



Limited distal duodenal resection: Surgical approach and outcomes. A case series[☆]



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ABSTRACT

Introduction: Tumours involving the duodenum are usually treated with pancreaticoduodenectomy, which may be associated with considerable morbidity. Limited distal duodenal resection, a relatively smaller procedure, can be done in some of these patients. We describe our experience with this operation for such lesions.

Methods: We retrospectively analyzed, from prospectively collected data 10 consecutive patients who underwent limited duodenal and proximal jejunal resection between March 2011 and Nov 2015.

Results: There were 8 males and 2 females who had a median age of 47 years. Their common presentations were abdominal pain (50%) and upper gastrointestinal bleeding (40%). Five had malignancy (adenocarcinoma: 2, neuroendocrine tumours: 2, non Hodgkin's lymphoma 1). Three had gastrointestinal stromal tumours (GISTs) and 2 had other benign tumours (lipoma 1, ectopic pancreas 1). The 30-day post-operative morbidity rate was 60% (n = 6) with mostly minor complications (Clavien grade 1 or 2). Median post-operative stay was 9 (range, 6–13) days. All ten patients were alive without recurrence after a median follow up of 26.5 months.

Conclusion: Limited distal duodenal resection is a feasible surgical alternative to a pancreaticoduodenectomy in carefully selected patients with benign and some malignant tumours of the third and fourth part of the duodenum.

1. Introduction

Resection of the duodenum with pancreaticoduodenectomy and bilioenteric, pancreaticoenteric and gastroenteric reconstruction still has a considerable morbidity (30–50%) [1]. Limited duodenal resection is an alternative to pancreaticoduodenectomy for benign and some malignant tumours of the duodenum with the hope of decreasing morbidity and achieving equivalent oncological outcomes [2–5,7–15]. Duodenal adenocarcinoma accounts for 45% of small bowel adenocarcinomas and 0.4% of all gastrointestinal malignancies [6]. The role of limited duodenal resection for malignant tumours of third (D3) and fourth (D4) part of duodenum without pancreatic and ampullary involvement has been evaluated in some recent studies [9,10,13,14]. We studied our experience with limited resection of the duodenum for selected malignant and benign distal duodenal and proximal jejunal tumours.

2. Methods

We retrospectively analyzed prospectively collected data of all patients who underwent limited resection of the duodenum from March 2011 to March 2016 in our unit. Ten patients underwent limited resection of the duodenum for tumours of its third and fourth part or the proximal jejunum. A limited resection of the duodenum i.e. either local wedge excision or segmental duodenectomy with duodenojejunal anastomosis with preservation of the pancreas was performed by a surgeon with at least five years experience in gastrointestinal surgery in a tertiary care academic institute. The patients' demographic data, clinical history, peri-operative details, post-operative outcomes (morbidity and 30 day mortality) and histopathological data were evaluated. Patients who underwent endoscopic excision, emergency surgical procedures, *trans*-duodenal ampullectomy/polypectomy or pancreatico-duodenectomy were excluded from the study. We have reported this work in line with the standard “preferred reporting of case series in surgery” (PROCESS) criteria [16].

[☆] This work has been reported in line with the PROCESS criteria.

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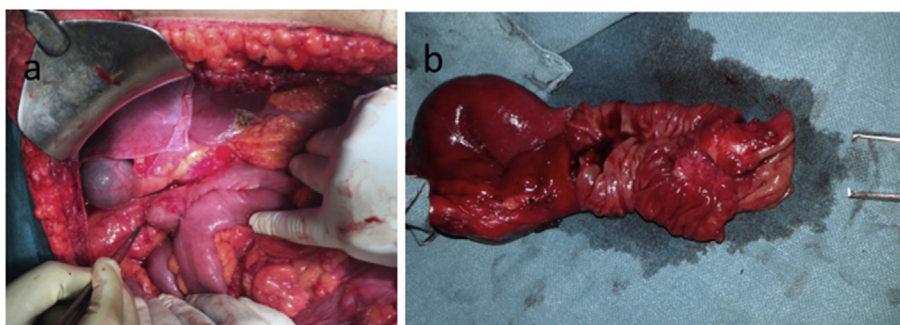


Fig. 1. Intra-operative photos showing a) side-to-side duodenojejunal anastomosis after segmental duodenectomy and mobilization of duodenojejunal flexure in case no.5 (Forcep pointing towards proximal duodenal stump) and b) cut and open specimen of the duodenum and proximal jejunum in the same patient showing tumour in distal part of the duodenum.

