

Bölüm 1

AKUT DİVERTİKÜLTDE TANI VE TEDAVİDE GÜNCEL YAKLAŞIMLAR

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Divertiküler hastalık, musküler bölgedeki zayıf noktalardan kolon mukozasının kese benzeri çıkışları olması şeklinde tanımlanmaktadır. Asemptomatik veya semptomatik olabilmektedir. Bu durum inflamasyonla birlikte olursa divertikülit adını alır.

EPİDEMİYOLOJİ

Divertikülozis koli hastalığı, hastaneye yatışların önemli nedenleri arasında gelmektedir. Avrupa ülkelerinde ve sanayileşen toplumlarda sağlık bakım hizmetlerinde önemli bir gider kapsamaktadır (1). Amerika Birleşik Devletleri'nde prevalansı 40 yaşında yüzde 20'nin altındadır, 60 yaşında yüzde 60'a çıkmaktadır (2). Divertiküllerin sayısı ve boyutları yaşla birlikte artmaktadır.

Batı ülkelerinde sol kolonda görülmeye ihtimali daha yüksektir.

Kolonoskopik incelemeleri değerlendirilen 624 hastaya yapılan bir çalışmada 260'ında (yüzde 42'sinde) divertikozis saptanmıştır. Yüzde 72'sinde sigmoid kolonda, yüzde 10'unda desandan kolonda, yüzde 6'sında transvers kolonda, yüzde 11'inde çıkan kolonda, yüzde 1'inde çekumda divertiküler hastalık saptanmıştır (3). Özellikle genç yaş gruplarında kadınların erkeklerle göre divertiküler hastalığa yakalanma ihtimali daha düşük olduğu saptanmıştır. Asya toplumlarında divertiküler hastalık ağırlıklı olarak sağ taraftadır (4).

RİSK FAKTÖRLERİ

İleri yaş, erkek cinsiyet, sigara içme ve yüksek vücut kitle indeksi, beyaz ırk divertikülozis için risk faktörleri olarak tanımlanmıştır (5,6,7). Genel bilinenin

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cerrahisi, yüksek yaşam kalitesi skorlarıyla sonuçlanmıştır. Hastaların neredeyse yarısı konservatif şekilde tedavi edildi ve devam eden inatçı şikayetler nedeniyle ameliyat gereği görüldü (198).

3 veya daha fazla divertikülit atağı tekrarlaması, komplike divertikülitli veya divertikülit sonrası kronik ağrısı olan 85 hastayı içeren LASER adlı çalışmada hastalar başlangıçla altı ay arasında konsevatif tedaviyle randomize edilmiştir. Rezeksiyon yapılanların yüzde 10'unda ciddi komplikasyonlar (apse ve anostomoz kaçakları) görülmüştür (199).

Divertiküler hastalıktan yapılan kolon operasyonları sonrası mortalite, hastalığın ciddiyetine ve komorbiditelerin varlığına bağlı olmakla beraber yüzde 1,3 ile 5 arasında değiştiği gösterilmiştir (64). Akut perfore divertikülit için yapılmış cerrahilerde yüzde 15 ile 25'lik bir mortalite ve yüzde 50'ye varan bir morbidite oranları ile ilişkilendirilmiştir (200).

Divertiküler hastalıkta uygulanan elektif cerrahiyi takiben postoperatif komplikasyon insidansı yüzde 5 ile 38 arasında değişmektedir (181). Laparskopik cerrahi açık cerrahiyle karşılaştırıldığında daha düşük postoperatif komplikasyon riski taşımaktadır (201).

Hastalar genellikle ameliyattan sonra divertiküler hastalıklardan kurtulmaktadır. Fakat yüzde 15'inde kolonda yeni divertikül gelişecektir ve yüzde 2 ile 11'inde tekrar ameliyat gerekecektir (202). Distal rezeksiyon sınırı rektuma kadar uzatılmazsa nüks olasılığı daha yüksek olacaktır.

Akut divertikülit nedeniyle kolektomi yapılan 17.368 hastada yapılan retrospektif bir çalışmada 164 hastada (yüzde 0,94) kanser saptanmıştır (203). Hastaların yüzde 84'ünde lokal ileri tümörler vardı ve yüzde 37'sinde pozitif lenf nodu saptanmıştır. Yapılan çok değişkenli analizde kanser, sepsis, kilo kaybı ve düşük albümün ile ilişkilendirilmiştir.

KAYNAKÇA

1. Everhart JE, Ruhl CE. Burden of digestive diseases in the United States part II: lower gastrointestinal diseases. *Gastroenterology* 2009; 136:741.
2. Peery AF, Keku TO, Martin CF, et al. Distribution and Characteristics of Colonic Diverticula in a United States Screening Population. *Clin Gastroenterol Hepatol* 2016; 14:980.
3. Peery AF, Keku TO, Galanko JA, Sandler RS. Sex and Race Disparities in Diverticulosis Prevalence. *Clin Gastroenterol Hepatol* 2020; 18:1980.
4. Reichert MC, Lammert F. The genetic epidemiology of diverticulosis and diverticular disease: Emerging evidence. *United European Gastroenterol J* 2015; 3:409.

