

[CASE REPORT]

A Hybrid Peripheral Nerve Sheath Tumor (Granular Cell Tumor+Schwannoma) of Cystic Duct Origin, Presenting with Gallbladder Enlargement and Abdominal Pain

Akira Imoto^{1,2}, Masahiro Yamamura¹, Atsushi Okuda¹, Nao Kawaguchi³, Koji Komeda³, Shigeru Kawabata^{4,5}, Emi Yasuda⁴, Yoshitaka Kurisu⁴, Takeshi Ogura¹, Sang-Woong Lee³, Yoshinobu Hirose⁴ and Hiroki Nishikawa¹

Abstract:

Granular cell tumors and schwannomas rarely occur in cystic ducts. We herein report a case of a hybrid tumor consisting of a cystic duct-originating granular cell tumor and schwannoma. A 48-year-old woman was referred to our hospital with the chief complaint of occasional postprandial abdominal pain after an enlarged gallbladder was found on ultrasonography. The cause was identified as a mass measuring approximately 7 mm in diameter in the cystic duct, and the patient underwent extrahepatic cholangiectomy. An examination of the surgical specimen revealed that the mass originated from the cystic duct and narrowed the duct lumen. Histopathologically, both granular cell tumors and schwannoma components were detected. To our knowledge, this is the first report of a hybrid peripheral nerve sheath tumor with a mixture of granuloma cell tumors and schwannomas.

Key words: hybrid peripheral nerve sheath tumor, granular cell tumor, schwannoma, cystic duct, bile duct

(Intern Med 65: 1779-1785, 2026)

(DOI: 10.2169/internalmedicine.6258-25)

Introduction

Benign bile duct tumors are rare. Burhans et al. reported four benign bile duct tumors among 4,000 biliary tract operations (0.1%), accounting for 6% of all neoplasms (1). Among the wide variety of benign bile duct tumors, epithelial tumors such as adenomas and papillomas account for the largest proportion (1, 2).

Granular cell tumors (GCTs) are non-epithelial tumors that are derived from Schwann cells and they can occur in any organ of the body (3). The most common sites are the skin and the tongue. Although 5-11% of cases occur in the gastrointestinal tract, the bile duct is rarely reported as a site of origin (4, 5). Schwannomas are also considered Schwann

cell neoplasms, and usually occur in the upper extremities, trunk, head and neck, retroperitoneum, mediastinum, pelvis, and peritoneum. Gastrointestinal tract manifestations are rare, most commonly arising in the stomach, followed by the large intestine and esophagus (6, 7). Schwannomas can also occur in the bile duct owing to the abundance of autonomic networks along the bile duct wall; however, this is extremely rare (8).

According to the 5th classification of tumors by the World Health Organization (WHO), the term hybrid peripheral nerve sheath tumor (HPNST) refers to a benign tumor that histopathologically combines the morphological and immunohistological features of two or more peripheral nerve sheath tumors (PNSTs) (9). Among the numerous PNSTs, the most common are schwannoma/neurofibroma/

¹Second Department of Internal Medicine, Osaka Medical and Pharmaceutical University, Japan, ²Department of Internal Medicine, Aoyama Hospital, Japan, ³Department of General and Gastroenterological Surgery, Osaka Medical and Pharmaceutical University, Japan, ⁴Department of Pathology, Osaka Medical and Pharmaceutical University, Japan and ⁵Department of Pathology, Organ Pathology Unit, Shimane University Faculty of Medicine, Japan

Received: July 14, 2025; Accepted: October 13, 2025; Advance Publication by J-STAGE: December 4, 2025

Correspondence to Dr. Akira Imoto, akira.imoto@ompu.ac.jp

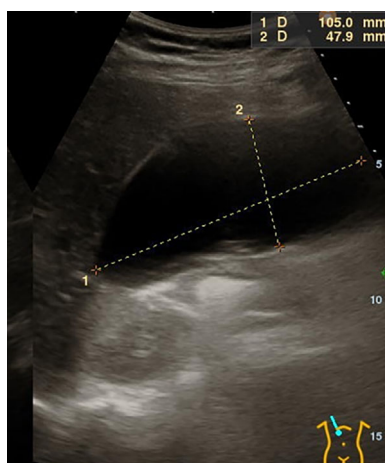


Figure 1. Abdominal ultrasound shows an enlarged gallbladder (105×48 mm²), but no thickening of the gallbladder wall and no internal stones or debris.

perineurioma (10). However, HPNST mixed with GCT and schwannomas have not yet been reported.

