# The diagnostic and surgical challenges of small bowel disease not involving the duodenum.

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**The diagnostic and surgical challenges of small bowel disease not involving the duodenum**

BACKGROUND: *Because of the lack of specific signs and symptoms, benign and malignant small bowel disease (SB) diagnoses and their treatments are very difficult. The aim of this study was to determine the challenges of diagnostic and surgical treatment of SB diseases.*
MATERIAL AND METHODS: *Of 51 patients, 29 (56.9%) had undergone surgery for non-malignant small bowel (NMSB) diseases, whereas 22 (43.1%) had malignant small bowel (MSB) diseases. All data were collected and compared between the two groups.*
RESULTS: *Patients with MSB had statistically higher levels of disease in the jejunum (50% versus 10.3%; p=0.004), while patients with NMSB had statistically higher disease levels in the ileum (89.7% versus 50%; p=0.002). Twelve (54.5 %) patients in MSB and 18 (62%) patients in NMSB had emergent laparotomy (P=0.76). There were not significant diferrences in postoperative complications (8 [36.4%] in MSB versus 4 [13.8%] in NMSB; p=0.10 and 5 [22.7%] versus 3 [10.3%]; p=0.374). Patients in the MSB group had a statistically signficant lower 5-year survival rate (p=0.038).*
CONCLUSION: *Overall this study showed that preoperative evaluation may not always be capable of differentiating MSB from NMSB disease. Therefore, most patients present with advanced disease stages.*

KEY WORDS: Adenocarcinoma, Ileum, Small bowel, Jejenum

## Introductions

Although the small bowel (SB) comprises the longest part of gastrointestinal system (GIS), the rate of malignant disease is the lowest in GIS cancers [1]. The true prevalance might be higher, but it may be concealed by a missed diagnosis in some patients [2]. Malignant and non-malignant SB (MSB and NMSB, respectively) diseases generally present with similar non-specific symptoms and signs such as occult blood loss, lower GIS bleeding, bowel obstruction, abdominal pain, diarrhea, constipation, and weight loss, especially in malignant diseases [3,4].

SB cancers are classified histologically as adenocarcinomas, lymphomas, sarcomas, gastrointestinal stromal tumors, and neuroendocrine tumors [5]. Surgery is still the mainstay of treatment for SB cancers [6]. It is well known that Crohn's disease (CD) eventually requires surgical treatment in about 70%-90% patients due to its complications [7]. Confusion may exist if patients did not have previous CD and present with its complications. Although the rate of complicated Meckel's diverticulum (MD) is low in adults, adult patients still can have complications such as divertilulitis, GI bleeding, and obstruction that generally require surgical treatment [8]. Benign SB disease polyps can cause intussusceptions that may require surgical treatment, but this occurrence is very rare [9].

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Overall, neither MSB nor NMSB have specific symptoms and signs; thus, it can cause a delaye in diagnosis and treatment that results in poor prognosis. The aim of this study was to analyze clinical presentation, challenges of diagnosis, and surgical treatment of MSB and NMSB.

## Material and Methods

Between January 2013 and January 2018, 51 patients underwent surgery for non-duodenal primary SB diseases. Fifty-one patients were divided into two groups: (1) MSB disease or (2) non-malignant (NMSB). Preoperative clinical signs and symptoms, radiological images, enteroscopy, and laboratory findings, including white blood count (WBC), hemoglobin, hematocrit, and carcinoembryonic antigen (CEA) were used for diagnosis. Preoperative, operative, and postoperative data including age, gender, indications for surgery, operation time, postoperative hospital stay, postoperative recurrence and complications, and postoperative mortality rates were retrospectively investigated. Patients with previous diagnosed SB disease were excluded. Polyps, lipoma, leiomyoma, CD, non-specific inflammation and stricture, and complicated MD were considerd primary NMSB. Primary small bowel cancers included adenocarcinomas, lymphomas, sarcomas, gastrointestinal stromal tumors (GIST), and neuroendocrine tumors.

## Statistical analyses

The NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) was used for statistical analysis. In order to analyze the data, a Student's t-test was used to compare definitive statistical methods (mean, standard deviation, median, frequency, rate, minimum and maximum) in addition to evaluating the normally distributed quantitative data. However, non-distributed quantitative data were compared between two groups using the Mann Whitney U test. To compare qualitative data between two groups Pearson chi-squared, Fisher-Freeman-Halton, and Fisher's Exact tests were used. The effects of risk factors in the 10-year survival analysis was done using a Cox Regression analysis. Survival in two groups was analyzed using a Kaplan-Meier analysis. P <0.05 was considered significant.

