First case of peritoneal seeding of prostate cancer during robot-assisted laparoscopic radical prostatectomy

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Peritoneal seeding with no further metastases of prostate cancer is very rare. To the best of our knowledge, there are only three cases reported in the available literature. There has not yet been a report of a patient undergoing robot-assisted laparoscopic radical prostatectomy (RALRP) that might have resulted in peritoneal seeding. We describe a patient who presented with a prostate-specific antigen (PSA) recurrence and who was found to have a solitary metastasis on the liver, 2 years after RALRP. The patient underwent open excision of the mass, which was densely adherent to the liver. Pathologic examination revealed metastatic adenocarcinoma, which stained positive for PSA. Our patient represents an unusual case of a surgically documented peritoneal seeding of prostate adenocarcinoma during RALRP.

Key Words: prostatic carcinoma, robotics, recurrence

Introduction

Peritoneal seeding with no further metastases of prostate cancer is very rare. To the best of our knowledge, there are only three cases reported in the available literature. There has not yet been a report of a patient undergoing robot-assisted laparoscopic radical prostatectomy (RALRP) that might have resulted in peritoneal seeding. We report the first known case of peritoneal seeding due to RALRP.

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Case report

A 73-year-old man had initially presented in 2006 with a rising prostate-specific antigen (PSA) level of 10.5 ng/mL and a firm prostate on digital rectal examination. The patient underwent a transrectal prostate biopsy that revealed a Gleason score 3 + 4 adenocarcinoma on the both side. Magnetic resonance imaging (MRI) and bone scans were negative for metastatic disease. The patient underwent RALRP with bilateral pelvic lymph node dissection in December 2006. The procedure was uneventful, proceeding in the usual fashion without complications. There were no differences in the procedure compared with other patients undergoing RALRP. During RALRP, the prostate had not been injured and tumor spillage

Figure 1. Computed tomography scan showing enhancing mass on the liver concerning for a hepatocellular carcinoma.

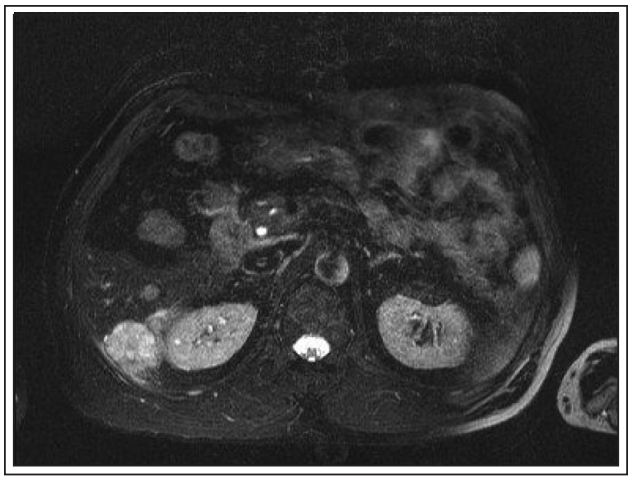

Figure 2. Superparamagnetic iron oxide-enhanced liver MRI demonstrating an enhancing mass on the liver concerning for a hepatocellular carcinoma.

had not occurred. The pathologic examination showed a Gleason score 4 + 3 adenocarcinoma on both sides and extending to the capsule with positive surgical margin (pT3aN0M0). From December 2006 to December 2008, the patient's PSA level increased from an initial value of 0.03 ng/mL to an eventual level of 12.37 ng/mL. The physical examination revealed an empty prostatic fossa. Pelvis MRI and bone scans findings were negative. Computed tomography of the abdomen and pelvis demonstrated an enhancing 3.5 cm soft-tissue density on the liver concerning for a hepatocellular carcinoma, Figure 1. Superparamagnetic iron oxide-enhanced liver MRI demonstrated an enhancing 4.3 cm mass on the liver concerning for a hepatocellular carcinoma, Figure 2. The belief of the radiologist was that the liver mass was within the liver capsule. The first reading of image study was hepatocellular carcinoma. But, our surgical team was open to the possibility of metastatic tumor from prostate cancer. The patient underwent open excision of the mass in our department of surgery, which was densely adherent to the liver. During open surgical resection, there was no evidence of metastasis of prostate cancer on other area except for the liver and the mass was densely adherent to the liver. Pathologic examination revealed a metastatic adenocarcinoma, which stained positive for PSA, Figure 3. According to the pathology report, the liver mass was on the outside of the liver capsule and was densely adherent to the liver. It was the opinion of the pathologist that the liver mass resulted from extrahepatic implantation. The patient represented an unusual case of a surgically documented recurrence of prostate adenocarcinoma in the intraperitoneum 2 years after RALRP. Postoperatively, the patient's PSA level decreased to 0.94 ng/mL. One year later, the PSA level was 0.65 ng/mL. No other metastasis occurred during follow up.

