Scientific Research Publishing

Open Journal of Radiology, 2023, 13, 87-93
https://www.scirp.org/journal/ojrad
ISSN Online: 2164-3032
ISSN Print: 2164-3024

Evaluation of Brain CT Images of Eclamptics in Portharcourt Nigeria

Job Gogo Otokwala[1], Emmanuel Chukuemeka Agi[2*]

[1]Intensive Care Unit, Department of Anaesthesiology, University of Port, Harcourt, Nigeria
[2]Department of Radiology, University of Port, Harcourt, Nigeria
Email: *achukuemeka@hotmail.com

How to cite this paper: Otokwala, J.G and Agi, E.C. (2023) Evaluation of Brain CT Images of Eclamptics in Portharcourt Nigeria. *Open Journal of Radiology*, **13**, 87-93.
https://doi.org/10.4236/ojrad.2023.132009

Received: March 22, 2023
Accepted: May 16, 2023
Published: May 19, 2023

Abstract

Eclampsia is a common complication of hypertensive disorders of pregnancy and in the puerperium with the attendant risk to both the mother and baby. Although it is a multi-systemic disorder, its manifestation that affects the brain and resulting in altered sensorium demands brain imaging to define the possible brain lesions and the implications for critical care management and outcome. We evaluated the CT brain lesions in the patients with eclampsia who were admitted in the intensive care unit, University of Port Harcourt, Port Harcourt Nigeria. Objective: To analyse the CT brain images of eclamptic parturients and the outcome following their admission in the intensive care unit. Methods: We undertook this observational study after obtaining ethical exemption from the University of Portharcourt Teaching Hospital ethical review board, and commenced the review between March 2021 to February 2023. We included all parturients that were admitted into the intensive care unit of the University of Portharcourt Teaching Hospital, a nine-bedded open intensive care unit with the clinical diagnosis of eclampsia. Every admitted parturient was required to obtain a brain computed tomography (CT) by local protocol. The brain CT images were retrieved for review from the parturients' relatives, radiology department and the ICU. Parturients included were aged ≥ 18 years. The radiological reports of these brain images which were also reviewed by a neurosurgeon in case of any need for secondary opinion were subjected to statistical analysis. Result: Thirty-one parturients were admitted with eclampsia with a mean age of 30 years ± 5.29. Sixteen (16) parturients died representing 52%. Only twenty-four (24) CT brain images were retrieved for review (77%). The following brain lesions were identified from the brain CT and they comprised the following: intracerebral haemorrhage, including extensions into the ventricles 7 (29.17%), cerebral oedema 12 (50%), subdural hematoma 1 (4.17%) and normal imaging 4 (16.66%). The subdural

haematoma was promptly evacuated with a good outcome. Conclusion: Neuro imaging comprising computed tomography and magnetic resonance imaging of the brain are basic ancillary investigations for patients with eclampsia presenting with neurologic deficits and low GCS. Early presentation and access to brain CT could influence outcome as it was demonstrated in the prompt intervention in the patient with subdural haematoma which was evacuated with a satisfactory outcome.

Keywords

Evaluation, Eclamptics, Brain CT, Intensive Care Unit, Portharcourt

1. Introduction

In Nigeria, eclampsia, which is a complication of the hypertensive disorders of pregnancy is a common phenomenon and a causation of maternal mortality and morbidity. The prevalence in Nigeria varies between 1 in 12 to 1 in 1,700 deliveries [1] [2]. This is associated with high mortality, which was reported to be in excess of 31.9% - 46.4% [3] [4]. It was observed that about 0.8% of women with hypertensive disorders of pregnancy ended up with eclampsia [5]. Although the cause of eclamptic seizure is obscure, it is reported that it involves the disruption of blood-brain barrier with the influx of ions, fluids, plasma proteins and some vasoactive factors into the brain parenchyma, and these blood particles have the tendency to trigger microglial activation [6] [7] [8] which have been found to be a seizure threshold lowering agent [9]. Several theories have been espoused to define the possible cause of brain pathologies in eclamptics and these include but not limited to the following: the loss of cerebral autoregulation with blood brain barrier disruption [10] [11] [12], a possible shift in the autoregulation curve in pregnancy to a much lower blood pressure [13] [14] to vascular dysfunction with the activation of superoxide in the endothelial cells.

