

# Evaluation of low and high b-values for the differentiation between pancreatic carcinoma and chronic pancreatitis using Diffusion-Weighted Imaging

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## Introduction:

The differentiation between pancreatic carcinoma and mass-forming chronic pancreatitis remains difficult. Measurement of the apparent diffusion coefficient (ADC) has been reported aid the depiction of pancreatic cancer due to a strong drop in ADC (1, 2). Recently, several studies showed that DWI may also aid in the differentiation between pancreatic cancer and chronic pancreatitis at high b-values ( $b = 500-1000 \text{ s/mm}^2$ ) (3, 4). It is well known, that the ADC represents microcirculation of blood as well as molecular diffusion of water, where the amount of perfusion contributing to ADC varies according to the gradient strength applied, with the strongest perfusion effects at low b-values. In this ongoing study, we evaluated the degree of differentiation between pancreatic carcinoma and pancreatitis at different b-values ranging from 25 to  $800 \text{ s/mm}^2$ .

## Material and methods:

To date 19 patients underwent DWI (parameters: EPI-DWI, TR/TE 1300/60ms, FOV 350 x 273mm, resolution 3,5 x 3,5 x 5mm, 14 slices, ( $b = 25, 50, 75, 100, 200, 300, 400, 600, 800 \text{ s/mm}^2$ ) and subsequent resection.. The histological diagnosis confirmed pancreatic carcinoma in 13 and chronic pancreatitis in 6 patients. We measured the ADC in a polygonal region of interest within the tumours and the foci of chronic pancreatitis for all b-values. The difference in ADC values between pancreatic carcinoma and chronic pancreatitis was tested using a Mann-Whitney-U-Test.

## Results:

The results showed significant differences in ADCs of pancreatic carcinoma and chronic pancreatitis at low b-values (table 1) with higher ADC-values for chronic pancreatitis than for pancreatic cancer. At  $b=75, 100, 150$  and  $200$ , the mean ADC- values were  $24.5, 23.2, 20.0$  and  $19.9 \cdot 10^{-4} \text{ s/mm}^2$  for chronic pancreatitis and  $18.4, 17.3, 15.7$  and  $14.8 \cdot 10^{-4} \text{ s/mm}^2$  for pancreatic cancer.

## Discussion and Conclusion:

In contrast to previous studies which reported a significant difference in ADC-values for pancreatic cancer and chronic pancreatitis at high b-values, we did not such differences at high b-values ( $b > 300$ ). However, the ADC-values for pancreatic cancer and chronic pancreatitis did reach a significant difference and lower b-values ( $b = 75, 100, 150$  and  $200$ ). At low b-values, perfusion effects dominate the measured ADC thus creating a more prominent difference in ADC between the two groups since, as a rule, pancreatic tumors are ill-perfused. At higher b-values, these perfusion effects diminish and so does the contrast between the two groups. Probably the results of  $b=25$  and  $b=50$  did not reach significant difference due to the noise bias at the lowest b-values. In conclusion, our results suggest that low b-value DWI is superior to high b-value DWI for the differentiation between pancreatic carcinoma and chronic pancreatitis.

## Literature:

1. Ichikawa T, Erturk SM, Motosugi U, et al. High-b value diffusion-weighted MRI for detecting pancreatic adenocarcinoma: preliminary results. AJR Am J Roentgenol 2007; 188:409-414.
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3. Takeuchi M, Matsuzaki K, Kubo H, Nishitani H. High-b-value diffusion-weighted magnetic resonance imaging of pancreatic cancer and mass-forming chronic pancreatitis: preliminary results. Acta Radiol 2008; 49:383-386.
4. Lee SS, Byun JH, Park BJ, et al. Quantitative analysis of diffusion-weighted magnetic resonance imaging of the pancreas: Usefulness in characterizing solid pancreatic masses. J Magn Reson Imaging 2008; 28:928-936.

Table 1: Measured ADC at different b-values

b-values	25	50	75	100	150	200	300	400	600	800
ADC-value pancreatic cancer ( $\cdot 10^{-4} \text{ s/mm}^2$ )	42,3 +/-15,9	25,2 +/-8,4	18,4 +/-6,0	17,3 +/-5,4	15,7 +/- 4,4	14,8 +/- 3,2	13,9 +/- 3,1	12,9 +/- 3,1	11,9 +/- 2,4	11,4 +/- 1,8
ADC-value chronic pancreatitis ( $\cdot 10^{-4} \text{ s/mm}^2$ )	44,5 +/- 6,4	32,4 +/- 7,6	24,5 +/-4,7	23,2 +/-5,3	20,0 +/-2,5	19,9 +/- 2,5	17,7 +/- 2,0	15,0 +/- 1,6	13,4 +/- 1,6	12,4 +/- 0,6
p-value	0,5	0,09	0,009	0,029	0,046	0,005	0,012	0,058	0,087	0,282

Figure 1: ADC-maps at different b-values for tumor and pancreatitis patients, arrows indicate the lesions.