## Results

This study was performed with a total of 51 patients. Of these, 24 (47.1%) were female, and 27 (52.9%) were male. The mean age was 52.6±18.1 (range:18–90) years old. Of these patients, 22 (43.1%) had MSB disease, whereas 29 (56.9%) had NMSB disease. Although the mean age was higher in MSB than in NMSB patients, the differences were not significant (57.5±17 versus 48.8±16 years; p=0.08). The differences in gender rate was not statistically significant (45.5% female in MSB versus 41.4% in NMSB; p=0.771). The preoperative symptoms and diagnostic values between the two groups were analyzed (Table I).

There were no significant differences in preoperative abdominal pain, GIS bleeding, diarrhea, and weight loss between the two groups (Table I). However, patients in the MSB group presented with statistically higher GIS obstruction signs and symptoms such as abdominal distention, nausea, and vomiting (63.6% versus 31%; p=0.02). Although the rate of palpable mass is numerically higher in MSB patients, the differences were not significant (13.6 % versus 0; p=0.074). There were no



Table I - *The preoperative symptoms and diagnostic values.*

| | | MSB (n=22) | NMSB (n=29) | p |
|---|---|---|---|---|
| Abdominal pain | | 15(68.2%) | 21 (72.4%) | b0.743 |
| GIS bleeding | | 1 (4.5%) | 1 (3.4%) | c1.000 |
| GIS Obstruction | | 14 (63.6%) | 9 (31%) | b0.020* |
| Abdominal mass | | 3 (13.6%) | 0 | c0.074 |
| Weight loss | | 1 (4.5%) | 1 (3.4%) | c1.000 |
| Diarrhea | | 0 | 4 (13.8%) | c0.124 |
| The lenght of complaining (day) | Min-Max (Median) | 1-90 (3) | 1-90 (7) | d0.418 |
| | Mean±SD | 9.86±19.57 | 14.41±21.62 | |
| Hemoglobin level | Min-Max (Median) | 5.1-16.8 (10.8) | 8,5-16,9 (11,9) | a0.133 |
| | Mean±SD | 10.97±2.37 | 11.84±1.7 | |
| Hematocrit level | Min-Max (Median) | 3.6-50.1 (31.9) | 26.5-49.3 (36.3) | a0.049* |
| | Mean±SD | 32.07±9.38 | 36.12±4.68 | |
| WBC | Min-Max (Median) | 0.7-20.3 (8.7) | 3.6-25.5 (10) | a0.045* |
| | Mean±SD | 8.93±4.48 | 12.04±6.32 | |
| Tumor marker (higher CEA) | | 11(50%) | 0 | b0.001** |

aStudent t Test; bPearson Chi-Square Test; cFisher's Exact TestdMann Whitney U Test; *p<0,05; **p<0,01

significant diferrences in preoperative hemoglobin between two groups whereas the hematocrit level was statistically lower in the MSB group (32.07±9.38 versus 36.12±4.68; p=0.049). The white blood count (WBC) was statistically higher in NMSB patients (12.04±6.3 versus 28.93±4.48; p=0.045). As expected, the tumor marker CEA was statistically higher in MSB patients (50% versus 0; p=0.001).

In preoperative evaluation, seven (31.8%) patients in MSB and 10 (34.5%) patients in NMSB had preoperative device-assisted eneteroscopy (DAE) (p=0.940). Of these patients, three (42.9%) patients in MSB and four (40%) patients in NMSB had a diagnosis via enteroscopy (p=0.95). The consistency between a preoperative radiological diagnosis and postoperative pathological diagnosis was higher in NMSB, but the diferrences were not significant (71.4% versus 42.1%; p=0.071). Overall, there were no significant differences in the rate of consistency between pre and intraoperative diagnoses in the groups (69% in NMSB versus 59.1% in MSB; p=0.656). Although almost all patients had surgery during the first admission to the hospital, 54.5% of the MSB and 62% of the NMSB patients had emergent laparotomy due to SB obstruction, acute peritonitis, or GIS bleeding (P=0.76). Five (22.7%) patients had tumor perforation in MSB while 6 (20.7%) had SB perforation in NMSB (p=0.860).