5. Peery AF, Keku TO, Galanko JA, Sandler RS. Sex and Race Disparities in Diverticulosis Prevalence. *Clin Gastroenterol Hepatol* 2020; 18:1980.
6. Alatise OI, Arigbabu AO, Agbakwuru EA, et al. Spectrum of colonoscopy findings in Ile-Ife Nigeria. *Niger Postgrad Med J* 2012; 19:219.
7. Yamamichi N, Shimamoto T, Takahashi Y, et al. Trend and risk factors of diverticulosis in Japan: age, gender, and lifestyle/metabolic-related factors may cooperatively affect on the colorectal diverticula formation. *PLoS One* 2015; 10:e0123688.
8. Miura S, Kodaira S, Shatari T, et al. Recent trends in diverticulosis of the right colon in Japan: retrospective review in a regional hospital. *Dis Colon Rectum* 2000; 43:1383.
9. Peery AF, Sandler RS, Ahnen DJ, et al. Constipation and a low-fiber diet are not associated with diverticulosis. *Clin Gastroenterol Hepatol* 2013; 11:1622.
10. Meyers MA, Alonso DR, Gray GE, Baer JW. Pathogenesis of bleeding colonic diverticulosis. *Gastroenterology* 1976; 71:577.
11. Golder M, Burleigh DE, Belai A, et al. Smooth muscle cholinergic denervation hypersensitivity in diverticular disease. *Lancet* 2003; 361:1945.
12. Wess L, Eastwood MA, Wess TJ, et al. Cross linking of collagen is increased in colonic diverticulosis. *Gut* 1995; 37:91.
13. Scheff RT, Zuckerman G, Harter H, et al. Diverticular disease in patients with chronic renal failure due to polycystic kidney disease. *Ann Intern Med* 1980; 92:202.
14. Shahedi K, Fuller G, Bolus R, et al. Long-term risk of acute diverticulitis among patients with incidental diverticulosis found during colonoscopy. *Clin Gastroenterol Hepatol* 2013; 11:1609.
15. Etzioni DA, Mack TM, Beart RW Jr, Kaiser AM. Diverticulitis in the United States: 1998-2005: changing patterns of disease and treatment. *Ann Surg* 2009; 249:210.
16. Wheat CL, Strate LL. Trends in Hospitalization for Diverticulitis and Diverticular Bleeding in the United States From 2000 to 2010. *Clin Gastroenterol Hepatol* 2016; 14:96.
17. Schauer PR, Ramos R, Ghiatas AA, Sirinek KR. Virulent diverticular disease in young obese men. *Am J Surg* 1992; 164:443.
18. Francis NK, Sylla P, Abou-Khalil M, et al. EAES and SAGES 2018 consensus conference on acute diverticulitis management: evidence-based recommendations for clinical practice. *Surg Endosc* 2019; 33:2726.
19. Strate LL, Liu YL, Aldoori WH, Giovannucci EL. Physical activity decreases diverticular complications. *Am J Gastroenterol* 2009; 104:1221.
20. Hjern F, Wolk A, Håkansson N. Obesity, physical inactivity, and colonic diverticular disease requiring hospitalization in women: a prospective cohort study. *Am J Gastroenterol* 2012; 107:296.
21. Humes DJ, Fleming KM, Spiller RC, West J. Concurrent drug use and the risk of perforated colonic diverticular disease: a population-based case-control study. *Gut* 2011; 60:219.
22. Strate LL, Liu YL, Huang ES, et al. Use of aspirin or nonsteroidal anti-inflammatory drugs increases risk for diverticulitis and diverticular bleeding. *Gastroenterology* 2011; 140:1427.
23. Aldoori WH, Giovannucci EL, Rimm EB, et al. Use of acetaminophen and nonsteroidal anti-inflammatory drugs: a prospective study and the risk of symptomatic diverticular disease in men. *Arch Fam Med* 1998; 7:255.

24. Maguire LH, Song M, Strate LE, et al. Higher serum levels of vitamin D are associated with a reduced risk of diverticulitis. *Clin Gastroenterol Hepatol* 2013; 11:1631.
25. Maguire LH, Song M, Strate LL, et al. Association of geographic and seasonal variation with diverticulitis admissions. *JAMA Surg* 2015; 150:74.
26. Granlund J, Svensson T, Olén O, et al. The genetic influence on diverticular disease--a twin study. *Aliment Pharmacol Ther* 2012; 35:1103.
27. Strate LL, Erichsen R, Baron JA, et al. Heritability and familial aggregation of diverticular disease: a population-based study of twins and siblings. *Gastroenterology* 2013; 144:736.
28. Rege RV, Nahrwold DL. Diverticular disease. *Curr Probl Surg* 1989; 26:133.
29. Ma W, Jovani M, Nguyen LH, et al. Association Between Inflammatory Diets, Circulating Markers of Inflammation, and Risk of Diverticulitis. *Clin Gastroenterol Hepatol* 2020; 18:2279.
30. Sugihara K, Muto T, Morioka Y, et al. Diverticular disease of the colon in Japan. A review of 615 cases. *Dis Colon Rectum* 1984; 27:531.
31. Parks TG. Natural history of diverticular disease of the colon. *Clin Gastroenterol* 1975; 4:53.
32. Textbook of Gastroenterology, Yamada T, Alpers DH, Kaplowitz N, et al (Eds), Lippincott Williams & Wilkins, Philadelphia, PA 2003.
33. Konvolinka CW. Acute diverticulitis under age forty. *Am J Surg* 1994; 167:562.
34. Rottier SJ, van Dijk ST, Ünlü Ç, et al. Complicated Disease Course in Initially Computed Tomography-Proven Uncomplicated Acute Diverticulitis. *Surg Infect (Larchmt)* 2019; 20:453.
35. Bahadursingh AM, Virgo KS, Kaminski DL, Longo WE. Spectrum of disease and outcome of complicated diverticular disease. *Am J Surg* 2003; 186:696.
36. Ambrosetti P, Chautems R, Soravia C, et al. Long-term outcome of mesocolic and pelvic diverticular abscesses of the left colon: a prospective study of 73 cases. *Dis Colon Rectum* 2005; 48:787.
37. Nagorney DM, Adson MA, Pemberton JH. Sigmoid diverticulitis with perforation and generalized peritonitis. *Dis Colon Rectum* 1985; 28:71.
38. Kriwanek S, Armbruster C, Beckerhinn P, Dittrich K. Prognostic factors for survival in colonic perforation. *Int J Colorectal Dis* 1994; 9:158.
39. Woods RJ, Lavery IC, Fazio VW, et al. Internal fistulas in diverticular disease. *Dis Colon Rectum* 1988; 31:591.
40. Gallo A, Ianiro G, Montalto M, Cammarota G. The Role of Biomarkers in Diverticular Disease. *J Clin Gastroenterol* 2016; 50 Suppl 1:S26.
41. Ambrosetti P, Robert JH, Witzig JA, et al. Acute left colonic diverticulitis: a prospective analysis of 226 consecutive cases. *Surgery* 1994; 115:546.
42. Mäkelä JT, Klintrup K, Rautio T. The role of low CRP values in the prediction of the development of acute diverticulitis. *Int J Colorectal Dis* 2016; 31:23.
43. Balk EM, Adam GP, Bhuma MR, et al. Diagnostic Imaging and Medical Management of Acute Left-Sided Colonic Diverticulitis : A Systematic Review. *Ann Intern Med* 2022; 175:379.
44. Snyder MJ. Imaging of colonic diverticular disease. *Clin Colon Rectal Surg* 2004; 17:155.

