




Krukenberg tumor on laparoscopy

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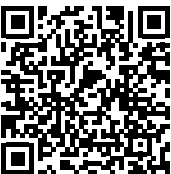
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Abstract

Introduction: Krukenberg tumors are metastatic ovarian tumors, commonly originating from gastrointestinal malignancies, characterized histologically by mucin-secreting signet ring cells within the ovarian stroma. Although Krukenberg tumors are a well-recognized entity, their laparoscopic appearance and intraoperative findings are infrequently described in the literature.

Aim: To describe the laparoscopic appearance and clinicopathologic features of Krukenberg tumor and highlight the diagnostic value of laparoscopy in such cases.

Case study: A 22-year-old woman presented with abdominal distension and vomiting for one month. Imaging revealed bilateral adnexal masses with ascites, without an identifiable primary lesion. Diagnostic laparoscopy demonstrated asymmetrical bilateral ovarian masses with smooth, bosselated surfaces, extensive peritoneal disease, omental caking, and ascites. Frozen section of omental biopsy revealed signet ring cells in a mucinous background. Histopathology and immunohistochemistry showed tumor cells positive for CK20, CDX2, and SATB2 and negative for CK7 and PAX8, consistent with metastatic mucinous adenocarcinoma. Subsequent colonoscopy identified a descending colon primary. The patient received one cycle of chemotherapy but succumbed to disseminated disease shortly thereafter.

Results and discussion: Krukenberg tumors commonly affect younger women and often present with nonspecific symptoms, leading to delayed diagnosis. Laparoscopy allows direct visualization of characteristic ovarian morphology, assessment of peritoneal disease, and targeted biopsies, facilitating early diagnosis and accurate staging. Immunohistochemistry plays a crucial role in differentiating metastatic gastrointestinal tumors from primary ovarian malignancies.

Conclusions: Laparoscopy is a valuable diagnostic tool in suspected Krukenberg tumors, providing characteristic visual findings and enabling timely histological confirmation. Awareness of their laparoscopic appearance may aid in early diagnosis and appropriate management of this aggressive disease.

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1. INTRODUCTION

Krukenberg tumors (KTs) are metastatic ovarian malignancies, primarily originating from gastrointestinal cancers such as gastric or colorectal cancer, and less commonly from breast cancer. Pathologically, these tumors are characterized by the presence of mucin-secreting signet-ring cells. Immunohistochemistry aids in diagnosis, with a CK7-negative and CK20-positive profile indicating a gastrointestinal origin. The prognosis for patients with KT is generally poor, often with survival less than two years from diagnosis, and it significantly depends on the primary tumor site.^{1,2}

During laparoscopy, Krukenberg tumors typically appear as bilateral ovarian masses, which can appear smooth, firm, and multinodular. The presence of ascites, pelvic deposits, and synchronous metastasis are common findings that can be identified during the procedure. Though laparoscopy is routinely performed, the laparoscopic findings of KT are rarely reported in literature.

2. AIM

This report aims to detail the laparoscopic appearance and clinicopathologic characteristics of these tumors. By providing a comprehensive overview, this report seeks to enhance understanding and improve the management of KT.

3. CASE PRESENTATION

A 22-year-lady with no comorbidities presented with a complaint of abdominal distension with vomiting for 1 month. Clinical examination revealed Eastern Cooperative Oncology Group Performance Status 1 (ECOG PS 1), normal vitals, normal abdominal, and digital rectal examinations. Computed tomography (CT) abdomen showed multiloculated bilateral adnexal cystic lesions measuring 7 x 6 cm on the right side and 5 x 4 cm on the left side, accompanied by ascites. However, no growth or thickening was appreciable in colon or stomach. Multislice spiral CT chest indicated normal lungs and mediastinum.

Ascitic fluid cytology repeated twice showed lymphocyte rich effusion and was negative for malignant cells. There was elevated serum CEA (23.7 ng/mL), and CA 125 levels (142 IU/mL) with normal serum CA 19.9 U/mL, beta-HCG and AFP values. Diagnostic laparoscopy revealed asymmetrical fleshy bilateral adnexal masses in pelvis with intact capsules, smooth surfaces devoid of peritoneal deposits, and bosselated appearance with multiple tumor deposits over parietal and pelvic peritoneum, bilateral subdiaphragmatic peritoneum, with omental caking, and ascites, with bowel and liver relatively free of deposits (Figure 1). A frozen section of the omental biopsy showed signet ring cells in a mucinous background suggestive of metastasis. Biopsies of the omentum, adnexa, and peritoneum were performed.

