Role of Magnetic Resonance Imaging in the Diagnosis of Different Pancreatic Lesions

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Abstract

Background: Pancreatic cancer is one of the most lethal human cancers that requires early diagnosis. Ultrasound, CT and MRI are different imaging modalities used for diagnosis of pancreatic masses. Diffusion-Weighted Imaging (DWI) and Time-signal Intensity Curve (TIC) can add to the diagnosis of pancreatic masses.

Aim of Study: The aim of this study was to evaluate the role of magnetic resonance imaging in the diagnosis of different pancreatic lesions.

Patients and Methods: Twenty-three patients were divided into 4 groups, group A (Acute Pancreatitis) (AP), group B (pancreatic cysts) which subdivided into malignant and benign cysts, group C (adenocarcinoma) and group D (Focal Pancreatitis) (FP), all patients groups were compared to the control group. MRI protocol included MRI-c (T1WI, T1 Fat Suppression (FS), T2WI, T2FS and IV dynamic contrast study) and DWI which performed on (1.5 Tesla) Magnet Unit General Electric (GE). TIC was obtained from the dynamic study and the results were divided into three patterns of curves.

Results: Control group demonstrated type-I TIC, group (A & D) demonstrated type-II and group C demonstrated type-III.

The mean Apparent Diffusion Coefficient (ADC) values were significant lower ($p<0.001$) in (A & C) groups, statically different ($p<0.02$) between benign and malignant cysts. Statistically different ($p<0.001$) between control and patients’ groups. The sensitivity, specificity, accuracy, positive and negative predictive values of DWI and MRI-c were 92.3%, 90%, 91.3%, 92.3%, 90% and 100%, 90%, 95.7%, 92.9%, 100%, respectively.

Conclusion: DWI and TIC were useful tools in diagnosis, characterization and differentiation between pancreatic lesions.

Key Words: Pancreatic lesions – DWI imaging – TIC.

Introduction

ADENOCARCINOMA is the most common malignant swelling of the pancreas which is very violent and lethal, with a five-year survival rate <5% [1]. Resection rates still low at 10-15% due to invasion and distant metastases [2]. Still remains to a trial to distinctive malignant from benign pancreatic soft tissue lesions [3]. "Diffusion-Weighted Imaging (DWI) is based upon the modalities of Brownian motion of small molecules in a tissue" [4].

The benign lesions have stretched extracellular space with freely movement of water molecules that resulting in easier diffusion exhibited as a decreased intensity of signal and increased ADC values, compared to the malignant masses that have large and multi cells which leading to restrict the water movement in between result in decreased ADC value and increased signal intensities [5,6].

The same clinical and image of both cancer pancreas and Chronic pancreatitis were frequently shown whereas a focal pancreatic lesion was seen commonly in the patients with chronic pancreatitis, however the rate of carcinoma is higher in these patients than others, so the detection of pancreatic mass is indicative as a tumor [7-9].

The facility to notice Pancreatic Carcinoma (PC) and pancreatic focal mass that rise from chronic pancreatitis on Magnetic Resonance Imaging (MRI) including T1-weighted gadolinium-enhanced gradient-echo sequences were previously reported [10-13].

There are many categories of pancreatic cysts, including neoplastic and non-neoplastic types with a wide variation of pathologic entities whereas pseudocysts denote about 85-90% of all pancreatic cystic lesions [14-17]. MRI is higher to detect and diagnosis of mild and acute pancreatitis than Computed Tomography (CT), MRI can estimate and evaluate the peri pancreatic inflammation and
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hemorrhage through the use of fluid sensitive sequences such as TSE-short-tau inversion recovery [18-20].

DWI was usefully in recognize and evaluate of pancreatitis, which the DWI showed an increasing of signal intensity with corresponding decreased ADC values compared to normal parenchyma of the pancreas [21].

Patients and Methods

This observational cross-sectional study was approved by the Local Ethics Committee during the period from March 2016 to May 2017.