Discussion

Prostate cancer is a common cancer in men. In America, 218,890 cases are diagnosed and 27,050 deaths occur annually.[1] The clinical behavior of prostate cancer ranges from a microscopic, well-differentiated tumor to an aggressive cancer with substantial invasive and metastatic potential. The most common metastatic targets for prostate cancer include lymph nodes, bone, lung and liver.[2] Metastases are more common in patients with poorly-differentiated lesions and are usually seen in tumors that penetrate the capsule.[3] In our patient, the pathologic prostate appearance showed a stage T3aN0M0 and Gleason score 4 + 3. Our patient represented prostate cancer extending to the capsule with surgical margin positive, but a not so high Gleason score. In our case, distant solitary metastasis of prostate cancer on the liver is unusually ahead of the patient's cancer stage and Gleason score.

Metastases from prostate cancer to the bone, lymph nodes and lung are common events, but peritoneal metastasis is very rare and has been seldomly reported in the literature. Even at autopsy, peritoneal metastasis is unusual, whereas bone (90%), lung (46%), liver (25%), pleural (21%) and adrenal (13%) metastases

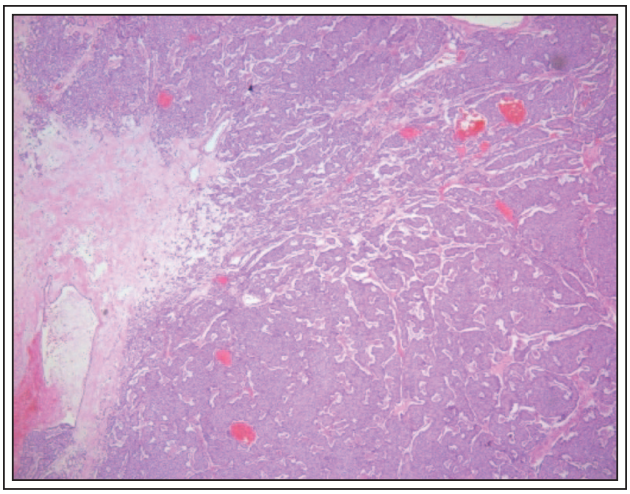

Figure 3. Pathologic examination of excised mass revealing prostatic adenocarcinoma with positive PSA stain. Hematoxylin-eosin stain, original magnification x100.

have been reported in a large autopsy series.[4] Only three cases with peritoneal metastasis from prostate cancer have been reported.[5-7] Although these three cases had no opportunity for tumor implantation, our patient might have incurred peritoneal seeding during RALRP. To our knowledge, this is the first case of peritoneal seeding due to RALRP.

The first step of peritoneal seeding is due to the flaking off of tumor cells, which then spread throughout the peritoneal cavity. Peritoneal fluid then transports the cancer cells from the pelvis to the upper abdominal quadrants. During breathing movements, negative pressure at the subphrenic level increases to a positive pressure, inducing a pressure gradient that keeps the fluid moving from the paracolic gutters up to the right sub-hepatic space and the right sub-diaphragmatic space.[8] Laparoscopic surgery induces fewer immunologic changes when compared with open laparotomy, with better preservation of the functions of the peritoneal macrophages, resulting in diminished perioperative tumor dissemination and better cancer outcomes.[9] However, animal studies have shown that carbon dioxide pneumoperitoneum can alter the morphology and function of mesothelial cells and facilitates transmesothelial tumor cell migration.[10] Such morphological peritoneal cellular alterations after pneumoperitoneum are influenced by the type of gas, amount of pressure and duration of insufflation. The manner in which the surgeon gains access to the abdominal cavity and the traumatic handling of the tumor during mobilization, resection or removal may have significant impact on the propensity of tumor cells to implant, survive and grow in the immediate postoperative period.

Gas insufflation during pneumoperitoneum would then lead to peritoneal dissemination when free tumor cells were present in the abdominal cavity. The other causes of such metastases appear to be surgical manipulation and overuse of ultrasonic scissors. Alternatively, the dissemination may be due to poor surgical technique. RALRP usually requires gas insufflation during pneumoperitoneum, dissection of the peritoneum (except for extraperitoneal approach) to approach the retzius space and a 30 degree Trendelenburg position. It can promote tumor burden migration to the intraperitoneal space.

In conclusion, we report the first case of peritoneal seeding due to RALRP. This case should help raise clinical awareness of the possibility of unusual metastatic sites in patients with primary prostate cancer during RALRP. During RALRP, surgeons should be aware of this situation. □

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