# Duodenum

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## 6.1 Introduction

Surgical emergencies associated with duodenal neoplasms pose a substantial challenge. In this chapter, we present an overview of common duodenal neoplasms, followed by a discussion of the presentation and management of three primary surgical emergencies: obstruction, perforation, and bleeding.

## 6.2 Neoplasms of the Duodenum

### 6.2.1 Primary Duodenal Malignancies

Small bowel cancers are rare, contributing to an estimated 0.6% of all new cancer cases and 0.3% of all cancer deaths in the United States in 2021 [1]. The distribution of these lesions across the small intestine varies widely by histologic subtype; over 50% of small bowel adenocarcinomas arise in the duodenum, while neuroendocrine tumors (NETs), lymphomas, and gastrointestinal stromal tumors (GISTs) occur less frequently in this location (15–20%, respectively). In contrast, most NETs arise in the ileum [2, 3]. Incidence of these tumors has not changed significantly over time [4], with the exception of a marked increase in the diagnosis of NETs over the last 2–3 decades [3]. Overall, duodenal malignancies comprise about 25% of all small

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A. Tarasconi et al. (eds.), *Oncologic Surgical Emergencies*, Hot Topics in Acute Care Surgery and Trauma, https://doi.org/10.1007/978-3-031-36860-8_6

bowel cancers [5]. Duodenal neoplasms may be difficult to diagnose, as they are not screened for routinely and often only present with nonspecific symptoms such as abdominal pain, nausea, vomiting, and/or indolent weight loss [6, 7]. In the emergent setting, histologic subtypes may present in any fashion, but GISTs most often manifest with bleeding, lymphomas most commonly with perforation, and adenocarcinomas most often with obstruction [6].

#### 6.2.1.1 Adenocarcinoma

The duodenum is the site of more than half of all intestinal adenocarcinomas accounting for nearly 60% of all duodenal malignancies [2]. A single-center series by Halfdanarson et al. suggested that duodenal tumors present at an earlier stage than jejunal or ileal tumors, likely owing to earlier onset of symptoms from higher flow obstruction [8]. Risk factors for small bowel adenocarcinoma include inflammatory bowel disease, celiac disease, and familial polyposis syndromes [9]. In the absence of powerful evidence supporting systemic or regional nonsurgical therapies, surgical resection is often a treatment priority. Notwithstanding, many patients present with locally advanced or disseminated disease precluding complete resection, and a broadening experience supports first-line systemic therapy in patients with higher risk or metastatic disease [3].

#### 6.2.1.2 Neuroendocrine Tumors (NETs)

Neuroendocrine tumors (NETs) of the small intestine were traditionally referred to as carcinoids, though the term NET is increasingly favored and encompasses both low-grade, more indolent tumors and higher grade lesions [10, 11]. These tumors account for 15–20% of primary duodenal malignancies [2, 3]. Approximately one-third of NETs are functional, the majority of which are gastrinomas or somatostatinomas [11, 12]. Risk factors for NETs include smoking, alcohol use [13], and multiple endocrine neoplasia type 1 (MEN-1) [14]. Endoscopic resection may be adequate for small nonfunctional NETs, but larger tumors and gastrinomas often require operative management, frequently including regional lymph node removal. A more permissive approach to localized NETs of the duodenum may be appropriate in patients with MEN-1 who often have multifocal disease [12]. A landmark study on the Zollinger-Ellison syndrome demonstrated that, even among the small proportion of MEN-1 patients free of disease immediately after operation, almost all recurred at 5 years, suggesting limited impact of surgery in this population other than for palliation [15].

