

I^2 values between 71% and 100% (Figure 2 to Figure 8) indicated statistically significant heterogeneity across the included studies in terms of all of the analyzed variables, and there were no contradictory findings in the sensitivity analysis.

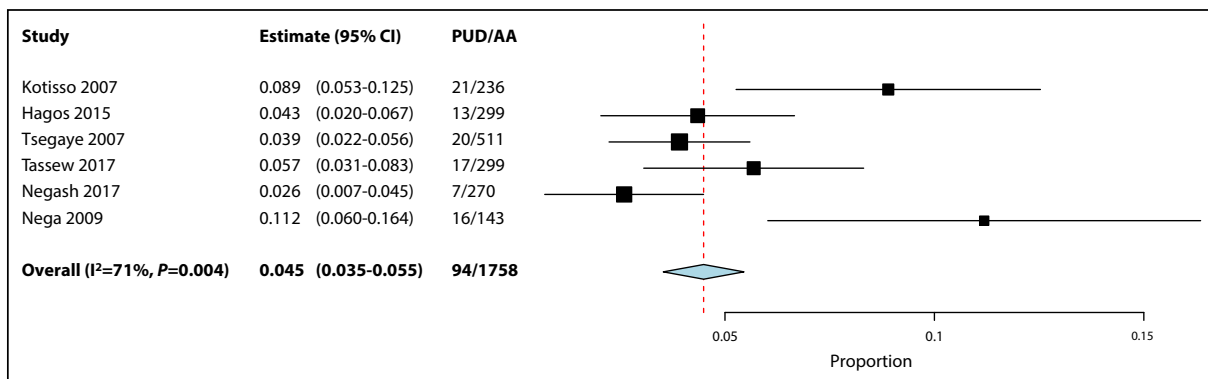


Figure 6. Forest depicting peptic ulcer disease prevalence estimates (among acute abdomen cases) according to studies conducted in Ethiopia with article publication dates between 1 January 2007 and 31 December 2018 (fixed-effects Meta-analysis)

AA, number of acute abdomen cases reported; CI, confidence interval; PUD, number of peptic ulcer disease cases reported among acute abdomen cases

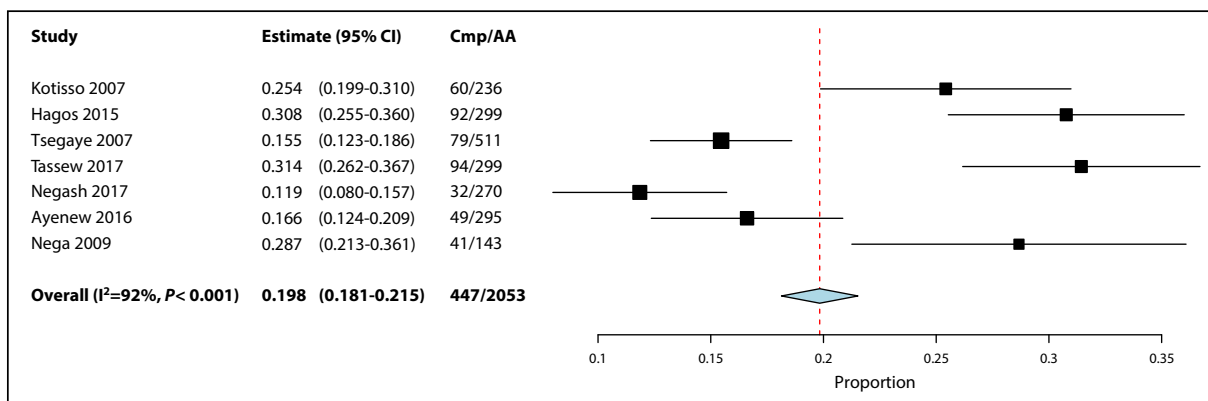


Figure 7. Forest plot depicting complication prevalence estimates (among acute abdomen cases) according to studies conducted in Ethiopia with article publication dates between 1 January 2007 and 31 December 2018 (fixed-effects meta-analysis)

