Literature Review
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Ansa Pancreatica: Clinical Significance in Recurrent Acute Pancreatitis

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Abstract

Objective. This study aimed to conduct a thorough literature review regarding the ansa pancreatica as a potential risk factor for recurrent acute pancreatitis, exploring its pathophysiological mechanisms and possible complications during the surgical management of pancreatic conditions. **Methods.** A comprehensive search was performed in the PubMed and Scopus databases using the keyword 'Ansa Pancreatica,' yielding a total of 80 articles (PubMed: 34, Scopus: 46, with 52 unique articles). After applying strict inclusion and exclusion criteria, unrelated and duplicate articles were removed, resulting in the selection of 38 relevant studies. **Results.** Ansa pancreatica was found to be a statistically significant independent risk factor for recurrent acute pancreatitis in the majority of the literature reviewed. The suggested pathophysiological mechanism involves anatomical obstruction and subsequent pre-activation of the pancreatic enzymes, causing an inflammatory cascade. Diagnosis can be established using Endoscopic Retrograde Cholangiopancreatography, Magnetic Resonance Cholangiopancreatography, or Endoscopic Ultrasonography, while treatment options are either conservative or surgical, with the invasive procedures being associated with a significant risk of complications. Furthermore, some studies have indicated a correlation between ansa pancreatica and intraductal mucinous neoplasms. **Conclusion.** The findings clearly show that Ansa Pancreatica is a rare anatomical variant with significant clinical and surgical implications, underscoring the necessity for clinicians to be aware of it to mitigate complications and effectively manage pancreatic diseases.

Key Words: Ansa Pancreatica ▪ Pancreatitis ▪ Recurrent Pancreatitis ▪ Pancreatic Ductal Anomalies.

Introduction

The term ansa originates from the Latin word ānsa, meaning handle or loop. This makes it the appropriate term for describing the anatomical variant in question, characterized by an S-shaped looping duct that branches from the duct of Wirsung, linking it to the accessory duct, and ending at or near the minor papilla. Studies from the 20th century have already linked ansa to recurrent acute pancreatitis (1), an inflammatory disease of the pancreas and a frequent emergency faced by general surgery departments (2). Ansa pancreatica constitutes a clinical challenge, as lack of awareness can hinder timely diagnosis and management of the underlying anatomical anomaly, resulting in complications and prolonged hospitalization (3).

The aim of this literature review is to provide a comprehensive and current examination of ansa pancreatica. More specifically, it seeks to explore the relationship between this variant and recurrent acute pancreatitis, review recent findings connecting Ansa with certain neoplasms, and present available imaging modalities alongside up-to-date surgical approaches for managing acute pancreatitis.

Materials and Methods

In June 2025, a comprehensive search was performed in the PubMed and Scopus databases using the keyword 'Ansa Pancreatica.' This search initially yielded 80 articles (34 from PubMed and 46

