

**COMPUTED TOMOGRAPHY HEAD FINDINGS AMONG ADULTS WITH
CHRONIC HEADACHE IN RELATION TO OTHER NEUROLOGICAL
SYMPTOMS AT MTRH, ELDORET – KENYA.**

BY

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**A RESEARCH THESIS PRESENTED TO THE SCHOOL OF MEDICINE IN
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DECLARATION

I declare that this is my original work and has not been presented in any other university or institution for an award of a degree or any academic credit. No part of this work may be reproduced or transmitted in any form without prior permission from the author or Moi University.

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DEDICATION

I would like to dedicate this study to my loving wife Nasra for her unwavering support and commitment. To my daughter Sumeya, and son Suheyb for they are a source of inspiration and laughter even at difficult times. To my parents and my brother Ismail for their unlimited support and love, and above all the almighty Allah for his guidance through the entire process

To you all, I truly appreciate

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LIST OF ABBREVIATIONS

ALARA	As Low as Reasonably Achievable
ACR	American College of Radiologist
AVMs	Arterio-Venous Malformations
CECT	Contrast Enhanced CT
CT	Computed Tomography
HIS	International Headache Society classification
IREC	Institutional Research and Ethics Committee
KNH	Kenyatta National Hospital
MMED	Masters of Medicine.
MRI	Magnetic Resonance Imaging
MTRH	Moi Teaching and Referral Hospital
NCECT	Non Contrast Enhanced CT
PACS	Picture Archiving and Communication System
SAH	Sub-Arachnoid Hemorrhage
SIGN	Scottish Intercollegiate Guidelines Network
US	United States
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Head - In vertebrates, the part of the body containing the brain and the organs of special sense.

Chronic headache Headache occurring for 15 or more days in a month for at least three months (**Olesen J.et al.2006**).

Neurological symptoms – Is defined in the context of symptoms that are commonly associated with chronic headache commonly referred to as RED FLAGS. It is adopted from a screening tool approved by many accredited professional bodies (elaborated in the literature review)

Normal head CT. Shows usual expected CT attenuation, configuration and size of various brain and bone window anatomy.

Abnormal head CT demonstrates structural pathology

ABSTRACT

Background: Headache is one of the commonest presenting complaints among patients in both emergency departments and general outpatient clinics and affects all people regardless of age, gender and race. Chronic headache is defined as headache occurring for 15 or more days in a month for at least three months. Computed Tomography (CT) has been the modality of choice for investigating patients with chronic headache because it is quick, accessible, easily available and relatively affordable. Majority of patients with chronic headache only, usually have normal CT examination unlike those with other additional neurological symptoms

Objective: To describe the pattern of CT scan head findings among adults presenting with chronic headache and describe the difference in CT findings in patients with chronic headache only and those with chronic headache and other neurological symptoms at MTRH, Eldoret. Kenya

Methods: This was a cross sectional study done at CT scan room in the Department of Radiology and Imaging at MTRH, Eldoret between September 2017 and August 2018. Ninety six (96) consecutive patients with chronic headache irrespective of presence or absence of other neurological symptoms were done head CT scan according to MTRH protocol. Upon obtaining an informed consent, Socio-demographic data and clinical symptoms were captured using a questionnaire while CT findings were recorded on standardised reporting form. All the images were reviewed by principal investigator and verified by two consultant radiologists. Analysis was done using STATA/MP Version 13. Categorical variables were summarized as frequencies and percentages while continuous variables as mean, median and standard deviation. Association between categorical variables were assessed using Pearson's chi-square. A p - values less than 0.05 was considered statistically significant. Results were presented using graphs, tables and charts.

Results: The age range of the studied patients was 18 – 80 years with a mean of 41.1 ±15.9 years and female preponderance (54.2%). In general, majority of the patients with chronic headache were found to have normal head CT scan (n= 52, 54.2%). For the abnormal CT scan head findings, intracranial (n=21, 47.7%) and extracranial (n=23, 52.3%) lesions were nearly equal in distribution. Vascular lesions (33% - ischaemic infarct and vascular haemorrhage) and brain atrophy (29%) were the two common intracranial finding. Sinusitis (82.6%) was the commonest extracranial finding with maxillary preponderance (69.6%). Thirty (90.9%) out the 33 cases who presented with additional neurological symptoms had positive yield on CT scan compared to 14(22.2%) out of 63 cases who presented with chronic headache only ($\chi^2=41.15$, $p < 0.001$).

