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Case Report

Colorectal adenocarcinoma infiltrating inguinal hernia mesh: a case report and systematic review

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ABSTRACT

Inguinal hernia repairs are standard procedures globally, but while reducing recurrence, they can introduce complications such as infection, migration, and bowel obstruction. The extent of prosthetic mesh involvement in synchronous malignancies, particularly regarding cancer seeding or direct invasion, remains underexplored. This case report highlights an uncommon presentation of colorectal adenocarcinoma, initially manifesting as a mesh-related complication, in a 74-year-old male with a history of two previous right inguinal hernia repairs. Initial evaluations, including colonoscopy and carcinoembryonic antigen levels, offered no indication of cancer. However, subsequent investigation led to robotic adhesiolysis, preperitoneal debridement, and mesh explantation, definitively revealing metastatic moderately differentiated adenocarcinoma on the mesh, strongly suggesting a colorectal primary neoplasia. Despite multiple interventions and chemotherapy, the patient developed progressive metastasis. We identified only 8 reported cases describing mesh invasion or complications due to various primary tumors presenting as inguinal masses, pain, or swelling, making this an extremely rare complication. Surgical management in these cases primarily involved tumor resection and mesh removal, with mixed outcomes. This case therefore underscores the rare but significant occurrence of metastatic colorectal adenocarcinoma seeding prosthetic mesh following inguinal hernia repair.

Keywords: Inguinal hernia, Abdominal wall, Adenocarcinoma

INTRODUCTION

Hernia repairs are one of the most common surgeries performed by general surgeons. More than 700,000 inguinal hernias are estimated to be repaired annually in the United States alone.[1] Over the past few decades, mesh-based repairs have replaced primary repairs at the standard of care in the elective setting, given the improved durability and decreased rate of hernia recurrence with mesh. The rise of prosthetic mesh has led to attendant complications, such as bowel obstruction, mesh infection, and mesh migration.[2]

Furthermore, many patients are submitted to inguinal hernia repair despite the presence of simultaneous diseases, such as metabolic disorders and abdominal pathologies, including neoplasias. Studies report increased post-operative risk for patients undergoing IHR with synchronous cancers. It is explored that this risk is mainly associated with consumptive syndrome and poor wound-related recovery.

However, specific mesh-related complications associated with cancer are a poorly explored event. There is a paucity of reports describing mesh complications due to cancer seeding the mesh, and its incidence is unknown. Also, there is a lack of reports of the primary tumor directly invading the mesh; to our knowledge, the few reported cases of cancer found in the prosthetic mesh are a result of metastases from a remote tumor. In this case report, we present the first case of colorectal adenocarcinoma that initially presented as a mesh complication, with subsequent cancer diagnosis.

CASE REPORT

The patient initially presented as an active 74-year-old male with a remote history of cardiac stents, who was referred to our clinic given concern for chronic mesh infection. Over 5 months, he had developed recurrent right lower quadrant abscesses requiring multiple hospitalizations and percutaneous drains placed by interventional radiology. He had previously undergone 2 right inguinal hernia repairs with mesh. The first repair was an open right inguinal herniorrhaphy with Marlex mesh in 2017. When this recurred, he underwent a robotic-assisted laparoscopic preperitoneal right inguinal herniorrhaphy with Bard mesh in 2019. In the same year, he was hospitalized for fevers and a right lower quadrant abscess near the cecum. This was resolved with intravenous antibiotics and drainage with a percutaneous interventional radiology-guided catheter. Carcino-embryonic antigen (CEA) level at the time was 1.2, and his last colonoscopy from 2012 was reportedly negative. As such, there was a low index of suspicion for colon cancer.

He subsequently underwent a colonoscopy in 2020, which demonstrated a benign cecal polyp and a patent appendiceal orifice. The cecal polyp pathology showed a sessile serrated adenoma which was removed in its entirety. Still, in 2020, the patient was once again hospitalized for a recurrent right lower quadrant abscess and underwent drainage by Interventional radiology. Fluid cultures grew *Bacteroides, E. coli, Morganella morganii*, and *Candida albicans*. He was treated with levofloxacin, metronidazole, and fluconazole.