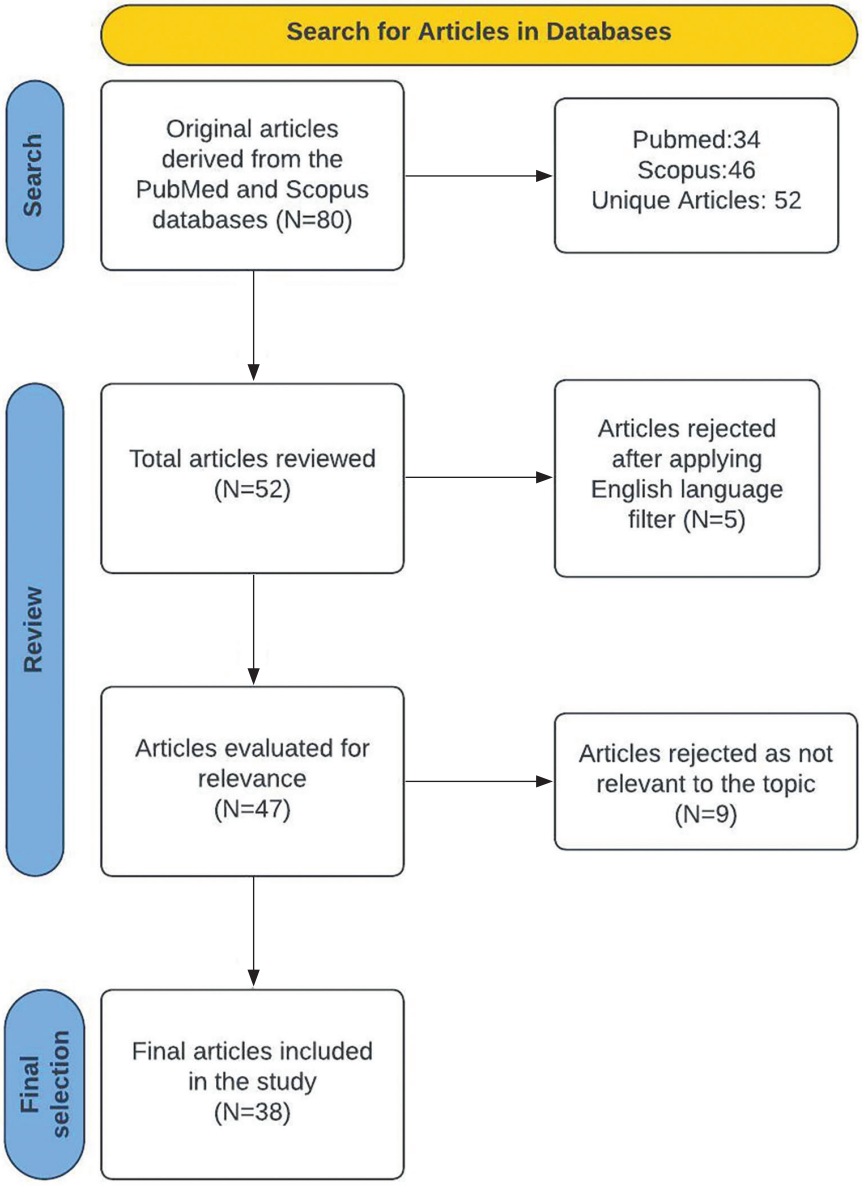

Figure 1. Flow chart of the literature search.

from Scopus, resulting in 52 unique entries). After applying specific inclusion and exclusion criteria (1. English Language and 2. Relevance), unrelated and duplicate articles were removed, leading to the final selection of 38 articles published between 1961 and 2024 (Figure 1).

Results

The review comprises 38 articles that include case studies (22), cohort studies (10), and literature reviews (6) (Table 1). Among the case studies, 3 focus on the Ansa variant, 3 link Ansa pancreatica to tumorigenesis, 13 examine the connection, or potential connection, between Ansa and pancreatitis, 4 discuss surgical complications in patients with the Ansa variant, and 1 questions the prevailing understanding of Ansa. The ages of patients in these case reports ranged from 11 to 80 years, with an average age of 46.4 years.

Table 1. Cited Studies (Reviews and Cohort Studies)

Title of review studies	Year	Author
Clinical importance of main pancreatic duct variants and possible correlation with pancreatic diseases	2020	Dugic A, et al.
Ansa pancreatica as a rare cause of pancreatitis: A review of case reports	2024	Bukowski JS, et al.
Ansa pancreatica. review of the literature	2019	Sotirios K, et al.
Development of the human pancreas and its exocrine function	2022	Mehta V, et al.
Pancreatitis in the developmentally anomalous pancreas	2020	Wood CG, et al.
Endoscopic ultrasound in pancreatic duct anomalies	2023	Chatterjee A, et al.
Title of cohort studies		
An anatomical-radiological study on the pancreatic duct pattern in man	1961	Dawson W, et al.
Accessory pancreatic duct patterns and their clinical implications	2015	Prasanna LC, et al.
Pancreatic ductal morphological pattern and dilatation in postoperative abdominal pain in patients with congenital choledochal cyst: an analysis of postoperative pancreatograms	2000	Koshinaga T, et al.
Anatomic variations of the pancreatic duct and their relevance with the cambridge classification system: MRCP findings of 1158 consecutive patients	2016	Adibelli ZH, et al.
Ansa pancreatica as a predisposing factor for recurrent acute pancreatitis	2016	Hayashi TY, et al.
Branch Fusion Between the Ventral and Dorsal Pancreatic Duct	1994	Hirooka T, et al.
Fusion variations of pancreatic ducts in patients with anomalous arrangement of pancreaticobiliary ductal system	1998	Ishii H, et al.
Groove pancreatitis: Endoscopic treatment via the minor papilla and duct of santorini morphology	2017	Chantarojanasiri T, et al.
Anatomical pancreatic variants in intraductal papillary mucinous neoplasm patients: a cross-sectional study	2022	Johansson K, et al.
Anatomical patterns of the pancreatic ductal system - A cadaveric and magnetic resonance cholangiopancreatography study	2019	Prasad M, et al.

