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ARTICLE ORIGINAL / RESEARCH ARTICLE

Epidemio-clinical and CT-scan profile of adult headache disorders in a sub-Saharan Africa country

Profil épidémio-clinique et tomodensitométrique des céphalées de l'adulte en Afrique sub-Saharienne

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Headache - Head CT-scan – sub-Saharan Africa – Minor brain trauma.

Mots-clés :
Céphalée – Scanner cérébral – Afrique sub-Saharienne – Traumatisme crânien léger.

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ABSTRACT

Objective: Given the little availability of MRI in sub-Saharan Africa, we carried out this study focusing on CT-scan in adult headache disorder, in order to determine epidemiological and clinical profile of adult patients undergoing CT-scan for headache disorder, and the organic pathologies discovered in sub-Saharan Africa.

Method: We carried out a multicentric prospective cross-sectional study in medical imaging departments of Yaounde Central Hospital and Douala Laquintinie Hospital, which are two teaching hospitals in Cameroon. We consecutively and non-exhaustively included all consenting patients aged eighteen years or above, referred to radiology department to undergo a head CT-scan as aetiological workup of headache disorder, from either traumatic or non-traumatic mechanism. Patients with a Glasgow coma scale less than thirteen were excluded. We interviewed eligible patients, and performed a neurological examination and a complete physical examination before they underwent head CT-scan. The scanning was performed using a brand HITACHI ECLOS 16 slices CT-scan, in helical mode with or without contrast enhancement according to the clinical context. The reading was done by experimented radiologists.

Results: The total number of patients was 169. There was a predominance of men (56.2%) and the average age was 43 years. Headache was secondary to a minor brain trauma in 37.2% (n= 63) of patients and 82.5% (n= 52) of trauma were due to the public highway accident. 78.1% (n= 132) of patients performed head CT-scan for acute headaches, of which 45.6% were recent sudden-onset headache and 32.5% were recent progressive headache. Headache was associated to an abnormal neurological examination in 72.8% (n= 123) of cases, fever in 20.7% (n= 35), and there were no associated clinical symptoms in 5.3% of cases. There was a notion of hypertension in 21.3% of cases (n= 36), HIV in 10.1% of cases (n= 17), and past history of stroke in 7.7% of cases (n= 13). In 38.5% of cases, CT findings were normal. CT-scan revealed 4 cases (2.4%) of incidental findings. CT revealed in 59.2% (n= 100) of cases the cause of headache disorder. These causes were dominated in non-traumatic headaches by stroke (13.6%), sinusitis (12.4%), encephalitis and abscesses (7.1%); and in post-traumatic headaches by intracranial haemorrhages (25%), followed by skull fractures (14.2%).

Conclusion: Headache is a symptom commonly explored in neuroradiology in sub-Saharan Africa, particularly the Cameroon. Traumatic causes are frequent in our setting. The major

findings observed on CT-scan are stroke, sinusitis, encephalitis and abscess in non-traumatic headache disorder, and intracranial haemorrhage, skull fractures in traumatic context.

RESUME

Objectif : Etant donné la faible disponibilité de l'IRM en Afrique sub-Saharienne, nous avons entrepris cette étude axée sur le scanner crânio-encéphalique dans les céphalées de l'adulte, dans le but de déterminer le profil épidémio-clinique des adultes réalisant un scanner crânio-encéphalique pour céphalées, ainsi que les pathologies révélées en Afrique sub-Saharienne.

Méthodologie : Nous avons mené une étude transversale descriptive multicentrique avec collecte prospective des données dans les services de radiologie et imagerie médicale de deux centres hospitalo-universitaires du Cameroun, l'Hôpital Central de Yaoundé et l'Hôpital Laquintinie de Douala. Nous avons inclus consécutivement et non-exhaustivement les patients consentant âgés de dix-huit ans et plus, adressés au service de radiologie pour réalisation d'un scanner crânio-encéphalique dans le cadre du bilan étiologique de céphalées consécutifs ou non à un mécanisme traumatique. Les patients avec score de coma de Glasgow inférieur à treize ont été exclus. Les patients éligibles ont bénéficié par la suite d'un interrogatoire, d'un examen neurologique, et d'un examen général préalablement à la réalisation du scanner crânio-encéphalique. Ce dernier a été réalisé à l'aide d'un appareil de marque HITACHI ECLOS de 16 barrettes en mode hélicoïdal avec ou sans injection de produit de contraste selon le contexte clinique. La lecture du scanner a été réalisée par des radiologues expérimentés.

