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Surgery Section

# Superior Mesenteric Artery First Approach versus Conventional Pancreaticoduodenectomy in Periampullary Adenocarcinomas: A Single Institutional Observational Study

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## ABSTRACT

**Introduction:** Periampullary malignancies represent a group of malignancies at and around the ampulla of Vater, whose clinical features and management are similar, with Pancreaticoduodenectomy (PD, Whipple procedure) being the standard surgical treatment. Superior Mesenteric Artery (SMA) first approach to PD (smaPD) is a modification of conventional PD (cPD) in which the SMA is assessed early in the surgery. This improves the assessment of intraoperative resectability, reduces bleeding during surgery and enhances the dissection of retroportal tissues, resulting in a greater number of resections with no residual tumour (R0).

**Aim:** To compare smaPD with cPD with respect to clinical, perioperative, histological, oncological and survival outcomes.

**Materials and Methods:** This was a retrospective observational study conducted at the Department of General Surgery at North Bengal Medical College and Hospital, West Bengal, India. A total of 58 patients with periampullary adenocarcinomas who had undergone PD from 1 May 2018 to 30 November 2023 were studied. The retrospective data of 58 matched patients (smaPD vs cPD) with n=29 in each group were retrieved from the records. They were compared with respect to clinical and intraoperative findings, postoperative complications, in-hospital mortality, Overall Survival (OS) and pathology parameters. Continuous data were analysed using Student's t-test and categorical data using the Chi-square test. OS was plotted using Kaplan-Meier survival curves and compared using the log-rank test. Results were considered statistically significant when p-value <0.05. Statistical software used: GraphPad Prism 10 (San Diego, USA) and Epi Info version 7.4.6 (Atlanta, Georgia, USA).

**Results:** The mean operative time in group A (smaPD) was 391.74±32.15 minutes whereas in group B (cPD) it was 306.55±39.57 minutes (p-value <0.0001). The mean blood loss in group A was 365.52±108.97 mL and in group B 424.14±58.34 mL (p-value=0.0162). R0 resection was higher in smaPD but this was not statistically significant (p-value=0.315). There was not much difference in terms of postoperative complications, length of hospital stay, pathology and OS (p-value=0.4034). Vascular anomalies were observed in four patients in group A.

**Conclusion:** The operative time was significantly longer in group A, but intraoperative blood loss was significantly lower, with more R0 resections. Advanced Multidetector Computed Tomography (MDCT) can accurately predict resectability preoperatively. In a rural setup, pursuing the smaPD technique for intraoperative assessment appears useful.

**Keywords:** Artery first, Resectability, Residual, Retroportal, Whipples

## INTRODUCTION

Periampullary cancers arise at or around the ampulla of Vater. The most common are pancreatic ductal adenocarcinoma, ampullary adenocarcinoma, distal cholangiocarcinoma and duodenal adenocarcinoma, in that order. The rest include neuroendocrine tumours, intraductal papillary mucinous neoplasms, mucinous cystic neoplasms, gastrointestinal stromal tumours, acinar cell tumours, solid pseudopapillary tumours, sarcomas and metastases. The clinical presentations are similar, as is their surgical management. The most common symptom is painless obstructive jaundice, often associated with recent weight loss, fatigue and pain [1]. MDCT detects the tumour, assesses resectability and spread [1,2]. Three-dimensional vascular reconstruction can reveal the relationship to the SMA, Celiac Axis (CA), Common Hepatic Artery (CHA), Superior Mesenteric Vein (SMV) and Portal Vein (PV). Magnetic Resonance Cholangiopancreatography (MRCP) is very useful in distal cholangiocarcinomas. Diagnosis is essentially clinicoradiological. A biopsy is considered (preferably endoscopic ultrasound-guided) only if the tumour is unresectable, has metastasised, is a candidate for neoadjuvant chemotherapy, or has a high index of suspicion of lymphoma [1,2]. PD is the only known potentially curative measure for periampullary carcinomas [1,3]. William Halstead, in 1898 at Johns Hopkins Hospital, performed the first successful surgery for periampullary cancer, in which he performed a local wedge resection of the periampullary duodenum with reimplantation of the bile and pancreatic ducts. Alessandro Codivilla performed the first resection of the duodenum with the head of the pancreas, but the patient died soon after. Walter Kausch performed a two-stage PD in 1909. Hirschel, in 1914, performed a one-stage PD who survived one year. However, PD became the mainstay surgical management of periampullary cancers since 1935 after Allen Oldfather Whipple refined the technique [1].

