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Vascular First, Tumor Second: A Case Series Evaluating the Artery-First Approach in Pancreaticoduodenectomy

MOHAMED ELDESOKY, M.D.*; HASSAN M. ABD EL RAZEK, M.D.**;
AHMED R. MANDOUR, M.D.*; MOHAMED SHERIF A. AHMED, M.D.*** and RAMI SAID, M.D.*

The Department of Surgery, Gastrointestinal Surgery Center, Mansoura University, Radiology Department**, Gastrointestinal Surgery Center, Mansoura University Hospitals and Surgery Department***, Faculty of Medicine, Mansoura University*

Abstract

Background: This study examines the clinical and oncological outcomes associated with the superior mesenteric artery (SMA) first approach in pancreaticoduodenectomy (PD) for patients diagnosed with malignancies of the pancreatic head.

Aim of Study: This study aims explicitly to pilot the technique's feasibility, safety, and efficacy in comparison to the conventional approach. The research seeks to enhance the comprehension of the possible benefits and limitations of the artery-first strategy in PD by investigating these critical parameters.

Patients and Methods: In a three years retrospective case series at Gastrointestinal Surgical Center (GISC), Mansoura University Hospitals, 17 patients were examined for perioperative parameters such operation duration, blood loss, complication rates, and oncological outcomes like R0 resection rates and overall survival. Improving surgical accuracy while reducing problems linked to traditional procedures is the goal of the SMA-first approach. The most common symptom was jaundice, and the individuals' median age was 62 years old, according to the results. With normal SMA margins seen in 94.1% of patients, preoperative imaging validated the viability of the SMA-first technique. A considerable frequency of postoperative problems was identified in the research, with pancreatic leakage accounting for 47.1% and total difficulties for 52.9%, even though the vascular margins were clean. Only one patient died within 30 days after surgery, and the average length of stay in the hospital after the procedure was 10 days. Consistent with earlier research highlighting its potential benefits, the SMA-first procedure showed improvements over conventional methods in relation to blood loss and surgical efficiency. On the other hand, anastomosis procedures in particular need further improvement because to the high risk of pancreatic leakage. In this case series, the SMA-first strategy in PD is shown to be safe and effective while indicating areas for improvement to enhance pancreatic cancer surgical results.

Results: The Median (IQR) age of included pancreatic head mass patients undergoing the artery-first approach was 62 (14) years. Gender distribution was nearly equal (male vs. female: 52% vs. 47.1%). The most common complaint on admission among them was jaundice (76.5%), followed by abdominal pain (47%) and loss of weight (23.5%), while fever and vomiting were recorded only in 11.8%. Diabetes and hypertension were recognized in 7.

Conclusion: This case series evaluating the artery-first approach for pancreaticoduodenectomy (PD) in patients with pancreatic head cancer demonstrates promising surgical and oncological outcomes. The technique allowed clear vascular margins in most cases, indicating its potential effectiveness in achieving R0 resections. Despite the low mortality rate and minimal intraoperative complications, the study revealed a significant incidence of postoperative complications, particularly pancreatic leakage, which underscores the need for refinement in surgical techniques, especially concerning anastomosis methods. The findings align with existing literature suggesting that while the artery-first strategy may enhance certain operative parameters, further investigation is warranted to confirm its long-term benefits and to address the challenges posed by postoperative complications. Overall, this research contributes valuable insights into the feasibility and safety of the artery-first SMA approach, paving the way for future studies aimed at optimizing outcomes for patients undergoing PD for pancreatic malignancies.