2.1. Surgical technique

The surgical technique consisted of Kocherization of the duodenum along with the Cattell and Braash maneuver followed by mobilization of the ligament of Treitz [9]. The whole of the small bowel, ascending colon and proximal transverse colon were retracted cranially to expose the duodenojejunal junction. This junction was then mobilized dividing the ligament of Treitz. The jejunum was passed to the right side below the superior mesenteric vessels. Depending upon the location of the tumour, dissection of the third part of the duodenum from the uncinate process of the pancreas was carried out. Small and benign tumours were managed by wedge resection of the duodenum. T-tube stents were inserted depending upon the proximity of the resection margin to the ampulla. We did intra-operative endoscopy in two patients, one with a D3 adenocarcinoma to identify the ampulla and the other with a duodenal lipoma to rule out other lesions. Reconstruction was done by a gastrojejunostomy (with closure of the duodenal defect) in two patients, and side-to-side duodenojejunal anastomosis (Figs. 1 and 2) in the rest. A feeding jejunostomy (FJ) was added depending upon the pre-operative and intra-operative assessment.

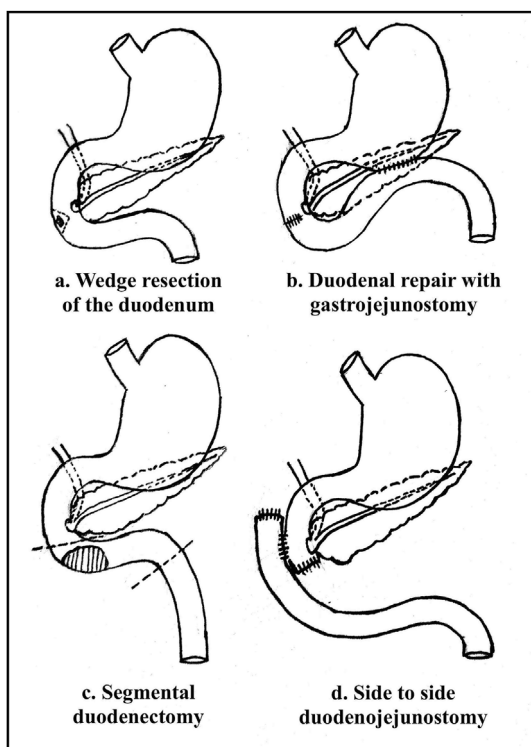


Fig. 2. Schematic diagram showing techniques of limited distal duodenal resection.

3. Results

3.1. Demographics and operative details

The characteristics of the 10 patients are shown in Tables 1 and 2. There were 8 males and 2 females, who had a median age of 47 years (range, 35–70). The most common clinical presentations were abdominal pain ($n = 5$, 50%), and upper gastrointestinal bleeding (melaina $n = 4$, 40%), followed by vomiting ($n=3$, 30%). The diagnosis was a gastrointestinal stromal tumour (GIST) in 3 (30%); primary duodenal adenocarcinoma in 2 (20%); neuroendocrine tumour in 2 and duodenal and proximal jejunal non Hodgkin's lymphoma (NHL), lipoma of the duodenum with duodenal diverticulum and ectopic pancreatic tissue in the wall of D3 part of the duodenum in one each. Eight patients underwent segmental duodenal resection and the rest had excision of a small wedge of the duodenal wall. The patient with a NHL required en bloc resection of the proximal jejunum, fourth part of duodenum and splenic flexure of the colon for a large tumour involving all these structures.

The median duration of surgery was 245 (range, 90–300) minutes (Table 3). The median intra-operative blood loss was 240 (range, 100–500) ml. Four patients who had presented with upper gastrointestinal bleeding required peri-operative blood transfusion of anaemia.