#### 6.2.1.3 Lymphomas

Small bowel lymphomas are rare (0.2–0.5 per 100,000 in the United States) and primarily present in the jejunum and ileum [16] (Fig. 6.1). Lymphomas comprise approximately 10% of all duodenal malignancies [2, 3]. The histologic subtypes of duodenal lymphomas vary significantly and are beyond the scope of this chapter. The mainstay of first-line treatment for all small bowel lymphomas is chemotherapy, with the notable addition of *H. pylori* treatment for mucosa-associated

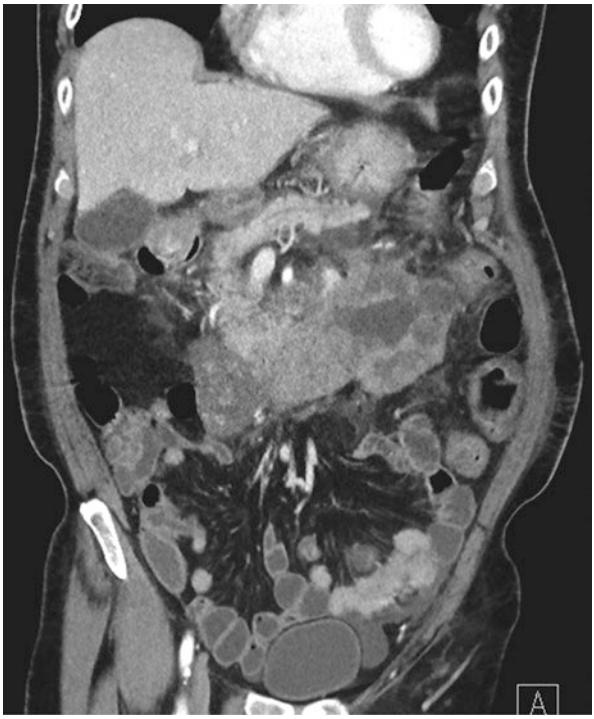


**Fig. 6.1** 68-Year-old male with known duodenal lymphoma. CT scan shows the distal duodenum and a proximal jejunal mass with a mesenteric calcified focus next to the duodenum. The patient ultimately underwent a pyloric exclusion and gastrojejunostomy

lymphoid tissue tumors (MALTs) [17, 18]. There is a role, in selected cases, for surgical palliation of symptoms or to improve candidacy for systemic therapy [6].

#### 6.2.1.4 Gastrointestinal Stromal Tumors (GISTs)

GISTs are the most common GI sarcoma and are more commonly diagnosed through increased recognition over the past two decades [19]. Approximately 28% of all GISTs are located in the small intestine; a quarter of these arise in the duodenum. Six percent of duodenal malignancies are GISTs [2, 19]. Surgical resection is the treatment of choice for localized disease; negative margin resection is the goal. Lymphadenectomy is unnecessary as GISTs rarely metastasize to lymph nodes, and this may allow for more conservative surgical approaches. The tyrosine kinase inhibitor imatinib is active against the majority of GISTs and may be indicated in the adjuvant and/or neoadjuvant setting [20].

### 6.2.2 Benign Duodenal Neoplasms

Benign neoplasms including lipomas, adenomas, leiomyomas, and other entities are relatively uncommon in the duodenum. They are often incidental findings or present with nonspecific symptoms of abdominal pain, nausea, and/or vomiting. Adenomas are the most common of benign lesions. While periampullary location may

complicate treatment approaches, many of these tumors can be managed with endoscopic or limited operative resection [21, 22].

### 6.2.3 Extension of a Pancreatic Malignancy

Pancreatic malignancies may infiltrate or compress the duodenum. Pancreatic cancer accounts for 3% of all new cancer cases and 8% of cancer deaths [1]. Up to 80% of patients with pancreatic cancer present with metastatic or locally advanced disease; 10–25% of patients develop symptoms of duodenal or gastric outlet obstruction at some point in their course [23]. The treatment for duodenal obstruction traditionally included operative gastrojejunostomy [24], but advances in endoscopic approaches have afforded alternatives including plastic or self-expanding metal stents [25] (Fig. 6.2). Decompressive gastrostomy tubes placed in surgery, by endoscopy, or by interventional radiology may also provide palliation in patients with particularly poor prognoses [23].

