DOI: 10.4274/ijgcr.galenos.2026.21931

Int J Gastrointest Cancer Res 2026;1:41-46

SMARCB1 (INI1)-deficient Rhabdoid Pancreatic Carcinoma: A Rare Subtype of Pancreatic Cancer

Mehmet Yılmaz, Mücteba Büyükkıroğlu, Duygu Bayır Garbioğlu, Bülent Yıldız, Metin Demir

Osmangazi University Faculty of Medicine, Department of Medical Oncology, Eskişehir, Türkiye

Abstract

Rhabdoid pancreatic carcinoma (RPC) is a rare and highly aggressive subtype of undifferentiated pancreatic carcinoma characterized by rhabdoid morphology and frequent loss of SWItch/sucrose non-fermentable chromatin-remodeling complex-related matrix-associated actin-dependent regulator of chromatin subfamily B member 1 (SMARCB1), integrase interactor 1 (INI1) expression. Due to its rarity, its clinicopathological characteristics and optimal management remain poorly defined. A 56-year-old woman with an Eastern Cooperative Oncology Group performance status of 1 presented with a one-month history of abdominal and back pain. Contrast-enhanced computed tomography revealed an infiltrative pancreatic head mass measuring 125×52×75 mm, with vascular involvement and multiple metastatic lymph nodes. Histopathological examination demonstrated RPC, with complete loss of nuclear SMARCB1 (INI1) expression by immunohistochemistry. Comprehensive next-generation sequencing showed KRAS wild-type status. The patient received modified 5-fluorouracil, leucovorin, irinotecan, and oxaliplatin (mFOLFIRINOX) chemotherapy and achieved partial regression of metastatic abdominal lymph nodes after six cycles. Treatment was continued for a total of 12 cycles before disease progression was documented. This case highlights the aggressive clinical behavior and distinctive molecular profile of SMARCB1 (INI1)-deficient RPC. The observed partial response to mFOLFIRINOX suggests that selected patients may derive temporary benefit from systemic chemotherapy; however, durable disease control remains challenging. Increased recognition of this rare entity and further investigation of molecularly targeted and immunotherapeutic strategies are needed to improve outcomes.

Keywords: Rhabdoid pancreatic carcinoma, SMARCB1 deficiency, INI1 loss, KRAS wild-type, mFOLFIRINOX

Introduction

Pancreatic cancer (PC) remains one of the leading causes of cancer-related mortality worldwide. In 2026, the United States alone is projected to have an estimated 67.530 new cases and 52.740 deaths, underscoring its disproportionately high mortality relative to incidence. Despite advances in systemic therapy, the 5-year relative survival rate remains approximately 13%, reflecting its aggressive biology and frequent late-stage presentation (1). While pancreatic ductal adenocarcinoma (PDAC) constitutes the majority of pancreatic malignancies, a small subset comprises undifferentiated pancreatic carcinomas (UPC), which are characterized by high-grade morphology and an aggressive clinical course. UPC accounts for approximately 2-7% of PC and includes anaplastic, sarcomatoid, rhabdoid, and carcinosarcoma subtypes (2). Within this heterogeneous group, rhabdoid pancreatic carcinoma (RPC) represents a rare histologic subtype distinguished by prominent rhabdoid morphology.

RPC is frequently associated with alterations in the SWItch/sucrose non-fermentable chromatin-remodeling complex, most notably the loss of matrix-associated actin-dependent regulator of chromatin subfamily B member 1 (SMARCB1), integrase interactor 1 (INI1) expression. Histologically, these tumors demonstrate sheets of poorly differentiated cells with abundant eosinophilic cytoplasm and eccentrically placed nuclei; they are often diagnosed at advanced stages and present with rapidly progressive disease. The designation "rhabdoid" in PC reflects its histopathologic resemblance to rhabdomyosarcoma (3).