Inclusion criteria:
1- Patient coming with abdominal pain, abdominal discomfort, jaundice, abdominal mass, significant weight loss and loss of appetite.
2- Patient made ultrasound or CT that reported any pancreatic lesion.
3- Pre-operative patient for detection of tumor staging.
4- Patient with abnormal level of pancreatic enzymes as alkaline phosphatase, amylase and lipase or high level of pancreatic tumor markers such as carbohydrate antigen 19-9 (CA 19-9) and Carcinoembryonic Antigen (CEA).
5- Patient with abnormal level of liver function tests as serum bilirubin, Asparate Aminotransferase (AST) and Alanine Aminotransferase (ALT).

Exclusion criteria:
1- Patient having any metallic implants as pacemaker, aneurysm clips, joint replacement or any other electronic or magnetically activated implant.
2- Patient with renal failure or heart failure.

Patients:

The study included 23 patients (9 males and 14 females); mean age ± SD, 54.4±11.9 years.

23 pancreatic lesions were divided into 4 groups; AP (acute pancreatitis) (group A) (n=5), pancreatic cyst (group B) (n=8), adenocarcinoma (group C) (n=9) and FP (focal mass forming pancreatitis) (group D) (n=1), furthermore the cystic lesions were subdivided into benign (n=4) and malignant (n=4) subgroup. They were examined by our standard complete upper abdomen protocol (including T1, T1FS, T2, T2FS and dynamic contrast study) and additional DWI.

Patients were asked to fast for 6 hours before the MRI examination and renal profile was done and reviewed for all patients. All twenty-three patients underwent intravenous MRI contrast; eighteen of them underwent pancreatic surgery or biopsy.

MR protocol and parameters:

1- MTI-c:
All patients were examined with a 1.5-T MR scanner magnet unit General Electric (GE) Healthcare using a phased-array body coil.

All patients were examined by the routine upper abdomen MRI protocol that included non-contrast axial T1-Weighted Images (T1WI) breath hold gradient echo with and without Fat Suppression (FS) (TR/TE, 195/1.5; number of excitation, 1; flip angle, 700), coronal and axial T2 Weighted Images (T2WI) single shot free breathing (TE=28m sec; TR ?4000ms; slice thickness 5mm; slice gap 1-2mm; matrix 200 X 240 with a field of view, 379 X 279) and T2 (FS) sequence (TE=80msec; TR ?4000msec; slice thickness 5mm; slice gap 2mm; matrix 204 X 384 with a field of view, 379 X 279). Then, 0.1mmol/kg of gadopentetate dimeglumine (Magnevist) was injected intravenously followed by flushing with 20ml saline solution.

The dynamic series comprised into 4 individual images, obtained at 25, 54, 08 and 150sec. That related to arterial, pancreatic parenchymal, venous and delayed phase respectively.

2- DWI:
Single-shot spin-echo echo-planar imaging and SPAIR FS pulse sequences were done.

Generalized auto-calibrating was used by integrated parallel imaging techniques and partially parallel acquisitions were used to twofold acceleration, as follows: repetition time/echo time, 5000/80 ms; section thickness, 5mm; gap, 1.7mm; matrix, 156 X 192; field of view, 300-400mm; bandwidth,
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1446Hz/pixel; parallel imaging factor of 2; partial Fourier factor, 6/8; averages, 2; free breathing; and b-values of 50, 500 and 1000s/mm\(^2\), less than 2min was taken in a typical scan.

The signal intensities of the pancreatic lesions in all DW images were assessed and compared with the signal intensities of the surrounding parenchyma.

3- ADC calculation:

The mean ADCs of the detected lesions and ADCs of the normal pancreatic parenchyma in the control group were obtained through inducement a Region of Interest (ROI) over the lesion then the ADC maps were generated automatically by the MR software, a free-hand ROI was traced with the trying to avoid bile ducts and vessels. The average of three measurements of b factors (50, 500 and 1,000s/mm\(^2\)) was verified as the final mean ADC.

4- Time Intensity Curve (TIC):

The ROI was drawn at the part of lesion or normal parenchyma in the control group then TICs were obtained. "The pancreatic TIC was generated as a percentage increase in the Signal Intensity (SI), according to the following enhancement formula: (SI post contrast-SI pre-contrast)/SI pre-contrast X 100" [22].