Key Words: *SMA – Pancreaticoduodenectomy – Ampullary Carcinoma – Artery first approach.*

Introduction

PANCREATICODUODENECTOMY (PD), accompanied by adjuvant or neoadjuvant chemotherapy, is the only curative treatment option for

Correspondence to: Dr. Mohamed Eldesoky,
E-Mail: msdesoky@mans.edu.eg

individuals with pancreatic and periampullary malignancies [1]. Utilizing conventional techniques to assess PD specimens often reveals a positive resection margin around the superior mesenteric Artery (SMA), a definitive indicator of poor prognosis [2]. The pancreatic mesenterium cannot be entirely excised in almost 80% of pancreatic cancer patients [3]. One of the methods to achieve R0 resection in pancreatoduodenectomy included careful arterial dissection and thorough removal of retropancreatic tissue, especially around the superior mesenteric artery (SMA), to enhance oncological results [2].

SMA's first approach in OPD has shown improved R0 resection rates, reduced complications, and enhanced survival outcomes for pancreatic cancer patients [4]. SMA is defined by two principal features: The prompt assessment of arterial involvement before irreversible surgical actions and the careful excision of the SMA resection margin to get an R0 resection [5]. Potential advantages, such as lower complication rates, improved 3-year survival rates, and less blood loss, have been highlighted by study of Jiangh et al. [4] compared to the usual technique. The findings of Jiang et al.'s meta-analysis indicated that the SMA-first strategy in pancreatoduodenectomy (SMA-PD) significantly improved operative and postoperative outcomes relative to conventional methods. Patients having SMA-PD exhibited diminished complication rates, including decreased occurrences of pancreatic fistula, delayed gastric emptying, and intra-abdominal infections, with improved surgical results, such as reduced blood loss and shortened postoperative hospital stay [4]. Nonetheless, the data is inconclusive since Sabater et al. [2] reported no significant changes in R0 resection rates or postoperative complications in their multicenter, randomized study. The data indicates that while the artery-first approach may be efficacious, its widespread use requires more confirmation.

Despite these developments, problems remain, especially in patients undergoing neoadjuvant treatment with a history of pancreatitis or those who are obese since surgical planes may be occluded. This case series aims to thoroughly assess the clinical and oncological outcomes linked to the artery-first strategy in pancreatoduodenectomy (PD) over three years, including a cohort of 17 patients. With a focus on perioperative parameters like operative time, blood loss, and complication rates, as well as oncological outcomes like R0 resection rates, lymph node yield, and overall survival.

Patients and Methods

Study design: A retrospective case series study was conducted to evaluate the outcomes of the superior mesenteric Artery (SMA) the first approach for pancreaticoduodenectomy. Over three years, the study included 17 consecutive patients undergoing this surgical approach at the Gastrointestinal Surgery Center (GISC), Mansoura University Hospitals From January 2022 – December 2024. Data was collected and analyzed to assess perioperative outcomes.

Inclusion criteria:

- Patients with malignant pancreatic head or periampullary lesions require pancreaticoduodenectomy with curative intent.
- Patients with adequate preoperative performance status.

Exclusion criteria:

- Patients with benign lesions.
- Patients deemed unfit for anesthesia.
- Patients with locally advanced or metastatic disease.
- Patients with infiltrated safety margins confirmed preoperatively.

Preoperative evaluation: All patients underwent comprehensive preoperative assessment, including Baseline History and Physical Examination, Demographics: Age, gender, and relevant medical history (e.g., diabetes, hypertension). Symptoms: Jaundice, abdominal pain, vomiting, weight loss. Physical signs: Jaundice and body weight measurements. Laboratory Tests: Serum bilirubin, alkaline phosphatase, SGPT, albumin, amylase, complete blood picture. Tumor markers: CEA and CA19-9. Imaging Studies: Abdominal ultrasound, CT imaging (pancreatic protocol). Endoscopic retrograde cholangiopancreatography (ERCP) with biliary drainage when indicated.