A tumour is resectable when there is no arterial tumour contact (CA, SMA, CHA) and no tumour contact with the SMV/PV or ≤180° contact without vein contour irregularity [2]. There is often incomplete oncological clearance around the mesopancreas and the tissues to the right of the SMA. Also, when the pancreas is transected, profuse blood loss makes the dissection even more difficult, increasing the possibility of a non R0 resection. To counteract this, the SMA-first approach is applied, wherein the SMA is referenced early in the operation to assess resectability before taking an irreversible step such as pancreatic transection and discovering that the tumour has irresectably involved the SMA and/or other vessels. Also, early ligation of the Inferior Pancreaticoduodenal Arteries (IPDA) prevents the pancreatic head from becoming congested with blood. All this reduces peroperative blood loss, improves retroportal tissue dissection and nodal clearance, increases R0 resection and prolongs long-term survival [3-5]. Given the advances in radiological evaluation by MDCT, a routine SMA-first approach is not required for assessment of unresectability [4]; but in a rural setup like ours, with radiological and logistical constraints, we feel the need for SMA-first approach to PD (smaPD).

The smaPD technique was first documented by Pessaux P et al., in their publication in 2006 [6]. Six different smaPD techniques exist [7]. Schneider M et al., described a technique of harvesting lymphatic and neural tissue in the triangle between the CA, SMA and PV, enabling the removal of possibly tumour-infiltrated tissue, thus potentially reducing the risk of local recurrence [8]. Gagner M and Pomp A first described laparoscopic PD in 1994. Though it is practised in many high-volume centres, many meta-analyses have obtained similar oncological results [9,10].

Comparative studies between smaPD and cPD have been conducted from across the globe [3,5-7]. However, no such comparative study has thus far been conducted from our sub-Himalayan region of West Bengal, India. Therefore, the aim of the present study was to compare smaPD and conventional PD (cPD) approaches with respect to the clinical, perioperative, histological, oncological and survival outcomes.

## MATERIALS AND METHODS

This was a single-institution retrospective observational study conducted in the Department of Surgery at a rural tertiary care centre of Eastern India. Institutional Ethics Committee clearance was obtained (Memo no. IEC/NBMC/M-04/F-03/2022). Data of patients who underwent PD from 1 May 2018 to 30 November 2023 for periampullary adenocarcinomas were retrieved from records. The cut-off date for follow-up data collection was 30 November 2024. The retrospective data were collected from records, compiled and analysed from 1 December 2024 to 15 January 2025. Patients had been followed-up routinely postoperatively at the third, sixth and twelfth months of the first postoperative year and then semi-annually. Every six months, MDCT abdomen and serum CA19-9 were observed.

**Inclusion criteria:** The retrospective data of 58 matched patients (29 in each group) were retrieved from the records. The data were compiled on Microsoft Excel and analysed using appropriate statistical methods.

**Exclusion criteria:** Patients with intraoperative findings of metastases/irresectability and those who were histologically negative for adenocarcinoma and who had received neoadjuvant therapy were excluded from our study. Irresectability was decided according to National Comprehensive Cancer Network (NCCN) guidelines Version 3.2024 [2].

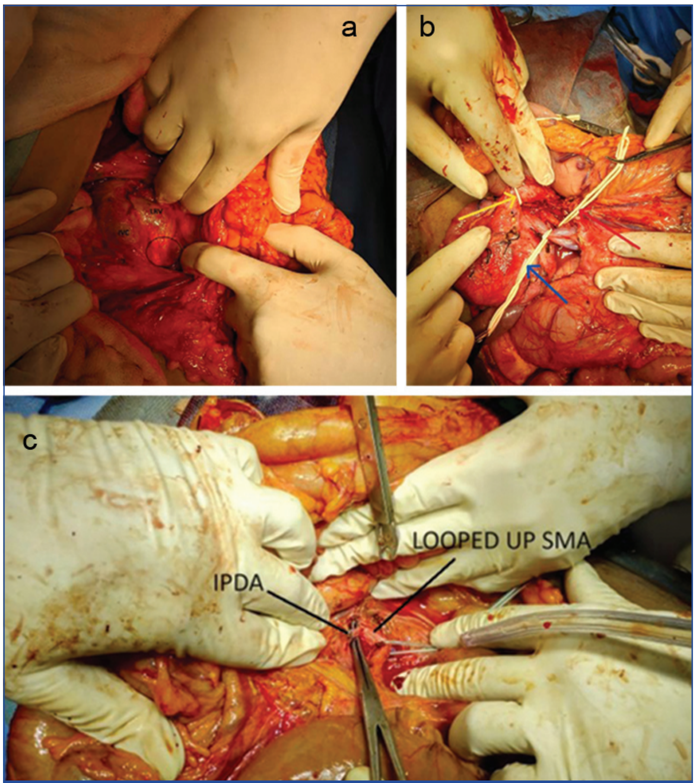
### Study Procedure

This study had two groups: Group A (reference group) smaPD and Group B (control group) the matched cPD group. The groups were matched by age, sex, location of tumour and follow-up time postsurgery. The clinical data/investigations, intraoperative parameters (operative time, intraoperative blood loss), postoperative complications (Delayed Gastric Emptying (DGE), Postoperative Pancreatic Fistula (POPF), Upper Gastrointestinal Bleeding (UGIB), Biliary Fistula (BF), Surgical Site Infection (SSI), diarrhoea and intra-abdominal haemorrhage), in-hospital mortality and OS were compared. Resection rates and nodal positivity were also compared. SMV/PV involvement was assessed preoperatively using pancreatic protocol CT and classified according to the Chaoyang classification [11].