The patterns of TIC in our study were classified into 3 types: Type I; characterized by a rapid rise to a peak (25sec) after administration of contrast material followed by a rapid decline. Type II, characterized by a rapid rise to a peak (45sec) after administration of contrast material followed by a slow decline. Type III, characterized by a slow rise to a peak (80sec) after administration of contrast material followed by a slow decline.

Image analysis:

Each lesion was verified through its morphological pattern including site, shape, margin, size, signal intensity, form of dynamic enhancement then a provisional diagnosis was informed, then we revised the DWI with ADC values and reviewed TIC for final radiological characterization of the pancreatic lesions.

In the control group; ADC values and (TIC) were obtained from their normal pancreatic parenchyma and then we compared its results with patients' results.

Statistical analysis:

Data were evaluated using IBM SPSS advanced statistics Version 22 (SPSS Inc., Chicago, IL.). Numerical data were articulated as mean and Standard Deviation (SD) and range. Qualitative data were noted as percentage and frequency.

For normally disseminated quantitative data, comparison between control and patients' groups was done using parametric t-test followed by ANOVA test. Calculation of sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and accuracy was done for the two diagnostic techniques (MRI-c and DWI with ADC value) considering results of the histopathology to be the gold standard for 18 focal lesions and clinical assessment with follow up biochemical signs to be the gold standard for 5 AP.

Results

The final diagnosis of 23 pancreatic lesions was 5 lesions of AP and 18 focal lesions by histopathologic examination that was as follows: 13 patients had a malignant lesion and 5 patients had a benign lesion. Malignant lesions included; 9 pancreatic adenocarcinoma, 2 malignant Intraductal Papillary Mucinous Tumour (IPMT), 1 mucinous cystadenocarcinoma, 1 malignant Solid Pseudo-papillary Neoplasm (SPN) and benign lesions included; 1 FP, 1 serous cystadenoma, 2 simple pseudo-pancreatic cysts and 1 complicated pseudo-pancreatic cyst.

By using MRI-c; 5 AP, 13 malignant lesions and 4 benign lesions were detected and correctly characterized. One false positive lesion was diagnosed, it was a lesion of Serous Cystadenoma with no false negative lesions. By DWI, 5 AP, 12 malignant lesions and 4 benign lesions were correctly characterized.

One false positive lesion was diagnosed, it was a lesion of complicated pseudo-pancreatic cyst and one false negative lesion, it was a lesion of malignant SPN (Table 1). The sensitivity, specificity, accuracy, positive and negative predictive values of DWI and MRI-c were 92.3%, 90%, 91 .3%, 92.3%, 90% and 100%, 90%, 95.7%, 92.9%, 100%, respectively (Table 2). The mean ADC value ± SD of the cystic lesions (n=8) was (2.80 ±0.63 X 10^-3 mm²/sec) ranged from 2.10 to 3.87 X 10^-3 mm²/sec; while the mean ADC of benign cysts (n=4) was 3.24±0.59 X 10^-3 mm²/s ranged from 2.46 to 3 .87 X 10^-3 mm²/s and that of malignant cysts (n=4) was 2.35 ±.0.19 X 10^-3 mm²/s ranged from 2.10 to 2.53 X 10^-3 mm²/s. The mean ADC value ± SD of acute pancreatitis was 1.28 ±0.08 X 10^-3 mm²/sec, ranged from 1.19 to 1.36 X 10^-3 mm²/sec, and that of the pancreatic adenocarcinomas
was $1.12 \pm 0.16 \times 10^{-3} \text{mm}^2/\text{sec}$, ranged from 0.91 to $1.36 \times 10^{-3} \text{mm}^2/\text{sec}$.

While the ADC value of the case with FP lesion, was $1.54 \times 10^{-3} \text{mm}^2/\text{sec}$. On the other hand, the mean $\pm$ SD of control group was $(1.84 \pm 0.12 \times 10^{-3} \text{mm}^2/\text{sec})$, ranged from 1.65 to $2.12 \times 10^{-3} \text{mm}^2/\text{sec}$. By TIC; the normal pancreatic tissue in control group demonstrated type I, while in acute pancreatitis, FP demonstrated type II and adenocarcinomas demonstrated type III. The age means difference between patients and control groups were statistically non-significant ($F=2.22$, $p=0.09$), while the difference between ADC mean values of our patients' groups and control group were statistically significant ($F=84.62$ and $p<0.001$).