3.2. Morbidity

Postoperative morbidity was graded as per Clavien Dindo classification (grade I minor deviation from normal postoperative course, grade II complications requiring therapeutic drugs outside of those allowed in grade I, grade III requiring surgical, endoscopic or radiological intervention, grade IV life threatening complications) [17]. Complications occurred in 6 (60%) patients, grade 1 or 2 in 5 (50%) patients and Clavien Grade IV in 1 (10%) patient who developed lower respiratory infection with respiratory distress requiring ICU stay. Delayed gastric emptying (DGE) was seen in six (60%) patients. Grade A and B DGE was seen in two (33.3%) and four (66.6%) patients respectively. There were no other complications. An oral gastrograffin follow through study was done between post-operative day 4 and 7 in all patients except the one with respiratory distress who underwent contrast enhanced computed tomography (CECT) to confirm the anastomotic integrity. One patient had mechanical obstruction due to narrowing at the FJ site. DGE improved with conservative management in all patients with a high nasogastric aspirate. There was no anastomotic leak. The median post-operative hospital stay was 9 days (range, 6–13 days).

3.3. Follow up and outcomes

All patients had R0 resections. All three patients with GISTs had low risk features for recurrence and did not receive any adjuvant treatment. Both patients with adenocarcinoma received adjuvant chemotherapy. They were asymptomatic and free of recurrence at a follow up duration

Table 1
Clinicopathological data of the patients.

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10
Age (Years)	52	70	40	43	52	37	35	44	50	58
Sex	M	F	M	M	M	M	M	M	F	M
Symptoms	Upper GI bleed	Upper GI bleed	Abdominal pain	Upper GI bleed	Abdominal pain, Vomiting and fever	Upper GI bleed	Abdominal pain, recurrent fever, vomiting	Abdominal pain	Vomiting	Abdominal pain
Comorbidities	HTN	HTN, CLD	None	CLD	None	None	HIV	None	None	None
ASA score	II	III	II	II	I	I	III	I	I	I
Preoperative Diagnosis	Tumour on D2 & D3	Tumour D3 with duodenal diverticulum	Tumour D4	Tumour D4	Adenocarcinoma D3	Tumour D4	Proximal jejunal tumour	Multilocular cystic lesion of DJ flexure	Adenocarcinoma of D4	Neuroendocrine tumour D3 with lymph nodal mass
Tumour Size (cm)	3.5 × 3	11 × 1.5	3 × 2	4 × 2	4 × 2	4 × 2	8 × 6	11 × 10	3 × 2	2 × 2
No. of segments resected	0	1	1	1	2	0	1	1	2	2

Acronyms: CLD: Chronic liver disease, D2: second portion of the duodenum, D3: third portion of duodenum, D4: fourth portion of duodenum, DJ: Duodenojejunal flexure, HTN: systemic hypertension, HIV: Human immunodeficiency virus, M: Male, F: Female.

of 47 months and 6 months respectively. All ten patients are alive at a median follow up period of 26.5 (range, 3–58) months.

Two patients had nonfunctioning duodenal neuroendocrine tumours. One of the patients with a neuroendocrine tumours had metastasis in a single lymph node while another patient had metastasis in a single liver nodule as well in one out of twelve lymph nodes resected and both the patients were asymptomatic at a follow up of 29 and 3 months respectively. The patient with a NHL had presented with upper gastrointestinal bleeding with a large mass in the upper abdomen. Preoperative biopsy was suggestive of a granulomatous inflammation. Postoperative histopathological analysis however showed a diffuse large B cell type NHL with CD 20 and leucocyte common antigen (LCA) positive tumour cells. The patient received chemotherapy postoperatively and was recurrence free at 45 months of follow up. The two patients with an ectopic pancreas in the duodenum and a duodenal lipoma were asymptomatic at follow up of 24 and 52 months respectively.

4. Discussion

The duodenum has a complex anatomy with its retroperitoneal location adjacent to major vascular structures and therefore, duodenal resection is a surgically challenging procedure. Limited resection for duodenal tumours can be divided into a pancreas sparing total or subtotal duodenectomy, pancreas sparing proximal duodenectomy and a pancreas sparing distal duodenectomy [7]. A pancreas sparing subtotal duodenectomy involves resection of the whole duodenum except the gastric pylorus and the duodenal bulb. A pancreas sparing proximal duodenectomy entails resection of the first and proximal second portion of the duodenum while in distal duodenectomy the third, fourth and distal second portion of the duodenum are resected [7].

