

## Review Article

# Right Sided Colonic Diverticulitis: A Comprehensive Review

Melissa Kyriakos Saad and Elias Saikaly\*

Department of General Surgery, Saint George Hospital University Medical Center, University of Balamand, Lebanon

## Abstract

Colonic diverticulum is defined as saccular out pouching or sac-like protrusion of the colonic wall. Its presence in the colon is termed colonic diverticulosis, once inflamed it called diverticulitis. There are two types of diverticula, true diverticula and false diverticula. While a true diverticulum is defined as herniation of the entire bowel wall, a false diverticulum involves only a protrusion of the mucosa and submucosa through the muscularis propria of the colon. Colonic diverticulosis is a relatively common pathology with a rising worldwide prevalence.

**Keywords:** Colonic diverticulum; Herniation; Acute appendicitis

## Introduction

Its prevalence varies according to the national origin, cultural background and diet. It is estimated that 30% of the population at age 50 and 50% after the age of 70 have colonic diverticulosis [1-4]. In fact, the true prevalence is presumed to be higher due to the fact that most affected individuals are asymptomatic and only 20% of patients with diverticulosis exhibit associated symptoms [5]. Colonic diverticulosis can affect any part of the colon, however its anatomical distribution varies between different populations and different geographical areas, while left sided diverticulosis is the most common worldwide, the prevalence of right sided diverticulosis is higher in the Asian population [3,6-8]. Furthermore, the incidence of solitary cecal diverticula and right sided diverticulosis is higher in the Oriental countries than in the west [9]. Right sided colonic diverticulosis is considered to be a rare entity. In western countries, right-sided diverticulosis affects approximately 5% of the population and accounts for 1.5% of patients presenting with diverticulitis. In Asian countries right-sided diverticulosis accounts for 20% of patients with diverticular disease and 75% of cases of diverticulitis [10].

## Pathophysiology

The pathophysiology of colonic diverticulosis being it right-sided or left-sided is yet to be completely understood, and is believed to be complex and multifactorial. The majority of colonic diverticula are false diverticula in which the mucosa and muscularis mucosa herniate through the colonic wall [11]. Right-sided diverticula may be solitary or numerous and can be found in the appendix, cecum, or throughout the ascending colon. When right-sided diverticula are solitary, they

are usually congenital and true diverticula; when multiple, they are typically acquired and false diverticula. In fact, solitary diverticulum of the cecum is thought to be a congenital lesion arising as a sacular projection during the sixth week of embryonic development [11,12]. If not inflamed, diverticula are soft and easily compressible; this allows a free communication between the diverticulum and the lumen of the colon. The pathophysiology of colonic diverticulitis is one extrapolated from the pathophysiology of acute appendicitis, suggesting that stasis or obstruction of the diverticulum orifice leads to bacterial overgrowth, increased pressure within the diverticula, followed by venous congestion and capillary compromise leading to inflammation, ischemia, micro perforation, abscess formation and possibly gross perforation with peritonitis.

## Risk Factors

Risk factors for the formation of diverticula have been identified. These include aging, low dietary fiber intake, cigarette smoking, alcohol intake, corticosteroids, altered collagen structure in the bowel, and increased acetylcholine activity [13-15]. Other factors such as colonic hypermobility, microflora content, and visceral hypersensitivity have been targets of research [16].

## Clinical Manifestations

Symptomatic diverticular disease represent a wide spectrum of clinical presentations ranging from mild abdominal discomfort, pain and bloating reaching free perforation, peritonitis, abscess formation or massive gastrointestinal bleeding.

When an inflammatory process occurs, right-sided diverticulitis often mimics appendicitis with a clinical presentation that is often indistinguishable from acute appendicitis especially that these patients are of young age. Therefore, the ability to distinguish between these two entities is of utmost importance as this will dictate a therapeutic plan that differs and avoid unnecessary surgery. Having said this, even the Alvarado score system which is the classical scoring system to distinguish between acute appendicitis and other abdominal pathologies is not efficient in distinguishing between these two pathologies [17]. In fact, studies have shown that right sided diverticulitis patients have higher range of Alvarado scores [18,19]. Hence, it is not enough and efficient to depend on this score to solely distinguish between these two pathologies.

**Citation:** Saad MK, Saikaly E. Right Sided Colonic Diverticulitis: A Comprehensive Review. *Surg Clin J.* 2021; 2(4): 1033.