AA, number of acute abdomen cases reported; CI, confidence interval; Cmp, number of complications reported among acute abdomen cases

Discussion

Surgical acute abdomen places a substantial burden on emergency healthcare services worldwide. Our analysis, which to the best of our knowledge, is the first meta-analysis of surgical acute abdomen in Ethiopia, highlights the high burden that this condition places on emergency healthcare services in the country, where it accounts for over 40% of emergency surgical procedures. We found that the most common causes of surgical acute abdomen in Ethiopia were acute appendicitis and bowel obstruction, with each accounting for over one-third of diagnoses for this condition.

The pattern of acute abdomen varies by geographic location, socioeconomic status, and cultural factors. Abdominal pain has been highlighted as the most common cause of hospital admissions in the United States,[13] where a retrospective study of 1000 consecutive patients at a single tertiary medical centre found that 41% of patients admitted to hospital with acute abdomen were classified as having nonspecific abdominal pain (NSAP).[14]

Overall, a similarly large proportion of patients with acute abdominal pain are classified as having NSAP in high-income countries, ranging from 15.5% to 36% in Italy, 21.1% in the United States, and 39.9% in the United Kingdom.[14]-[20] Although NSAP is a commonly applied diagnostic classification in low- and middle-income countries in Africa and Asia, specific causes are also often identified. A study conducted in the Combined Military Hospital Kharian in Pakistan identified acute appendicitis (21.4%) as the most frequent cause of acute abdomen, followed by NSAP (15.4%), acute intestinal obstruction (14.5%), acute cholecystitis (12.7%), and perforated duodenal ulcer (11.8%).[21] In another acute abdomen study conducted in Pakistan, acute appendicitis accounted for 35% of acute abdomen cases, while intestinal obstruction, gut perforation, and cholecystitis accounted for 28.5%, 23.3%, and 7.2% of cases, respectively.[22] In Africa, some authors have reported a shift from bowel obstruction to acute appendi-

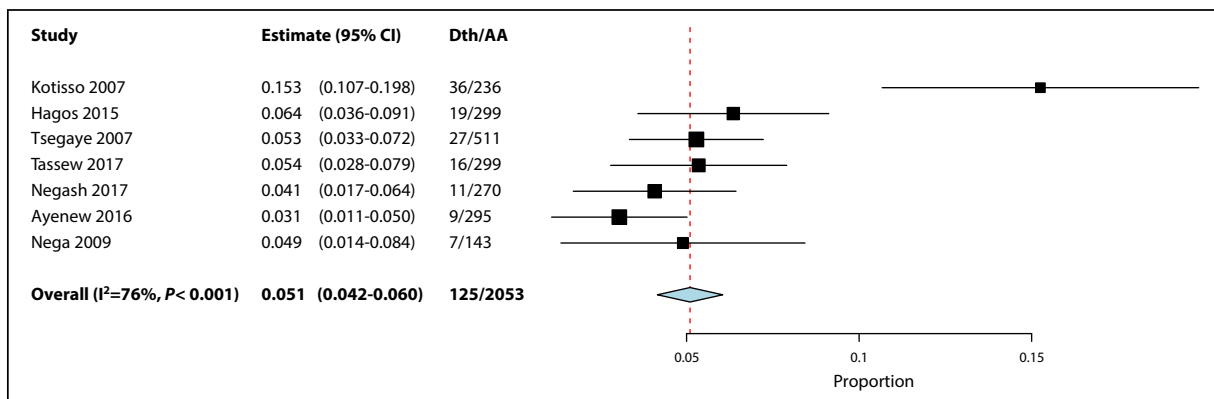


Figure 8. Forest plot depicting mortality rates (among acute abdomen cases) according to studies conducted in Ethiopia with article publication dates between 1 January 2007 and 31 December 2018 (fixed-effects meta-analysis)