He was referred to our clinic for surgical evaluation, with the working diagnosis of chronic mesh infection. A preoperative computerized tomography (CT) scan was obtained; findings are demonstrated in Figure 1. We performed a robotic adhesiolysis with dissection of dense colonic phlegmon from the pelvis, preperitoneal debridement and drainage of chronic abscess, explantation of right preperitoneal infected inguinal mesh, and appendectomy. Final pathology revealed metastatic moderately differentiated adenocarcinoma on the explanted mesh, favoring colorectal primary. Moderately differentiated adenocarcinoma was also seen involving the appendiceal serosa and peri appendiceal tissue, suggesting metastasis versus direct extension of the tumor. The appendiceal margin was negative for malignancy. Mismatch proteins showed loss of PMS2, indicating indicated high probability of Lynch syndrome.

A colonoscopy in the same year showed a mass in the cecum involving the appendiceal orifice; 4 biopsies were performed, which showed only benign colonic mucosa with patchy inflammation, as no submucosal tissue was present. PET/CT showed a large 11 cm right lower quadrant mass abutting the wall of the abdomen and colon. The patient then underwent 3 cycles of neoadjuvant FOLFOX. Chemotherapy was stopped prematurely, as he did not tolerate it well. CT imaging showed the increased size of the mass, with an invasion of the bladder dome and abdominal wall. He subsequently underwent en bloc resection of the tumor, which involved a right colectomy, small bowel resection, partial sigmoid colectomy with primary anastomosis, partial resection of the right lower quadrant abdominal wall, partial cystectomy, right ureterolysis, and mesh reconstruction of the abdominal wall.

As this was performed at an outside hospital, the details of the resection and reconstruction were not available for review. The tumor measured 13.8×9.5×9.3 cm and was found to be moderately differentiated colonic adenocarcinoma on final pathology. No perforation was identified. Two right retroperitoneal lymph node nodules containing adenocarcinoma were involved, and the abdominal wall margin was focally positive for the tumor. All other margins were negative. Three tumor deposits were present in total, with 9/40 positive lymph nodes and perineural invasion, with no evidence of lymphovascular invasion (Stage IV, T4bN2bM1 disease). There was no evidence of treatment effect or tumor regression. A second PET scan showed numerous FDG avid nodules in the peritoneum, retroperitoneum, and body wall consistent with malignant implants. Keytruda (pembrolizumab) was initiated as a palliative treatment for metastatic DNA mismatch repair (MMR) deficient colorectal cancer. CT scan showed a good interim response to therapy, with complete resolution of the peritoneal, retroperitoneal, and body wall implants with no new malignant findings.

He has since developed an enlarging right iliac flank hernia, with a recurrence of a large right-sided inguinal hernia. He finds this large right lower quadrant bulge aesthetically displeasing but is otherwise asymptomatic.

Literature review

In our literature review, eight studies were included, all describing cases of other instances of mesh involvement in malignancies with inguinal mesh involvement. All the included studies were single case reports (Figure 1).

The studies included patients aged from 55 to 88 years, all of whom presented with clinical symptoms such as an inguinal mass, abdominal pain, and swelling. Some of the case reports showed patients with more specific symptoms, such as a ruptured bowel or weight loss. The

inguinal mass was often associated with tenderness, and some cases described an increasing bulge in the left inguinal region. Diagnostic tools varied, but most cases utilized a combination of CT scans, MRI, PET scans, and ultrasonography to identify both the mesh and neoplastic lesions. Elevated markers such as CA-19.9 were observed in two cases, mostly being used for a follow-up after malignancy resection. In all instances, the patients had a history of hernia repair using mesh, with mesh plug repair being the most common method. In some reports, tumors were found to infiltrate the mesh, spreading into surrounding tissues such as the inguinal canal, scrotum, or anterior inguinal canal. One specific case demonstrated metastasis to the metallic stapler. The neoplasia diagnosis comprised adenocarcinoma, squamous cell, and B-cell lymphoma. Primary organs involved the large bowel, stomach, lung, and pancreas. Full patients, neoplasia, and mesh invasion information are found in Table 1.

