Multidetector computed tomography detection of perineural infiltration around the superior mesenteric artery in intrahepatic cholangiocarcinoma: A case report

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Abstract. Intrahepatic cholangiocarcinoma (IHCC) is the second most common primary liver malignancy after hepatocellular carcinoma and is associated with a poor prognosis. Although surgical resection remains the only potentially curative treatment, the 5-year survival rate is <30%. Among various prognostic factors, perineural invasion (PNI) is considered noteworthy. Multidetector computed tomography (MDCT) plays a critical role in the diagnosis and staging of IHCC and may aid in the detection of PNI. The current study presents the clinical course and radiological findings of an 82-year-old woman with IHCC who showed PNI around the superior mesenteric artery, highlighting the importance of preoperative MDCT evaluation.

Introduction

Intrahepatic cholangiocarcinoma (IHCC) accounts for 10-20% of primary liver cancer cases and is the second most common cancer after HCC. However, it accounts for <10% of all bile duct cancers (1). In South Korea, the incidence of cholangiocarcinoma (including intrahepatic cholangiocarcinoma) has been reported to be increasing (2). Surgical resection remains the only potentially curative treatment; however, even after complete resection, the 5-year survival rate remains at <30%. For unresectable cases, the survival rate drops to <10% (3,4).

Several prognostic factors have been identified, including lymph node metastasis, vascular invasion and perineural invasion (PNI) (1). While histological confirmation is required for a definitive diagnosis of PNI, imaging modalities such as multidetector computed tomography (MDCT) have demonstrated potential in suggesting PNI. Raghavan *et al* (5) reported the value of MDCT in detecting PNI involving the celiac plexus, which may indicate unresectability.

The current study presents a rare case of IHCC with suspected PNI along the nerve plexus surrounding the superior mesenteric artery (SMA), rather than the more commonly reported celiac plexus, in order to emphasize the diagnostic role of preoperative MDCT in surgical planning.

Case report

In November 2024, an 82-year-old woman presented to Pusan National University Hospital (Busan, Republic of Korea) with a 1-month history of intermittent abdominal pain. A physical examination showed no notable results, and laboratory tests showed no significant abnormalities except for an elevated carcinoembryonic antigen (CEA) level of 44.1 ng/ml (normal range, 0-5 ng/ml).

After referral to the hospital, contrast-enhanced MDCT (Aquilion ONE/CC scanner with a 2-mm reconstruction/slice thickness; Canon Medical Systems Corporation) was performed for diagnostic evaluation and staging, which revealed a 45-mm mass in liver segment 2/3, with irregular peripheral rim enhancement. Additionally, soft-tissue encasement around the SMA was noted, raising suspicion of PNI (Figs. 1 and 2). Magnetic resonance cholangiopancreatography demonstrated T2 hyperintensity and diffusion restriction in the lesion, as well as infiltration involving the bile duct (B3) with ductal dilatation (Figs. 2 and 3). Ultrasound-guided biopsy confirmed the diagnosis of an adenocarcinoma. Whole-body 18F-fluorodeoxyglucose (FDG)-positron emission tomography/CT was performed for metastatic evaluation, which showed no evidence of distant metastasis and no definite abnormal FDG uptake suggestive of SMA involvement (Fig. 4).

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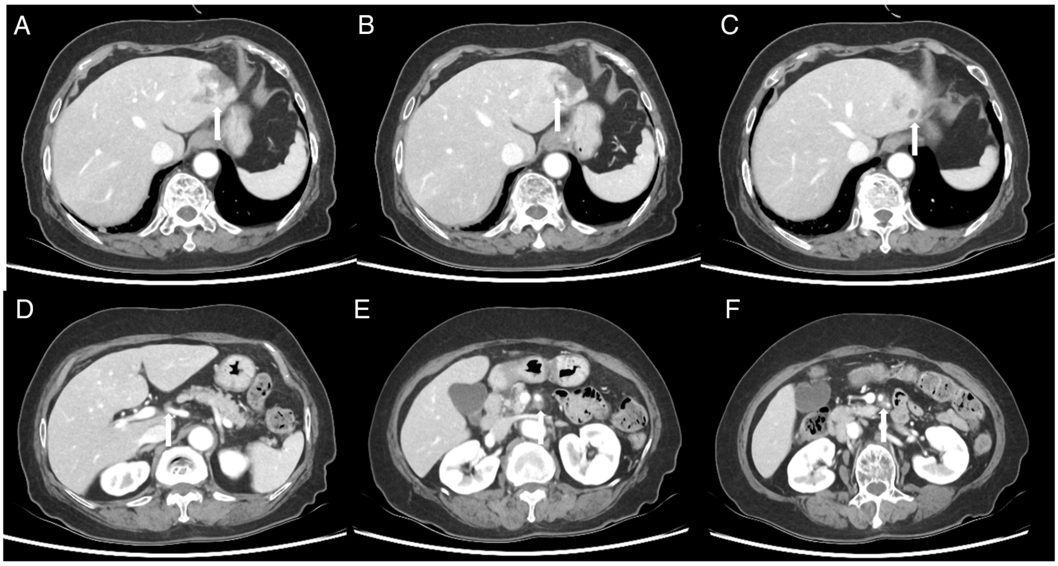