The ADC value was also significantly lower for malignant cysts than for benign cysts ($2.35 \pm 0.19 \times 10^{-3} \text{mm}^2/\text{sec}$ versus $3.24 \pm 0.59 \times 10^{-3} \text{mm}^2/\text{sec}$; $p<0.02$). The optimal cutoff value of ADC for differentiating malignant cyst from benign cyst was $2.49 \times 10^{-3} \text{mm}^2/\text{sec}$. The mean ADC values of both acute pancreatitis and adenocarcinoma groups were significantly ($p<0.001$) lower than those of cystic and control groups Fig. (1).

![Fig. (1): Box plot of the ADC values of patient groups and control group.](image)

![Fig. (2): A 57-year-old female patient complained of acute abdominal pain and back pain. Examination showed acute epigastric pain. Diagnosis of acute pancreatitis.](image)
Fig. (3): A 60-year-old diabetic female patient complained of abdominal pain. Examination showed abdominal tenderness over epigastric area. Diagnosis of pancreatic body adenocarcinoma.

Contrast enhanced axial CT showed irregular border of the pancreas (long white arrow) with non-enhanced area of necrosis is seen at the body (about 30%) (long yellow arrow); with strandy density in the fat planes (short white arrow) and fluid collection surrounding it (short yellow arrow) (a). Axial T2WI showed diffuse enlarged pancreas with heterogenous hyperintense signal, strandy density in the fat planes surrounding it (short white arrows) and fluid collection (short yellow arrow) and hyperintense necrotic area is seen at pancreatic body (long yellow arrow) (b). Enhanced T1WI showed non-enhanced area of necrosis at the body (arrow) (c). MIP study of dynamic contrast enhanced MRI with ROI at the body (arrow) (d). TIC obtained by dynamic contrast study showed type II pattern (e). DWI showed hyperintense signal (restricted) all over the pancreas (arrows) (f). ADC map obtained by DWI showed low signal and low selected area ADC value (1.36 X 10^{-3} mm^2/s) (arrow) (g). MIP; (Maximum Intensity Projection).

Contrast enhanced axial CT showed non-enhanced hypodense ill-defined pancreatic body mass (long yellow arrows), showed encasement of celiac trunk (long white arrow) & splenic vein (short yellow arrow) with multiple bilobar hepatic focal lesion (short white arrow) are seen scattered (a). Axial T1WI (b) and axial T2WI (c) showed an ill-defined heterogenous hypointense on T1 and hyperintense on T2 lesion is seen at pancreatic body measures (6 X 4cm) (arrow). Enhanced T1WI showed heterogenous enhancement of mentioned body mass with encasement of celiac trunk (long white arrow) and splenic vein (long yellow arrow) with multiple non-enhanced hepatic focal lesions (short yellow arrow) and ascites (short white arrow) (d). MIP with ROI at the body mass (arrow) (e). TIC obtained by dynamic contrast study showed type III pattern (f). DWI showed (restricted) hypointense signal at the body mass (arrow) (g). ADC map obtained by DWI showed a low selected area ADC value (1.28 X 10^{-3} mm^2/s) (arrow) (h).
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Table (1): True +ve, true –ve, false +ve and false –ve of DWI and MRI-c for pancreatic lesions.

<table>
<thead>
<tr>
<th></th>
<th>True +ve</th>
<th>True –ve</th>
<th>False +ve</th>
<th>False –ve</th>
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<tr>
<td>MRI-c</td>
<td>13</td>
<td>9</td>
<td>1</td>
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<tr>
<td>DWI</td>
<td>12</td>
<td>9</td>
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<td>1</td>
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<tr>
<td>DWI + MRI-c</td>
<td>13</td>
<td>10</td>
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a: Contrast enhanced MRI. DWI: Diffusion Weighted Image.

Table (2): Qualitative analysis of DWI and MRI-c for pancreatic lesions.

