Scientific Eminence Group

European Journal of Gastroenterology and Digestive Diseases

Review Article

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Giant Duodenal Lipoma. A Case Report and Narrative Review of Published Cases and their Treatment Strategy

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Citation

Lieselot Potums, Frederik Huysentruyt, Pieter D'hooge, Peter Delvaux (2024) Giant Duodenal Lipoma. A Case Report and Narrative Review of Published Cases and their Treatment Strategy. Eur J Gastroenterol Digestive Dis 2: 1-20

Publication Dates

Received date: June 19, 2024
Accepted date: July 19, 2024
Published date: July 22, 2024

Abstract

Background: Duodenal lipoma is a rare benign tumour. Only 4% of all gastrointestinal lipomas are found in the duodenum causing a wide range of vague abdominal symptoms, intussusception or bleeding. Diagnosis is easily made during endoscopic ultrasound or computed tomography. There are no clear treatment guidelines or recommendations available.

Results: We present a case of a 79-year-old male with anorexia, nausea and unintentional weight loss due to a duodenal lipoma. The duodenal lipoma was resected via laparotomy and duodenotomy with primary closure of the duodenum. A literature review was performed for all English reported cases treated surgically or endoscopically from 2001 until 2024 using PubMed (N= 75). Clinical presentation and lesion characteristics are important in choosing a treatment strategy. Literature suggests treating all symptomatic duodenal lipomas, whereas watchful waiting can be a valid option in asymptomatic patients. Multiple surgical and endoscopic treatment options are available.

Conclusion: Minimally invasive techniques should be considered first since duodenal lipoma is a benign disease. Patient characteristics and spatial features (location, size, number) are determining in the selection of the right treatment modality. Treatment needs to be tailored to each patient.

Keywords: Lipoma; Duodenum; Digestive System Surgical Procedures; Endoscopy

List of Abbreviations

CT: Computed Tomography; D2: Second part of the duodenum; EUS: Endoscopic Ultra Sonography; HU: Houssndsfield Unit; MRI: Magnetic Resonance Imaging; ESD: Endoscopic Submucosal Dissection; EFTR: Endoscopic Full Thickness Resection; LECS: Laparoscopic Endoscopic Collaborative Surgery; PSD: Pancreas Sparing Duodenectomy

Introduction

A lipoma is a benign, adipose tumour that can appear throughout the whole gastrointestinal tract. Most commonly, they are found at the level of the colon (64%), ileum and jejunum (26%). Only 4% of all gastrointestinal lipomas are found in the duodenum. They present as a single and slow--growing tumour and are most often found in the second part of the duodenum or descending duodenum [1]. It is a neoplasm of mesenchymal origin. Other mesenchymal tumours include leiomyomas, leiomyoblastomas, haemangiomas, fibroids, neurofibroma-like tumours, schwannomas, gangliomas and lymphangiomas [2]. Duodenal lipoma can present itself as a sessile or a pedunculated mass, often incidentally diagnosed on endoscopy, computed tomography (CT) or during surgery.

Small lipomas (diameter < 2 cm) tend to be asymptomatic. When exceeding a diameter of 2 cm, it can cause a wide range of vague symptoms and therefore an easily missed diagnosis in daily practice. Epigastric pain, fullness, nausea, vomiting, obstruction and rarely intussusception have been described [1,3-7]. Gastrointestinal tract bleeding can occur from overlying ulcerated mucosa, causing anemia and melena or occult gastrointestinal bleeding [3,8-16]. Rare symptoms are obstructive jaundice and pancreatitis [17,18].

To our knowledge, there are no clear guidelines concerning the treatment of duodenal lipoma. Our aim was to review possible treatment strategies since we encountered a patient with a symptomatic giant duodenal lipoma ourselves. Therefore, a literature search on PubMed was performed for published cases of duodenal lipoma and their treatment strategy. All case reports published in English from 2001 until 2024 were included (table 1).

Case Report

A 79-year-old male patient presented with anorexia, nausea, unintentional weight loss of 2 kg and constipation. There is a medical history of splenectomy, rectal adenocarcinoma (p-T3N0M0, Dukes b) treated with open total mesorectal excision and few years later an incisional hernia treated with open ventral hernia mesh repair. Active medication included calcium channel blockers. Upon clinical examination, there was no recurrence of the ventral hernia. Upper gastrointestinal endoscopy showed an extensive submucosal mass in the second part of the duodenum, easily passable with a scope, over a length of 10 cm, suggestive of a duodenal lipoma.

Computed tomography (CT) of the abdomen confirmed the presence of a duodenal lipoma extending from the 2nd to 4th part of the duodenum, measuring 95 mm x 30 mm (Figure 1 - 3).

Figure 1: Computed tomography of the abdomen - coronal section. The mass at the level of the duodenum measures -120 to -90 HU representing a duodenal lipoma, indicated with arrows

Figure 2: Computed tomography of the abdomen - transverse section. Duodenal lipoma is indicated with arrows

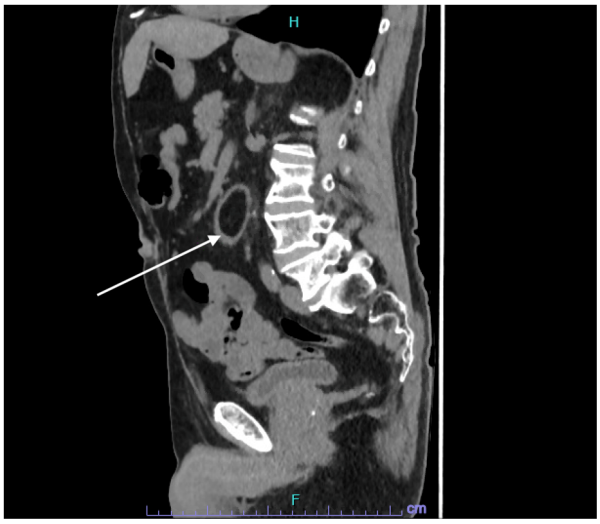

Figure 3: Computed tomography of the abdomen- sagittal section. Duodenal lipoma is indicated with an arrow

Due to his surgical history, laparoscopy was not found to be a safe surgical approach. We performed a redo midline, upper abdomen, laparotomy. After extensive adhesiolysis and identification of the Treitz ligament, no mass could be palpated at this level. Proceeding with mobilization of the duodenum by performing the Kocher manoeuvre, a large mass could be palpated in the descending part of the duodenum(D2). Longitudinal duodenotomy at the level of D2 revealed a pedunculated mass originating from the posterior wall of the duodenum (Figure 4-6).

