

Resection of the Uncinate Process of the Pancreas – An Exceptional Alternative to Pancreaticoduodenectomy for Non-Enucleable Benign and Low-Grade Malignant Tumors of the Uncinate Process. Surgical Technique, Case Report and Literature Review

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Rezumat

Rezecția procesului uncinat al pancreasului – alternativă de excepție la duodenopancreatectomia cefalică pentru tumorile benigne și cu grad scăzut de malignitate non-enucleabile ale procesului uncinat.

Tehnica chirurgicală, prezentare de caz și recenzie a literaturii de specialitate

Tumorile situate în procesul uncinat al pancreasului sunt rezecate în mod tradițional prin duodenopancreatectomie cefalică (DPC), o procedură chirurgicală cu morbiditate ridicată și rate de mortalitate ce nu pot fi neglijate. Astfel, pentru cazuri selectate de tumori benigne și cu grad scăzut de malignitate, au fost propuse rezecții pancreatice mai conservatoare. În acest articol, descriem tehnica de rezecție a procesului uncinat al pancreasului (RPU) la o pacientă în vârstă de 64 de ani, diagnosticată cu o tumoră neuroendocrină bine diferențiată, cu evoluție postoperatorie imediată simplă. În plus, a fost efectuată o căutare bibliografică cuprinzătoare în bazele de date pentru a identifica lucrări referitoare la indicațiile și rezultatele RPU. În concluzie, RPU reprezintă o alternativă fezabilă și sigură, totuși de excepție la DPC pentru pacienți atent selectați cu tumori benigne sau cu grad scăzut de malignitate ale procesului uncinat, eliminând povara mortalității postoperatorii și a insuficienței endocrine și exocrine asociate cu DPC. Cu toate acestea, RPU este o procedură chirurgicală complexă care necesită cunoștințe precise ale anatomiei pancreasului. Având în vedere numărul limitat de pacienți raportați cu RPU, sunt necesare studii suplimentare pentru a confirma beneficiile reale ale acestei tehnici complexe.

Cuvinte cheie: rezecția procesului uncinat, uncinatectomie, pancreatctomie ventrală, chirurgie cu prezervarea pancreasului, patologie pancreatică benignă, patologie pancreatică cu grad scăzut de malignitate, duodenopancreatectomie cefalică

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Abstract

Tumors located in the uncinata process of the pancreas are traditionally resected by pancreaticoduodenectomy (PD), a surgical procedure that carries high morbidity and non-negligible mortality rates. Thus, for selected cases of benign and low-grade malignant tumors, more conservative pancreatic resections were proposed. Hereby, we describe the technique of resection of the uncinata process of the pancreas (RUP) in a 64-year-old female patient diagnosed with a well-differentiated neuroendocrine tumor, with an uneventful early postoperative outcome. Furthermore, a comprehensive literature search across databases was conducted to identify papers on the indications and outcomes of RUP. In conclusion, RUP is an exceptional yet feasible and safe alternative to PD for carefully selected patients with non-enucleable benign or low-grade malignant tumors of the uncinata process, eliminating the burden of postoperative mortality and long-term endocrine and exocrine insufficiency associated with PD. However, RUP is a complex surgical procedure that requires precise knowledge of the pancreas anatomy. Considering the limited number of patients reported with RUP, further studies are needed to confirm the real benefits of this challenging technique.

Keywords: resection of the uncinata process, uncinatotomy, ventral pancreatectomy, pancreas-preserving surgery, benign pancreatic pathology, low-grade malignant pancreatic pathology, pancreaticoduodenectomy

Introduction

Tumors located in the uncinata process of the pancreas are traditionally resected by pancreaticoduodenectomy (PD). However, PD represents a complex surgical procedure that is widely considered to have high morbidity rates and non-negligible mortality rates. Thus, severe morbidity rates after PD vary between 20.3% and 31.5% (1-3), while postoperative 90-day mortality may reach 11% (4). Furthermore, the long-term functional consequences of PD are also a significant concern, particularly the morbidities related to postoperative endocrine and exocrine insufficiencies. Thus, long-term survivors after PD can be affected by functional impairment and the reduction of quality of life, as endocrine and exocrine insufficiency rates after PD are pretty high: 43% - 51.6% and 87.5% - 100%, respectively (5,6). The long-term functional consequences of PD are of particular interest for pancreatic pathologies with expected prolonged survival after surgery. At the same time, a few specific pathologies of the uncinata process, such as benign and low-grade malignant pancreatic pathology, where systematic loco-regional lymph node dissection is not mandatory, may benefit from pancreas-sparing alternative surgical procedures to PD (7-13); for the above-mentioned pathologies located in the uncinata process, in selected cases, enucleation or resection of the uncinata process of the pancreas (RUP) is a viable alternative, when appropriate. Nevertheless, in a few cases of tumors located in

the uncinata process of the pancreas, negative resection margins cannot be achieved by enucleation. In these particular cases, RUP represents the single parenchyma-sparing alternative to PD (12).

Herein, we describe the RUP technique and review the indications and outcomes of previously published similar cases.

Case Report

A 64-year-old female patient, with a medical history of cholecystectomy for lithiasis (20 years ago) and arterial hypertension, was investigated for recurrent episodes of upper abdominal pain and recent weight loss. Laboratory studies showed no abnormalities, including CA 19-9 levels. The contrast-enhanced computed tomography scan showed a hypervascular lesion measuring 27 x 19 mm within the uncinata process of the pancreas, with no other abnormalities (*Fig. 1*). Magnetic resonance imaging confirmed the presence of the lesion in the pancreas (*Fig. 2*). Furthermore, an endoscopic ultrasound was performed with fine needle biopsy showing a neuroendocrine G1 tumor, with Ki67 of 2%.