Surgical Technique:

SMA-First Approach:

SMA-first approach After releasing the hepatic flexure of the colon, the inferior vena cava (IVC) and left renal vein (LRV) are revealed by the Kocher maneuver. The duodenum and head of the pancreas are separated from the retroperitoneum. Above the LRV, the peri-arterial plexus of the SMA is dissected immediately above the membrane of the Artery to its root, exposing the beginning of the SMA. The SMA sheath is dissected longitudinally, the uncinatemesopancreas is dissected along the anterior, right, and posterior edges of the SMA adventitia and the inferior pancreaticoduodenal Artery (IPDA) is ligated and divided in the process. Next, the nerve and connective tissue between the SMA and the uncinate process were disconnected along the root of the SMA. At this point, the arterial blood supply to the uncinate process is thoroughly disconnected, and only the SMV or PV is connected to the resected tissue. If the SMV was invaded, segmental vessel resection or lateral wedge resection could be performed, or if not invaded, the uncinate process could be gradually separated from the SMV or PV.

Intraoperative Data Collection includes liver status (normal, cholestatic or cirrhotic), tumor size and pancreatic duct diameter, pancreatic texture (soft or firm), Operational time, estimated blood loss, and blood transfusion requirements.

Postoperative management and follow-up:

1- Postoperative Data Collection: Complications: Pancreatic fistula, bile leak, hemorrhage, and collection; Postoperative liver function tests: Bilirubin, albumin, and SGPT; ICU and total hospital stay duration; and Mortality within 30 days of surgery.
2- Outcome Measures: Evaluation of postoperative pancreatic fistula (POPF) delayed gastric emptying (DGE), and post pancreatectomy hemorrhage (PPH) based on International Study Group of Pancreatic Surgery (ISGPS) guidelines.

Follow-up:

Patients were followed-up for six months postoperatively, with clinical assessments and imaging performed at three and six months. Tumor markers (CEA, CA19-9) were monitored, and survival outcomes were recorded.

Data analysis: Collected data were tabulated and analyzed using SPSS software. Continuous variables were presented as means ± standard deviations, while categorical variables were expressed as frequencies and percentages. Comparisons were performed using appropriate statistical tests, with a significance level set at $p<0.05$.

Ethical considerations:

The Institutional Research Board (IRB) of Mansoura Medical College approved the study protocol. All participants gave verbally informed consent. Confidentiality and privacy were maintained throughout the study, and collected data were used solely for research purposes.

Results

The Median (IQR) age of included pancreatic head mass patients undergoing the artery-first approach was 62 (14) years. Gender distribution was nearly equal (male vs. female: 52% vs. 47.1%). The most common complaint on admission among them was jaundice (76.5%), followed by abdominal pain (47%) and loss of weight (23.5%), while fever and vomiting were recorded only in 11.8%. Diabetes and hypertension were recognized in 7 out of 17 pancreatic mass patients.

The presurgical investigations as radiological and laboratory test results of included patients were documented in Table (1), i.e. the Median (IQR) of their tumor markers CEA was 3 (3), CA19-9 Median (IQR) was 78 (319), and SGPT Median (IQR) was 62.0 (103). Additionally, the preoperative CT imaging scan results of included patients revealed that two-thirds of them had pancreatic mass, while the other third had ampullary one, 94.1% of them had normal SMA Margin, 76% had normal SMV margin, and 88% had normal CT-PV. The Median (IQR) of all pancreatic head masses in CT was 3 (1.5). Only 2 patients had EUS biopsy before, and 6 out of 17 had preoperative biliary drainage by ERCP.

Table (2) discusses the Operational characteristics and pathological findings of Pancreatic head mass patients. We found that 10 patients (58.8%) had normal liver status, while 3 had cirrhotic liver (17.6%), 3 had cholestatic liver (17.6%), and only 1 had focal liver lesion (5.6%).

The most common PHM mass type was inter-operative mass (76.5%). Nine out of 17 patients (52.9%) had soft pancreas, while the other 8 had firm pancreas (47.1%). Concerning duct position, only 1 was recorded to have an eccentric position, while the rest were equally distributed between central and posterior positions (8 patients each). The median (IQR) of the pancreatic duct diameter of all included patients was 4.0 (3.5).

