ROLE OF DIFFUSION WEIGHTED MRI IN THE CHARACTERIZATION OF ABDOMINO-PELVIC LYMPHADENOPATHY

Thesis

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Abstract

In our study we found a significant difference between the ADC values of benign and malignant abdomino-pelvic pelvic lymph nodes with a threshold ADC value equal to $1.20\times10^{-3}mm^2/sec$ identified. This value could be used in the pre-treatment phase for better oncologic staging.DWI could be considered an important supportive tool in differentiation between benign and malignant lymph nodes, and can to a lesser extent differentiate between the types of malignant lymphadenopathy and as an indicator for improvement post chemotherapy or radiotherapy.

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List Of Abbreviations

ACE= angiotensin-converting enzyme**.**
ADC= apparent diffusion coefficient.
BH= breath hold.
CD= Castleman disease.
CT = computed tomography.
DCs= dendritic cells.
DW= diffusion weighted.
DWI= diffusion weighted imaging.
DW MRI= diffusion weighted magnetic resonance imaging.
EPI= echo planner imaging.
FDG= fluorodeoxyglucose.
FFE= fast field echo.
Fig= figure.
FNA= fine needle aspiration.
FS= fast spin.
FSE = fast spin echo.
GRAPPA= generalized auto- calibrating partially parallel acquisition.
GRE= gradient recalled echo.
HCC= hepatocellular carcinoma.
HD= Hodgkin disease.
HL= Hodgkin lymphoma.
IVC = inferior vena cava.
LN= lymph node.
min= minute.
MR= magnetic resonance.
MRI = magnetic resonance imaging.
msec= millisecond.
NEX= number of excitations.
NHL= non Hodgkin lymphoma.
PET = Positron emission tomography**.**
RCC = renal cell carcinoma.
RF= radiofrequecy.
RLH= reactive lymphoid hyperplasia.
ROI= region of interest**.**
RT= respiratory triggered.
SE= spin echo.
sec= second.
SGE= spoiled gradient echo

SI= signal intensity.
SNR=signal to noise ratio.
SOR= standard of reference.
SPAIR = spectral attenuated inversion recovery (fat suppression MRI technique).
SUV max = maximum standardized uptake value**.**
T= tesla.
TE= echo time.
TR= repetition time.
TSE= turbo spin echo.
US= ultrasonography.
WIs= weighted images.

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INTRODUCTION

Lymphadenopathy is an abnormal increase in size and / or altered consistency of the lymph nodes .The condition is generally not a disease by itself , rather , it may be a symptom of one of many possible underlying problems and serves as an excellent clue to them . It could be due to infections, autoimmune disorders or malignancies (metastatic or lymphomas) ***(Sambandon et al, 2011).***

Oncologic staging requires evaluation of lymph node metastases. The most accurate method to determine lymph nodes composition and differentiate between benign and malignant involvement is histopathologic analysis. However tissue sampling can be very challenging in the abdomen and it is not uncommon to have inadequate samples thus leading to false-negative results ***(Chojniak R et al, 2006)***.

Up to today, parameters used by conventional imaging techniques are shape, size, extracapsular spread and an abnormal inner architecture. The size is certainly the most used criterion for the diagnosis, whereas the presence of central necrosis is the most reliable sign of malignancy. ***(Perronea A et al, 2011).***

Small lymph nodes with a maximum short axial diameter below 10 mm are more challenging for radiologists, because the mere use of this size criterion will result in misclassification of malignant lymph nodes as normal on MRI evaluation **(*Vandecaveye et al, 2009)***.

Recently the use of PET-CT for imaging of lymph node metastasis has attracted much attention. Studies showed the use of the standard maximum uptake value (SUV) of PET-CT could be used with high accuracy.

Nevertheless, there are disadvantages, where only a small number of institutions have PET-CT facilities. Also PET-CT risks exposure to radioactive material and is expensive. On the contrary, DWI does not involve the use of radioactive material or the use of contrast media. In addition, imaging can be performed in a relatively short amount of time and inexpensively ***(O. Yasui et al, 2009)***.