**Copyright:** © 2020 Melissa Kyriakos

**Publisher Name:** Medtext Publications LLC

**Manuscript compiled:** May 17<sup>th</sup>, 2021

**\*Corresponding author:** Elias Saikaly, Colorectal Surgery, Department of General Surgery, Saint George Hospital University Medical Center, University of Balamand, Beirut, Lebanon, E-mail: dreliaasaikaly@gmail.com

From here, Graham and Ballantyne [20] reported that some differences do exist when large groups of patients with both disorders are compared. Symptoms may be chronic and intermittent in some patients with right-sided diverticulitis [21], and systemic signs and symptoms are often absent. Furthermore, Markham and Li [22] in their series reported that 69% of patients presented with no systemic symptoms. Significant clinical findings suggestive of right-sided diverticulitis versus appendicitis include a low incidence of nausea, emesis, and anorexia accompanying the abdominal pain as well as variable point of maximum tenderness to palpation on abdominal exam [23]. Furthermore, the patterns of pain differ between acute appendicitis and right sided diverticulitis. In fact, pain related to right-sided diverticulitis usually start and remain localized in the right lower quadrant [24], whereas, pain related to acute appendicitis is typically described as migrating starting at the epigastrium and migrating to the right lower quadrant at later stage which is caused by the stimulation of the visceral afferent nerve fibers that enter the spinal cord at thoracic levels T8 through T10.

However, it is more challenging to differentiate between isolated cecal diverticulitis and acute appendicitis, with more than 70 percent of patients with cecal diverticulitis operated on with a preoperative diagnosis of acute appendicitis [12]. Furthermore, Wagner and Zollinger [25] reported that the correct diagnosis of cecal diverticulitis was made only in 5.3 percent of cases.

## Imaging

Prior to routine use of radiographic imaging, the majority of patients with right sided diverticulitis were diagnosed at the time of surgery. However, knowing that diagnostic accuracy is of utmost importance as the mainstay of management of right sided diverticulitis is conservative medical treatment rather than operative surgical management. Hence, recognizing specific imaging findings enables the radiologist to make the correct diagnosis and helps in establishing the appropriate surgical or medical therapy. To date, computed tomography scan, magnetic resonance imaging, and ultrasound have all been described as effective modalities to diagnose and distinguish right-sided diverticulitis from other intra-abdominal pathology. This will translate directly into dictating a treatment plan and avoiding unnecessary surgery.

Computed tomography scan is widely available and being used in many institutes as the diagnostic modality of choice for evaluating abdominal pain. In fact, some studies suggest that the diagnosis of right side colonic diverticulitis can be correctly made by computed tomography scan [26,27]. Specific imaging findings suggesting right sided diverticulitis are similar to finding of left sided diverticulitis which include focal peri colonic inflammation, presence of one diverticula or multiple diverticula, colonic wall thickening, thickening of the adjacent fascia, and extra luminal mass effect [26-28]. Furthermore, in most cases of right sided diverticulitis a circumferential thickening rather than eccentric thickening of the colonic wall is observed [26,29].

Having said this, with the use of computed tomography scan a diagnostic accuracy of 90 to 95 percent can be achieved, but still it can be mistaken for appendicitis with abscess, Crohn's disease, omental infarction, or colon cancer [30,31]. Furthermore, bowel wall thickening has also been demonstrated in other disease such as irradiation colitis, ischemic colitis, and pseudomembranous colitis [32]. Hence, colonic wall thickening should not be used solely to diagnose right sided colonic diverticulitis.

The Hinchey classification system [33] is widely used to define the severity of the colonic diverticulitis and guide treatment. Accordingly Stage I refers to pericolic inflammation or confined pericolic abscesses, stage II to pelvic or retroperitoneal abscesses, stage III to perforation with purulent peritonitis, and stage IV to perforation with fecal peritonitis.

The second widely available modality for investigating abdominal pain in general and right sided abdominal pain in particular is abdominal ultrasound. When performed by experienced radiologist a 91.3% sensitivity rate and 99.8% specificity rate can be achieved for a correct diagnosis [30,34,35]. In fact, Chou et al. [36] reviewed 934 patients with clinically indeterminate right-sided abdominal pain who were investigated by abdominal ultrasound and reported an overall accuracy of 99.5% in the diagnosis of cecal diverticulitis. The most typically seen feature of diverticulitis during ultrasound is an ovoid or rounded hypo echoic structure extruding from a contiguous bowel wall [35]. Local wall thickening of the colon can also be seen with preservation of the sonographic layered appearance of bowel musculature. This can present as a non-specific target sign [37]. Inflamed surrounding mesentery and omentum appear hyper echoic and non-compressible [37]. Inspissated feces or entrapped air, often causing shadow artefact, may be present within the out pouching bowel lumen [37-39]. Furthermore, in cases with perforation, abscess formation with hyperechoic and heterogeneous image can be seen [37].

