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Original Research Article

SPLEEN-PRESERVING DISTAL PANCREATECTOMY IN THE SURGICAL MANAGEMENT OF PANCREATIC CYSTIC LESIONS: CLINICOPATHOLOGICAL PROFILE AND PERIOPERATIVE OUTCOMES FROM A TERTIARY CARE CENTRE IN SOUTH INDIA

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ABSTRACT

Background: Pancreatic cystic lesions (PCLs) encompass a heterogeneous group of neoplastic and non-neoplastic conditions with diverse biological behaviour and management strategies. In selected patients undergoing distal pancreatectomy, preservation of the spleen may avoid the long-term consequences of splenectomy. This study evaluates the clinicopathological profile and surgical outcomes of PCLs, with particular emphasis on spleen-preserving distal pancreatectomy. **Materials and Methods:** This retrospective observational study included 26 patients who underwent surgery for pancreatic cystic lesions at a tertiary care centre in Chennai, India, between June 2023 and May 2025. Demographic characteristics, clinical presentation, histopathology, operative procedures and postoperative outcomes were analysed descriptively. Spleen-preserving distal pancreatectomy was performed using either the Kimura or Warshaw technique. **Result:** The mean age was 48.9 ± 15.4 years, and 20 patients (76.9%) were female. Twenty-four patients (92.3%) were symptomatic. Histopathology revealed serous cystic neoplasm (SCN) in 9 patients (34.6%), mucinous cystic neoplasm (MCN) in 8 (30.8%), intraductal papillary mucinous neoplasm (IPMN) in 3 (11.5%), solid pseudopapillary neoplasm (SPEN) in 3 (11.5%) and pseudocyst in 3 (11.5%). Distal pancreatectomy was performed in 19 patients. Spleen preservation was achieved in 8 (42.1%), using the Kimura technique in 2 and the Warshaw technique in 6. All eight patients developed postoperative left upper quadrant pain. Four developed associated fever, all following the Warshaw procedure. Symptom-triggered contrast-enhanced computed tomography demonstrated small peripheral splenic infarcts in two Warshaw patients, with preserved perfusion of the remaining splenic parenchyma. Both were managed conservatively without re-intervention or secondary splenectomy. There was no perioperative mortality. **Conclusion:** Spleen preservation was achieved in 42.1% of patients undergoing distal pancreatectomy in this series. Both Kimura and Warshaw techniques enabled spleen preservation in appropriately selected patients. Limited peripheral splenic infarction following the Warshaw procedure was successfully managed conservatively. These findings support consideration of spleen preservation when oncological clearance and technical feasibility permit.

INTRODUCTION

Pancreatic cystic lesions comprise a heterogeneous group of pathological entities, ranging from benign inflammatory collections to premalignant and malignant neoplasms. The increasing use and improved resolution of cross-sectional imaging have contributed to the detection of pancreatic cystic lesions, including those discovered incidentally. Their clinical management remains challenging because biological behaviour, malignant potential and natural history vary considerably between histological subtypes.[1-3]

The major pancreatic cystic neoplasms include serous cystic neoplasms (SCNs), mucinous cystic neoplasms (MCNs), intraductal papillary mucinous neoplasms (IPMNs) and solid pseudopapillary neoplasms (SPENs). Pseudocysts, although not neoplastic, remain an important differential diagnosis. Accurate preoperative characterisation is essential to avoid unnecessary surgery while ensuring

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timely resection of lesions with significant malignant potential.[4-6]

Management is guided by clinical presentation, radiological characteristics, ductal communication, cyst size, mural nodules, main pancreatic duct involvement and other indicators of malignant transformation. International guidelines have helped standardise risk stratification and management, although clinical decisions continue to require individualised assessment.[7]

Surgical procedures are selected according to lesion location, histopathology, malignant potential and the need to achieve adequate oncological clearance. Distal pancreatectomy is commonly performed for lesions involving the pancreatic body and tail. Traditionally, distal pancreatectomy has frequently been accompanied by splenectomy. However, in appropriately selected patients with benign or low-risk lesions, spleen preservation is desirable to avoid the potential long-term consequences of asplenia.[8]

Two principal techniques are used for spleen-preserving distal pancreatectomy. The Kimura technique preserves the splenic artery and vein, whereas the Warshaw technique involves division of these vessels while maintaining splenic perfusion through the short gastric and gastroepiploic collateral circulation. Each technique has specific technical considerations and potential complications.[9]

The present study evaluates the clinicopathological characteristics and perioperative outcomes of patients undergoing surgery for pancreatic cystic lesions at a tertiary care centre in South India, with particular emphasis on the feasibility, techniques and postoperative outcomes of spleen-preserving distal pancreatectomy.[10]

Aim and Objectives

Primary objective: To evaluate the feasibility and outcomes of spleen-preserving distal pancreatectomy in patients undergoing surgery for pancreatic cystic lesions.