Regarding pancreatic cutting methods, the most frequent method used was a sharp knife (52.9%), followed by diathermy (35.3%), and the least frequent was harmonic (11.8%). Nearly all of them (88.2%) had PJ anastomosis. Ten out of 17 patients (58.8%) had interrupted pancreatic anastomosis construction, while six had continuous one (35.3%). The surgeon used absorbable Pancreatic sutures in half of them.

About surgical technique, D to M equal to duct technique was performed in 15 patients. Tumor pathological findings revealed that most of the respected cancer was adenocarcinoma (82.4%). Most of them had mod differentiation (70.6%). The LN dissected median (IQR) was 12 (7). Only one patient needs a blood transfusion.

Table (3) records surgical outcomes, which reveal that nearly half of them had postoperative complications (52.9%) and pancreatic leakage (47.1%). Only 2 patients suffered from bile leakage, while only 1 patient had internal leakage. Hemorrhage was recorded in 2 patients, and 2 patients complained of pancreatitis.

Nearly a third of the patients included had wound infections. The median (IQR) of postoperative stays in hospital in general and ICU for all included patients was 10 (7.5) and 2 (5) days, respectively. Only 1 patient was recorded to be dead after the operation, while 11 were still alive, and 5 lost contact with them. Nearly a third underwent postchemo radiotherapy, and the other third did not take it, while the last third is unknown.

Table (1): Baseline characteristics of included Pancreatic head mass patients undergo for Artery first approach.

Variable	Frequency (%) N=17
Age in years Median (IQR)	62 (14)
Gender:	
Male	9 (52.9%)
Female	8 (47.1%)
Patients complained history:	
Jaundice	13 (76.5%)
Abdominal pain	8 (47.1%)
Fever	2 (11.8%)
vomiting	2 (11.8%)
Loss of weight	4 (23.5%)
Diabetes	7 (41.7%)
Hypertension	7 (41.7%)
Previous surgery	4 (23.6%)
Preoperative laboratory tests	Median (IQR)
WBCs	8.5 (5.45)
Total bilirubin	5.0 (15.7)
Alkaline phosphatase	11.0 (15)
SGPT	62.0 (103)
Albumin	3.7 (0.45)
Hemoglobin	11.0 (2.15)
Tumor markers CEA	3.0 (3.0)
CA19-9	78 (319)
Preoperative imaging studies (CT)	Frequency (%)
Mass type:	
Ampullary	4 (23.5%)
Pancreatic	13 (76.5%)
SMV margin:	
Normal	13 (76.5%)
Partial encasing	2 (11.8%)
Contacting	2 (11.8%)
SMA Margin:	
Normal	16 (94.1%)
Contacting	1 (5.9%)
CT-PV:	
Normal	15 (88.2%)
Partially encasing	1 (5.9%)
Contacting	1 (5.9%)
Mass size by CT	3 (1.5)
EUS biopsy	2 (11.8%)
Preoperative biliary drainage by ERCP	6 (35.3%)

Table (2): Operative characteristics and pathological findings of Pancreatic head mass patients undergoing artery-first approach