MSB patients had statistically higher number of diseases in the jejunum (50% versus 10.3%; p=0.004) while patients in NMSB had statistically higher disease in ileum (89.7% versus 50%; p=0.002 [Table II]). No statistical diferrences were found between the two groups in terms of the length of the resected SB (38.77±48.31 versus 19.37±10.46 cm in NMSB; p=0.205), the length of the operation (2.23±0.75 versus 2.69±0.93 h; p=0.08), and blood transfusions in operating room (1.50±1.90 versus 0.83±1.47; p=0.146).

As pathological diagnosis of MSB, nine (40.9%) patients had SB adenocarcinomas, six (27.3%) had lymphomas, four (18.2%) had GİST tumor, two (9%) had mesenchymal tumors, and one (4.6%) had malign melanoma of the SB. Of these, four GİST tumors (3 [75%]) were staged as high grade one (25%), which is an intermediate grade. Nine (50%) patients had stage-3, six (33.3%) had stage-4, and three (16.7%) had stage-2. Surgical margin were clear in all patients. In NMSB patients, 10 (34.5%) had complicated CD, 10 (34.5%) had non-specific chronic inflammation, four (13.8%) had complicated meckel diverticulitis, three (10.3%) had polyps, and two (6.9%) had limpomas of the SB.



TABLE II - *The analysis of intraoperative values*

| | | MSB(n=22) | NMSB(n=29) | p |
|---|---|---|---|---|
| The location of disease in SB | leum | 11 (50 %) | 26 (89.7%) | a0.002a0.004 |
| | Jejenum | 11 (50%) | 3 (10.3) | |
| The lenght of resected SB (cm) | Min-Max(Median) | 6-220 (20.5) | 3-50 (17) | b0.205 |
| | Mean±SD | 38.77±48,31 | 19.37±10.46 | |
| The lenght of operation (h) | Min-Max(Median) | 1-4 (2) | 1-5 (3) | b0.080 |
| | Mean±SD | 2.23±0.75 | 2.69±0.93 | |
| Erythrocyte suspension transfusion (U) | Min-Max (Median) | 0-7 (0.5) | 0-5 (0) | b0.146 |
| | Mean±SD | 1.50±1.90 | 0.83±1.47 | |

aPearson Chi-Square Test; bMann Whitney U Test, SB: Small bowel SD: Standard deviation

TABLE III - *Postoperative outcomes in both groups*

| | | MSB (n=22) | NMSB(n=29) | p |
|---|---|---|---|---|
| Total complication rate | | 8 (36.4%) | 4 (13.8%) | b0.10 |
| Surgical wound infection | | 5 (22.7%) | 3 (10.3%) | c0.374 |
| Anastomosis leak | | 1 (4.5%) | 1 (3.4%) | c1.000 |
| The length of ICU stay (day) | Min-Max (Median) | 0-11 (1) | 0-5 (0) | d0.006** |
| | Mean±SD | 2.18±3.13 | 0.59±1.27 | |
| The lenght of hospital stay (day) | Min-Max (Median) | 5-20 (7.5) | 0-28 (9) | d0.250 |
| | Mean±SD | 9.05±3.93 | 10.34±5.53 | |
| Metastasis | | 10 (45.5%) | 0 | c0,001** |
| Chemotherapy | | 14 (63.6%) | 0 | b0,001** |

bPearson Chi-Square Test; cFisher's Exact Test; dMann Whitney U Test **p<0,01; ICU: Intensive care unit

TABLE IV - *The analysis of univariate and multivariate Cox Regression analysis of the risk factors*

| | Univariate | | | Multivariate | | |
|---|---|---|---|---|---|---|
| | p | HR | %95 CI | p | HR | %95 CI |
| The lenght of complaining (d) | 0,643 | 0,994 | 0,967-1,021 | | | |
| Tumor marker (CEA) | 0,183 | 2,554 | 0,643-10,152 | | | |
| The lenght of removed SB (cm) | 0,013* | 1,012 | 1,002-1,021 | 0,013* | 1,012 | 1,002-1,021 |
| Total postoperative complication | 0,224 | 1,882 | 0,680-5,212 | | | |
| Surgical wound infection | 0,036* | 2,971 | 1,072-8,233 | | | |
| Metastasis | 0,587 | 1,328 | 0,477-3,695 | | | |