We herein report a case of HPNST of a GCT and schwannoma arising from the cystic duct.

Case Report

A 48-year-old woman underwent abdominal ultrasonography (US) that showed an enlarged gallbladder during an annual physical examination. No abnormalities were observed. For several years, she had experienced strong right upper quadrant pain 3-4 times a year, particularly after eating oily foods. On each occasion, the pain disappeared after approximately 20 min of rest. Because of the suspected relationship between this episode and her enlarged gallbladder, she was referred to our hospital to undergo a thorough investigation.

Physical examination revealed a body temperature of 36.4 °C, heart rate of 75 beats/min, blood pressure of 103/61 mmHg, and respiratory rate of 16 breaths/min. The abdomen was soft and flat, with no palpable masses or tenderness. On auscultation, respiratory and cardiac sounds were normal and no cardiac murmurs were audible. Laboratory tests, including those for tumor markers, showed no obvious abnormalities.

Abdominal US confirmed an enlarged gallbladder (105×48 mm²) with no thickening of the walls or internal stones or debris (Fig. 1).

Abdominal contrast-enhanced computed tomography (CT) showed a mass measuring 7 mm in diameter with a contrast effect near the cystic duct (Fig. 2a, b, white arrowheads). No other abnormalities were observed in the bile duct system.

Magnetic resonance imaging (MRI) revealed a cystic duct mass with signal hypointensity on MR cholangiopancreatography (Fig. 3, yellow arrowheads) and pale signal hyperintensity on fat saturation T1-weighted imaging (data not shown), consistent with stone findings. No edema of the

gallbladder wall, opacity of the surrounding fatty tissue, or confluence abnormalities were observed.

Endoscopic ultrasound (EUS) revealed a heterogeneous, hypoechoic mass with a maximum diameter of 7-8 mm in the cystic duct, thus suggesting cancer of the cystic duct (Fig. 4; white arrowheads).

Peroral cholangioscopy (POCS) (eyeMAX; Micro-Tech, Nanjing, China) performed at the time of endoscopic retrograde cholangiopancreatography (ERCP) showed that the cystic duct was almost completely occluded at a site 2 cm from the union of the cystic and common hepatic ducts, and a guidewire could not be advanced to the gallbladder because of the tortuosity and occlusion of the duct (Fig. 5a, b). The mucosa in this area appeared to be endoscopically normal, and the cystic duct mass was thought to be external to the duct, growing outside the wall, draining the lumen, and obstructing the duct. Histological examinations could not be performed at that time.

Upper gastrointestinal endoscopy did not reveal any particular findings that could cause abdominal pain (data not shown).

Based on these results, a cystic duct obstruction and an enlarged gallbladder due to a cystic duct tumor were diagnosed, and the patient was scheduled to undergo open extrahepatic cholangiectomy and cholecystectomy.

As planned, open extrahepatic cholangiectomy and cholecystectomy were performed with a choledochojejunostomy for reconstruction. In addition, lymph node dissection was performed around the duodenal mesentery. Intraoperative findings showed a tumor in the cystic duct slightly lateral to the bifurcation of the common bile duct.

A gross examination of the surgical specimen showed that the mass in the cystic duct was a substantial nodule with a pale, yellowish-white coloration (Fig. 6a). Hematoxylin and Eosin staining showed that the nodule consisted of solitary, diffusely proliferating cells with round nuclei and abundant granular pale acidophilic cytoplasm (Fig. 6b). Immunostaining was positive for S100 (Fig. 6c), and GCT was diagnosed. In addition, the nerve tissue was found to be surrounded by neoplastic Schwann cells without any existing perineural cells that showed positive staining for glucose transporter 1 (GLUT1), thus resulting in a diagnosis of schwannoma (Fig. 6d).

Based on these histopathological findings, the cystic duct tumor was diagnosed as a HPNST consisting of a mixture of GCT and schwannoma. The symptoms resolved after surgery and the postoperative course was uneventful. The patient has been regularly followed up for two years, and no adverse events or recurrence have been observed.