Of the 6 reviews, 3 confirm a significant association between Ansa pancreatica and pancreatitis, while 2 suggest a possible link. The final review emphasizes the benefits of endoscopic ultrasound (EUS) in diagnosing pancreatic duct irregularities, including Ansa. Among the 10 cohort studies, 4 connect the variant with pancreatitis, 5 characterize the variant itself, and 1 identified an elevated risk for multiple cystic lesions in patients presenting with papillary mucinous neoplasm alongside Ansa pancreatica.

Discussion

Embryologically, the pancreas develops from two endodermal buds, the ventral and dorsal buds, which appear during the fifth week of embryonic development. The ventral bud differentiates into the head and uncinate process, while the dorsal bud gives rise to the neck, body, and tail. Consequently, the dorsal bud forms the duct of Santorini, and the duct of Wirsung is formed by both buds—its proximal third from the ventral bud and the distal two-thirds from the dorsal bud (3).

As previously described, Ansa forms through the merging of an inferior branch of the main pancreatic duct (MPD) with either an inferior branch of the proximal accessory pancreatic duct (APD) or directly with the proximal part of the APD (4-6) (Figure 2).

The formation of the S-shaped loop may serve to alleviate drainage issues caused by the obstruction of the APD near its junction with the MPD by connecting the two ducts (7). However, evidence indicates the presence of two subtypes in terms of the patency of the APD: one with a patent duct of Santorini leading to the duodenum (minor

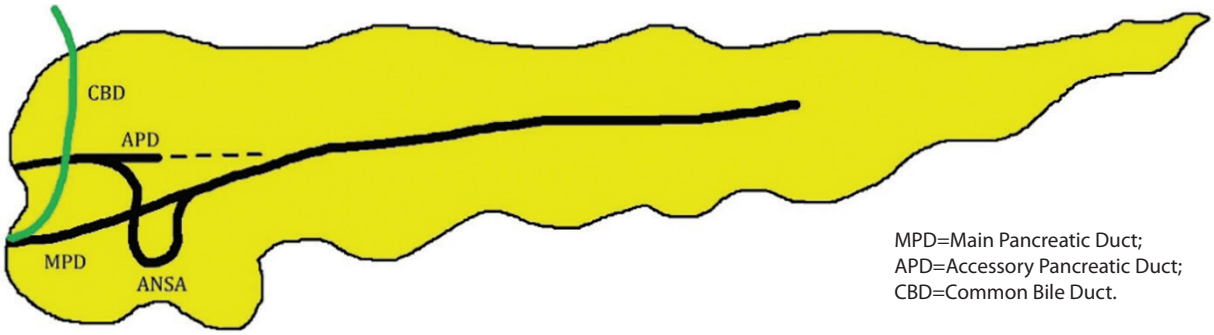

Figure 2. Ansa Pancreatica.

papilla) and one without (6-8). Most studies report that the non-patent type is the more common variant, comprising approximately 55.5% to 80% of cases (6, 7, 9).

Notable discrepancies in the literature warrant attention. Some authors classify the patent subtype as a distinct ductal anomaly (8). Additionally, Guerroum et al. described a case of Ansa with a non-patent major papilla (10), while Koshinaga et al. stated that all Ansa cases with congenital choledochal cysts presented with a radiologically patent APD and dilated ducts (11). These controversies underscore the necessity for additional research concerning whether these sub-variants should be included within or excluded from the Ansa spectrum.

First identified by Dawson and Langman in 1961 (6), Ansa pancreatica is the rarest variation of pancreatic ducts, with its true incidence still uncertain. Among various studies, the reported incidence varies considerably, ranging from 0.25% to 22.5% (12, 7). The maximum figure of 22.5% deviates significantly from the rest of the findings, in which the maximum reported incidence is 6,7%, and derives from an Indian cadaveric cohort study (7), underscoring a potential correlation between ethnicity and the occurrence of this variant. In a significant retrospective study by Abidelli et al. involving 1158 patients, the incidence of Ansa was found to be 1.2% (13), while Hayashi et al. reported rates of 0.85% within a community group (14). Neither study found sex to influence the variation's prevalence. It is crucial to note that both employed MRCP as their imaging modality, which may slightly underestimate Ansa's true occurrence compared to ERCP or surgical investigations, despite being the only non-invasive option for healthy individuals (13, 14).