*p<0,05

Although postoperative total complications and surgical wound infection rates were numerically higher in MSB patients, there were no statistically significant differencs (eight [36.4%] versus four [13.8%]; p=0.10 and five [22.7%] vs three [10.3%]; p=0.374 as shown in Table III). Although the length of the intensive care unit (ICU) stay was statistically higher in MSB patients (2.18±3.13 versus 0.59±1.27 days; p=0.006), no significant differences were found in the length of hospital stay (9.05±3.93 versus 10.34±5.53; p=0.250). The univariate analysis showed that the lenght of the removed SB and wound infection had significant effects on survival rate (p=0.013 and p=0.036, respectively; Table IV). The multivariate Cox regression analysis was done for those factors that were significant in univariate analysis, and it showed that only the length of the removed SB had significant effects on the 10-year survival (p=0.013; Table IV).

During the follow-up period, only 14 (63.6%) patients received chemotherapy in the MSB group, and 10 (45.5%) had metastasis or recurrences. Overall, 35 (68.6%) patients were surviving at the time that this study was concluded (Fig. 1). Ten (45.5%) patients in the MSB group had survived for 31.50±5.68 months while 25 (86.2%) patients in the NMSB group had survived for 49.12±5.06 months during the follow-up period. The 5-year survival rates in the two groups were analyzed using the log rank test, and it was noted that patients in the MSB group had significantly lower survival rates (p=0.038; Fig. 2)

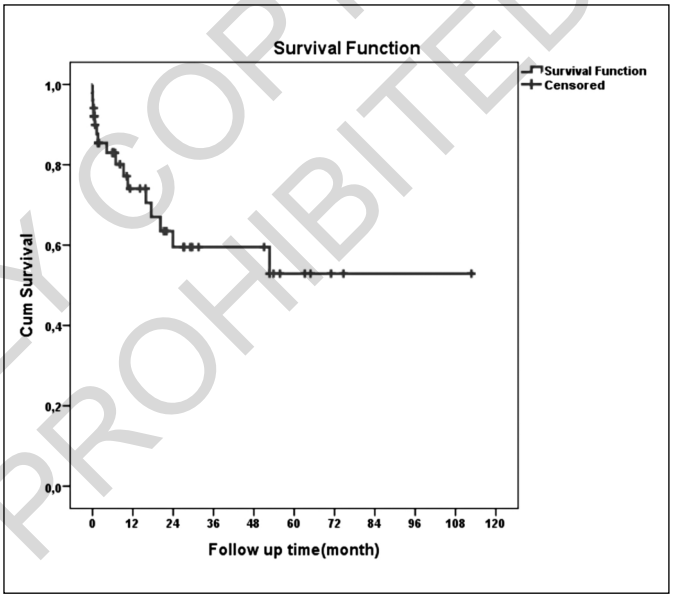


Fig. 1: The survival analysis in all patients.

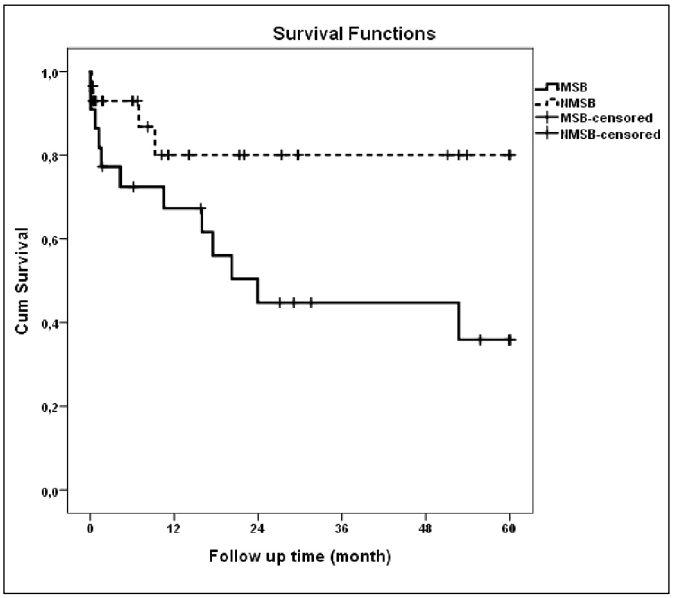


Fig. 2: The survival rate in the two groups.