Conclusion: (1) Sinusitis was the commonest finding with maxillary sinus being the most affected (69.6%). (2) There was a higher abnormal yield on head CT when a patient presented with chronic headache in addition to other neurological symptoms compared to those presenting with chronic headache only.

Recommendation: Higher index of suspicion of abnormal findings on CT scan of the head advised when a patient presents with chronic headache plus other neurological symptoms

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Headache is defined as diffuse or focal pain in various parts of the head, with the pain not confined to an area of a nerve distribution, (Couchman, Forjuoh et al. 2004).

Chronic headache is defined as headache that persists for 15 or more days every month for a period of 3 months or more (Steiner 2004).

Headache is one of the commonest presenting complaints in general outpatient clinics and is ranked among the tenth most disabling conditions worldwide according to World Health Organization, parameters (Stovner and Andree 2010).

On the global burden of headache, a prevalence of 50% has been reported in Asia, Australia, Europe, and North America (Stovner, Hagen et al. 2007). In Africa, data on headache prevalence is sparse, with a study done in rural Tanzania revealing the 1-year prevalence of headache as 23.1% (Dent, Spiss et al. 2004) while in Ethiopia, any headache prevalence was at 44.9, and that of chronic headache, 3.2% was documented by (Zebenigus, Tekle-Haimanot et al. 2016). In Zambia: prevalence of any headache was 61.6% while chronic headache was 11.5% (Mbewe, Zairenthiama et al. 2015).

The most important tools in the diagnosis and treatment of headache disorders are detailed reports on the patient's history and general physical examination with special emphasis on careful clinical neurological examinations. However, other authors have advocated for additional paraclinical investigation owing to the multiple etiological factors of chronic headache, and the diagnostic challenge it possess to the clinicians.

Thus neuroimaging investigation becomes an integral part if not mandatory. (Sandrini, Friberg et al. 2011).

With regards to hypertension related hypertension both Farhad Assarzadegan et al 2013 in Iran and American Heart Association agree that severe hypertension results interference of blood brain barrier and leakage of blood from adjacent vessels to the brain parenchyma subsequently resulting brain eodema.

According to a study by Gill – Gouveia et al 2003 in Portugal, headache associated with refractive errors was rarely identified in individuals with refractive errors. However, in those with chronic headache, proper correction of refractive errors significantly improved headache complaints and did so primarily by decreasing the frequency of headache episodes.

Radiological examinations are often considered in patients with chronic headache as patients fear they may have a serious illness. Since such examinations are not particularly invasive or uncomfortable and as they detect any intracranial pathology present, the threshold for requesting them is therefore low. Moreover when deciding to use radiological techniques to aid diagnosis in patients with headache, one should consider the likelihood of detecting underlying diseases (Rasmussen 2001).

The two main neuroimaging modalities available for evaluation of the various causes of headache are computed tomography (CT) and magnetic resonance imaging (MRI). CT, by virtue of its ubiquity, ease of use, speed, and relatively lower cost, is usually the first investigation to be requested in cases of chronic headache.

Clinicians frequently request neuroimaging mainly for diagnostic certainty, thus avoid missing a potentially treatable pathology, for medico legal concerns and more

fundamentally to address patient's and relative's concern and anxiety. This has therefore led to its indiscriminate use, leading to increasing radiation exposure to the patients and increasing healthcare cost. Furthermore, multiple earlier studies have shown that in the vast majority of patients with chronic headache and normal neurological examination, CT scan may be normal (Frishberg, Rosenberg et al. 2000)

The other side of the issue is the ethical dilemma of whether it is correct to deny a patient an investigation which can potentially lead to diagnosis of a life-threatening disease, e.g. a brain tumour. (Hawasli A, .et al 2014). This study therefore aims to evaluate the value of CT scan among adults presenting with chronic headache irrespective of the presence or absence of other neurological symptoms.

