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Intracerebral Changes Detected by CT Scan of Brain in Eclampsia

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Abstract

Objective: To evaluate the different neurological changes in brain in eclampsia by CT scan in relation to neurologic symptoms.Method: This is prospective observational study in a tertiary hospital. CT scan of brain is performed within 48 hours of eclampsia after confinement of fetus and after stabilising the mother with standard MgSO4 protocol. The CT scans of brain are performed with 5mm and 10mm section in the axial plain.Results: CT scan of brain shows, 31.6

Index terms— computed tomography, eclampsia.

1 Introduction

clampsia is defined as occurrence of convulsion, not caused by any co-incidental neurological disorder (e.g. epilepsy) in a woman whose condition also meets the criteria for preeclampsia 1 which is a complex multi-organ disorder characterised by pregnancy induced hypertension and proteinuria after 20 wks of pregnancy(exception-gestational trophoblastic disease or multiple pregnancy). The diagnostic criteria are being blood pressure ?140/90 mm Hg and proteinuria (?300 mg/24 hours or ?1+ dipstick). 1 The incidence of eclampsia in developing country like India is 1 in 100 to 1in 1700 deliveries. Cerebral complications are the major cause of deaths in eclampsia; still the neuropathophysiology of eclamptic seizure is mostly unknown. There are two distinct but related types of cerebral pathology. 2 The first is gross haemorrhage due to ruptured arteries caused by severe hypertension of any cause, not necessarily only by preeclampsia or eclampsia. The second type of post-mortem lesions are edema, hyperaemia, ischemic microinfarcts and petechial haemorrhages. The mechanism of the cerebral lesions in eclampsia is unclear. The neurologic manifestations of severe eclampsia are identical to those of hypertensive encephalopathy, 2 which is clinically manifested as generalised tonic-clonic seizure and usually preceded by neurological symptoms like hyper-reflexia, altered sensorium, headache, visual changes and even coma.

There are two theories to describe pathogenesis of hypertensive encephalopathy 3 :-1. Theory of vasospasm: Due to increased hypertension cerebral autoregulation causes intense cerebral vasospasm, followed by local anoxic damage to capillary endothelium and disruption of blood-brain barrier which leads to cerebral edema (cytotoxic edema) 2. Theory of hyperperfusion: Sudden fluctuation in blood pressure exerts pressure on blood vessel wall leads to extravasations of fluid and protein and pericapillary ring haemorrhage (vasogenic edema) with increased blood-brain permeability The recent advances in radiologic imaging including the use of computed tomography (CT) scans and magnetic resonance imaging (MRI), have greatly enhanced our understanding about the correlation between neurologic manifestations and neuro-anatomic and pathological characteristics of eclampsia 4 . Harandou M et al 6 ; showed that 73.68% cases of eclamptic mothers who are still symptomatic after 24 hours have cerebral edema and 10.5% have cerebral hemorrhage and 15.7% have normal CT scan study.

The aim of the study is to evaluate the different neurological changes in brain in eclampsia in relation to neurologic symptoms by CT scan. In this study, CT scan methodology has been adopted because it is less expensive, easily available and results are almost same but MRI reflects more and minute information.

2 II.

3 Methodology

This is a prospective study of CT scan finding of brain on cases of eclampsia admitted in a tertiary hospital. The study population are chosen by random samplings who are patient of eclampsia admitted through emergency and also indoor patients who develop eclampsia after admission. a) Inclusion Criteria If the mother is not already delivered, assessment of cervix and delivery of the fetus is done accordingly either by induction of labour or Caesarean section. CT scan of brain is performed within 48 hours of eclampsia after confinement of fetus and after stabilising the mother. The CT scans of brain are performed with 5mm and 10mm section in the axial plain without intravenous contrast. The CT scan findings are evaluated with clinical characteristics. Level of consciousness is classified according to Glasgow coma scale (<8 severe, 9-12 moderate and >13 minor) 5 . Statistical analysis is performed with aid of Statistical Package for the Social Sciences (SPSS 16, SPSS Inc., Chicago, IL, USA). P value <0.05 is considered for statistical significance.