Address for Correspondence: Mehmet Yılmaz, MD, Osmangazi University Faculty of Medicine, Department of Medical Oncology, Eskişehir, Türkiye
E-mail: drmylmz42@gmail.com **ORCID:** orcid.org/0000-0002-7447-9187
Received: 27.02.2026 **Accepted:** 20.07.2026 **Publication Date:** 07.08.2026

Cite this article as: Yılmaz M, Büyükkıroğlu M, Bayır Garbioğlu D, Yıldız B, Demir M. SMARCB1 (INI1)-deficient rhabdoid pancreatic carcinoma: a rare subtype of pancreatic cancer. Int J Gastrointest Cancer Res. 2026;1:41-46

Given its rarity and the limited clinical experience, the clinicopathologic spectrum and optimal management strategies for RPC remain incompletely defined. Herein, we present a case of metastatic SMARCB1 (INI1)-deficient RPC, which adds to the limited body of evidence and helps to further clarify the diagnostic and clinicopathologic features of this aggressive entity.

Case Presentation

A 56-year-old woman presented with a one-month history of abdominal and back pain. At presentation, the patient had an Eastern Cooperative Oncology Group performance status of 1. Contrast-enhanced computed tomography (CT) of the chest, abdomen, and pelvis revealed a 38×29 mm lesion in the gallbladder fundus and a 125×52×75 mm infiltrative mass centered in the pancreatic head, encasing the common bile duct and extending into the paraaortic and paracaval regions. The lesion was in close contact with the celiac trunk, superior mesenteric artery, and portal vein. Multiple metastatic lymph nodes forming conglomerates were identified in the abdomen.

Serum tumor markers were within normal limits. Laboratory evaluation demonstrated elevated levels of liver enzymes, including aspartate aminotransferase (78 U/L), alanine aminotransferase (170 U/L), alkaline phosphatase (239 U/L), and gamma-glutamyl transferase (215 U/L). Thoracic CT showed multiple enlarged mediastinal lymph nodes, the largest measuring 2.5 cm in the left upper paratracheal region.

Histopathological examination of the pancreatic head mass revealed findings consistent with SMARCB1 (INI1)-deficient RPC. Immunohistochemical analysis demonstrated complete loss of nuclear SMARCB1 (INI1) expression, confirming the diagnosis. Comprehensive next-generation sequencing (NGS) of tumor tissue did not reveal a KRAS mutation.

The patient was initiated on modified 5-fluorouracil, leucovorin, irinotecan, and oxaliplatin (mFOLFIRINOX), administered every 14 days, at standard dosing (oxaliplatin 85 mg/m^2, irinotecan 180 mg/m^2, leucovorin 400 mg/m^2, and fluorouracil 400 mg/m^2 bolus followed by 2400 mg/m^2 continuous infusion). After six cycles, partial regression of the abdominal lymph nodes was observed (Figures 1A and 1B). Treatment was continued for a total of 12 cycles. At the end of therapy, disease progression was documented in several lymph nodes, while the primary pancreatic lesion remained radiologically stable.

Second-line chemotherapy with gemcitabine (900 mg/m^2 on days 1 and 8) and docetaxel (100 mg/m^2 on day 8), administered every 21 days, was initiated. However, the patient died one month after initiation of second-line therapy from progressive disease.