With the diagnosis of neuroendocrine tumor of the uncinata process of the pancreas, the patient was referred for surgery in April 2025. The indication for surgery was made based on the persistent pain symptoms, recent weight loss, and tumor diameter of more than 20 mm. The initial preoperative plan was to perform either a pancreatic enucleation or a PD, depending on the intra-

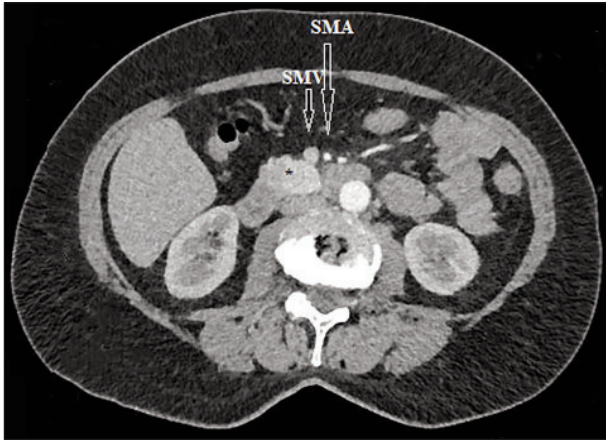


Figure 1. Contrast-enhanced axial computed tomography scan in arterial phase showing a 27 x 19 mm hypervascular, well-circumscribed tumor (*), with smooth margins, in the uncinata process of the pancreas, displacing but not invading the superior mesenteric vein (SMV); the superior mesenteric artery (SMA) is at a distance from the tumor.

operative aspects, including achievement of negative resection margins.

Surgical Technique

A vertical midline incision was made, followed by abdominal exploration and full mobilization of the pancreatic head with the duodenum (Kocher maneuver). The root of the transverse mesocolon and the further uncinata process were exposed, quite similar to an uncinata-first approach PD (14). The uncinata process with the tumor was dis-

sected from the superior mesenteric vein, with careful ligations of the draining veins, and also from the duodenum. Both the anterior pancreaticoduodenal arcade and the inferior pancreaticoduodenal artery were carefully spared. A complete RUP was preferred over simple enucleation, as enucleation alone would not ensure negative resection margins. RUP was performed using bipolar electrocautery, following a transection plane parallel to the Wirsung duct, with careful ligation of the vessels to the remaining pancreatic head and duodenum using 4/0 polypropylene sutures. A hemostatic sealant was placed in the remnant cut surface of the pancreatic head, and two drains were left in place at the resection site (*Fig. 3*). The operative time was 120 minutes, considering also associated viscerolysis for adherence from a previous open cholecystectomy. Intraoperative blood loss was minimal (50 mL).

Postoperative Management and Outcomes

The patient received subcutaneous injections of the somatostatin analog octreotide, both intra- and postoperatively (200 micrograms, three times daily for up to 7 days). The postoperative course was uneventful; the patient was discharged on postoperative day 10.

The final pathological examination of the operative specimen revealed a 25 x 20 mm well-defined and encapsulated tumor of the uncinata process of the pancreas (*Fig. 4*), with a histopathological and immunohistochemical diagnosis of a

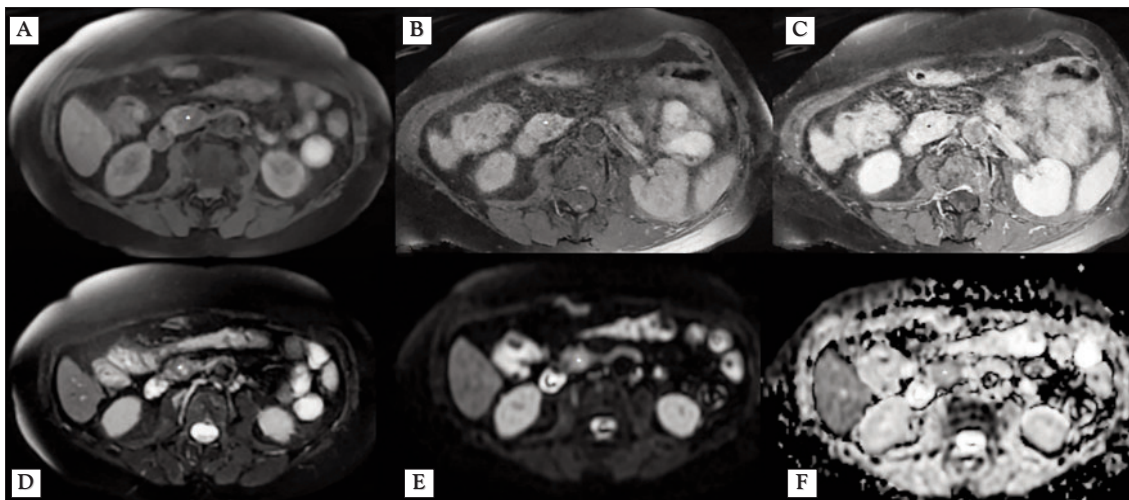


Figure 2. Magnetic resonance imaging showing a nodular lesion of the uncinata process of the pancreas measuring 22 x 21 mm, with a hypointense signal in T1-weighted images (A–C), a discrete hyperintense signal in T2-weighted images (D), gadophylic (c), with light restricted diffusion (E–F).