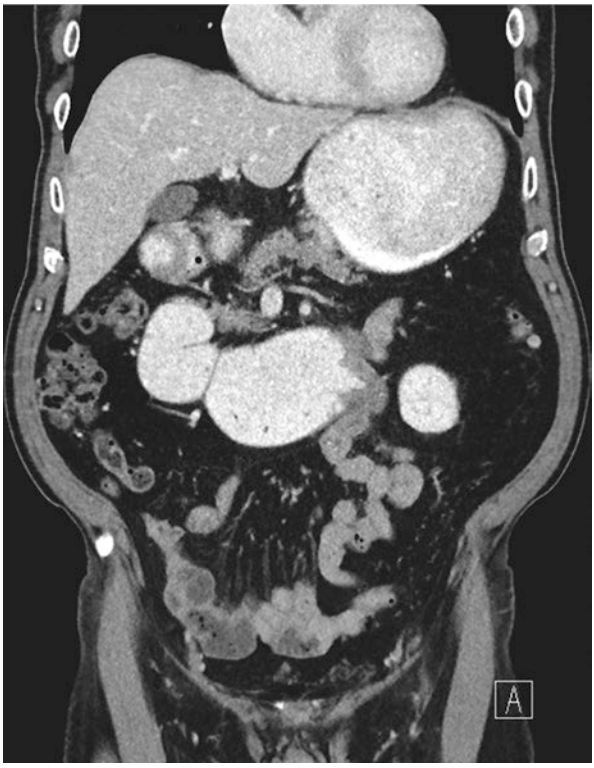


**Fig. 6.2** CT scan tomogram from a 70-year-old male who presented acutely obstructed at the distal duodenum from an adenocarcinoma. Note the distended duodenum and stomach. The patient ultimately underwent resection with duodenojejunostomy anastomosis

### 6.2.4 Metastatic Disease to the Duodenum

Metastatic disease to the small bowel is relatively rare. Melanoma is the most common malignancy to metastasize to the gastrointestinal tract; the stomach or duodenum is involved in 5–50% of these cases [26, 27]. Other potential primary cancers to metastasize to the duodenum include colon, lobular breast, pancreatic, lung, and renal cell carcinomas [7]. Similarly to primary duodenal tumors, metastases may present with obstruction or bleeding, though the latter is uncommon [28, 29].

## 6.3 Surgical Emergencies

### 6.3.1 Intestinal Obstruction

#### 6.3.1.1 Presentation

Patients presenting with an obstructing mass in the duodenum may manifest a combination of abdominal pain, bloating, and vomiting [30]. The likelihood of an obstructive presentation is dependent on the type and location of malignancy; for example, about 25% of duodenal adenocarcinomas present with obstruction, but this is less common if the tumor is located near the ampulla [31]. Vomiting is a hallmark of obstructive presentations, occurring in up to 80% of patients [32], and may be large volume and projectile in nature [33]. A shorter duration and rapid progression of abdominal pain may indicate a benign etiology rather than malignancy [32], and pain associated with peptic stricture may be more colicky in nature [33]. Weight loss is commonly endorsed by patients with gastroduodenal malignancy that has been present long enough to cause obstruction [32].

#### 6.3.1.2 Physical Exam and Laboratory Findings

On examination, patients with a duodenal obstruction may display vague epigastric tenderness. A "succussion splash," or a splashing sound audible through a stethoscope when the abdomen is rocked or tapped, may be present, indicating gastroduodenal accumulation of contents. Mild diffuse abdominal distention may be present, though this is unlikely to be diffuse as the distal bowel will be decompressed. Patients may appear dehydrated or malnourished. If patients have been vomiting, laboratory examination may reflect hypokalemia and/or a hypochloremic metabolic alkalosis [34, 35].

