Submucosal Giant Lipoma of the Colon as an Unusual Cause of Partial Intestinal Occlusion: Report on Seven Consecutive Cases

Mehmet Tolga Kafadar[1], *Erkan Dalbaşı*[2], *Abdullah Oğuz*[1], *Ulaş Aday*[3]

[1]Department of General Surgery, Dicle University School of Medicine, Diyarbakır, Turkey
[2]Clinic of General Surgery, Memorial Hospital, Diyarbakır, Turkey
[3]Department of Gastrointestinal Surgery, Dicle University School of Medicine, Diyarbakır, Turkey

Cite this article as: Kafadar MT, Dalbaşı E, Oğuz A, Aday U. Submucosal giant lipoma of the colon as an unusual cause of partial intestinal occlusion: Report on seven consecutive cases. *Turk J Gastroenterol.* 2021; 32(7): 560-566.

ABSTRACT

Background: *Colonic lipomas begin to be symptomatic when they reach a certain size, although the presentation can vary. In this study, we aimed to evaluate our experiences with the management of patients who presented with symptomatic giant colonic lipomas.*

Methods: *The data of 7 patients with single colonic lipoma were retrospectively reviewed. The following data were evaluated: age, gender, clinical and diagnostic findings, American Society of Anesthesiologists (ASA) score, operative findings, postoperative complications, mortality, hospital stay duration, and hospital readmission. The diagnosis of colonic lipoma was established by computed tomography (CT).*

Results: *In this study, 4 (57.1%) of 7 patients with colonic lipoma were female, and 3 (42.9%) were male. The mean age was 56.7 years (range, 45-69). The main symptoms were abdominal pain (100%), and constipation (71.4%). The findings of intestinal occlusion detected on CT confirmed the diagnosis in all patients. Colon lipoma was located in the ascending colon in 2 patients, in the hepatic flexure in 2 patients, in the transverse colon in 2 patients, and in the cecum in 1 patient. The surgical procedure was uneventful in all patients. Four (57.1%) patients underwent laparoscopic colonic resection, while in the remaining 3 (42.9%) patients, a laparotomy was performed. The mean operating time was 185.7 min (150-210). Length of stay was 7.1 days (6-10), with no mortality. The mean diameter of the lesions was 7.4 cm (6-9). At a 6-month follow-up, all patients were asymptomatic with no signs of recurrence.*

Conclusion: *Although colon lipomas are rare, they are of great importance because they can be symptomatic and can be confused with colon malignancies in the differential diagnosis. Being able to make a definitive preoperative diagnosis will change the surgical strategy. A minimally invasive surgical approach should be employed to resect symptomatic colonic lipomas with an experienced surgical team in eligible patients whenever possible.*

Keywords: *Colon, laparoscopic, symptomatic lipoma*

INTRODUCTION

Colon lipomas are extremely rare benign non-epithelial tumors originating from adipose tissue. They are detected in the second frequency after adenoma in the colon. It is most common in the cecum and ascending colon.[1] Their preoperative diagnosis is difficult. They are usually asymptomatic, so they are often detected incidentally during colonoscopy, surgery, or autopsy. It is more common in women than in men. The most common age is 50-60 years.[2] It has been reported that up to 25% of lipomas are symptomatic and a significant portion of them are larger than 2 cm. Colon lipomas can vary in size from 2 mm to 30 cm, and lipomas larger than 5 cm in diameter are called giant lipomas. There is a correlation between symptoms and tumor size.[3] The main symptoms are abdominal pain, bloating, change in bowel habit, rarely intussusception, and bleeding.[4] It has been reported that 90% of them are submucosal, and about 10% are subserosal. They are frequently confused with colon malignancies due to the symptoms they cause, their location, and structural features. Differential diagnosis of malignant tumors with preoperative imaging methods is very important in determining the treatment option in these patients. This similarity sometimes unnecessarily lays the groundwork for extensive surgical treatment applications.[5] Herein, we aimed to present our surgical experiences in single giant colonic lipomas.