In our investigation, we encountered an alternative presentation of Ansa, where a looping duct intersects the duct of Wirsung as it connects with the duct of Santorini (12, 14). In this contentious variant, the APD is present but does not contribute to the loop formation, which entirely arises from the MPD or its branches. Additionally, we identified two studies that contest the existence of Ansa pancreatica. In their case report, Suda et al. indicated no evidence of fusion between two inferior branches, suggesting instead that Ansa arises solely from the APD with the MPD merging directly into the APD (15). They did, however, affirm the merger of an inferior branch from the dorsal pancreatic duct (APD) with the ventral duct (MPD). While Dawson and Langman (6) initially defined Ansa as resulting from two inferior branches from the MPD and APD, many researchers consider the direct merging of an inferior branch from the MPD into the APD as characteristic of Ansa, as the S-shaped loop is present in those cases too (5, 8, 9). This finding may be seen as an additional subvariant.

Hirooka et al., in their cohort study, reported a branch originating from the MPD following the expected curvature and terminating at the minor papilla, without any evidence of the APD or its branches, thereby questioning the validity of Ansa (16). Nonetheless, it should be noted that the sample lacked histopathological examination,

which may undermine the findings' reliability. Clearly, further research is essential to elucidate the extensive range of Ansa's subvariants, as a consensus on many subtypes remains elusive, primarily due to their infrequency. Future research could also examine the clinical impact of each of these subvariants, given that the current literature is already limited and predominantly focuses on the most frequent and academically endorsed subtypes.The relevance of Ansa pancreatica is underscored by its relationship with pancreatitis. The majority of the literature indicates that Ansa serves as a predisposing (5, 13, 14, 17, 19) or a potential predisposing factor (2, 7, 9, 20- 22) for pancreatitis. Ishii et al., in their cohort study, found that approximately 7% of patients with this anatomical variation experienced acute pancreatitis (1), while Hirooka et al. reported a uch higher incidence of 80% (4 out of 5) (16). Hayashi et al. established that the occurrence of Ansa was notably elevated (11.1%) among patients with recurrent acute pancreatitis, indicating a 20% risk for those with Ansa, which provides strong statistical evidence (14).

The association between Ansa and pancreatitis has been well-documented, with numerous authors linking it to: recurrent acute pancreatitis (5, 14, 16, 17, 19), acute pancreatitis (14, 19, 20), alcoholic pancreatitis (5, 17, 23), walled-off pancreatitis (17, 23), pancreatitis due to functional stenosis of the sphincter of Oddi (10), and even groove pancreatitis (24). Furthermore, Hussain S.N.F. et al. discussed the case of an 11-year-old patient whose acute pancreatitis was attributed to Ansa pancreatica, thereby including it in the differential diagnosis for the pediatric age group (25). In this demographic, acute pancreatitis is associated with high mortality and morbidity rates, making early diagnosis crucial for favorable outcomes.

The suggested pathophysiological mechanism for pancreatitis onset involves the obstruction of pancreatic secretion flow. Specifically, the looped duct meets the main pancreatic duct (MPD) at an oblique angle, resulting in increased intraductal pressure and early activation of pancreatic enzymes, which subsequently digest pancreatic tissue, trigger an inflammatory response, and lead to pancreatitis (3, 8, 12, 26). Additionally, a possibly non-functional duct of Santorini draining into the minor papilla may exacerbate the already insufficient drainage (8).

Recent studies have highlighted some connections between Ansa pancreatica and intraductal pancreatic mucinous neoplasm (IPMN) or major papilla adenoma (27-29). The first cohort study exploring the relationship between Ansa pancreatica and IPMN found a significant association linking Ansa with the presence of multiple cysts in IPMN patients, a known high-risk factor for concurrent pancreatic ductal adenocarcinoma (30). However, more research is warranted to clarify the causal links.

Lee S.-W. et al. reported a case involving concurrent gallbladder agenesis, Ansa, and Santorinicoele (31). While it is established that obstruction of the ductal wall plays a role in Santorinicoele's pathogenesis, it remains unclear whether Ansa pancreatica or gallbladder agenesis has a causal relationship. In clinical practice, ansa pancreatica can be diagnosed via Endoscopic Retrograde Cholangiopancreatography (ERCP), Magnetic Resonance Cholangiopancreatography (MRCP), and Endoscopic Ultrasonography (EUS) (32). ERCP is regarded as the gold standard imaging technique for this variation, though the sigmoid (S-shaped) branch of Ansa pancreatica may be misidentified as annular pancreas during imaging. Distinctions can be made through the pancreatogram—annular pancreas typically encircles the duodenum, while Ansa's looping branch stays within the pancreatic confines and does not cross the duodenum (8).