#### 6.3.1.3 Imaging

A variety of imaging techniques may demonstrate the gastric outlet obstruction resulting from a duodenal mass. Plain-film X-ray may reveal a "double-bubble" sign indicating a distended stomach adjacent to a distended duodenum [36]. Similarly, a fluoroscopic upper GI series may demonstrate partial or complete obstruction at some segment of the duodenum. However, most commonly, a computed tomography (CT) scan is readily available and used to make the diagnosis of an obstructive duodenal mass. Computed tomography offers several imaging

characteristics that may help differentiate the various types of duodenal masses. GISTs are often relatively large, lobular, well-circumscribed, vascular masses [37], while lipomas have the appearance (density) of fat and often appear intraluminal on imaging due to their size despite their submucosal location [38]. Adenocarcinomas may have an "apple-core" appearance with associated narrowing or thickening of the duodenal wall, with or without ulceration or invasion into adjacent structures. If there is question as to the extent of local invasion of adjacent structures or encasement of vessels, or if the lesion is periampullary, an MRI can be helpful [39]. NETs tend to occur in the proximal portion of the duodenum (first or second segments) and appear as focal intraluminal masses [40]. In the setting of clinical intestinal obstruction, it may be useful to perform a CT of the abdomen with oral contrast to radiographically evaluate for complete or partial obstruction. Oral contrast should be preferentially administered via a nasogastric tube and subsequently followed with rapid evacuation to avoid high-volume emesis and aspiration.

#### 6.3.1.4 Management

As in any case of gastrointestinal obstruction, a nasogastric tube for gastric decompression is warranted. Electrolyte abnormalities (particularly $Mg^{2+}$, $Ca^{2+}$, $PO4^{-}$, and $K^{+}$) as well as volume depletion should be aggressively corrected. Surgical management should focus on both decompression and restoration of gastrointestinal continuity, with or without resection of the primary lesion. If the patient's condition allows for pathologic diagnosis and oncologic staging, resection may be indicated, and if the patient is safely able to tolerate a definitive operation, an oncological operation should be performed. Otherwise, palliative surgical management with gastrojejunal bypass is often the chosen approach. If the latter is performed, it is important that the patient be maintained on acid-suppressive therapy postoperatively [30]. If bypass is not feasible, gastrostomy tube placement for drainage with or without a jejunostomy tube for feeding may be helpful. Alternatively, endoscopic stenting of the duodenal obstruction can be considered [41] (Fig. 6.3). This approach is best suited for patients with extremely poor prognosis and life expectancy (<6 months), including those with widely disseminated metastatic disease upon presentation. Duodenal stenting is not without complication risk, as stents may migrate or cause perforation or bleeding, or may also obstruct [23, 25, 42]. Depending on

**Fig. 6.3** Commercial biliary stent most often inserted endoscopically or through interventional radiology approaches. [Courtesy of Cook Medical LLC. (With permission)]

the patient and expected survival, these risks may be mitigated through the use of diverse types of stents (i.e., covered vs uncovered) [43].

A subset of patients presenting with duodenal obstruction deserve special consideration: those with some concurrent degree of biliary obstruction. These patients may additionally and/or concurrently require a biliary bypass (thus a "double bypass") with a Roux limb anastomosed to both the bile duct and the stomach [24]. Outcomes for gastrojejunostomy with or without biliary bypass are reasonable given the often debilitated and malnourished nature of this patient population; however, this procedure has definite inherent risks. An analysis of the American College of Surgeons National Surgical Quality Improvement Project (ACS NSQIP) data from 2005 to 2011 identified a 20% 30-day morbidity rate when this operation was undertaken for patients with unresectable pancreatic cancer. This was found to be higher than in patients who underwent laparotomy alone, though no difference in mortality was detected, reflecting the grave prognosis for most patients with unresectable periampullary cancer [44]. Unsurprisingly, emergent operation was associated with increased morbidity [45].