Autopsy findings of massive cerebral oedema, white matter haemorrhage and necrosis all support the influence of autoregulation dysfunction with the loss of blood brain barrier as a common pathway to the onset of seizures and altered sensorium seen in eclamptics [15].

Following from above, does neuroimaging have a role in the management of eclampsia? It is observed that parturients with focal neurological deficits, recurrent seizures especially those occurring in the second trimester, or prolonged coma require neuroimaging. The presence of intracranial abnormalities may require surgical intervention, in the case of haemorrhage or pharmacological treatments. The essence of this paper therefore was to evaluate the type and proportion of brain lesions seen in eclamptic women that presented in the intensive care unit at the University of Port Harcourt Teaching Hospital Nigeria and the observed outcome.

2. Methodology

We undertook this non randomised retrospective observational review of the brain computed tomography (CT) images of all eclamptic parturients on admission at the intensive care unit (ICU) of the University of Port Harcourt Teaching Hospital Port Harcourt Nigeria, during the study period March 2021-February 2023, a nine hundred and twenty bedded tertiary teaching hospital with a nine bedded ICU which sub serves all medical and surgical units. We obtained ethical exemption from the hospital's research and ethics review board. Every admitted parturient was required to obtain a brain computed tomography (CT) by local protocol. The brain CT images were retrieved for review from the parturients' relatives, radiology department and the ICU. The radiological reports of these brain images were also reviewed by the in house neurosurgeon in case of any need for secondary opinion. Sample size for retrospective study for 13months was calculated based on the available sample size (N = 31).

Inclusion criteria included: Adults ≥ 18 years with clinical diagnosis of eclampsia presenting with neurological deficits during pregnancy and the puerperium and must be admitted into the intensive care unit (ICU) for more than twenty-four hours. Parturients must have retrieved brain CT images and all images must be read by a consultant radiologist. All brain CT images that could not be retrieved were excluded from the study. Parturients with known intracranial pathologies such as tumours and seizure disorder were excluded. Patients with mental health problems were also excluded.

The descriptive data of the parturients were obtained from the ICU register as well as the radiological unit register. These comprise: age, co-morbidity, brain CT lesion and outcome. Statistical analysis was performed using Jamovi statistical software version1.2 (https://www.jamovi.org) accessed 01/03/2023.

3. Results

A total of 31 parturients were admitted with a clinical diagnosis of eclampsia in 13months. Access to brain CT was available for review in only twenty-four patients (77%) and these were analysed and presented in this study. The mean age of parturients was 30.6 ± 5.9 years. Sixteen parturients died (51.6%). Retrieved CT images were 24 (77.4%) while 7 (22.6%) images could not be retrieved. CT findings depicted the following: Subdural haematoma 1 (4.17%), Intracerebral haemorrhage 7 (29.17%), Cerebral oedema 12 (50.0%), normal imaging 4 (16.66%). All the parturients were admitted postpartum and mostly from the Unbooked labour ward. The affected parts of the brain included the right parieto-occipital lobe, effacement of the cerebral sulci and gyri with associated compression of the anterior and posterior horns due to cerebral oedema. Other parts of the brain involved included: the left occipital lobe white matter, right occipital lobe infarct, left sided acute intracerebral and occipital lobe haemorrhage and Left sided subdural haematoma.

4. Discussion

The usefulness of neuroimaging especially the brain CT in defining the management and prognosis of eclamptics has been reported in the literature [16] and in this study, the relevance of neuroimaging as a guide became much more valuable in deciding possible interventions for the critically-ill parturients with eclampsia in Nigeria.