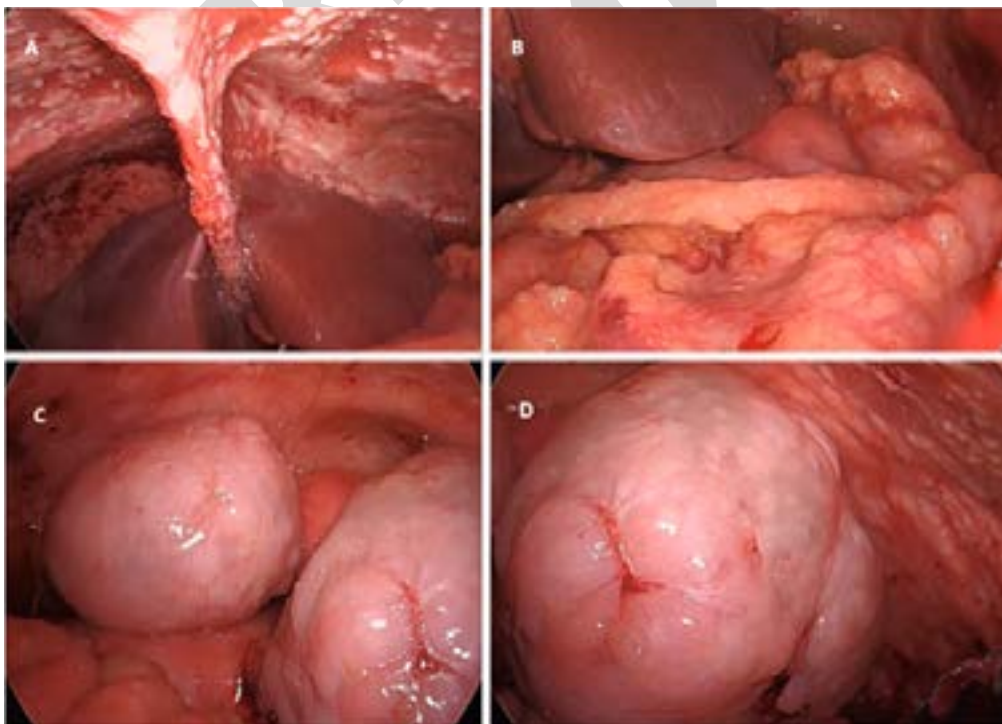


Figure 1. Laparoscopic images of Krukenberg's tumor: (A) diffuse peritoneal disease over the subdiaphragmatic peritoneum and falciform ligament; (B) omental caking obscuring transverse colon visualization; (C) bilateral asymmetrical adnexal masses with a smooth, bosselated surface devoid of surface tumor deposits; (D) pelvic peritoneal disease along with a right adnexal mass.

