

# STAGING OF OVARIAN CANCER WITH CONTINUOUSLY MOVING TABLE MR ACQUISITIONS: A COMPARISON TO COMPUTED TOMOGRAPHY

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## INTRODUCTION

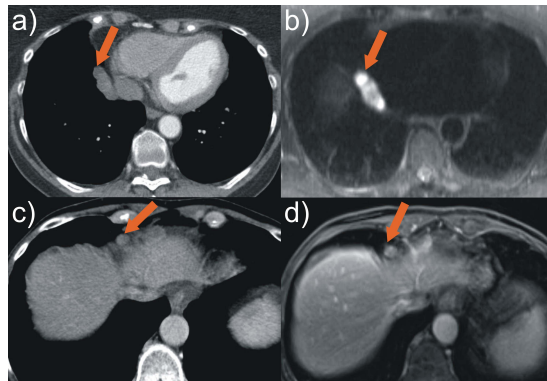
One in 70 women in the Western World will develop ovarian cancer (lifetime risk 1.4%). In Europe, it is estimated that 61,000 cases are diagnosed, and 39,000 deaths from ovarian cancer occur annually. More than 70% of patients with ovarian cancer are diagnosed in an advanced tumor stage. The tumor stage at the time of diagnosis is generally considered as the most important prognostic factor. Regarding local staging MRI is superior to Computed Tomography (CT) but not feasible for whole body staging due to long acquisition times. Whole body screening of ovarian cancer is therefore still performed with CT. However, in a study using CT small peritoneal implants of less than 1 cm in size were detected with a sensitivity of only 25–50% [1]. In this study we therefore investigated a combination of a high resolution pelvic MRI and a Sliding Multi Slice (SMS) [2] MRI protocol with continuously moving table for whole body staging of ovarian cancer. The results were compared to conventional Multi Slice CT (MSCT).

## METHODS

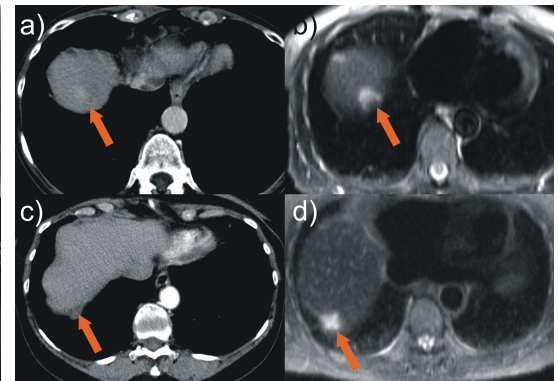
20 patients with sonographically and clinically suspected primary or recurrent ovarian cancer underwent paired MSCT and MRI examinations. Time interval between the examinations averaged three days. CT examinations were performed with a dual source CT (Somatom Definition, Siemens Medical Solutions, Erlangen), MRI examinations with a 1.5T wholebody scanner (Magnetom Avanto, Siemens Medical Solutions, Erlangen). The MRI protocol was divided into two parts. The first part consisted of a stationary T2-weighted high resolution imaging protocol of the pelvis in the axial, sagittal and coronal planes. The second part consisted of continuously moving table acquisitions: an axial T2-weighted SMS Short Tau Inversion Recovery Turbo spin echo sequence (SMS STIR) and an abdominal contrast enhanced T1-weighted axial SMS Fast Low Angle Shot (FLASH) sequence. For the T2-weighted STIR TSE the experimental parameters are given as follows: TE/TI/TR = 101/150/3656 ms, 6 mm slice thickness, FOV = (400x338) mm<sup>2</sup>, matrix = 256x166, pixel bandwidth = 450 Hz/Px, ETL = 314 ms, echo spacing = 4.6 ms. With a table speed of  $v = 4$  mm/s, a longitudinal FOV of 80 to 105 cm was covered in 3.3 to 4.3 minutes by applying 6/8 Partial Fourier. Since STIR SMS imaging was performed during free breathing, a reconstruction method as proposed in [3] was applied to compensate for breathing motion artifacts. T1-weighted SMS FLASH examinations were performed during breath hold with the following parameter: TE/TR = 2/102 ms, 5 mm slice thickness, FOV = (350x263) mm<sup>2</sup>, Matrix = 320x224, pixel bandwidth = 300 Hz/Px, flip angle 70°, GRAPPA acceleration factor 2. With a table speed of  $v = 10$  mm/s a longitudinal FOV from the upper thorax to the pelvic floor was covered by 2-3 breath holds. The CT and MRI images were independently randomized. Two radiologists evaluated all detectable intra- and extra pelvic disease manifestations in both modalities. Laparotomy and histopathology were available as reference standard for all patients.

## RESULTS

Concerning peritoneal spread MRI was superior in detecting diaphragmal and liver surface lesions with 89% (8/9) and 92% (12/13) compared to 67% (6/9) and 69% (9/13) for MSCT. Patient examples are shown in **Fig. 1**. MRI showed one false positive diaphragmal lesion. MRI detected all cases of rectosigmoid infiltration (8/8), whereas MSCT had two false negative findings (see **Fig. 2**). MRI could correctly rule out bladder and rectosigmoid infiltration that had been suspected by MSCT in two cases. No cases of hepatic spread or direct hepatic infiltration as well as enlarged abdominal or supradiaphragmal lymph nodes were missed by either method.



**Figure 1:** a,c) MSCT, b) axial T2-weighted SMS STIR and d) axial CE T1-weighted SMS FLASH images of two patients with ovarian cancer showing clearly the supradiaphragmal spread.



**Figure 2:** a,c) MSCT and b,d) axial T2-weighted SMS STIR images of two patients with ovarian cancer. In both patients peritoneal carcinosis in the right dome was missed by computed tomography.

## DISCUSSION

The combination of high resolution pelvic MRI and whole body SMS MRI has already been demonstrated successfully in patients with rectal cancer [4,5]. In this study a comparable technique was applied to ovarian cancer patients in whom the detection of peritoneal disease manifestations has been a drawback of the generally applied imaging studies. It could clearly be demonstrated, that MRI was superior to CT for staging of local tumor extent and showed excellent detection of peritoneal spread from ovarian cancer. The SMS examinations with continuously moving table offered equal detection of hepatic and nodal metastases compared to MSCT. Consequently, this imaging strategy raises the possibility of a one-stop staging regimen for ovarian cancer patients with MRI.

## REFERENCES

[1] Coakley FV et al. Radiology 2002;223(2):495-499, [2] Fautz HP, Kannengiesser SA. Magn Reson Med 2006;55(2):363-370, [3] Fautz HP et al. Magn Reson Med 2006;57(1):226-232, [4] Baumann T et al. Invest. Radiology 2008;43(6):359-367, [5] Sommer G et al. J Magn Reson Imaging 2008;27(3):666-672.