Advanced MRI Techniques in Differentiating Purulent From High Grade Neoplastic Processes of the Brain

Essay

Submitted for Partial Fulfillment of Master Degree in radio diagnosis

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استخدام التقنيات الجديدة في التصوير بالرنين المغناطيسي في التشخيص التفريقي بين اورام المخ و امراضة الصديدية

رسالة

توطئه للحصول على درجة الماجستير فى الأشعة التشخصية

مقدمة من

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Summary

Introduction

Intracranial tumors are a significant health problem. The annual incidence of primary and secondary central nervous system neoplasms ranges from 10 to 17 per 100,000 persons.

Inflammatory diseases of the central nervous system (CNS) are playing an increasingly important role in the clinical practice of neuroradiology: Infections of the CNS frequently involve immunocompromised patients and are being accompanied increasingly more with the employment of innovative and aggressive immunosuppressive and immunomodulatory therapies. Noninfectious inflammation, such as multiple sclerosis, accounts for about 10% of all neurological diseases

Imaging plays an integral role in intracranial tumor management. Magnetic resonance (MR) imaging in particular has emerged as the imaging modality most frequently used to evaluate intracranial tumors, and it continues to have an ever-expanding, multifaceted role.

The diagnosis of brain abscess is usually made based on the clinical presentation and imaging findings. Typically, contrast-enhanced MRI reveals ring enhancement in the capsule stage and solid enhancement in the cerebritis stage of brain abscesses. The abscess may be multiloculated and/or multifocal. Brain abscess and cerebritis may therefore mimic a brain tumour, such as a high-grade glioma or metastasis on conventional imaging

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List of Contents

Title	*Page*

List of diagrams

List of figures

List of abbreviations

MRI	Magnetic resonance imaging
WHO	World Health Organization
CNS	central nervous system
CT	Computed tomography
DWI	Diffusion weighted imaging
CSF	cerebrospinal fluid
ADC	apparent diffusion coefficient
TE	time evolution
MRS	magnetic resonance spectroscopy
cMRI	conventional magnetic resonance imaging
RF	radio-frequency (RF) pulse
FID	free induction decay (FID)
PPM	parts per million (ppm)
HMRS	proton MR spectroscopy (HMRS)
NAA	N-acetyle aspartate (NAA
Cr	creatine (Cr)
VOI	volume of interest (VOI)
TE	TE (time to echo)
TR	time to resonance

Cho	Choline (Cho)
Lip	Lipids (Lip)
GIx	Glutamine & glutamate (Glx)
MIns	Myo-inositol (MIns)
STEAM	Stimulated echo acquisition mode (STEAM)
PRESS	Point resolved spectroscopy(PRESS)
SV	Single Voxel (SV)
MV	multivoxel (MV)
CSI	chemical shift imaging (CSI)
SI	spectroscopic imaging (SI)

(2D)	two dimensional (2D)
(2D)	three dimensional (3D)
T	Tesla (T)
Lac	Lactate (Lac)
AVM	artero venous malformation
FLAR	Fluid attenuation inversion recovery
MPNST	Malignant peripheral nerve sheath tumor (MPNST)
GBM	glioblastomamultiforme (GBM)

LGGS	low-grade gliomas (LGGs)
AAS	Anaplastic Astrocytoma
GC	Gliomatosis Cerebri
PCNSL	Primary Central Nervous SystemLymphoma (PCNSL)
AIDS	acquired immunodeficiency syndrome (AIDS)
EBV	Epstein–Barr virus (EBV)
(T1wI),	spin-echo T1-weighted image (T1WI)
(PDWI),	proton density-weighted image (PDWI)
(T2WI),	T2-weighted image (T2WI)
Gd	gadolinium (Gd)

Introduction & aim of the work

Introduction

Intracranial tumors are a significant health problem. The annual incidence of primary and secondary central nervous system neoplasms ranges from 10 to 17 per 100,000 persons. Imaging plays an integral role in intracranial tumor management. Magnetic resonance (MR) imaging in particular has emerged as the imaging modality most frequently used to evaluate intracranial tumors, and it continues to have an ever-expanding, multifaceted role. ***(Riyadh, et al* 2006)**

The original classification scheme of brain tumor proposed by Bailey and Cushing in the 1920s serves as the foundation for the histological categorization of all brain tumors currently proposed by the World Health Organization (WHO). Basically, the WHO classification scheme recognizes seven major categories based on the cell of origin . These include tumors of neuroepithelial cells (primarily glial cells composed of astrocytes, oligodendrocytes, ependymal cells, and choroid plexus); tumors of the nerve sheath (composed of Schwann cells and fibroblasts); tumors of the meninges (composed of meningothelial, mesenchymal, and melanocytic tumors); tumors of lymphoproliferative cells; tumors of germ cell origin; tumors of the sella; and metastatic disease. Each of these cells of origin give rise to a particular tumor type. ***(Brant, et al 2007)***

Inflammatory diseases of the central nervous system (CNS) are playing an increasingly important role in the clinical practice of neuroradiology:

Infections of the CNS frequently involve immunocompromised patients and are being accompanied increasingly more with the employment of innovative and aggressive immunosuppressive and immunomodulatory therapies. Noninfectious inflammation, such as multiple sclerosis, accounts for about 10% of all neurological diseases. (***Baert, et al 2009)***

The diagnosis of brain abscess is usually made based on the clinical presentation and imaging findings. Typically, contrast-enhanced MRI reveals ring enhancement in the capsule stage and solid enhancement in the cerebritis stage of brain abscesses. The abscess may be multiloculated and/or multifocal. Brain abscess and cerebritis may therefore mimic a brain tumour, such as a high-grade glioma or metastasis on conventional imaging. **(** ***Noguchi, et al 1999*****)**

Brain abscesses and brain tumors may have similar clinical presentations. For example, only 50% brain abscess patients have fever, which could be masked by corticosteroid therapy. Also, the differential diagnosis of brain abscesses versus cystic or necrotic tumors may be difficult based on computed tomography (CT) or magnetic resonance (MR) imaging findings. However, the strategies of management for abscess and neoplasm are very different, and it is especially imperative to have a correct diagnosis before any surgical intervention of cystic brain lesions. The MR special techniques, diffusion-weighted imaging (DWI) and proton (1H) MR spectroscopy, are useful as additional diagnostic modalities for differentiating brain abscesses from cystic or necrotic brain tumors. DWI