### 6.3.2 Duodenal Perforation

#### 6.3.2.1 Presentation

Perforation of a duodenal malignancy may occur after an extended period of obstruction, from an aggressive necrotic tumor and/or in the context of neoadjuvant, adjuvant, or palliative therapy (i.e., radiation or chemotherapy). Patients that develop a perforation present with sudden onset of severe epigastric pain and/or diffusely throughout the abdomen, particularly if it involves the intraperitoneal portion of the duodenum. Conversely, a retroperitoneal or contained duodenal perforation may present with more indolent and subtle symptoms including malaise, nausea/vomiting, and fever. Patients with intraperitoneal perforations presenting soon after onset may have more localized pain; if later, pain may be more diffuse. The pain may radiate to the right shoulder secondary to irritation of the right diaphragm from accumulating of subdiaphragmatic succus or gastric contents [46]. In some cases, perforations may remain contained or "self-sealed," in which case the pain may actually diminish with time and be nearly resolved upon presentation. Patients may also report a history of weight loss or food intolerance leading up to the acute presentation [47]. In the case of an actively treated duodenal malignancy, perforation in this setting may result from tissue necrosis occurring secondary to treatment (i.e., following chemotherapy for lymphoma) [48].

#### 6.3.2.2 Physical Exam and Laboratory Findings

Patients can exhibit abdominal tenderness, with or without peritonitis (including guarding and rebound tenderness). Depending on the duration of symptoms, this may be accompanied with signs of sepsis and shock, including fever, tachycardia, hypotension, and hyperlactatemia [47]. It is worth noting, however, that these are the signs and symptoms of any free intraperitoneal perforation, including that of the

stomach and colon. Given that the duodenum is, in part, a retroperitoneal structure, some perforations may be contained and not cause peritonitis [49].

Laboratory workup should include a complete blood count, looking in particular for a leukocytosis, and a lactic acid elevation, particularly for patients who are clinically in shock. In those with an unidentified etiology for hollow viscus perforation, studies for other potential causes (i.e., *H. pylori*, gastrin levels) may be helpful, though these are less useful in the setting of known malignancy [47]. If malignancy is suspected based on history or imaging at the time of presentation, tumor markers such as CEA and CA 19-9 can be obtained to guide future surveillance [31].

#### 6.3.2.3 Imaging

Upright or lateral decubitus abdominal radiographs may demonstrate pneumoperitoneum, though the sensitivity of this finding is less than 80% [46]. While in some cases such findings in themselves may be sufficient to proceed directly to laparotomy, in the absence of extreme hemodynamic instability and when at a center with rapid access to cross-sectional imaging, it is reasonable to obtain a CT scan to help rule out other sources of hollow viscus perforation and to help plan the operative intervention [50]. In the setting of perforation, a discrete tumor may not always be identifiable on CT imaging, but if a tumor is visible, adenocarcinoma will most often appear as a focal area of wall thickening. GISTs, on the other hand, will appear as exophytic masses with heterogeneous enhancement with or without ulceration, while lymphomas will appear with homogenous enhancement and may have clear lymph node involvement [50]. Even small bubbles of gas surrounding any mass suggests perforation, as does extravasation of an oral contrast agent [47]. Other findings suspicious for perforation include mesenteric fat stranding locally, bowel wall thickening, or bowel wall discontinuity [51]. Live fluoroscopic examination may be useful, but more time consuming than CT imaging, which has a sensitivity of 96% or greater for the diagnosis of hollow viscus perforation [52]. Albeit less sensitive, abdominal sonography may be useful in detecting free fluid [53].

#### 6.3.2.4 Management

Broad-spectrum antibiotics should be administered early as mortality in septic shock rises steadily for every hour delay in antibiotic administration [54]. The patient should be resuscitated promptly while awaiting definitive management. This should continue intraoperatively and not delay surgical intervention which, if possible, should involve resection of the tumor. However, the indications to resect in the setting of perforation may be limited, particularly with a mass of unknown pathology or in the setting of extraduodenal extension or distant metastasis. Even when technically feasible, malnutrition, hemodynamic instability, and organ dysfunction (e.g., worsening acute kidney injury) represent relative contraindications to a more extensive resection [55, 56].