Secondary objectives

1. To describe the demographic and clinical profile of patients undergoing surgery for pancreatic cystic lesions.
2. To analyse the histopathological spectrum and anatomical distribution of the lesions.
3. To describe the surgical procedures performed and perioperative outcomes.
4. To document the use of Kimura and Warshaw techniques and their associated postoperative splenic complications.

MATERIALS AND METHODS

Study design and setting: This retrospective observational study was conducted at the Institute of Surgical Gastroenterology, Coloproctology and Liver Transplantation, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, Tamil Nadu, India. Patients undergoing surgical management of pancreatic cystic lesions between June 2023 and May 2025 were included.

Study population: A total of 26 patients who underwent surgery for pancreatic cystic lesions during the study period were included. Both symptomatic and incidentally detected lesions were considered.

Data collection: Clinical and operative information was reviewed from institutional records. Variables included age, sex, presenting symptoms, comorbidities, lesion location and size, histopathological diagnosis, surgical procedure, operative approach, spleen-preservation technique, postoperative complications and perioperative mortality.

Surgical management: The operative procedure was selected according to lesion location, preoperative radiological assessment, intraoperative findings and the anticipated need for oncological clearance. For distal pancreatic lesions, spleen preservation was attempted in appropriately selected patients when considered oncologically and technically feasible. The Kimura technique involved preservation of the splenic artery and vein. The Warshaw technique involved division of the splenic artery and vein with preservation of the short gastric and gastroepiploic collateral circulation.

Assessment of splenic complications: Patients who developed postoperative left upper quadrant abdominal pain underwent contrast-enhanced computed tomography. The presence, extent and distribution of splenic infarction and perfusion of the remaining splenic parenchyma were assessed.

Statistical analysis: Data were analysed descriptively. Continuous variables are expressed as mean and standard deviation, while categorical variables are presented as frequencies and percentages. Given the small sample size and absence of a comparison group, no inferential statistical comparison between surgical techniques was undertaken.

RESULTS

Demographic and clinical characteristics: A total of 26 patients underwent surgery for pancreatic cystic lesions during the study period. The mean age was 48.9 ± 15.4 years (range, 20–74 years). There was a female predominance, with 20 females (76.9%) and 6 males (23.1%). Diabetes mellitus was present in 10 patients (38.5%). Twenty-four patients (92.3%) were symptomatic, while two (7.7%) had incidentally detected lesions. Abdominal pain was the predominant presenting symptom, reported in 20 patients (76.9%). Vomiting was observed in 3 (11.5%), abdominal mass in 3 (11.5%) and

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obstructive jaundice in 1 (3.8%). Some patients had more than one presenting symptom [Table 1].

Table 1: Demographic and clinical characteristics of the study population (N = 26)

Characteristic	Value
Age, years, mean ± SD (range)	48.9 ± 15.4 (20–74)
Sex	
Female, n (%)	20 (76.9)
Male, n (%)	6 (23.1)
Diabetes mellitus, n (%)	10 (38.5)
Mode of presentation	
Symptomatic, n (%)	24 (92.3)
Incidentally detected, n (%)	2 (7.7)
Presenting symptoms*	
Abdominal pain, n (%)	20 (76.9)
Vomiting, n (%)	3 (11.5)
Abdominal mass, n (%)	3 (11.5)
Obstructive jaundice, n (%)	1 (3.8)

SD, standard deviation. *Some patients had more than one presenting symptom; percentages therefore do not sum to 100%.