AA, number of acute abdomen cases reported; CI, confidence interval; Dth, number of deaths among acute abdomen cases

tis as the primary cause of emergency admissions for acute abdomen.[23] In a study conducted in Ghana, the most common causes of surgical acute abdomen admissions were acute appendicitis, typhoid perforation, and bowel obstruction, accounting for 22.4%, 16.2%, and 12.6% of cases, respectively.[24] A study conducted in Nigeria identified the most common causes of surgical acute abdomen as appendicitis (30.3% of cases), bowel obstruction (27.9% of cases), typhoid ileal perforation (14.9% of cases), and perforated peptic ulcer (7.6% of cases).[3] A study conducted in Sudan found acute appendicitis to be by far the most common cause of acute abdomen, accounting for 63% of cases.[25] We speculate that differences in causes of surgical acute abdomen in different geographical locations may be attributable to variations in cultural practices, health infrastructure, availability of diagnostics, and dietary habits.

Limitations

Significant between-study heterogeneity was present in this meta-analysis, which was at least partly attributable to the substantial variation in the age and sex compositions of the study samples. Further large-scale, high-quality research using standard methods, outcome definitions, and outcome measures are required to confirm these findings and provide more detailed evidence regarding surgical acute abdomen in Ethiopia.

References

- Gans SL, Pols MA, Stoker J, Boermeester MA; expert steering group. Guideline for the diagnostic pathway in patients with acute abdominal pain. *Dig Surg*. 2015;32(1):23-31. doi:10.1159/000371583 [View Article] [PubMed]
- Squires R, Carter SN, Postier RG. Acute abdomen. In: Townsend CM, Evers BM, Beauchamp RD, Mattox KL, eds. *Sabiston Textbook of Surgery*. 20th ed. Elsevier; 2017.
- Agboola JO, Olatoke SA, Rahman GA. Pattern and presentation of acute abdomen in a Nigerian teaching hospital. *Niger Med J*. 2014;55(3):266-270. doi:10.4103/0300-1652.132068 [View Article] [PubMed]

- JBI, Faculty of Health and Medical Sciences, The University of Adelaide. Critical appraisal tools 2020. Accessed 20 March 2022. <https://jbi.global/critical-appraisal-tools>
- Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ*. 2003;327(7414):557-560. doi:10.1136/bmj.327.7414.557 [View Article] [PubMed]
- Kotisso B, Abdurhaman Z. Pattern of acute abdomen in adult patients in Tikur Anbessa Teaching Hospital, Addis Ababa, Ethiopia. *East Cent Afr J Surg* 2007;12(1):47-52.
- Hagos M. Acute abdomen in adults: a two year experience in Mekelle, Ethiopia. *Ethiop Med J*. 2015;53(1):19-24. [PubMed]
- Tsegaye S, Osman M, Bekele A. Surgically treated acute abdomen at Gondar University Hospital, Ethiopia. *East Cent Afr J Surg*. 2007;12(1):53-57.
- Tassew B, Tegegne Haile M, Benti Tefera T, Sileshi Balda S, Bekele Gonfa K, Mubashir K. Presentation and outcome of acute abdomen in Goba Referral Hospital, Goba, southeast Ethiopia: retrospective study. *SM J Fam Med*. 2017;1(1):1003.
- Negash M, Teklewold B, Pawulos W. Assessment of non-traumatic acute abdominal cases treated operatively at Wolaita Sodo Teaching and Referral Hospital, Southern Ethiopia. *J Pharm Alternat Med*. 2017;14:25-33.
- Ayenew Z, Tamirat Gizaw A, Workneh D, Fentahun N. Outcome of non-traumatic surgical acute abdomen in Nekemte Referral Hospital southwest Ethiopia: a retrospective cross-sectional study. *Surg Curr Res*. 2016;7:282. doi:10.4172/2161-1076.1000282 [View Article]
- Nega B. Pattern of acute abdomen and variables associated with adverse outcome in a rural primary hospital setting. *Ethiop Med J*. 2009;47(2):143-151. [PubMed]
- Martin RF, Rossi RL. The acute abdomen. An overview and algorithms. *Surg Clin North Am*. 1997;77(6):1227-1243. doi:10.1016/s0039-6109(05)70615-0 [View Article] [PubMed]
- Brewer BJ, Golden GT, Hitch DC, Rudolf LE, Wangenstein SL. Abdominal pain. An analysis of 1,000 consecutive cases in a University Hospital emergency room. *Am J Surg*. 1976;131(2):219-223. doi:10.1016/0002-9610(76)90101-x [View Article] [PubMed]
- Cervellin G, Mora R, Ticinesi A, et al. Epidemiology and outcomes of acute abdominal pain in a large urban Emergency Department: retrospective analysis of 5,340 cases. *Ann Transl Med*. 2016;4(19):362. doi:10.21037/atm.2016.09.10 [View Article] [PubMed]