MATERIALS AND METHODS

The medical reports of the patients with the diagnosis of giant colonic lipoma between January 2015 and December 2019 at 2 institutions (Dicle University

Corresponding author: ***Mehmet Tolga Kafadar****, e-mail:* ***drtolgakafadar@hotmail.com***
Received: ***October 8, 2020*** *Accepted:* ***December 27, 2020*** *Available Online Date:* ***August 16, 2021***

DOI: 10.5152/tjg.2021.20896

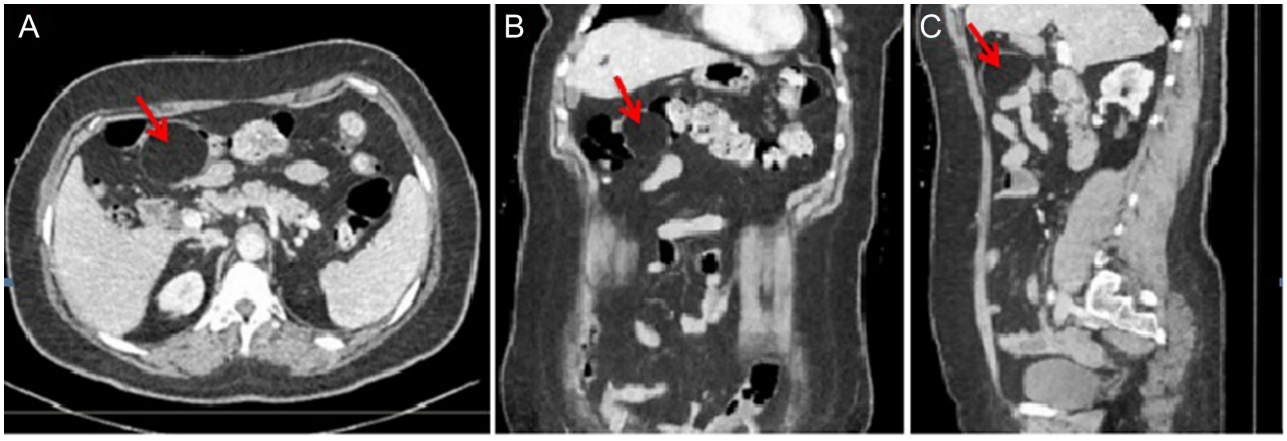

Figure 1. Preoperative axial (A), coronal (B), and sagittal (C) computed tomography scans of abdomen revealed a round mass within the lumen of the transverse colon, densitometric values were consistent with a homogeneous fatty lesion causing colonic obstruction (red arrows).

School of Medicine and Diyarbakır Memorial Hospital-Department of General Surgery) were analyzed retrospectively. The patients described in this series presented with the symptoms of abdominal pain, constipation, rectal bleeding, vomiting, and nausea. The diagnosis of giant colonic lipoma was confirmed in all patients by computed tomography (CT) (Figure 1A-C). We reviewed their age, gender, clinical and diagnostic findings, American Society of Anesthesiologists (ASA) score, surgical procedure, operative findings, postoperative complications, mortality, hospital stay duration, histopathological findings, and hospital readmission.

RESULTS

A total of 7 patients with a diagnosis of colonic lipomas were identified, and there were 4 women and 3 men. The mean age at the time of diagnosis 56.7 years with the range of 45-69 years. Medical history was present in 2 patients with diabetes mellitus, 2 patients with anemia, and 1 patient with coronary artery disease. One patient had a previous history of abdominal surgery (umbilical hernia). The most common presenting symptoms were abdominal pain and constipation. One patient was admitted to the clinic with rectal bleeding. Four patients (57.1%) were ASA 3, and 3 (42.9%) ASA 2. All of the patients were presented with parsiyel intestinal obstruction symptoms and were operated under semi-urgent conditions due to a giant, symptomatic colon lipoma which could lead to different serious complications in the future. Four (57.1%) patients underwent laparoscopic colonic resection (5-port) (Figure 2Aand B), while in the remaining 3 (42.9%) patients, a laparotomy was performed. The mean diameter of the lesions was 7.4 cm (6-9). Clinical features and surgical techniques are summarized in Table 1. The macroscopic appearance was typical submucosal lipomas in all cases (Figure 2C). The postoperative period was uneventful, and there was no mortality. Postoperative complication developed in 1 female patient. This case developed ileus, and medical treatment was applied to her. Wound infection developed in a patient with diabetes

