

## MAGNETIC RESONANCE IMAGING (MRI) BRAIN FINDINGS IN SEVERE PRE – ECLAMPSIA / ECLAMPSIA

Ganesh RV<sup>1</sup>, Lee SF<sup>1</sup>, Murad AZ<sup>2</sup>, Ghazali I<sup>1</sup>, Paul Ng<sup>3</sup>, Azian AA<sup>4</sup>, Azlin S<sup>4</sup>,  
Devaraj A.S<sup>5</sup>.

<sup>1</sup> Dept. of Obstetrics & Gynaecology, Hospital Tengku Ampuan Afzan, Kuantan, Pahang,

<sup>2</sup> Dept. of Obstetrics & Gynaecology, Kulliyah of Medicine,  
International Islamic University, Kuantan, Pahang

<sup>3</sup> Dept. of Obstetrics & Gynaecology, Medical Faculty, Hospital UKM.

<sup>4</sup> Dept. of Radiology, Kulliyah of Medicine, International Islamic University Malaysia

<sup>5</sup> Department of Ophthalmology, Hospital Tengku Ampuan Afzan, Kuantan, Pahang,

### ABSTRACT

MRI is mainly used in obstetrics in the evaluation of maternal bony pelvis, the cervix for cervical incompetence, localisation of placental site, diagnosis of gestational trophoblastic disease and its severity and in diagnosing fetal malformations such as renal agenesis. This study aimed to correlate the MRI brain findings in patients with symptomatic and asymptomatic severe pre – eclampsia/ eclampsia and to determine the value of MRI as a predictive diagnostic tool in the management of such cases. This is a prospective descriptive study of 30 pregnant mothers with clinical signs and symptoms of pre-eclampsia / severe pre-eclampsia / eclampsia admitted to the pre-eclampsia room (High Dependency Unit) of the labour room of the Hospital Tengku Ampuan Afzan Kuantan Pahang, Malaysia from 1<sup>st</sup> January 2004 to 30<sup>th</sup> June 2004. General findings indicate that there were no conclusive results with regard to the correlation between the MRI brain changes seen in both groups of patients.

(Keywords : magnetic resonance imaging, eclampsia, pre-eclampsia)

### ADDRESS OF CORRESPONDENCE:

Dr. Ahmad Murad Zainuddin,  
Dept. of Obstetrics & Gynaecology,  
Kulliyah of Medicine,  
International Islamic University  
Malaysia  
Kuantan, Pahang Darul Makmur

### INTRODUCTION

Hypertensive disorders in pregnancy (HDP) account for 7–10 % of hospital admission. The prevalence of this disorder in our country was 23.3 per 1000 livebirths in 1997. This disorder

requires optimal management and treatment as it is associated with an increase in both maternal and fetal morbidity and mortality. It also accounts for 12 % of maternal deaths in the developing countries. In Malaysia, it is the third contributor for maternal mortality, falling third to postpartum haemorrhage (Report on the confidential enquiries into maternal death in Malaysia 1997-2000, Ministry of Health Malaysia 2005) whereas in the United Kingdom (UK), it is the main contributor of maternal morbidity and mortality. The incidence in UK is reported to be 4.9 / 10,000 deliveries (Douglas et al, 1994 ). In the year 2003, it accounted for 25.2 % (142 / 563) of admission to the high dependency unit of our labour room in Hospital Tengku Ampuan Afzan, Kuantan.(HTAA). (Annual Report 2003, Dept. of Ob – Gyn, HTAA).

Pre-eclampsia is a disorder characterised by hypertension, abnormal peripheral oedema and proteinuria occurring in 4–5% of pregnant women. (Cunningham et al, 1989; Lindheimer et al, 1989). Many patients with pre-eclampsia develop neurological signs and symptoms such as headache, visual changes, confusion, loss of consciousness and ultimately seizures or eclampsia.

In view of this, it is essential to diagnose, manage and treat such patients with this disorder optimally to alleviate

any untoward pregnancy outcome. Both maternal and fetal surveillance is therefore important to curb this disorder.