Resection was performed using a powered stapler (EcheIonTM flex 60 mm), positioned at the base of the stalk of this pedunculated mass after luxating it through the duodenotomy and checking for safe distance from Vater's ampulla. After primary transverse closure of the duodenotomy, a Blake drain was placed alongside the duodenum.

The postoperative period was uneventful. Upper gastrointestinal contrast series on the third postoperative day showed no signs of contrast leakage, normal duodenal appearance and stomach emptying. Oral intake was resumed, and the drain was removed successfully. The patient was discharged home on day 6.

Histopathological diagnosis confirmed a submucosal lipoma with no signs of malignancy. At the one-month post surgery follow-up, the patient had no residual complaints of nausea, good oral intake without any postprandial discomfort and a stable body weight.

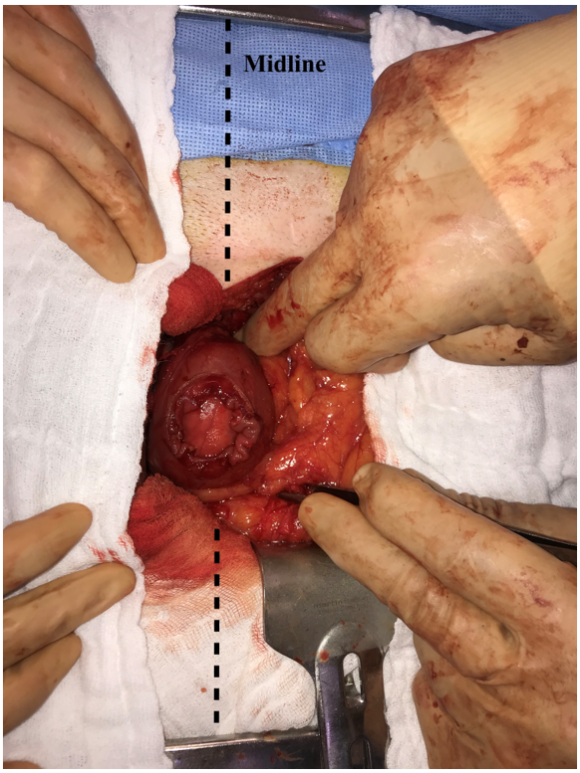

Figure 4: Operative photo: Redo upper abdomen midline laparotomy. A longitudinal incision of the anterior aspect of the second part of the duodenum revealing a submucosal, yellowish mass originating from the posterior wall

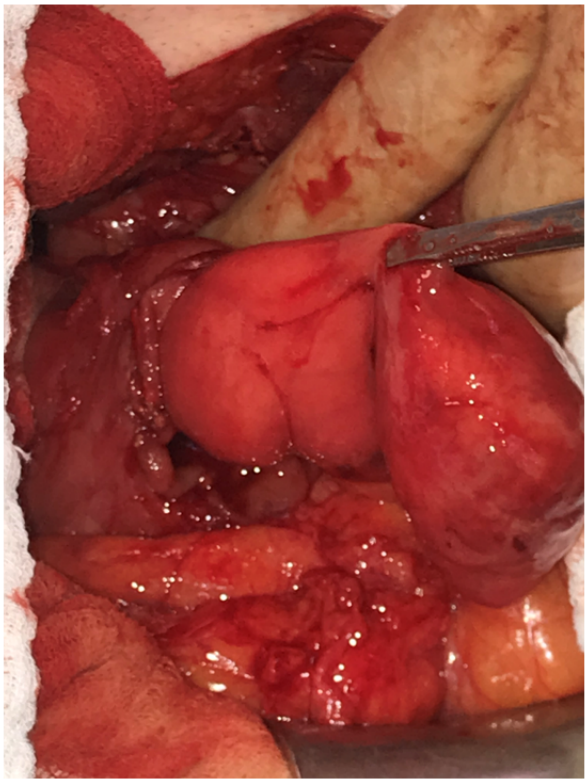

Figure 5: Operative photo. Duodenal lipoma presenting itself as a large pedunculated mass, which was luxated easily through the longitudinal duodenotomy

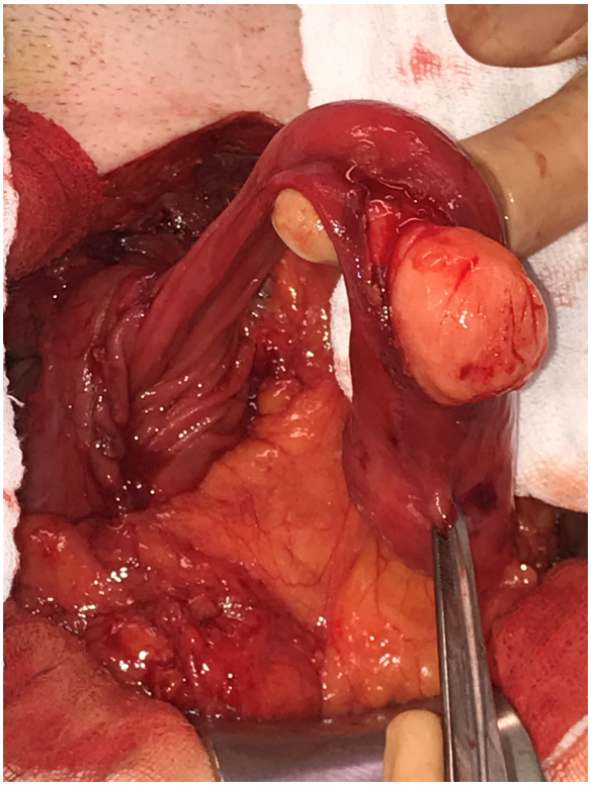

Figure 6: Operative photo. The overlying normal mucosa was incised, revealing a well-defined submucosal lipoma

Materials and Methods

There are no clear guidelines concerning the treatment of duodenal lipoma to our knowledge. Our aim was to review possible treatment strategies since we encountered a patient with a symptomatic giant duodenal lipoma for the first time.

A literature review was performed using the search term "duodenal lipoma" in PubMed. This search generated 157 articles published from 2001 until May 2024, of which 51 case reports of duodenal lipoma published in English and 2 retrospective studies. The retrospective study by Yang et al. was included since all patient characteristics and treatment details were available per individual patient. Xiang et al. did not provide individual information and thus was not included in our review. Case reports of gastric and jejunal lipoma were excluded.

Results

We included 51 case reports and one retrospective study representing 75 patients diagnosed with duodenal lipoma over a time span of 24 years (table 1). There were five cases of multiple lipomas; 44 patients were diagnosed with a single lipoma, of which one was multilobulated, two case reports and the retrospective study by Yang et al. did not mention specific spatial information (26 patients). The size varied between 10 mm and 115 mm. Twenty-three patients were treated surgically of which 4 robot-assisted procedures. Three cases described a combined surgical and endoscopic approach [19-21]. Forty--seven patients were treated endoscopically. In two patients the lipoma was not resected. One case report by Mariani et al. reporting a duodenal lipoma obstructing a biliary stent which was not resected and in the case reported by Talaat et al. stenting of the common bile duct for obstructive jaundice was preferred over resection of the duodenal lipoma [17,18].