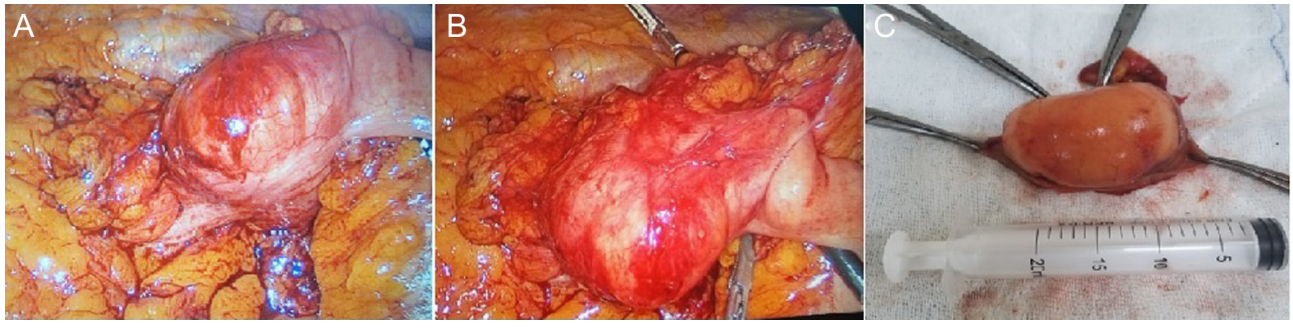

Figure 2. Intraoperative view of the colonic lipoma (A, B), macroscopic view of the excised giant colonic lipoma (C).

Table 1. Clinical Features of Patients (Colonic Lipomas) Included in the Study

Case	Age/Gender	Symptoms	Location	Size of Lesion (cm)	ASA	Surgery
1	69, F	Abdominal pain, rectal bleeding	Hepatic flexura	8 × 6	3	Right hemicolectomy
2	63, F	Abdominal pain, constipation	Ascending colon	7 × 6	3	Right hemicolectomy
3	64, M	Abdominal pain	Hepatic flexura	9 × 8	2	Right hemicolectomy
4	55, F	Abdominal pain, constipation	Transverse colon	7 × 5	2	Laparoscopic segmenter colon resection
5	48, M	Abdominal pain, constipation, nausea	Caecum	6 × 5	3	Laparoscopic right hemicolectomy
6	53, F	Abdominal pain, constipation	Ascending colon	7 × 6	3	Laparoscopic right hemicolectomy
7	45, M	Abdominal pain, constipation, nausea, vomiting	Transverse colon	8 × 7	2	Laparoscopic segmenter colon resection

ASA, American Society of Anesthesiologists; F, Female; M, Male.

who underwent open surgery, and this patient was given daily wound dressing. The histopathological examination confirmed the diagnosis (Figure 3). During a follow-up period of 6 months, the patients were free of symptoms, and the colonoscopy and abdominal CT revealed that there was no recurrence or metachronous lesion of colon lipomas after 6 months of surgery in all cases.

DISCUSSION

Symptomatic lipomas of the colon are extremely rare and are usually solitary. Autopsy studies have shown that colonic lipomas are seen in 0.2-4.4% of the general population and constitute 1.8% of all colonic benign lesions.[6] It has been reported in the literature that colonic lipomas smaller than 2 cm do not give a clear symptom. Since lipomas detected in the elderly are larger than the younger ones, the symptomatic patient group is generally the elderly. As the size of the lipoma increases, the possibility of bleeding and anemia due to ulcer, necrosis in the colon mucosa increases.[7] In our series, the mean age was 56.7, and the mean size of lipomas was 7.4 cm.

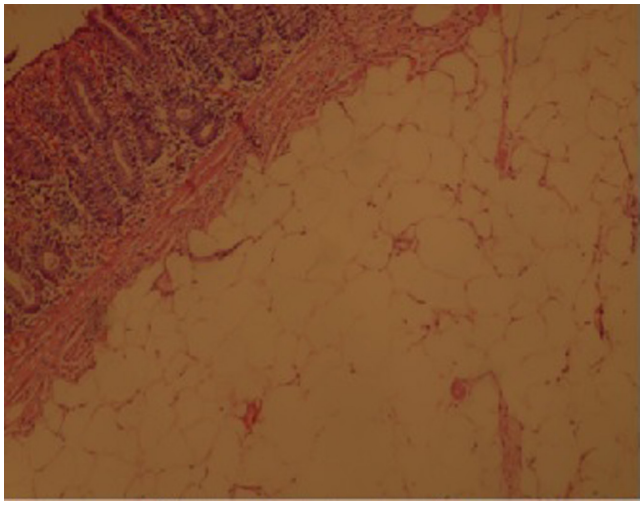

Figure 3. Histopathology showed that the lesion was located in the submucosa of adipose origin. (H&E: 20×)