45. Laméris W, van Randen A, Bipat S, et al. Graded compression ultrasonography and computed tomography in acute colonic diverticulitis: meta-analysis of test accuracy. *Eur Radiol* 2008; 18:2498.
46. Heverhagen JT, Sitter H, Zielke A, Klose KJ. Prospective evaluation of the value of magnetic resonance imaging in suspected acute sigmoid diverticulitis. *Dis Colon Rectum* 2008; 51:1810.
47. Heverhagen JT, Zielke A, Ishaque N, et al. Acute colonic diverticulitis: visualization in magnetic resonance imaging. *Magn Reson Imaging* 2001; 19:1275.
48. McKee RF, Deignan RW, Krukowski ZH. Radiological investigation in acute diverticulitis. *Br J Surg* 1993; 80:560.
49. Qaseem A, Etxeandia-Ikobaltzeta I, Lin JS, et al. Diagnosis and Management of Acute Left-Sided Colonic Diverticulitis: A Clinical Guideline From the American College of Physicians. *Ann Intern Med* 2022; 175:399.
50. Stollman NH, Raskin JB. Diagnosis and management of diverticular disease of the colon in adults. Ad Hoc Practice Parameters Committee of the American College of Gastroenterology. *Am J Gastroenterol* 1999; 94:3110.
51. Trenkner SW, Thompson WM. Since the advent of CT scanning, what role does the contrast enema examination play in the diagnosis of acute diverticulitis? *AJR Am J Roentgenol* 1994; 162:1493.
52. Padidar AM, Jeffrey RB Jr, Mindelzun RE, Dolph JF. Differentiating sigmoid diverticulitis from carcinoma on CT scans: mesenteric inflammation suggests diverticulitis. *AJR Am J Roentgenol* 1994; 163:81.
53. Chintapalli KN, Chopra S, Ghiatas AA, et al. Diverticulitis versus colon cancer: differentiation with helical CT findings. *Radiology* 1999; 210:429.
54. Johnson CD, Baker ME, Rice RP, et al. Diagnosis of acute colonic diverticulitis: comparison of barium enema and CT. *AJR Am J Roentgenol* 1987; 148:541.
55. Balthazar EJ, Megibow A, Schinella RA, Gordon R. Limitations in the CT diagnosis of acute diverticulitis: comparison of CT, contrast enema, and pathologic findings in 16 patients. *AJR Am J Roentgenol* 1990; 154:281.
56. Sharma PV, Eglinton T, Hider P, Frizelle F. Systematic review and meta-analysis of the role of routine colonic evaluation after radiologically confirmed acute diverticulitis. *Ann Surg* 2014; 259:263.
57. Mortensen LQ, Burcharth J, Andresen K, et al. An 18-Year Nationwide Cohort Study on The Association Between Diverticulitis and Colon Cancer. *Ann Surg* 2017; 265:954.
58. Qaseem A, Etxeandia-Ikobaltzeta I, Lin JS, et al. Colonoscopy for Diagnostic Evaluation and Interventions to Prevent Recurrence After Acute Left-Sided Colonic Diverticulitis: A Clinical Guideline From the American College of Physicians. *Ann Intern Med* 2022; 175:416.
59. Daniels L, Ünlü Ç, de Korte N, et al. Randomized clinical trial of observational versus antibiotic treatment for a first episode of CT-proven uncomplicated acute diverticulitis. *Br J Surg* 2017; 104:52.
60. Bharucha AE, Parthasarathy G, Ditah I, et al. Temporal Trends in the Incidence and Natural History of Diverticulitis: A Population-Based Study. *Am J Gastroenterol* 2015; 110:1589.

