



Preoperative Ultrasound-Guided Metastasectomy: Enhancing Surgical Planning and Complete Resection of Metastatic Disease

Emaan Anya Mahmood¹ & Michael Yaakovian²

1. Houston Methodist Sugar Land Hospital, Department of Surgery, 16605 Southwest Freeway, Suite 430, Sugar Land, TX, 77479, USA
2. Houston Methodist Sugar Land Hospital, Institute of Academic Medicine, Division Chief, Department of Surgery, 16605 Southwest Freeway, Suite 450, Sugar Land, TX 77479, USA

Abstract: Background: Curative resection of asynchronous metastatic colon cancer can be technically challenging when metastatic implants are difficult to identify intraoperatively. Accurate preoperative localization may facilitate complete resection while allowing preservation of surrounding structures and achievement of negative margins. Computed tomography (CT)-guided localization has previously been described; however, ultrasound-guided localization may provide a practical alternative. Case Presentation: A 72-year-old woman with a history of a 15.5-cm moderately differentiated mucinous adenocarcinoma of the colon with visceral peritoneal and small bowel involvement underwent en bloc resection with negative margins and 15 negative lymph nodes, followed by six cycles of adjuvant FOLFOX chemotherapy. Two years and four months after her initial operation, surveillance PET imaging demonstrated a right lower quadrant peritoneal/retroperitoneal lesion concerning for asynchronous metastatic disease. Multidisciplinary review at GI Oncology Tumor Board led to the decision to perform ultrasound-guided biopsy and preoperative localization. Ultrasound identified the lesion, which was confirmed to represent metastatic mucinous adenocarcinoma and was subsequently marked with 7 cc of tattoo dye. The patient subsequently underwent laparoscopic metastasectomy, with successful identification and complete resection of the marked lesion and negative margins. She was discharged 48 hours after surgery and resumed adjuvant chemotherapy 14 days later. Conclusion: Ultrasound-guided preoperative localization and tattoo marking represents a novel and potentially useful alternative to CT-guided localization for selected patients with asynchronous metastatic colon cancer. In this case, ultrasound localization facilitated minimally invasive identification and complete resection of a difficult-to-localize metastatic implant with negative margins. Although additional experience is needed to establish the broader applicability of this technique, ultrasound-guided localization may provide a practical, real-time approach to facilitating curative-intent metastasectomy in appropriately selected patients.

BACKGROUND

Curative-intent resection of metastatic implants from advanced colon cancer can be technically challenging, particularly when lesions are difficult to identify intraoperatively or are located within the visceral peritoneal or retroperitoneal space. Successful metastasectomy requires accurate lesion localization, meticulous dissection, and achievement of negative margins, all of which may be difficult when the metastatic implant is not readily apparent at the time of surgery.

Preoperative localization of metastatic lesions may facilitate surgical identification and complete resection. CT-guided percutaneous needle localization with tattoo marking has previously been described as a means of identifying otherwise difficult-to-localize metastatic lesions, with favorable results in a limited series.

We describe a novel adjunctive technique using ultrasound-guided localization and tattoo marking of an asynchronous metastatic colon cancer implant. The lesion was identified and marked preoperatively under real-time ultrasound guidance, subsequently allowing successful laparoscopic metastasectomy with negative margins. This technique provides a potential alternative to CT-guided localization for appropriately selected patients undergoing curative-intent resection of metastatic colon cancer.

CASE PRESENTATION

We present a 72 year old female that was found to have an asynchronous metastatic lesion 2 years and 4 months after her index operation. At the time of her initial surgery she was found to have a large (15.5 cm) moderately differentiated mucinous adenocarcinoma with invasion into the visceral peritoneum and involving the small intestine. She underwent an en-bloc resection where all margins were negative for cancer. She had 15 lymph nodes retrieved that were all negative for cancer. The patient did excellent.

The patient completed 6 rounds of FOLFOX adjuvant chemotherapy.

Surveillance PET imaging identified a PET avid lesion in the right peritoneum. A PET scan was done with showed an asynchronous metastatic lesion measuring up to approximately 4.2 cm in maximum diameter (previously 4 cm). The mass again demonstrated low level uptake with a maximum SUV of 4.3.

The patient was presented at GI Oncology Tumor Board and with the aid of radiology it was decided to embark upon an ultrasound guided biopsy and tattoo marking of the lesion. The patient was admitted to the radiology suite and underwent an ultrasound. The lesion was biopsied, and it was confirmed to be mucinous adenocarcinoma involving fibroadipose tissue compatible with the patient's known colon primary. It was then immediately injected with 7 cc of Endo-Spot tattoo dye. The patient did excellent.

Ultrasound Procedure for Localization and Marking the Mass

Patient was brought into the examination suite and kept in a supine position in the bed. Sonographic imaging was performed, demonstrating the right lower quadrant retroperitoneal heterogeneously hypoechoic oval-shaped partially cystic mass. Site was marked and overlying skin was prepped and draped utilizing all elements of maximal barrier sterile technique.

Lidocaine 1% was injected into the marked skin and deeper soft tissues. Ultrasound-guided 18-gauge Chiba needle was advanced to the edge of the targeted mass. 10 cc of methylene blue imaging was injected into the anterior and anteromedial periphery of this targeted mass or staining.