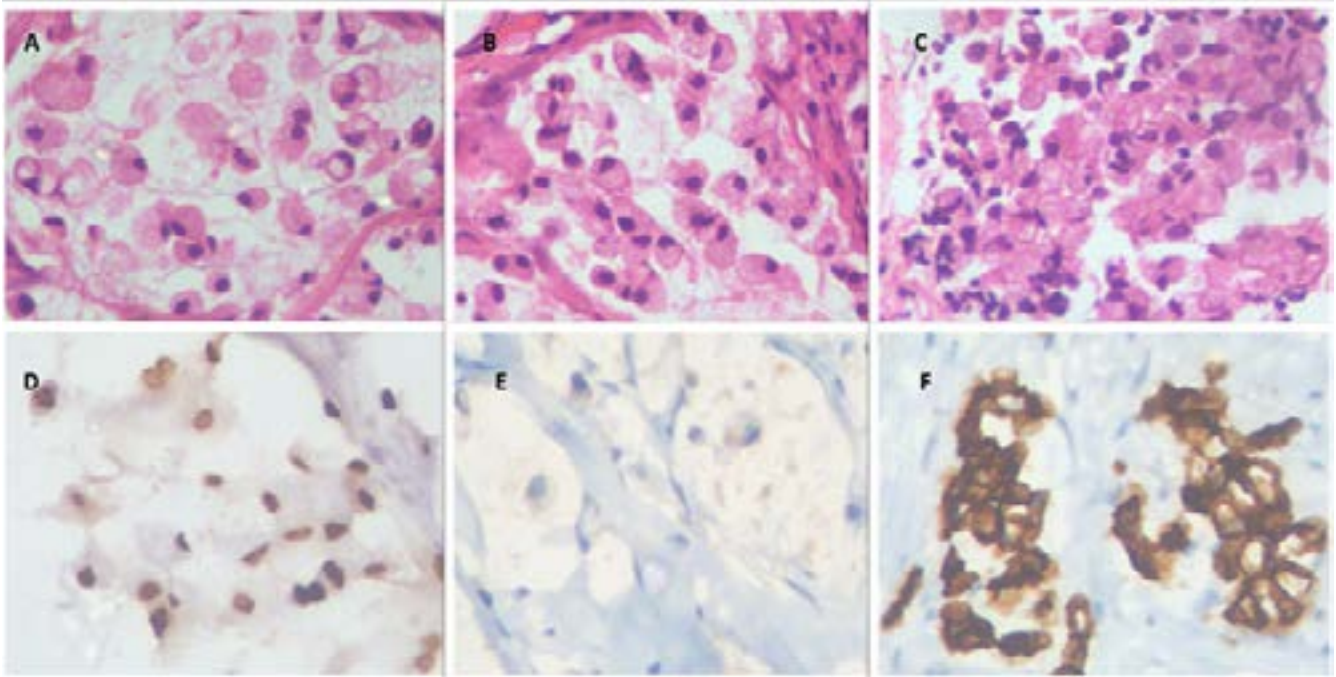


Figure 2. Sheets of signet ring cells in mucin pools: (A) omental biopsy (HE, magnification 400x), (B) adnexal biopsy (HE, magnification 400x), and (C) colon biopsy (HE, magnification 100x). Immunohistochemistry results (magnification 400x): (D) positivity for CDX2, (E) negativity for CK7, and (F) positivity for CK20.

Histopathology of all these biopsies showed similar histology with sheets of signet ring cells floating in pools of extra cellular mucin. Immunohistochemistry (IHC) revealed tumor cells that were positive for cytokeratin 20, SATB2, and CDX2. The tumor cells were negative for cytokeratin 7 and PAX8 (Figure 2). The above findings confirmed the diagnosis of metastatic mucinous adenocarcinoma (signet ring cell type), recommending a search for the primary site in the gastrointestinal tract. A subsequent colonoscopy revealed growth located at 45 cm from anal verge in the left colon (Figure 3B). Biopsy from this lesion showed a tumor with similar morphology as the metastatic sites confirming descending colon as the primary site. She received single cycle of CapeOX based chemotherapy and died of disseminated disease 22 days after surgery.

4. DISCUSSION

KTs are secondary ovarian neoplasms that typically arise from gastrointestinal cancers, particularly those of the stomach and colon. Characterized by mucin-secreting signet ring cells within the ovarian stroma, KT's account for 1%–2% of all ovarian tumors. These tumors more frequently affect younger women likely due to the rich ovarian blood supply that facilitates metastasis. Clinically, KT's often present subtly with nonspecific symptoms, leading to delayed diagnosis and poor outcomes.¹

A systematic review and meta-analysis aimed to better characterize KT's, revealed that the most com-

mon primary tumor sites as the stomach (42.5%), colon-rectum (26.1%), breast (9.3%), and appendix (5%).¹ Nearly half (48.7%) of KT's were synchronous with the primary tumor, 64.3% were bilateral, and 40.5% had a diameter of at least 10 cm. Additionally, 55.3% showed extraovarian extent, and 49% had peritoneal involvement. Common presenting symptoms included ascites (51.7%), palpable masses (31.3%), pain (29.3%), abdominal distention (28.7%), irregular bleeding (9.1%), and some patients were asymptomatic (11.2%).¹

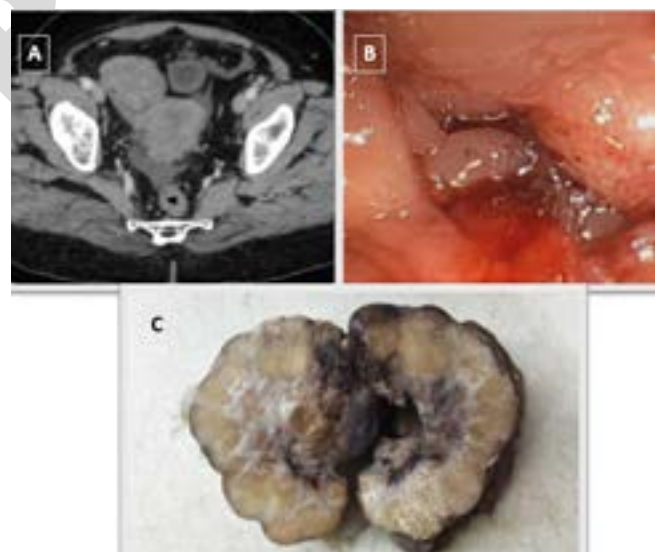


Figure 3. (A) CT abdomen images of Krukenberg tumor revealing enhancing solid asymmetrical adnexal masses with smooth surface. (B) Colonoscopy showing obstructive growth in descending colon. (C) The cut section of the Krukenberg tumor reveals a pale, solid structure. Note the lobulated yet smooth surface of the mass (C belongs to a different patient).