All patients received adjuvant chemotherapy, except those with poor general condition or who refused chemotherapy. Venous Resection (VR) types, as described by the International Study Group of Pancreatic Surgeons (ISGPS), were performed at the institution: Type 1, partial venous excision with direct closure by suture; Type 2, partial venous excision using a patch; Type 3, segmental resection with primary venovenous anastomosis; and Type 4, segmental resection with an interposed venous conduit [12].

POPF was defined according to the International Study Group of Pancreatic Fistula [13].

In smaPD, we first dissect out 16B1 for a frozen section to exclude metastasis [Table/Fig-1a].Then we reference the SMA early and ligate the IPDA [Table/Fig-1b,c].




**[Table/Fig-1]:** a) 16B1 nodal station (black circle), IVC is inferior vena cava, LRV is left renal vein; b) SMA looped up; c) IPDA referenced.
LRV: Left renal vein; IVC: Inferior vena cava, Encircled area- is 16B1 station of lymph node; Yellow arrow- looped up neck of pancreas; Red arrow- looped up superior mesenteric artery; Blue arrow- looped up Superior Mesenteric Vein (SMV); IPDA: Inferior pancreaticoduodenal artery; SMA: Superior mesenteric artery

## STATISTICAL ANALYSIS

The collected data were tabulated in Microsoft Excel. Continuous quantitative variables were expressed as mean±SD and categorical qualitative variables as absolute frequencies (numbers) and relative frequencies (percentages). Categorical data were analysed using the Chi-square test and continuous data using the unpaired t-test. OS was plotted using Kaplan-Meier survival curves and compared with the log-rank test. A p-value <0.05 was considered statistically significant. Statistical software used: GraphPad Prism 10 (San Diego, USA) and Epi Info version 7.4.6 (Atlanta, GA, USA).

## RESULTS

**Demographic and intraoperative data:** The mean age was 48.83±6.53 years in group A and 50.38±7.17 years in group B. Sex distribution was equal in both groups. The mean operative time was shorter in group B: group A 391.74±32.15 minutes vs group B 306.55±39.57 minutes (p-value <0.001). The mean blood loss was lower in group A: 365.52±108.97 mL (range 250-600 mL) vs group B 424.14±58.34 mL (range 360-550 mL) (p-value=0.0162). Intraoperative incidents were not significantly different in both groups. Classical PD and PPPD were performed in 20 and 9 patients respectively in group A, whereas in 19 and 10 patients in group B (p-value=0.779, NS). Tumour location was similar in both groups, the most common being the head of the pancreas. Co-morbidities were also similar between groups [Table/Fig-2].

| Factor | | Group A | Group B | $\chi^2$/p-value |
|---|---|---|---|---|
| Age (years) | | 48.83±6.53 | 50.38±7.17 | 0.3931 |
| Sex, N (%) | Male | 21 (72.4) | 21 (72.4) | 1 |
| | Female | 8 (27.6) | 8 (27.6) | |
| Tumour location, N (%); TNM Stage (I,II,III), N (%) | Pancreatic head | 12 (41.4); 3(25), 9 (75), 0(0) | 12 (41.4) 3 (25),9 (75), 0 (0) | 1 |
| | Distal CBD | 9 (31) 3 (33),6 (67), 0 (0) | 9 (31) 3 (33), 6 (67), 0 (0) | 1 |
| | Duodenum | 6 (20.7) 2 (33.33), 2 (33.3), 2 (33.33) | 6 (20.7) 2 (33.33), 2 (33.3), 2 (33.33) | 1 |
| | Ampulla of Vater | 2 (6.9) 1 (50), 0 (0),1 (50) | 2 (6.9) 1 (50), 0 (0),1 (50) | 1 |
| Operative time (minutes) | | 391.74±32.15 | 306.55±39.57 | <0.0001 S |
| Intraoperative blood loss (mL) | | 365.52±108.97 | 424.14±58.34 | 0.0162 S |
| Postoperative stay | | 15.14±5.23 | 16.51±2.94 | 0.224 |
| Co-morbidities N (%) | DM | 8 (27.6) | 7 (24.1) | 0.0364/ 0.981966 |
| | HTN | 7 (24.1) | 7 (24.1) | |
| | Pulmonary | 2 (6.9) | 2 (6.9) | |
| Type of PD N (%) | Classical | 20 (69) | 19 (65.5) | 0.078/ p 0.7797 |
| | ppPD | 9 (31) | 10 (34.5) | |