One major organ that is grossly affected by eclampsia is the brain. Autopsy findings in eclamptics had revealed the presence of massive cerebral oedema, white matter haemorrhages and necrosis [6]. Vasogenicoedema arising from endothelial damage has been implicated along the distribution of the posterior cerebral arteries [17] affecting the parieto-occipital lobes. In clinical observations, the brain CT and MRI are commonly used in patients with signs of focal neurological deficits, seizures and altered sensorium, with the CT having the superiority in diagnosing haemorrhages and cerebral oedema [18]. Majority of the patients studied in this report were in their 30s, this was similar to other observations [16] [17]. The high mortality rate is also consistent with other reports [19] [20] and affected mostly patients in Unbooked labour wards. These subsets of patients are usually poor and could barely afford brain CT, often present late to critical care and this could also account for the delay to access brain CT. The time lag and late presentation could have contributed to the high mortality. One case of subdural haematoma as shown in the result (**Figure 1**) was identified in this study, in a patient that could have been passively managed as routine eclamptic but surgical evacuation was promptly done in this case with rapid recovery of neurological deficits. The other CT findings included: intracerebral haemorrhage (**Figure 2** and **Figure 4**) affecting the parietal lobe similar to the report of MC Kinney *et al.* [21]. Cerebral oedema (**Figure 3**) was the commonest finding in this study, representing about 50% of the CT findings. This was similar to the reports of Richard *et al.* [22] and others [23]. Is there regional variation in the brain lesions in eclampsia, this may be a push for further evaluation. While cerebral infarct was commoner in a Canadian series [24], the French, reported more of cerebral oedema [25], and in our study, a preponderance of cerebral oedema (**Figure 3**) and intracerebral bleed (**Figure 2** and **Figure 4**). It was

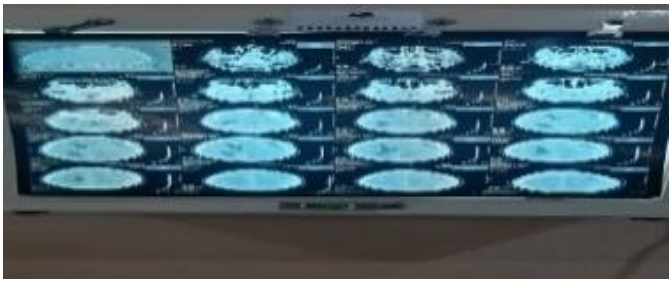

Figure 1. Showing left sidedsubacute subdural haematoma with effacement of the ipsilateral lateral ventricle as well as deviation (herniation) of the falxcerebri. There was elevated intracranial pressure and falcine herniation and displacement.

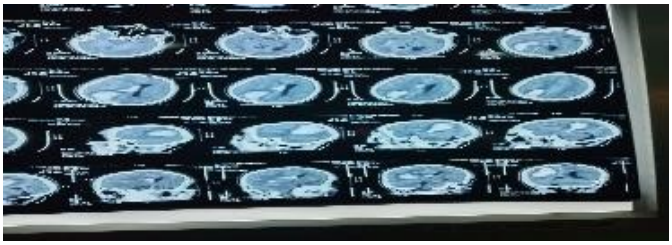

Figure 2. Right sided acute intraventricular and intracerebral (parieto-occipital lobe) haemorrhage.

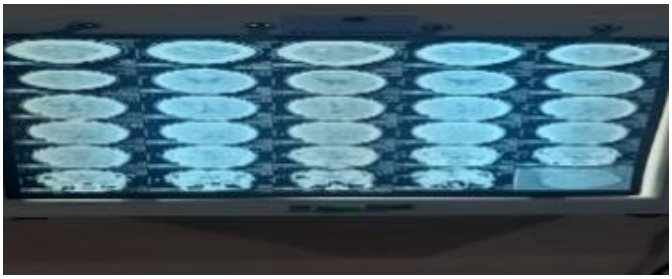

Figure 3. Effacement of the cerebral sulci and gyri with compression of the ventricles. Impression: cerebral.

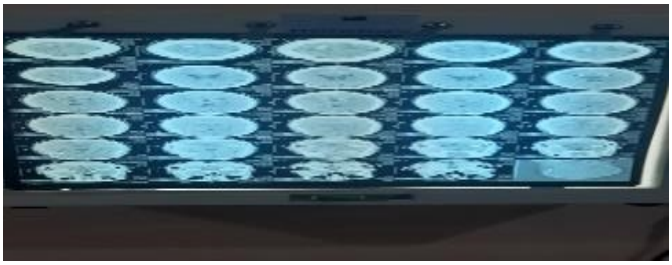

Figure 4. There is hyper dense area (acute bleed) in the left occipital lobe white matter. An ill-defined hypo dense area is seen in the right occipital lobe, indicating left side acute intracerebral (occipital lobe) haemorrhage. Right sided occipital lobe infarct.