4 III.

5 Results

Total 38 eclamptic mothers are included in this study. Median age of the mothers is 23 years with standard deviation (SD) of 3.8years. 47.4% eclamptic mothers are primigravida and 52.6% eclamptic mothers are multigravida. Among them 28.9% have postpartum eclampsia, 39.8% have intrapartum eclampsia and 31.6% have antepartum eclampsia. 39.47% mothers delivered by normal delivery and 60.53% mothers have undergone LSCS.

CT scan of brain shows, 31.6% have cerebral edema (diffuse white matter low density areas, patchy area of low density, loss of normal cortical sulci) 23.7% have cerebral infract (hypo attenuating brain tissue), 7.9% have cerebral haemorrhage (intraventricular/ parenchymal hemorrhage), while 36.8% have no detectable findings. Parietal region of the brain is affected in 67% followed by parieto-occipital area (17%), occipital area (8%) and brain stem (8%). (Figure **??**) In this study there is no difference between blood pressure distributions between those who have CT scan findings than those who have not positive CT scan findings. (Figure **??**) Figure **??**

6 Discussion

In this study cerebral edema is most common lesion (31.6%) detected by CT scan, but most importantly 37.8% eclamptic mothers have no CT scan finding. These finding is corroborative with the findings of Harandou M et al 6 and Akan H et al 22 (Figure 4). Regarding area of distribution parietal and occipital area is the most frequent site of brain lesions in CT scan; supported by observation of Naidu et al 7 . They found parieto-occipital involvement in 97.4% of cases. Sometimes diffuse brain edema is associated with compression or dilatation of 3 rd and 4 th ventricles. There is two such cases in our study. One rare case of lacunar infarct and another rare subarachnoid haemorrhage is found in this study.

The CT scan findings observed in this study is similar to that observed in patients have severe hypertensive encephalopathy 9 or more similar to its variant Posterior reversible encephalopathy syndrome (PRES) . PRES is characterized by headache, altered mental status, visual disturbances, and seizures. Although hypertensive encephalopathy can arise in patients with conditions in which there is acute systemic hypertension alone, it most commonly occurs in patients also having pre-existing endothelial dysfunction or damage. The Year 2014 E combination of acute hypertension and endothelial damage results in hydrostatic edema -a specific form of vasogenic edema characterised by the forced leakage of serum through capillary walls and into the brain interstitium-which, if severe enough, will be radiographically evident. 10,11 Vasogenic edema is most common finding in eclampsia which explain the reversible nature of most eclampsia. The patients which show no significant finding in CT scan may have very mild vasogenic edema not enough for radiologic detection. The CT scan findings of cerebral infarction are originating from anoxia and cytotoxic edema. This may represents the spectrum of eclampsia ranges from an initially reversible phase of vasogenic edema formation to a later phase of ischemic damage and hemorrhage, which carries a worse prognosis with residual neurologic effect 21 . In fact, laboratory studies of hypertensive encephalopathy, suggest that as vasogenic edema progresses, local tissue pressure increases. This causes a decrease in regional perfusion pressure and a reduction of blood flow to ischemic levels. Subsequently, areas surrounding marked vasogenic edema may progress to infarction and cytotoxic edema. 21 Brain perfusion is maintained by an auto regulatory system of small arteries and arterioles that has myogenic and neurogenic component 11 . In PRES cases direct toxic effect on endothelium or vessel distension decrease the effect of myogenic mechanism. Then neurogenic mechanisms take over regulation of cerebral perfusion. The perivascular sympathetic nerves travel in the adventitial layer of cerebral blood vessels and are relatively protected from agents that cause endothelial damage. Since the vertebra-basilar system and posterior cerebral arteries are sparsely innervated by sympathetic nerves 12 ; the occipital lobe and other posterior brain regions may be particularly susceptible to breakthrough of auto-regulation with elevated systemic pressure. Vasoconstriction induced by sympathetic innervations, moderately protects anterior circulation areas from over perfusion.