**[Table/Fig-2]:** Distribution of the patient and operative variables.
Qualitative variables- Sex,Tumour location, Comorbidities, Type of PD; Others-Quantitative; t test used for continuous data, chi square for categorical data

## Pathology data [Table/Fig-3]

There were no significant differences between the two groups regarding tumour type, staging, or grade [Table/Fig-2,3]. R0 resection (no residual tumour) was more frequent and R1 resection (microscopic residual tumour) was less frequent in group A, although this difference was not statistically significant (p-value=0.315). Thus, with similar prognostic factors influencing survival, we can assess the impact of the type of approach (group A vs group B) on survival. The SMA margin was positive in four cases of group B but none in group A. The mean lymph nodes retrieved was 12.69±5.54 (range 6-22) in group A and 10±2.59 (range 5-14) in group B (p-value=0.1782); mean nodal positivity was 1.65±1.88 (range 0-6) and 1.24±1.15 (range 0-4), respectively (p-value=0.32).

| Variables | | Group A | Group B | $\chi^2$/p-value |
|---|---|---|---|---|
| Grade N (%) | Well differentiated | 8 (27.6) | 9 (31) | 0.0959/ p 0.9532 |
| | Moderately well differentiated | 14 (48.3) | 13 (44.9) | |
| | Poorly differentiated | 7 (24.1) | 7 (24.1) | |
| Resection N (%) | R0 | 25 (86.20) | 22 (75.9) | 1.010/ p 0.3150 |
| | R1 | 4 (13.80) | 7 (24.1) | |
| Margin positive N (%) | Bile duct margin | 0 | 0 | NS |
| | Neck pancreas margin | 0 | 1 (3.4) | |
| | Uncinate margin | 2 (6.9) | 3 (10.3) | |
| | SMA margin | 0 | 4 (13.80) | |
| | SMV margin | 0 | 0 | |
| Lymph nodes mean (SD) | Retrieved | 12.69±5.54 | 10±2.59 | 0.1782 |
| | Positive | 1.65±1.88 | 1.24±1.15 | 0.3207 |

**[Table/Fig-3]:** Pathology information in the two groups.
Qualitative variables- Grade, Resection, Margin positivity; Quantitative-Lymph nodes; t test used for continuous data, chi square for categorical data

## Postoperative events [Table/Fig-4]

In group A, POPF occurred in eight patients: seven were grade A and one was grade B (all conservatively managed). POPF types followed the ISGPS classification [13]. There was haemoperitoneum from the pancreatic stump, but it was managed by transfusion (4 units each of packed red blood cells, fresh frozen plasma and platelets) in one patient who developed grade B POPF. Post-pancreatectomy haemorrhage presented as UGIB in two patients and intra-abdominal bleeding in four patients; these occurred after 24 hours and were managed with blood transfusions. Bronchopneumonia was observed in five patients and treated with antibiotics; one patient developed massive lung collapse and succumbed after one month.There were two additional in-hospital mortalities at one week and two weeks due to pulmonary embolism. SSI occurred in seven cases and intra-abdominal abscesses were seen in three patients. Diarrhoea and biliary leaks were observed in seven cases each. DGE was the most common complication, occurring in 13 patients. The average postoperative stay was 15.14±5.23 days (range 7-30 days).

In Group B too, DGE was the most common complication, occurring in 12 patients, followed by POPF in 11 and SSI in 10. Grade A fistula occurred in eight patients (all conservatively managed), two patients had grade B fistula (conservatively managed) and one patient developed a grade C POPF (this patient had a soft pancreas with a pancreatic duct caliber of about 1 mm) and subsequently died after two weeks despite aggressive conservative management (nil per os, total parenteral nutrition, enteral nutrition via feeding jejunostomy and subcutaneous octreotide).Two patients developed haemoperitoneum and three had upper gastrointestinal bleeding (UGIB); all were managed conservatively. Bronchopneumonia and intra-abdominal abscesses were observed in four patients each and recovered with antibiotics. Diarrhoea and biliary leaks were found in five and six patients, respectively. The mean postoperative stay was 16.51±2.94 days (range 7-22 days). There was an elderly lady who developed a massive myocardial infarction one week postoperatively and succumbed.

Overall, there was no statistically significant difference between the two groups regarding postoperative complications [Table/Fig-4].