Discussion

HPNSTs have recently been classified under the WHO criteria as soft tissue tumors that combine the features of multiple PNSTs (10, 11). In 1998, Feany et al. initially described nine cases of hybrid tumors that contained a

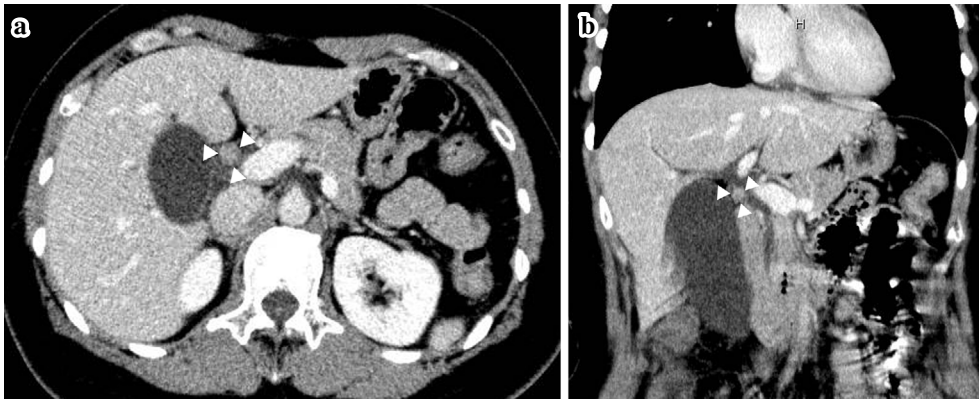


Figure 2. A mass, measuring 7 mm in diameter, with contrast effect near the cystic duct (white arrowheads) is observed on computed tomography in both axial (a) and coronal (b) sections. No other specific abnormalities are evident in the bile duct system.

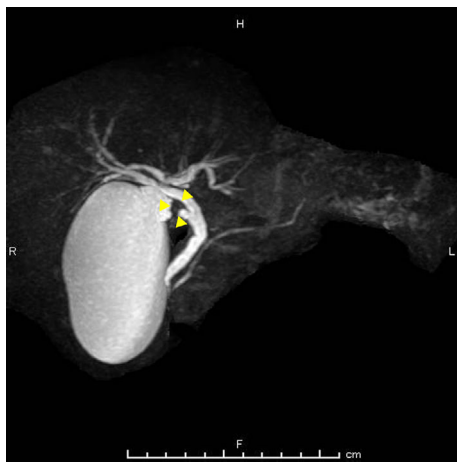


Figure 3. The mass in the cystic duct shows signal hypointensity on magnetic resonance cholangiopancreatography (yellow arrowheads), consistent with findings for a stone. No edema of the gallbladder wall or opacity of surrounding fatty tissue is evident. No abnormalities of pancreaticobiliary confluence are observed.



Figure 4. Endoscopic ultrasound shows a heterogeneous, hypoechoic mass, measuring 7-8 mm in diameter (white arrowheads), in the cystic duct, suggestive of cancer of the cystic duct.

schwannoma-like degenerative mass within the neurofibroma (12). Zamecnik et al. also reported that eight of 99 cases diagnosed with neurofibroma contained neuroperineurioma-like histopathological features and designated these hybrid tumors (neurofibroma/perineurioma) in 2001 (13). Michal et al. described six cases of hybrid tumors containing cell clusters with schwannoma-like immunohistochemical features and neuroperineurioma-like immunohistochemical features within a single tumor (14). The most common type of HPNST is schwannoma/perineurioma, which often occurs as a subcutaneous/dermal tumor in the limbs (15, 16). The tumor cells showed Schwann cell-like morphology, but the overall structure was similar to that of soft tissue perineuriomas. An immunohistochemical examination showed that all tumors were positive for S100 and epithelial membrane antigen (EMA) (17). The next most frequent combination is neurofibroma/schwannoma, which may involve larger peripheral nerves (15, 18). This variant is

commonly observed in patients with genetic syndromes (schwannomatosis, neurofibromatosis type 1, and neurofibromatosis type 2) (19). The rarest variation is neurofibroma/perineurioma, which is usually diagnosed by immunohistochemistry, highlighting EMA-positive areas within plexiform neurofibromas (15, 16, 20). Although several articles on HPNST with combinations of neurofibroma/schwannoma/perineurioma have since been reported, no reports of HPNST combining granuloma/schwannoma, as in the present case, were found in a PubMed search.