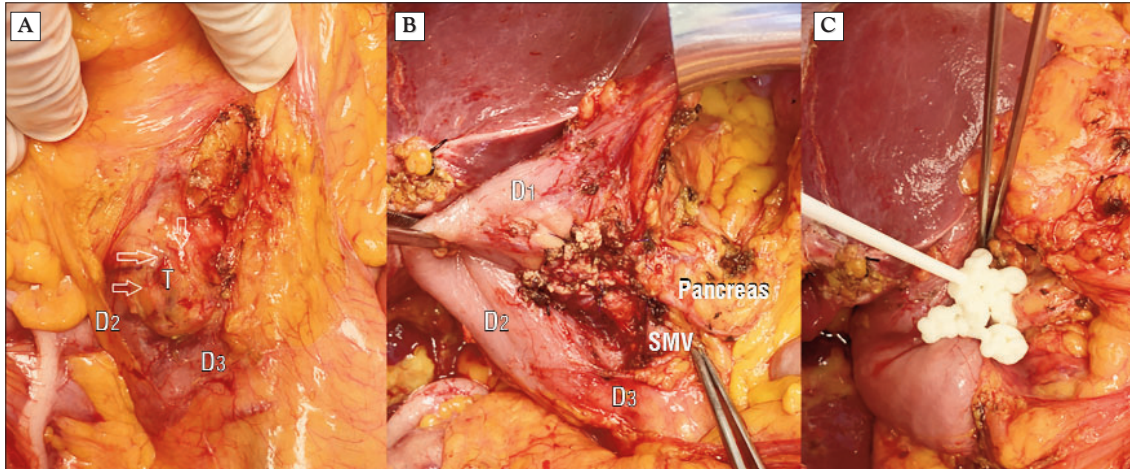


Figure 3. Intraoperative aspects (A) before the resection of the uncinata process, showing the tumor (T) (the arrows mark the delimitation of the tumor from the normal pancreas; D2 – duodenum 2; D3 – duodenum 3; MCV – middle colic vessels); (B-C) after the resection of the uncinata process, showing postoperative aspects, including using hemostatic agents (C) (D1 – duodenum 1; D2 – duodenum 2; D3 – duodenum 3; SMV – superior mesenteric vein).

well-differentiated (G1) neuroendocrine tumor, pT2, pN0, with a Ki-67 Index of 1-2%. Large negative resection margins were also obtained. It is worth mentioning that the removal of lymph nodes of the posterior surface of the pancreatic head reveals no metastatic disease.

At 8 months after surgery, the patient remains symptom-free with no clinical signs of pancreatic exocrine insufficiency, endocrine pancreatic insufficiency, or imaging signs of disease recurrence.

However, magnetic resonance imaging at 3 months after surgery revealed an asymptomatic 65 x 40 mm postoperative pseudocyst, which was conservatively managed and reduced to 35 x 30 mm at 8 months after surgery (Fig. 5). It is worth mentioning that preoperative imaging examinations showed the tumor was at a distance from the Wirsung duct (Fig. 6, A), while the postoperative ones showed the close relationship of the pseudocyst with the Wirsung duct (Fig. 6, B).

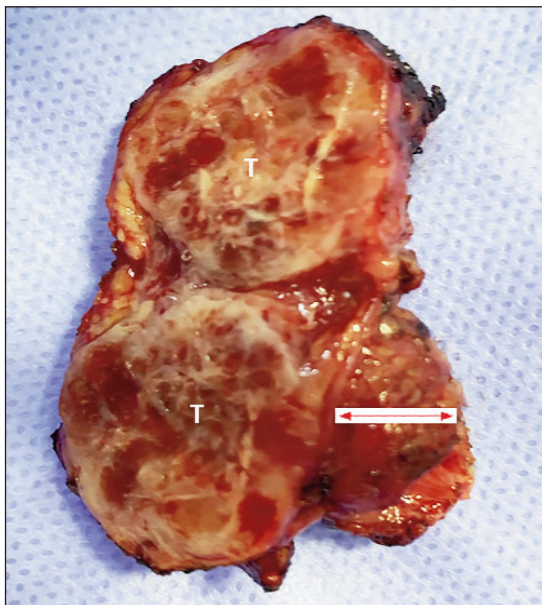


Figure 4. Operative specimen (transected, macroscopic appearance) (T – tumor).

Literature Review

Search Strategy

A comprehensive literature search was performed across databases, including Scopus, Web of Science, and PubMed, to include English-language reported relevant papers using the following terms: “uncinate process resection”, “uncinectomy”, and “ventral pancreatectomy”. The search included studies, case reports, and reviews published up to October 2025 (Fig. 7). The references of the identified papers were also screened for additional relevant studies or case reports.

Results

A total of 23 full-text papers were retrieved that addressed RUP/ventral pancreatectomy techniques (Fig. 7) (7-9,11-13,15-31). However, only 15 papers (11-13,18-28,31) reported both indications and outcomes in 76 patients who underwent RUP/ventral pancreatectomy (Table 1).

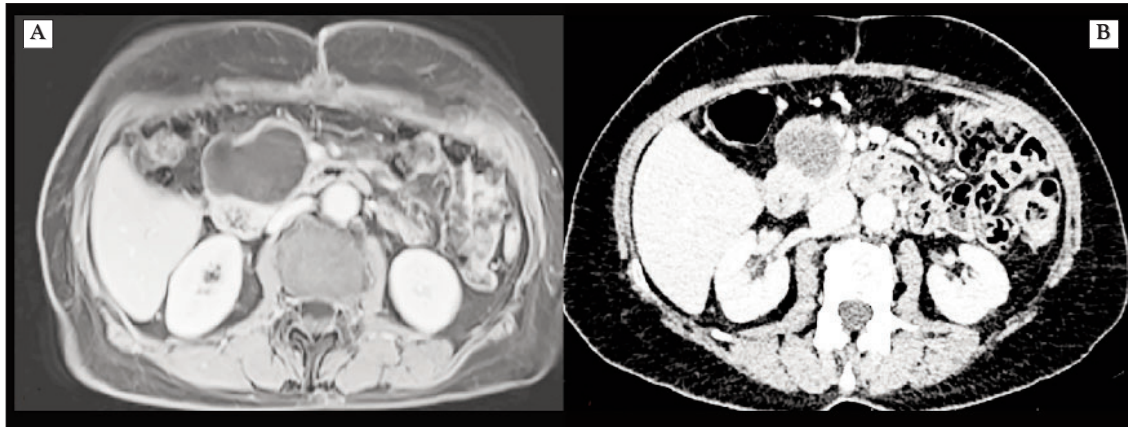


Figure 5. (A) Magnetic resonance imaging at 3 months after surgery showing a hypointense T1 lesion (65 x 40 mm), highly suggesting a postoperative pseudocyst; (B) contrast-enhanced computed tomography showing the reduced pancreatic pseudocysts (35 x 30 mm) at 7 months after surgery.