Variable	Frequency (%) N=
Liver status:	
Normal	10 (58.8%)
Cirrhotic	3 (17.6%)
Cholestatic	3 (17.6%)
Focal lesion in liver (biopsy –ve)	1 (5.9%)
Inter-operative mass:	
PHM	13 (76.5%)
Ampullary	3 (17.6%)
Uncinate	1 (5.9%)
Pancreatic duct diameter (Median (IQR))	4.0 (3.5)
Duct from post (Median (IQR))	3.0 (3.0)
Consistency of the pancreas:	
Soft	9 (52.9%)
Firm	8 (47.1%)
Duct position:	
Central	8 (47.1%)
Posterior	8 (47.1%)
Eccentric	1 (5.9%)
Pancreatic cutting method:	
Sharp knife	9 (52.9%)
Diathermy	6 (35.3%)
Harmonic	2 (11.8%)
Type of anastomosis:	
PG	2 (11.8%)
PJ	15 (88.2%)
Pancreatic anastomosis construction:	
Continuous	6 (35.3%)
Interrupted	10 (58.8%)
Combined	1 (5.9%)
Pancreatic suture:	
Absorbable	8 (47.1%)
Non absorbable	4 (23.5%)
Combined	4 (23.5%)
Type of suture:	
Vicryl	5 (29.4%)
PDS	2 (11.8%)
Maxon	5 (29.4%)
Silk	1 (5.9%)
Proline	4 (23.5%)
Technique used:	
D to M equal to duct	15 (88.2%)
Dunking anastomosis without duct to mucosa	1 (5.9%)
Dunking and equal to stump with D to M	1 (5.9%)
Tumor pathological result:	
Adenocarcinoma	14 (82.4%)
NeuroendocrinalTumour (Carcinoid)	2 (11.8%)
Papillary Cystadenoma with Dysplasia	1 (5.9%)

Table (2): Count.

Variable	Frequency (%) N=
Tumor differentiation:	
Well Differentiated	4 (23.5%)
Moderately Differentiated	12 (70.6%)
Number of LN infiltrated (Median (IQR))	1 (2)
Number of LN dissected (Median (IQR))	12 (7)
Blood loss in ml (Median (IQR))	300.0 (225.0)
Blood transfusion	1 (5.9%)

Table (3): Surgical outcomes of included Pancreatic head mass patients undergo Artery first approach.

Variable	Frequency (%) N=17
Patients complained of postoperative complications	9 (52.9%)
Patients complained of pancreatic leakage	8 (47.1%)
Patients complained of bile leakage	2 (11.8%)
Patients complained of internal leakage	1 (5.9%)
Patients complained of postoperative Hemorrhage	2 (11.8%)
Patients complained of postoperative pancreatitis	2 (11.8%)
Patients complained of postoperative Wound infection	5 (29.4%)
Postoperative stays in hospital (days) (Median (IQR))	10 (7.5)
Postoperative stay in ICU (days) (Median (IQR))	2 (5)
Patient outcome:	
Dead	1 (5.9%)
Still alive	11 (64.7%)
Loss of contact	5 (29.4%)
Post-chemo radiotherapy:	
Yes	6 (35.3%)
No	6 (35.3%)
Unknown	5 (29.4%)
Postoperative investigations (Median (IQR)):	
WBCs	29 (35)
SGPT	2.7 (0.4)
Albumin	11.7 (4.4)

Discussion

Recent updates in pancreatic surgery highlight significant advancements aimed at improving outcomes for patients with pancreatic cancer, a condition known for its poor prognosis. Venous resections are now routinely performed to enable en bloc tumor removal, while arterial resections are reserved for select patients due to their associated risks [6]. The study evaluated the application of the artery-first SMA (Superior Mesenteric Artery) technique in 17 cases of pancreatic head cancer, focusing on preoperative, intraoperative, and postoperative outcomes. The symptom profile highlights the aggressive and obstructive nature of pancreatic cancer, often leading to jaundice and weight loss. Identifying these symptoms early may help in expediting diagnosis and surgical planning. The most commonly reported symptom in this study, jaundice (76.5%), reflects the tumor's early compression of the bile duct, leading to bile buildup in the bloodstream. This is a hallmark feature of pancreatic head masses and is an essential clinical indicator, often prompting early medical intervention [3]. In this case series, preoperative imaging confirmed that most patients were suitable for the artery-first SMA technique, with clear margins around key vessels in most cases. Tumor marker levels varied, reflecting disease heterogeneity. The artery first approach was feasible despite variable liver conditions. Pancreatic consistency and duct positioning impacted surgical technique and may have influenced complication rates such as pancreatic leakage. Zhang et al. [7] reported that eighteen patients healed without difficulties, while three died of intra-abdominal hemorrhage caused by a pancreatic fistula, even though the bleeding did not occur at the artery anastomosis site. All repaired arteries demonstrated satisfactory patency throughout follow-up. The median postoperative survival was 11.6 months for all 11 patients with pancreatic cancer [7]. In comparison, our case series using the artery-first SMA approach demonstrated minimal intraoperative complications, with only one patient requiring a blood transfusion. However, postoperative complications, particularly pancreatic leakage (47.1%), remained a significant challenge despite achieving clear vascular margins in most patients (94.1% with normal SMA margin).