GCT was first described by Abrikossoff in 1926 as granular cell myoblastoma and was standardized under the current terminology by the WHO classification in 1970 (21). Histopathologically, GCT comprise foci of polygonal tumor cells with eosinophilic granular structures in the cytoplasm (22). GCT are defined under the 5th WHO classification of tumors as nests and sheets of epithelioid to polygonal cells, abundant, intensely eosinophilic, granular cytoplasm, and positive results for S100 and SRY-box transcription factor 10 (SOX10) on immunohistochemical examination (9). In the present case, the focal growth of the tumor with cyto-

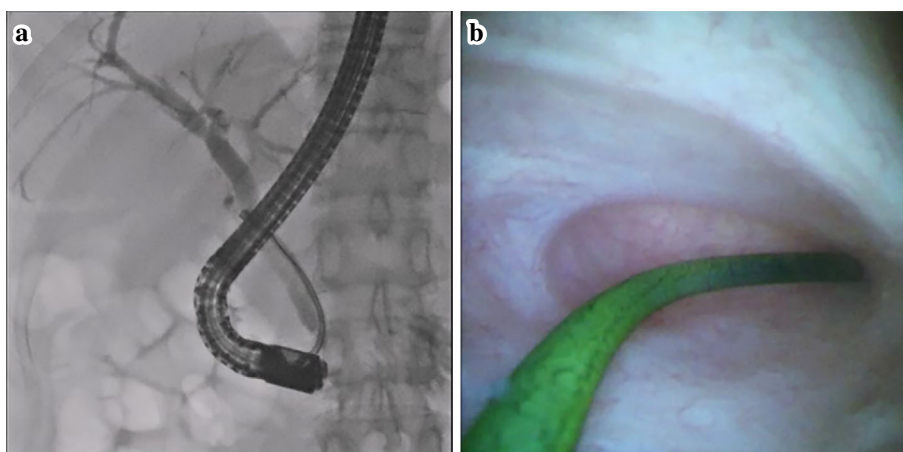


Figure 5. Peroral cholangioscopy (POCS) under endoscopic retrograde cholangiopancreatography. a) POCS is performed via the cystic duct. The cystic duct is almost completely occluded at a site 2 cm from the union of the cystic and common hepatic ducts. b) The mucosa of the occluded area appears endoscopically normal. A guidewire cannot be inserted into the gallbladder due to tortuosity and occlusion of the duct.

plasm containing eosinophilic granular structures was observed. In addition, positive results were observed for S100, thus leading to a diagnosis of GCT.

Fanburg-Smith et al. defined six histological criteria [necrosis, spindling of the tumor cells, vesicular nuclei with large nucleoli, increased mitotic activity (>2 mitoses/10 high-power fields at 200× magnification), high nuclear-to-cytoplasmic (N:C) ratio, and pleomorphism] to classify GCT; if three or more of the six criteria were fulfilled, then the tumor was classified as histologically malignant. However, if a GCT met one or two criteria, it was classified as atypical, and if it had none of the criteria or only focal pleomorphism, it was classified as benign (23). Based on this definition, the GCT in this case was evaluated, and it was confirmed that it had none of the criteria indicating a benign tumor.

Schwannomas are benign encapsulated nerve sheath tumors that are usually attached to peripheral nerves and arise from differentiated Schwann cells (24). According to the 5th WHO classification of tumors, schwannomas are spindle cell tumors that are entirely or nearly entirely composed of differentiated neoplastic Schwann cells that show nuclear palisading (Verocay bodies). Diffuse staining for S100 in the cell nuclei and cytoplasm is also observed in schwannomas (9). In the present case, bundles of Schwann cells were observed within the nodules. If the bundles are pre-existing non-neoplastic nerve tissue, then perineurial cells, which normally show positive staining for GLUT1, should be present. However, the bundles of Schwann cells did not show any positive staining for GLUT1 (data not shown), thus leading to a diagnosis of schwannoma.