Limited resection of the distal duodenum may entail either a local wedge resection or segmental resection. Our protocol for evaluation and management of patients with distal duodenal pathology is briefly presented in Fig. 3. If a duodenal pathology is suspected on clinical examination, we perform detailed upper gastrointestinal endoscopic examination including side-viewing endoscopy and endoscopic ultrasound as indicated along with cross sectional imaging with multi-detector CECT (Fig. 4). In patients with obvious involvement of the major duodenal papilla, we perform pancreaticoduodenectomy after thorough assessment for ruling out metastatic disease. If the major duodenal papilla is free or if there is ambiguity after imaging and endoscopic evaluation, we do thorough surgical assessment including intra-

operative endoscopic evaluation. For small benign tumours of the third and fourth part of duodenum with adequate residual lumen after resection, we perform wedge resection of the lesions with duodenal repair. The defect after a wedge resection may be closed primarily, by applying jejunal patch or with a Roux en Y duodenojejunal anastomosis [8,14]. It is our practice to perform the gastrojejunostomy in such patients to minimize the effects of small duodenal leak and stenosis. For benign tumours of second part of the duodenum, we perform wedge resection only if adequate margin of resection without threatening the major papilla can be achieved. We do segmental duodenal resection for selected malignant distal duodenal and duodenojejunal flexure tumours as well as benign tumours in which wedge resection will likely cause duodenal narrowing. An extended Kocher maneuver with full mobilization of the duodenum and proximal jejunum is important for creation of a tension free duodenojejunal anastomosis. We used the Cattell and Braash maneuver for distal duodenal exposure in 8 out of ten patients in our series and we feel it is extremely useful for this purpose as has also been described previously [9,10].

Although a duodenojejunal anastomosis may be performed in an end-to-end, side-to-side or an end-to-side fashion [10,11], we prefer a side-to-side duodenojejunal anastomosis. Dorcaratto et al. [13] reported more complications and longer postoperative stay in patients with end to side compared to end-to-end anastomoses. There are limited studies to address this issue, and hence definitive conclusions regarding choice of anastomotic technique cannot be drawn [10–13].

The median operative time and blood loss (245 min and 240 ml respectively) in our study were lower compared to most of the previously reported series (range of 130–300 min and 160–1100 ml respectively) [9,10,12,13]. DGE (60%) was the most common postoperative complication. Although anastomotic leak, bleeding and postoperative pancreatitis, have been reported in patients undergoing limited duodenal resection, we did not encounter these complications [13,14].

Surgical resection is the only curative treatment for GISTs and a limited duodenal resection is a good option for duodenal GISTs [15]. These tumours are usually well encapsulated, lymphatic spread is rare and a small margin of clearance is sufficient [18,19]. Routine lymphadenectomy is not recommended for GISTs unless the lymph nodes are grossly involved [11]. Even though the literature on limited duodenal resection describes only small numbers of patients, equivalent disease free and overall survival have been reported with limited duodenal resection as compared to pancreaticoduodenectomy [4,5,11,13]. Our results show that the limited resection of duodenal

Table 2
Operative data and postoperative outcomes.

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10
Operating time (minutes)	90	270	250	195	240	120	300	255	200	160
Blood loss (ml)	100	200	100	250	400	100	500	300	230	400
Surgery	WR + GJ + FJ	SD + DJ	SD + DJ	SD + DJ + FJ	SD + DJ + FJ	WR + GJ + FJ	Enbloc SD + LHC + DJ + FJ	SD + DJ + FJ	SD + DJ	SD + DJ + FJ
Post-operative stay (Days)	10	6	6	6	9	6	10	9	13	10
Post operative complications	DGE Grade B	DGE Grade A	No	No	No	No	LRTI, ICU stay, DGE Grade B	DGE Grade A	DGE Grade B	DGE Grade B
Histopathology	GIST CD117 + Ki67 < 2%	Lipoma	Heterotrophic pancreas	GIST CD117 +, CD34 + Ki67 < 1%	Moderately differentiated adeno-carcinoma	GIST CD117 + Ki67 < 1%	Large B cell NHL CD 20 + LCA +	Grade 1 NET Ki67 < 3% LN metastases	Moderately differentiated adeno-carcinoma	Grade 1 NET Ki67 < 3% LN and Liver Metastases.
Adjuvant therapy	No	No	No	No	Chemo therapy	No	Chemo therapy	No	Chemo therapy	No
Follow up (months)	58	52	24	14	4	3	45	29	47	3

Acronyms: CD: clusters of differentiation, DJ: duodenojejunosotomy, DGE: delayed gastric emptying, FJ: Feeding jejunostomy, GJ: Gastrojejunostomy, GIST: Gastrointestinal stromal tumours, LCA: Leucocyte common antigen, LHC: Left hemicolectomy, LN: lymph node, LRTI: Lower respiratory tract infection, NHL: non Hodgkin Lymphoma, SD: segmental duodenectomy, WR: wedge resection.