Intraluminal content spillage and contamination must be controlled early, even though definitive management may be delayed for a subsequent intervention ("damage control") [57]. Definitive management of duodenal perforations can be achieved by primary closure and/or omental flap or patch (Cellan-Jones or Graham patch)

[58, 59]. This is traditionally done via laparotomy but is increasingly being done laparoscopically in those familiar with the technique and in stable patients [60]. When the tumor itself perforates, these approaches often fail as the tissue is tenuous and will not hold stitches. In this case, alternative surgical management is required, and exclusion and bypass may be necessary. Pyloric exclusion involves closing the pylorus (either internally through a gastrotomy or by stapling externally across) and restoring bowel continuity with a gastrojejunal bypass [58, 61]. There is little data supporting this technique in the setting of perforated malignancy, and the benefit of pyloric exclusion in traumatic injury has also been called into question [62]. Notwithstanding, the significant challenges associated with a perforated duodenal tumor sometimes necessitate creative solutions including closure, reinforcement with vascularized tissue, exclusion, bypass, or duodenal drainage [63]. The latter can sometimes be accomplished with placement of a distal jejunostomy tube directed retrograde accompanied by extraluminal drains around the perforated bowel segment. Additionally, in the setting of failed attempt at closure or patch of a duodenal leak, percutaneous transhepatic biliary drainage may be helpful to divert bile.

### 6.3.3 Duodenal Bleeding

#### 6.3.3.1 Presentation

Patients presenting with bleeding duodenal lesions may manifest similar signs and symptoms as those with any upper gastrointestinal bleed including those of simple peptic ulcers. They may present with a primary complaint of hematemesis and/or melena or experience symptoms of hypovolemia, such as lightheadedness. Most often, bleeding is slow, and occult and microcytic anemia is the only indication [64]. Melena is a somewhat sensitive sign, as it may reflect as little as 100 mL of luminal bleeding. Hematochezia may also be present, particularly if the bleed is brisk [53]. Importantly, patients may suffer an intraperitoneal or retroperitoneal duodenal bleed and never display findings of intraluminal blood [48]. Bleeding is a more common presenting symptom in patients with GISTs, as compared with other tumors [6].

#### 6.3.3.2 Physical Exam and Laboratory Findings

On examination, patients will often have painless bleeding with hematemesis, melena, or hematochezia per rectum as described above. If the hemorrhage is brisk, the patient will also demonstrate signs of hemorrhagic shock with signs of volume depletion, such as pallor and cool, clammy extremities [65]. Vital signs may reveal tachycardia with or without hypotension, depending on the class of shock [66, 67]. It is important to realize that hypotension may not manifest until 30% of the patient's blood volume has been lost, otherwise termed class III or IV hemorrhagic shock [67]. Urine output may be decreased [68]. Laboratory examination is likely to show a low hemoglobin, though it may be normal initially. Other laboratory evidence of ongoing bleeding may include acute kidney injury with increased creatinine and electrolyte derangements [65]. In the setting of an acute bleed, anemia will more

likely be normocytic, while in the setting of chronic low-grade bleeding, the anemia will be microcytic as with iron deficiency [68]. Additional laboratory abnormalities may include elevations in lactate, secondary to tissue hypoperfusion [67].

#### 6.3.3.3 Imaging

As in the case of any upper gastrointestinal bleed, diagnosis and management mostly occur in parallel. Often, the preferred initial maneuver (after resuscitation) is upper endoscopy, as this can be both diagnostic and therapeutic [53]. Alternatively when endoscopy is not available or bleeding is too profuse to allow proper endoscopic visualization, CT angiography (CTA) is a rapid and often very accessible option. Though not the traditional first-line investigative option, CTA sensitivity and positive predictive value have improved, and this may be a reasonable place to start in the absence of other options [53]. In this context, oral contrast (i.e., Gastrografin) should be avoided in favor of intravenous contrast alone [69]. The sensitivity of CTA in gastrointestinal bleeds is about 50%, with a slightly greater sensitivity for acute as opposed to chronic bleeds [70]. Data on tumor hemorrhage in particular is sparse, but for all GI bleeds, a minimum hemorrhage rate of 0.3–0.5 cc/min is required for CTA detection [71]. Other modalities for detection of upper GI bleeding include visceral angiography, which also detects bleeding at the same rates [72], and nuclear scintigraphy, which is significantly more sensitive (minimum bleeding rate detection at 0.02–0.05 cc/min) but not offering much utility in the setting of a bleeding duodenal mass that is likely visible on endoscopy [73].