<table>
<thead>
<tr>
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<th>DWI</th>
<th>MRI-c</th>
<th>DWI + MRI-c</th>
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<tbody>
<tr>
<td>Sensitivity (%)</td>
<td>92.3</td>
<td>100</td>
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</tr>
<tr>
<td>Specificity (%)</td>
<td>90</td>
<td>90</td>
<td>100</td>
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<tr>
<td>PPV (%)</td>
<td>92.3</td>
<td>92.9</td>
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<tr>
<td>NPV (%)</td>
<td>90</td>
<td>100</td>
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<tr>
<td>Accuracy (%)</td>
<td>91.3</td>
<td>95.7</td>
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PPV: Positive Predictive Value. NPV: Negative Predictive Value.

Discussion

In our study, we noted that the most of acute pancreatitis lesions (80%) showed restricted diffusion (increase signal intensity on DWI with decrease ADC values) and the mean ADC value in pancreatitis group (1.28 ±0.083 X 10⁻³ mm²/sec) was significant (p<0.001) lower than the mean ADC value of the control group (1.84 ±0.12 X 10⁻³ mm²/sec).

That correlated with Thomas et al., [23] and Yencilek et al., [24], who reported restricted diffusion in cases of acute pancreatitis that showed increased intensity of signal on DWI with decreased ADC values, they noted the mean ADC values in pancreatitis was (1.19 X 10⁻³ mm²/sec±0.32) lower than normal pancreatic parenchyma (1.78 X 10⁻³ mm²/sec±0.29).

In our study, we found that the maximum contrast enhancement in acute pancreatitis was observed at (45sec.) that corresponding to parenchymal phase and showed type II pattern of TIC Fig. (2). Other studies performed by Busirreddy et al., [28] and Salemi et al., [26] had the same conclusion that the supreme enhancement phase of pancreatic parenchyma in acute pancreatitis lesion was detected at the late arterial phase (40sec.), and the TIC showed (rabid increased followed by signal plateau).

In our study, we noted that the mean ADC value of malignant cysts (2.35 ±0.19 X 10⁻³ mm²/sec) was significantly (p<0.02) lower than that of benign cysts (3.24 ±0.59 X 10⁻³ mm²/sec) with cutoff value of ADC for differentiate malignant from benign cyst was 2.49 X 10⁻³ mm²/sec and DWI correctly noted one case of serous cystadenoma, that was falsely characterized as a malignant cyst on MRI-c, which measured high ADC value that was 3.87 X 10⁻³ mm²/sec. This correlated with Sandrasegaran et al., [27], who reported that the ADC of malignant cysts were significantly lower than ADC of benign and the cut-off ADC value for differentiating between benign and malignant cystic was 2.85 X 10⁻³ mm²/sec.

In our study, there was one false positive lesion by DWI; that was a lesion of complicated pseudocyst as it showed diffusion restriction with low ADC value.

Other studies performed by kartalis et al., [28], and Ajaykumar et al., [29] had the same conclusion that complicated pseudocysts showed some restriction on DWI that is thought to be due to high viscosity of its content. Many previous studies reported that the neoplastic cysts and complicated pseudocysts have a viscous content and septation that lead to restriction of diffusion and decrease in ADCs values compared to the simple cysts and pseudocysts have a lower viscosity that lead to a higher ADC [30-32].

In our study, we found that the mean ADC value of adenocarcinoma (1.12 ±0.16 X 10⁻³ mm²/sec): Ranged (0.91-1.36 X 10⁻³ mm²/sec) was significantly (p<0.001) lower than mean ADC of normal pancreas (1.84±0.12 X 10⁻³ mm²/sec): Ranged (1.65-2.12 X 10⁻³ mm²/sec), findings were consistent with the results of Wang et al., [33] and Matsuki et al., [34], they reported that the mean ADC value of PC; ranged (1.1-1.4 X 10⁻³ mm²/sec) was significantly lower than that of normal pancreas; ranged (1.6-1.9 X 10⁻³ mm²/sec); and correlated with Choi et al., [35], who reported that the mean ADC value of the adenocarcinomas was 1.13 ±0.23 X 10⁻³ mm²/sec. DWI correctly characterized one case with FP that was non-restricted (isointense on DWI with iso-intense signal and ADC value was 1.54 X 10⁻³ mm²/sec on ADC maps). That correlated with Zhang et al., [36], who noted that the mean ADC value of masses are lower in PC than FP (1.17 ±0.23, 1.47±0.18, respectively), and the cutoff value of ADC of adenocarcinoma was 1.3036; and also correlated with Ab Warda et al., [37], who showed that the mass forming pancreatitis did show high signal intensity on DWI and had benign reading by ADC value.