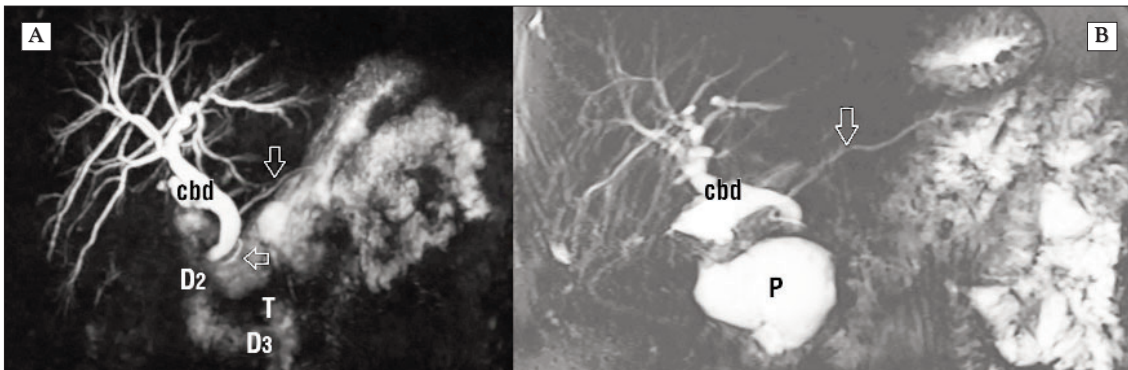


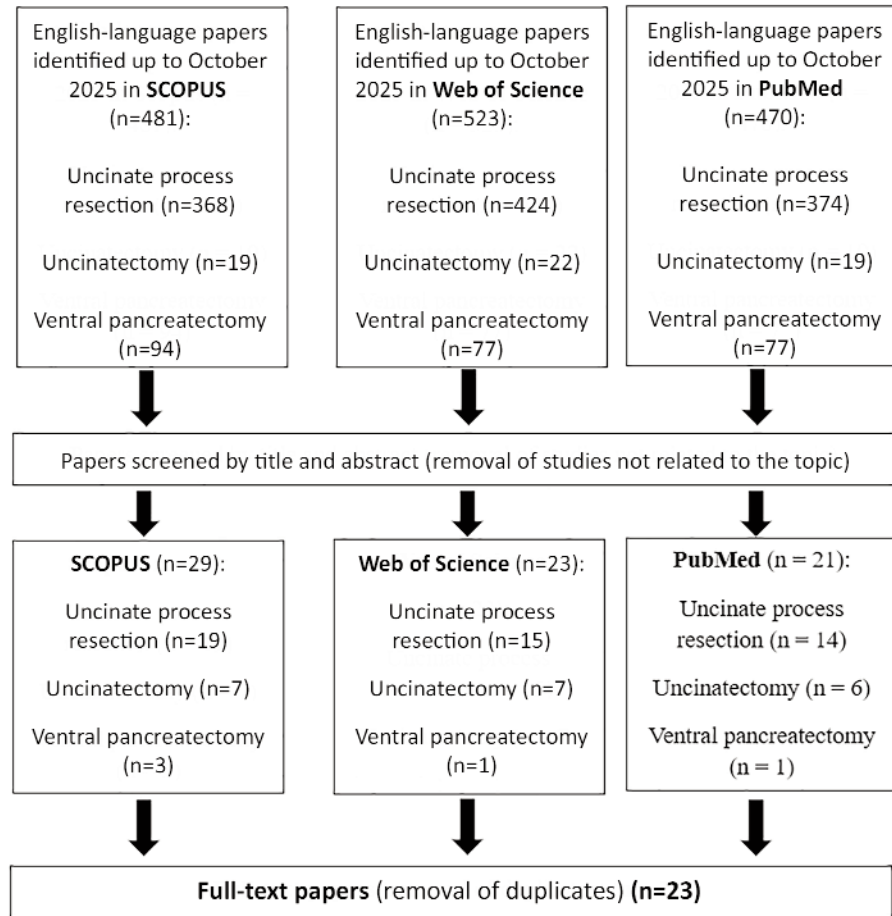
Figure 6. Magnetic resonance imaging showing the Wirsung duct at a distance from the tumor (T) in the preoperative setting (A); at 3 months after surgery, the Wirsung duct can be observed at a distance from the postoperative pseudocyst too (B) (white arrows mark the Wirsung duct; cbd – common bile duct; P – postoperative pseudocyst; D2 – duodenum 2; D3 – duodenum 3).

Table 1. Studies reporting indications and outcomes of patients undergoing RUP/ventral pancreatectomy, including the patient presented above.

Author, year	N	Pathology	Negative margins	C-R POPF	Severe complications	LOH, days	Follow-up, mo	Exocrine/endocrine insufficiencies	Technique
Nakagohri, 1996 (21)	1	Malignant IPMN	Yes	No	No	36	14 [§]	No	VP [§]
Ryu, 1996 (26)	3	Cystadenoma	100%	33%	No	48	19 [§]	NR	VP [§]
Sharma, 2006 (27)	1	IPMN	Yes	No	No	8	12 [§]	NR	RUP [§]
Machado, 2009 (18)	1	SPTP	Yes	No	No	4	2 [§]	No	RUP [†]
Paik, 2009 (23)	9	IPMN	100%	33%	11%	21	17 [§]	NR	RUPS (?)
Poves, 2009 (24)	1	Ganglioneuroma	Yes	No	No	6	NR	NR	RUP [†]
Nakagohri, 2010 (22)	15	IPMN (2 pts malignant)	80%	47%	13%	NR	81 [§]	No	VP [§]
Rotellar, 2011 (25)	1	NET	Yes	No	No	3	12 [§]	No	RUP [†]
Tsai, 2011 (31)	1	SPTP	Yes	No	No	4	20 [§]	No	RUP [†]
Surjan, 2017 (28)	1	NET	Yes	No	No	4	8 [§]	No	RUP [†]
Machado, 2018 (19)	1	NET	Yes	No	No	3	NR	NR	RUP [†]
Machado, 2022 (20)	29	NET (16 pts), IPMN (10 pts), SPTP (3 pts)	100%	3.4%	No	5	62 [§]	No	RUP [†]
Bell-Allen, 2023 (11)	5	NET (2 pts), IPMN (3 pts)	100%	40%	40%	6	6 [§]	No	RUP [†]
Bejarano, 2023 (12)	7	NET (4 pts), IPMN (2 pts), paraganglioma (1 pt)	100%	86%	57%	18	115 [§]	No	RUP [§]
Lim, 2024 (13)	3	NET	Yes	0%	No	4	NR	NR	RUP [§]
Present case, 2025	1	NET	Yes	NO	No	10	8 [§]	No	RUP [§]