## Discussion

Although the SB consists of the duodenum, jejenum, and ileum, we excluded duodenal diseases due to the relative ease of reaching these diseases using endoscopy, which was done routinely making it easier to diagnose duodenal diseases than jejenal and ileal diseases. As expected in this study in addition to information reported in literature, most patients with jejenum and ileum malignancies presented with complication at the time of diagnosis [10]. As reported in literature, small bowel dis-

eases are difficult to diagnose because they require complex diagnostic instruments such as device-assisted enteroscopy (DAE) or capsule enteroscopy (CE) [11,12]. However, all of the needed instruments and experienced physicians may not be available everywhere. In this study, only about 30% of patients had enteroscopy that was consistent with some other centers [13], but no patients had CE. Although DAE and CE are valuable special instruments, their diagnostic accurcy is limited as reported in literature [14,15]. Our study was consistent with those in the literature with respect to the limited diagnostic accuracy of DAE in SB disease that was around 40%, which was even lower than the values reported in literature studies [14,15]. There are contradicting reports in the literature in terms of the sensitivity of radiology in malignant SB diseases [16,17]. The radiological diagnostic accuracy in this study was 42% that was consistent with some studies but contradicted others [16,17] that may be due to the percentage of variety in tumors because the sensitivity of radiology can be diferrent in certain kind of SB cancers. It has been reported that the sensitivity of radiology is higher in GIST compared with adenocarcinoma because the rate of adenocarcinoma was higher in this study; this finding may have caused the lower sensitivity of radiology in this study [17]. There are not consistency in literature in terms of the sensitivity of radiology in non-malignant SB diseases due to most likely the variety of diseases and their sensitivity to radiology. The sensitivity for non-malignant SB, which was 71% in this study, was consistent with some studies but contradictary to other studies [18-20]. Overall, the concordance between pre and postoperative diagnoses of SB disease by using DAE and abdominal computurized tomography (CT), tumor markers, physical examination, and symptoms was 59.1% in MSB and 69% in NMSB diseases in this study.

The main obstacles for early diagnosis of SB diseases are not only the difficulties of making an earlier diagnosis, limited diagnostic tools, and lack of experienced physicians but also the symptoms that patients presented, including non-specific symptoms that may not alert physician for possible SB diseases; thus, it can result in a delay in diagnosis at the time of presentation at the hospital [21,22]. The delay in diagnosis of SB malignancy resulted in a delay in treatment, and subsequently poor prognosis resulting from this delayed diagnosis was shown in this study and also reported in literature [23]. Most patients presented with abdominal pain in both groups that was consistent with reports in the literature (8). However, in this study, the cases of SB obstruction due to intestinal intussusception presenting with abdominal distention, nausea, vomiting, and palpable abdominal mass were higher in MSB compared to NMSB in this study, consistent with reports in the literature [24]. Weight loss and GI bleeding were identified at similar percentages in both groups. In terms of expected laboratory parameters, WBCs were higher in NMSB diseases resulting from complicated MD and CD that presented with abcesses or fistulas that may result in elevated inflammatory markers [25]. Most MSB patients had lower hematocrits, which was most likely due to occult bleeding from malignanat lesions that generally present with either overt or obscure GI bleeding [26].

In this study, adenocarcinomas were about 40% of SB cancers, which was consistent with reports in the literature [27]. Also consistent with reports in the literature, most malignant tumors were located in the jejunum (3), while most non-malignant diseases such as complicated adult MD and CD were located in ileum in this study, a finding that was consistent with reports in the literature [8,28]. In this study, in patients presenting with advanced stage cancers, about 50% patients had stage-3 and 33% were at stage-4 when they had surgery, consistent with reports in the literature [3,21]. Moreover, in this study 21% of NMSB patients had SB perforation when surgery was done, and 23% patients presented with perforated tumors. This finding was consistent with a study in the literature, which included only lymphomas in their study [29]. In this study, the rate of perforation was similar in both groups. The length of operating times, intraoperative blood transfusions, and postoperative complications were similar in two groups.

Similar to malignant SB diseses, non-malignant SB diseases also lacked specific symptoms and signs that could cause delays in diagnosis and treatment. Similar to NMSB diseases, patients with MD can present with spontaneous perforations and intraabdominal abcesses. This occurrence is very rare as reported in literature and also confirmed by our study [30]. Resection and anastomosis is a safe treatment for patients with complicated CD and MD that require surgical treatment [8,31]. Moreover, treating CD complication such as fistulas and strictures improve postoperative patients' situations [31]. In this study, no anastomosis-related complications occurred in patients with complicated CD who underwent SB resection and anastomosis. Postoperative surgical wound infections were reported to be higher in benign SB diseases such as complicated CD than cancers [32], but in this study even surgical site infection rates were higher in NMSB although it was not significant.