Table 3
Preoperative data and postoperative outcomes.

		n = 10
Age		35-70 years (median 47)
Sex	Male	Female
	8	2
Presentation	Pain in abdomen	5 (50%)
	UGI bleeding	4 (40%)
	Vomiting	3 (30%)
Surgery done	SD + DJ + FJ	4
	SD + DJ	3
	Enbloc	
	SD + LHC + DJ + FJ	1
	WR + GJ + FJ	2
Duration of surgery		90–300 min (median 245 min)
Blood loss		100-500 ml (median 245 ml)
Complications		6 (60%)
1.DGE		6 (60%)
Grade A		2 (33.3%)
Grade B		4 (66.6%)
2. LRTI		1 (10%)
Length of stay		6-13 days (median 9 days)
Follow up		3-58 months (median 26.5 months)

Acronyms: DJ: duodenojejunosotomy, DGE: delayed gastric emptying, FJ: feeding jejunostomy, GJ: Gastrojejunostomy, LHC: Left hemicolectomy, LRTI: lower respiratory tract inflammation, SD: segmental duodenectomy, WR: wedge resection.

GISTs is a feasible option and good long-term disease free survival can be achieved.

Adenocarcinoma involving the fourth part of duodenum and proximal jejunum can also be treated with a limited duodenal resection. In a study by Onkendi et al. [14] even though the average lymph nodes sampled in segmental duodenectomy group were 8 compared to 12 in the pancreaticoduodenectomy group, there was no survival difference between the two groups. Also, a couple of other studies have reported similar survival outcomes and negligible morbidity with limited duodenal resection in patients with duodenal adenocarcinoma involving the distal part of the duodenum [9,20]. These reports and our study show that the limited distal duodenal resection can be a feasible option for malignant distal duodenal tumours with comparable survival outcomes to pancreaticoduodenectomy [9,14,20].

Duodenal neuroendocrine tumours account for 2–3% of all gastrointestinal neuroendocrine tumours [21]. As indicated in few previous reports, our study also found that these tumours can be managed by limited duodenal resection with satisfactory long-term survival rates even in the presence of lymph node metastases [22,23].

4.1. Limitations

The rarity of patients with disease amenable to this surgical procedure limits the size of our study. However our data, documents the feasibility and safety of performing a limited duodenal resection for benign and selected malignant tumours of the distal duodenum. A well-designed prospective study is needed to establish the oncological equivalence of this procedure to pancreaticoduodenectomy in patients with distal duodenal adenocarcinoma.

5. Conclusion

Limited duodenal resection is a feasible option for selected patients with tumours involving the distal duodenum and/or proximal jejunum with good short-and long-term outcomes.