Contrast-enhanced colonogaraphy, CT, colonoscopy, endoscopic ultrasonography (USG) can be used in the diagnosis of colon lipomas. Smoothly circumscribed radiolucent filling defect can be seen on contrast-enhanced graphs. In addition to being non-invasive, CT can be used to exclude colon malignancies most frequently involving lipomas and to evaluate all intra-abdominal organs. Lipomas seen as round masses with smooth surfaces in adipose tissue density on CT are mostly diagnostic.[8] Colonoscopy allows visualization of the lesion and biopsy for histopathological evaluation. While ulcer and necrosis can be seen in the area of the lesion in colonoscopy, oil leakage from the lesion can also be seen during a biopsy.[9] Definitive diagnosis can be made by histopathological examination. On microscopy, a tumor consisting of mature fat cells with a mucous membrane in natural boundaries on its surface and a thin fibrous capsule beneath is seen.[10] Since colon lipomas are usually submucosally located, care should be taken to perform a deep biopsy in order to make a diagnosis as a result of the biopsy. The submucosal location of the lipoma can be clearly demonstrated on endoscopic USG, and the lesion is defined as hyperechogenic.[11] It has been reported that angiography can be used in the diagnosis of small lipomas.[12]

The method to be chosen in the treatment of colonic lipomas may vary from patient to patient. In this context, the method preferred depends on many factors such as the size of the lipoma, its location, whether it is symptomatic or not, the definitive diagnosis in the preoperative period, its differentiation with malignancy, the current diagnosis and treatment options (colonoscopic treatment, laparoscopic or robotic surgery), the patient's age and comorbidities.[13,14] Because of being benign masses, it may be appropriate to prefer endoscopic methods especially in cases diagnosed preoperatively.[15] There are publications in the literature stating that asymptomatic lipomas up to 2-2.5 cm can be removed by colonoscopy.[16] Some authors have suggested that colonic lipomas larger than 2 cm can also be successfully removed by colonoscopy.[17] However, Tamura et al.[18] recommended that lipomas larger than 2 cm should not be resected endoscopically. We did not try a colonoscopic treatment because of the large size of symptomatic lipomas in our series.

Obtaining information about the anatomical features of the mass with endoluminal USG will increase the success rate of both endoscopic and surgical treatment. However, the risk of perforation, bleeding, and incomplete resection should not be ignored, especially in large and sessile lesions.[19] Jiang et al.[20] suggested that if the lipoma is larger than 4 cm, has a sessile or limited pedicle, if there is suspicion of malignancy or intussusception, if it contains the muscular layer or serosa, and if it cannot be removed radically in colonoscopy, endoscopic removal would not be appropriate and it should be surgically removed.

In surgical treatment, many interventions such as hemicolectomy, segmental resection, enucleation with colotomy, or local excision can be applied depending on the definitive diagnosis in the preoperative period. Wider resections may be required in examinations and observations performed in the preoperative and perioperative period, in cases with a risk of malignancy or in cases that cannot be clearly distinguished, and in cases of complications.[21] Although surgical treatment can be performed with conventional and mini-laparotomy, there are publications reporting that minimally invasive methods are superior to conventional surgery even in cases of invagination, if the conditions are suitable.[22] On the other hand, the most important factor limiting laparoscopy is determining the location of the lesion. Marking can be done using appropriate dye or intraoperative colonoscopy can be performed. CT colonography can provide valuable information for the localization of lesions, especially in cases in which wider resection is planned.[23]