CR-POPF – clinically relevant postoperative pancreatic fistulae; LOH – postoperative hospital stay; IPMN – intrapapillary mucinous neoplasm; NET – neuroendocrine tumor; SPTP – solid pseudopapillary tumor; VP – ventral pancreatectomy; RUP – resection of the uncinata process of the pancreas; [§] no evidence of disease recurrence; [†] open surgery; [‡] laparoscopic approach; [¶] robotic approach; ¹ 6 robotic, 14 laparoscopic, 9 open; ² 1 robotic, 2 laparoscopic; ³ no evidence of disease recurrence except of 1 patient (86%); NR – not reported

Figure 7. Flowchart illustrating the literature search and study selection process.



Discussions

Approaching tumors of the uncinete process of the pancreas is difficult due to its key anatomical position and close relationships with major vascular structures such as the superior mesenteric artery and vein, and inferior vena cava (Fig. 1, 2), making negative resection margins more challenging to achieve than in tumors located in the pancreatic head (32-34). The presence of abnormal arterial variants, including replaced or accessory right hepatic arteries arising from the superior mesenteric artery, may further increase the complexity of uncinete process dissection even during PD (34).

Partial resection of the pancreas, including RUP, is technically feasible based on embryological fundamentals (35-44). A plane between the two pancreatic buds (dorsal and ventral) was described as an embryological fusion plane, allowing safe segmental resection of the pancreas (38,42-44), which might also be favored by the presence of

pancreas divisum (20,29,40). Thus, the lower part of the pancreatic head, including the uncinete process, arises mainly from the ventral pancreatic bud (32,39,43). That is why, for a few authors, RUP is also considered a ventral pancreatectomy. However, there are a few significant differences between RUP and ventral pancreatectomy: the latter includes exposure to, or even resection of, the Wirsung duct (21,26,29,36,38,42), whereas RUP does not (8,19,20,23,27). Furthermore, in autopsy studies, Uchida and colleagues have shown that in 62.5% of cases, the uncinete process included both the ventral and dorsal pancreas (35). Nevertheless, a few macroscopic, histological, and imaging differences were described between the ventral and dorsal pancreas (35,43). The lack of precise anatomical and surgical landmarks for the uncinete process of the pancreas (12,19,26,32) contributes to the confusion between ventral pancreatectomy and RUP techniques. The uncinete process of the pancreas is usually defined as the leftward projection from the right lateral

margin of the superior mesenteric vein. However, this definition primarily serves research purposes, particularly for imaging studies (33), as intraoperative aspects are more complex (Fig. 3). Sauvanet and co-workers proposed that for the RUP technique, the parenchymal transection should be parallel to the Wirsung duct, in order to differentiate this technique from other parenchyma sparing surgical procedures such as ventral pancreatectomy, inferior pancreatic head resection or simple enucleation (8). The same parenchymal transection plane for RUP is also sustained by Bejarano and co-workers (12), as was the case in the above-presented patient.

According to Sakamoto and co-workers, the first RUP was reported by Watanabe and co-workers in 1991 in a Japanese journal (38). However, confusion may have arisen, as the technique described by Watanabe and co-workers is more appropriately termed a ventral pancreatectomy (26,38), a procedure also performed in 1991 by Takada (29). The term ventral pancreatectomy, as described by Watanabe and co-workers in 1991 and by Takada in 1993, is contested by Sakamoto and co-workers, who argue that there is no evidence that the removed parenchyma belongs to the former ventral pancreatic bud (38). Based on our English-language literature review, the RUP technique was first described by Sharma and colleagues in 2006 – the open approach (27) – and by Machado in 2009 and 2018 – the laparoscopic (18) and, respectively, the robotic approach (19).

During RUP, special attention should be made to the ductal branches that drain the uncinata process, which may join not only the main pancreatic duct but also the accessory duct (37,45). The use of sealant agents, as in the above-reported patient (Fig. 3), may occlude small branches, aiming to reduce the burden of postoperative pancreatic fistula (24,27,46). Furthermore, given the difficulties in identifying the anatomical limits of the RUP technique, careful intraoperative evaluation (including highly recommended intraoperative ultrasound) is mandatory to avoid injury to the distal common bile duct and the Wirsung duct (11,12,19, 20,23-25,28); the addition of indocyanine green fluorescence to intraoperative ultrasound may potentially increase the safety of RUP by a more precise tumor demarcation (19,47). Preoperative identification of the relationship between the tumor and the main pancreatic duct is also of particular importance to avoid intraoperative injuries (12,20, 31) (Fig. 6). Preoperative pancreatic duct stents were proposed to be used to reduce the risk of

Wirsung duct injuries with secondary postoperative pancreatic fistula after RUP (11,30). Meticulous dissection of the uncinata process along the right and posterior side of the superior mesenteric vein, with identification and ligation of the venous tributaries, is also mandatory to avoid unpleasant bleeding (19,20) and is definitely facilitated by an anterior approach, as in the uncinata-first PD (14) or by an inframesocolic approach (25), as was the case in the above-presented patient. Additionally, preservation of the vascular supply to the second and third parts of the duodenum should be considered to avoid duodenal ischemia and its secondary perforation (8,18-21,24,28,30).

Regarding the utility of the Kocher maneuver during RUP, the literature studies reached conflicting results. Surgeons who refrain from using the Kocher maneuver during RUP claim better preservation of the retroperitoneal vessels supplying the duodenum (21,29). In contrast, a few other surgeons stress the usefulness of fully mobilizing the pancreatic head with the duodenum during RUP (11-13,15,18-20,27,31,38), as was the case in the above-mentioned patient.

A minimally invasive approach, including both laparoscopic and robotic techniques, has been demonstrated to be feasible and safe for uncinata process tumors, despite their complexity and close relationship to major vascular structures (7,11,13, 16,18-20,25,28,31,48). A minimally invasive RUP was associated with significantly fewer hospital days than the open approach (20).