16. Caporale N, Morselli-Labate AM, Nardi E, Cogliandro R, Cavazza M, Stanghellini V. Acute abdominal pain in the emergency department of a university hospital in Italy. *United European Gastroenterol J*. 2016;4(2):297-304. doi:10.1177/2050640615606012 [\[View Article\]](#) [\[PubMed\]](#)
17. Caterino S, Cavallini M, Meli C, et al. Il dolore addominale acuto in chirurgia d'urgenza. Studio clinico-epidemiologico su 450 pazienti [Acute abdominal pain in emergency surgery. Clinical epidemiologic study of 450 patients]. *Ann Ital Chir*. 1997;68(6):807-818. [\[PubMed\]](#)
18. Irvin TT. Abdominal pain: a surgical audit of 1190 emergency admissions. *Br J Surg*. 1989;76(11):1121-1125. doi:10.1002/bjs.1800761105 [\[View Article\]](#) [\[PubMed\]](#)
19. Flasar MH, Cross R, Goldberg E. Acute abdominal pain. *Prim Care*. 2006;33(3):659-vi. doi:10.1016/j.pop.2006.06.004 [\[View Article\]](#) [\[PubMed\]](#)
20. Powers RD, Guertler AT. Abdominal pain in the ED: stability and change over 20 years. *Am J Emerg Med*. 1995;13(3):301-303. doi:10.1016/0735-6757(95)90204-X [\[View Article\]](#) [\[PubMed\]](#)
21. Asif M, Almas D, Hashmi JS. Acute abdomen; causes. *Prof Med J*. 2008; 15(1):120-124.
22. Memon AA, Bhutto AA, Shaikh GS, Jokhio A, Soomro Q. Spectrum of diseases in patients with non-traumatic acute abdomen. *J Liaquat Univ Med Health Sci*. 2008;7(3):180-183.
23. Ajao OG. Abdominal emergencies in a tropical African population. *Br J Surg*. 1981;68(5):345-347. doi:10.1002/bjs.1800680519 [\[View Article\]](#) [\[PubMed\]](#)
24. Ohene-Yeboah M. Acute surgical admissions for abdominal pain in adults in Kumasi, Ghana. *ANZ J Surg*. 2006;76(10):898-903. doi:10.1111/j.1445-2197.2006.03905.x [\[View Article\]](#) [\[PubMed\]](#)
25. Doumi EBA, Mohammed MI. Acute abdomen at El Obeid Hospital, western Sudan. *Sudan J Med Sci*. 2009;4(2):137-140. doi:10.4314/sjms.v4i2.44904 [\[View Article\]](#)

Peer Reviewed**Competing Interests:** None declared**Received:** 6 May 2020 • **Revised:** 17 Jul 2020**Accepted:** 22 Jul 2020 • **Published Online:** 7 Jan 2021**Cite this article as:** Fentahun Awedew A, Shimels T. Epidemiological pattern and outcomes of surgical acute abdomen in Ethiopia: A meta-analysis. *East Cent Afr J Surg*. 2021;26(3):135-142. doi:10.4314/ecaajs.v26i3.6

© Atalel F.A. & Tesfaneh S. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit <http://creativecommons.org/licenses/by/4.0/>.