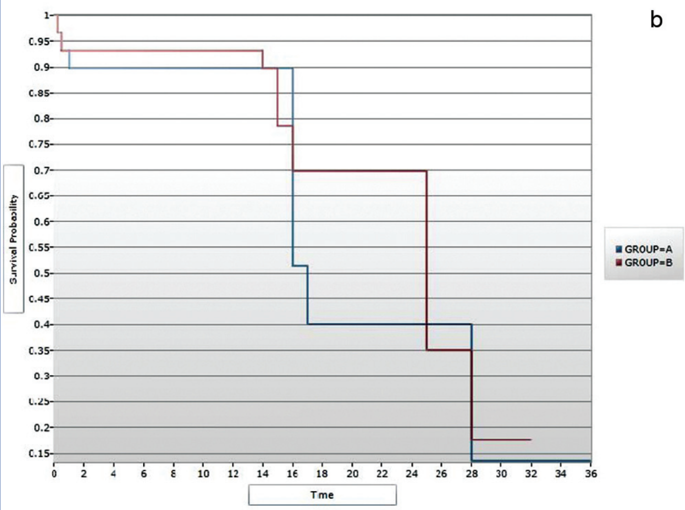
| Variables N (%) | | Group A | Group B | $\chi^2$/p-value |
|---|---|---|---|---|
| Delayed Gastric Emptying (DGE) | Yes | 13 (44.83) | 12 (41.37) | 0.070/ 0.7909 |
| | No | 16 (55.17) | 17 (58.63) | |
| Surgical Site Infection (SSI) | Yes | 7 (24.1) | 10 (34.5) | 0.749/ 0.3868 |
| | No | 22 (75.9) | 19 (65.5) | |
| Postoperative Pancreatic Fistula (POPF) | Yes | 8 (27.6) | 11(37.9) | 0.704/ 0.4013 |
| | No | 21(72.4) | 18 (62.1) | |
| Biliary leak | Yes | 7 (24.1) | 6 (20.7) | 0.099/ 0.7529 |
| | No | 22 (75.9) | 23 (79.3) | |
| Intrabdominal haemorrhage | Yes | 4 (13.8) | 2 (6.9) | 0.744/ 0.3885 |
| | No | 25 (86.2) | 27 (93.1) | |
| Upper Gastrointestinal Bleeding (UGIB) | Yes | 2 (6.9) | 3 (10.3) | 0.219/ 0.6399 |
| | No | 27 (93.1) | 26 (89.7) | |
| Diarrhoea | Yes | 7 (24.1) | 5 (17.2) | 0.420/ 0.5168 |
| | No | 22 (75.9) | 24 (82.8) | |
| Bronchopneumonia | Yes | 5 (17.2) | 4 (13.8) | 0.132/ 0.7169 |
| | No | 24 (82.8) | 25 (86.2) | |
| Intra-abdominal abscess | Yes | 3 (10.3) | 4 (13.8) | 0.162/ 0.6869 |
| | No | 26 (89.7) | 25 (86.2) | |
| In hospital mortality | Yes | 3 (10.3) | 2 (6.9) | 0.219/ 0.6399 |
| | No | 26 (89.7) | 27 (93.1) | |

**[Table/Fig-4]:** Postoperative events in the two groups.

## Patient survival

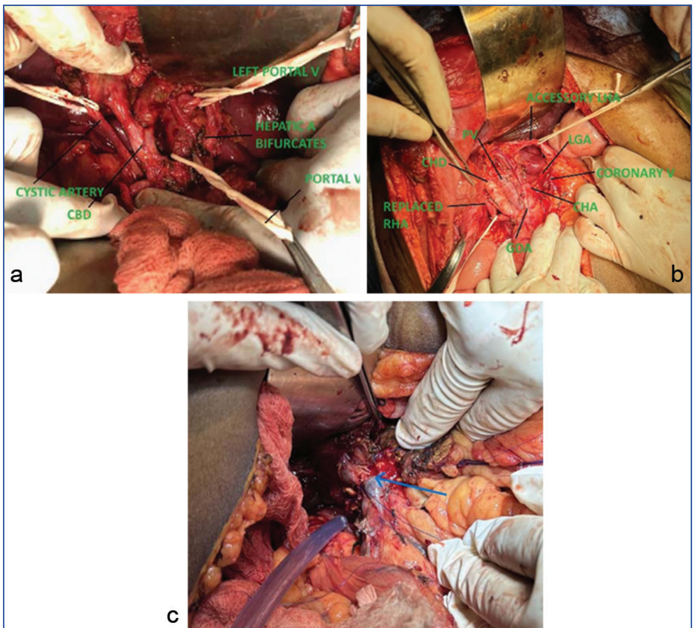
The mean OS was 15.92±7.1 months in group A and 16.47±6.37 months in group B. There was no statistically significant difference between the two groups in OS (p-value=0.4034), with a similar median survival of 16 months [Table/Fig-5]. Follow-up lasted until the death/cut-off date of November 30, 2024.