One retrospective study was published in 2021 by Yang et al. comparing endoscopic submucosal dissection (ESD) and endoscopic full thickness resection (EFTR) depending on how the lesion was relating to the muscularis propria layer on endoscopic ultrasound.

The literature search showed only one systematic review by Pei et al. discussing all published cases of duodenal lipoma from 1948 until 2016 in addition to their own encountered patient with duodenal lipoma [22]. There are no clinical trials or meta-analysis published.

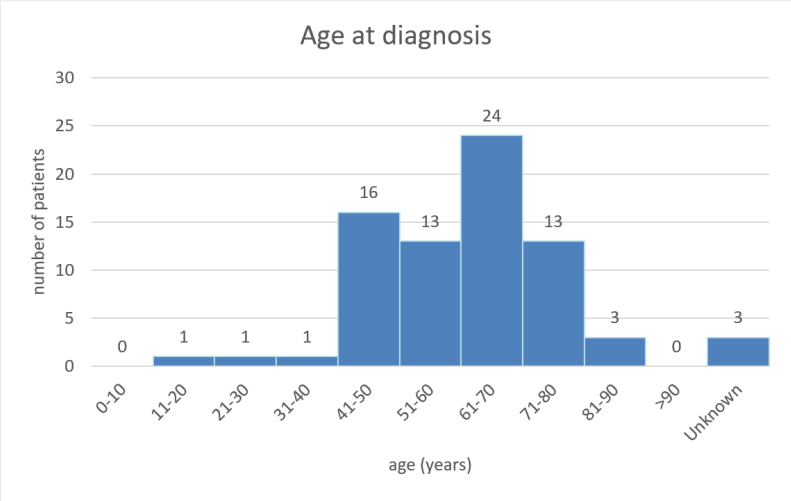

Figure 7: Plot showing the number of patients diagnosed with duodenal lipoma in each age category per 10 years, with a total number of patients n=75, including 3 patients of unknown age and no reported cases older than 85 years

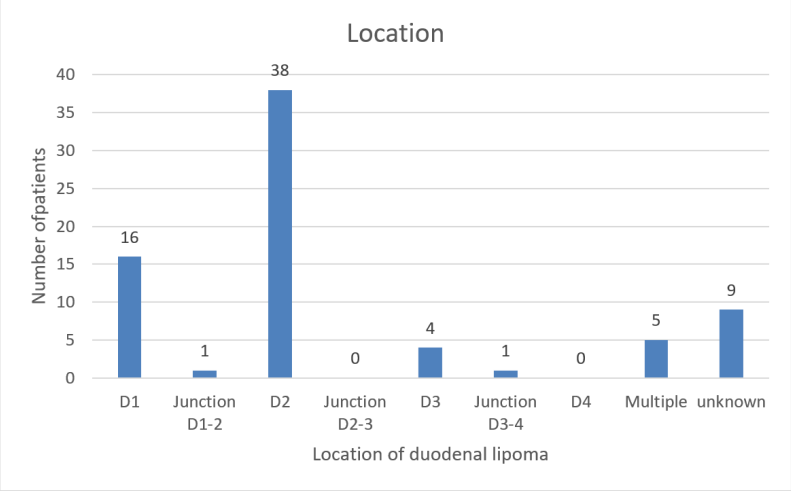

Figure 8: Anatomical location of all reported duodenal lipoma. D1: first segment of duodenum, D2: second part of duodenum, D3: third part of duodenum, D4: fourth part of duodenum

Discussion

From 2001 until 2024, the majority of reported cases (24 patients, 32%) including all patients of a retrospective study by Yang et al. were diagnosed with duodenal lipoma in their 7th decade of life. We found no diagnosis before the age of 15 or above the age of 85 (table 1, figure 7). Thirty-eight female (51%) and thirty-four male (45%) patients were diagnosed, 2 case reports (3 patients, 4%) did not mention patient gender or age. The majority of lipoma were found in the second part of the duodenum (figure 8).

Symptoms

Duodenal lipoma can cause vague abdominal symptoms such as epigastric fullness and postprandial discomfort. Unintentional weight loss, gastric outlet obstruction with nausea and (projectile) vomiting are also reported. Intussusception is described with the lipoma acting as the leading point causing duodeno-duodenal intussusception [7].

Symptoms of upper gastrointestinal bleeding (hematemesis, melena, anemia, fatigue) can be associated because of ulceration of the overlying mucosa, often seen upon endoscopy. Some rare symptoms, such as obstructive jaundice and (recurrent)pancreatitis, have been described in 3 case reports [17,18,20].

Large lipomas tend to cause symptoms more often, whereas small lipomas are frequently found by coincidence on CT scan, during endoscopy or intraoperatively. The literature review by Pei et al. stated that 80% of symptomatic lipomas have a diameter of >2 cm [22]. Other authors mention that lipomas <1 cm are usually asymptomatic and lipomas of > 4 cm are more likely to cause obstruction, intussusception or bleeding [2]. The cut-off diameter for large or giant lipoma differs depending on the author.

Diagnosis

Duodenal lipomas are often found by accident during endoscopy and endoscopic ultrasonography (EUS). They have a characteristic appearance because of their fat content and their submucosal location in the enteric wall. During endoscopy a lipoma can appear as a round yellowish elevated lesion. A positive 'Pillow sign', consisting of a visible indentation when palpating the lesion with closed forceps, is described as a typical endoscopic feature for a lipoma [23]. Characteristic presentation during EUS consists of an intense, homogeneous, hyperechoic lesion originating from the submucosa [23,24]. Endoscopy with EUS is the most accurate imaging modality for morphological features (sessile, pedunculated) and defining the exact location of the lipoma establishing its distance to the ampulla of Vater. These features are determining in selecting the right treatment option.

Differential diagnosis consists of other hyperechoic lesions, e.g. renal cell carcinoma metastasis, ampullary carcinoma, hamartomatous duodenal polyp and gangliocytic paraganglioma[25]. Other duodenal lesions to keep in mind are gastrointestinal stromal tumours, carcinoids, solitary Peutz-Jeghers polyp and adenoma [23]. Yang et al. describes a possible risk of malignancy especially when the duodenal lipoma exceeds 5cm, referring to the UK guidelines for management of soft tissue sarcoma's [26,27]. Reviewing these guidelines ourselves we found no specific statements on visceral or duodenal lipoma in particular. Gaspar et al. and the systematic review by Pei et al. report no malignant transformation [22,23].