Regarding the indications, RUP should be performed whenever negative resection margins cannot be achieved by enucleation. A few surgeons suggest using RUP rather than enucleation for lesions in the uncinata process, especially for larger tumors (> 2 cm) located closer to the main or accessory pancreatic duct, to avoid devitalized pancreatic tissue resulting from dissection to facilitate access to the area (11), as was the case in the aforementioned patient. It is worth noting that RUP represents an exceptional type of pancreatic resection (0.6%) even at high-volume centers (12).

Based on our English-language literature review, 50 patients with documented RUP were identified (Supplementary Table S1) (11-13,18-20, 24,25,27,28,31). The patients who underwent ventral pancreatectomy were excluded from the analyses (21,22,26), as were the series by Paik and co-workers, in which the resection technique is unclear (23). A previous review published in 2023 identified only 29 patients with RUP; however, the review by Bejarano and co-workers also included

patients who underwent ventral pancreatectomy or uncinata process enucleation (12). As mentioned above, our present review includes only documented RUP.

As shown in *Supplementary Table S1*, the primary indication for RUP was NET (28 patients; 56%), followed by IPMN (16 patients; 32%) and SPTP (4 patients; 8%). Negative resection margins were achieved in all patients with RUP. Regarding the approach, 19 patients underwent RUP via open (38%), 19 via laparoscopic (38%), and 12 via robotic (24%). A CR-POPF was observed in 9 patients (18%) after RUP, with severe complications in 6 patients (12%), and no mortality (11-13,20,24,25,27,28,31). A clinically relevant delayed gastric emptying was reported in 2 patients (4%) (12,13). The median postoperative hospital stay was 6 days (3-18 days)(11-13,20,24,25,27,28,31).

In the long term, no patient developed exocrine or endocrine insufficiency, with a median follow-up time of 12 months (6-115 months) (11,12,20,25,27, 28,31). A postoperative persistent pancreatic pseudocyst requiring further late surgery was reported in the series of Machado and co-workers (20). In our patient, the postoperative pseudocyst did not require any therapy at this time. A duodenal stricture was also observed in one patient in the literature reports (23).

Considering analyses of the literature-retrieved patients, one might conclude that NET and IPMN remain the main indications for RUP (88%), with the majority of patients undergoing minimally invasive surgery (62%), achieving negative resection margins, and showing no functional endocrine or exocrine impairments in the long-term. Although a POPF remains a significant concern after parenchyma-sparing pancreatic resections, the reported rate in the present series of RUP is acceptable for such a complex technique, along with other complication rates such as severe morbidity or delayed gastric emptying, and short hospital stays. The nil mortality rate represents another asset of RUP.

Conclusions

RUP is an exceptional yet feasible and safe alternative to PD for carefully selected patients with non-enucleable benign or low-grade malignant tumors of the uncinata process of the pancreas, preserving the pancreas parenchyma, bile duct, and duodenum. Although the burden of postoperative mortality and long-term endocrine and exocrine insufficiency in PD is overcome by the

RUP, the RUP is a complex surgical procedure that requires precise knowledge of pancreas anatomy. It is particularly challenging to identify the transection plane without injuring the Wirsung duct. Considering the limited number of patients reported with RUP, further studies are needed to confirm the real benefits of this provocative technique.

Conflicts of Interest: none.

Ethical Statement

The patient consented to the use of the data, imaging, and publication, subject to anonymization.

References

- Mackay TM, Gleeson EM, Wellner UF, Williamson C, Busch OR, Groot Koerkamp B, et al. Transatlantic registries of pancreatic surgery in the United States of America, Germany, the Netherlands, and Sweden: Comparing design, variables, patients, treatment strategies, and outcomes. *Surgery*. 2021;169(2): 396–402.
- Vavter K, Kuhn S, Pitt H, Wells A, Jensen HK, Mavros MN. Complications and failure-to-rescue after pancreatectomy and hospital participation in the targeted American College of Surgeons National Surgical Quality Improvement Program registry. *Surgery*. 2023;174(5):1235–40.
- Tschaidse T, Hofmann FO, Renz B, Hungbauer M, Klingner C, Bührer HJ, et al. Perioperative outcomes in an age-adapted analysis of the German StuDoQIPancreas registry for PDAC. *BMC Surg*. 2025;25(1):4.
- Duhn J, Von Fritsch L, Bolm L, Braun R, Honselmann K, Litkevych S, et al. Perioperative and oncologic outcomes after total pancreatectomy and pancreatoduodenectomy for pancreatic head adenocarcinoma - A propensity score - matched analysis from the German Cancer Registry Group. *Surgery*. 2025; 181:109292.
- Karwat S, Singh H, Sharma AK, Sharma V, Gupta P, Gupta V, et al. Pancreatic Dysfunction and Reduction in Quality of Life Is Common After Pancreaticoduodenectomy. *Dig Dis Sci*. 2023;68(7):3167-73.
- Phillips ME, Pinn G, Karanjia ND, Kumar R, Frampton AE, Hart KH. The need for life-long holistic follow-up after pancreaticoduodenectomy. *Dig Liver Dis*. 2025; 57(10):1965–73.
- Lin R, Lin X, Wu W, Wang C, Lu F, Yang Y, et al. Robotic parenchymal-sparing pancreatectomy and pancreas-sparing duodenectomy avoid pancreaticoduodenectomy for benign and low-grade malignant tumours. *Langenbecks Arch Surg*. 2022;407(8):3843–50.
- Sauvanet A, Gaujoux S, Blanc B, Couvelard A, Dokmak S, Vulliamme MP, et al. Parenchyma-Sparing Pancreatectomy for Presumed Noninvasive Intraductal Papillary Mucinous Neoplasms of the Pancreas. *Ann Surg*. 2014;260(2):364–71.
- De Carbonnières A, Challine A, Cottreau AS, Coriat R, Soyfer P, Abou Ali E, et al. Surgical management of insulinoma over three decades. *HPB*. 2021;23(12): 1799–806.
- Guo T, Liu Y, Yang Z, Li J, You K, Zhao D, et al. Intraductal papillary mucinous neoplasm of the accessory pancreatic duct in the pancreas uncinata process: A case report. *Medicine (Baltimore)*. 2023;102(21):e33840.
- Bell-Allen N, McKay B, Kilburn D, Waters P, Cavallucci D. Robotic enucleation & uncinectomy of complex lesions of the proximal pancreas. *ANZ J Surg*. 2023; 93(12):2897–903.
- Bejarano N, Busquets J, Peláez N, Secanella L, Sorribas M, Ramos E, et al. Experience in the resection of the uncinata process of the pancreas: Indications and results. *Literature review*. *Cir Esp Engl Ed*. 2023;101(8):522–9.
- Lim TW, Tan HL, Tan EK, Cheow PC, Goh BKP. Short-term outcomes of laparoscopic and robotic limited resections of pancreatic neuroendocrine tumours of the uncinata process: Report of six cases and review of the literature. *J Minim Access Surg*. 2024;20(3):288-293.
- Hackert T, Werner J, Weitz J, Schmidt J, Büchler MW. Uncinate process first - a