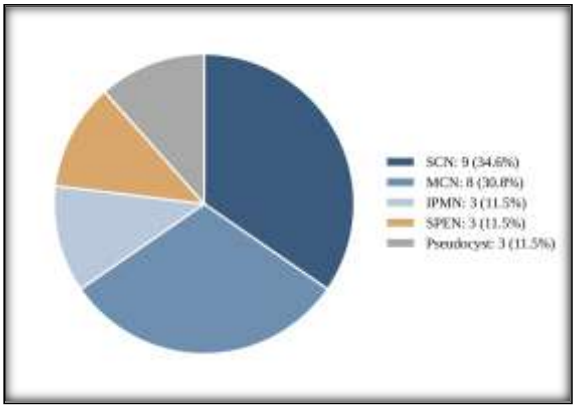


Figure 1: Histopathological distribution of pancreatic cystic lesions (N = 26). SCN, serous cystic neoplasm; MCN, mucinous cystic neoplasm; IPMN, intraductal papillary mucinous neoplasm; SPEN, solid pseudopapillary neoplasm.

Histopathological distribution: Histopathology revealed SCN in 9 patients (34.6%), MCN in 8 (30.8%), IPMN in 3 (11.5%), SPEN in 3 (11.5%) and pseudocyst in 3 (11.5%). SCN was the most frequent diagnosis, followed by MCN [Figure 1].

Clinicopathological characteristics by subtype: SCN: Nine patients; five (55.6%) female; mean age 60.7 ± 8.6 years. Lesions were in the head in 2 (22.2%), body in 3 (33.3%) and tail in 4 (44.4%); mean size 8.0 ± 4.0 cm.

MCN: Eight patients, all female; mean age 41.8 ± 13.6 years. Lesions were in the head in 1 (12.5%), body in 1 (12.5%) and tail in 6 (75%); mean size 6.8 ± 4.4 cm.

IPMN: Three patients, including two males (66.7%); mean age 56.0 ± 10.5 years. One lesion (33.3%) was in the head and two (66.7%) in the tail; mean size 3.0 ± 1.0 cm. Ductal communication was identified in all three.

SPEN: Three patients, all female; mean age 23.7 ± 5.5 years. Two lesions (66.7%) were in the head and one (33.3%) in the tail; mean size 12.4 ± 6.6 cm.

Pseudocyst: Three patients, all female; mean age 50.7 ± 4.0 years. All lesions were in the pancreatic body; mean size 4.3 ± 1.3 cm [Table 2].

Table 2: Clinicopathological characteristics by histological subtype

Subtype	n (%)	Age, years, mean ± SD	Female, n (%)	Location, n (head / body / tail)	Size, cm, mean ± SD	Ductal comm.
SCN	9 (34.6)	60.7 ± 8.6	5 (55.6)	2 / 3 / 4	8.0 ± 4.0	—
MCN	8 (30.8)	41.8 ± 13.6	8 (100)	1 / 1 / 6	6.8 ± 4.4	—
IPMN	3 (11.5)	56.0 ± 10.5	1 (33.3)	1 / 0 / 2	3.0 ± 1.0	3/3
SPEN	3 (11.5)	23.7 ± 5.5	3 (100)	2 / 0 / 1	12.4 ± 6.6	—
Pseudocyst	3 (11.5)	50.7 ± 4.0	3 (100)	0 / 3 / 0	4.3 ± 1.3	—
Total	26 (100)	48.9 ± 15.4	20 (76.9)	6 / 7 / 13	—	—

SCN, serous cystic neoplasm; MCN, mucinous cystic neoplasm; IPMN, intraductal papillary mucinous neoplasm; SPEN, solid pseudopapillary neoplasm. Ductal comm., ductal communication identified.

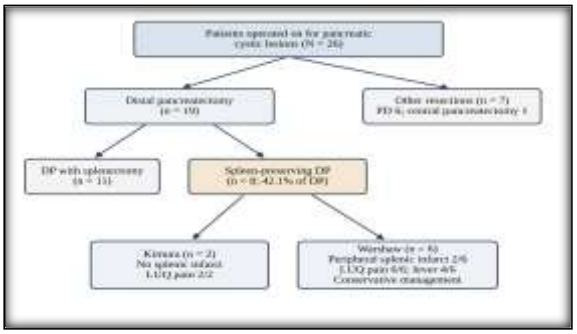


Figure 2: Flow of patients and operative procedures. DP, distal pancreatectomy; PD, pancreaticoduodenectomy; LUQ, left upper quadrant.