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

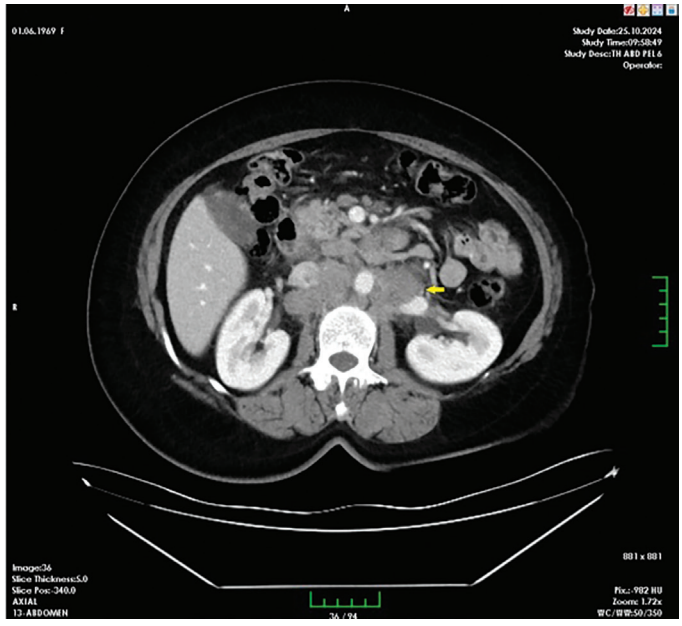

Figure 1A. Baseline CT before initiation of mFOLFIRINOX (cycle 0)

CT: Computed tomography, mFOLFIRINOX: Modified 5-fluorouracil, leucovorin, irinotecan, and oxaliplatin

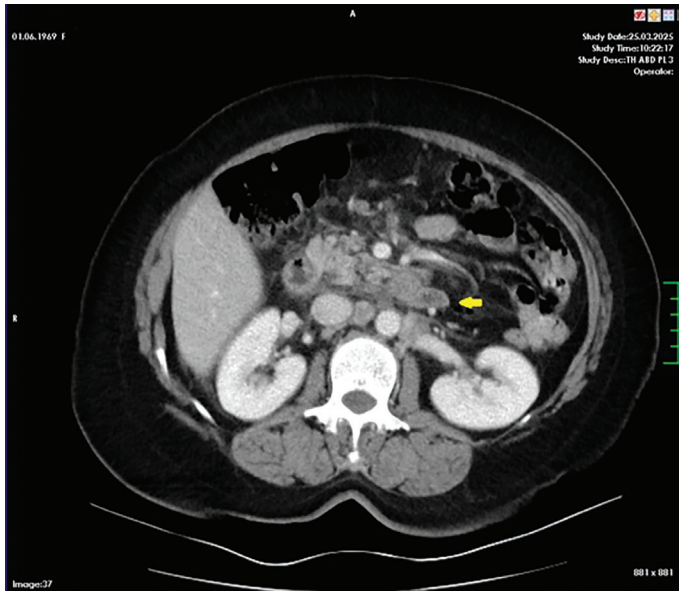

Figure 1B. CT after completion of six cycles of mFOLFIRINOX demonstrating partial radiologic response

CT: Computed tomography, mFOLFIRINOX: Modified 5-fluorouracil, leucovorin, irinotecan, and oxaliplatin

Discussion

UPC represents a rare and biologically aggressive subset of exocrine pancreatic malignancies, comprising approximately 2-7% of all PC (2,4). Within the current World Health Organization 5th edition classification, these tumors are subcategorized into anaplastic, sarcomatoid, and rhabdoid types, as well as undifferentiated carcinomas (UC) with osteoclast-like giant cells (5).

RPC is a particularly infrequent and lethal variant defined by its characteristic histomorphology, which mimics malignant rhabdoid tumors of childhood (6). This case, a 56-year-old woman with a markedly enlarged (125 mm) metastatic pancreatic head mass and KRAS wild-type status, highlights the distinctive clinical and molecular profile associated with this entity. This case contributes to the emerging evidence that RPC is not merely a high-grade variant of PDAC but a unique clinicopathologic entity often driven by alterations in the SWI/SNF chromatin-remodeling complex (7).

The clinicopathologic correlations observed in this case align with the aggressive parameters reported in the limited RPC literature. While conventional PDAC typically presents with smaller masses, UCs, especially the rhabdoid subtype, are characterized by larger tumor dimensions at diagnosis, with reported median sizes ranging from 4.6 cm to over 9.0 cm (7). In the present case, the tumor reached a maximum dimension of 12.5 cm, exceeding previously reported averages and highlighting the aggressive growth kinetics of this tumor type. Demographic data for RPC show a slight male predominance and a median age of onset in the 6th or 7th decade, though cases have been reported in patients as young as 13 years old (7,8).