also observed in this study that there were some cases with no obvious abnormality as detected on brain CT, this could be supported by the observation by Hamandou *et al.* [25] of cerebral oedema being seen in eclamptics with apparently normal brain CT but on MRI. Cost to access these investigations in resource limited settings reflects the apparently low yield of neuroimaging in an eclampsia rich environment. The care required for all eclampsia patients remain the same with strong neuro protective support and other measures to optimise functional reserves and drive improved outcome.

5. Conclusions

It is routine to do brain CT for all eclamptics presenting with signs of neurological deficit.

Prompt intervention with neurocritical care bundles, such as early airway protection and mechanical ventilation and all ancillary neuro protective meas-

ures will obviate further deteriorations which are a major cause of maternal morbidity and mortality.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] World Health Organization International Collaborative Study of Hypertensive Disorders of Pregnancy (1998) Geographic Variations in the Incidence of Hypertension in Pregnancy. *American Journal of Obstetrics and Gynecology*, **151**, 80-83.

[2] Knight, M. (2007) Eclampsia in the United Kingdom 2005. *BJOG: An International Journal of Obstetrics & Gynaecology*, **114**, 1072-1078. https://doi.org/10.1111/j.1471-0528.2007.01423.x

[3] Lee, W., O'Connell, C.M. and Baskett, T.F. (2004) Maternal and Perinatal Outcomes of Eclampsia: Nosa Scotia, 1981-2000. *Journal of Obstetrics and Gynaecology Canada*, **26**, 119-123. https://doi.org/10.1016/S1701-2163(16)30487-X

[4] Begum, M.R., Begum, A., Quadir, E., Akhter, S. and Shamsuddin, L. (2004) Eclampsia: Still a Problem in Bangladesh. *Medscape General Medicine*, **6**, Article 52.

[5] Altman, D., Carroli, G., Duley, L., *et al.* (2002) Do Women with Preeclampsia, and Their Babies, Benefit from Magnesium Sulphate? The Magpie Trial: A Randomized Placebo-Controlled Trial. *The Lancet*, **359**, 1877-1890. https://doi.org/10.1016/S0140-6736(02)08778-0

[6] Marchi, N., Tierney, W., Alexopoulos, A.V., Puvenna, V., Granata, T. and Janigro, D. (2011) The Aetiological Role of Blood Brain Barrier Dysfunction in Seizure Disorders. *Cardiovascular Psychiatry and Neurology*, **2011**, Article ID: 482415. https://doi.org/10.1155/2011/482415

[7] Johnson, A.C., Tremble, S.M., Chan, S.L., *et al.* (2014) Magnesium Sulfate Treatment Reverses Seizure Susceptibility and Decreases Neuroinflammation in a Rat Model of Severe Preeclampsia. *PLOS ONE*, **9**, e113670. https://doi.org/10.1371/journal.pone.0113670

[8] Oby, E. and Janigro, D. (2022) The Blood-Brain Barrier and Epilepsy. *Epilepsia*, **47**, 1761-1774. https://doi.org/10.1111/j.1528-1167.2006.00817.x

[9] Michal, F.B. and Baha, M.S. (2022) Eclampsia in the 21st Century. *American Journal of Obstetrics and Gynecology*, **226**, S1237-S1253. https://doi.org/10.1016/j.ajog.2020.09.037

[10] Jones-Muhammad, M. and Warrington, J.P. (2019) Cerebral Blood Flow Regulation in Pregnancy, Hypertension and Hypertensive Disorders of Pregnancy. *Brain Sciences*, **2019**, Article 224. https://doi.org/10.3390/brainsci9090224

[11] Cipolla, M.J., Bishop, N. and Chan, S.L. (2012) Effect of Pregnancy on Autoregulation of Cerebral Blood Flow in Anterior versus Posterior Cerebrum. *Hypertension*, **60**, 705-711. https://doi.org/10.1161/HYPERTENSIONAHA.112.198952