Headache is most common neurologic symptoms in this study (68.4%). Akutsu T et al(1992) 13 and Chang WN et al(1996) 14 also get similar results. Eclamptic mothers with visual symptoms and coma have more lesions

in parieto-occipital region and parietal region respectively is corroborative with the findings of Chakravarty A, Chakrabarty SD(2002) 15 and Chang WN et al(1996) 14 . Mothers who have develop coma with Glasgow coma scale <8 and with recurrent episode of convulsion (>5 times in number) develop more findings in CT scan. This finding is correlated to study of Richards et al 16 showing severity of edema is related to duration of intermittent seizures. Also, mothers who become fully oriented within 24 hours have significantly less chance of having brain lesions in CT scan. As cerebral mass effect along with diffuse white matter hypo-densities is associated significantly more with coma (p0.034); these mothers recovered later from their eclamptic episodes 17 . In this study preterm eclamptic mother are significantly having pronounced CT scan finding than term mother ($p<0.05$); as preterm mothers are more severely affected in respect to more prodromal symptoms, multiple seizures, major maternal complication 18 . In our study, there is no statistical significant difference in blood pressure values between cases of positive CT scan findings and cases with normal CT scan findings. Brain edema detected in preeclampsia/eclampsia is thought to be secondary to endothelial injury, rather than hypertension. This finding is correlated with the findings of Schwartz et al. 19 V.

7 Conclusion

It is evident from this study that cerebral edema is most common cerebral lesions followed by infarction and hemorrhage and parieto-occipital regions of brain is the most common affected area. Although almost 38% eclamptic mother s do not have cerebral lesions, those who have lesions are significantly related to level of consciousness, number of convulsive episode and time taken to recover fully oriented state. Most common neurological finding is headache followed by altered sensorium and hyper-reflexia, visual disturbances and coma. CT scan of brain can provide useful intracerebral information to detect different brain lesions in eclampsia which may have different prognosis with residual effect and may need specific modification in management protocol to prevent long term neurologic sequels and reduce maternal mortality and morbidity; although these parameters are not included in this study. Hira B and Moodley J (2004) have shown that CT scan does change management in 27% of eclamptic mothers which is statistically significant. 20 CT scan of brain in eclampsia can provide useful intracerebral information and should be done in cases with severe neurologic manifestations, if possible for every eclamptic mother.

Figure 1: Figure

and 90 mm of Hg diastolic with urine albumin of more than 0.3gm/L). both antepartum and postpartum
b) Exclusion Criteria
1. Women who are known case of Hypertension, Epilepsy.
Dr. S. Khandaker ? , Dr. M. Haldar ? & Dr. S. Munshi ? 2. Seizures due to metabolic disturbances, space occupying lesions or intracerebral infections.
Total 38 eclamptic mothers is chosen according to inclusion criteria. Basic information including age, parity and gestational age, previous medical or obstetric history is taken.
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1. Patients with Eclampsia (at least one episode of seizure in women with more than 20 weeks gestation or less than 06 weeks postpartum with blood pressure more than 140 mm of Hg systolic
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Figure 2:

1: Different areas of brain involvement by CT scan

		Cerebral edema	Cerebral haemorrhage	Cerebral infract
Basal ganglia and internal capsule		4.1%	0%	4.1%
	Cerebral cortex: occipital	8.3%	0%	0%
	Cerebral cortex: parietal	37.5%	8.3%	20.8%
Cerebral cortex: both parieto-occipital		0%	4.1%	12.5%

Among different neurologic symptoms 68.4% mothers have headache, 18.4% have visual disturbances, 34.2% have altered sensorium with hyper-reflexia and 36.6% have coma. Among different neurologic symptoms the CT scan findings are shown in figure 2. Eclamptic mother who presented with visual disturbances (7/38) mostly have brain lesions in parieto-occipital and occipital region (6/7), which is stati significant.(p<0.005) Similarly, mothers presented coma(14/38) mostly have lesions in parietal corte (10/14) also, significant.(p 0.002) But no associat found with area of lesions and other symptoms li headache and hyperreflexia.

Figure 2: CT scan findings among different neurologic symptoms

	CT Scan of brain			
	Normal CT findings	Cerebral edema	Cerebral infarction	Cerebral
Neurologic symptoms	Altered sensorium and hyper-reflexia	38.5%	46.2%	15.4% 0%
	Headache	26.9%	30.8%	30.8% 11.5%
	Visual disturbances	14.3%	28.6%	42.9% 14.3%
	Coma	7.1%	35.7%	35.7% 21.4%

[Note: Year( )53.3% eclamptic mothers are preterm (< 37 weeks completed gestational age); among them 42.]

Figure 3:

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