Previous studies noted that the restricted diffusion in tumor caused by hyper-cellularity and the signal intensities and the ADC values are dependent on the cellularity and amount of tissue fibrosis [38,39].
In our study, we noted that all the pancreatic adenocarcinoma lesions showed delayed heterogeneous enhancement in post dynamic contrast study that showed type III pattern of TIC with peak at (80sec.) Fig. (3), while a case of FP that correctly diagnosed by MRI-c showed type II pattern with peak at (45sec.) which related to parenchymal phase. This finding was consistent with Megibow et al., [40], Tajima et al., [41] and Zhang et al., [36], who reported that adenocarcinoma displayed delayed enhancement and the peak of FP in the time intensity curve was earlier than the peak of PC; that the peak in FP was at 45 second, while in PC was at 2 or 3 minutes, and the curve of adenocarcinoma demonstrated slower increase to peak followed by slower decline. These were consistent with the previous studies, reporting that pancreatic carcinoma was hypo-vascular tumor character, while FP showed an earlier enhancement followed by a slow decreasing pattern [42,43].

In our study, the mean ADC value of control group (1.84±0.12 X 10^-3 mm^2/s), range (1.65-2.12 X 10^-3 mm^2/s) and showed type I pattern of TIC with a peak at (25s); that correlated with Thomas et al., [29] and Barral et al., [44], they reported that the range of mean ADC value for normal pancreatic group was (1.77±0.32 X 10^-3 mm^2/s) and agreed with Kim et al., [45], who noted that the normal pattern of pancreatic parenchymal enhancement showed TIC of type A characterized by rapid peak followed by a rapid decrease. We noted that the mean ADC value of cystic lesions (2.80±0.63) was more than the ADC value of adenocarcinomas (1.12±0.16) and FP (1.54 X 10^-3 mm^2/s).

That correlated with Wang et al., [33], who reported that the mean ADC values showed higher values in cystic lesions than in solid lesions.

In our study, we noted that the mean ADC value of adenocarcinoma group (1.12 ± 0.16 X 1 0^-3 mm^2/ sec) was lower than the mean ADC value of pancreatitis group (1.28±0.08 X 1 0^-3 mm^2/sec). That correlated with Barral et al., [44], who noted that the mean ADC value of acute & chronic pancreatitis (1.3 X 1 0^-3 & 1.5 X 1 0^-3 mm^2/s) was higher than ductal adenocarcinoma (1.1 X 1 0^-3 mm^2/s) respectively. Finally, our results showed that, MRI-c showed higher sensitivity than DWI. The sensitivity, specificity and NPP of MRI-c were 100%, 90% and 100% while in DWI was 92.3%, 90 and 90% respectively. That correlation with Kartalis et al., [28], who noted that MRI-c showed higher sensitivity than DWI. The sensitivity, specificity and NPP of MRI-c were 100%, 97% and 100%, while in ADC was 92%, 97 and 98% respectively. In our study, the correlation of sensitivity, specificity and NPV between both MRI-c and DWI was 100%, 100% and 100% respectively.

This agreed with the study done by Abo Warda et al., [37] that noted both MRI-c and DWI were corresponding to each other; by using two tests, the sensitivity was 100%, specificity was 100% and NPV was 100%.

**Conclusion:**

MRI plays an important role in the diagnosis of different pancreatic lesions and can assess the neoplastic pancreatic lesions with accurate detection of extension, vascular encasement, nodal involvement and hepatic metastatic lesions.

DWI is an imaging technique that is sensitive to water diffusion in living tissues and ADC measures can differentiate between benign and malignant pancreatic tumors.