61. Humes DJ, West J. Role of acute diverticulitis in the development of complicated colonic diverticular disease and 1-year mortality after diagnosis in the UK: population-based cohort study. Gut 2012; 61:95.
62. Rafferty J, Shellito P, Hyman NH, et al. Practice parameters for sigmoid diverticulitis. Dis Colon Rectum 2006; 49:939.
63. Binda GA, Arezzo A, Serventi A, et al. Multicentre observational study of the natural history of left-sided acute diverticulitis. Br J Surg 2012; 99:276.
64. Sarin S, Boulos PB. Long-term outcome of patients presenting with acute complications of diverticular disease. Ann R Coll Surg Engl 1994; 76:117.
65. Balk EM, Adam GP, Bhuma MR, et al. Diagnostic Imaging and Medical Management of Acute Left-Sided Colonic Diverticulitis : A Systematic Review. Ann Intern Med 2022; 175:379.
66. Alonso S, Pera M, Parés D, et al. Outpatient treatment of patients with uncomplicated acute diverticulitis. Colorectal Dis 2010; 12:e278.
67. Hall J, Hardiman K, Lee S, et al. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Treatment of Left-Sided Colonic Diverticulitis. Dis Colon Rectum 2020; 63:728.
68. Mora-López L, Ruiz-Edo N, Estrada-Ferrer O, et al. Efficacy and Safety of Nonantibiotic Outpatient Treatment in Mild Acute Diverticulitis (DINAMO-study): A Multicentre, Randomised, Open-label, Noninferiority Trial. Ann Surg 2021; 274:e435.
69. Sirany AE, Gaertner WB, Madoff RD, Kwaan MR. Diverticulitis Diagnosed in the Emergency Room: Is It Safe to Discharge Home? J Am Coll Surg 2017; 225:21.
70. Schechter S, Mulvey J, Eisenstat TE. Management of uncomplicated acute diverticulitis: results of a survey. Dis Colon Rectum 1999; 42:470.
71. Salzman H, Lillie D. Diverticular disease: diagnosis and treatment. Am Fam Physician 2005; 72:1229.
72. Stollman N, Smalley W, Hirano I, AGA Institute Clinical Guidelines Committee. American Gastroenterological Association Institute Guideline on the Management of Acute Diverticulitis. Gastroenterology 2015; 149:1944.
73. Shah SD, Cifu AS. JAMA clinical guidelines synopsis: Management of acute diverticulitis. JAMA 2017; 318:291.
74. Stocchi L. Current indications and role of surgery in the management of sigmoid diverticulitis. World J Gastroenterol 2010; 16:804.
75. Qaseem A, Etxeandia-Ikobaltzeta I, Lin JS, et al. Diagnosis and Management of Acute Left-Sided Colonic Diverticulitis: A Clinical Guideline From the American College of Physicians. Ann Intern Med 2022; 175:399.
76. Vennix S, Morton DG, Hahnloser D, et al. Systematic review of evidence and consensus on diverticulitis: an analysis of national and international guidelines. Colorectal Dis 2014; 16:866.
77. Krobot K, Yin D, Zhang Q, et al. Effect of inappropriate initial empiric antibiotic therapy on outcome of patients with community-acquired intra-abdominal infections requiring surgery. Eur J Clin Microbiol Infect Dis 2004; 23:682.
78. Morris AM, Regenbogen SE, Hardiman KM, Hendren S. Sigmoid diverticulitis: a systematic review. JAMA 2014; 311:287.
79. Regenbogen SE, Hardiman KM, Hendren S, Morris AM. Surgery for diverticulitis in the 21st century: a systematic review. JAMA Surg 2014; 149:292.

80. Sallinen VJ, Mentula PJ, Leppäniemi AK. Nonoperative management of perforated diverticulitis with extraluminal air is safe and effective in selected patients. *Dis Colon Rectum* 2014; 57:875.
81. Vogels S, Frouws M, Morks AN, et al. Treating acute colonic diverticulitis with extra-luminal pericolic air: An Acute Care Surgery in the Netherlands (ACCSENT) multi-center retrospective cohort study. *Surgery* 2021; 169:1182.
82. Titos-García A, Aranda-Narváez JM, Romacho-López L, et al. Nonoperative management of perforated acute diverticulitis with extraluminal air: results and risk factors of failure. *Int J Colorectal Dis* 2017; 32:1503.
83. Thorisson A, Nikberg M, Andreasson K, et al. Non-operative management of perforated diverticulitis with extraluminal or free air - a retrospective single center cohort study. *Scand J Gastroenterol* 2018; 53:1298.
84. Gregersen R, Mortensen LQ, Burcharth J, et al. Treatment of patients with acute colonic diverticulitis complicated by abscess formation: A systematic review. *Int J Surg* 2016; 35:201.
85. Siewert B, Tye G, Kruskal J, et al. Impact of CT-guided drainage in the treatment of diverticular abscesses: size matters. *AJR Am J Roentgenol* 2006; 186:680.
86. Kaiser AM, Jiang JK, Lake JP, et al. The management of complicated diverticulitis and the role of computed tomography. *Am J Gastroenterol* 2005; 100:910.
87. Gaertner WB, Willis DJ, Madoff RD, et al. Percutaneous drainage of colonic diverticular abscess: is colon resection necessary? *Dis Colon Rectum* 2013; 56:622.
88. Mali J, Mentula P, Leppäniemi A, Sallinen V. Determinants of treatment and outcomes of diverticular abscesses. *World J Emerg Surg* 2019; 14:31.
89. Brandt D, Gervaz P, Durmishi Y, et al. Percutaneous CT scan-guided drainage vs. antibiotic therapy alone for Hinckey II diverticulitis: a case-control study. *Dis Colon Rectum* 2006; 49:1533.
90. Kuligowska E, Keller E, Ferrucci JT. Treatment of pelvic abscesses: value of one-step sonographically guided transrectal needle aspiration and lavage. *AJR Am J Roentgenol* 1995; 164:201.
91. Schiller VL, Schreiber L, Seaton C, Sarti DA. Transvaginal sonographic diagnosis of sigmoid diverticulitis. *Abdom Imaging* 1995; 20:253.
92. Neff CC, vanSonnenberg E, Casola G, et al. Diverticular abscesses: percutaneous drainage. *Radiology* 1987; 163:15.
93. Dichman ML, Rosenstock SJ, Shabanzadeh DM. Antibiotics for uncomplicated diverticulitis. *Cochrane Database Syst Rev* 2022; 6:CD009092.
94. Chabok A, Pählman L, Hjern F, et al. Randomized clinical trial of antibiotics in acute uncomplicated diverticulitis. *Br J Surg* 2012; 99:532.
95. Isacson D, Smedh K, Nikberg M, Chabok A. Long-term follow-up of the AVOD randomized trial of antibiotic avoidance in uncomplicated diverticulitis. *Br J Surg* 2019; 106:1542.
96. Daniels L, Ünlü Ç, de Korte N, et al. Randomized clinical trial of observational versus antibiotic treatment for a first episode of CT-proven uncomplicated acute diverticulitis. *Br J Surg* 2017; 104:52.
97. Jaung R, Nisbet S, Gosselink MP, et al. Antibiotics Do Not Reduce Length of Hospital Stay for Uncomplicated Diverticulitis in a Pragmatic Double-Blind Randomized Trial. *Clin Gastroenterol Hepatol* 2021; 19:503.