| OS in months | Group A | Group B | p-value (log-rank test) |
|---|---|---|---|
| Mean±SD | 15.92±7.1 | 16.47±6.37 | 0.4034 |




**[Table/Fig-5]:** a, OS comparison and log rank analysis ; b, Kaplan Meier survival chart for OS.
Blue: Group A, Red: Group B, Time in months, Survival probability in %

**Vascular aberrations:** Four cases with vascular aberrations were observed. In one case, the cystic artery arose from the SMA [Table/Fig-6a; Video-1]. In another, a replaced right hepatic artery arising from the SMA was encountered [Video-2]. In a third case, a replaced RHA with an accessory left hepatic artery arising from the left gastric artery (Michel Type VIII) was present [Table/Fig-6b] and in the fourth case, the horizontal course of the CHA ran behind the PV [Video-3].




**[Table/Fig-6]:** a) Cystic artery from SMA; b) Michel Type VIII; c) Type 1 VR.
Hepatic a-hepatic artery, portal v-portal vein, CBD: Common bile duct, PV-portal vein, RHA: Right hepatic artery, CHD: Common hepatic duct, LHA: Left hepatic artery, GDA: Gastroduodenal artery: Blue arrow- repaired portal vein

PV involvement occurred in two patients in both groups (p=1, NS). In both groups, the SMV involvement was <1/4 of its circumference (Chaoyang Type 1). ISGPS Type 1 VR was performed using 5-0 polypropylene [Table/Fig-6c].

## DISCUSSION

Present study compared two groups of smaPD and cPD and found that smaPD offered lesser blood loss at the cost of a longer operative time. In the present study, the mean operative time was significantly greater in group A (p-value <0.0001). This finding was concordant with most studies and may be related to the learning curve of the technique [14]. However, Dumitrascu T et al., and Tohamy AZ et al., reported shorter operative times in the smaPD group [15,16]. Müller PC et al., found no difference in operative time [17]. Müller PC et al., documented lesser blood loss (p-value <0.001), similar operative time (p-value=0.58) and a lower overall complication rate (p-value=0.001) in smaPD. There were fewer POPF (p-value=0.001) and fewer DGE (p-value=0.001) and more postoperative diarrhoea (p-value=0.03), with no difference in postoperative blood loss (p-value=0.32). However, mean intraoperative blood loss was significantly lower in present study group A (p-value=0.0162). Several studies have demonstrated a similar finding, attributable to earlier vascular control [13,15]. Postoperative stay was similar in both groups (p-value=0.224). Different hospital stays have been demonstrated in different studies. There was no significant difference in the studies by Dumitrascu T et al., and Tohamy AZ et al., [15,16]. SSI (7 vs 10 cases), POPF (8 vs 11 cases), diarrhoea (7 vs 5 cases) and intra-abdominal abscess (3 vs 4 cases) were observed in group A and group B, respectively. DGE, the most common complication, was similar in the two groups (13 vs 12 cases). UGIB, biliary leak and bronchopneumonia were similar between the groups. DGE has been reported in 12-15% in most studies, though a few have reported up to 45%, whereas POPF has been recorded in 3-28% [1,18]. Mirrielees JA et al., observed that the most relevant postoperative complications were DGE (17.3%), POPF (10.1%), incisional SSI (10.0%) and organ/space SSI (6.2%) [19]. Although mortality rates in PD have dropped in high-volume centres, the complication rate remains as high as 25-70% [20]. Venous involvement, when reconstructible, is no longer a contraindication to resection [3]. In present study, author performed partial right lateral circumference removal of the PV and direct repair in four cases, two in each group (ISGPS Type 1 VR). Author encountered all the vascular variations in group A. Noussios G et al., reported an incidence of 0.35% of Michel Type VIII in 19,013 subjects [21]. Andall RG et al., reported a 0.29% incidence of a cystic artery origin from the SMA in 9,836 subjects [22]. R0 resection was observed in 25 group A cases versus 22 group B cases, whereas R1 resection was achieved in four group A cases and seven group B cases (p-value=0.315). Jiang X et al., and Müller PC et al., documented increased R0 rates in smaPD (p-value=0.001) [2,17].

The medial and posterior margins are the most commonly involved margins [12,14]. Warschkow R et al., reported that a higher nodal yield increased diagnostic accuracy and survival [23]. Eskander MF et al., confirmed that no additional benefit is achieved beyond 30 nodes [24]. In the present study, nodal retrieval and positivity were not statistically significant between the two groups.