Computed tomography (CT) has grown in popularity for diagnostic purposes in the last decade. Lipomas are easily and reliably identified on CT because of their appearance as a smooth margined mass combined with a characteristic low uniform (fat density) attenuation with a low Hounsfield Unit (HU) count from -70 to -120 HU [28-30].

Combining information from EUS and CT, the diagnosis of duodenal lipoma can easily be confirmed because of its characteristic features on both imaging modalities. When the diagnosis remains uncertain, EUS with biopsy is an option to differentiate from possible malignant lesions.

In addition, lipomas have specific characteristics on magnetic resonance imaging (MRI). They show a high signal intensity on a T1-weighted image and an iso-signal intensity on T2-weighted images [30,31].

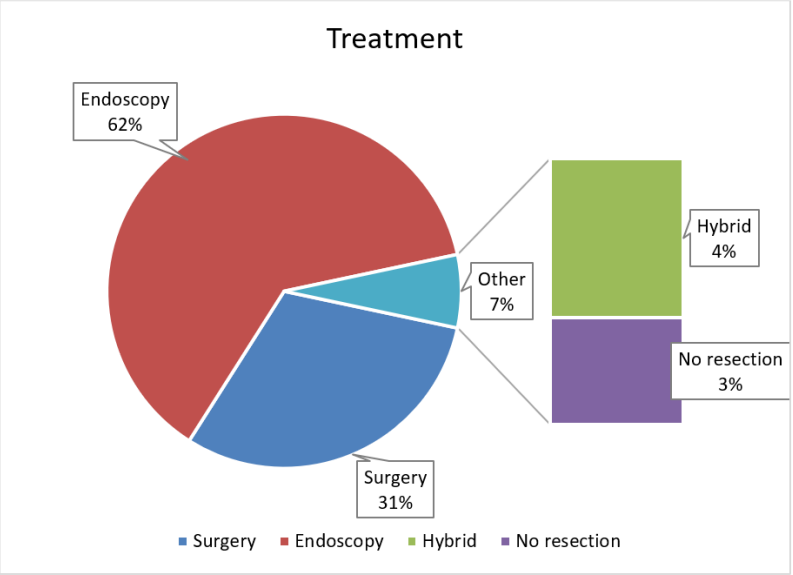

Figure 9: Diagram showing all different treatment modalities in English published cases from 2001 until may 2024

Treatment

Duodenal lipomas come in different sizes and shapes, as do their treatment options. The majority of patients was treated endoscopically (62%), 31% was treated surgically and 4% underwent a hybrid treatment strategy combining both (figure 9). Important features to consider are size, location in the duodenum (relation to the ampulla of Vater) and patient-specific characteristics. The most determining factor is clinical presentation. Lipoma is a lesion of benign nature. In the retrospective study by Yang et al, the authors are concerned about possible malignancy whereas the systematic review by Pei et al. state that malignant change of duodenal lipoma is unheard of and they consider these lesions as benign [22,26]. We found no reports of malignancy or malignant deterioration of duodenal lipoma from 2001 until present.

Given its benign nature, treatment is recommended when patients are symptomatic. A pedunculated duodenal lipoma lends itself to endoscopic management when not too bulky. Large and sessile lipomas are often better managed with surgical intervention.

The majority of patients (47 patients; 62%) were treated endoscopically (figure 10). This high number can partially be explained by the included retrospective study which only reviewed endoscopic treated patients in their hospital. In this study a remarkedly large number of asymptomatic patients were treated claiming resection of the lipoma was the patients' wish (8 patients). Several endoscopic techniques are described: SNARE polypectomy (17 patients), unroofing technique (2 patients), endoscopic submucosal dissection (ESD, 21 patients) and endoscopic full thickness resection (EFTR, 4 patients). For three patients the endoscopic technique was not specified. In 36% of all endoscopic treated patients, the SNARE technique using a two-channel scope was used. One channel is used for the introduction of an electrocautery snare, and the other channel for grasping forceps pulling the lipoma through the loop of the [4,8,12,15,16,32-42]. The unroofing technique used in 2 patients (4% of all endoscopic treated patients) consisted of cutting the upper half of the lipoma and extruding the remaining adipose tissue from this open surface. It is considered a simple technique with minimal risk of perforation. The main disadvantage is the fragmented resection [24,43]. Yang et al. compares the use of ESD to endoscopic full resection (EFTR), choosing EFTR when the lesion was near the muscularis propria layer. In those patients the nearby muscularis propria and serosa were also resected, closing the defect in the duodenal wall with purse-string sutures using endoloops and clips. This technique is accompanied with the need for pneumoperitoneum desufflation during and after procedure and a gastro-intestinal tube was left behind at level of the resection site. Hospital stay in this study was rather long for both techniques from 5 days until 16 days hospital stay which is longer than the hospital stay of our patient treated with open surgical excision [26].

The most used endoscopic technique, accounting for 21 patients (45% of all endoscopic treated patients) is the endoscopic submucosal dissection (ESD) frequently mentioned as the preferred approach for resection. With increasing lipoma diameter, the endoscopic intervention becomes increasingly challenging with a higher risk of perforation and more fragmentated tissue for histo-pathological examination. Another large disadvantage is the long intervention time reported up to 4 hours in this literature search. Therefore, this technique is not suitable for every patient nor every lesion [19,26,44,45].

Two case reports did not resect the duodenal lipoma causing obstructive jaundice. One lipoma was lifted out of a present biliary stent with the tip of the endoscope without resection[18]. In the second case, endoscopic bare metal stenting was preferred to treat the jaundice without resection of the responsible lipoma [17].