MRI is a recently introduced technique for viewing the internal anatomy of the body. It is based on the physical phenomenon of nuclear magnetic resonance discovered in 1946 by Felix Bloch and Edward Purcell. Its main use in obstetrics is in the evaluation of maternal bony pelvis, the cervix for cervical incompetence, localisation of placental site, diagnosis of gestational trophoblastic disease and its severity and in diagnosing fetal malformations such as renal agenesis. Although MRI is a relatively new imaging modality as compared to the other pre – existing modalities such as CT Scans and ultrasounds, rapid progress has been achieved to rival or surpass currently accepted imaging techniques in certain areas (SS Ratnam et al, 1992).

#### OBJECTIVE OF THE STUDY

1. To correlate the MRI brain findings in patients with symptomatic and asymptomatic severe pre-eclampsia/eclampsia.
2. To determine the value of MRI as a predictive diagnostic tool in the management of such cases.

## METHODOLOGY

### a. Study setting

This study was conducted in the Department of Obstetrics and Gynaecology of Hospital Tengku Ampuan Afzan, Kuantan, Pahang in collaboration with two other departments, the Department of Radiology, Kulliyah of Medicine, International Islamic Universiti Malaysia (IIUM), Kuantan, Pahang and the Department of Ophthalmology, Hospital Tengku Ampuan Afzan, Kuantan, Pahang.

### b. Duration

A study over a 6 month period from 1<sup>st</sup> January 2004 to 30<sup>th</sup> June 2004.

### c. Study design

This was a prospective, randomised descriptive study of pregnant mothers with clinical signs and symptoms of pre-eclampsia/severe pre-eclampsia/eclampsia admitted to the pre-eclampsia (PE) room which is the high dependency units of the labour in Hospital Tengku Ampuan Afzan.

### d. Subjects

Pregnant mothers beyond 20 weeks of gestation with pre-eclampsia/eclampsia admitted to the PE room for blood pressure stabilisation requiring an

intravenous/parenteral antihypertensive agent or admitted for stabilisation of symptoms of impending eclampsia requiring magnesium sulphate were counselled and recruited into this study. Based on whether they were symptomatic or not symptomatic, these participants were again divided into two groups, namely Group A (Without symptoms) and Group B (With symptoms).

### e. Selection Criteria

There were inclusion and exclusion criteria devised for patient selection for this study :

#### a. Inclusion criteria :

All pregnant mothers who were admitted to the PE room for severe pre-eclampsia requiring blood pressure and / or symptoms stabilisation.

1. Systolic blood pressure greater than 160 mmHg or a diastolic blood pressure greater than or equal to 110 mm Hg on 2 occasions 6 hours apart.
2. Proteinuria of 3+ or > 3 gm/ L
3. Oliguria ( A urinary output of less than 400 ml / 24 hours )
4. Symptoms of headache, visual disturbances and epigastric pain
5. Signs of hyper-reflexia, pulmonary oedema, retinal haemorrhage, exudates or papilloedema.
6. Eclampsia, either antepartum, intrapartum or postpartum.



b. Exclusion criteria :

1. Pregnancy dating less than 20 weeks
2. Patients with pregnancy induced hypertension (PIH) who are able to achieve good blood pressure control with only oral medications without the need for any parenteral anti – hypertensive agents.
3. Patients with cardiac pacemakers.
4. Patients with ferromagnetic cerebral aneurismal clips.
5. Patients with metallic cochlear implants.
6. Patients with metallic foreign body in the eye.
7. Claustrophobic patients.

Once the patient was admitted to the PE room, the patient was counselled before being subjected to the MRI investigation. The written consent was taken either from the patient herself or from her husband only. A questionnaire from the X- Ray department, to exclude any conditions that may be a contraindication for MRI, were also duly filled up by the attending medical officer in charge of the PE room.

All the pregnant ladies who were admitted to the PE room for the indication of severe pre-eclampsia or hypertensive crisis, with or without the presence of the neurological signs, require intravenous antihypertensive agents. These patients, once stabilized, counselled and had agreed to with a written consent, were sent to the

radiology department for the MRI to be performed. The radiologist concerned was informed earlier prior to sending the patient. Patients who were admitted to the PE room late at night or during public holidays were stabilised and sent to the MRI room the next morning during office hours.