Treatment strategies across the cases were diverse, but most patients underwent surgical resection of the tumor alongside mesh removal. Almost all the cases decided to do a primary repair of the hernia, with one patient undergoing a new onlay mesh placement. Interestingly, this patient presented with no hernia or neoplastic recurrence in a follow-up of 30 months. Several patients also received adjuvant therapies, such as chemotherapy or radiotherapy, especially in cases of advanced malignancies.

Additionally, one patient died from acute heart failure four months after the surgery, while another died to peritoneal carcinomatosis within 45 days of the procedure. Despite these complications, hernia recurrence was not observed in most of the patients after surgery, although some patients chose not to have their hernia repaired due to personal or family preferences. All the interventions and outcomes are found in Table 2. Regarding the outcome of neoplastic disease, no recurrence of the cancer was reported in several patients after successful surgical intervention and chemotherapy. In one case, a patient with metastasis to the right groin and regional lymph nodes continued to receive chemotherapy. Follow-up periods varied between 8 and 30 months, with most patients showing stable conditions or no recurrence of the hernia or cancer.

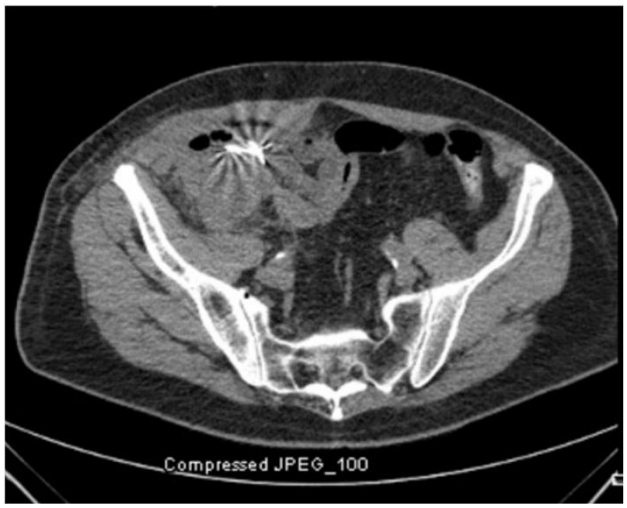

Figure 1: CT scan prior to mesh resection 4/2020.

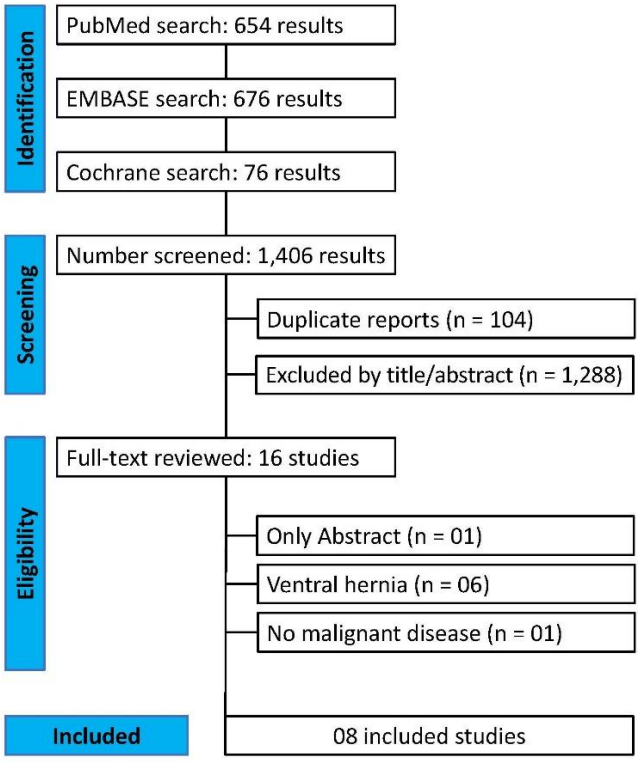

Figure 2: PRISMA flow of the included studies.

Table 1: Baseline characteristics of the included studies.

