

## Rectal cancer Neoadjuvant therapy assessment with quantitative diffusion imaging ?

O. Moens<sup>1</sup>, J. Absil<sup>1</sup>, A. Demols<sup>2</sup>, T. Metens<sup>1</sup>, and C. Matos<sup>1</sup>

<sup>1</sup>Magnetic Resonance-Radiology, Université Libre de Bruxelles Hôpital Erasme, Brussels, Belgium, <sup>2</sup>Gastroenterology, Université Libre de Bruxelles Hôpital Erasme, Brussels, Belgium

**Objective:** To determine the contribution of quantitative diffusion imaging in the evaluation of response to neoadjuvant therapy in patients with advanced rectal cancer.

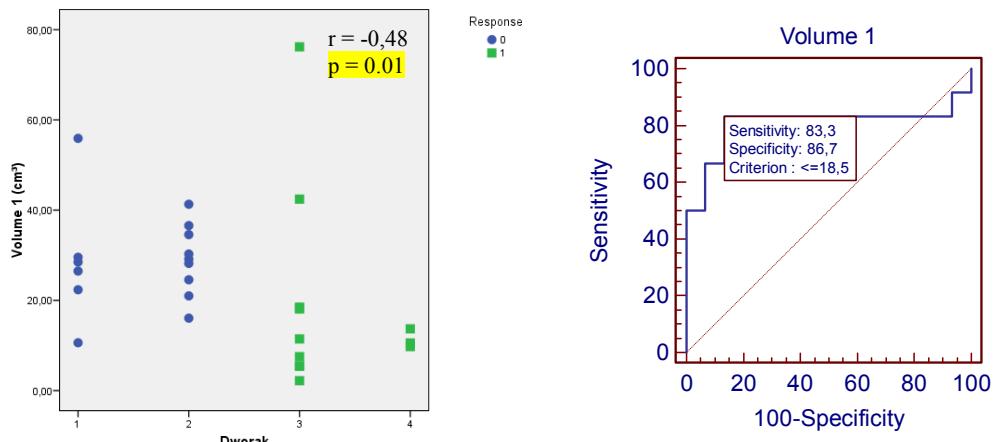
**Methods:** Thirty patients with rectal cancer requiring neoadjuvant radiochemotherapy before surgery were included. They underwent two pelvic 3T-MRI (Philips Achieva, 6-element coil) respectively before and after the end of neoadjuvant treatment (mean: 32 days). All patients were prepared with enema. Conventional T2-weighted TSE sequences were acquired, as well as diffusion-weighted imaging (DW-SE-EPI,  $b=0$  and  $1500\text{s/mm}^2$ , Sense factor 2) with respiratory triggering. Apparent diffusion coefficients (ADC) were calculated from ROIs drawn by an experienced radiologist. For  $N=17$  patients,  $b=100\text{s/mm}^2$  was added to calculate the perfusion fraction (f) according to [1]. Tumor volumes were measured on anonymized and randomized images. Patients were identified as responders or nonresponders based on pathologic tumor regression grade according to Dworak [2]. The Mann-Whitney and Wilcoxon tests were used to compare volumes, ADC and f between groups and within each group before and after treatment; Spearman correlation with pathology was analyzed. ROC curves were obtained to evaluate the diagnostic performance of these parameters.

**Results:** Histology identified 14 responders and 16 nonresponders. Table 1 summarizes the quantitative results (mean values of tumor volume, volume variation, ADC, ADC variation and f) for both groups before and after treatment. The tumor volume decreased in all patients (R, responders:  $p=0.002$ ; NR, non-responders:  $p=0.0007$ ), but the volume change was not different between the two groups ( $p=0.18$ ); nonresponders had significantly larger tumors ( $p=0.007$  and  $p=0.011$  pre- and post-treatment). ADC increased in all patients (R:  $p=0.001$ ; NR:  $p=0.0005$ ), but the ADC variation was not different between the two groups ( $p=0.19$ ). ADC and f were not significantly different between groups before (ADC:  $p=0.22$ , f:  $p=0.52$ ) and after treatment (ADC:  $p=0.66$ , f:  $p=0.95$ ). The pretreatment tumor volume correlated well with the Dworak grade ( $p=0.01$ ) and was a good indicator of the response (Fig.1). The volume variation, ADC and f pretreatment did not correlate with the Dworak grade ( $\Delta V$ :  $p=0.09$ ; ADC:  $p=0.45$ , f:  $p=0.75$ ).

	Volume 1 ( $\text{cm}^3$ )	Volume 2 ( $\text{cm}^3$ )	$\Delta V$	ADC 1 ( $10^{-6}\text{mm}^2/\text{s}$ )	ADC 2 ( $10^{-6}\text{mm}^2/\text{s}$ )	$\Delta \text{ADC}$ ( $10^{-6}\text{mm}^2/\text{s}$ )	f 1	f 2
R	18,44 $\pm 21$	3,51 $\pm 3,9$	-76% $\pm 29$	783,70 $\pm 138$	1242,46 $\pm 250$	459 $\pm 269$	0,12 $\pm 0,04$	0,12 $\pm 0,1$
NR	29,01 $\pm 11$	8,46 $\pm 4,8$	-70% $\pm 16$	858,13 $\pm 183$	1202,06 $\pm 211$	344 $\pm 230$	0,12 $\pm 0,03$	0,13 $\pm 0,07$

Table 1 : Quantitative measurements (mean values and standard deviations); volumes were obtained for  $N=27$  patients (3 patients presented complicated tumor morphology), ADC were calculated for  $N=29$  patients (1 patient had susceptibility artifacts) and f was obtained for  $N=17$  patients.

Fig 1 : (left) statistically significant correlation between pre-treatment volume and Dworak grade ( $r=-0.48$ ,  $p=0.01$ ); (right) ROC curve of the pre-treatment volume: below the threshold of  $18.5 \text{ cm}^3$ , patient can be considered as responder with a sensibility, specificity, PPV and NPV of respectively 83,3%, 86,7%, 83,3% et 86,7%.



**Conclusions:** In our study, quantitative parameters of diffusion imaging do not assess or predict response to neoadjuvant therapy in patients with advanced rectal cancer. Tumor volume variation does not appear to constitute a response criterion neither. Instead, tumor volume measurement before treatment appears to be a good predictor of treatment response.

**References :** [1] LeBihan D. Radiology 168:497-505 (1988); [2] Dworak O. Int J Colorectal Dis 12:19-23 (1997).