98. Desai M, Fathallah J, Nutalapati V, Saligram S. Antibiotics Versus No Antibiotics for Acute Uncomplicated Diverticulitis: A Systematic Review and Meta-analysis. *Dis Colon Rectum* 2019; 62:1005.
99. van Dijk ST, Chabok A, Dijkgraaf MG, et al. Observational versus antibiotic treatment for uncomplicated diverticulitis: an individual-patient data meta-analysis. *Br J Surg* 2020; 107:1062.
100. Brook I, Wexler HM, Goldstein EJ. Antianaerobic antimicrobials: spectrum and susceptibility testing. *Clin Microbiol Rev* 2013; 26:526.
101. Gaber CE, Kinlaw AC, Edwards JK, et al. Comparative Effectiveness and Harms of Antibiotics for Outpatient Diverticulitis : Two Nationwide Cohort Studies. *Ann Intern Med* 2021; 174:737.
102. Al-Masrouri S, Garfinkle R, Al-Rashid F, et al. Readmission for Treatment Failure After Nonoperative Management of Acute Diverticulitis: A Nationwide Readmissions Database Analysis. *Dis Colon Rectum* 2020; 63:217.
103. Horgan AF, McConnell EJ, Wolff BG, et al. Atypical diverticular disease: surgical results. *Dis Colon Rectum* 2001; 44:1315.
104. Boostrom SY, Wolff BG, Cima RR, et al. Uncomplicated diverticulitis, more complicated than we thought. *J Gastrointest Surg* 2012; 16:1744.
105. Rottier SJ, van Dijk ST, van Geloven AAW, et al. Meta-analysis of the role of colonoscopy after an episode of left-sided acute diverticulitis. *Br J Surg* 2019; 106:988.
106. Tehranian S, Klinge M, Saul M, et al. Prevalence of colorectal cancer and advanced adenoma in patients with acute diverticulitis: implications for follow-up colonoscopy. *Gastrointest Endosc* 2020; 91:634.
107. Brar MS, Roxin G, Yaffe PB, et al. Colonoscopy following nonoperative management of uncomplicated diverticulitis may not be warranted. *Dis Colon Rectum* 2013; 56:1259.
108. Al-Khamis A, Abou Khalil J, Demian M, et al. Sigmoid Colectomy for Acute Diverticulitis in Immunosuppressed vs Immunocompetent Patients: Outcomes From the ACS-NSQIP Database. *Dis Colon Rectum* 2016; 59:101.
109. McKechnie T, Lee Y, Kruse C, et al. Operative management of colonic diverticular disease in the setting of immunosuppression: A systematic review and meta-analysis. *Am J Surg* 2021; 221:72.
110. Gahagan JV, Halabi WJ, Nguyen VQ, et al. Colorectal Surgery in Patients with HIV and AIDS: Trends and Outcomes over a 10-Year Period in the USA. *J Gastrointest Surg* 2016; 20:1239.
111. Strate LL, Keeley BR, Cao Y, et al. Western Dietary Pattern Increases, and Prudent Dietary Pattern Decreases, Risk of Incident Diverticulitis in a Prospective Cohort Study. *Gastroenterology* 2017; 152:1023.
112. Liu PH, Cao Y, Keeley BR, et al. Adherence to a Healthy Lifestyle is Associated With a Lower Risk of Diverticulitis among Men. *Am J Gastroenterol* 2017; 112:1868.
113. Aune D, Sen A, Norat T, Riboli E. Dietary fibre intake and the risk of diverticular disease: a systematic review and meta-analysis of prospective studies. *Eur J Nutr* 2020; 59:421.
114. Aldoori WH, Giovannucci EL, Rockett HR, et al. A prospective study of dietary fiber types and symptomatic diverticular disease in men. *J Nutr* 1998; 128:714.