Study	Study design	Age (in years)	Clinical presentation	Diagnostic tools	Previous hernia repair	Neoplasia characteristics	Mesh involvement
Ueda et al, 2024[9]	Case report	55	Increasing bulge on the left inguinal region	CT scan showing left kidney, colon and mesh invasion	Mesh Plug Repair	Retroperitoneal liposarcoma with left kidney and left colon invasion.	Tumoral invasion from the posterior inguinal canal with mesh invasion up to the scrotum and anterior inguinal canal tearing.
Kenta et al, 2020[10]	Case report	81	Left groin mass and local tenderness	CT scan, PET-Scan, MRI and CA-19.9	Left Transinguinal Preperitoneal Indirect Hernia Repair with Onflax Mesh	Previously resected pancreatic tubular adenocarcinoma with R0 surgical margin and no signs of neoplastic recurrence	Mesh invasion from the pancreatic tubular adenocarcinoma diagnosed by pathology (Metastasis)
Li et al, 2010[4]	Case report	82	3-day history of intermittent abdominal pain + Ruptured bowel (7-month history of left groin irreducible mass)	CT scan	Suprapubic prostatectomy for benign prostate hyperplasia + bilateral mesh-plug repair	Previous sigmoidectomy for node negative moderately differentiated mucinous adenocarcinoma of the sigmoid	Mesh-plug with adherent tissue: moderately differentiated metastatic mucinous adenocarcinoma both on the mesh and small bowel.
Pocard et al, 1999[3]	Case report	72	Left inguinal tenderness mass	USG and CT	Laparoscopic bilateral hernia repair	Whitish 8 cm B-cell lymphoma involving mesentery, ulcerating serosa and surrounding superior mesenteric vessels	Distant tumoral infiltration of the bilateral mesh and preperitoneal space + peritoneum metastasis
Rajaram et al, 2008[11]	Case report	70	Left inguinal tenderness mass	CT + USG-guided biopsy	TAPP direct left inguinal hernia repair with polypropylene mesh (titanium staple fixation)	Not well-differentiated invasive squamous cell carcinoma of the lung diagnosed secondarily to the inguinal mass	Not well-differentiated invasive squamous cell carcinoma at the titanium staple.
Bouillot et al, 1999[12]	Case report	71	Hard inguinal swelling + Weight loss	CT, Contrast enema, Colonoscopy, CEA marker	Open mesh repair (Dacron mesh)	Voluminous ulcerated cecal mass budding into the lumen (Colonoscopy). Well-differentiated adenocarcinoma on biopsy. Well-differentiated adenocarcinoma + five positive lymph nodes on surgery.	Cecal tumor perforated in the parietal muscles + abscess developed in the mesh.
Imai et al, 2003[5]	Case report	88	Right groin tenderness	CT	Open mesh plug recurrent right inguinal hernia repair	Distal gastrectomy and a partial colectomy + lymph node dissection:Gastric (T2, N0, M0)+ transverse colon cancer (T4, N1, M0)	Granuloma and necrotic mass within the mesh: Well-differentiated adenocarcinoma + necrosis and abscess in the plug prosthesis
Kudou et al, 2015[8]	Case report	85	Staging of primary malignancy	Colonoscopy+ CT+PET-CT	Bilateral open mesh plug repair	Ascending colon cancer: moderately to well-differentiated adenocarcinoma (colonoscopy)+Regional lymph nodes, liver and right groin metastasis (T4a, N2a, M1a)	Bilateral lymph node metastasis adjacent to previous surgical mesh

*N/A: Data not available; CT: Computerized tomography; MRI: Magnetic Resonance Imaging; USG: Ultrasonography; TAPP: Transabdominal preperitoneal

Table 2: Included case reports interventions and outcomes.