MRCP is a non-invasive modality for assessing pancreatic ducts, presenting a safer alternative to ERCP, as it can identify malignancies and carries a lower risk of complications (13). However, despite improvements in imaging, MRCP may miss cases of Ansa when compared to ERCP, as it detects larger ducts with significant pancreatic secretion congestion (14). Nevertheless, Abidelli et al. suggest that the accuracy of ERCP and MRCP is approximately equivalent (13). Notably, Shaikh et al. provided the initial imaging of the variation using EUS, which poses fewer complications than ERCP and has a higher accuracy than

MRCP (8). Consequently, the authors advocate for utilizing EUS when MRCP results are negative before resorting to ERCP. However, there is still no unanimous agreement on the superiority of any diagnostic tool presently (32). The treatment approaches for pancreatitis arising from Ansa pancreatica are still debated. Given the potential for serious iatrogenic complications, the selection of patients for endoscopic management must be meticulous, after careful evaluation of their risk-benefit ratio (3).

Sphincterotomy and/or stent placement in the pancreatic duct remain the most commonly employed strategies (12). Sphincterotomy may target the major papilla, the minor papilla, or both, improving pancreatic flow dynamics, and is promising in reducing pancreatitis recurrence (12, 19, 33). An alternative to sphincterotomy is botulinum toxin injection, albeit used less frequently (34). Surgical pancreatico-jejunostomy has been suggested by Guerroum et al. (10) for non-patent major papilla cases. If endoscopic cannulation for sphincterotomy becomes technically challenging due to Ansa (33, 34), a Rendez-Vous technique is recommended (23, 35, 36). This approach may be conducted as a transgastric procedure with ultrasound assistance (36) or via a transpapillary (retrograde) method (23, 35), depending on anatomical and technical factors. If all other methods fail to avert pancreatitis recurrence, endoscopic ligation of the Ansa deformity might be a consideration (19).

In order to avoid the significant risk of complications associated with interventional techniques, Harbi H. et al. opted for a conservative management strategy, employing pancreatic enzyme replacement therapy (pancrelipase) to decrease pancreatic secretions and, consequently, lower intraductal pressure (37). This approach successfully prevented acute pancreatitis recurrence during a two-year follow-up, thus being added to potential treatment strategies, although its therapeutic effectiveness remains unproven. Given the significant complications resulting from an unrevealed Ansa, such as post-ERCP pancreatitis (38), some authors recommend preoperative screening when there is a substantial suspicion of pancreatic duct abnormalities (1) or multiple occurrences of pancreatitis without an identifiable cause (8). Additionally, Ha J. et al. proposed screening for ductal variations like Ansa in all cases of recurrent pancreatitis localized in the head or uncinate process of the pancreas (4).

Conclusion

This literature review aims to offer a comprehensive and systematic examination of the uncommon anatomical structure known as Ansa pancreatica. The analysis of current data demonstrated ansa pancreatica as an independent risk factor for recurrent acute pancreatitis, primarily due to the obstruction of the flow of pancreatic secretions. Furthermore, emerging studies associating the variant with IPMN warrant further attention. The available imaging techniques for assessing Ansa pancreatica comprise ERCP, MRCP, and EUS, while the treatment strategies are either conservative or interventional, with the invasive approach carrying a significant risk for complications. As a result, healthcare professionals should consider it as a potential differential diagnosis to facilitate accurate diagnosis, select the appropriate management strategy, and minimize the risk of procedural and disease-related complications.

What Is Already Known on This Topic: *Existing literature has already described the various subtypes of Ansa pancreatica, established its clinical relevance, and outlined the available imaging and surgical techniques reported to date. However, given the rarity of Ansa and the fact that a considerable portion of the available data and evidence derives from isolated case reports, consensus regarding its subtypes and optimal management remains elusive.*

What This Study Adds:
The aim of the present study is to investigate the full spectrum of the suggested subvariants of Ansa Pancreatica and their clinical implications, particularly pancreatitis and possible association with IPMN or major papilla adenoma. Additionally, the study summarizes the current imaging modalities and treatment approaches, either surgical or conservative.

Authors' Contributions: Conception and design: ASak; Acquisition, analysis and interpretation of data: ASak; Drafting the article: ASak and DF; Revising it critically for important

intellectual content: ASak, ASh, ASam and DF; Approved final version of the manuscript: ASak, ASh, ASam, NS and DF.

Conflict of Interest: The authors declare that they have no conflict of interest.

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