1.2 Problem Statement

Chronic headache is a worldwide problem, affecting 1.7–4% of the world's adult population (WHO fact sheet 2012). It has a global prevalence of 50% reported in Asia, Australia, Europe and North America.(Stovner, Hagen et al. 2007)

CT scan is commonly used in the evaluation of patients with chronic headache.

Majority of the patients referred for head CT scan have been shown to have normal findings. Some authors argue that there is a higher yield for abnormal findings in head CT in patients with chronic headache in addition to other neurological findings (Gowda and Babu 2016) . On the other hand, other studies showed that there is high diagnostic yield of CT in patients with chronic headache without neurological symptoms or focal neurological deficit (Ezeala-Adikaibe, Ohaegbulam et al. 2011) .

CT scan of the head is an investigation frequently carried out for patients with chronic headache in our settings (100 cases in the year 2016 at MTRH). Majority of these lack

additional neurological symptoms and their head CT scans are mostly reported normal or have clinically insignificant findings.

Hence there is need to determine the patterns of CT scan head in our settings and also the yield for abnormal findings for patients with chronic headache only against those with chronic headache in addition to other neurological symptoms.

1.3 Justification

CT has been the modality of choice for investigating patients with chronic headache because it is quick, accessible, easily available and relatively affordable.

Several Studies have shown the present CT scanners have higher resolution and they acquire volumetric data instead of axial slices with inter-slice gap as used in the older generation scanners. This has increased the positive yield in patients with chronic headache. In addition, there is a wide geographical variation in head CT scan findings among patients with chronic headache due to difference in endemicity of the etiology (Kumari, Kumar et al. 2017) and (Imarhiagbe and Ogbeide 2011)

Chronic headaches are a frequent presenting symptom among patients, with CT scan frequently used as the first line of imaging. This is evidenced by data from (Gupta, Khandelwal et al. 2015) which showed that in a single facility within a period of 2years (2011-2013) a total of 2498 head Ct scans were done for chronic headache following referral from various departments. In addition, at MTRH in the year 2016, 100 patients with chronic headache were referred for CT scan. Despite the regular use of CT scan for patients with chronic headache in our settings, there is paucity of data on the pattern of head CT scan findings.

Currently available local studies offer only limited guidance on neuroimaging of chronic headache patients. The aim of this study is to estimate the frequency of significant pathology in patients with chronic headache and to determine the

likelihood of identifying abnormal findings on CT head in patients with chronic headache only vis-à-vis those with chronic headache in addition to other neurological symptoms.

The data from this study will highlight the burden of study subject and also help us understand the patterns of CT scan findings among adults with chronic headache in our catchment area, ultimately contributing to improving the diagnosis and lay a foundation for an institutional neuroimaging protocol or guidelines in the future.

1.4 Research Question

What are the patterns of CT scan head findings among adults presenting with chronic headache in relation to chronic headache with additional neurological symptoms at MTRH Eldoret, Kenya?

1.5 Research Objectives

1.5.1 Broad objective

To assess the pattern of Computed Tomography (CT) head findings among adults presenting with chronic headache in relation to chronic headache with additional neurological symptoms at MTRH, Eldoret -Kenya

1.5.2 Specific objectives

1. To describe the Pattern of CT scan head findings among adults presenting with chronic headache at MTRH
2. To describe the difference in CT findings between those with chronic headache only and those with chronic headache and other neurological symptoms at MTRH

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Headache is an almost universal experience and one of the most common symptoms in medical practice. It varies from an infrequent and trivial nuisance to a pointer to serious disease (Wong, Wong et al. 1995).

Chronic headache is defined as “headache occurring for 15 or more days in a month for at least three months (Olesen, Bousser et al. 2006). It is one of the common complaints encountered in day-to-day neurological practice. However, when the headache becomes recurring or chronic, neurophysician consultation is often sought.