In the differential diagnosis of colon masses, liposarcomas should be kept in mind with benign lipomas. Some cases of colonic liposarcoma previously published in the literature are shown in Table 2. Liposarcoma is one of the most common soft-tissue sarcomas and represents 20% of mesenchymal malignancies. Primary colonic liposarcoma tends to occur in adults, with a peak incidence between fifth and sixth decades and an equal sex distribution. It is thus difficult to distinguish them preoperatively from other colon cancers. It tends to occur in the retroperitoneum and deep soft tissues of the trunk and in extremities in adults. However, it has been observed rarely in the gastrointestinal system, and colon liposarcoma is extremely uncommon. It is unlike lipoma and relatively rare in fat-rich areas such as the subcutaneous tissue and mesocolon. Historically, liposarcoma has been divided into 5 subtypes according to the World Health Organization: well-differentiated, dedifferentiated, myxoid, pleomorphic, and mixed type.[24] Liposarcoma is generally a slow-growing, heterogeneous, locally aggressive tumor, which usually becomes symptomatic when the size of the tumor increases to a large extent. The symptomatology of primary colonic liposarcomas depends on the location of the mass. Clinical features of primary liposarcoma of the colon are variable and nonspecific; abdominal pain, diarrhea, weight loss, anemia, and hematochezia, constipation and sometimes, an abdominal mass may be palpable.[25]

Treatment modalities for intra-abdominal liposarcomas include resection, chemotherapy, and radiation. Surgery is the mainstay of the treatment for primary colonic liposarcoma. Usually, an en bloc (radical complete surgical) resection of the tumor is carried out with macroscopically negative margins, and this type of surgery markedly increases the survival rate. In most patients, location, density, and displacement, rather than the invasion of the adjacent organs, are diagnostic of the tumor and preclude the pre-treatment biopsy.[26] However, in some patients, radiology may point toward different entities, such as lymphoma, neuroendocrine tumor, or gastrointestinal stromal tumor, which may necessitate a pre-treatment biopsy. In contrast to limb sarcomas, removal of the entire tumor in colonic liposarcoma/liposarcomatosis may not be achieved. As a consequence, disease recurrence and death may ensue.[27] Liposarcomas are considered among the most radioresponsive soft-tissue tumors, hence

Table 2. Reported Characteristics of Cases of Colonic Liposarcoma

	Age/Gender	Location	Size of Lesion (cm)	Surgery	Histological Subtype
Sawayama et al. (2017)	52, F	Ascending colon	6 × 5	Complet radical resection + lymph node dissection	Well-differentiated/dedifferentiated
Choi et al. (2010)	41, M	Ascending colon	15 × 10	Right hemicolectomy	Well-differentiated
Sultania et al. (2019)	57, F	Ascending colon	20 × 15	Right hemicolectomy	Well-differentiated
Guadagno et al. (2019)	53, M	Hepatic flexura	4 × 3	Right hemicolectomy	Dedifferentiated
Türkoğlu et al. (2014)	71, F	Transverse colon	23 × 19	Segmenter colon + gastric wedge resection	Dedifferentiated
Parks et al. (1994)	54, F	Hepatic flexura	6 × 5	Right hemicolectomy	Pleomorphic
Chen et al. (2004)	52, F	Descending colon	Polypoid mass	Left hemicolectomy	Well-differentiated
Gutsu et al. (2006)	46, M	Ascending colon	12 × 10	Right hemicolectomy	Myxoid type
D'Annibale et al. (2009)	79, F	Transverse colon	10 × 10	Right hemicolectomy+partial gastric resection	Pleomorphic
Yuri et al. (2011)	73, M	Transverse colon	12 × 9	Segmenter colon resection	Well-differentiated
Fernandes et al. (2016)	32, F	Rectosigmoid	4 × 3	Hartmann procedure	Well-differentiated
Takeda et al. (2012)	71, M	Ascending colon	11 × 9	Right hemicolectomy + central	Dedifferentiated
Sato et al. (2014)	72, M	Retroperitoneal+ Ascending colon	20 × 15	Pancreatectomy Right hemicolectomy + right nephrectomy	Well-differentiated
Suzuki et al. (2009)	53, M	Ascending colon	12 × 8	Right hemicolectomy	Well-differentiated
Chou et al. (2016)	62, M	Ascending colon	14 × 9	Right hemicolectomy	Myxoid type
Rudnicki et al. (2015)	34, M	Rectosigmoid	4 × 3	Rectosigmoid junction resection	Well-differentiated
Choi et al. (2014)	73, M	Ascending colon	12 × 11	Right hemicolectomy	Myxoid type
Shahidzadeh et al. (2007)	56, F	Hepatic flexura	3.5 × 3	Polypectomy	Well-differentiated
Sasaki et al. (2006)	58, M	Sigmoid colon (recurrence)	14 × 11	Not surgery (chemotheraphy)	Pleomorphic
Serafini et al. (2020)	75, M	Descending colon	8 × 7	Left hemicolectomy	Dedifferentiated