Study	Intervention	Post-intervention complications	Hernia recurrence	Neoplasia outcome	Follow-up
Ueda et al, 2024[9]	Left colectomy, nephrectomy, mesh excision + inguinal hernia repair with new onlay mesh placement	N/A	No recurrence	No neoplastic recurrence	30 months
Kenta et al, 2020[10]	Open left inguinal exploration with en bloc resection and primary suture	N/A	No recurrence	No neoplastic recurrence	21 months
Li et al, 2010[4]	Urgent open inguinal and abdominal incision with primary closure from intra-abdominal approach and inguinal incision left open.	N/A	N/A	N/A	Patient died from acute heart failure 4 months postoperatively
Pocard et al, 2019[3]	Laparotomy+ Chemotherapy	N/A	N/A	N/A	N/A
Rajaram et al, 2008[11]	Laparotomy+ chemotherapy	N/A	N/A	N/A	N/A
Bouillot et al, 1999[12]	Right colectomy and primary ileotransverse anastomosis+ Full-thickness parietal wall excision+ Primary closure of the abdominal wall +chemoradiotherapy	Postoperative ileus	No recurrence	No neoplastic recurrence	24 months
Imai et al, 2003[5]	Open inguinal exploration	N/A	N/A	N/A	Patient died of peritoneal carcinomatosis 45 days after the last operation
Kudou et al, 2015[8]	Laparoscopic assisted right hemi-colectomy and D3 lymph node resection + Chemotherapy	No complications	No recurrence (mesh was not excised due to patient or the family preference)	Malignancy being monitored (patient under the chemotherapy)	8 months

DISCUSSION

We present an interesting case of colorectal adenocarcinoma that was diagnosed as a result of mesh involvement. To our knowledge, only one similar case was reported, as described in our results. Prior reports of cancer seeding mesh were found to be due to metastases from a previously diagnosed malignancy, rather than initially presenting as a mesh infection from direct invasion.

A case presented by Pocard et al described distant peritoneal metastases from a nodal mesenteric lymphoma after laparoscopic inguinal hernia repair to preperitoneal meshes, but there are no similar reports of carcinoma metastasizing to preperitoneal mesh.[3] Compared to the six other reported cases of metastasis to mesh, this may also be the second case with the presenting sign of malignancy being the mesh complications.[4-6] The case report involving a diagnosis of the malignancy following an initial presentation as an inguinal hernia mesh-related complication, described by Li et al evidenced a different clinical presentation from ours. They described an emergent case presenting with an incarcerated bowel, with a history of irreducible mass from 7 months before the diagnosis. This description highlights the importance of a tailored approach when analyzing atypical mesh-related complications.

Similarly to this case, Imai, et al reported a case of metastasis to a mesh-plug prosthesis that presented as an abscess. However, this patient had a known history of transverse colon cancer. In patients with a previous diagnosis of cancer, mass formation around the inguinal mesh confirmed with imaging should lead to suspicion of metastasis.[7] However, our case presented a particularly difficult diagnosis as the patient's underlying primary colorectal malignancy was yet undiscovered, and he had had a colonoscopy prior that year which did not show cancer. Other than the chronic nature of the inguinal mesh complications, no other signs pointed towards metastasis, making this case very unusual.

Kudou et al. discussed in their report of colon cancer metastasis to bilateral inguinal hernia repair sites possible factors that may contribute to the implantation and growth of tumor cells in the peritoneum.[8] They proposed that chronic inflammation of the mesh or peritoneal trauma may be inciting events. It is difficult to say whether the cancer was present prior to mesh implanation or afterwards. We hypothesize that a micro-perforation secondary to the cancer incited the first abscess then IR drain placement seeded the preperitoneal space and ultimately the mesh. Chronic inflammation may have been the inciting event for tumor growth in our case due to the patient's history of chronic inguinal hernia mesh infection and abscess.

There is a paucity of reports describing mesh complications due to cancer seeding the mesh, and its incidence is unknown. To our knowledge, the few reported cases of cancer found in the prosthetic mesh are a result of peritoneal metastases from a remote or previously resected tumor. Our case initially presented as a mesh infection and was diagnosed later as a result of mesh invasion. This case is a reminder to clinicians that atypical characteristics of inguinal mesh hernia repairs may warrant further work up and can represent underlying pathology. These findings highlight the importance of long-term monitoring for patients with mesh implants, especially those with underlying malignancies, as well as the potential for mesh-related neoplastic involvement.

CONCLUSION

We present a case of metastatic colorectal adenocarcinoma seeding preperitoneal inguinal hernia mesh. If mass formation around mesh prosthesis is confirmed with imaging, the differential diagnosis should include metastatic disease in the appropriate patient population.

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