Overall, in this study, the 5-year postoperative survival rate for small bowel maligncy was 45%, which was consistent with reports in the literature [33,34]. As expected in this study, the 5-year survival was lower in MSB compared with non-malignant diseases. The risk analysis done by Cox regression analysis showed that the length of the removed SB had effects on the 10-year survival in this study, which was consistent with the literaure [35].

This study had some limitations. First, in general, any retrospective study has limitations. Second, the number of patients could have been higher, but it is accepted that isolated jejenal and primary ileal diseases for a single center may not be as many as desired. Third, even though we divided patients into two groups, each group

still had different disease natures that may have different presentations and treatment responses. Since there are only a few studies in the literature for non-duodenal SB disease, we thought that this study would contribute more information to the literature.

## Conclusion

Primary SB diseases present challenges for diagnosis and intraoperative decision making. As reported in the literature, patients present with a combination of non-specific symptoms and signs, which may not alert physician for a possible SB diseases, thus so it can causing a delay in diagnosis. A delayed in diagnosis can result in a poor prognosis. Overall, this study showed that preoperative evaluation may not be able differentiate malignant SB disease from non-malignant SB diseases in some patients. The definitive diagnosis can only be made intraoperatively and confirmed pathologically. In order to avoid the risk of delayed diagnosis, non-specific abdominal symptoms and signs with uncertain diagnosis should alert physician for possible non-duodenal SB diseases, and patients should be referred to an advanced center in which there is an experienced physician with available advanced diagnostic instruments for SB. The main points in SB diseases are early diagnosis and immediate and effective treatments.

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## References

1. Siegel RL, Miller KD, Jemal A: *Cancer statistics.* CA Cancer J Clin, 2017; 67(1):7-30.

2. De Latour RA, Kilaru SM, Gross SA: *Management of small bowel polyps: A literature review.* 2017; 31(4):401-408.

3. Talamonti MS, Goetz LH , Rao S, Joehl RJ: *Primary cancers of the small bowel: analysis of prognostic factors and results of surgical management.* Arch Surg, 2002; 199(6):564-70.

4. Halfdanarson TR, McWilliams RR, Donohue JH, Quevedo JF: *A single institution experience with 491 cases of small bowel adenocarcinoma.* Am J Surg, 2010; 199(6):797-803.

5. Schottenfeld D, Beebe-Dimmer JL, Vigneau FD: *The epidemiology and pathogenesis of neoplasia in the small intestine.* Ann Epidemiol, 2009; 19(1):58-69.

6. Lech G, Korcz W, Kowalczyk E, et al.: *Primary small bowel adenocarcinoma: current view on clinical features, risk and prognostic factors, treatment and outcome.* Scand J Gastroenterol, 2017; 52(11):1194-202.

7. Bednarz W, Czopnik P, Wojtczak B, et al.: *Analysis of results of surgical treatment in Crohn's disease.* Hepatogastroenterology, 2008; 55:998-1001.

8. Parvanescu A, Bruzzi M, Voron T, et al.: *Complicated Meckel's diverticulum: Presentation modes in adults. Medicine (Baltimore).* 2018; 97(38):e12457.

9. Stewart D, Hughes M, Hope W: *Laparoscopic-assisted small bowel resection for treatment of adult small bowel intussusception: A case report.* Cases Journal, 2008; 1(1):432.

10. Negoi I, Paun S, Hostiuc S, et al.: *Most small bowel cancers are revealed by a complication.* Einstein (Sao Paulo), 2015; 13(4):500-05.

11. Cheung DY, Lee IS, Chang DK, et al.: *Korean Gut Images Study Group. Capsule endoscopy in small bowel tumors: A multicenter Korean study.* J Gastroenterol Hepatol, 2010; 25(6):1079-86.

12. Tang L, Huang LY, Cui J, Wu CR: Effect of double-balloon enteroscopy on diagnosis and treatment of small-bowel diseases. Chin Med J (Engl), 2018; 131(11):1321-326.

13. Mellouki I, Jellali K, Ibrahimi A: *Tumors of the small bowel: about 27 cases.* Pan Afr Med J, 2018; 30:13.

14. Chen WG, Shan GD, Zhang H et al.: *Double baloon enteroscopy in small bowel disease: Eight years single-center experience in China.* Medicine (Baltimore) 2016; 95(42):e5104

15. Pasha SF, Leighton JA: *Evidence-based guide on capsule endoscopy for small bowel bleeding.* Gastroenterol Hepatol (NY). 2017; 13(2):88-93.

