ORIGINAL ARTICLE

Role of diffusion weighted imaging in characterization of pancreatic pathology

CrossMark

Eman Salah Mohammed Abdallah [*,1], **Mohamed Ibrahim Mahmoud Ali** [1], **Maryse Yousef Awadallah** [2], **Hamed Samir Hamed El Ghawabi** [3]

Department of Diagnostic Radiology, Faculty of Medicine, Cairo University, Egypt

Abstract *Purpose:* The purpose of the study was to show the value of combination of conventional MRI with DWI to raise the sensitivity and specificity considering the differentiation between pancreatic benign and malignant lesions.

Patients and methods: Study included 30 patients performed in the radiology department, Cairo University, as well as in a private center: 21 males and 9 females. Age of patients ranged between 27 and 76 years.

The study was performed between August 2012 and April 2014. Patients were subjected to proper history taking, conventional MRI and DWI.

Result: In our study using combined qualitative analysis of diffusion weighted imaging and quantitative analysis of ADC values we found that results of diffusion weighted MRI are approaching that of contrast enhanced MRI not only in detecting pancreatic tumors but also in detection of tumor necrosis and liver metastasis which are essential information to reflect disease prognosis and treatment strategies.

Conclusion: Conventional MRI in combination with functional diffusion weighted imaging gave us helpful information regarding the characterization of pancreatic benign and malignant lesions. Diffusion weighted imaging may detect small masses better than conventional MRI although it has poor spatial resolution.

* Corresponding author.
E-mail addresses: dr_eman.radiology@yahoo.com (E.S.M. Abdallah), Mohamed.ibrahim82@hotmail.com (M.I.M. Ali), maryseawadallah@gmail.com (M.Y. Awadallah), elghawabi@gmail.com (H.S.H. El Ghawabi).
[1] Radiology specialist at Alfa Scan Radiology Center, Egypt.
[2] Lecturer of Radiodiagnosis, Faculty of Medicine, Cairo University, Egypt.
[3] Professor of Radiodiagnosis, Faculty of Medicine, Cairo University, Egypt.
Peer review under responsibility of The Egyptian Society of Radiology and Nuclear Medicine.

1. Introduction

Pancreatic carcinomas have about only 5% overall 5-years survival because of the delayed diagnosis, and at that time, only about 10% or less are candidates for surgical resection (1).

One crucial consideration in treating patients suspected to have pancreatic tumors is how to diagnose it. So far, ultrasound and contrast enhanced CT has been widely used in the diagnosis of pancreatic tumors. However differentiating

benign lesions from pancreatic cancer was considerably difficult. This dilemma is clinically relevant and to overcome this dilemma, the development of sensitive and specific imaging modalities appears highly desirable (2).

More recently the use of MRI in detecting pancreatic tumors was demonstrated in particularly faster sequences that reduced motion artifacts and facilitated characterization of pancreatic lesions. In addition, one major advantage of MR imaging is its ability to visualize the pancreatobiliary system non-invasively (2).

Regarding the DWI, it is based on Brownian motion (random thermal diffusion) which discusses the movement of small molecules in a tissue. On applying diffusion weighting to a sequence which is the combination of pulses and strong gradients, we can calculate the ADC value in a given tissue and thus quantify the gathered effects of capillary perfusion and diffusion of water molecules (3).

Using DWI as a helpful tool in diagnosing neoplastic diseases has been proven to be on basis that malignant cells have larger volume and more close alignment. That hypercellularity reduces extracellular space causing restriction of free movement of water particles thus reducing the ADC value and giving hyperintense signal on DWI (3).

On the contrary, benign lesions are hypocellular and cause expansion of extracellular space, which in turn causes free diffusion of the water molecules thus increasing the ADC value with hypointense signal on DWI (3).

Diffusion-weighted MRI is considered an important tool in diagnosing CNS diseases being helpful in diagnosing ischemic strokes (4) and recently DWI of diseases of pelvic organs has promising results (5).

The implementation of fast imaging techniques as parallel imaging made DWI of upper abdomen a useful tool in differentiating malignant from benign lesions of the liver and also it was found to be a promising tool in pancreatic imaging (6).

2. Aim of the work

In view of increasing the use of MRI in the diagnosis and management of pancreatic malignancies, the purpose of this study was to show the value of DW MRI in diagnosing pancreatic cancer as well as to correlate the results of DW MRI with those of pathology or tumor markers aiming to use DWI MRI as a reasonable alternative modality especially when contrast administration is contraindicated.

3. Patients and methods

3.1. Study population

Inclusion criteria:

- The study was prospectively carried on 30 patients showing pancreatic cystic and/or solid lesions in previous studies for better characterization (between August 2012 and April 2014). Age of the study group ranged between 27 and 76 years. The study is IBR approved.

  Exclusion criteria:

- Patients refusing or having contraindication to the examination like cardiac pace makers.

- Patients with bleeding tendency as contraindication to biopsy.

3.2. Patient preparation

Patients fast for 4 h before the MRI examination in order to optimize visualization of the pancreatico-biliary tree.

3.3. MRI technique

MR imaging was performed on high field system (1.5 T) magnet units (Philips Acheiva) and Siemens.

Conventional MRI imaging consisted of axial T2-WI with fat suppression, T1-dynamic contrast-enhanced imaging (T1-WI) fat saturation as well as diffusion weighted imaging using different b values, $b = 0$, 500 and 1000 s/mm^2. Axial images were reconstructed to 256×256 matrix images after scanning.

4. Imaging evaluation

The morphological features of each lesion recorded included size, shape, margin, signal characteristics, pattern of enhancement in the dynamic imaging as well as site of the lesions. Then provisional diagnosis was reported. Second, we reviewed the diffusion images with ADC values for final radiological characterization and detection of the pancreatic lesions.

5. ADC calculation

We measured the mean ADC value of the lesions detected through drawing the region of interest over the lesion. The ROI is traced along the boundaries of the lesion by using an electronic cursor. It is manually placed to ensure that it is smaller in size than the actual lesion and thus it is not including adjacent normal tissue.

6. Statistical analysis

Results are expressed as mean ± standard deviation or number (%).

Comparison is carried between the mean values of ADC in the two studied groups using unpaired t test.

Comparison is carried between the mean values of ADC in the three studied groups using (ANOVA) test.

Comparison is carried between categorical data using chi-square test.

Standard diagnostic indices that include sensitivity, specificity, positive, negative predictive values as well as diagnostic efficacy were calculated as described by Galen (7).

SPSS computer program (version 12 windows) was used for data analysis.

P value less or equal to 0.05 was considered significant and less than 0.01 was considered highly significant.

7. Discussion

Although contrast enhanced MRI is considered the routine protocol it is invasive, time consuming and requires adequate