#### 6.3.3.4 Management

As with any GI bleed, the first priority is prompt evaluation of hemodynamic status, remembering that the airway may be in jeopardy in the patient with active hematemesis and may need to be secured prior to further management. Particularly in the setting of acute hemorrhage and significant volume loss, ensuring adequate intravenous access is essential to allow for resuscitation [53, 64]. Importantly, there is some evidence that a restrictive transfusion strategy (transfusion trigger 7 g/dL) is associated with better outcomes than a liberal transfusion strategy (9 g/dL), even in upper GI bleeding patients [74]. Another randomized study demonstrated similar outcomes between transfusion thresholds of 8 g/dL and 10 g/dL, suggesting that at a minimum, a restrictive strategy may be safe [75]. For patients in acute hemorrhagic shock, permissive hypotension may result in less blood products transfused and may confer a survival benefit [76]. Coagulopathy should be corrected promptly. There is controversy regarding the use of tranexamic acid (TXA) in the setting of upper GI bleeding. Though there have been meta-analyses suggesting some benefit for GI bleeding in general (upper and lower, primarily upper in the included studies) [77, 78], the HALT-IT trial, an international, randomized, placebo-controlled trial in upper GI bleeds, found no benefit [79].

After stabilization, the primary goal should be nonoperative management of acute bleeding, in an attempt to temporize and ultimately plan an elective definitive operation (if indicated) [61]. As noted above, the first step in this process should be an upper endoscopy, not only to identify the site of bleeding but also to attempt to

achieve hemostasis through the use of endoscopic clipping, submucosal epinephrine injection, cautery, or application of topical hemostatic agents [61, 80].

Endoscopic management of recurrent duodenal tumor hemorrhage can be entertained, but no data exists to support or recommend it. One might, however, extrapolate from bleeding ulcer data, which suggests that repeated attempts at endoscopic management may be beneficial [81]. When the bleeding surface has high-risk features (i.e., exposed vessel) or when there is a diffuse area of devitalized necrotic tissue, trans-arterial embolization may be the more ideal method for definitive bleeding control [61, 82, 83]. It is worth noting that, although rebleeding rates are high, in the short term, bleeding often either stops with endoscopic intervention or is self-limited [84]. This gives providers time to develop more appropriate long-term strategies, which may include up-front surgical resection in oncologic fashion or neoadjuvant treatment, which may in itself help ameliorate bleeding [85]. In the case of unresectable tumors, nonoperative management strategies may help with both tumor shrinkage and palliation of bleeding. These may include imatinib for GISTs [86] or radiation for other malignancies [87].

## 6.4 Special Considerations

### 6.4.1 Metastatic Disease

In certain cases, the surgical emergency may be the index presentation of the patient's malignancy. In some, gross metastatic disease may be readily apparent, either on preoperative imaging or intraoperatively. Surgical management of the acute issue should not deviate from the approaches described above in the face of metastatic disease. Bleeding must be controlled, perforation must be managed, and obstruction must be relieved. However, the presence of metastatic disease warrants an up-front goal-of-care discussion and might favor less invasive modalities for definitive management. For example, an obstruction that might have been manageable with a distal gastrectomy might be better managed with a gastrojejunostomy or a duodenal stent [25, 42, 43]. As discussed above, bleeding may better be managed directly with angioembolization [82, 83]. Perforation, in many cases, will mandate operation regardless of cancer stage; however, every attempt should be made to limit intervention in cases when operation is not expected to prolong life [61].

## 6.5 Anatomic Considerations

### 6.5.1 Involvement of the Ampulla

Surgical emergencies of the duodenum may be complicated by involvement of the ampulla of Vater. In cases of tumor bleeding or perforation involving the ampulla or periampullary duodenum, the approach should be the same as for metastatic disease. Less invasive or complex options are preferred, as outcomes from emergent

pancreaticoduodenectomy are poor, with perioperative mortality that varies by indication but may be as high as 20% and a complication rate of 90% [88, 89]. In the case of bleeding, endoscopic or interventional radiology management should be used, and in the case of perforation, exclusion and bypass should be favored over oncologic resection [61].