16. Horton KM, Fishman EK: *The current status of multidetector row CT and three-dimensional imaging of the small bowel.* Radiol Clin North Am, 2003; 41(2):199-212.

17. Shinya T, Inai R, Tanaka T, et al.: *Small bowel neoplasms: enhancement patterns and differentiation using post-contrast multiphasic multidetector CT.* Abdom Radiol (NY), 2017; 42(3):794-801.

18. Sheikh MT, Sheikh MT, et al.: *Role of multi-detector CT (MDCT) in evaluation of bowel diseases.* J Clin Diagn Res, 2017; 11(7):11-13.

19. Seastedt KP, Trencheva K, Michelassi F, et al.: *Accuracy of CT enterography and magnetic resonance enterography imaging to detect lesions preoperatively in patients undergoing surgery for Crohn's disease.* Dis Colon Rectum, 2014; 57(12):1364-70.

20. Dohan A, El Fattach H, Barat M, et al.: *Neuroendocrine tumors of the small bowel: evaluation with MR-enterography.* Clin Imaging, 2016; 40(3):541-47.

21. Dabaja BS, Suki D, Pro B, et al.: *Adenocarcinoma of the small bowel: presentation, prognostic factors, and outcome of 217 patients.* Cancer, 2004; 101:518-26.

22. Cheung DY, Choi MG: *Current advance in small bowel tumors.* Clin Endosc, 2011; 44:13-21.

23. Zhang S, Yuan W, Zhang J, et al.: *Clinicopathological features, surgical treatments, and survival outcomes of patients with small bowel adenocarcinoma.* Medicine (Baltimore), 2017; 96(31):e7713.

24. Marsicovetere P, Ivatury SJ, White B, Holubar SD: *Intestinal intussusception: etiology, diagnosis, and treatment.* Clin Colon Rectal Surg, 2017; 30(1):30-39.

25. Ge X, Hu D, Cao Y, et al.: *Procalcitonin in Crohn's disease with fever episodes, a variable to differentiate intra-abdominal abscess from disease flares.* Int J Surg, 2016; 36:34-39.

26. Schatz RA, Rockey DC: *Gastrointestinal bleeding due to gastrointestinal tract malignancy: natural history, management, and outcomes.* Dig Dis Sci, 2017; 62(2):491-501.

27. Bilimoria KY, Bentrem DJ, Wayne JD, et al.: *Small bowel cancer in the United States: changes in epidemiology, treatment, and survival over the last 20 years.* Ann Surg, 2009; 249:63-71.

28. Slavu I, Tulin A, Alecu L, et al.: *Clinical pattern of surgical crohn disease patients.* Chirurgia (Bucur), 2018; 113(4):497-502.

29. Hong YW, Kuo IM, Liu YY, Yeh TS: *The role of surgical management in primary small bowel lymphoma: A sigle-center experience.* Eur J Surg Oncol, 2017; 43(10):1886-893.

30. Kotha VK, Khandelwal A, Saboo SS, et al.: *Radiologist's perspective for the Meckel's diverticulum and its complications.* Br J Radiol, 2014; 87:20130743.

31. Lee JS, Kim HJ, Cho HM, et al.: *The importance of the Crohn's disease activity index in surgery for small bowel Crohn's disease.* J Visc Surg, 2016; 153(5):339-45.

32. Uchino M, Ikeuchi H, Tsuchida T, et al.: *Surgical site infection following surgery for inflammatorybowel disease in patients with clean-contaminated wounds.* World J Surg, 2009; 33:1042-48.

33. Young JI, Mongoue-Tchokote S, Wieghard N, et al.: *Treatment and survival of small-bowel adenocarcinoma in the united states: A comparison with colon cancer.* Dis Colon Rectum, 2016; 59(4):306-15.

34. Aparicio T, Zaanan A, Svrcek M, et al.: *Small bowel adenocarcinoma: epidemiology, risk factors, diagnosis and treatment.* Dig Liver Dis, 2014; 46(2):97-104.

35. Vantini I, Benini L, Bonfante F, et al.: *Survival rate and prognostic factors in patients with intestinal failure.* Dig Liver Dis, 2004; 36(1):46-55.