Résultats : Nous avons colligé 169 patients. Il y'avait une prédominance des hommes (56.2%). L'âge moyen était de 43ans. La céphalée était secondaire à un traumatisme crânien léger chez 37.2% (n=63) des patients et 82.5% (n=52) de ces traumatismes étaient causés par un accident de la voie publique. 78.1% (n=132) des patients avaient des céphalées aigües (45.6% pour la céphalée récente brutale et 32.5% pour la céphalée récente progressive). Les céphalées étaient associées à une anomalie de l'examen neurologique dans 72.8% (n= 123) des cas, la fièvre dans 20.7% (n= 35) des cas, et il n'y avait aucun signe clinique associé dans 5.3% (n= 9) des cas. On retrouvait une notion d'HTA dans 21.3% (n= 36) des cas, de VIH dans 10.1% (n= 17) des cas, et un antécédent d'AVC dans 7.7% (n= 13) des cas. Le scanner était normal dans 38.5% des cas, et a révélé 4 cas d'anomalies non significatives (2.4%). Dans 59.2% des cas, la cause des céphalées a été retrouvée ; ces étiologies étaient dominées hors contexte traumatique par les AVC (13.6%), la sinusite (12.4%), l'encéphalite et l'abcès cérébral (7.1%) ; et en contexte post-traumatique par les hémorragies intracrâniennes (25%), suivies des fractures du crâne (14.2%).

Conclusion : La céphalée est un symptôme fréquemment exploré en neuroradiologie en Afrique sub-Saharienne et au Cameroun en particulier. Les causes traumatiques sont fréquentes dans notre contexte. Les principales anomalies observées au scanner crânio-encéphalique sont les AVC, la sinusite, l'encéphalite et l'abcès en contexte non-traumatique, et les hémorragies intracrâniennes, et les fractures du crâne en contexte traumatique.

1. Introduction

Headache or cephalalgia is defined as localized or diffuse pain in various parts of the head, with the pain not confined to the area of distribution of a nerve, and eventually irradiating to the face or the neck [1,2]. Headache is a common reason for consultation in primary care medicine and emergency departments [3]. In USA, headache account for 1.2 million of consultations in emergencies per year [2]. The World Health Organisation (WHO) ranges headache disorder among ten major world-wide pathological conditions [4–6]. International Headache Society classifies headache into primary (without any organic substratum) or secondary (with organic substratum) according to many criteria in order to select which patients suffering of headache disorder need CT-scan or MRI investigations [1,7].

Although in most cases no further investigation is necessary, the anamnesis and a physical examination may suggest in some cases a secondary cause, thus requiring brain imaging [3,8,9]. The choice of imaging method will then depend on the degree of emergency and clinical suspicion. Brain CT is the examination of choice in an emergency cases [3,10], with or without contrast medium injection according to the suspected disease, while MRI, more sensitive, is especially useful in the ambulatory examination of intracranial tumor or infectious pathologies [9,11,12]. Yet, MRI which is the gold standard in the evaluation of headache disorder [12], is little available and accessible in our setting.

Given the little availability of MRI in sub-Saharan Africa, we carried out this study focusing on CT-scan in adult headache disorder, in order to determine epidemiological and clinical profile of adult patients undergoing CT-scan for headache disorder, and the organic pathologies discovered in sub-Saharan Africa.

2. Patients and Method

2.1 Design

We carried out a multicentric prospective cross-sectional study in medical imaging departments of Yaounde Central Hospital and Douala Laquintinie Hospital, which are two teaching hospitals in Cameroon, over a period of five months (from January to May 2017).

2.2 Sampling

We consecutively and non-exhaustively included all consenting patients aged eighteen years or above, referred to radiology department of to undergo a head CT-scan as aetiological workup of headache disorder, from either traumatic or non-traumatic mechanism. Patients with a Glasgow coma scale less than thirteen were excluded. The minimal sample size was calculated using the formula $n=t^2 \times p\ (1-p)/m^2$ where n is the minimal sample size required for the study, t is the accuracy level to 95% (standard value is 1.96), p is the estimated prevalence in the study setting, m is the error margin to 5% (standard value is 0.05). We referred to the study of Becker LA and al, title *Use of CT-scan for the investigation of headache*, which found that CT-scans were ordered for approximately 3% of patients with headaches [1,13]. The minimal sample size was therefore estimated based on that prevalence at 45 patients requesting head CT-scan for headache disorder.