- novel approach for pancreatic head resection. *Langenbecks Arch Surg*. 2010; 395(8):1161–4.
15. Busquets J, Fabregat J, Borobia FG, Jorba R, Valls C, Serrano T, et al. Organ-preserving surgery for benign lesions and low-grade malignancies of the pancreatic head: A matched case-control study. *Surg Today*. 2010;40(2):125–31.
 16. Cienfuegos JA, Salguero J, Núñez-Córdoba JM, Ruiz-Canela M, Benito A, Ocaña S, et al. Short- and long-term outcomes of laparoscopic organ-sparing resection in pancreatic neuroendocrine tumors: a single-center experience. *Surg Endosc*. 2017;31(10):3847–57.
 17. Cui B, Lin H. Castleman disease and paraneoplastic pemphigus in a pregnant woman: A case report. *Medicine (Baltimore)*. 2021;100(13):e24990.
 18. Machado MA, Makdissi FF, Surjan RC, Machado MC. Laparoscopic resection of uncinate process of the pancreas. *Surg Endosc*. 2009;23(6):1391–2.
 19. Machado MAC, Surjan R, Basseres T, Makdissi F. Robotic resection of the uncinate process of the pancreas. *J Robot Surg*. 2019;13(5):699–702.
 20. Machado MA, Ardengh JC, Makdissi FF, Machado MC. Minimally Invasive Resection of the Uncinate Process of the Pancreas: Anatomical Considerations and Surgical Technique. *Surg Innov*. 2022;29(5):600–7.
 21. Nakagohri T, Asano T, Takayama W, Uematsu T, Hasegawa M, Miyauchi H, et al. Resection of the inferior head of the pancreas: Report of a case. *Surg Today*. 1996;26(8):640–4.
 22. Nakagohri T, Kinoshita T, Konishi M, Takahashi S, Gotohda N, Kobayashi S, et al. Inferior head resection of the pancreas for intraductal papillary mucinous neoplasms. *J Hepato-Biliary-Pancreat Sci*. 2010;17(6):798–802.
 23. Paik KY, Choi SH. Experience of limited pancreatic head resection for management of branch duct intraductal papillary mucinous neoplasm in a single center. *World J Gastroenterol*. 2009;15(23):2904.
 24. Poves I, Burdío F, Iglesias M, Martínez-Serrano MDLÁ, Aguilar G, Grande L. Resection of the uncinate process of the pancreas due to a ganglioneuroma. *World J Gastroenterol*. 2009;15(34):4334.
 25. Rotellar F, Pardo F, Benito A, Martí-Cruchaga P, Zozaya G, Cienfuegos JA. Laparoscopic resection of the uncinate process of the pancreas: the inframesocolic approach and hanging maneuver of the mesenteric root. *Surg Endosc*. 2011;25(10):3426–7.
 26. Ryu M, Takayama W, Watanabe K, Honda I, Yamamoto H, Arai Y. Ventral pancreatic resection for adenoma and low-grade malignancies of the head of the pancreas. *Surg Today*. 1996;26(7):476–81.
 27. Sharma MS, Brams DM, Birkett DH, Munson JL. Uncinectomy: A Novel Surgical Option for the Management of Intraductal Papillary Mucinous Tumors of the Pancreas. *Dig Surg*. 2006;23(1–2):121–4.
 28. Surjan RC, Basseres T, Makdissi FF, Machado MAC, Ardengh JC. Laparoscopic uncinectomy: a more conservative approach to the uncinate process of the pancreas. *ABCD Arq Bras Cir Dig São Paulo*. 2017;30(2):147–9.
 29. Takada T. Ventral pancreatotomy: Resection of the ventral segment of the pancreas. *J Hepatobiliary Pancreat Surg*. 1993;1(1):36–40.
 30. Takada T, Amano H, Ammori BJ. A novel technique for multiple pancreatometomies: removal of the uncinate process of the pancreas combined with medial pancreatotomy. *J Hepatobiliary Pancreat Surg*. 2000;7(1):49–52.
 31. Tsai FJ, Lee JY, Chang YT. Laparoscopic Resection of a Giant Solid Pseudopapillary Neoplasm of Uncinate Process of the Pancreas in a Child. *J Laparoendosc Adv Surg Tech*. 2011;21(10):979–82.
 32. O'Sullivan AW, Heaton N, Rela M. Cancer of the uncinate process of the pancreas: surgical anatomy and clinicopathological features. *Hepatobiliary Pancreat Dis Int HBPDI*. 2009;8(6):569–74.
 33. Zhu C, Ma L, Jia Z, Shi H, Jin J, Lou W, et al. Novel morphological classification of the normal pancreatic uncinate process based on computed tomography. *J Int Med Res*. 2020;48(9):0300060520957453.
 34. Fassari A, De Blasi V, Amariutei A, Rosso E. Overcoming the Challenges of Uncinate Process Oncologic Management: The Left-Side Approach in Minimally Invasive Pancreatoduodenectomy: Step-by-Step Technique and Video. *Ann Surg Oncol*. 2025;32(10):7450–1.
 35. Uchida T, Takada T, Ammori BJ, Suda K, Takahashi T. Three-Dimensional reconstruction of the ventral and dorsal pancreas: a new insight into anatomy and embryonic development. *J Hepatobiliary Pancreat Surg*. 1999;6(2):176–80.
 36. Yamaguchi K, Shimizu S, Yokohata K, Noshiro H, Chijiwa K, Tanaka M. Ductal branch-oriented minimal pancreatotomy: Two cases of successful treatment. *J Hepatobiliary Pancreat Surg*. 1999;6(1):69–73.
 37. Takahashi S, Akita K, Goseki N, Sato T. Spatial arrangement of the pancreatic ducts in the head of the pancreas with special reference to the branches of the uncinate process. *Surgery*. 1999;125(2):178–85.
 38. Sakamoto Y, Nagai M, Tanaka N, Nobori M, Tsukamoto T, Nokubi M, et al. Anatomical segmentectomy of the head of the pancreas along the embryological fusion plane: A feasible procedure? *Surgery*. 2000;128(5):822–31.
 39. Kimura W. Surgical anatomy of the pancreas for limited resection. *J Hepatobiliary Pancreat Surg*. 2000;7(5):473–9.
 40. Scallon O, Sauvanet A, Cazals-Hatem D, Vullierme MP, Ruszniewski P, Belghiti J. Dorsal Pancreatotomy: An Embryology-Based Resection. *J Gastrointest Surg*. 2006;10(3):434–8.
 41. Iacono C, Ruzzenente A, Conci S, Xillo L, Guglielmi A. Head dorsal pancreatotomy: An alternative to the pancreaticoduodenectomy for not enucleable benign or low-grade malignant lesions. *Pancreatol*. 2014;14(5):822–31.
 42. Zhu C, Jia Z, Zhang X, Yu Q, Qin X. Anatomical segmentectomy of the pancreatic head along the embryological fusion plane: A case series and a literature review. *Medicine (Baltimore)*. 2018;97(18):e0623.
 43. Renard Y, De Mestier L, Perez M, Avisse C, Lévy P, Kianmanesh R. Unraveling Pancreatic Segmentation. *World J Surg*. 2018;42(4):1147–53.
 44. Łacka M, Łaski D, Hać S, Szymański M. Partial pancreatic resection along the embryological fusion plane - no longer a fantasy. *Folia Morphol*. 2020;79(3): 640–4.
 45. Schmitt F, Maignan A, Ploteau S, Hamel A, Lagier S, Blin Y, et al. New anatomical data on the drainage patterns of the uncinate process of the pancreas. *Surg Radiol Anat*. 2010;32(8):777–81.
 46. Furtado R, Weinberg L, Haghghi KS, Burnett D, Croagh D, Muralidharan V, et al. A Biodegradable Polymeric Sealant Applied to Transected Margin Following Stapled Distal Pancreatotomy Reduces Overall Complication: A Randomised Controlled Trial. *ANZ J Surg*. 2025 Dec 5;ans.70419.
 47. De Palma C, Delvecchio A, Ferraro V, Stasi M, Casella A, Filippo R, et al. Illuminating the Uncinate: Advanced Indocyanine Green Fluorescence and Ultrasound-Guided Robotic Enucleation of a Pancreatic Insulinoma in a Challenging Position. *Ann Surg Oncol*. 2025;32(13):9988–94.
 48. Li Y, Li F, Liu H, Wang L. Using the Root of the Mesentery to Guide a Novel Operative Approach for Laparoscopic Insulinoma Resection. *J Laparoendosc Adv Surg Tech*. 2016;26(7):557–9.