In the present case, the patient's falls within the relatively younger age range reported for SWI/SNF-deficient tumors compared with conventional PDAC. Furthermore, the localization of the primary tumor in the pancreatic head in this case is consistent with recent large-scale reviews showing a predilection for the head (68%) in SWI/SNF-deficient undifferentiated variants, whereas other UC subtypes are more evenly distributed (7).

The molecular landscape of RPC is increasingly understood through the paradigm of SWI/SNF complex alterations, most notably the loss of SMARCB1 (INI1) expression (9,10,11). A seminal analysis by Agaimy et al. (9) proposed a binary classification of RPC based on KRAS and SMARCB1 (INI1) status: a pleomorphic giant cell subtype characterized by KRAS alterations and intact SMARCB1 (INI1), and a monomorphic anaplastic subtype defined by the loss of SMARCB1 (INI1) and the absence of KRAS mutations. The present case, in which comprehensive NGS did not identify a KRAS mutation, appears to align with the latter molecular pathway. Recent genomic data from Yavas et al. (7) support this association, noting that carcinomas with SMARCB1 (INI1) deletions frequently lack canonical PDAC driver mutations such as KRAS, TP53, and SMAD family member 4. The loss of SMARCB1 (INI1) function leads to global epigenetic dysregulation, stimulating the MYC proto-oncogene network and promoting mesenchymal reprogramming in a KRAS-independent manner (12). This molecular transition is often accompanied by the loss of cellular adhesion molecules like E-cadherin and β-catenin, contributing to the discohesive, infiltrative growth pattern observed in RPC (13).

Diagnostic challenges are a hallmark of RPC due to its nonspecific clinical presentation and the lack of reliable biomarkers. Similar to the present case, patients frequently present with non-specific abdominal or back pain, while serum tumor markers such as cancer antigen 19-9 and the carcinoembryonic antigen are often within normal limits, in contrast to conventional PDAC (10,14,15). Radiologically, RPC often presents as a large, hypovascular mass with extensive internal necrosis or hemorrhage (16). Pathological diagnosis is therefore mandatory and relies on endoscopic ultrasound-guided fine-needle aspiration or biopsy (14). Immunohistochemically, RPC must demonstrate at least focal positivity for epithelial markers such as cytokeratins to distinguish it from true sarcomas (6). The integration of SMARCB1 (INI1) staining is now considered essential when rhabdoid cells are identified, as its loss is highly specific for the SMARCB1 (INI1)-deficient subtype (7,17).

Management strategies for RPC remain unstandardized, and clinical outcomes are generally suboptimal. Radical surgical resection remains the only curative treatment option, but its utility is often limited by the frequent presence of metastatic disease at the time of diagnosis, as seen in our case (10,14). Pooled analyses indicate that even with surgery, median survival is often restricted to approximately three months, with over 77% of patients dying within one year (17). For metastatic or unresectable RPC, systemic therapy is the primary treatment modality, yet responses to standard PDAC regimens are inconsistent. Our case showed a partial regression of abdominal lymph nodes after six cycles of mFOLFIRINOX, which is a noteworthy outcome given that many reports describe immediate progression on this regimen (17,18). However, the subsequent disease progression in several lymph nodes underscores the transient nature of such responses. Evidence is mounting that gemcitabine plus nab-paclitaxel may offer more sustained responses in some

patients with undifferentiated variants; some case reports have even shown complete responses. The ongoing phase II clinical trial (jRCTs031220099) investigating this combination in UC may provide more definitive guidance (14).