Figure 1. Multidetector CT findings of intrahepatic cholangiocarcinoma with suspected PNI around the SMA. In the contrast enhanced CT exam, (A) a 4.0-cm sized heterogenous enhancing mass (arrow) in liver left lobe was noted. (B) Bile duct dilatation (arrow), adjacent to the mass, was noted. (C) Around the hepatic mass, <1 cm satellite nodule (arrow) was also noted. In addition, extrahepatic soft-tissue lesions (arrow), representing PNI, were noted around (D) the common hepatic chain, (E) the SMA and (F) the first jejunal branch. CT, computed tomography; SMA, superior mesenteric artery; PNI, perineural invasion.

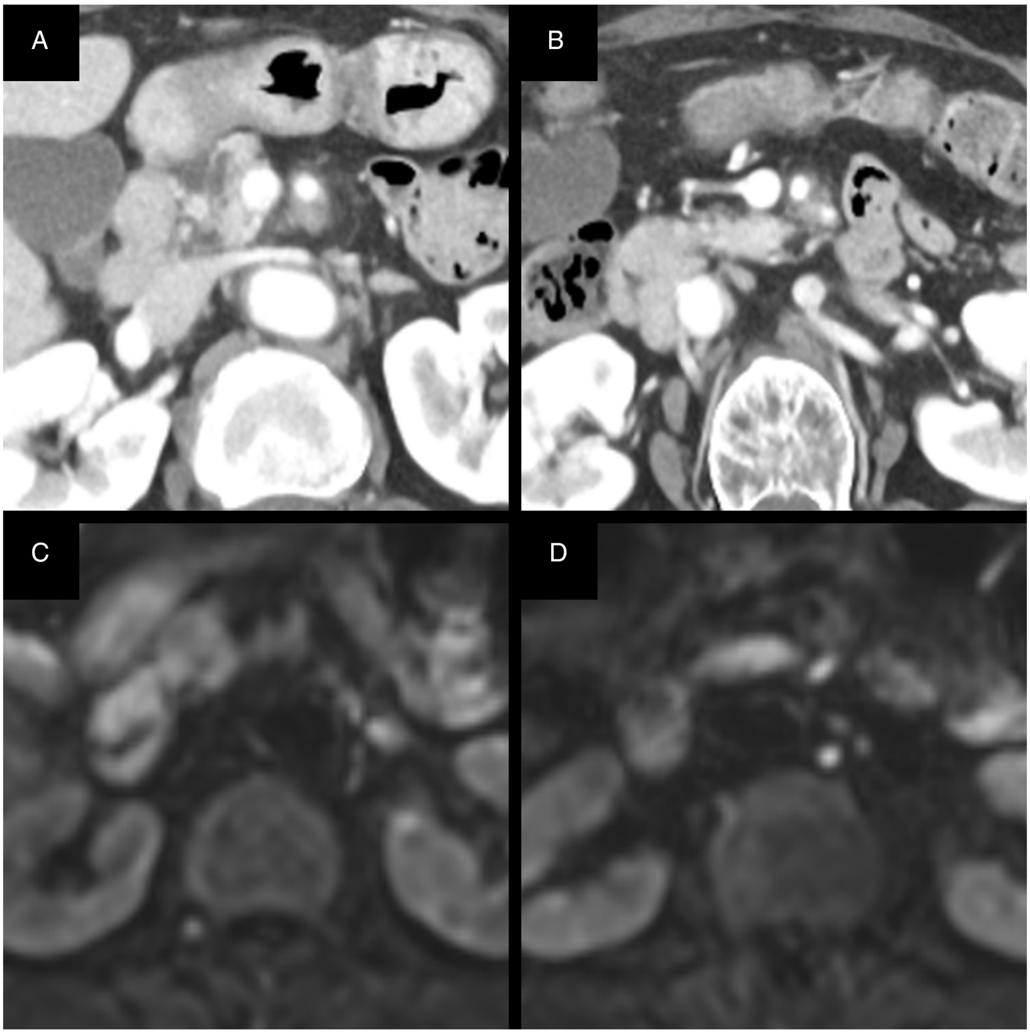

Figure 2. Enlarged (magnified) views focusing on the SMA region. (A and B) Baseline contrast-enhanced computed tomography images demonstrate perivascular soft-tissue encasement around the SMA, raising radiological suspicion for perineural/perivascular