4.1. PATHOLOGY AND IMMUNOHISTOCHEMISTRY

KTs are characterized by the presence of mucin-secreting signet ring cells within the dense fibroblastic stroma of the ovaries. Gross examination reveals grayish to white tumor, with a solid, smooth external surface. The cut section shows a pale, solid structure (Figure 3C). Microscopically, these tumors exhibit poorly differentiated adenocarcinoma cells that infiltrate the ovarian stroma, often accompanied by a sarcomatoid reaction. Immunohistochemically, KT typically show a distinct profile that aids in distinguishing them from primary ovarian neoplasms. A cytokeratin 7 (CK7)-negative and cytokeratin 20 (CK20)-positive immunophenotype strongly suggests a gastrointestinal origin, particularly colorectal cancer. Additionally, a carcinoembryonic antigen (CEA)-positive and cancer antigen 125 (CA-125)-negative profile further supports a metastatic gastrointestinal origin, whereas primary ovarian tumors usually present with the opposite profile (CA-125 positive and CEA negative). This immunohistochemical distinction is crucial for accurate diagnosis and subsequent treatment planning.^{2,3}

4.2. ROUTE OF METASTASIS

KTs primarily spread through three potential routes: lymphatic, peritoneal, and hematogenous.⁴ The lymphatic route is widely accepted, where cancer cells from gastric cancer metastasize to peri-gastric nodes, forming emboli that block lymphatic flow and reach the ovaries through the para-aortic and pelvic lymph nodes. This is supported by frequent lymphovascular invasion seen in KTs and the presence of tumor cells in the hilum and cortex of the ovary. The peritoneal spread theory hypothesizes that KTs are a form of peritoneal involvement, often associated with free peritoneal cancer cells and peritoneal carcinomatosis, particularly the signet ring cell carcinomas known for high peritoneal diffusion. Lastly, hematogenous spread is suggested due to the prevalence of KTs in premenopausal women with greater ovarian vascularity, the presence of pulmonary metastases, and lymphovascular invasion. This route is further supported by the occurrence of KTs following breast cancer and the presence of circulating tumor cells that metastasize hematogenously.⁴

4.3. LAPAROSCOPIC AND IMAGING FINDINGS

Laparoscopic examination of KT often reveals asymmetric enlargement of the ovaries with a characteristic fleshy bosselated (bumpy) contour. The capsular surface of ovaries is typically smooth and lacks adhesions or peritoneal deposits, which distinguishes them from

other metastatic ovarian tumors that often present with surface implants.⁵ This is often accompanied by peritoneal dissemination on parietal, pelvic and diaphragmatic peritoneal surfaces with malignant ascites and omental deposits. The sectioned surfaces of these tumors are typically pale or white and can range from solid and firm to edematous and gelatinous (Figure 3C). On sonography, KT can appear as solid, mixed solid and cystic, or predominantly cystic masses with well-defined margins and exhibit the 'lead vessel sign,' consisting of a large lead vessel penetrating the tumor from the periphery and then branching in a tree pattern. CT imaging typically shows bilateral pelvic masses with a well-demarcated intratumoral cystic component, and the cyst walls often exhibit contrast enhancement or can exhibit completely solid pattern (Figure 3A). MRI findings include T1 and T2 hypointensity of solid components due to dense stromal reaction, with T2 hyperintensity in cystic areas representing non-enhancing mucin.²

4.4. PROGNOSIS

The prognosis for patients with KT is generally poor, with survival often being less than two years from diagnosis. The outlook largely depends on the primary tumor site, with gastric cancer-associated KT having a particularly grim prognosis compared to those originating from colorectal or breast cancer. A study utilizing multivariate analysis identified several independent factors associated with poor overall survival (OS) in patients with KT including synchronous metastasis, pelvic invasion, presence of ascites, and the absence of metastasectomy. Despite the generally poor prognosis, ovarian metastasectomy may offer a survival benefit. Therefore, meticulous treatment planning is crucial for managing these patients effectively.⁶

5. CONCLUSIONS

Laparoscopy is a valuable diagnostic tool in suspected Krukenberg tumors, providing characteristic visual findings and enabling timely histological confirmation. Awareness of their laparoscopic appearance may aid in early diagnosis and appropriate management of this aggressive disease.

CONFLICT OF INTEREST

None declared.

FUNDING

None declared.

ETHICS

Bioethical committee approval No. IEC/2024/190 was obtained.

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