115. Ünlü C, Daniels L, Vrouenraets BC, Boermeester MA. A systematic review of high-fibre dietary therapy in diverticular disease. *Int J Colorectal Dis* 2012; 27:419.
116. Aune D, Sen A, Leitzmann MF, et al. Tobacco smoking and the risk of diverticular disease - a systematic review and meta-analysis of prospective studies. *Colorectal Dis* 2017; 19:621.
117. Aune D, Sen A, Leitzmann MF, et al. Body mass index and physical activity and the risk of diverticular disease: a systematic review and meta-analysis of prospective studies. *Eur J Nutr* 2017; 56:2423.
118. Strate LL, Liu YL, Syngal S, et al. Nut, corn, and popcorn consumption and the incidence of diverticular disease. *JAMA* 2008; 300:907.
119. Stollman N, Magowan S, Shanahan F, et al. A randomized controlled study of mesalamine after acute diverticulitis: results of the DIVA trial. *J Clin Gastroenterol* 2013; 47:621.
120. Raskin JB, Kamm MA, Jamal MM, et al. Mesalamine did not prevent recurrent diverticulitis in phase 3 controlled trials. *Gastroenterology* 2014; 147:793.
121. Parente F, Bargiggia S, Prada A, et al. Intermittent treatment with mesalazine in the prevention of diverticulitis recurrence: a randomised multicentre pilot double-blind placebo-controlled study of 24-month duration. *Int J Colorectal Dis* 2013; 28:1423.
122. Carter F, Alsayb M, Marshall JK, Yuan Y. Mesalamine (5-ASA) for the prevention of recurrent diverticulitis. *Cochrane Database Syst Rev* 2017; 10:CD009839.
123. Hall JE, Roberts PL, Ricciardi R, et al. Long-term follow-up after an initial episode of diverticulitis: what are the predictors of recurrence? *Dis Colon Rectum* 2011; 54:283.
124. Binda GA, Arezzo A, Serventi A, et al. Multicentre observational study of the natural history of left-sided acute diverticulitis. *Br J Surg* 2012; 99:276.
125. El-Sayed C, Radley S, Mytton J, et al. Risk of Recurrent Disease and Surgery Following an Admission for Acute Diverticulitis. *Dis Colon Rectum* 2018; 61:382.
126. Li D, de Mestral C, Baxter NN, et al. Risk of readmission and emergency surgery following nonoperative management of colonic diverticulitis: a population-based analysis. *Ann Surg* 2014; 260:423.
127. Ritz JP, Lehmann KS, Frericks B, et al. Outcome of patients with acute sigmoid diverticulitis: multivariate analysis of risk factors for free perforation. *Surgery* 2011; 149:606.
128. Janes S, Meagher A, Frizelle FA. Elective surgery after acute diverticulitis. *Br J Surg* 2005; 92:133.
129. Chapman JR, Dozois EJ, Wolff BG, et al. Diverticulitis: a progressive disease? Do multiple recurrences predict less favorable outcomes? *Ann Surg* 2006; 243:876.
130. Colorectal Writing Group for the SCOAP-CERTAIN Collaborative. The impact of delaying elective resection of diverticulitis on laparoscopic conversion rate. *Am J Surg* 2015; 209:913.
131. Thornblade LW, Simianu VV, Davidson GH, Flum DR. Elective Surgery for Diverticulitis and the Risk of Recurrence and Ostomy. *Ann Surg* 2021; 273:1157.
132. Thaler K, Baig MK, Berho M, et al. Determinants of recurrence after sigmoid resection for uncomplicated diverticulitis. *Dis Colon Rectum* 2003; 46:385.
133. Choi KK, Martinolich J, Canete JJ, et al. Elective Laparoscopic Sigmoid Colectomy for Diverticulitis-an Updated Look at Recurrence After Surgery. *J Gastrointest Surg* 2020; 24:388.

134. Pautrat K, Bretagnol F, Huten N, de Calan L. Acute diverticulitis in very young patients: a frequent surgical management. *Dis Colon Rectum* 2007; 50:472.
135. Chautems RC, Ambrosetti P, Ludwig A, et al. Long-term follow-up after first acute episode of sigmoid diverticulitis: is surgery mandatory?: a prospective study of 118 patients. *Dis Colon Rectum* 2002; 45:962.
136. Broderick-Villa G, Burchette RJ, Collins JC, et al. Hospitalization for acute diverticulitis does not mandate routine elective colectomy. *Arch Surg* 2005; 140:576.
137. Ritz JP, Lehmann KS, Stroux A, et al. Sigmoid diverticulitis in young patients--a more aggressive disease than in older patients? *J Gastrointest Surg* 2011; 15:667.
138. Vignati PV, Welch JP, Cohen JL. Long-term management of diverticulitis in young patients. *Dis Colon Rectum* 1995; 38:627.
139. Imaeda H, Hibi T. The Burden of Diverticular Disease and Its Complications: West versus East. *Inflamm Intest Dis* 2018; 3:61.
140. Oh HK, Han EC, Ha HK, et al. Surgical management of colonic diverticular disease: discrepancy between right- and left-sided diseases. *World J Gastroenterol* 2014; 20:10115.
141. Lee YF, Tang DD, Patel SH, et al. Recurrence of Acute Right Colon Diverticulitis Following Nonoperative Management: A Systematic Review and Meta-analysis. *Dis Colon Rectum* 2020; 63:1466.
142. Ngoi SS, Chia J, Goh MY, et al. Surgical management of right colon diverticulitis. *Dis Colon Rectum* 1992; 35:799.
143. Sugihara K, Muto T, Morioka Y, et al. Diverticular disease of the colon in Japan. A review of 615 cases. *Dis Colon Rectum* 1984; 27:531.
144. Hildebrand P, Kropp M, Stellmacher F, et al. Surgery for right-sided colonic diverticulitis: results of a 10-year-observation period. *Langenbecks Arch Surg* 2007; 392:143.
145. Luu LH, Vuong NL, Yen VTH, et al. Laparoscopic diverticulectomy versus non-operative treatment for uncomplicated right colonic diverticulitis. *Surg Endosc* 2020; 34:2019.
146. Constantinides VA, Tekkis PP, Senapati A, Association of Coloproctology of Great Britain Ireland. Prospective multicentre evaluation of adverse outcomes following treatment for complicated diverticular disease. *Br J Surg* 2006; 93:1503.
147. Constantinides VA, Tekkis PP, Athanasiou T, et al. Primary resection with anastomosis vs. Hartmann's procedure in nonelective surgery for acute colonic diverticulitis: a systematic review. *Dis Colon Rectum* 2006; 49:966.
148. Abbas S. Resection and primary anastomosis in acute complicated diverticulitis, a systematic review of the literature. *Int J Colorectal Dis* 2007; 22:351.
149. Cirocchi R, Arezzo A, Vettoretto N, et al. Role of damage control surgery in the treatment of Hinche III and IV sigmoid diverticulitis: a tailored strategy. *Medicine (Baltimore)* 2014; 93:e184.
150. Tartaglia D, Costa G, Camillò A, et al. Damage control surgery for perforated diverticulitis with diffuse peritonitis: saves lives and reduces ostomy. *World J Emerg Surg* 2019; 14:19.
151. Sohn M, Iesalnieks I, Agha A, et al. Perforated Diverticulitis with Generalized Peritonitis: Low Stoma Rate Using a "Damage Control Strategy". *World J Surg* 2018; 42:3189.