Decision-making may be slightly more complex in the case of an obstructing ampullary tumor, mandating some attention to the bile duct. Indeed, as described earlier, biliary obstruction is a common presentation of duodenal and pancreatic head malignancies, with 70% of pancreatic cancers presenting with jaundice [90, 91]. As noted above, both duodenal stents [92] and biliary stents [91] are well-accepted options if the tumor is unresectable (Fig. 6.4).

### 6.5.2 Enteric Access

If in the operating room for one of the above surgical emergencies, one should consider placing enteral access (i.e., jejunostomy tube) prior to closing the laparotomy. This is particularly true for the patient undergoing operation for duodenal obstruction as there is a significant incidence of delayed gastric emptying after palliative gastrojejunostomy [93]. This evidence has been used by some to advocate the use of stenting over gastrojejunostomy [94, 95], but in cases where the decision has already been made to perform an operation, a jejunostomy tube may make sense. On the other hand, more recent literature suggests important morbidity from prophylactic jejunostomy tube placement [96], both following pancreaticoduodenectomy [97, 98] and after resection for gastric cancer [99]. It is unclear, however, whether these data make a legitimate argument against jejunostomy tube placement once already in surgery, as there may be confounding by indication in that surgeons may opt to place a tube in sicker and more frail patients. The issue remains controversial, but there is likely a population of patients for whom a feeding jejunostomy should be considered.

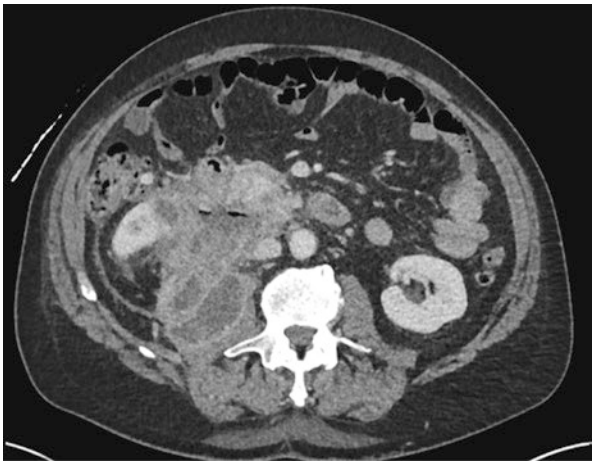

**Fig. 6.4** 64-Year-old male with duodenal GIST encasing the kidney and inferior vena cava who subsequently underwent gastrojejunostomy and pyloric exclusion

### 6.5.3 Goals of Care

Patients presenting with duodenal surgical emergencies are at high perioperative risk and are often found to have advanced disease. In general, emergency surgery carries a significantly greater mortality (12.5% vs. 2.7%) and morbidity (32.8% vs. 12.7%) risk than elective general surgery [100]. Data on oncologic surgical emergencies is limited, but these risks are likely even higher in patients with malignancies [101]. Beyond the perioperative phase, one must also consider the patient's long- and short-term prognosis prior to undertaking surgical intervention. Adequate communication regarding goals of care with the patient and his/her loved ones prior to major surgery has long been problematic [102], particularly in emergency surgery [103], but is of utmost importance [104]. A frank preoperative discussion should occur between the surgeon, patient, oncologist when possible, and family where the risks, prognosis, and goals of care are explicitly stated and all questions answered.

## 6.6 Conclusion

A variety of duodenal malignancies may present with obstruction, perforation, or bleeding, requiring prompt resuscitation and consideration of operative or nonoperative interventions. While general principles are largely similar to those applicable in non-oncologic emergency surgery, the extent of disease, prognosis, preexisting conditions and nutritional status, long-term treatment plan, and the patient's goals of care may complicate decision-making. Careful consideration will be needed to proceed to optimal surgical care individualized to the patient, the tumor, and the complication.

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