F, female; M, male.

preoperative or postoperative adjuvant radiation therapy should be offered. Adjuvant radiation therapy may constitute a valuable treatment option in order to improve local control, specifically with the involved margins or high-grade tumors. Adjuvant chemotherapy has not yet been shown to significantly change outcomes.[28]

The prognosis for colonic liposarcoma is still difficult to predict. It may be affected by a variety of factors, including location, size, dissemination of the disease, as well as histological type. Dedifferentiated liposarcoma has a worse prognosis than well-differentiated liposarcoma because of the high incidence of local recurrence and distant metastasis. Approximately 40% of dedifferentiated liposarcomas will recur locally, and 17% will metastasize, and 28% of patients will ultimately die of the tumor.[29] Therefore, complete removal with a clear resection margin is extremely important. Pleomorphic liposarcoma is a high-grade tumor containing a variable number of pleomorphic lipoblasts. It is aggressive, showing a high metastasis rate, with the lung representing the most common site of metastasis and tumor-associated mortality of 40%.[30]

CONCLUSION

Surgical removal of large and symptomatic colon lipomas is required both to exclude the diagnosis of malignancy and to prevent complications that may develop. Especially in cases with early diagnosis, choosing minimally invasive methods as much as possible by experienced surgical teams will provide an advantage in terms of both low morbidity and patient comfort.

Ethics Committee Approval: Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects".

Informed Consent: Informed consent was obtained from patients who participated in this study.

Peer Review: Externally peer-reviewed.

Author Contributions: Concept – MTK, ED; Design – MTK, AO; Supervision –MTK, UA Fundings – MTK, ED, AO ; Materials – ED, AO; Data Collection and/or Processing – MTK, ED, AO, UA; Analysis and / or Interpretation – MTK.,UA; Literature Review – MTK, ED; Writing – MTK, Critical Review – MTK, UA.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Grasso E, Guastella T. Giant submucosal lipoma cause colocolonic intussusception. A case report and review of literature. Ann Ital Chir. 2012;83(6):559-562.
2. Barron SL, Gonzalez RS. Clinicopathologic analysis and subclassification of benign lipomatous lesions of the colon. Virchows Arch. 2019;474(3):309-313. [CrossRef]
3. Nebbia JF, Cucchi JM, Novellas S, Bertrand S, Chevallier P, Bruneton JN. Lipomas of the right colon: report on six cases. Clin Imaging. 2007;31(6):390-393.
4. Ullah S, Ahmed H, Jehangir E. Giant colonic lipoma presenting with intermittent intestinal obstruction. J Coll Physicians Surg Pak. 2012;22(12):792-793. [CrossRef]
5. Bentama K, Chourak M, Chemlal I, et al. Intestinal subocclusion due to colonic lipoma: a case report. Pan Afr Med J. 2011;10:22. [CrossRef]
6. Barchetti F, Al Ansari N, De Marco V, Caravani F, Broglia L. Giant lipoma of descending colon diagnosed at CT: report of a case. Eur Rev Med Pharmacol Sci. 2010;14(6):573-575.
7. Ghidirim G, Mishin I, Gutsu E, et al. Giant submucosal lipoma of the cecum: report of a case and review of literature. Rom J Gastroenterol. 2005;14(4):393-396.
8. Ozen O, Guler Y, Yuksel Y. Giant colonic lipoma causing intussusception: CT scan and clinical findings. Pan Afr Med J. 2019;32:27. [CrossRef]
9. Chiu CC, Wei PL, Huang MT, et al. Colonoscopic-assisted laparoscopic resection of a colon lipoma. J Laparoendosc Adv Surg Tech A. 2006;16(1):37-40. [CrossRef]
10. Ustünsoy E, Türeyen A, Topçu I, Basim H. Intestinal obstruction due to a giant lipoma of the ascending colon: a case report. Turk J Gastroenterol. 2003;14(4):280-281.
11. Lee KJ, Kim GH, Park DY, et al. Endoscopic resection of gastrointestinal lipomas: a single-center experience. Surg Endosc. 2014;28(1):185-192. [CrossRef]
12. Zhang H, Cong JC, Chen CS, Qiao L, Liu EQ. Submucous colon lipoma: a case report and review of the literature. World J Gastroenterol. 2005;11(20):3167-3169. [CrossRef]
13. Wei R, Xu W, Xiao Y, Zeng F, Mao S. Laparoscopic segmental resection of the rectum for upper rectal intussusception caused by a giant rectal lipoma: A case report. Med (Baltim). 2018;97(39):e12272. [CrossRef]
14. Basterra Ederra M, Bolado Concejo F, Caballero García P, Oteiza Martínez F. [Giant lipoma-induced colonic intussusception. Laparoscopic management) Gastroenterol Hepatol. 2011;34(8):589-590. [CrossRef]
15. Okada K, Shatari T, Suzuki K, et al. Is endoscopic submucosal dissection really contraindicated for a large submucosal lipoma of the colon? Endoscopy. 2008;40(suppl 2):E227. [CrossRef]
16. Mantzoros I, Raptis D, Pramateftakis MG, et al. Colonic lipomas: our experience in diagnosis and treatment. Tech Coloproctol. 2011;15(suppl 1):S71-S73. [CrossRef]
17. De Silva BA, Deen R, Wijenayake WK. Colonoscopy-assisted laparoscopic resection of an obstructing 'giant' lipoma of the transverse colon. ANZ J Surg. 2015;85(10):785-786. [CrossRef]
18. Tamura S, Yokoyama Y, Morita T, et al. 'Giant' colon lipoma: what kind of findings are necessary for the indication of endoscopic resection? Am J Gastroenterol. 2001;96(6):1944-1946. [CrossRef]
19. Andrei LS, Andrei AC, Usurelu DL, et al. Rare cause of intestinal obstruction - submucous lipoma of the sigmoid colon. Chirurgia (Bucur). 2014;109(1):142-147.