In a document on the global burden of headache, a prevalence of 50% has been reported in Asia, Australia, Europe, and North America (Stovner, Hagen et al. 2007).

Life time prevalence of headache in United Kingdom is 93%. Work, home life and social activities are affected in 43% of headache patients and 20% have at least moderate headache related disability (Wong, Wong et al. 1995). The incidence and prevalence of headache in the Indian subcontinent have not been adequately researched. ((Rao, Kulkarni et al. 2012). There is sparse data in the epidemiology of headache disorders in sub-Saharan Africa. (Haimanot 2011).

Headache is a symptom that is multifactorial in aetiology. Some of the common triggers include alcohol, particularly red wine, heavy caffeine consumption and certain foods, such as processed meats that contain nitrates, changes in sleep or lack of sleep, poor posture, skipped meals and stress.

2.1.2 Diagnosis

The most important tools in the diagnosis and treatment of headache disorders are, without doubt, careful clinical neurological examinations and detailed reports on the patient's history and symptoms. Application of the diagnostic criteria of the International Headache Society (IHS) Classification is critical and can lead to the most probable diagnosis that allows adequate treatment. (Olesen and Steiner 2004).

However in many cases, particularly when the headache presents as atypical with dynamic clinical features or as a symptom of another primary illness, clinicians find it necessary to supplement the clinical work up of the patient with neuroimaging investigations. Moreover, differential diagnosis of chronic headache presents several difficulties, and neuroimaging investigation is invariably mandatory. (Sandrini, Friberg et al. 2011).

According to a study by Gill – Gouveia et al 2003 in Portugal, headache associated with refractive errors was rarely identified in individuals with refractive errors. However, in those with chronic headache, proper correction of refractive errors significantly improved headache complaints and did so primarily by decreasing the frequency of headache episodes.

Radiological examinations are often sought in patients with chronic headache. Most headache sufferers seeking medical attention fear they may have a serious illness and will often request a radiological investigation.

Computed tomography (CT) is a medical imaging technique used to aid diagnosis and to guide interventional and therapeutic procedures. It uses ionizing radiation that allows rapid acquisition of high resolution three dimensional images thus providing cross-sectional images of the brain. This imaging modality is non-invasive although

an intravenous contrast agent is sometimes required to enhance suspected pathologies (Levin 2008). As such CT head plays a vital role in the diagnostic evaluation of chronic headache by detecting any abnormality.

Moreover, CT is less expensive, easily available and almost as accurate as MRI in detecting clinically significant intracranial lesions thus plays a critical role in the diagnosis of chronic headache with suspected intracranial pathology, and therefore the threshold for requesting it is low. However, when deciding whether to ask for CT in patients with headache, one should consider the likelihood of detecting underlying diseases (Rasmussen 2001).

Although majority of the patients who present with chronic headache have no neurologic abnormality, many patients undergo evaluation with computed tomography (CT) and more recently, magnetic resonance imaging (MRI) to exclude underlying abnormalities (Tsushima and Endo 2005)

Studies that have been done so far show that CT is of extremely low yield in patients who undergo imaging for chronic headache without neurologic signs and symptoms (Subedee 2011). MR imaging, which is more sensitive than CT in detecting intracranial abnormality ((Haughton, Rimm et al. 1986), has also been found to be unrewarding in evaluation of chronic or recurrent headache without neurological abnormality (Tsushima and Endo 2005). Yet patient's demand for thorough and sophisticated imaging evaluation coupled with the low threshold among doctors for requesting these investigations has accelerated the use of CT and MRI despite the evidences against their use.

Most patients with chronic headache due to intracranial pathology have alarming clinical features referred to as “red flags.” These are constellation of signs and symptoms that act as screening tool to help in identifying those who benefit from neuroimaging. These steps not only increase yield, but also limit cost as well as burden in health care system. These include presence of focal neurological symptoms or findings, abrupt onset, alteration of headache characteristics, increasing intensity and frequency, persistence despite analgesics, nausea and vomiting, features of systemic illness, paralysis, confusion, loss of memory, and altered level of consciousness among others.