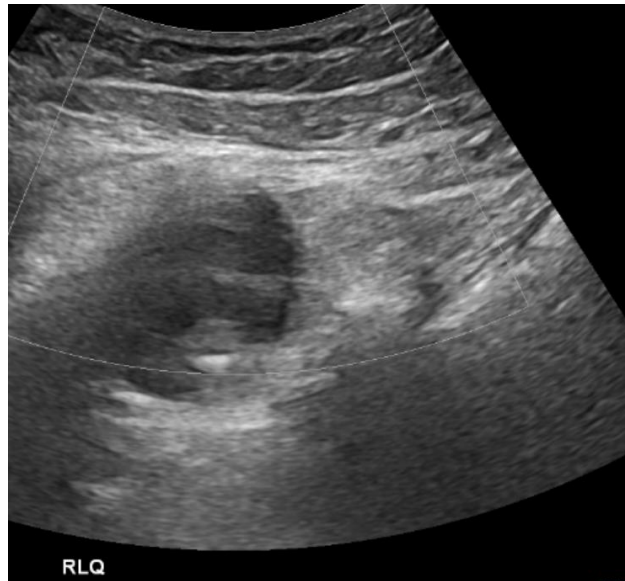


Figure 1: Successful ultrasound-guided right lower quadrant retroperitoneal mass needle puncture and methylene blue fiducial dye injection, for preoperative marking.

She subsequently underwent a laparoscopic resection of her metastatic recurrence. The tattoo dye delineated the precise location of the metastatic lesion.

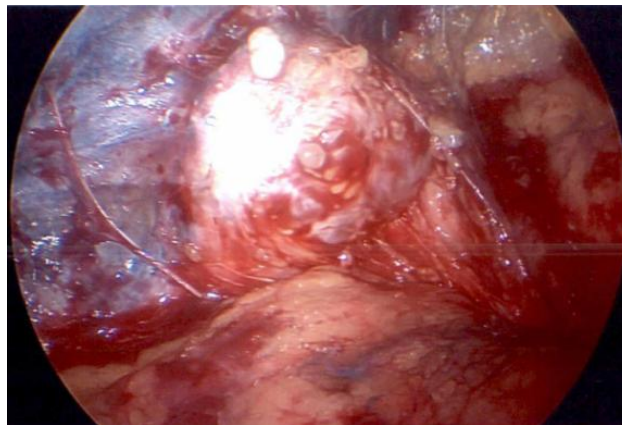


Figure 2: Intra-operative, the tattoo hue was markedly evident. The lesion was identified and resected. The margins were negative, the patient underwent a successful metastectomy.

DISCUSSION

Metastatic implants in the peritoneum signal an ominous survival in patients with advanced colon cancer. Studies have reported the median survival to be 22 months, with some studies reporting right sided lesions faring worse than left sided lesions. [1,2,3] Contiguous organ resection, when abutted and invaded with cancer, has shown a positive impact in survival in several studies, paradoxically contraindicated with other reports in the literature that liver and lung resection do not contribute favorably to overall survival. [4.5.6] Liver resection in asynchronous metastatic disease has been shown to fare better than isolated

pulmonary resection, however the worst prognosis was attributed to peritoneal metastases. [7,8] The 3 year disease overall survival fell to 18.1% in comparison to 50.2% and 61.5% for lung and liver respectively. Distant metastatic disease, such as thoracic disease with marked lymphadenopathy has seen mortality rates as high as 100% within 22 months.[9] The presence of distant metastatic disease poses a challenge in the surgical decision making for the patient when coupled with the post operative morbidity and subsequent mortality.

Asynchronous metastatic disease in the abdomen carries a more favorable prognosis than other sites. The index resection of the metastatic disease process yields to a better prognosis than multiple surgeries for disease recurrence. [10,11] Although HIPEC therapy has been used in primary peritoneal carcinoma, the ability to resect a solitary metastatic lesion has fared with better disease free survival. [12,13] The primary limitation of surgical metastectomy, especially in smaller lesions, has been the ability to locate the metastatic lesion and safely resect it with negative margins.

Previous localization of asynchronous metastatic lesions has been described using CT guided imaging. We have described and performed a localization technique with radiologic ultrasound imaging readily available at most hospitals, yielding to precise localization of the metastatic lesions. [14] To our knowledge, this has not been described before. The patient subsequently underwent a successful metastectomy, with negative margins and achieved a disease free state, confirmed with both imaging and laboratory markers. The push for disease free survival and hope is ever expanding and our pursuit for efficacious operative management therefore continues.

CONCLUSION

Curative resection of asynchronous metastatic colon cancer can be technically challenging, particularly when metastatic implants are small, difficult to identify intraoperatively, or located within the peritoneal or retroperitoneal space. Accurate preoperative localization may facilitate complete surgical resection while preserving surrounding structures and achieving negative margins. In this case, ultrasound-guided localization and tattoo marking provided a safe and effective method for identifying an asynchronous metastatic implant prior to laparoscopic metastasectomy. Unlike previously described CT-guided localization techniques, ultrasound offers real-time visualization without the need for CT guidance and may provide a practical, readily accessible alternative in appropriately selected patients.

Our experience demonstrates that ultrasound-guided localization can successfully facilitate minimally invasive resection of an otherwise difficult-to-localize metastatic lesion. Although additional experience and larger studies are needed to establish the reproducibility and broader applicability of this technique, ultrasound-guided preoperative localization represents a promising adjunct in the surgical management of selected patients with asynchronous metastatic colon cancer.

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