Traumatic (amputation) neuromas may occur in the cystic duct following trauma or cholecystectomy (25). They represent rare non-neoplastic lesions that form at the proximal end of an injured nerve after trauma or surgery, with a healing process that involves hyperplastic proliferation of nerve

fibers and connective tissue (26). Possible causes of traumatic neuromas include infection, inflammatory disease, trauma, stones, surgery, and other biliary diseases (27). In the present case, the patient had no history of abdominal trauma or surgery, and no stones or debris in the gallbladder; thus, it was not considered to be a traumatic neuroma.

Aksoy et al. reported that CD68 might be a potentially useful marker for distinguishing GCT from schwannoma (28). As shown in Supplementary material, both the GCT and schwannoma were positive for S100, whereas CD68-positive staining was found only in the GCT. In the present case, CD68 was also useful for distinguishing GCT from schwannomas.

According to the 5th WHO classification of tumors, schwannomas are biphasic tumors composed of compact areas (Antoni A tissue) with occasional nuclear palisading (Verocay bodies) and parallel rows of Schwann cell nuclei separated by their aligned cell processes, alternating with loosely arranged foci (Antoni B tissue) containing a cobweb-like network of tumor processes with collections of lipid-laden histiocytes (9). In the present case, schwannomas showed only Antoni A tissue but not Antoni B tissue. In addition, no Antoni B tissue component in the GCT was confirmed by assessing the immunohistochemical phenotype using CD68 staining.

Both GCTs and schwannomas rarely occur in the bile ducts, and even more rarely in the cystic duct (3). About 50 cases of bile duct GCT have been reported so far (3, 29). The patients were young (mean age, 33.9 years), and females were more commonly affected (29). The frequency by site in the extrahepatic bile ducts is reported to be 58.1% in the common bile duct, 23.3% in the common hepatic duct, 14% in the choledochal duct, and 2.3% in the gallbladder or duodenal papilla (29). The main symptoms are jaundice, abdominal pain, and itching (3, 30). The tumor size ranges from 0.5 cm to 4.0 cm, with an average of 1.6 cm (29). In