Numerous accredited organizations and professional bodies, notably European Federation of Neurosurgical Societies, Appropriateness Criteria for Headache (ACR), Institute for Clinical Systems improvement, Scottish Intercollegiate Network and American Academy of Neurology among others approve the use of RED FLAGS as an appropriate screening tool for chronic or recurrent headache with a potential underlying aetiology, thus the need for neuroimaging such as CT scan.

Appropriate selection of patients with chronic headache for neuroimaging is important. According to the Scottish Intercollegiate Guidelines Network (SIGN) and other accredited professional bodies aforementioned above, the patient’s history forms the most critical part in making diagnosis of headache. It is important therefore to identify patients with "red flags" that come to light during the history and physical examination for recurrent or chronic headache with potential underlying pathology that need further diagnostic evaluation especially neuroimaging. The red flags include:

- Onset of new or different headache
- Nausea or vomiting
- Worst headache ever experienced
- Progressive visual or neurologic changes
- Paralysis
- Weakness, ataxia, or loss of coordination
- Drowsiness, confusion, memory impairment, or loss of consciousness
- Onset of headache after age of 50 years
- Papilloedema
- Stiff neck
- Onset of headache with exertion, sexual activity, or coughing
- Systemic illness
- Numbness
- Asymmetry of papillary response
- Sensory loss
- Signs of meningeal irritation

While cases of severe acute headaches should expectedly have emergency CT scan to exclude significant causes like subarachnoid haemorrhage and space occupying lesions, in chronic headaches and where the clinical signs are not clearly defined or are difficult to elucidate, the opinion of a neurologist should be sought (Clinch 2001).

Neuroimaging may relieve the patient's as well as relative's anxiety about having an underlying pathologic condition; therefore, neuroimaging may improve patient overall satisfaction and medical care (Magambo 2012). Various guidelines have been developed on neuroimaging and chronic headache. An example of these includes one developed United States Headache Consortium (mainly composed of academic neurologists). The aim of these guidelines is to develop scientifically sound, clinically relevant protocols on chronic headache in the primary care setting.

2.2 Review of past studies

2.2.1 Pattern of CT scan findings in chronic headache

Studies before 1991 on the yield of CT imaging in patients with headache but normal neurologic examination were reviewed. (Frishberg, Rosenberg et al. 2000). Most of the larger ones were performed with first-generation CT. Of 897 studies of migraine patients, only 4 were positive, (3 tumours, 1 AVM), a 0.4% yield of potentially treatable lesions. In patients with unspecified headache, 1825 scans yielded 43 lesions (21 tumours, 8 hydrocephalus, 6 AVMs, 5 subdural hematomas, and 3 aneurysms). (Rasmussen 2001)

A study done at Memfys Hospital and University of Nigeria Teaching Hospital in Enugu, Nigeria by Aziela Adikaibe et al in which the CT scan findings of 50 participants with chronic headache without obvious neurological deficit were retrospectively reviewed. Of the 70 cases, 31 (44.2%) had positive CT scan yield while the rest of the cases were normal. Notable findings included hydrocephalus, Tumours aneurysm and AVM among other findings. The study concluded that there was a high diagnostic yield of CT in patients with chronic headache without focal neurological deficit.

Another study was done in Tanzania by Magambo. M. among patients presenting with headache. A total of 85 participants, (47 Females and 38 Males) were studied and had CT scan done. Out of 85 CT scans done, 27 cases showed to have significant findings. The prevalence of positive scans was 31.8%. The commonest abnormal CT findings was sinusitis (9.4%), with brain atrophy coming second (4.7 %). there were primary brain tumour (2.5%). and cerebral infarcts (3.5%),

This study had more clinically significant intracranial findings. This could possibly be explained by the fact that the Tanzanian study was looking at all cases of headache disorders and irrespective of the presence or absence of neurological symptoms. There was strong correlation between clinical diagnosis and CT scan findings in a number of clinically significant intracranial lesions in the Tanzanian study. There was negative correlation between clinical diagnosis and cerebral infarct on CT scan

In Nigeria a study was done by Frank A. et al 2011, where the objective was to establish whether patients with chronic or recurrent headaches should have neuroimaging (CT scan) before being referred to a neurologist. All CT scans were reviewed by a specialist radiologist. The study showed that the yield for positive results was too low if neuroimaging was done before referring these patients to a neurologist and recommended that, these patients should be referred to the neurologists first before neuroimaging (Stovner and Andree 2010).