The prognostic implications of RPC are profound, with median overall survival typically ranging from three to six months (14). Our case illustrates the biological aggressiveness of the tumor, which progressed despite twelve cycles of intensive combination chemotherapy. This aggressive behavior is likely mediated by the loss of SWI/SNF function and the concomitant activation of epithelial-mesenchymal transition pathways (14,17). Emerging data suggest that PD-L1 enrichment is common in UPC, potentially providing a rationale for the use of immune checkpoint inhibitors in a subset of patients (7,14,15). Although a previously reported case of SMARCB1 (INI1)-deficient PC achieved a complete response to pembrolizumab, RPC was not specifically described (19). The response to immunotherapy in the present case therefore remains to be elucidated in future investigations (20). PD-L1 expression was not evaluated in the present case.

This case of metastatic SMARCB1 (INI1)-deficient RPC reinforces the need to consider this rare entity in the differential diagnosis of large, rapidly enlarging pancreatic masses, particularly when tumor markers are normal and KRAS is wild-type. Our case contributes to the limited literature by documenting a partial clinical response to mFOLFIRINOX before eventual disease progression and by adding detail to the scant evidence regarding the systemic management of metastatic RPC. Given the aggressive biology and poor prognosis, early identification by immunohistochemical evaluation of SWI/SNF subunits is critical. Future progress in managing RPC will require multi-institutional collaboration to evaluate targeted strategies, such as immunotherapy, in the context of specific molecular subtypes. Maintaining this index case as a central reference highlights that, while RPC is highly aggressive, a deeper understanding of its unique molecular drivers may eventually pave the way for precision oncology in this challenging patient population.

Ethics

Informed Consent: Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Footnotes

Authorship Contributions

Concept: M.D., Design: M.Y., M.B., Data Collection or Processing: M.Y., D.B.G., B.Y., M.D., Analysis or Interpretation: M.Y., D.B.G., B.Y., Literature Search: M.Y., M.B., Writing: M.Y., M.D.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Lara PN Jr, Hershman DL. Cancer statistics, 2026: charting a course for a national cancer research agenda. CA Cancer J Clin. 2026;76(1):e70061.
2. Yao WQ, Ma XY, Wang GH. Clinicopathologic features of SMARCB1/INI1-deficient pancreatic undifferentiated rhabdoid carcinoma: a case report and review of literature. World J Gastrointest Oncol. 2026;18(1):114021.
3. Hua Y, Soni P, Larsen D, Zreik R, Leng B, Rampisela D. SMARCB1/INI1-deficient pancreatic undifferentiated rhabdoid carcinoma mimicking solid pseudopapillary neoplasm: a case report and review of the literature. World J Gastroenterol. 2020;26(36):5520-5526.
4. Wakatsuki T, Irisawa A, Imamura H, et al. Complete response of anaplastic pancreatic carcinoma to paclitaxel treatment selected by chemosensitivity testing. Int J Clin Oncol. 2010;15(3):310-313.
5. Nagtegaal ID, Odze RD, Klimstra D, et al. The 2019 WHO classification of tumours of the digestive system. Histopathology. 2020;76(2):182-188.
6. Land G, Van Haeringen B, Cooper C, Andelkovic V, O'Rourke T. A rare case of rhabdoid pancreatic carcinoma: prolonged disease-free survival following upfront resection and adjuvant chemotherapy. Cureus. 2023;15(12):e50145.
7. Yavas A, Ozcan K, Adsay NV, et al. SWI/SNF complex-deficient undifferentiated carcinoma of the pancreas: clinicopathologic and genomic analysis. Mod Pathol. 2024;37(11):100585.
8. Clark CJ, Graham RP, Arun JS, Harmsen WS, Reid-Lombardo KM. Clinical outcomes for anaplastic pancreatic cancer: a population-based study. J Am Coll Surg. 2012;215(5):627-634.
9. Agaimy A, Haller F, Frohnauer J, et al. Pancreatic undifferentiated rhabdoid carcinoma: KRAS alterations and SMARCB1 expression status define two subtypes. Mod Pathol. 2015;28(2):248-260.
10. Mugaanyi J, Lu C, Lu C, Wang C. Extended pancreato-duodenectomy coupled with adjuvant chemotherapy for SMARCB1/INI1 deficient pancreatic carcinoma: a case report and literature review. Int J Surg Case Rep. 2021;82:105938.
11. Sano M, Homma T, Hayashi E, et al. Clinicopathological characteristics of anaplastic carcinoma of the pancreas with rhabdoid features. Virchows Arch. 2014;465(5):531-538.
12. Genovese G, Carugo A, Tepper J, et al. Synthetic vulnerabilities of mesenchymal subpopulations in pancreatic cancer. Nature. 2017;542(7641):362-366.
13. Mora-Blanco EL, Mishina Y, Tillman EJ, et al. Activation of β-catenin/TCF targets following loss of the tumor suppressor SNF5. Oncogene. 2014;33(7):933-938.