2.3 Data collection and statistical analysis

We interviewed eligible patients, and performed a neurological examination and a complete physical examination before they underwent head CT-scan. The scanning was performed using a brand HITACHI ECLOS 16 slices CT-scan, in helical mode with or without contrast enhancement according to the clinical context, beginning from C2 vertebra to the whole cranium, and with a millimetric and multiplan reconstruction. The reading was performed in both cerebral and bone windows by experimented radiologists, and the examination of the facial block and cervical occipital hinge was systematically done. The CT-scan results and all others collected data were entered on a survey sheet. Statistical analysis was performed using the SPSS version 23.0 software, and studied parameters were age, gender, comorbidities, traumatic history and mechanism, characteristics of headache, accompanying signs of headaches, CT protocol, and CT image findings.

3. Results

The total number of patients was 169. There was a predominance with 56.2% of men (n= 95). The average age was 43 years, with the extremes ranging from 18 to 90 years, and a predominance of the age group between 20 to 39 years.

Headache was secondary to a minor brain trauma in 37.2% (n= 63) of patients and 82.5% (n= 52) of trauma were due to the public highway accident (**Figure 1**).

Figure 1: Distribution of causes of minor brain trauma leading to headache disorder.

78.1% (n= 132) of patients performed head CT-scan for acute headaches, of which 45.6% were recent sudden-onset headache and 32.5% were recent progressive headache (**Figure 2**).

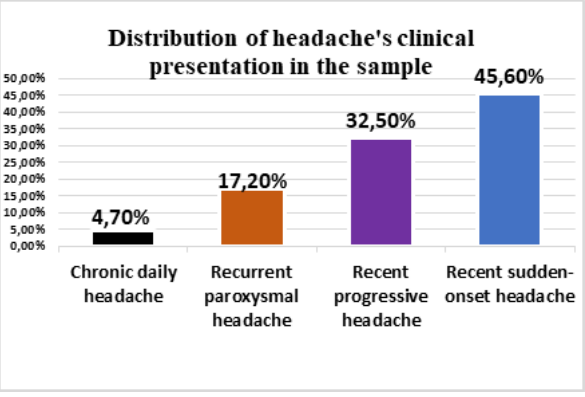

Figure 2: Clinical presentation of headaches in patients.

Headache was associated to an abnormal neurological examination in 72.8% (n= 123) of cases, fever in 20.7%

(n= 35), and there were no associated clinical symptoms in 5.3% of cases.

There was a notion of hypertension in 21.3% of cases (n= 36), HIV in 10.1% of cases (n= 17), and past history of stroke in 7.7% of cases (n= 13).

In 40 cases (23.7%), an acquisition after iodinated contrast medium injection was performed.

In 38.5% of cases, CT findings were normal. CT-scan revealed 4 cases (2.4%) of incidental findings, represented by 2 cases of cerebral calcifications, 1 case of sinus polyp, and 1 case of arachnoid cyst. CT revealed in 59.2% (n= 100) of cases the cause of headache disorder.

These causes were dominated in non-traumatic headaches by stroke (13.6%), followed by sinusitis (12.4%), encephalitis and abscesses (7.1%). Strokes were haemorrhagic in 16 cases and ischemic in 7 cases.

Aetiologies of headaches disorders secondary to minor brain trauma were dominated by intracranial haemorrhages (25%), followed by skull fractures (14.2%). Intracranial haemorrhages were intraparenchymatous haemorrhage in 18 cases, sub-dural haemorrhage in 14 cases, extra-dural haemorrhage in 7 cases, and intraventricular haemorrhage in 3 cases. **The table I** shows the distribution of aetiologies of headache disorder in our sample illustrated by **figures 3, 4 and 5**.

Table I. Aetiologies of headache disorder according to CT-scan results.

Aetiologies of headache disorder		n	%
Infectious	Sinusitis	21	12.4
	Encephalitis	7	4.1
	Cerebral abscess	5	3.0
Vascular	Haemorrhagic stroke	16	9.5
	Ischemic stroke	7	4.1
	Cerebral oedema	2	1.2
Tumoral	Primitive tumor	7	4.1
	Cerebral metastasis	1	0.6
Traumatic	Skull fracture	24	14.2
	Intraparenchymatous haemorrhage	18	10.7
	Sub-dural haemorrhage	14	8.3
	Extra-dural haemorrhage	7	4.1
	Intraventricular haemorrhage	3	1.8

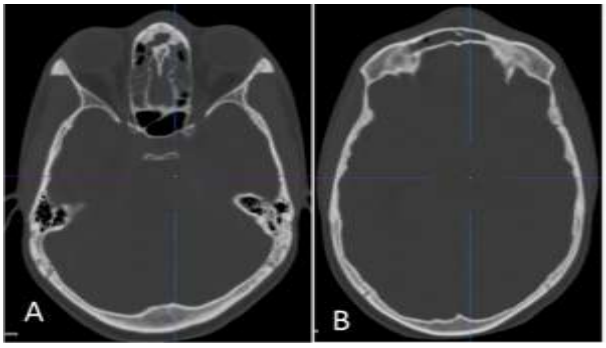

Figure 3: Patient aged 24 years, headache and fever. Brain CT-scan show fronto-ethmoidal acute sinusitis.