In present study, there was no statistical difference regarding OS (p-value=0.4034). This perhaps indicates that OS is more dependent on tumour biology and other factors. Earlier control of the IPDA may not prevent micrometastatic spread. Wang X et al., realised that TNM stage, resection margin, overall complications and adjuvant therapy were independent risk factors affecting OS [25]. Pandanaboyana S et al., documented a 1- and 3-year OS of 90% and 53% (group A) versus 80% and 16% (group B); p-value=0.04 [5]. The mean OS in group A was 26.9±7.78 months and 24.8±9.48 in group B, with no significant difference (p-value=0.35) in the study by Tohamy AZ et al., [16]. Wang X et al., found that the median OS was 21.8 months in smaPD, whereas it was 19.8 months in cPD (p-value=0.900); also the number of nodes harvested was greater in the smaPD group (19 vs 15, p-value=0.021). The R0 resection rate was higher (93.3% vs 82.6%, p-value=0.197) and SMA margin positivity was lower (0 vs 13%). There were no differences regarding complication rates and mortality [25].

### Limitation(s)

Since this was a retrospective study, there might be selection bias because non randomised groups were compared. It was conducted at a single centre. Prospective multicentre studies can improve the results.

## CONCLUSION(S)

Both groups in present study had similar postoperative complications, mortality and OS. At sophisticated centres, current-generation MDCT with 3D reconstructions and maximum intensity projections can identify subtle vascular involvement and determine resectability preoperatively. But at a rural centre like ours with limited resources, smaPD is a very useful approach to appreciate intraoperative resectability and achieve better R0 resection rates, notwithstanding significantly reduced intraoperative blood loss. Furthermore, when SMV/PV invasion is detected, smaPD is useful as it decreases intraportal tumour dissemination and makes vascular repair technically easier.

## REFERENCES


[1] Poruk KE, Griffin JF, Wolfgang CL, Cameron JL. Pancreatic and Periampullary Cancer. In: Yeo CJ, DeMeester SR, Matthews JB, McFadden DW, Fleshman JW, (eds). Shackelford's Surgery of the Alimentary Tract. 8th edition. Philadelphia: Elsevier; 2019.p. 1136-44.

[2] NCCN Guidelines Version 3.2024 Pancreatic Adenocarcinoma. 2024 (August 2). Available from: https://www.nccn.org/professionals/physician_gls/pdf/pancreatic.pdf.

[3] Jiang X, Yu Z, Ma Z, Deng H, Ren W, Shi W, et al. Superior mesenteric artery first approach can improve the clinical outcomes of pancreaticoduodenectomy: A meta-analysis. Int J Surg. 2020;73:14-24. Available from: https://doi.org/10.1016/j.ijsu.2019.11.007.

[4] Allen PJ. Pancreaticoduodenectomy. In: Jarnagin WM, Allen PJ, Chapman WC, D'Angelica MI, DeMatteo RP, Gian Do RK, Vauthey JN (eds). Blumgart's surgery of the liver, biliary tract and pancreas. 7th edition. Philadelphia: Elsevier; 2023. p. 1683.

[5] Pandanaboyana S, Loveday B, Windsor JA. Artery first approach to pancreatic cancer resection: A review of the evidence for benefit. J Pancreas. 2017;18(5):369-71.

[6] Pessaux P, Varma D, Arnaud JP. Pancreaticoduodenectomy: Superior mesenteric artery first approach. J Gastrointest Surg. 2006; 10(4):607-11. Available from: https://doi.org/10.1016/j.gassur.2005.05.001.

[7] Sanjay P, Takaori K, Govil S, Shrikhande S, Windsor J. 'Artery-first' approaches to PD. Br J Surg. 2012;99:1027-35. Available from: https://doi.org/10.1002/bjs.8763.

[8] Schneider M, Strobel O, Hackert T, Büchler MW. Pancreatic resection for cancer-the Heidelberg technique. Langenbecks Arch Surg. 2019;404:1017-22. Available from: https://doi.org/10.1007/s00423-019-01839-1.

[9] Feng Q, Liao W, Xin Z, Jin H, Du J, Cai Y, et al. Laparoscopic pancreaticoduodenectomy versus conventional open approach for patients with pancreatic duct adenocarcinoma: An up-to-date systematic review and meta-analysis. Front Oncol. 2021;11:749140. Doi: 10.3389/fonc.2021.749140. PMID: 34778064; PMCID: PMC8578898.

[10] Khalid A, Ahmed H, Amini N, Pasha SA, Newman E, King DA, et al. Outcomes of minimally invasive vs. open pancreatoduodenectomies in pancreatic adenocarcinoma: Analysis of ACS-NSQIP data. Langenbecks Arch Surg. 2024;409(1):258. Doi: 10.1007/s00423-024-03454-1. PMID: 39168872.