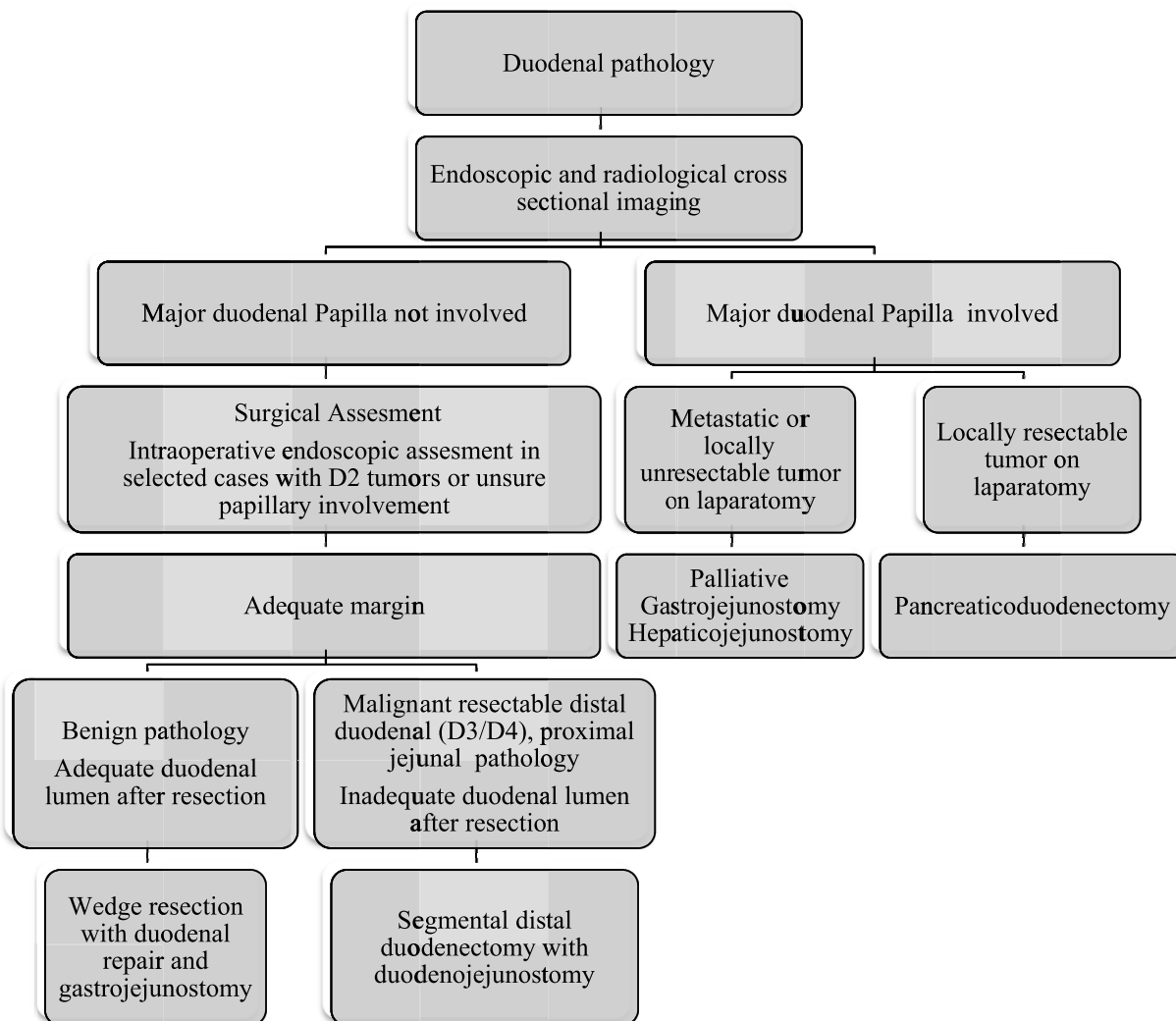


Fig. 3. Algorithm for evaluation and management of distal duodenal pathology.

Ethical approval

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Author contribution

- 1) Ankush Golhar: Study design and planning, data acquisition, clinical work, drafted the manuscript.
- 2) Vivek Mangla: Study design and planning, clinical work, data acquisition, manuscript revision.
- 3) Siddharth Mehrotra: Data acquisition, clinical work and drafted the manuscript

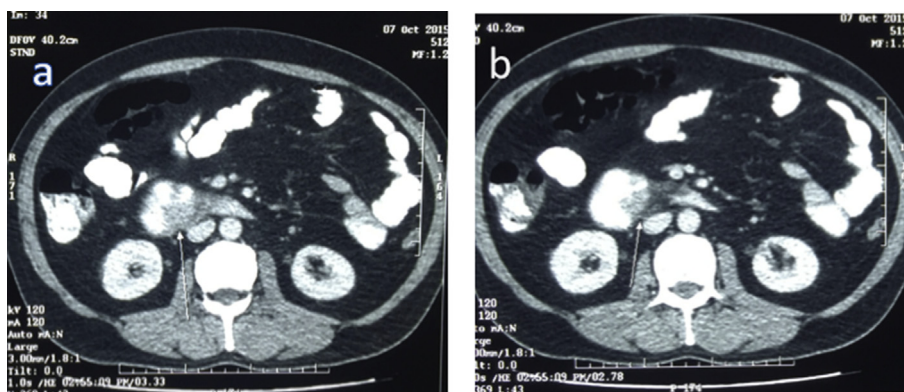


Fig. 4. Computed tomography images in case no. 5 showing growth in the third part of duodenum (Arrows pointing towards growth).

- 4) Shailendra Lalwani: Data acquisition, Clinical work and manuscript revision
- 5) Naimish Mehta: Data acquisition, Clinical work and manuscript revision
- 6) Samiran Nundy: Design of work, clinical work and manuscript revision.

Conflicts of interest

None.

Research registration number

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Guarantor

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