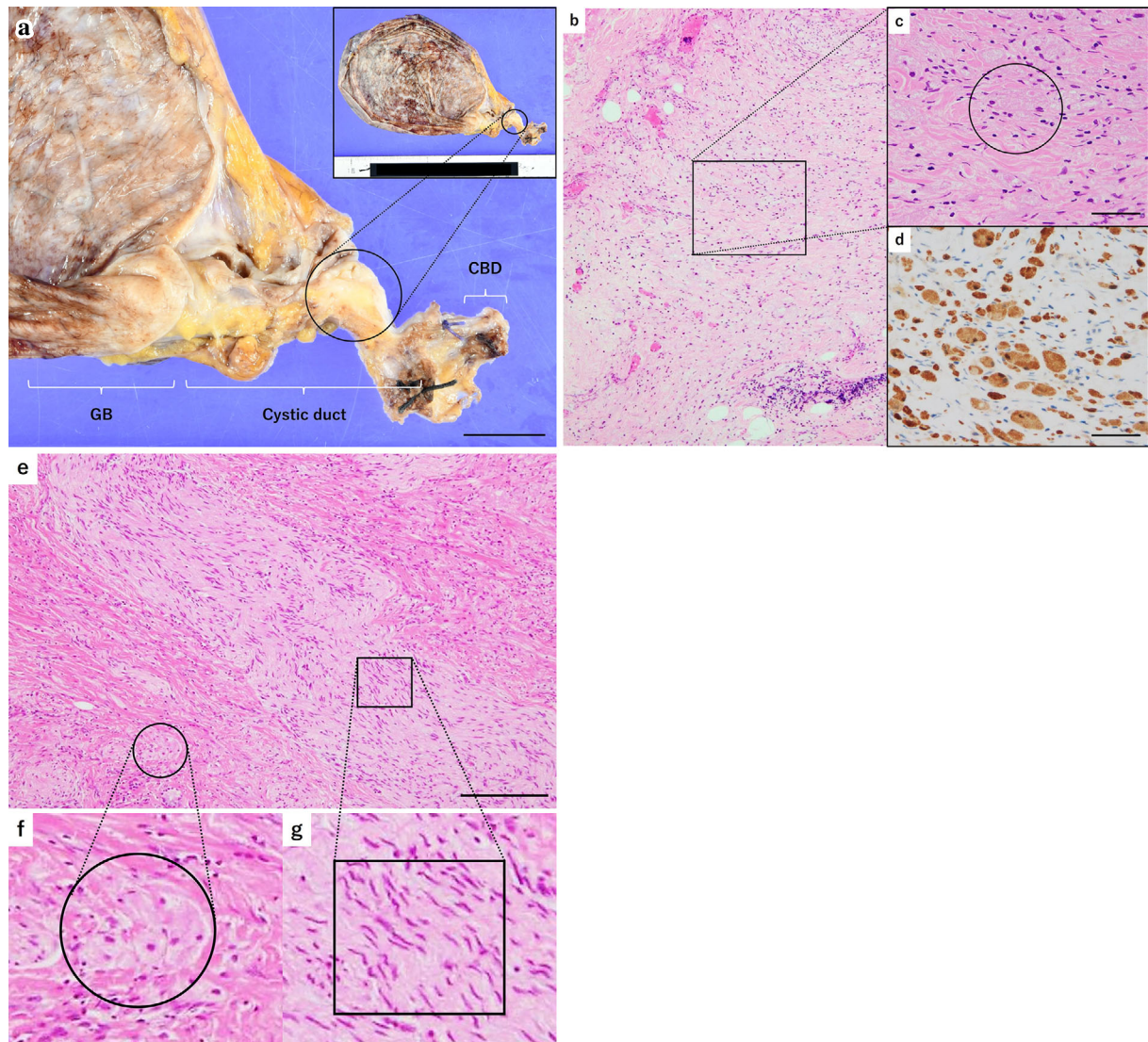


Figure 6. Surgical specimen. a) A pale, yellowish-white nodule (black circle) is seen in the cystic duct. GB: gallbladder, CBD: common bile duct, Scale bar, 10 mm. b) A granular cell tumor (GCT) with abundant granular pale acidophilic cytoplasm on Hematoxylin and Eosin staining. c) GCT cells in a black circle, shown in the higher magnification of the black-lined inset in panel b. Scale bar, 50 μ m. d) Positive S100 staining of the GCT cells. Scale bar, 50 μ m. e) A hybrid nerve sheath tumor composed of GCT and schwannoma. Scale bar, 250 μ m. f) GCT cells in a black circle, shown in the higher magnification of the black circle inset in panel e. g) Neoplastic Schwann cells in the schwannoma in a black cube, shown in the higher magnification of the black cube inset in panel e.

comparison, this case was somewhat smaller, with diameters of 7-8 mm.

More than 20 cases of schwannoma arising from the extrahepatic bile ducts have been reported to date (24, 31-33), but most have involved the common bile duct, and none appear to have involved the cystic duct. Cholangiogenic schwannoma is also more common in women, but the average age is 48.3 years, which is slightly older than that of GCT (24, 31, 32). As with GCT, the main symptoms are associated with bile duct obstruction, followed by jaundice and abdominal pain (24, 31, 32).

Since a histopathological examination, including immunostaining, is necessary to diagnose benign tumors of the bile duct and sufficient amounts of tissue are difficult to ob-

tain from masses in the bile duct, making preoperative definitive diagnosis is therefore often impossible (34, 35). In this case, cholangioscopy was attempted to observe and obtain tissue samples; however, the cystic duct was too tortuous to allow the mass to be reached, and the preoperative diagnosis was only suspected to be a cystic duct mass of some kind. Although recent advances in cholangioscopy have been considerable (36, 37), MRI and contrast-enhanced CT were more useful than cholangioscopy for making a preoperative diagnosis in the present case.

In this report, a case of cystic duct tumor discovered after the patient presented with abdominal pain and an enlarged gallbladder was described. Benign primary tumors of the cystic duct causing cholecystitis-like symptoms due to bile

outflow obstruction are extremely rare. Moreover, the tumor tissue was suspected to represent HPNST (GCT/schwannoma), thus making this case thought-provoking in terms of histopathology. To date, there have been no reports of HPNST with GCT and schwannoma, but it is possible that such reports will emerge in the future. Therefore, an analysis of a larger number of cases is warranted.

The authors state that they have no Conflict of Interest (COI).

Acknowledgement

The authors would like to thank Dr. Etsuko Makino, Setsuko Tsujimura, Mayumi Hagiwara, and Masashi Imoto for their helpful suggestions regarding this manuscript.