Both ultrasound and computed tomography scan are comparable in detecting right sided diverticulitis with an overall accuracy of greater than 90 percent in different studies [37,40,41]. However, ultrasound has the advantage of allowing the radiologist to study the tenderest location along with the fact that it doesn't use any ionizing radiation [42]. Furthermore, Ripolles et al. [43] reported that ultrasound can be used for follow-up of patients with right sided diverticulitis, as 26% of these patients will experience recurrence.

Thirdly, the role of magnetic resonance imaging for diagnosis of right sided colonic diverticulitis has been reported recently by a study from Netherland [44]. However, its availability is limited and only some hospitals and centers have it readily available. Its role is limited to select patients with contraindications to computed tomography scan and in whom ultrasound is nondiagnostic.

## Management

Management of right sided diverticulitis has to be tailored to each and every patient especially that there are no universally accepted guidelines for treatment, and most treatment options are extrapolated from management of left sided colonic diverticulitis with management algorithms varying according to the time of diagnosis.

If right sided diverticulitis is diagnosed on imaging upon presentation then the severity of presentation dictates management. That is, when uncomplicated right sided diverticulitis is made, management should consist of bowel rest and intravenous antibiotics. In fact, published reports demonstrate long-term remission solely with medical conservative therapy for uncomplicated right sided colonic diverticulitis. Komuta et al. [46] published a study demonstrating 99% of patients preoperatively diagnosed with uncomplicated right colon diverticulitis were successfully treated with bowel rest and antibiotics. Add to this that Karatepe et al. [46] concluded that medical treatment may be sufficient in many patients with diverticulitis without peritonitis. Furthermore, Little et al. [47] reported that in the absence

of perforation and peritonitis, conservative treatment may be possible and that patients are typically managed medically first until complications are apparent or are imminent. In addition, multiple studies have shown that conservative treatment for right sided diverticulitis was successful with good long term outcomes [48-52].

For patients diagnosed with complicated right colon diverticulitis manifested by abscess formation, but are hemodynamically stable, treatment consists of intravenous antibiotics, bowel rest with or without percutaneous drainage. On the contrary, patients with frank perforation or those who are clinically unstable should be taken for immediate surgical intervention. In such cases the surgical management is controversial with surgeons being divided regarding the optimal management. Some surgeons support a formal right hemi colectomy while others advocate less extensive resection or approach. The real challenge lies in whether to resect at all and if deemed for resection how much of resection is needed [53,54]. To add more to the complexity of the debate, some surgeons prefer a simple diverticulectomy, especially for isolated cecal diverticulitis, if the local conditions permit along with prophylactic appendectomy and antibiotics [22,54]. Diverticulectomy is considered a minor surgical procedure, similar to appendectomy, and it has been known to have low complication rate and comparable risk of recurrence of disease when compared to right colectomy [55-57]. However, things maybe more complicated and at times where a perforated neoplasm cannot be ruled out a right hemi colectomy is inevitable [58-60], especially that approaches used to exclude malignancy during surgery are not reliable and this includes obtaining a frozen tissue section [60].

On the other end of the spectrum, are patients that were not diagnosed preoperatively and were taken for the operating theater with a presumed diagnosis of acute appendicitis and the diagnosis of right sided diverticulitis or cecal diverticulitis was made during surgery. In these patients the above dilemma applies. Hence, how much of resection is needed, which type of resection, and will diverticulectomy alone be sufficient.

Right sided diverticulitis has a relatively indolent course once compared to left sided diverticulitis and in contrast to left colon diverticulitis the recommendations regarding age and frequency of attacks should not prompt elective colon resection as recurrence requiring emergent intervention is rare [61]. In fact, Yang et al. [62] examined the management and outcome of 113 patients with right sided colon diverticulitis over 10 years and demonstrated an uncomplicated recurrence rate of 20%. Add to this that Komuta et al. [45] in their report published in 2004 reported 20 percent recurrence rate on an average of 3 years of which 15 percent experienced a third attack and again all patients who recurred a third time had uncomplicated presentations and were successfully treated without operative intervention.