extension. (C and D) Corresponding magnetic resonance imaging demonstrates a perivascular soft-tissue lesion around the SMA, supporting radiological suspicion of SMA-related perineural/perivascular involvement. SMA, superior mesenteric artery.

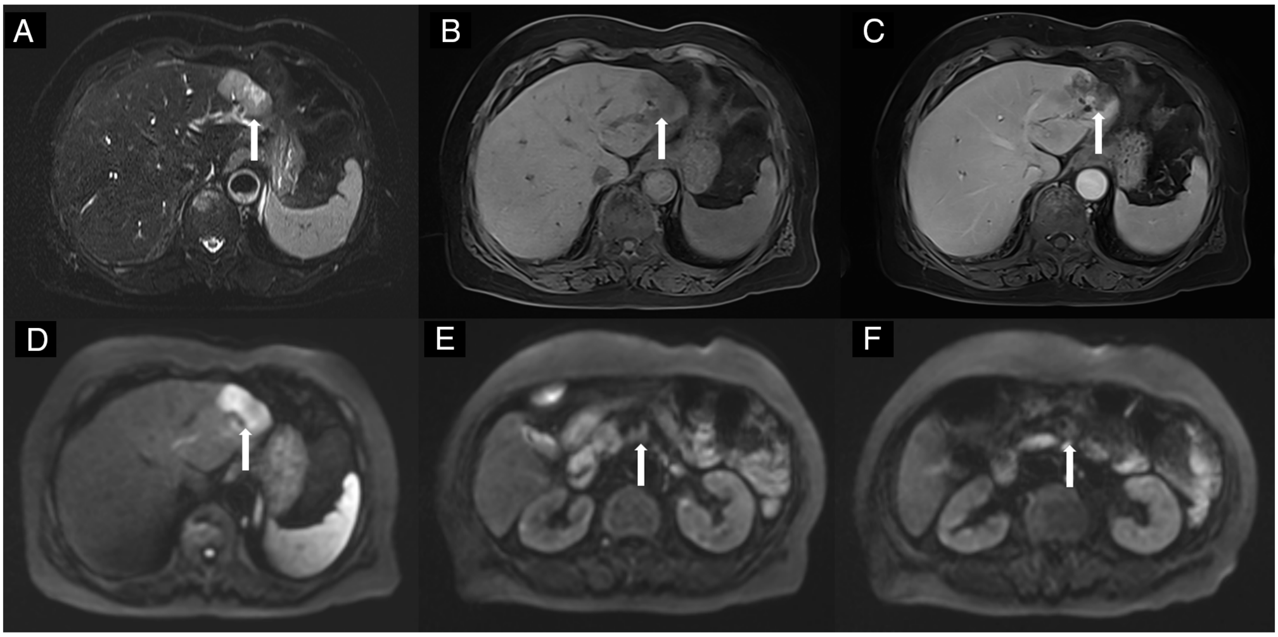

Figure 3. Magnetic resonance cholangiopancreatography and magnetic resonance findings of intrahepatic cholangiocarcinoma with PNI around the SMA. (A) A 4.0-cm mass demonstrated high signal intensity (arrow) on T2WI (arrow), (B) low signal intensity (arrow) on T1WI, (C) heterogenous enhancement (arrow) on the portal venous phase and (D) diffusion restriction (arrow) on diffusion WI. In addition, extrahepatic soft-tissue lesions (arrow), representing PNI, demonstrated diffusion restriction around (E) the SMA and (F) the first jejunal branch. WI, weighted imaging; SMA, superior mesenteric artery; PNI, perineural invasion.