14. Imaoka H, Ikeda M, Umemoto K, et al. Comprehensive review of undifferentiated carcinoma of the pancreas: from epidemiology to treatment. Jpn J Clin Oncol. 2023;53(9):764-773.

15. Lehrke HD, Graham RP, McWilliams RR, et al. Undifferentiated pancreatic carcinomas display enrichment for frequency and extent of PD-L1 expression by tumor cells. Am J Clin Pathol. 2017;148(5):441-449.

16. Ishigami K, Nishie A, Yamamoto T, et al. Imaging features of undifferentiated carcinoma of the pancreas. J Med Imaging Radiat Oncol. 2019;63(5):580-588.

17. Batog WI, McEntee P, Swan N, Ridgway PF. Pooled analysis of rhabdoid pancreatic carcinomas: should they be resected? Clin Surg Oncol. 2024;3(1):100033.

18. King DA, Rahalkar S, Bingham DB, Fisher GA. Pancreatic INI1-deficient undifferentiated rhabdoid carcinoma achieves complete clinical response on gemcitabine and nab-paclitaxel following immediate progression on FOLFIRINOX: a case report. J Gastrointest Oncol. 2021;12(2):874-879.

19. Botta GP, Kato S, Patel H, et al. SWI/SNF complex alterations as a biomarker of immunotherapy efficacy in pancreatic cancer. JCI Insight. 2021;6(18):e150453.

20. Besaw RJ, Terra AR, Malvar GL, Chapman TR, Hertan LM, Schlechter BL. Durable Response to PD-1 blockade in a patient with metastatic pancreatic undifferentiated carcinoma with osteoclast-like giant cells. J Natl Compr Canc Netw. 2021;19(3):247-252.

Reader Questions

Based on the manuscript: "SMARCB1-deficient Rhabdoid Pancreatic Carcinoma: A Case Report"

1. Which molecular alteration is most commonly associated with rhabdoid pancreatic carcinoma?

A. KRAS amplification

B. SMARCB1 (INI1) loss

C. HER2 amplification

D. BRAF V600E mutation

Correct Answer: B. SMARCB1 (INI1) loss

2. Which chemotherapy regimen was used as first-line treatment in this case?

A. Gemcitabine plus nab-paclitaxel

B. FOLFIRI

C. Modified FOLFIRINOX

D. Gemcitabine monotherapy

Correct Answer: C. Modified FOLFIRINOX

3. What was the patient's best radiologic response after six cycles of first-line chemotherapy?

A. Complete response

B. Partial regression of abdominal lymph nodes

C. Stable disease in all lesions

D. Progressive disease

Correct Answer: B. Partial regression of abdominal lymph nodes

4. Which molecular feature supported the diagnosis of the monomorphic SMARCB1-deficient subtype?

A. KRAS mutation

B. TP53 mutation

C. Loss of SMARCB1 (INI1) expression with KRAS wild-type status

D. EGFR amplification

Correct Answer: C. Loss of SMARCB1 (INI1) expression with KRAS wild-type status

5. According to the discussion, which emerging therapeutic approach may have potential in selected SMARCB1-deficient pancreatic tumors?

A. Anti-EGFR therapy

B. Immune checkpoint inhibition

C. Anti-HER2 therapy

D. PARP inhibition

Correct Answer: B. Immune checkpoint inhibition