**Competing interests:**

The authors pronounce that they have no competing interests.

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دراسة دور التصوير بالرنين المغناطيسي في تشخيص إصابات البنكرياس المختلفة

يعد سرطان البنكرياس على الرغم من كونه غير متوقع هو من بين الأسباب الرئيسية المرتبطة بالسرطان في جميع أنحاء العالم. حيث أنه وفقاً للجمعية الأمريكية للسرطان، فإن نسبة البقاء على قيد الحياة سنة واحدة هو 24٪، نسبة بقائها 5 أعوام هو 5٪ مع نتائج مماثلة ذكرت في جميع أنحاء العالم.

يقدم الاستئصال الجراحي الكامل مع العلاج الكيميائي أفضل النتائج في علاج هذا السرطان. ومع ذلك، فإن الاكتشاف المتأخر للمريض وتأخر ظهور الأعراض على المريض، قد تكون العملية الجراحية بنية الإستكشاف الجراحي أكثر منها بنية العلاج الطرقية من المحتمل أن تكون غير ناجحة نتيجة لزيادة معدل الإنتشار، لذا فإن التقييم الدقيق قبل العملية هو المهم على مر السنين.

وقد أثبت الرنين جدارته واستخدامه على نطاق واسع في تشخيص أمراض البنكرياس المتعددة حيث أنه تقد ذيقته وحساسية في تصوير الأنسجة عن بقي وسائل التصوير المختلفة.

كما فقد تقدم الأدلة الأخيرة استخدام التصوير بالرنين المغناطيسي وتشخيص خاصية الإنتشار الموروز مع إعمل الإنتشار الظاهر في تقييم الإنتشار التشريحي والكمي للبنكرياس والرئة يمكننا من خلال تلك النتائج.

وفي الأدلة الأخيرة أيضاً ظهرت تقنيات منحني شدة إشارة الوقت للبنكرياس والتي تم الحصول عليها من التصوير الديناميكي باستخدام الصبغة تتكون تقنية مراقبة دقيقة لقياس العمق للبنى في البنكرياس.

وتهدف هذه الدراسة إلى تقييم دور التصوير بالرنين المغناطيسي في تشخيص خاصية الإنتشار المتعددة بين إصابات البنكرياس المختلفة.

تم فحص 23 مريضا من المشتبه إصابتهم بأمراض البنكرياس المختلفة تراوح عمرهم ما بين 25 إلى 74 عاما قدم إلى مستشفى جامعة طبي بنغازي من الأم بالطين والقلب والرئتين الإكلينيكية تبين إثبات الإصابة بالتهاب أو أورام البنكرياس.

تم رصد 9 حالات أومور البنكرياس السرطانية و 6 حالات الإنتشار الجدي والمنعزرة للفحص 80 حالة صلبية برنامج حديثة وسرطانية.

وتم عمل فحوصات الدم الامطاع والكشف بالرنين المغناطيسي بالأشعة الصوتية الوضعية عديدة الجريمة والتصوير بالرنين المغناطيسي، مضمنة التصوير بأداة الاستعملية المريحة وعملية الإنتشار والتصوير الدنيا مسرحه بالصبيحة. وعند 18 مرسم منهم ل alcanç عينة من حصة البنكرياس وتفتح نتائج الفحص بالرنين المغناطيسي يتطلب الت🤗 انتشار مهيب للهول المرضي والمقدمة بينهم تبين حساسية ودقة الرنين المغناطيسي العالية في تقييم وتشخيص أمراض البنكرياس المختلفة.

وربما في استخدام خاصية الإنتشار الموروز أثبت دوره الهام في تقييم أورام البنكرياس باستخدام التصوير الدقيق لمكن الإنتشار الوري، والشفاء بالإصابة، واكتشاف إنتشاره للعدة اليسارية والكبد، والهدف.

أخيراً، يعتبر التصوير بالرنين المغناطيسي من أمراض الوسائل التشخيصية التي يمكن أن إعتماد عليها في الكشف المبكر عن أورام البنكرياس، ويمكن استخدامه كطريق تصويري أساسي في الممارسة الأكليوية لهذه الحالات.