In this case series, the surgical approach demonstrated reasonable control over the resection process, achieving adequate tumor excision with minimal transfusion requirements. Using the artery-first SMA approach patients got effective control over tumor margins, with 94.1% of patients showing standard SMA margins and 76% having normal SMV margins. However, the procedure did not prevent significant postoperative complications, particularlypancreatic leakage (47.1%) and other complications (52.9%). Similar to Gall et al.'s findings, while our approach achieved satisfactory technical and oncological outcomes (e.g., clear margins and low mortality), long-term survival outcomes and postoperative recovery were affected by complications, suggesting that further surgical technique refinement may be necessary to optimize results. While postoperative complications, particularly pancreatic leakage, were notable, the overall surgical mortality was low. The artery-first SMA approach effectively minimized significant vascular complications and achieved reasonable postoperative recovery. Pancreatic leakage remains a significant complication following pancreaticoduodenectomy, as demon-

strated by the high leakage rate (47.1%) observed in our series. Several factors may explain this elevated incidence. Surgeon experience is crucial; technical proficiency in performing precise pancreatic anastomosis, especially in the artery-first approach, strongly influences leakage rates. Thus, technical refinement focusing specifically on the pancreatic anastomosis construction such as standardized duct-to-mucosa techniques, meticulous handling of soft pancreatic tissue, and training programs to enhance surgeon expertise may help mitigate this complication and improve patient outcomes in future implementations of the SMA-first approach.

Jiang et al. **[4]** conducted a meta-analysis showing that SMA-first pancreaticoduodenectomy (SMA-PD) had significant advantages over the standard technique (S-PD). SMA-PD was associated with a lower overall complication rate (OR 0.62), reduced pancreatic fistula (OR 0.52), delayed gastric emptying (OR 0.42), and intraabdominal infections (OR 0.39). However, it resulted in a higher diarrhea rate (OR 1.91) due to extensive lymphatic and neural dissection. Operative benefits included reduced blood loss (WMD -264.84 mL) and shorter postoperative stays (WMD -4.49 days), though operative times were comparable. In pancreatic cancer patients, SMA-PD achieved a higher R0 resection rate (OR 2.92), lower recurrence rate (OR 0.14), and improved 1-, 2-, and 3-year survival rates. Our case series using the artery-first SMA approach showed similar success in achieving clear vascular margins (94.1% normal SMA margin) with minimal intraoperative blood loss (only 1 transfusion case). However, unlike Jiang et al.'s findings of reduced pancreatic fistula, our series experienced a high rate of pancreatic leakage (47.1%) and other complications (52.9%).

Pal et al. **[8]** reported that the posterior SMA-first (P-SMA) approach for pancreatoduodenectomy (PD) improved operative efficiency and lymph node retrieval in patients with periampullary cancers. The P-SMA approach had a shorter operative time (321.1±54.0 vs. 357.6±55.8 minutes, p=0.05) and higher lymph node yield (10.7 vs. 5.95, p=0.001). However, the positivity of circumferential resection margin (CRM) did not differ significantly (17.6% vs. 23.8%, p=0.71). Recurrence and mortality rates were lower in the P-SMA group but not statistically significant at a 28-month follow-up. This study demonstrated similar efficiency in achieving clear SMA margins (94.1% with normal SMA margin) and a comparable median lymph node retrieval (12 nodes). A retrospective study conducted at St. Marianna University School of Medicine demonstrated that the artery-first approach pancreatoduodenectomy (AFA-PD) with complete lymphadenectomy around the superior mesenteric artery (SMA) significantly improved oncological outcomes compared to conventional pancreatoduodenectomy (PD). Patients undergoing AFA-PD had a longer median survival time (40.3 vs. 22.6 months; p=0.0140) and a higher 5-year survival rate (40.3% vs. 5.9%; p=0.005). Another recent study demonstrated that pancreatectomy with arterial resection (P-AR) for locally advanced pancreatic adenocarcinoma can be performed with acceptable safety, showing an overall mortality of 5.1% and morbidity of 41.5%. Patients undergoing P-AR had a high rate of neoadjuvant chemotherapy (75.4%), simultaneous venous resections (89%), and arterial reconstructions (85.5%). The study reported R0 resection in 52.4% of cases, with venous and arterial wall invasion observed in 74.2% and 58% of patients, respectively **[9].**

