Magnetic resonance imaging study of cerebrospinal fluid

Magnetic Resonance Imaging Study of Cerebrospinal Fluid Dynamics in Congenital Brain Anomalies

Protocol of Thesis for Partial Fulfillment of Master Degree in Radiodiagnosis

By

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Introduction

Congenital brain anomalies are abnormal developments of the brain that happen during intrauterine life and they are rare among the congenital anomalies of various organ systems. These anomalies of the central nervous system cause approximately 25% of perinatal deaths and account for about 33% of all major anomalies diagnosed at or after birth. The etiology of congenital brain anomalies is poorly understood, albeit some clinical and experimental evidence indicates that a variety of factors, including genetic (chromosome abnormality), environmental (ionizing radiation, toxic agents), infection (rubella and cytomegalovirus), and nutrition (hypervitaminosis A) might play some roles(Chen & Zimmerman, 2000).

It is important to diagnose these conditions as early as possible due to its far reaching neurological deficit and detrimental outcome. Most of the congenital brain anomalies can be reliably diagnosed by neuroimaging (computed tomography or magnetic resonance imaging) of the brain. Radiologist and treating physician should be aware of various specific imaging appearances and unique signs of these anomalies to avoid delay in diagnosis and thereby further treatment (Singh, Srivastav, Singhania, & Devi, 2014).

Imaging techniques may be underutilized when clinicians are unaware of the technique or don’t recognize its potential. During the last three decades, flow-sensitive magnetic resonance imaging (MRI) techniques have been increasingly applied to quantitatively and qualitatively assess cerebrospinal fluid (CSF) flow dynamics in congenital brain disorders. CSF flowmetry is an extremely valuable tool because it is rapid, sensitive, non-invasive, easily performed and provides critical information in preoperative assessment as

well as post-operative follow up of these patients. It is also effective in treatment planning (Yildiz, Yazici, Hakyemez, Erdogan, & Parlak, 2006; Zhang & Li, 2012).

Phase contrast MRI is one the magnetic resonance angiography techniques that have been modified to study the CSF hydrodynamics. The normal and abnormal CSF hydrodynamics can be assessed quantitatively by measuring the peak velocity of CSF in the aqueduct using two-dimensional phase-contrast MRI which demonstrates mechanical coupling between cerebral blood and CSF flow during the cardiac cycle. The normal physiologic motion of CSF is pulsatile which synchronizes with the cardiac cycle. Quantitative analysis of CSF flow in pathways such as aqueduct that is tubular and relatively regular in diameter is desirable because the resulting laminar flow can be measured accurately by phase-contrast MRI. Qualitative assessment provides visual appreciation of the CSF flow through the aqueduct and basal cisterns. (Giiang, Chen, Chen, Huang, & Chung, 2000).

Aim of Work

The aim of this work is to assess the CSF flow dynamics in different congenital brain anomalies using phase-contrast magnetic resonance imaging (PC MRI).

Patients

- Site of the study: Mansoura University Hospital, Radiodiagnosis Department, MRI unit
- Sample size: 30 patients

- Duration: within 1 year
- Inclusion Criteria

Patients with congenital brain anomalies diagnosed clinically or radiologically

- Exclusion criteria
    - Patients / Guardians refusing the procedure
    - Patients have contraindications to MRI studies
    - Patients with associated known arrhythmias

Methodology

- All patients will be subjected to:

1. Full clinical examination
2. Radiological investigations (MRI including phase contrast study of CSF flow dynamics)
3. Electrocardiograph (ECG)

- Informed consent will be obtained from all patients after full explanation of the benefits and risks of the procedure.
- Any unexpected risks appear during the course of the research will be cleared to the participants and the ethical committee on time
- Any patients will be treated in the hospital if any complications occur to them related to the technique
- Privacy and confidentiality will be maintained to all patients.

References

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