Diffusion-weighted magnetic resonance imaging (MRI) is an imaging technique showing molecular diffusion. Cell size, density and integrity influence the signal intensity seen on diffusion-weighted images ***(Abdel Razek et al, 2006)***.

Diffusion-weighted MRI examinations have many technical restrictions such as respiratory, cardiac, or peristaltic physiologic activity, all of which affect image quality and make evaluation, which is very sensitive to motion, more difficult. Consequently, prior to the development of fast MRI techniques, diffusion-weighted imaging was limited to cranial examinations. With the development of echo-planar imaging (EPI), and fast MRI technique, radiologists have overcome the long imaging times and related artifacts of conventional techniques, and diffusion-weighted MRI is now available for abdominal evaluations as well ***(Coenegrachts et al, 2007)*.**

Several previous studies applied DW MR imaging to improve lymph node staging in various abdominal and pelvic malignancies. In these studies, quantitative analysis was performed by measuring ADCs to differentiate benign from malignant nodes.

Several studies described significantly lower ADC values in malignant than benign lymph nodes, others could not confirm these promising results. In this study, we will review the ADC values of lymph nodes visualized on abdominal or pelvic MRI images and their relationship with the final clinical diagnosis.

AIM OF THE WORK

To study the Value of diffusion weighted MRI in the characterization of abdomino-pelvic lymphadenopathy and its ability to differentiate benign from malignant lymph nodes.

ANATOMY OF ABDOMINO-PELVIC LYMPH NODES

The lymphatics of the abdomen and pelvis are divided into parietal and visceral vessels and nodes ***(Benoit Lengele´ et al, 2007)***.

1) ABDOMINAL LYMPH NODES:

I- Parietal vessels and nodes

The superficial parietal lymphatic vessels of the abdominal wall drain the lymph from the anterior and posterior abdominal skin and subcutaneous tissue upwards into the pectoral and subscapular axillary nodes, respectively. Nevertheless, the low abdominal integuments located below the umbilicus are supplied by descending lymph vessels which terminate in the superficial inguinal nodes ***(Benoit Lengele´ et al, 2007)***.

The deep parietal vessels originate from the muscles and fasciae of the abdominal wall. Running in the subperitoneal adipose tissue, they converge superiorly in a few small inferior diaphragmatic nodes and inferiorly they follow the deep inferior epigastric vessels to join the external iliac nodes. Posteriorly, they cross the quadratus lumborum and the psoas to end in the lateral or posterior lumbo-aortic nodes ***(Benoit Lengele´ et al, 2007)***.

II- Visceral vessels and nodes

Arising from the various abdominal organs, the visceral lymphatic vessels pass through several outlying nodes firstly located close to the viscera, then occupy an intermediate position in the peritoneal ligaments and

mesos. Finally, they reach larger groups of nodes associated with the major paired or uneven branches of the abdominal aorta, and terminate in the lumbar peri-aortic nodes (Fig. 1.1).

The *lumbar peri-aortic nodes* include four groups of nodes which are not clearly differentiated from each other topographically, although functionally each of them possesses a specific lymphatic territory. These four groups are divided into pre-aortic nodes, right and left lateral aortic nodes, and post-aortic nodes ***(Whitmore I, 1998)***.

The *median pre-aortic nodes* drain the lymphatics of the digestive tract running along the ventral branches of the abdominal aorta. Their efferents form the intestinal trunks which open into the cisterna chili ***(Rouviere H & Tobias MJ, 1938)***.

On both sides the *lateral aortic nodes* receive efferent vessels arising from the common iliac nodes as well as terminal lymphatic collectors originating along the lateral branches of the aorta, from the kidneys, the suprarenal glands and the male or female gonadic glands. Therefore they constitute the main terminal group of nodes of all the abdominal or pelvic viscera of the urogenital system. They give rise to several large efferent vessels which constitute the right and left lumbar trunks, ending on both sides in the inferolateral corners of the cisterna chili ***(Poirier et al, 1903)***.