The artery-first SMA technique demonstrated satisfactory surgical and oncological outcomes in patients with pancreatic head cancer. Clear vascular margins were maintained in most cases, and the low mortality rate supports the approach's safety. However, the high rate of pancreatic leakage highlights an area for improvement in surgical technique. Postoperative recovery and survival rates were acceptable, with some variability in adjuvant therapy use.

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الأوعية الدموية أولاً، والورم ثانياً: سلسلة حالات لتقييم نهج الشريان أولا فى استئصال البنكرياس والاثنى عشر

تُقيّم هذه الدراسة النتائج السريرية والأورام المرتبطة باستخدام نهج الشريان المساريقى العلوى أولًا (SMA-first) فى عمليات استئصال رأس البنكرياس والاثنى عشر (Pancreaticoduodenectomy - PD) لدى المرضى المصابين بأورام فى رأس البنكرياس.

أُجريت الدراسة كدراسة حالة استعادية على مدى ثلاث سنوات فى مركز جراحة الجهاز الهضمى (GISC)، بمستشفيات جامعة المنصورة، حيث تم تحليل بيانات ١٧ مريضًا شملت مؤشرات الفترة المحيطة بالجراحة مثل مدة العملية، كمية فقدان الدم، معدلات المضاعفات، بالإضافة إلى المؤشرات الأورامية مثل معدل الاستئصال الكامل (R0) والبقاء الكلى.

يهدف نهج الشريان SMA أولًا إلى تحسين الدقة الجراحية وتقليل المشكلات المرتبطة بالنهج التقليدى.

وأظهرت النتائج أن العرض السريرى الأكثر شيوعًا كان اليرقان، بينما بلغ الوسيط العمرى للمرضى ٦٢ عامًا.

أكد التصوير المسبق للجراحة صلاحية تطبيق هذا النهج، حيث لوحظت هوامش سليمة حول الشريان SMA فى ٩٤,١٪ من الحالات.

ورغم أن الهوامش الوعائية كانت نظيفة، فقد أظهرت الدراسة وجود معدل كبير من المضاعفات بعد الجراحة، حيث بلغت نسبة حدوث تسرب البنكرياس ٤٧,١٪، والمضاعفات الكلية ٥٢,٩٪.

سُجلت حالة وفاة واحدة فقط خلال ٣٠ يومًا بعد الجراحة، وبلغ متوسط مدة الإقامة بالمستشفى بعد العملية ١٠ أيام.

وقد أظهر نهج SMA أولًا تحسنًا مقارنة بالطرق التقليدية فيما يتعلق بفقدان الدم وكفاءة الأداء الجراحى، مما يتماشى مع دراسات سابقة أبرزت فوائده المحتملة.

ومع ذلك، تبقى إجراءات المفاغرة بحاجة إلى تحسين بسبب ارتفاع معدل تسرب البنكرياس.

تُظهر هذه السلسلة من الحالات أن نهج SMA أولًا فى جراحات PD آمن وفعّال، مع إبراز بعض الجوانب التى تستوجب التحسين لتحسين نتائج جراحة سرطان البنكرياس.