Having said the above, in treatment of right sided diverticulitis a patient-tailored approach should be adopted with exceptional consideration to the subgroup of high-risk patients. Patients must be adequately selected and the impact of the disease on the quality of life weighed against the risk of surgical intervention. Currently, resection or other intervention is applied when there is no response to an initial course of antibiotics, if percutaneous intervention is not feasible, unstable patients, and if complications develop. Finally, once conservative management has been decided, follow-up is required either by computed tomography scan, abdominal ultrasound or colonoscopy especially that with the non-operative approach

the correct diagnosis remains uncertain and the need to rule out malignancy in a certain subgroup of patients is essential.

## Conclusion

As the understanding of right sided diverticula has evolved so does its treatment options. Management should be tailored according to patient's presentation. Elective resection should be considered based on patient preference, frequency of recurrences, duration and severity of symptoms after the attacks and the comorbidity of the patient or in cases where malignancy is suspected or can't be ruled out. Complicated diverticulitis presenting as an abscess formation should be managed by percutaneous drainage when feasible or by surgical drainage if deemed not possible percutaneously. Operative intervention is indicated in cases of patient instability or perforation. Non operative diagnosis of right-sided colonic diverticulitis is of utmost importance as most of the cases can be managed conservatively. Radiologists should be aware of the appearance of this disorder on computed tomography scan and ultrasound so that patients can be treated successfully. Further research is required to explore the indications for emergency and elective surgery and the optimal operative procedures for right-sided diverticulitis.

## References

1. 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(2):210-17.
2. Kang JY, Hoare J, Tinto A, Subramanian S, Ellis C, Majeed A, et al. Diverticular disease of the colon - on the rise: a study of hospital admissions in England between 1989/1990 and 1999/2000. *Aliment Pharmacol Ther.* 2003;17(9):1189-95.
3. Lee YS. Diverticular disease of the large bowel in Singapore. An autopsy survey. *Dis Colon Rectum.* 1986; 29(5):330-5.
4. Richter S, vd Linde J, Dominok GW. [Diverticular disease. Pathology and clinical aspects based on 368 autopsy cases] (in German). *Zentralbl Chir.* 1991;116(17):991-8.
5. Ahmed R, Gearhart SL. Diverticular disease and common anorectal disorders. In: Kasper DL, Hauser SL, editors. *Harrison's principles of internal medicine.* New York: McGraw-Hill education; 2015. p. 1971-8.
6. Arfwidsson S, Knock NG, Lehmann L, Winberg T. Pathogenesis of multiple diverticula of the sigmoid colon in diverticular disease. *Acta Chir Scand Suppl.* 1964;63(suppl 342):1-68.
7. Chia JG, Wilde CC, Ngoi SS, Goh PM, Ong CL. Trends of diverticular disease of the large bowel in a newly developed country. *Dis Colon Rectum.* 1991;34(6):498-501.
8. Salzman H, Lillie D. Diverticular disease: diagnosis and treatment. *Am Fam Physician.* 2005;72(7):1229- 34.
9. De la Vega JM. The large intestine. In: Bockus HL, editor. *Gastroenterology.* 3rd ed. Philadelphia: WB Saunders. 1976:976-88.
10. Hughes LE. Postmortem survey of diverticular disease of the colon. I. Diverticulosis and diverticulitis. *Gut.* 1969.10(5):336-51.
11. Griffiths EA, Bergin FG, Henry JA, Mudawi AM. Acute inflammation of a congenital cecal diverticulum mimicking appendicitis. *Med Sci Monit.* 2003;9(12):CS107-9.
12. Lane JS, Sarkar R, Schmit PJ, Chandler CF, Thompson JE Jr. Surgical approach to cecal diverticulitis. *J Am Coll Surg.* 1999;188(6):629-34.
13. Floch MH, White JA. Management of diverticular disease is changing. *World J Gastroenterol.* 2006; 12(20):3225-8.
14. Bordeianou L, Hodin R. Controversies in the surgical management of sigmoid diverticulitis. *J Gastrointest Surg.* 2007;11(4):542-8.
15. Komarica EB, Zvezdic Z. Right-sided perforate d ascending colonic diverticulum mimicking acute appendicitis. *Acta Inform Med.* 2012;20(4):269-70.
16. Radhi JM, Ramsay JA, Boutross-Tadross O. "Diverticular disease of the right colon".