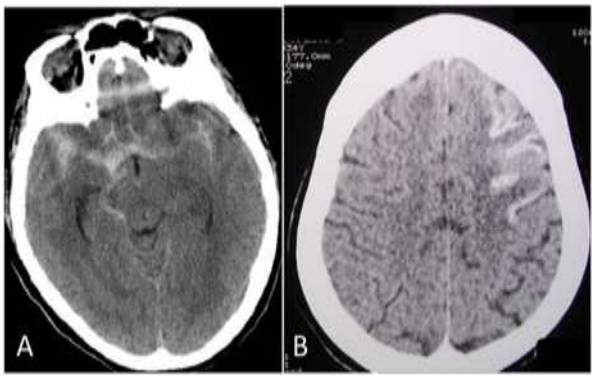

Figure 4: patients aged 45 (A) and 34 (B) years, thunderclap headaches and hypertension. Unenhanced Brain CT-scan subarachnoid haemorrhage caused by aneurism of Willis polygon (A) avec cortical arteriovenous malformation (B).

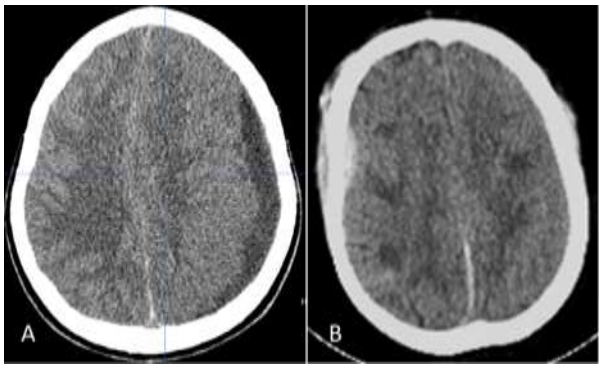

Figure 5: Chronic subdural hematoma (A) in 53-year-old female with history of moto-bike accident and minor extra-dural hematoma (B) in a 21-year-old boy with headache after a public highway accident.

4. Discussion

Men were predominant in the sample, with a proportion of 56%. It seems to have a relationship between the gender predominance and the proportion of post-traumatic headache in a sample because, **Ndabahweje**

and al which included headaches posterior to brain trauma in their sample equally showed a male gender predominance [14]. **Isyaku and al** in their research on CT-scan findings after brain traumas also showed a male gender predominance with a sex ratio of 2.5 [15]; nevertheless, in samples accounting a low proportion or no case of post-traumatic headaches, there was a female gender predominance [3,16]. The study sample was mainly young adults with an average age of 43 years, and extremes from 18 to 90 years. These results are the same than those described in many literatures. The most represented range of age was 20 to 39 years. **Kouame and al** rather found 40 to 49 years [3] and noted that their sample accounted 8% of brain traumas. It is related to the fact that brain traumas and their consequences are mainly underwent by young adults before 40 years, such as **Isyaku and al** showed [15]; so, the more is the proportion of brain trauma the more the predominant age range is young like in our sample which accounted for a tierce of cases of brain trauma.

Public highway accident was the cause of 82.5% of minor brain trauma. In the study or **Mbongo and al**, it is also predominant with 70% [17]. The low development of countries in sub-Saharan leads to a deficiency of asphalted ways, existent ways are dilapidated and badly conditioned, and the traffic is anarchic and dominated by moto bike drivers who daily do not respect the code of road. This inventory of fixtures has made the bed of the increase of public highway accident frequency this last years, which is now a real public health problem in those countries by his high prevalence. In occidental countries with greater level of development, automobile accidents are less frequent like showed by **Kelly and al**, which found a prevalence of 16.2% in more developed countries [18].

Recent sudden-onset headache followed by recent progressive headache were the headache's clinical presentation which mostly induced head CT-scan requests in our study. These were described respectively by 45.6% and 32.5% of patients. The study of **Sonhaye and al** showed similar observations [16]. According to the literature, acute headache presentation, alone, or associated with others clinical signs denominated as "red flags" are warning signs that might lead physicians to suspect a serious intracranial pathology like tumors and intracranial bleeding and order CT-scan or MRI [1,8,19]; On other hand, acute headache disorders are still a source of worry for the patients which subsequently ask to the physician to order neuroimaging in order to alleviate their anxiety, and for physicians too, due to the fear of missing a serious intracranial morbid process [1,7,20].

