

Peritoneal Metastases Evaluation: A Comparison Between FDG-PET/CT and MRI with Correlation Between SUV and ADC

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Target audience Radiologists, oncologists, and other professionals working in the field of MRI and PET/CT.

Purpose Metastatic peritoneal malignancies are associated with advanced diseases and traditionally are considered incurable. There are, however, new medical advances using intraperitoneal chemotherapy and hyperthermic chemotherapy, which are promising in controlling local disease. Moreover, cytoreductive surgery can act as a neoadjuvant treatment to chemotherapy. With these potential effective therapies, imaging of peritoneal metastasis becomes important for surgical planning, treatment response assessment and complications monitoring. The challenge remains in evaluating peritoneal dissemination due to the large anatomical coverage and no consensus exists in the use of imaging in peritoneal metastasis. Both FDG-PET/CT¹ and MRI² are used in the evaluation of peritoneal metastasis with gadolinium-enhanced MRI excellent in depicting peritoneal metastasis of small volume³. The relationship between glucose metabolism (measured by SUV) and tumor cellularity (quantified by ADC) of peritoneal metastasis derived from FDG-PET/CT and MRI respectively has never been evaluated. The purposes of this study are to assess the diagnostic performance of FDG-PET/CT, DWI, MRI and DWI/MRI in peritoneal metastasis evaluation; and to elucidate the correlation between SUV and ADC.

Methods Patients with suspected peritoneal metastasis were prospectively recruited for FDG-PET/CT and MRI. Both examinations were performed within 4 weeks of each other (9±8 days) without intervening therapies. Histology and radiological follow-ups were taken as standard of references. Sixteen anatomical sites in the abdomen and pelvis were systemically evaluated for peritoneal metastases. Images were reviewed independently by two radiologists at separate sessions. SUVmax, SUVmean, ADCmin and ADCmean were obtained by manually drawing ROIs over the peritoneal metastases on FDG-PET and DWI, respectively. Diagnostic characteristics defined by sensitivity, specificity, accuracy, positive predictive value (PPV), negative

Table 1 Summary of diagnostic performance (mean value in percentage)

	DWI	MRI	DWI/MRI	PET/CT
Sensitivity	82	87	92	90
Specificity	99	100	99	100
Accuracy	95	97	98	98
PPV	96	98	97	98
NPV	94	96	98	97
AUC	90	93	96	95

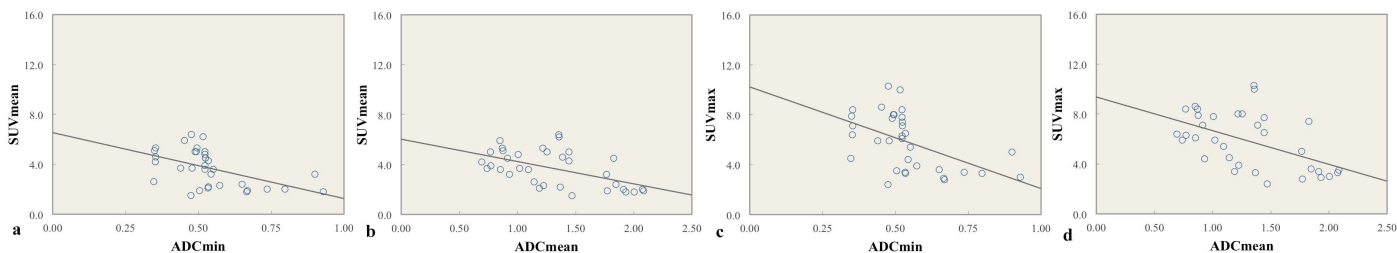


Fig.1 a-d Inverse correlation between SUVmean and ADCmin (a), SUVmean and ADCmean (b), SUVmean and ADCmin (c), SUVmax and ADCmean (d).

predictive value (NPV) and area under the curve (AUC) were calculated for DWI, MRI, DWI/MRI and FDG-PET/CT. For statistical analysis, McNemar test, Kappa test and Pearson's correlation coefficient were used. **Results** Peritoneal metastases were confirmed in 8 patients by histology (50%) and radiological follow-ups (50%). A total of 128 anatomical sites were analyzed. Diagnostic performances of the different techniques evaluated by 2 radiologists were summarized in table 1, expressed in mean percentage. There was no statistical difference in the diagnostic performances of these imaging techniques in peritoneal metastases detection. Kappa values (0.901, 0.881, 0.932 and 0.977) were excellent for all imaging techniques. ADCmin was inversely correlated with SUVmean ($r=-0.513$, $p=0.002$, Fig.1a) and SUVmax ($r=-0.508$, $p=0.002$, Fig.1c). Similarly, ADCmean had negative correlation with SUVmean ($r=-0.534$, $p=0.001$, Fig.1b) and SUVmax ($r=-0.518$, $p=0.002$, Fig.1d). **Discussions** Adding DWI to conventional MRI improved the sensitivity as compared to DWI or conventional MRI (92% vs. 82% for DWI and 87% for MRI). DWI acquisition only added an extra 5-6 minute to the imaging time and should be performed concurrently with conventional MRI. DWI reveals restriction in diffusion in tumor, which provides complimentary information to conventional MRI. DWI/MRI and FDG-PET/CT have similar diagnostic performance but the cost of MRI is approximately half of that of FDG-PET/CT and does not involve radiation. Although glucose metabolism and tissue cellularity represent different facets of cell biology, our study demonstrated a relationship between them. Peritoneal metastasis that has high cell proliferation accompanied by increased glucose metabolism (SUV) has increased tissue cellularity, and therefore more restriction in diffusion, leading to lower ADC. This was consolidated by the significant negative correlation found between ADC and SUV. Thus both ADC and SUV could be used as measures of tumor aggressiveness and potentially parameters to monitor changes in the tumor microenvironment throughout therapy, preceding morphological changes. **Conclusions** DWI/MRI has comparable diagnostic performance to FDG-PET/CT in peritoneal metastases detection with DWI/MRI saving cost and negating radiation exposure. The significant inverse correlation between SUV and ADC suggests the relationship between glucose metabolism and tissue cellularity. ADC and SUV can be used synergistically or alternatively in disease detection, and potentially extending their roles in treatment response evaluation and disease monitoring. **References** [1] Kyriazi S, Kaye SB, deSouza NM. Imaging ovarian cancer and peritoneal metastases-current and emerging techniques. *Nat Rev Clin Oncol.* Jul 2010;7(7):381-393. [2] Low RN. MR imaging of the peritoneal spread of malignancy. *Abdom Imaging.* Jun 2007;32(3):267-283. [3] Low RN, Sebrechts CP, Barone RM, Muller W. Diffusion-weighted MRI of peritoneal tumors: comparison with conventional MRI and surgical and histopathologic findings--a feasibility study. *AJR Am J Roentgenol.* Aug 2009;193(2):461-470.