[12] Friedman, A., Kaufer, D. and Heinemann, U. (2009) Blood-Brain Barrier Breakdown Inducing Astrocytic Transformation: Novel Targets for the Prevention of Epilepsy. *Epilepsy Research*, **85**, 142-149. https://doi.org/10.1016/j.eplepsyres.2009.03.005

[13] Chapman, A.C., Cipolla, M.J. and Chan, S.L. (2013) Effect of Pregnancy and Nitric

oxide on Myogenic Vasodilation of Posterior Cerebral Arteries and the Lower Limit of Cerebral Blood Flow Autoregulation. *Reproductive Sciences*, **20**, 1046-1054. https://doi.org/10.1177/1933719112473661

[14] Cipolla, M.J., Vitullo, L. and McKinnon, J. (2004) Cerebral Artery Reactivity Changes during Pregnancy and the Postpartum Period: A Role in Eclampsia? *American Journal of Physiology-Heart and Circulatory Physiology*, **286**, H2127-H2132. https://doi.org/10.1152/ajpheart.01154.2003

[15] Hecht, J.L., Ordi, J., Carrilho, C., *et al.* (2017) The Pathology of Eclampsia: An Autopsy Series. *Hypertension in Pregnancy*, **36**, 259-268. https://doi.org/10.1080/10641955.2017.1329430

[16] Madhavi, K.N., Guguloth, K., Sivaranjani, B.S.V. and Sreevalli, M. (2023) Computed Tomography Brain Scan Findings in Eclampsia. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, **12**, 94-97. https://doi.org/10.18203/2320-1770.ijrcog20223257

[17] Royburt, M., Seidman, D.S., Serr, D.M. and Mashiah, S. (1991) Neurologic Involvement in Hypertensive Disease of Pregnancy. *Obstetrical & Gynecological Survey*, **46**, 656-664. https://doi.org/10.1097/00006254-199110000-00002

[18] Zhu, X.W. (1993) Cerebral Lesions in the Severe Pregnancy Induced Hypertension: 61 Cases of X-Ray Computed Tomography of the Brain. *Chinese Journal of Obstetrics and Gynecology*, **28**, 275-277.

[19] Rabiu, K.A., Adewunmi, A.A., Ottun, T.A., *et al.* (2018) Risk Factors for Maternal Mortality Associated with Eclampsia Presenting at a Nigerian Tertiary Hospital. *International Journal of Women's Health*, **10**, 715-721. https://doi.org/10.2147/IJWH.S178729

[20] Nwobodo, E.I. and Ahmed, Y. (2011) Maternal Mortality Associated with Eclampsia in Sokoto Nigeria. *Orient Journal of Medicine*, **23**, 1-4.

[21] McKinney, A.M., Short, J., Jruwit, C.L., *et al.* (2007) Posterior Reversible Encephalopathy Syndrome: Incidence of Atypical Regions of Involvement and Imaging Findings. *American Journal of Roentgenology*, **189**, 904-912. https://doi.org/10.2214/AJR.07.2024

[22] Richards, A., Graham, D. and Bullock, R. (1988) Clinicopathological Study of Neurological Complications Due to Hypertensive Disorders of Pregnancy. *Journal of Neurology, Neurosurgery, and Psychiatry*, **51**, 416-421. https://doi.org/10.1136/jnnp.51.3.416

[23] Brouh, Y., Konan, K.J. and Ouattara, A. (2016) Brain Lesions in Eclamptics: A Series of 39 Cases Admitted in an Intensive Care Unit. *Indian Journal of Critical Care Medicine*, **20**, 178-181. https://doi.org/10.4103/0972-5229.178183

[24] Jaigobin, C. and Silver, F.L. (2000) Stroke and Pregnancy. *Stroke*, **31**, 2948-2951. https://doi.org/10.1161/01.STR.31.12.2948

[25] Hamandou, M., Madani, N., Labibe, S., Messouak, O., *et al.* (2006) Neuroimaging Findings in Eclamptic Patients Still Symptomatic after 24 Hours: A Descriptive Study about 19 Cases. *Annales Françaises d'Anesthésie et de Réanimation*, **25**, 577-583. https://doi.org/10.1016/j.annfar.2006.02.022