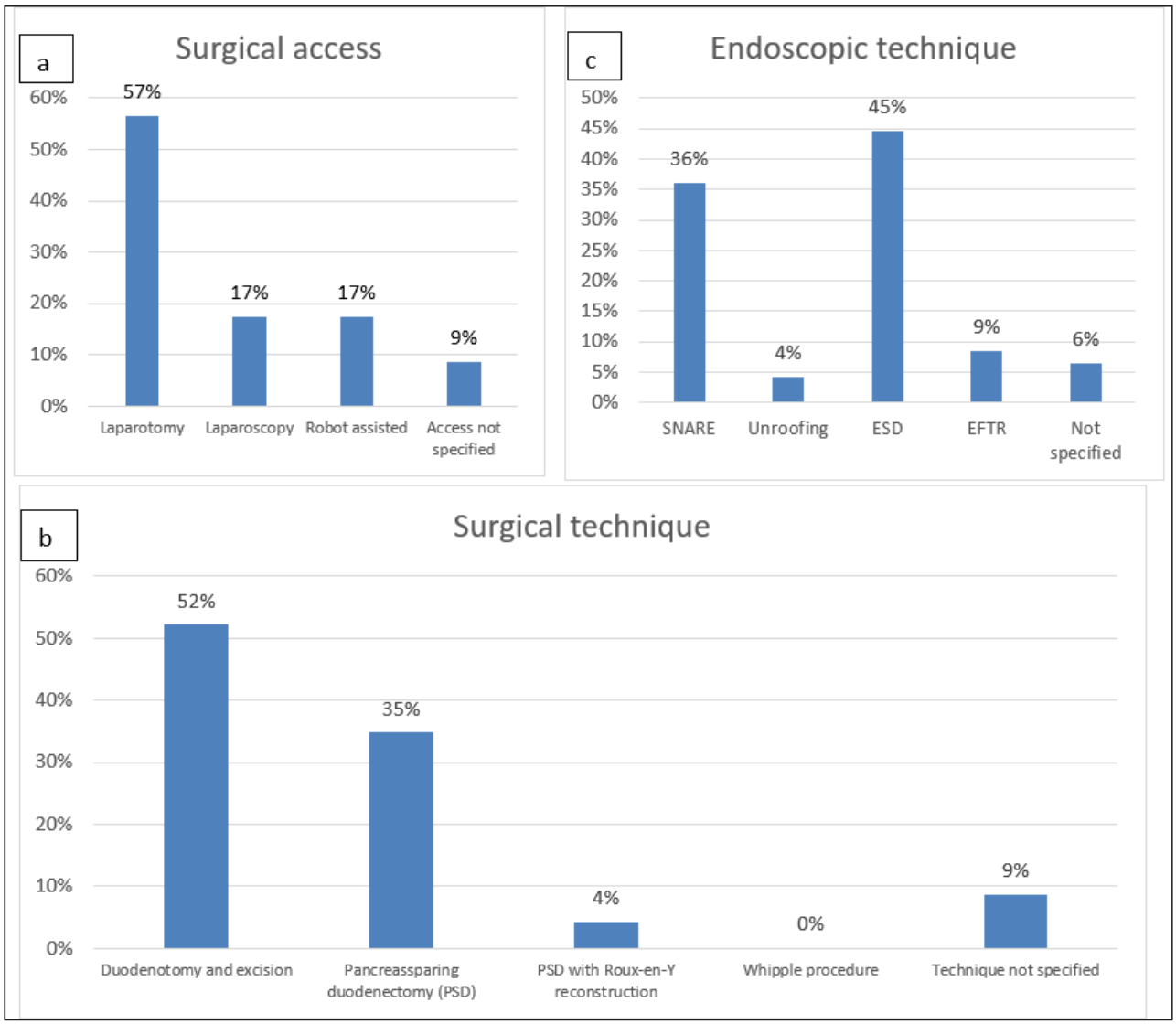

Figure 10: Treatment options for duodenal lipoma. a: Surgical access, b: Surgical techniques, c: Endoscopic options for resection. PSD: pancreas sparing duodenectomy, ESD: Endoscopic submucosal dissection, EFTR: Endoscopic full thickness resection

Surgical management was described in 23 patients (31%). Surgical access options are laparotomy (13 patients) or minimally invasive via laparoscopy (4 patients) or robot-assisted surgery as described in 4 patients (figure 10). The access was not specified in two patients.

Different useful surgical techniques are duodenotomy with excision/enucleation of the lipoma and primary closure (12 patients), a pancreas sparing duodenectomy (PSD) with end--to-end or side-to-side duodenojejunostomy (8 patients), PSD with the need for Roux-en-Y reconstruction (1 patient) and Whipple procedure (no reported cases) all summarized in figure 10 [1,5-7,10,11,13,14,31,46–58]. The resection technique was not further specified in two patients [31,55]. Three patients underwent a hybrid approach combining endoscopy and surgical techniques. One patient had multiple intestinal lipomas resected via laparotomy with resection of each palpated (jejunal) lipoma combined with ESD for the one duodenal lipoma[19]. One patient was treated with ESD but needed laparoscopic removal of the specimen [20]. And one patient underwent a hybrid laparoscopic endoscopic collaborative surgery (LECS) procedure in which ESD was performed with en bloc resection of the lipoma followed by laparoscopic suturing of a mucosal defect [21].