Prior to sending the patients to the MRI room, the Ophthalmology registrar performed funduscopy eye examination for both eyes to rule out the presence or absence of any hypertensive retinopathies. The grading of the hypertensive eye changes was adopted from the Modified Scheie's classification of hypertensive eye changes (Mandava et al, 1999). All the data required along with the patients' signs and symptoms were recorded in a proforma designed for this study which was kept in the PE room. No contrast medium was used for all patients participating in this study. MRI findings were recorded by the attending radiologist in the proforma sent with the patient. Patients with significant brain changes during the MRI were called back for repeat MRI postnatally, after two (2) months.

Patients who were given an appointment for a repeat MRI were reminded to come back for the same procedure prior to being discharged from the postnatal ward. Data collected were obtained from patient's own record.

### Statistical analysis :

Data in this study were analyzed using SPSS Version 12. A frequency distribution table, cross tabulation and Chi Square test (Fisher's Exact Test) were used. A p value of  $< 0.05$  was considered significant.

### RESULTS

A total of 30 patients were included in this study. They were further divided into two groups, namely Group A and Group B. Group A were those patients without symptoms ( $n=15$ ) while Group B were patients who presented with severe pre-eclampsia associated with symptoms ( $n=15$ ).

The majority of patients in group A had normal findings (73.3 %). As for the patients in group B, 6 out of 15 patients (40 %) had normal eye findings and grade 1 eye findings respectively. The p value was 0.427, calculated by using the Chi Square test which was not significant.

From Table 2, 3/15 patients (20%) had positive MRI brain changes. These three patients were reported to have either ischemia or infarct confined to the left parietal lobes. None of these subjects had any lesions in other lobes of the

brain. Thus, there was absence of multi-lobe involvement in the participants studied.

The MRI brain changes of patients in group B was double that of group A, 6/15 (40% versus 20%). Ischemia and infarction were seen mainly in the parietal lobe with multilobe involvements of frontal and the occipital lobes. (Fronto – parietal and occipito – parietal lobes).

No intracranial haemorrhage was seen in any of the thirty candidates. Interestingly, the parietal lobe involvement in patients from both groups showed ischaemia / infarct MRI brain changes predominantly in the left parietal lobe as compared to the other lobes of the brain. Two patients were given an appointment each for a repeat MRI postnatally for having ischaemia in multiple lobes of their brain. Only one patient came back for the repeat MRI as instructed and the repeat MRI showed an improvement of brain changes as compared to the one done prior to her delivery. The other patient defaulted the follow up due to logistic reason but was well at the time when we called to enquire. Both these patients who were scheduled for the repeat MRI postnatally were from group B (Symptomatic).

**Table 1 : Fundoscopic Hypertensive Eye Changes in Groups A and B**

<b>Grading of the eye changes</b>	<b>Group A Number</b>	<b>Group B Number</b>
<b>Normal findings</b>	11	6
<b>Grade 0</b>	Nil	Nil
<b>Grade 1</b>	3	6
<b>Grade 2</b>	1	3
<b>Grade 3</b>	Nil	Nil
<b>Grade 4</b>	Nil	Nil

**Table 2 : MRI Brain Findings of Group A and Group B patients.**

<b>MRI brain findings</b>				
<b>Groups</b>	<b>Normal MRI</b>	<b>Abnormal MRI</b>	<b>Total (n = 15)</b>	<b>% Abnormality</b>
<b>Group A</b>	12	3	15	20 %
<b>Group B</b>	9	6	15	40 %
<b>Total</b>	21	9	30	

## DISCUSSION

Hypertensive disorders in pregnancy has long been a major cause for an increase in both maternal and fetal mortality and morbidity. In The United Kingdom (UK) the incidence of eclampsia was 4.9/10,000 maternities (Douglas et al, 1994). The national quality indicator approach (QAP) uses "eclampsia" as a proxy for quality management of hypertensive disorders of pregnancy (HDP).

MRI has been used to evaluate obstetric, placental and fetal anomalies in pregnant patients for more than one year. MRI is recognised as a beneficial diagnostic tool and is utilised to assess a wide range of diseases and conditions that affect the pregnant patient as well as her fetus.