Other studies in support of the above findings alluded that while cases of severe acute headaches should expectedly have emergency CT scan to exclude underlying pathological causes like subarachnoid haemorrhage and space occupying lesions, in chronic and recurrent headaches and where the clinical signs are not clearly defined or are difficult to elucidate, the opinion of a neurologist should be sought (Clinch 2001).

A similar study was done by Anish Subedee 2012 in Nepal whose objective was to find out the proportion of intracranial abnormalities in patients with chronic headache with normal neurological examination using computed tomography (CT) and compare the findings with previously done similar studies.

CT images of 56 patients with chronic headache and normal neurological findings were reviewed retrospectively. In 38 of 56 patients, both plain and contrast enhanced

CT were done. Patients were divided into three groups according to the CT findings. Those with no abnormality, those with minor abnormality (that did not alter patient management) and those with clinically significant abnormality. Proportion of patients in each group was determined and results were compared with previous studies with similar study design. The results were as follows: 50 had normal CT (89.29 %), four had minor abnormality (7.14%) that did not alter patient management and two had significant lesions (3.57%) that required a new intervention.

In this study contrast enhanced CT did not improve lesion detection. The minor findings detected were sub-ependymal calcifications of tuberous sclerosis, calcified neurocysticercosis and old lacunar infarctions in external capsule. Clinically significant lesions detected were small ring enhancing lesion (neurocysticercosis or tuberculoma) and pineal cyst.

Results of this study were compared with previous study with similar study design. The Z test showed that the difference in proportions in these studies was not statistically significant ($p = 0.0708$ for minor findings and $p = 0.2033$ for significant findings) (Subedee 2012)

Several studies have confirmed the low yield of imaging procedures of isolated headache unaccompanied by other neurologic findings (Jordan, Ramirez et al. 2000). Most of them are retrospective reviews though. A prospective review of 293 CT scans from an ambulatory setting disclosed that most of them were ordered because of suspected tumour (49%) or SAH (9%). Fifty-nine (17%) were ordered because of patient expectation or medico-legal concerns (Becker, Green et al. 1993).

2.2.2 CT scan findings in Patients with chronic headache and other neurological symptoms.

A prospective observational study was done by Pankaj et al in the year 2013 in Nepal in which all head CT of patients presenting with headache were evaluated over a period of 8 months. During the study, 256 patients underwent CT scan of head.

Participants were grouped into two depending on the presence or absence of neurological symptoms and/or signs. Group I (24) represented the cases with headache and any form of neurological symptoms or signs. Group II (232) represented the cases of chronic headache not associated with abnormal neurological signs or symptoms.

They concluded that the CT findings were significant, in those patients who presented with headache and abnormal neurological findings, as compared to those with headache without accompanying abnormal neurological findings. (Nepal, Shrestha et al. 2014).

A similar but retrospective study was carried out by Gupta et al in 2015, in India, on the prevalence of normal and positive CT head findings in a large cohort of patients with chronic headaches. This was primarily done to ascertain the frequency of normal head computed tomography (CT) scans and positive CT scan findings in patients having chronic headache as chief complaint. Head CT scans done over a period of two years were retrospectively evaluated. Based on the CT reports, the patients were divided into two groups: Group A, having chronic headache as the only complaint, and Group B, having chronic headache and additional neurological signs or symptoms. A total of 2498 patient reports were evaluated.

In principle these two studies agreed, and had similar observational outcome where the group of patients who presented with chronic headache as the only chief complaint had higher percentage of normal CT scan findings compared to the second group with both chronic headache and additional neurological symptoms or signs with higher rate of abnormal CT findings.

