

## Differentiation between malignant and benign cervical tissue on the basis of the apparent diffusion coefficient is sensitive and independent of the b-value combination used for ADC calculation.

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**Background** In MR body imaging a variety of different b-value combinations is used for the detection of malignancies with diffusion weighted imaging. Subsequent comparison of literature is challenged by uncertainty about the influence of the b-value combination on the apparent diffusion coefficient (ADC).

**Objective** To evaluate the influence of b-value combination on ADC-based differentiation of malignant from benign tissue in cervical cancer.

**Method** 35 consecutive patients with stage IBI, IB2 or IIA cervical cancer underwent 3T MRI (Achieva, Philips Medical Systems, the Netherlands) with a 6 channel SENSE-torso coil. In addition to conventional T1- and T2-weighted images, free breathing diffusion weighted data sets were acquired using a single shot Echo Planar Imaging sequence (matrix= 256x256; TR/TE= 5000/54 ms; b = 0,150,500,1000 s/mm<sup>2</sup>; slice thickness/gap = 4/0 mm). ROIs of benign and malignant cervix were handdrawn on ADC maps under the guidance of a radiologist with 10 years experience in abdominal imaging (Figure 1). Malignant and benign cervical ADCs were calculated from three different b-value combinations on the basis of the same ROIs, and were compared using a students t test. The b-value combinations used were: b = 0,1000 (commonly used in the literature), b= 0,150,500,1000 (maximum available data) and b = 150,500,1000 s/mm<sup>2</sup> (minimizing the influence of perfusion<sup>1</sup>). Receiver operating characteristics (ROC) curves were plotted for analysis of optimal ADC cutoff-values, defined by the highest area under the curve (AUC). All patients subsequently underwent a radical hysterectomy with pelvic lymph node dissection. Imaging results were then compared to the histopathological analysis of the specimen.

**Results** For all b-value combinations ADCs were significantly (p<0.001; Figure 2) lower in cervical malignancies ( $0,97 \pm 0,18 \cdot 10^{-3}$ ,  $0,91 \pm 0,23 \cdot 10^{-3}$  and  $0,83 \pm 0,18 \cdot 10^{-3}$  mm<sup>2</sup>/s respectively to aforementioned b value combinations) than in benign cervix ( $1,62 \pm 0,23 \cdot 10^{-3}$ ,  $1,58 \pm 0,21 \cdot 10^{-3}$  and  $1,42 \pm 0,22 \cdot 10^{-3}$  mm<sup>2</sup>/s). Furthermore, ADCs were uninfluenced by tumor-stage or tumor-volume and pathological characteristics such as histological type, tumor-differentiation, or angio-invasion. Table 1 summarizes the optimal ADC cutoff values with corresponding sensitivity, specificity and AUC with 95%-confidence interval for the three b-value combinations. When tumor ADC was above, or benign ADC was below the given cut-off value, all cases but one still showed a higher benign than malignant ADC. There were no significant differences between the diagnostic performances of the three b-value combinations.

**Discussion/conclusion** With appropriately chosen cutoff values ADC can sensitively differentiate malignant from benign cervical tissue. The potential diagnostic accuracy was independent of the evaluated tumor characteristics and of the evaluated b-value combinations. Although the difference was not-significant with the current number of subjects studied, excluding b = 0 s/mm<sup>2</sup> resulted in lower ADCs, indicating a possible separation of flow-insensitive form flow-sensitive ADC values.

**References** <sup>1</sup> DM Koh, DJ Collins; AJR 2007; 188:1622-1635

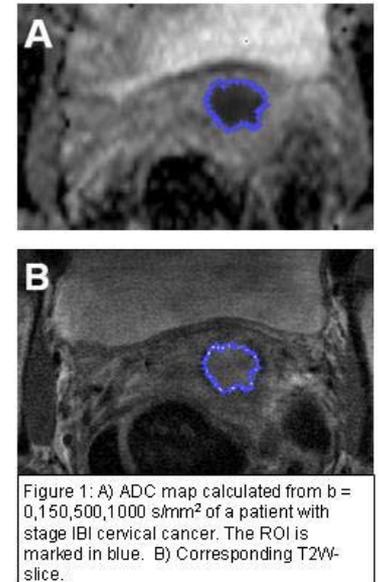


Figure 1: A) ADC map calculated from b = 0,150,500,1000 s/mm<sup>2</sup> of a patient with stage IBI cervical cancer. The ROI is marked in blue. B) Corresponding T2W-slice.

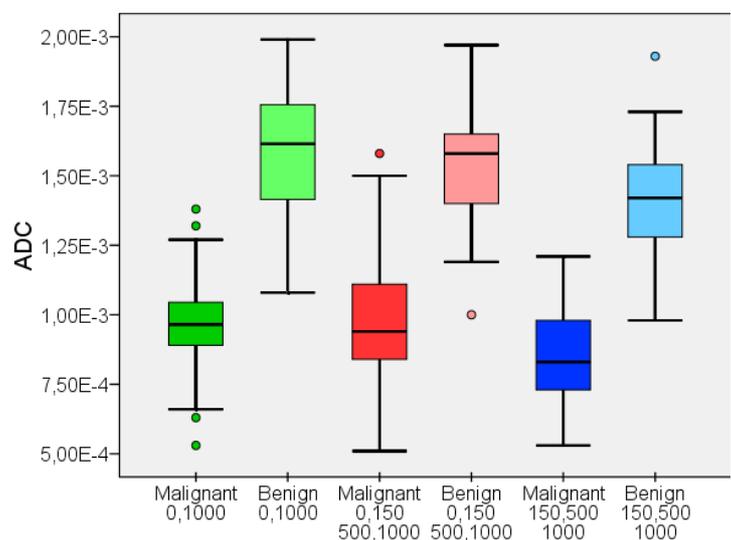


Figure 2: boxplots displaying ADCs split out by tissue and b-value combination

B-value combination	ADC cutoff	Sensitivity	Specificity	AUC (95% CI)
0,1000 s/mm <sup>2</sup>	$1,200 \cdot 10^{-3}$ mm <sup>2</sup> /s	93,8 %	90,6 %	0,922 (0,845 - 0,998)
0,150,500,1000 s/mm <sup>2</sup>	$1,185 \cdot 10^{-3}$ mm <sup>2</sup> /s	96,9 %	90,6 %	0,938 (0,868 - 1,000)
150,500,1000 s/mm <sup>2</sup>	$1,115 \cdot 10^{-3}$ mm <sup>2</sup> /s	90,6 %	93,7 %	0,922 (0,845 - 0,998)