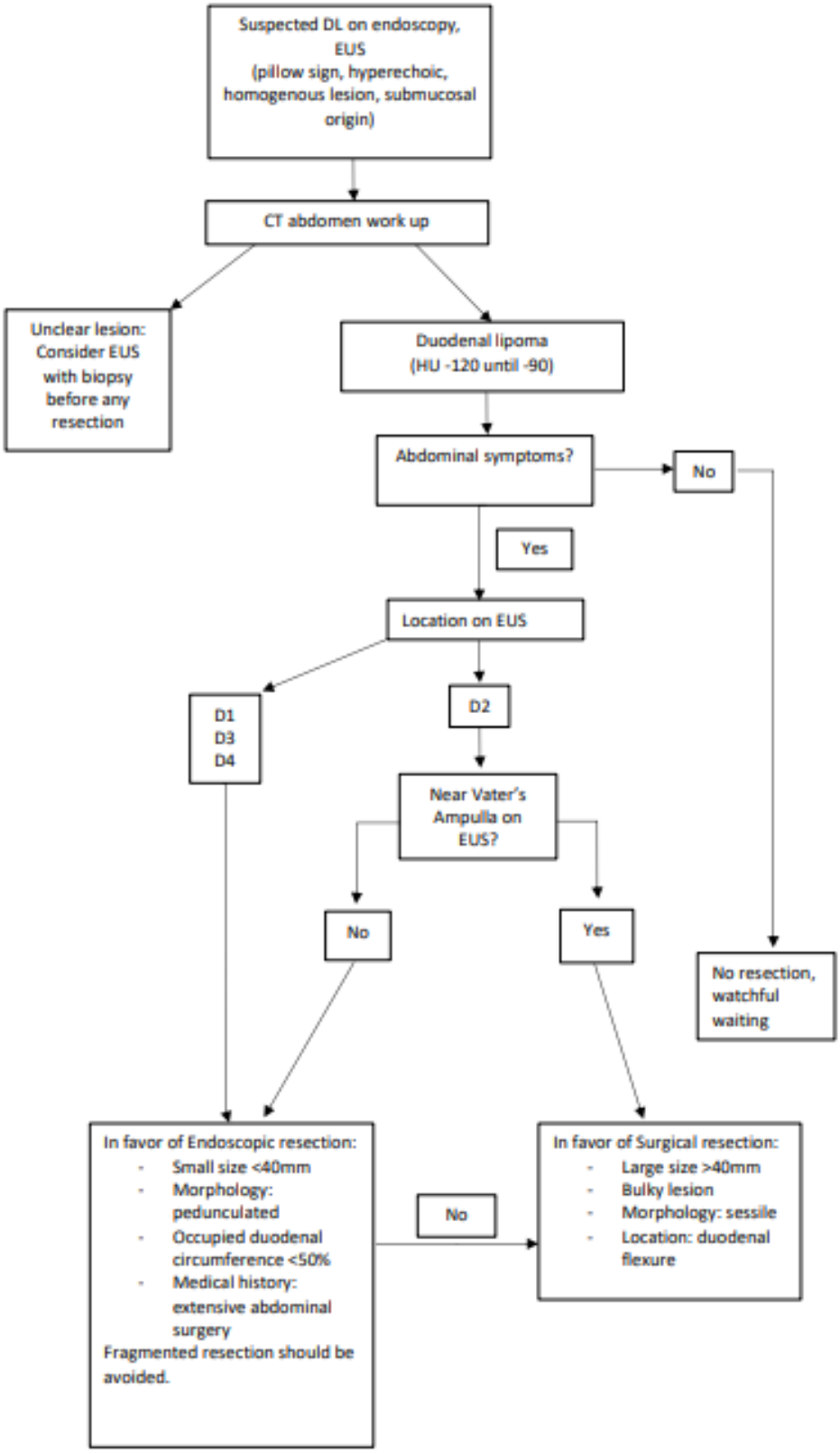

Figure 11: Flow chart with proposed practical guidelines for the management of duodenal lipoma in daily practice. DL: Duodenal lipoma; EUS: Endoscopic ultra-sonography; D1: first part of duodenum; D2: second part of duodenum; D3: third part of duodenum; D4: fourth part of duodenum

Based on reviewed literature we propose a practical flow-chart useful in daily practice when encountering a patient with duodenal lipoma (figure 11). When large and bulky, surgical excision is a more appropriate course of action. No clear

cut-off diameter is established in the literature from which surgery is preferred over endoscopic resection. Several authors describe large lipoma as being too difficult for endoscopic resection, especially when located in D2 and near Vaters' ampulla. The systematic review by Mao Wei Pei et al. (2017) mentions large and sessile lesions as difficult to manage endoscopically because of the increasing risk of perforation and bleeding with increasing lesion size, but a size cut off favoring surgical treatment was not discussed. Kato Motohiko et al.(2019) published a retrospective study identifying lesion size >40mm, lesion location in duodenal flexure and occupied circumference >50% as characteristics associated with technical difficulties during ESD. [59] Therefore 40mm could be a possible size cut-off from which surgery should be considered over endoscopic treatment. Criteria in favor of surgery are location near Vater's ampulla, sessile and large lipoma and no clear diagnosis of benign nature since endoscopic resection often results in fragmented and sometimes incomplete resection. Future research is needed to establishing a clear size cut-off from which surgery is preferred over endoscopic management. This could result in more evidence-based guidelines supporting gastroenterologist and surgeons in daily practice.

Laparoscopic and robotic approaches are technically feasible and have been described in several cases. Patient history and location of the lipoma in the duodenum are important factors in determining if your patient can be considered for minimally invasive surgery.

In our case, laparotomy was preferred given the patients' surgical history and extensive adhesions were to be expected. Additionally, the duodenal lipoma was located at the posterior wall of the descending duodenum, a location difficult to access laparoscopically.

Several good treatment options and techniques have been described for symptomatic duodenal lipoma. In summary, there is endoscopy (SNARE, unroofing technique, ESD, EFTR), laparoscopy and laparotomy (duodenotomy with excision/enucleation, PSD with or without Roux-en-Y reconstruction), robotic assisted procedures and hybrid approach.

There is a need for larger studies with long term follow up of patients to assess outcomes of all the different treatment modalities. This will contribute to more evidence-based guidelines concerning the management of duodenal lipoma to better support and guide gastroenterologists and abdominal surgeons when encountering this rare pathology in their daily practice.

Conclusion

Duodenal lipoma is a difficult and rare diagnosis. Therefore, it is important to keep this benign tumour in mind when investigating a patient with vague abdominal, nonspecific complaints.

A CT scan and MRI can confirm the diagnosis based on the imaging characteristics of a lipoma but are less accurate in exact localization. Endoscopic ultrasound is more accurate in determining the precise location of the duodenal lipoma in relation to Vaters' ampulla and evaluating its morphology and spatial features (sessile, pedunculated).

Dealing with a benign disease, always consider the least invasive technique seen fit for each patient. Watchful waiting is considered a safe option for asymptomatic duodenal lipoma. When symptomatic, excision is recommended endoscopically or surgically depending on the characteristics of the patient and the lesion.

The best treatment option is the technique most suited for your specific patient taken medical history and characteristics of the lipoma into account. Spatial characteristics of the lipoma such as size, morphology and location, are important factors in determining the appropriate treatment access and technique.

There are no treatment guidelines available. Individual assessment is needed but clear evidence-based guidelines are mandatory in further improving the care for patients diagnosed with duodenal lipoma. Therefor larger studies are needed, assessing long-term outcomes of all different treatment strategies, contributing to evidence-based guidelines.

Acknowledgements

Not applicable

Declarations

No funding was received for this article. The authors report there are no competing interests to declare. The patient gave consent for publication.

All data generated or analysed during this study are included in this published article and its supplementary information files.

Author Contributions

Potums L. acted as writer of the original draft of the article, performing the literature search and review included.

Huysentruyt F., D'hooge P. and Delvaux P. were major contributors throughout the writing and re-writing process of the manuscript, proofreading and help in re-writing the discussion section.

All the authors have read and approved the final manuscript.