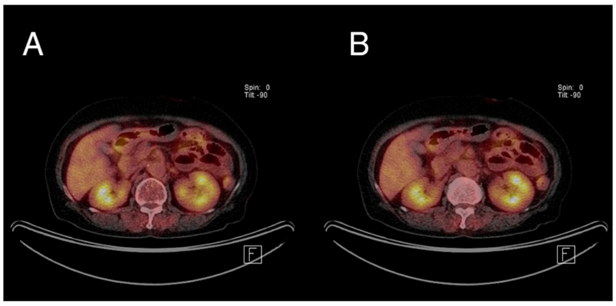

Figure 4. FDG PET/CT images of the SMA. (A and B) Representative FDG PET/CT images focusing on the SMA region. SMA, superior mesenteric artery; FDG PET/CT, 18F-fluorodeoxyglucose positron emission tomography/computed tomography.

The follow-up CEA levels rapidly increased to 69.7 ng/ml at 3 weeks and 181 ng/ml at 5 weeks after the initial diagnosis.

After 2 months, follow-up CT demonstrated tumor growth (from 45 to 50 mm), more conspicuous progressive perivascular soft-tissue encasement around the SMA, and multiple enlarged lymph nodes in the hepatoduodenal ligament and para-aortic areas, consistent with disease progression. Given the patient's advanced age and the strong radiological suspicion of lymph node metastasis and SMA involvement, surgical resection was not pursued and non-surgical management was planned; therefore, resection-based histopathological confirmation was not available. The patient's abdominal pain worsened, and palliative radiotherapy targeting the SMA region was initiated 2 months after the diagnosis (45 Gy in 18 fractions over ~1 month). Chemotherapy was considered, but the patient declined due to poor general condition, although pain relief was experienced following the radiotherapy. The patient was admitted to hospice care 7 months after the diagnosis and died of disease progression 10 months after the diagnosis.

Discussion

MDCT is a key imaging modality for the diagnosis and staging of IHCC, which typically presents as a hypodense mass with irregular rim enhancement during the arterial and portal venous phases and delayed central enhancement in later phases. These features help to differentiate IHCC from other hepatic malignancies (5-7). PNI is a major adverse prognostic factor in IHCC and is associated with abdominal pain, poor resectability and early recurrence (6). Although histological confirmation remains the gold standard, MDCT can suggest PNI when there is perivascular/perineural soft-tissue encasement accompanied by loss of fat planes or vessel deformity; accordingly, the progressive soft-tissue encasement around the SMA in the present patient was interpreted as radiological suspicion for SMA-PNI (5,8).

The hepatobiliary system is primarily innervated by the celiac plexus, and most studies have focused on the perineural spread along this pathway (8). However, the autonomic nerve plexus surrounding the SMA connects to the celiac plexus, providing an alternative route for tumor dissemination (9). In the present case, the patient exhibited PNI around the SMA rather than around the celiac plexus, leading to disease progression and unresectability (8,10). However, the therapeutic efficacy of more aggressive treatment modalities, such as surgical resection and systemic chemotherapy, could not be evaluated.

This rare presentation highlights the possibility that SMA-PNI may have a prognostic significance similar to that of celiac PNI and should be evaluated using the same radiological criteria, namely, soft tissue thickening around the SMA, loss of fat planes, vessel deformation and longitudinal spread along the neurovascular bundles. The differential diagnoses for perivascular soft-tissue thickening include perivascular inflammation, fibrotic/desmoplastic reaction and perivascular metastatic nodal disease. These may be further evaluated using high-resolution MRI, interval change on follow-up imaging, associations with clinical/laboratory inflammatory markers or biopsies when imaging findings are equivocal.

The current case underscores the expanded scope of the perineural pathways in IHCC and suggests that SMA involvement may represent an advanced disease stage with limited surgical options. Early recognition of SMA-PNI using MDCT may prompt timely therapeutic decisions regarding radiotherapy or non-surgical palliative strategies. While the present case highlights a rare manifestation of SMA-PNI in IHCC, the interpretation of MDCT findings must be approached cautiously due to the limited specificity and potential overlap with non-neoplastic perivascular conditions. Given the single-case nature of this report, further studies are required to validate the diagnostic and prognostic implications of SMA-PNI.

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Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

MHO, BGN and HIS were responsible for the study concept and design. BGN, YMP and HIS performed the analysis and interpretation of the clinical and imaging findings. BGN collected the clinical data. SK, NKL, YMP and SBH contributed to the acquisition and radiological interpretation of the CT/MRI/PET/CT images and assisted in figure preparation. MHO, BGN and HIS drafted the manuscript. YMP and HIS critically revised the manuscript for important intellectual content. MHO and BGN confirm the authenticity of all the raw data. All authors have read and approved the final manuscript, and agree to be accountable for all aspects of the work.

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Written informed consent for publication of the case report and accompanying images was obtained at the time of diagnosis.

Competing interests

The authors declare that they have no competing interests.

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