References

- Burhans R, Myers RT. Benign neoplasms of the extrahepatic biliary ducts. *Am Surg* **37**: 161-166, 1971.
- Shapiro PF, Lifvendahl RA. Tumors of the extrahepatic bile-ducts. *Ann Surg* **94**: 61-79, 1931.
- Barakat M, Kar AA, Pourshahid S, et al. Gastrointestinal and biliary granular cell tumor: diagnosis and management. *Ann Gastroenterol* **31**: 439-447, 2018.
- Lack EE, Worsham GF, Callihan MD, et al. Granular cell tumor: a clinicopathologic study of 110 patients. *J Surg Oncol* **13**: 301-316, 1980.
- Johnston J, Helwig EB. Granular cell tumors of the gastrointestinal tract and perianal region: a study of 74 cases. *Dig Dis Sci* **26**: 807-816, 1981.
- Sarlomo-Rikala M, Miettinen M. Gastric schwannoma - a clinicopathological analysis of six cases. *Histopathology* **27**: 355-360, 1995.
- Miettinen M, Shekitka KM, Sobin LH. Schwannomas in the colon and rectum: a clinicopathologic and immunohistochemical study of 20 cases. *Am J Surg Pathol* **25**: 846-855, 2001.
- Jung JH, Joo KR, Chae MJ, et al. Extrahepatic biliary schwannomas: a case report. *J Korean Med Sci* **22**: 549-552, 2007.
- Stemmer-Rachamimov OA, Hornick JL. Hybrid nerve sheath tumour, Peripheral nerve sheath tumours. In: WHO Classification of Tumours Editorial Board. *Soft Tissue and Bone Tumours* [Internet]. Lyon (France): International Agency for Research on Cancer; 2020. (WHO classification of tumours series, 5th ed.; vol. 3) [Internet]. [cited 2025 Jun 18]. Available from: <https://tumourclassification.iarc.who.int/chapters/33>
- Leung KCP, Ko TCS. Orbital hybrid peripheral nerve sheath tumors. *Taiwan J Ophthalmol* **10**: 181-183, 2020.
- Ud Din N, Ahmad Z, Abdul-Ghafar J, Ahmed R. Hybrid peripheral nerve sheath tumors: report of five cases and detailed review of literature. *BMC Cancer* **17**: 349, 2017.
- Feany MB, Anthony DC, Fletcher CD. Nerve sheath tumours with hybrid features of neurofibroma and schwannoma: a conceptual challenge. *Histopathology* **32**: 405-410, 1998.
- Zamecnik M, Michal M. Perineurial cell differentiation in neurofibromas. Report of eight cases including a case with composite perineurioma-neurofibroma features. *Pathol Res Pract* **197**: 537-544, 2001.
- Michal M, Kazakov DV, Belousova I, Bisceglia M, Zamecnik M, Mukensnabl P. A benign neoplasm with histopathological features of both schwannoma and retiform perineurioma (benign schwannoma-perineurioma): a report of six cases of a distinctive soft tissue tumor with a predilection for the fingers. *Virchows Arch* **445**: 347-353, 2004.
- Belakhova SM, Rodriguez FJ. Diagnostic pathology of tumors of peripheral nerve. *Neurosurgery* **88**: 443-456, 2021.
- Lenartowicz KA, Monie DD, Amrami KK, Klein CJ, Giannini C, Spinner RJ. Hybrid tumors with perineurioma components: a systematic review of the literature and illustrative case. *Acta Neurochir (Wien)* **165**: 935-945, 2023.
- Hornick JL, Bundock EA, Fletcher CD. Hybrid schwannoma/perineurioma: clinicopathologic analysis of 42 distinctive benign nerve sheath tumors. *Am J Surg Pathol* **33**: 1554-1561, 2009.
- Leite AA, Mariz B, Oliveira LA, Assunção Júnior JNR, Almeida OP, Vargas PA. Hybrid neurofibroma/schwannoma of the oral cavity: a rare case report and literature review. *Int J Surg Pathol* **31**: 695-701, 2023.
- Harder A, Wesemann M, Hagel C, et al. Hybrid neurofibroma/schwannoma is overrepresented among schwannomatosis and neurofibromatosis patients. *Am J Surg Pathol* **36**: 702-709, 2012.
- Agaimy A. Microscopic intraneural perineurial cell proliferations in patients with neurofibromatosis type 1. *Ann Diagn Pathol* **18**: 95-98, 2014.