Surgical procedures: Distal pancreatectomy with splenectomy was performed in 11 patients (42.3%), while spleen-preserving distal pancreatectomy was performed in 8 (30.8%). Pancreaticoduodenectomy was performed in 6 (23.1%) and central pancreatectomy in 1 (3.8%). Thus, distal pancreatectomy was performed in 19 patients

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(73.1%). An open approach was used in 21 patients (80.8%), while 5 (19.2%) underwent laparoscopic surgery [Table 4; Figure 2].

Spleen-preserving distal pancreatectomy: Spleen preservation was achieved in 8 of the 19 patients undergoing distal pancreatectomy (42.1%). The Kimura technique was used in 2 patients (25% of spleen-preserving procedures) and the Warshaw technique in 6 (75%). All eight patients developed postoperative left upper quadrant abdominal pain. Four developed associated fever, and all four belonged to the Warshaw group. In view of postoperative symptoms, all eight patients underwent contrast-enhanced CT evaluation. Small peripheral splenic infarcts were identified in two of the six Warshaw patients (33.3%). Perfusion of the remaining splenic parenchyma was preserved in both. Both patients were managed conservatively; neither required re-intervention or secondary splenectomy. No splenic infarction was identified in the two patients who underwent the Kimura technique [Table 3].

Table 3: Postoperative splenic outcomes after spleen-preserving distal pancreatectomy (n = 8)

Technique	n	LUQ pain, n (%)	Fever, n (%)	CT splenic infarct, n (%)	Management and outcome
Kimura	2	2 (100)	0 (0)	0 (0)	—
Warshaw	6	6 (100)	4 (66.7)	2 (33.3)	Infarcts conservatively managed; no re-intervention or secondary splenectomy
Total	8	8 (100)	4 (50.0)	2 (25.0)	No secondary splenectomy

LUQ, left upper quadrant. All eight patients underwent contrast-enhanced CT for postoperative symptoms. Infarcts were small and peripheral, with preserved perfusion of the remaining splenic parenchyma. No statistical comparison was made owing to small numbers.

Postoperative complications and mortality: Recorded postoperative complications included surgical-site/wound infection in 5 patients (19.2%), pancreatic leak in 2 (7.7%), post-pancreatectomy haemorrhage in 1 (3.8%) and reoperation in 1 (3.8%; [Table 4]). There was no perioperative mortality. Pancreatic leaks are reported without an ISGPS grade because the documented grading details were not available for this analysis.

Table 4: Operative details and postoperative outcomes (N = 26)

Variable	n	%
Procedure performed		
Distal pancreatectomy with splenectomy	11	42.3
Spleen-preserving distal pancreatectomy	8	30.8
Pancreaticoduodenectomy	6	23.1
Central pancreatectomy	1	3.8
Operative approach		
Open	21	80.8
Laparoscopic	5	19.2
Postoperative complications		
Surgical-site / wound infection	5	19.2
Pancreatic leak*	2	7.7
Post-pancreatectomy haemorrhage	1	3.8
Reoperation	1	3.8
Perioperative mortality	0	0

*Reported without ISGPS grade because grading details were not available. Overall, distal pancreatectomy was performed in 19 patients (73.1%).

DISCUSSION

Pancreatic cystic lesions represent a diverse group of conditions requiring careful clinical, radiological and pathological evaluation. The decision to operate must balance the risk of malignant transformation or invasive disease against the morbidity associated with pancreatic resection. This study describes the clinicopathological profile and surgical management of 26 patients treated at a tertiary care centre in South India.

The cohort demonstrated a female predominance (76.9%) and a mean age of 48.9 years. SCN and MCN together accounted for nearly two-thirds of the histopathological diagnoses. The three pseudocysts reinforce the importance of using the broader term pancreatic cystic lesions rather than pancreatic cystic neoplasms when describing the entire study population.

Spleen preservation as the principal surgical contribution: The most noteworthy surgical finding was spleen preservation in 8 of 19 patients (42.1%) undergoing distal pancreatectomy. Preservation of the spleen is desirable in selected patients with benign or low-risk lesions, provided adequate oncological clearance is not compromised. Avoiding splenectomy may prevent lifelong susceptibility to overwhelming postsplenectomy infection and reduce the need for additional preventive measures associated with asplenia.

The Kimura technique preserves the splenic artery and vein, maintaining the physiological vascular supply to the spleen. The Warshaw technique

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sacrifices these vessels but relies on collateral perfusion through the short gastric and gastroepiploic vessels. In this series, Kimura was used in two patients and Warshaw in six, reflecting the importance of adapting the operative strategy to vascular anatomy and intraoperative feasibility.