Appendix – Additional information

Table 1: Literature overview of all in English published cases from 2001 until 2024 (June) in order of publication date. Hb: hemoglobin; y: years; mm: millimeter; D1: first part of the duodenum; D2: second part of the duodenum; D3: third part of the duodenum; D4: fourth part of the duodenum

	Reference	Gender	Age (y)	Symptoms	Histology	Morphology	Size (mm)	Location	Treatment
1	Chung-Fang Tung et al. (2001)	M	73	Tarry stools, Anemia (Hb 7,8g/dL)	Lipoma, Superficial ulceration	Single,Pedunculated	45	D2	Endoscopic electrosurgical SNARE polypectomy
2	L. Lundell et al. (2002)	M	44	Obstructive jaundice, gastric outlet obstruction	Lipoma	Giant multiple lipoma	-	D2 D3 D4 Jejunum	Surgery: Laparotomy, Pancreas-sparing duodenectomy
3	Suketo Sou et al. (2003)	Fhybr	81	Massive melena, Anemia (Hb 6,2g/dL)	Lipoma, ulceration at tip	Single, Pedunculated	50	D3	Endoscopic electrosurgical SNARE polypectomy
4	Marie-Cécile Blanchet et al. (2003)	F	69	Nausea, vomiting, abdominal pain, weight loss	Lipoma	Single, lobulated polypoid	50	D2	Endoscopic electrosurgical SNARE polypectomy
5	Saleh N Abu Daff et al. (2008)	F	53	Vomiting, abdominal discomfort	Lipoma	-	-	-	Surgery: Laparoscopic enucleation, duodenotomy
6	Wen-Hsin Huang et al. (2008)	M	46	Upper abdominal fullness after eating	Lipoma	Single	20	D1	Endoscopic endoloop-assisted unroofing technique
7		F	75	Postprandial discomfort	Lipoma	Single, polypoid	20	D2	Endoscopic endoloop-assisted unroofing technique
8	DRC Spalding et al. (2007)	F	71	Gastric outlet obstruction	Lipoma	Single	-	D3-D4	Surgery: Laparotomy, Pancreas-sparing distal duodenectomy
9	Billy W. Long et al. (2008)	-	-	Upper gastrointestinal haemorrhage	Lipoma	Single	40	D3	Endoscopic polypectomy
10	Harish K. Mohamed et al. (2008)	F	70	Upper gastrointestinal haemorrhage	Lipoma	Single	55	D2	Endoscopic polypectomy
11	Atsuhiko Murata et al. (2008)	M	67	Recurrent tarry stools, anemia	Lipoma	Single, pedunculated	40	D2	Endoscopic polypectomy with detachable SNARE

12	Haley Clifford et al. (2009)	M	70	Melena	Lipoma	Single, pedunculated	-	-	Endoscopic endoloop and SNARE polypectomy
13	Cheng-Wang Chang et al. (2010)	F	59	Melena, abdominal distention, palpitation, anemia (Hb 8,2g/dL)	Lipoma, ulcer at tip	Single, pedunculated	40	D2	Surgery: laparotomy, duodenotomy
14	Helga M. Ouwerkerk et al. (2010)	F	52	Melena, abdominal distention, vomitus	Lipoma	Single	17	D1	Surgery: laparotomy, Duodenotomy
15	R. Kadaba et al. (2011)	F	60	Fatigue, tiredness, generally unwell, anaemia (Hb 6,5g/dL)	Lipoma	Single	60	D1	Surgery: duodenotomy, transduodenal resection in the submucosal plane, not further specified
16	Dianbo Cao et al. (2011)	F	68	Melena, weight loss	Lipoma, ectopic duodenal glands	Single, polypoid	40	D2	Surgery: laparotomy, technique not specified
17	Jelena Djokie Kovac et al. (2012)	M	65	Vomiting, epigastric pain, postprandial fullness	Lipomas	Multiple, polypoid	10, 25	D1, D2	Surgery: laparotomy, technique not specified
18	Tae Hee Lee et al. (2013)	F	57	Intermittent upper abdominal pain	Lipoma	Single, polypoid	-	-	Endoscopic electrocautery SNARE
19	Amit Kumar Parmar et al. (2013)	F	43	Postprandial abdominal fullness, nausea, vomiting	Lipoma	Single	60	D1	Surgery: Laparoscopic excision, longitudinal duodenotomy
20	Promise N Wichendu et al. (2013)	M	40	Projectile vomiting, epigastric fullness, constipation, abdominal discomfort	Lipoma	Single, pedunculated	110	D2	Surgery: Exploratory laparotomy, duodenotomy
21	Henrik Thorlacius et al. (2013)	M	66	Fatigue, acute upper gastrointestinal bleeding (Hb 9,2 g/dL), melena	Lipoma, ulcerations	Single, polypoid	35	D2	Endoscopic endoloop and SNARE
22	Ismail Yaman et al. (2014)	F	59	Upper abdominal fullness, heartburn, anemia (Hb 9,7g/dL)	Lipoma	Single, polypoid	40	D2	Endoscopic SNARE polypectomy
23	Fatih Aslan et al. (2014)	M	77	Nausea, vomiting, dyspepsia	Lipoma	Single	90	Duodenum, extending to antrum	Endoscopic submucosal dissection (ESD)

24	Downs-Canner et al. (2015)	-	-	-	Lipoma	-	-	Duodenum	Robotic surgery (Transduodenal excision / Segmental duodenal resection)
25		-	-	-	Lipoma	-	-	Duodenum	Robotic surgery (Transduodenal excision / Segmental duodenal resection)
26	Nizar Talaat et al. (2016)	M	79	Darkening urine, itching, scleral icterus	Lipoma	Single	-	Gastro-duodenal	NO resection: Endoscopic placement of 10x60mm fully covered metal stent
27	Dinesh Zirpe et al. (2016)	M	45	Melena, anemia (Hb 8g/dL)	Lipoma, ulcerations	Multiple, polypoid	40	D3/D4, proximal jejunum	Surgery: Laparotomy, duodenectomy (2cm distal to ampulla) and proximal jejunum, side-to-side duodenojejunostomy
28	Chuncheng Wu et al. (2017)	F	64	Postprandial abdominal discomfort, intermittent melena, symptomatic anemia (Hb 9,0g/dL)	Lipoma	Single	100	D2	Endoscopic submucosal dissection (ESD)
29	Alberto Mariani et al. (2017)	M	70	Jaundice	Lipoma	Single	15	D2	NO resection.
30	Maowei Pei et al. (2017)	F	67	Abdominal pain, vomiting, constipation, epigastric fullness	Lipoma	Multiple	13 - 110	D2/D3/D4, proximal jejunum	Surgery: Exploratory laparotomy, duodenectomy (4cm distal to ampulla, proximal jejunum, end-to-end duodenojejunal hand-sewn anastomosis)
31	Taro Iwatsubo et al. (2017)	M	70-79	-	Tubular adenoma, lipoma beneath	Single	30	D2	Hybrid: Laparoscopic endoscopic cooperative surgery (LECS), first endoscopic submucosal dissection, en bloc resection, laparoscopic suturing of mucosal defect from outside the duodenum
32	Viviana Parra et al. (2018)	M	63	Chronic abdominal pain, intermittent postprandial vomiting	Lipoma	Single	-	D2	Endoscopic Modified SNARE polypectomy
33	Ankush Golhar et al. (2018)	F	70	Upper gastrointestinal bleed	Lipoma	Single	110	D3	Surgery: Laparotomy, Segmental duodenectomy, duodenojejunostomy