152. Maggard MA, Zingmond D, O'Connell JB, Ko CY. What proportion of patients with an ostomy (for diverticulitis) get reversed? *Am Surg* 2004; 70:928.
153. Vermeulen J, Coene PP, Van Hout NM, et al. Restoration of bowel continuity after surgery for acute perforated diverticulitis: should Hartmann's procedure be considered a one-stage procedure? *Colorectal Dis* 2009; 11:619.
154. Banerjee S, Leather AJ, Rennie JA, et al. Feasibility and morbidity of reversal of Hartmann's. *Colorectal Dis* 2005; 7:454.
155. Vermeulen J, Gosselink MP, Busschbach JJ, Lange JF. Avoiding or reversing Hartmann's procedure provides improved quality of life after perforated diverticulitis. *J Gastrointest Surg* 2010; 14:651.
156. Biondo S, Lopez Borao J, Millan M, et al. Current status of the treatment of acute colonic diverticulitis: a systematic review. *Colorectal Dis* 2012; 14:e1.
157. Bridoux V, Regimbeau JM, Ouassis M, et al. Hartmann's Procedure or Primary Anastomosis for Generalized Peritonitis due to Perforated Diverticulitis: A Prospective Multicenter Randomized Trial (DIVERTI). *J Am Coll Surg* 2017; 225:798.
158. Binda GA, Karas JR, Serventi A, et al. Primary anastomosis vs nonrestorative resection for perforated diverticulitis with peritonitis: a prematurely terminated randomized controlled trial. *Colorectal Dis* 2012; 14:1403.
159. Acuna SA, Wood T, Chesney TR, et al. Operative Strategies for Perforated Diverticulitis: A Systematic Review and Meta-analysis. *Dis Colon Rectum* 2018; 61:1442.
160. Halim H, Askari A, Nunn R, Hollingshead J. Primary resection anastomosis versus Hartmann's procedure in Hincher III and IV diverticulitis. *World J Emerg Surg* 2019; 14:32.
161. Goldstone RN, Cauley CE, Chang DC, et al. The Effect of Surgical Training and Operative Approach on Outcomes in Acute Diverticulitis: Should Guidelines Be Revised? *Dis Colon Rectum* 2019; 62:71.
162. Cauley CE, Patel R, Bordeianou L. Use of Primary Anastomosis With Diverting Ileostomy in Patients With Acute Diverticulitis Requiring Urgent Operative Intervention. *Dis Colon Rectum* 2018; 61:586.
163. Sanaiha Y, Hadaya J, Aguayo E, et al. Comparison of Diversion Strategies for Management of Acute Complicated Diverticulitis in a US Nationwide Cohort. *JAMA Netw Open* 2021; 4:e2130674.
164. O'Sullivan GC, Murphy D, O'Brien MG, Ireland A. Laparoscopic management of generalized peritonitis due to perforated colonic diverticula. *Am J Surg* 1996; 171:432.
165. Myers E, Hurley M, O'Sullivan GC, et al. Laparoscopic peritoneal lavage for generalized peritonitis due to perforated diverticulitis. *Br J Surg* 2008; 95:97.
166. Galbraith N, Carter JV, Netz U, et al. Laparoscopic Lavage in the Management of Perforated Diverticulitis: a Contemporary Meta-analysis. *J Gastrointest Surg* 2017; 21:1491.
167. Binda GA, Bonino MA, Siri G, et al. Multicentre international trial of laparoscopic lavage for Hincher III acute diverticulitis (LLO Study). *Br J Surg* 2018; 105:1835.
168. Biffl WL, Moore FA, Moore EE. What is the current role of laparoscopic lavage in perforated diverticulitis? *J Trauma Acute Care Surg* 2017; 82:810.
169. Samuelsson A, Bock D, Prytz M, et al. Laparoscopic lavage for perforated diverticulitis in the LapLav study: population-based registry study. *Br J Surg* 2021; 108:1236.