The neurologic manifestations of severe pre-eclampsia-eclampsia were identical to those of hypertensive encephalopathy (Barton et al, 1991; Schwartz et al, 1992). Cross sectional imaging in patients with severe hypertensive encephalopathy showed oedema in the subcortical white matter and cortex that predominantly involved the occipital lobes (Schwartz et al, 1992). From this study, the predominant lobe that was involved was the parietal lobe, specifically the left parietal lobe.

Clinical and radiographic signs in patients with hypertensive encephalopathy are believed to be related to the effects of acutely increased systemic blood pressure on the autoregulation of the cerebral vasculature. Although once widely believed to reflect the effects of vasospasm and thrombosis (Trommer et al, 1988 ; Lewis et al, 1988) neurologic deficits in patients with hypertensive encephalopathy are now believed to be most commonly caused by vasogenic oedema that arises from the escape of fluid from the intravascular compartment into the interstitium because of breakthrough of autoregulation (Schaefer et al, 1997).

In a study by Schwartz et al, (2000), it was noted that patients who had brain oedema also had evidence of more severe systemic disease than those who had normal MRI findings. As compared with patients without brain oedema, these patients had significantly increased uric acid and serum creatinine levels, which implied renal dysfunction (Many et al, 1996), and increased haematocrit and white cell count concentration, which reflected relative haemoconcentration owing to decreased intravascular volume (Sibai et al, 1996).

In this study, there appeared to be no correlation between the symptomatic and asymptomatic severe pre-



eclampsia/eclampsia patients on the MRI brain changes that were reported, as the p value noted was 0.427 which was not significant. Therefore, although the number of patients with positive MRI brain changes of group B was double that of group A, based on the p value, the findings seen were not significant.

In the study conducted by Schwartz et al (2000), it was concluded that the endothelial dysfunction experienced by these patients was more likely related to circulating endothelial toxins (Rodgers et al, 1988) or antibodies against the endothelium (Rappaport et al, 1990).

Seizures were more common in patients with brain oedema than in those with normal findings. This reflects the irritative effects of fluid in the subcortical and cortical tissues. Some authors (Yaffe et al, 1995; Dillon et al, 1998) have suggested that on the basis of the common association of seizures with hypertensive encephalopathy, the radiographic findings in patients with hypertensive encephalopathy may actually represent seizure oedema. Interestingly, the radiographic abnormalities in patients with hypertensive encephalopathy can occur in the absence of seizures.

Abnormalities in the endothelial wall disrupts red blood cells and results in the production of schistocytes, anisocytes, microspherocytes and in the release of

LDH into the serum (Lindenbaum et al, 1996). However in our patients, all the liver function tests sent returned as normal and only in one case was there an increment in the red blood cell count seen (erythrocytosis). This was most likely an isolated incidence and may not be directly due to the cerebral vascular endothelial disruption after all.

As for the safety of MRI in pregnancy, all pregnant mothers should be informed that, to date, there has been no indication that its uses during pregnancy has any detrimental effects on both mother and fetus. This policy has been adopted by the American College of Radiology and is considered to be the standard of care with respect to the use of MRI procedures in pregnant women. However, it would be prudent to limit the use of MRI in patients who are in the first trimester.

High contrast sensitivity (Greater sensitivity in white matter disease) and multiplanar capabilities deems MRI as an excellent non – ionizing imaging modality and a diagnostic tool, compared to Computerised Tomographic scan. Previous modalities used in the past such as Lumbar punctures and Electro – encephalogram are no longer used in clinical practice due to the complications involved and limited value of their results.

There appears to be no conclusive results with regard to the correlation



between the MRI brain changes seen in both groups of patients. The power of this study was small ( $n = 30$ ) and this could be a factor in the results. Perhaps a study with a larger population would yield a more conclusive and significant outcome.

### CONCLUSION

In conclusion, although MRI is a relatively new imaging modality, rapid

progress has been achieved to rival or surpass currently accepted imaging techniques in certain areas. There is no doubt that ultrasonography will remain the imaging mode of choice because of its relatively low cost and flexibility as an integral part of an antenatal care. MRI could therefore act as a useful adjunct in certain situations.

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