34	Mohammadreza Shervinrad et al. (2019)	M	75	Vomiting, anorexia, unintentional weight loss, Anemia (Hb 10,0 g/dL)	Lipoma	Multi-lobed	60, 70, 115	D1-D2	Surgery: Partial duodenal resection, access not further specified
35	Hung Chieh Lan et al. (2018)	F	65	Occult gastrointestinal bleeding, anemia	Lipoma	Single, pedunculated	27	D1	Endoscopic SNARE polypectomy
36	Douglas Tjandra et al. (2019)	F	68	Melena, upper abdominal pain, intussusception with lipoma D1 as leading point	Lipoma	Single, pedunculated	105	D1	Surgery: Laparoscopy, duodenotomy and primary repair
37	Yasunori Yoshimoto et al. (2019)	F	47	Abdominal pain, medical history of open bowel resection for intestinal obstruction caused by intussusception of multiple intestinal lipoma	Lipoma	Multiple	20	Duodenum, jejunum until distal ileum	Hybrid: Diagnostic laparoscopy, converted to open laparotomy, resection of each palpated intestinal lipoma. Duodenal lipoma was resected by endoscopic submucosal dissection (ESD).
38	Seo Yeon Gwak et al. (2020, Epub 2019)	F	85	Hematemesis, nausea, vomiting	Lipoma, ulcerations	Single	20	D1	Endoscopic resection using SNARE
39	Karthik Gnanapandithan et al. (2020)	F	55	Postprandial epigastric fullness	Lipoma	Single, broad based	50	D1	Endoscopic endoloop ligation, SNARE
40	Hisamichi Yoshii et al. (2020)	M	72	Melena, anemia (Hb 6,0g/dL)	Lipoma, mucosal ulceration	Single, sessile	40	D2	Surgery: Laparoscopy, pancreassparing partial duodenectomy, Roux-en-Y reconstruction
-	Yuichiro Ozeki et al. (2020)	M	60	-	Hyperplasia Brunner's Glands	Single	35	D2	Endoscopic electrosurgical SNARE, with hemoclip anchoring at head of lipoma
41		F	50	-	Lipoma	Single	30	D3	Endoscopic electrosurgical SNARE, with hembrotoclip anchoring at head of lipoma
42	Marouane Baiss et al. (2021)	M	58	Melena, anemie (Hb 7,8g/dL)	Lipoma	Single	100	D1	Surgery: Laparotomy, longitudinal duodenotomy
43	Logan D. Glosser et al. (2021)	F	53	Constipation, anoreia	Lipoma	Single	-	D3	Robot assisted laparoscopic excision via transverse duodenotomy

-	Bin Yang et al. (2021) 23 patients	12 M11 F		8 symptomatic patients					Depending on relation to muscularis propria layer.Endoscopic submucosal dissection: ESDEndoscopic full thickness resection: EFTR
44		M	41	Melena	Lipoma	-	22	D1	ESD
45		M	61	Epigastric pain	Lipoma	-	23	D2	ESD
46		F	69	Epigastric pain	Lipoma	-	22	D2	ESD
47		M	62	Patient desires resection	Lipoma	-	22	D2	ESD
48		M	28	Patient desires resection	Lipoma	-	25	D2	EFTR
49		M	62	Patient desires resection	Lipoma	-	21	D2	ESD
50		F	70	Patient desires resection	Lipoma	-	30	D2	ESD
51		M	70	Epigastric pain	Lipoma	-	23	D2	ESD
52		M	72	Melena	Lipoma	-	60	D2	ESD
53		F	49	Patient desires resection	Lipoma	-	75	D1	EFTR
54		F	49	Epigastric pain	Lipoma	-	20	D2	ESD
55		F	42	Patient desires resection	Lipoma	-	40	D2	ESD
56		F	44	Patient desires resection	Lipoma	-	23	D2	ESD
57		M	67	Patient desires resection	Lipoma	-	24	D2	ESD
58		M	55	Patient desires resection	Lipoma	-	25	D2	ESD
59		F	65	Patient desires resection	Lipoma	-	30	D2	ESD
60		F	58	Epigastric pain	Lipoma	-	28	D1	EFTR
61		F	52	Patient desires resection	Lipoma	-	23	D2	ESD
62		F	73	Patient desires resection	Lipoma	-	25	D1	ESD
63		M	64	Patient desires resection	Lipoma	-	21	D2	ESD
64		M	73	Patient desires resection	Lipoma	-	24	D1	ESD
65		F	47	Epigastric pain	Lipoma	-	22	D2	ESD
66		F	42	Patient desires resection	Lipoma	-	26	D2	EFTR

67	Beom Jin Shin et al. (2021)	F	78	Asymptomatic	Lipoma and Brunner Gland hyperplasia in 1 polypoid lesion	Single, Pedunculated polyp with erosions	35	D2	Endoscopic SNARE polypectomy
68	Shimura Takaya et al (2021)	F	53	Recurrent pancreatitis	Lipoma	Single, Pedunculated with stalk originating from para-ampulla of Vater	60	D2	Hybrid: Endoscopic submucosal dissection, laparoscopic removal of specimen from jejunum
69	Branko Brankovic et al. (2022)	M	45	Upper gastro intestinal bleeding, Melena, Anemia (Hb 8,5g/dL)	Lipoma	Single	35	-	Surgery: Laparotomy, duodenotomy and excision
70	Mohammed I. Mousa et al. (2023)	F	49	Abdominal pain, melena	Lipoma	Single, pedunculated	23	D1	Endoscopic SNARE resection
71	Ryan Alghanemi et al. (2023)	M	67	Weight loss, night sweats, constipation, postprandial fullness	Lipoma	Single	74	D1	Robotic assisted duodenotomy, excision
72	Kazuya Miyaguchi et al. (2023)	F	50	Upper abdominal pain, melena, symptomatic anemia (Hb 6,6g/dL)	Composite tumor: lipoma combined with gastric-type NUMP	Single, pedunculated, erosions	30	D2	Endoscopic resection
73	Isabel Tarrio et al. (2023)	M	82	Jaundice	Lipoma	Single, pedunculated	20-30	-	Endoscopic SNARE resection
74	Carl Cosgrave et al. (2023)	M	73	Syncope and melena with need for transfusion	Lipoma	Single, pedunculated	65	D2	Endoscopic SNARE resection
75	Manish Sahni et al. (2024)	M	15	Jaundice, intermittent upper gastrointestinal bleeding	Lipoma	Sessile	70	D2, Ampulla	Surgery: Laparotomy, duodenotomy with excision and plastic repair sphincter of Oddi (pancreas preserving)

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