In our study, the associated signs were abnormal neurological examination in 72.8%, fever in 20.7%, and in 5.3% of headaches, there were no associated signs. Additionally, there were a notion of hypertension in 21.3%, HIV infection in 10.1%, and past history of stroke in 10.1% of cases. **Kajal and al** showed that abnormal neurological examination in headache patients were correlated to significant findings on head CT-scan [21]; so, the high prevalence of patients having an abnormal neurological examination could explain the prevalence of 59.2% of significant brain findings on head CT-scan. On other hand, hypertension and past history of stroke are major cardiovascular risk factors of which occurrence could explain the predominance neurovascular disorders in our sample [22]. Additionally, the HIV/AIDS pandemic in sub-Saharan Africa has led to the emergence neurological opportunistic infections such as brain abscesses and encephalitis of which clinical manifestation is main headache disorder [16,23].

The role of neuroimaging in headache is recognized by all. But its systematic use in the presence of headache is controversial [24–26]. Our study, although prospective has not considered the clinical criteria of the feasibility or not of neuroimaging. All examinations requested for headache whatever the motive have been taken into account. These examinations consisted of the performance of a head CT scan without and after iodinated contrast medium IV-injection according to the case. No other neuroimaging was performed in our study. MRI, considered as the best diagnostic means of headaches was not possible for two reasons. Firstly, it is a costly examination and it is little available. Then in our country we only have MRI of low fields; which limits its diagnostic efficacy. Secondly, we can't communicate directly with the attending physician. We can do it only by a written report in which we have sometimes suggested MRI in addition. Patients with normal headache and with a normal scanner are mostly ambulant [3].

The prevalence of abnormal findings was 61.5% which is contrast with literature. We noted that most studies on headaches disorder and computed tomography excluded headache disorder due to brain trauma. However, considering the evidence that neuroimaging is justified in patients with headache disorder when there is

suspicion of secondary headache, International classification of headache disorders in the third edition classifies post-traumatic headaches in the ranging of secondary headaches, so that needing neuroimaging examination [27]. The proportion of post-traumatic headache in our study seems to be the main reason of this high prevalence of abnormal CT-scan findings.

The prevalence of incidental findings was 2.4% with 2 cases of cerebral calcifications, 1 case of sinus polyp, and 1 case of arachnoid cyst. This result contrasts to **You and al** in Canada, who found 21.8% of incidental findings [13]. This makes the consideration of disparities in health care policies between sub-Saharan Africa and high economic income countries where health care access is easier, leading to overuse of neuroimaging for investigating headache disorder [28].

In non-traumatic headache patients, the CT-scan profile of findings was predominated by stroke (13.6%), sinusitis (12.4%), abscesses and encephalitis (7.1%). These results are similar with the literature [3,16]. In the literature, brain tumours are rare; we found 7 cases of primitive tumour (4.1%) and 1 case of cerebral metastasis. **Ndabahweje and al** showed similar results with 4.1% [14] and **Onwuchekwa and al** found no case in their study [29].

In patients experiencing headache disorder after minor brain trauma, head CT-scan mainly found intracranial haemorrhages in 25% and skull fractures in 14.2%. these results are similar with the literature [17,18]. It could be explain by the fact that skull fractures are mainly caused by high energy impact; yet, most cases of minor brain trauma show low energy impact mechanism which lead mainly to vascular and parenchymal injuries but are not sufficient to cause skull fracture.

5. Conclusion

Our study showed epidemiological and clinical profile of adult patients undergoing CT-scan for headache disorder, and the organic pathologies discovered in sub-Saharan Africa. Headache, a symptom commonly explored in neuroradiology, affects in sub-Saharan Africa, particularly the Cameroon, young patients on average from 43 years and mostly males. Public highway accidents are the main cause of post-traumatic headache disorder, 78.1% patients underwent head CT-scan for acute headache disorders isolated or with associated signs. Head CT-scan revealed causes of headache disorder in 61.5% of cases; which were by decreasing order of frequency stroke, sinusitis, encephalitis and abscess in non-traumatic condition. After minor brain trauma, it was intracranial haemorrhages and skull fractures. MRI being the gold standard in neuroradiology we believe it is essential to perform same studies with MRI especially for the cases where CT-scan were normal in presence of abnormal neurological examination.

Conflict of interest

None of the authors have a conflict of interest with regard to the work in the manuscript.

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