- BMC Res Notes. 2011;4:383.
17. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med.* 1986;15(5): 557-64.
  18. Chen SC, Chang KJ, Wei TC, Yu SC, Wang SM. Can cecal diverticulitis be differentiated from acute appendicitis? *J Formos Med Assoc.* 1994;93(3):263-5.
  19. McKay R, Shepherd J. The use of the clinical scoring system by Alvarado in the decision to perform computed tomography for acute appendicitis in the ED. *Am J Emerg Med.* 2007;25(5):489-93.
  20. Graham SM, Ballantyne GH. Cecal diverticulitis: a review of the American experience. *Dis Colon Rectum.* 1987;30(10):821-6.
  21. Koren D, Sparger KA, Shailam R, Sadow PM. Case records of the Massachusetts General Hospital: Case 13-2021: A Newborn Girl with a Neck Mass. *N Engl J Med.* 2021;384:1647-55.
  22. Markham NI, Li AK. Diverticulitis of the right colon: experience from Hong Kong. *Gut.* 1992;33(4):547-9.
  23. Nirula R, Greaney G. Right-sided diverticulitis: a difficult diagnosis. *Am Surg.* 1997;63(10):871-3.
  24. Birnbaum BA, Wilson SR. Appendicitis at the millennium. *Radiol.* 2000;215(2):337-48.
  25. Wagner DE, Zollinger RW. Diverticulitis of the cecum and ascending colon. *Ann Surg.* 1961;83:436-43.
  26. Oudenhoven LFIJ, Koumans RK, Puylaert JB. Right colonic diverticulitis: US and CT findings--new insights about frequency and natural history. *Radiology.* 1998;208(3):611-8.
  27. Katz DS, Lane MJ, Ross BA, Gold BM, Jeffrey RB Jr, Mindelzun RE. Diverticulitis of the right colon revisited. *Am Roentgenol Soc.* 1998;171:151-6.
  28. Crist DW, Fishman EK, Scatarige JC, Cameron JL. Acute diverticulitis of the cecum and ascending colon diagnosed by computed tomography. *Surg Gynecol Obstet.* 1988;166:99-102.
  29. Jang HJ, Lim HK, Lee SJ, Choi SH, Lee MH, Choi MH. Acute diverticulitis of the cecum and ascending colon: thin-section helical CT findings. *AJR Am J Roentgenol.* 1999;172(3):601-4.
  30. Oudenhoven LF, Koumans RK, Puylaert JB. Right colonic diverticulitis: US and CT findings--new insights about frequency and natural history. *Radiology.* 1998;208(3):611-8.
  31. Jang HJ, Lim HK, Lee SJ, Choi SH, Lee MH, Choi MH. Acute diverticulitis of the cecum and ascending colon: thin-section helical CT findings. *Am J Roentgenol.* 1999;172(3):601-4.
  32. Hata J, Haruma K, Suenaga K, Yoshihara M, Yamamoto G, Tanaka S, et al. Ultrasonographic assessment of inflammatory bowel disease. *Am J Gastroenterol.* 1992;87(4):443-7.
  33. Hinchey EJ, Schaaf PG, Richards GK. Treatment of perforated diverticulitis of the colon. *Adv Surg.* 1978; 12:85-109.
  34. Jang HJ, Lim HK, Lee SJ, Lee WJ, Kim EY, Kim SH. Acute diverticulitis of the cecum and ascending colon: the value of thin-section helical CT findings in excluding colonic carcinoma. *Am J Roentgenol.* 2000;174(5):1397-402.
  35. Chou YH, Chiou HJ, Tiu CM, Chen JD, Hsu CC, Lee CH, et al. Sonography of acute right side colonic diverticulitis. *Am J Surg.* 2001;181(2):122-7.
  36. Chou YH, Chiou HJ, Tiu CM, Chen JD, Hsu CC, Lee CH, et al. Sonography of acute right side colonic diverticulitis. *Am J Surg.* 2001;181(2):122-7.
  37. Helou N, Abdalkader M, Abu-Rustum RS. Sonography: first-line modality in the diagnosis of acute colonic diverticulitis? *J Ultrasound Med.* 2013;32(10):1689-94.
  38. Puylaert JB. Ultrasound of colon diverticulitis. *Dig Dis.* 2012;30(1):56-9.
  39. Mazzei MA, Squitieri NC, Guerrini S, Ianora AAS, Cagini L, Macarini L, et al. Sigmoid diverticulitis: US findings. *Crit Ultrasound J.* 2013;5 Suppl 1(Suppl 1):S5.
  40. Destigter KK, Keating DP. Imaging update: acute colonic diverticulitis. *Clin Colon Rectal Surg.* 2009;22(3):147-55.