Supplementary Material

Supplementary Table S1. Studies reporting the indications and outcomes of patients undergoing documented RUP, including the patient presented above.

Author, year	N	Pathology	Negative margins	C-R POPF	Severe complications	LOH, days	Follow-up, mo	Exocrine/endocrine insufficiencies	Technique
Sharma, 2006 (27)	1	IPMN	Yes	No	No	8	12 [‡]	NR	RUP [§]
Machado, 2009 (18)	1	SPTP	Yes	No	No	4	2 [‡]	No	RUP [†]
Poves, 2009 (24)	1	Ganglioneuroma	Yes	No	No	6	NR	NR	RUP [§]
Rotellar, 2011 (25)	1	NET	Yes	No	No	3	12 [‡]	No	RUP [†]
Tsai, 2011 (31)	1	SPTP	Yes	No	No	4	20 [‡]	No	RUP [†]
Surjan, 2017 (28)	1	NET	Yes	No	No	4	8 [‡]	No	RUP [†]
Machado, 2018 (19)	1	NET	Yes	No	No	3	NR	NR	RUP [‡]
Machado, 2022 (20)	29	NET (16 pts), IPMN (10 pts), SPTP (3 pts)	100%	3.4%	No	5	62 [‡]	No	RUP [†]
Bell-Allen, 2023 (11)	5	NET (2 pts), IPMN (3 pts)	100%	40%	40%	6	6 [‡]	No	RUP [‡]
Bejarano, 2023 (12)	7	NET (4 pts), IPMN (2 pts), paraganglioma (1 pt)	100%	86%	57%	18	115 [‡]	No	RUP [§]
Lim, 2024 (13)	3	NET	Yes	0%	No	4	NR	NR	RUP [‡]
Present case, 2025	1	NET	Yes	NO	No	10	8 [‡]	No	RUP [§]

CR-POPF – clinically relevant postoperative pancreatic fistulae; LOH – postoperative hospital stay; IPMN – intrapapillary mucinous neoplasm; NET – neuroendocrine tumor; SPTP – solid pseudopapillary tumor; RUP – resection of the uncinata process of the pancreas; [‡]no evidence of disease recurrence; [§]open surgery; [†]laparoscopic approach; [‡]robotic approach; 16 robotic, 14 laparoscopic, 9 open; 21 robotic, 2 laparoscopic; 3no evidence of disease recurrence except of 1 patient (86%); NR – not reported