- Neelon D, Lannan F, Childs J. Granular cell tumor. In: StatPearls. StatPearls Publishing, Treasure Island, 2025 [Internet]. [updated 2023 Jul 3; cited 2025 Feb 11]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK563150/>
- Stefansson K, Wollmann RL. S-100 protein in granular cell tumors (granular cell myoblastomas). *Cancer* **49**: 1834-1838, 1982.
- Fanburg-Smith JC, Meis-Kindblom JM, Fante R, Kindblom LG. Malignant granular cell tumor of soft tissue: diagnostic criteria and clinicopathologic correlation. *Am J Surg Pathol* **22**: 779-794, 1998.
- Thakur S, Dash NR, Barwad A, Das P, Madhusudhan KS, Yadav R. Schwannoma of common bile duct: a clinico-radiologic diagnostic quagmire - a case report. *GE Port J Gastroenterol* **31**: 1-8, 2023.
- Kaka Ali HH, Gharib DT, Hassan MN, et al. Biliary tree traumatic neuroma following laparoscopic cholecystectomy: a case report and literature review. *Med Int (Lond)* **3**: 37, 2023.
- Lee JY. Traumatic neuroma at the mastectomy site, unusual benign lesion, mimicking tumor recurrence: a report of two cases. *Radiol Case Rep* **17**: 662-666, 2022.
- Sleiman YA, Hassoun ZA, Nasser HA, Abs L, Allouch M. A late unusual complication after an open cholecystectomy: amputation neuroma of the CBD causing obstructive jaundice. *Int J Surg Case Rep* **39**: 123-125, 2017.
- Aksoy S, Abali H, Kilickap S, Harputluoglu H, Erman M. Metastatic granular cell tumor: a case report and review of the literature. *Acta Oncol* **45**: 91-94, 2006.
- Saito J, Kitagawa M, Kusanagi H, et al. Granular cell tumor of the common bile duct: a Japanese case. *World J Gastroenterol* **18**: 6324-6327, 2012.
- Jung C, Heo I, Kim SB, Park S, Cho SY. Biliary granular cell tumor. *J Pathol Transl Med* **49**: 89-91, 2015.
- Fonseca GM, Montagnini AL, Rocha Mde S, et al. Biliary tract schwannoma: a rare cause of obstructive jaundice in a young patient. *World J Gastroenterol* **18**: 5305-5308, 2012.
- Marin Campos C, García Sanz I, Muñoz de Nova JL, Valdés de Anca A, Martín Pérez ME. Schwannoma of the biliary tract resembling cholangiocarcinoma: a case report and review. *Ann R Coll Surg Engl* **98**: e143-e146, 2016.
- García Picazo A, Vega Novillo V, Gallardo Gallego R, Loinaz Seguro C, Justo Alonso I. Bile duct schwannoma, an uncommon cause of a bile duct tumor, diagnosis and therapeutic management. *Rev Esp Enferm Dig* **115**: 587-588, 2023.
- Gamblin TC, Krasinskas AM, Slivka AS, et al. Fibroinflammatory biliary stricture: a rare bile duct lesion masquerading as cholangiocarcinoma. *J Gastrointest Surg* **13**: 713-721, 2009.
- Victor DW, Sherman S, Karakan T, Khashab MA. Current endo-

scopic approach to indeterminate biliary strictures. *World J Gastroenterol* **18**: 6197-6205, 2012.

36. Ogura T, Hirose Y, Ueno S, et al. Prospective registration study of diagnostic yield and sample size in forceps biopsy using a novel device under digital cholangioscopy guidance with macroscopic on-site evaluation. *J Hepatobiliary Pancreat Sci* **30**: 686-692, 2023.
37. Kawakami Y, Masaki Y, Ishigami K, et al. Peroral cholangioscopy-guided biopsy with novel biopsy forceps in comprehensive cancer

genomic profiling for cystic duct carcinoma. *Endoscopy* **56** (S 01): E414-E415, 2024.

The Internal Medicine is an Open Access journal distributed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view the details of this license, please visit (<https://creativecommons.org/licenses/by-nc-nd/4.0/>).

© 2026 The Japanese Society of Internal Medicine
Intern Med 65: 1779-1785, 2026