20. Jiang L, Jiang LS, Li FY, et al. Giant submucosal lipoma located in the descending colon: a case report and review of the literature. World J Gastroenterol. 2007;13(42):5664-5667. [CrossRef]
21. Abiodun-Wright W, Keshinro S, Olumide F. Lipoma of the transverse colon presenting as simple intestinal obstruction: A Case Report. Niger Postgrad Med J. 2014;21(4):350-352.
22. Peters MB Jr, Obermeyer RJ, Ojeda HF, et al. Laparoscopic management of colonic lipomas: a case report and review of the literature. JSLS. 2005;9(3):342-344.
23. Moussa OM, Tee M, Khan AU, Selvasekar CR. Computerized tomography providing definitive diagnosis of colonic lipoma: a case series. Surg Laparosc Endosc Percutan Tech. 2013;23(6):e232-e234. [CrossRef]
24. Fletcher CD, Unni KK, Mertens F, World Health Organization Classification of Tumors. Pathology and Genetics of Tumors of Soft Tissue and Bone. Lyon, France: IARC Press; 2002.:227-232.
25. Türkoğlu MA, Elpek GÖ, Doğru V, et al. An unusual case of primary colonic dedifferentiated liposarcoma. Int J Surg Case Rep. 2014;5(1):8-11. [CrossRef]
26. Lahat G, Tuvin D, Wei C, et al. New perspectives for staging and prognosis in soft tissue sarcoma. Ann Surg Oncol. 2008;15(10):2739-2748. [CrossRef]
27. Stojadinovic A, Leung DH, Hoos A, et al. Analysis of the prognostic significance of microscopic margins in 2,084 localized primary adult soft tissue sarcomas. Ann Surg. 2002;235(3):424-434. [CrossRef]
28. Pervaiz N, Colterjohn N, Farrokhyar F, et al. A systematic meta-analysis of randomized controlled trials of adjuvant chemotherapy for localized resectable soft-tissue sarcoma. Cancer. 2008;113(3):573-581. [CrossRef]
29. Serafini L, Lauro A, Eusebi LH, et al. Dedifferentiated liposarcoma of the descending colon: A case report and review of the literature. Dig Dis Sci. 2020;65(6):1643-1651. [CrossRef]
30. Singer S, Antonescu CR, Riedel E, Brennan MF. Histologic subtype and margin of resection predict pattern of recurrence and survival for retroperitoneal liposarcoma. Ann Surg. 2003;238(3):358-370; discussion 370-371. [CrossRef]