[11] Zhu J, Li X, Kou J, Ma J, Li L, Fan H, et al. Proposed Chaoyang vascular classification for superior mesenteric-portal vein invasion, resection, and reconstruction in patients with pancreatic head cancer during pancreaticoduodenectomy - A retrospective cohort study. Int J Surg. 2018;53:292-97. Epub 2018 Apr 11. Doi: 10.1016/j.ijsu.2018.04.011. PMID: 29654962.

[12] Kung JWC, Parks RW. Vascular resections in minimally invasive surgery for pancreatic cancer. Laparoscopic, Endoscopic and Robotic Surgery. 2022;5(1):03-09. Available from: https://doi.org/10.1016/j.lers.2021.09.003.

[13] Bassi C, Marchegiani G, Dervenis C, Sarr M, Hilal MA, Adham M, et al. The 2016 update of the International Study Group (ISGPS) definition and grading of postoperative pancreatic fistula: 11 years after. Surgery. 2017;161(3):584-91.

[14] Hirono S, Kawai M, Okada K, Miyazawa M, Shimizu A, Kitahata Y, et al. Mesenteric approach during pancreaticoduodenectomy for pancreatic ductal adenocarcinoma. Ann Gastroenterol Surg. 2017;1:208-18.

[15] Dumitrascu T, David L, Popescu I. Posterior versus standard approach in pancreatoduodenectomy: A case-match study. Langenbecks Arch Surg. 2010;395(6):677-84. Epub 2009 May 6. Doi: 10.1007/s00423-009-0499-3. PMID: 19418065; PMCID: PMC2908755.

[16] Tohamy AZ, Eltyb HA, Hussien MT, Atta H. Artery first versus traditional approach in pancreatoduodenectomy for pancreatic head cancer. Int Surg J. 2021;8(1):1-11. Available from: https://dx.doi.org/10.18203/2349-2902.isj20205420.

[17] Müller PC, Müller BP, Hackert,T. Contemporary artery-first approaches in pancreatoduodenectomy. Br J Surg. 2023;110(12):1570-73. Available from: https://doi.org/10.1093/bjs/znad175.

[18] Welsch T, Borm M, Degrate L, Hinz U, Buchler MW, Wente MN. Evaluation of the International Study Group of Pancreatic Surgery definition of delayed gastric emptying after pancreatoduodenectomy in a high-volume centre. Br J Surg. 2010;97(7):1043-50.

[19] Mirrielees JA, Weber SM, Abbott DE, Greenberg CC, Minter RM, Scarborough JE. Pancreatic fistula and delayed gastric emptying are the highest-impact complications after whipple. J Surg Res. 2020;250:80-87.

[20] Dua F, Wanga X, Lina H, Zhaoa X. Pancreaticoduodenectomy with arterial approach of total mesenteric resection of the pancreas for pancreatic head cancer. Gastroenterol Res. 2019;12(5):256-62.

[21] Noussios G, Dimitriou I, Chatzis I, Katsourakis A. The main anatomic variations of the hepatic artery and their importance in surgical practice: Review of the literature. J Clin Med Res. 2017;9(4):248-52. Available from: https://doi.org/10.14740/jocmr2902w.

[22] Andall RG, Matusz P, du Plessis M, Ward R, Tubbs RS, Loukas M. The clinical anatomy of cystic artery variations: A review of over 9800 cases. Surg Radiol Anat. 2016;38(5):529-39. Epub 2015 Dec 23. Doi: 10.1007/s00276-015-1600-y. PMID: 26698600.

[23] Warschkow R, Widmann B, Beutner U, Marti L, Steffen T, Schiesser M, et al. The more the better-lower rate of stage migration and better survival in patients with retrieval of 20 or more regional lymph nodes in pancreatic cancer: A population-based propensity score matched and trend SEER analysis. Pancreas. 2017;46:648-57. Doi: 10.1097/MPA.0000000000000784.

[24] Eskander MF, de Geus SW, Kasumova GG, Ng SC, Al-Refaie W, Ayata G, et al. Evolution and impact of lymph node dissection during pancreaticoduodenectomy for pancreatic cancer. Surgery. 2007;161:968-76. Doi: 10.1016/j.surg.2016.09.032.

[25] Wang X, Luo, Q, Li, S, Wu Y, Zhen T, Zhu F, et al. A comparative study of the "superior mesenteric artery first" approach versus the conventional approach in short-term and long-term outcomes in patients with pancreatic ductal adenocarcinoma undergoing laparoscopic pancreaticoduodenectomy. Surg Endosc. 2023;37:9326-38. Available from: https://link.springer.com/article/10.1007/s00464-023-10470-7.



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