170. Roberts P, Abel M, Rosen L, et al. Practice parameters for sigmoid diverticulitis. The Standards Task Force American Society of Colon and Rectal Surgeons. *Dis Colon Rectum* 1995; 38:125.
171. Nagorney DM, Adson MA, Pemberton JH. Sigmoid diverticulitis with perforation and generalized peritonitis. *Dis Colon Rectum* 1985; 28:71.
172. Rodkey GV, Welch CE. Changing patterns in the surgical treatment of diverticular disease. *Ann Surg* 1984; 200:466.
173. You K, Bendl R, Taut C, et al. Randomized clinical trial of elective resection versus observation in diverticulitis with extraluminal air or abscess initially managed conservatively. *Br J Surg* 2018; 105:971.
174. van de Wall BJM, Stam MAW, Draisma WA, et al. Surgery versus conservative management for recurrent and ongoing left-sided diverticulitis (DIRECT trial): an open-label, multicentre, randomised controlled trial. *Lancet Gastroenterol Hepatol* 2017; 2:13.
175. Benn PL, Wolff BG, Ilstrup DM. Level of anastomosis and recurrent colonic diverticulitis. *Am J Surg* 1986; 151:269.
176. Köhler L, Sauerland S, Neugebauer E. Diagnosis and treatment of diverticular disease: results of a consensus development conference. The Scientific Committee of the European Association for Endoscopic Surgery. *Surg Endosc* 1999; 13:430.
177. Köckerling F, Schneider C, Reymond MA, et al. Laparoscopic resection of sigmoid diverticulitis. Results of a multicenter study. Laparoscopic Colorectal Surgery Study Group. *Surg Endosc* 1999; 13:567.
178. Franklin ME Jr, Dorman JP, Jacobs M, Plasencia G. Is laparoscopic surgery applicable to complicated colonic diverticular disease? *Surg Endosc* 1997; 11:1021.
179. Stevenson AR, Stitz RW, Lumley JW, Fielding GA. Laparoscopically assisted anterior resection for diverticular disease: follow-up of 100 consecutive patients. *Ann Surg* 1998; 227:335.
180. Eijsbouts QA, Cuesta MA, de Brauw LM, Sietses C. Elective laparoscopic-assisted sigmoid resection for diverticular disease. *Surg Endosc* 1997; 11:750.
181. Klarenbeek BR, Veenhof AA, Bergamaschi R, et al. Laparoscopic sigmoid resection for diverticulitis decreases major morbidity rates: a randomized control trial: short-term results of the Sigma Trial. *Ann Surg* 2009; 249:39.
182. Klarenbeek BR, Coupé VM, van der Peet DL, Cuesta MA. The cost effectiveness of elective laparoscopic sigmoid resection for symptomatic diverticular disease: financial outcome of the randomized control Sigma trial. *Surg Endosc* 2011; 25:776.
183. Gervaz P, Inan I, Perneger T, et al. A prospective, randomized, single-blind comparison of laparoscopic versus open sigmoid colectomy for diverticulitis. *Ann Surg* 2010; 252:3.
184. Raue W, Paolucci V, Asperger W, et al. Laparoscopic sigmoid resection for diverticular disease has no advantages over open approach: midterm results of a randomized controlled trial. *Langenbecks Arch Surg* 2011; 396:973.
185. Abraha I, Binda GA, Montedori A, et al. Laparoscopic versus open resection for sigmoid diverticulitis. *Cochrane Database Syst Rev* 2017; 11:CD009277.
186. Tuech JJ, Regenet N, Hennekinne S, et al. Laparoscopic colectomy for sigmoid diverticulitis in obese and nonobese patients: a prospective comparative study. *Surg Endosc* 2001; 15:1427.

187. Tuech JJ, Pessaux P, Regenet N, et al. Laparoscopic colectomy for sigmoid diverticulitis: a prospective study in the elderly. *Hepatogastroenterology* 2001; 48:1045.
188. Currie A, Christmas C, Aldean H, et al. Systematic review of self-expanding stents in the management of benign colorectal obstruction. *Colorectal Dis* 2014; 16:239.
189. Khan RMA, Hajibandeh S, Hajibandeh S. Early elective versus delayed elective surgery in acute recurrent diverticulitis: A systematic review and meta-analysis. *Int J Surg* 2017; 46:92.
190. Kassir R, Tsiminikakis N, Celebic A, et al. Timing of laparoscopic elective surgery for acute left colonic diverticulitis. Retrospective analysis of 332 patients. *Am J Surg* 2020; 220:182.
191. Rose J, Parina RP, Faiz O, et al. Long-term Outcomes After Initial Presentation of Diverticulitis. *Ann Surg* 2015; 262:1046.
192. Devaraj B, Liu W, Tatum J, et al. Medically Treated Diverticular Abscess Associated With High Risk of Recurrence and Disease Complications. *Dis Colon Rectum* 2016; 59:208.
193. Young-Fadok TM. Diverticulitis. *N Engl J Med* 2018; 379:1635.
194. Aquina CT, Fleming FJ, Hall J, Hyman N. Do All Patients Require Resection After Successful Drainage of Diverticular Abscesses? *J Gastrointest Surg* 2020; 24:219.
195. Schlussel AT, Wiseman JT, Kelly JF, et al. Location is everything: The role of splenic flexure mobilization during colon resection for diverticulitis. *Int J Surg* 2017; 40:124.
196. Thaler K, Baig MK, Berho M, et al. Determinants of recurrence after sigmoid resection for uncomplicated diverticulitis. *Dis Colon Rectum* 2003; 46:385.
197. Zhang HY, Zhao CL, Xie J, et al. To drain or not to drain in colorectal anastomosis: a meta-analysis. *Int J Colorectal Dis* 2016; 31:951.
198. Bolkenstein HE, Consten ECJ, van der Palen J, et al. Long-term Outcome of Surgery Versus Conservative Management for Recurrent and Ongoing Complaints After an Episode of Diverticulitis: 5-year Follow-up Results of a Multicenter Randomized Controlled Trial (DIRECT-Trial). *Ann Surg* 2019; 269:612.
199. Santos A, Mentula P, Pinta T, et al. Comparing Laparoscopic Elective Sigmoid Resection With Conservative Treatment in Improving Quality of Life of Patients With Diverticulitis: The Laparoscopic Elective Sigmoid Resection Following Diverticulitis (LASER) Randomized Clinical Trial. *JAMA Surg* 2021; 156:129.
200. Morris CR, Harvey IM, Stebbings WS, Hart AR. Incidence of perforated diverticulitis and risk factors for death in a UK population. *Br J Surg* 2008; 95:876.
201. Siddiqui MR, Sajid MS, Qureshi S, et al. Elective laparoscopic sigmoid resection for diverticular disease has fewer complications than conventional surgery: a meta-analysis. *Am J Surg* 2010; 200:144.
202. Wolff BG, Ready RL, MacCarty RL, et al. Influence of sigmoid resection on progression of diverticular disease of the colon. *Dis Colon Rectum* 1984; 27:645.
203. Hassab TH, Patel SD, D'Adamo CR, et al. Predictors of underlying carcinoma in patients with suspected acute diverticulitis. *Surgery* 2021; 169:1323.