  41. Werner A, Diehl SJ, Farag-Soliman M, Duber C. Multi-slice spiral CT in routine diagnosis of suspected acute left-sided colonic diverticulitis: a prospective study of 120 patients. *Eur Radiol.* 2003;13(12):2596-603.
  42. King WC, Shuaib W, Vijayarathi A, Fajardo CG, Cabrera WE, Costa JL. Benefits of ultrasound in diagnosing suspected uncomplicated acute diverticulitis. *J Ultrasound Med.* 2015;34(1):53-8.
  43. Ripolles T, Agramunt M, Martinez MJ, Costa S, Gomez-Abril SA, Richart J. The role of ultrasound in the diagnosis, management and evolutive prognosis of acute left-sided colonic diverticulitis: a review of 208 patients. *Eur Radiol* 2003;13(12):2587-95.
  44. Cobben LPJ, Groot I, Blickman JG, Puylaert JB. Right colonic diverticulitis: MR appearance. *Abdominal Imaging.* 2003;28(6):794-8.
  45. Komuta K, Yamanaka S, Okada K, Kamohara Y, Ueda T, Makimoto N, et al. Toward therapeutic guidelines for patients with acute right colonic diverticulitis. *Am J Surg.* 2004;187(2):233-7.
  46. Karatepe O, Gulcicek OB, Adas G, Battal M, Ozdenkaya Y, Kurtulus I, et al. Cecal diverticulitis mimicking acute Appendicitis: A report of 4 cases. *World J Emerg Surg.* 2008;3:16.
  47. Little A, Culver A. Right-Sided Sigmoid Diverticular Perforation. *West J Emerg Med.* 2012;13(1):103-5.
  48. Kim MR, Bong-Hyeon K, Kim HJ, Hyeon-Min C, Oh ST, Jun-Gi K. Treatment of right colonic diverticulitis: the role of nonoperative treatment. *J Korean Soc Coloproctol.* 2010;26(6):402-6.
  49. Matsushima K. Management of right-sided diverticulitis: a retrospective review from a hospital in Japan. *Surg Today.* 2010;40(4):321-5.
  50. Tan KK, Wong J, Sim R. Non-operative treatment of right-sided colonic diverticulitis has good long-term outcome: a review of 226 patients. *Int J Colorectal Dis.* 2013;28(6):849-54.
  51. Yamanaka S, Okada K, Kamohara Y, Ueda T, Makimoto N, Toshiaki Shiogama, et al. Toward therapeutic guidelines for patients with acute right colonic diverticulitis. *Am J Surg.* 2004;187(2):233-7.
  52. Issa N, Paran H, Yasin M, Neufeld D. Conservative treatment of right-sided colonic diverticulitis. *Eur J Gastroenterol Hepatol.* 2012;24(11):1254-8.
  53. Hall JF. Long-term follow-up after an initial episode of diverticulitis: what are the predictors of recurrence? *Dis Colon Rectum.* 2011;54(3):283-8.
  54. Greaney EM, Snyder WH. Acute diverticulitis of the cecum encountered at emergency surgery. *Am J Surg.* 1957;94(2):270-81.
  55. Lee IK. Right colonic diverticulitis. *J Korean Soc Coloproctol.* 2010;26(4):241-5.
  56. Lee IK, Kim SH, Lee YS, Kim HJ, Lee SK, Kang WK, et al. Diverticulitis of the right colon: tips for preoperative diagnosis and treatment strategy. *J Korean Soc Coloproctol.* 2007;23:223-31.
  57. Lee IK, Lee YS, Kim SJ, Gorden DL, Won DY, Kim HJ, et al. Laparoscopic and open surgery for right colonic diverticulitis. *Am Surg.* 2010;76(5):486-91.
  58. Luoma A, Nagy AG. Cecal diverticulitis. *Can J Surg.* 1989;32(4):283-6.
  59. Arrington P, Judd CS Jr. Cecal diverticulitis. *Am J Surg.* 1981;142(1):56.
  60. Wyble EJ, Lee WC. Cecal diverticulitis: changing trends in management. *South Med J.* 1988;81(3):313-6.
  61. Moon HJ, Park JK, Lee JI, Lee JH, Shin HJ, Kim WS. Conservative treatment for patients with acute right colonic diverticulitis. *Am Surg.* 2007;73(12):1237-41.
  62. Yang HR, Huang HH, Wang YC, Chi-Hsun H, Ping-Kuei C, Long-Bin J, et al. Management of right colon diverticulitis: a 10-year experience. *World J Surg.* 2006;30(10):1929-34.