The spleen-preservation rate is noteworthy when compared with published Indian institutional experiences. Chaudhari and colleagues reported spleen-preserving resections in approximately 3% of their overall multicentre cohort of 423 patients. Sharma and Bheerappa reported spleen preservation in 9 of 91 patients (9.8%); their series included 29 distal pancreatectomies. The present study achieved spleen preservation in 42.1% of distal pancreatectomies [Table 5]. These comparisons should be interpreted cautiously because patient selection, operative indications and denominators differ between studies. Nevertheless, the findings highlight a substantial emphasis on spleen preservation in the present series.

Table 5: Spleen preservation in the present series compared with published Indian experiences

Study	Setting	Total patients	Distal pancreatectomies	Spleen preservation (% of total)	Spleen preservation (% of DP)
Chaudhari et al.	Multicentre	423	Not stated	~3%	Not stated
Sharma & Bheerappa	Single centre	91	29	9 (9.8%)	Not stated
Present series	Single centre	26	19	8 (30.8%)	8 (42.1%)

DP, distal pancreatectomy. Patient selection, indications and denominators differ between studies; comparisons should be interpreted cautiously.

Outcomes following Kimura and Warshaw techniques: A further contribution is the documentation of symptom-triggered postoperative imaging and technique-specific splenic outcomes. All eight patients experienced postoperative left upper quadrant pain. Four developed associated fever, all following the Warshaw procedure. Contrast-enhanced CT demonstrated small peripheral splenic infarcts in two Warshaw patients. Importantly, the infarcts were limited to the peripheral splenic parenchyma, with preserved perfusion of the remaining spleen. Both patients were managed conservatively without re-intervention or secondary splenectomy.

Splenic infarction following the Warshaw procedure is a recognised concern because splenic perfusion becomes dependent on collateral circulation after division of the splenic vessels. The findings suggest that limited peripheral infarction does not invariably necessitate intervention when the remaining splenic parenchyma is adequately perfused and the patient can be managed clinically.

The absence of documented infarction in the two Kimura patients is encouraging but cannot establish superiority of the vessel-preserving technique because of the very small number of patients in each group. Similarly, postoperative pain in all eight patients should not be attributed solely to infarction, as CT demonstrated infarction in only two. These findings underline the importance of selecting the technique according to individual vascular anatomy and operative feasibility, and support symptom-directed imaging when patients develop postoperative pain or fever.

Perioperative outcomes and clinical implications: The overall complication profile included wound infection, pancreatic leak and post-pancreatectomy haemorrhage. No perioperative mortality was recorded. The sample size is insufficient to draw definitive conclusions regarding comparative safety. The findings support consideration of an organ-preserving approach to distal pancreatectomy in appropriately selected patients. The Kimura technique offers preservation of the native splenic vessels, while the Warshaw technique provides an alternative when vessel preservation is not feasible.



Image 1: Contrast enhanced CT abdomen axial image showing peripheral small wedge shaped hypodense non enhancing area in spleen suggestive of infarct

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Image 2: Post distal pancreatectomy with warshaw technique showing splenic infarct

Limitations: This study is a retrospective, single-centre analysis with a relatively small sample size. The number of patients undergoing each spleen-preserving technique was limited, precluding meaningful statistical comparison between the Kimura and Warshaw procedures. There was no matched comparison group of patients undergoing distal pancreatectomy with splenectomy. Long-term follow-up data, including splenic function, late infectious complications, endocrine and exocrine pancreatic function, and oncological outcomes, were not available for comprehensive evaluation. The findings should therefore be interpreted as an institutional surgical experience rather than definitive evidence of superiority of a particular technique.

CONCLUSION

Spleen preservation was achieved in 42.1% of patients undergoing distal pancreatectomy in this tertiary care series. Both Kimura and Warshaw techniques were utilised, allowing preservation of the spleen in appropriately selected patients. Two patients undergoing the Warshaw procedure developed small peripheral splenic infarcts with preserved perfusion of the remaining splenic parenchyma. Both were successfully managed conservatively without re-intervention or secondary splenectomy. The findings highlight the feasibility of spleen-preserving distal pancreatectomy using individualised vascular strategies. Spleen preservation should be considered whenever technically feasible and oncologically appropriate. Larger prospective studies with standardised assessment of splenic perfusion and long-term splenic function are needed.

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