However there are overt differences between the two studies. The commonest abnormal CT findings in the Nepal study was sinusitis followed by parenchymal lesions whereas in Gupta et al study Calcified granuloma and chronic infarcts were commoner.

Also the duration of the study was different and more importantly the study population was different with the Gupta study involving a much larger sample than the study in Nepal. The study protocol and the CT scans used in Gupta study is well outlined where it was carried out using a 4-slice and 16-slice spiral CT scanners; and 10 mm contiguous slices were taken from foramen magnum to the vertex, which were then reconstructed into 3 mm slices both in soft tissue and bone window. The Nepal study report did not elaborate the study protocol and the type of CT scanner used.

Another study that could be compared with that of Gupta et al is the one done by Mitchell et al. in 1993 to evaluate whether routine CT neuroimaging is necessary in patients with chronic headache irrespective of the presence or absence of neurological findings. They studied 350 patients of which only 2% had CT findings which were clinically significant. They found that an additional 7% of the patients had positive CT findings that were clinically insignificant (do not require change of management plan)

More importantly, all of the patients in their study who had significant CT findings had some neurological finding or abnormal symptom (Mitchell et al. 1993). Its limitation of comparably smaller sample population notwithstanding, this study too, invariably outlined the likelihood of high positive CT scan findings among patients presenting with chronic headache and neurological signs or symptoms.

Overall there were glaring differences between Gupta et al study and the other older studies aforementioned above. The Gupta et al, study detected much more positive head CT scans as compared to previous studies in which they tried to attribute to multiple reasons. The most obvious is the referral bias; in which patients coming to their hospital were those who are usually referred from primary or secondary care centres, which means the significant number of normal patients will be reduced at that level. The second is the fact that present CT scanners have higher resolution and they acquire volumetric data instead of axial slices with inter-slice gap as used in the older generation scanners. This could potentially be another reason. Also, all the scans were reviewed by neuroradiologists instead of general radiologists, which could also explain the higher number.

Manish Kumar et al (October 2015-March 2017) did a prospective descriptive study in India to evaluate the organic causes of headache in patients undergoing computed tomography (CT) scan of the both with or without neurologic signs and symptoms.

A total of 2072 patients were enrolled in this study coming from various departments. Patients were divided into three groups based on CT findings: **Group I** - those with no abnormality, **Group II** those with minor abnormality (not altering the patient management), and **Group III** those with clinically significant abnormality (required alteration of current management protocol).

The CT detected abnormality constituted 9.84% in which major and minor abnormalities were 3.28% and 6.26%, respectively that would require further evaluation or alter previous management protocol.

The conclusion from this study was that the positive yield of intracranial abnormalities detected by the CT scan in this particular study was almost similar to the ones undertaken previously provided normal neurological examinations. In the absence of neurological abnormality, CT scan did not offer any advantages.

CHAPTER THREE

3.0 MATERIALS AND METHOD

3.1 Study Design

This was a prospective cross-sectional study and was carried out within a period of one year- from 1st of September 2017 to 30th August 2018.

3.2 Study Site

The study was conducted at the Radiology and Imaging department of Moi Teaching and Referral Hospital, Eldoret. The Hospital is within Eldoret town, Uasin Gishu County, which is 360 Kilometres North West of Nairobi. MTRH is a level 6 health facility serving as a teaching hospital for Moi University School of Medicine, Nursing, Public Health and Dentistry. Other institutions that utilize this facility include Kenya Medical Training Centre (KMTC), Eldoret and University of Eastern Africa (Baraton) School of Nursing. MTRH is also a training centre for medical, clinical and nursing officer interns. It serves as the main referral hospital for the Western part of Kenya and North rift and has a catchment population of approximately 13 million people. Apart from Radiology and Imaging, the facility has several other Masters of Medicine (MMED) programmes such as Internal Medicine, General Surgery, and Orthopaedics, Child Health and Paediatrics, Reproductive Health, Mental Health among others.

3.3 Study population

The study population were all adults presenting with chronic headache at Moi Teaching and Referral Hospital and referred for head CT scan evaluation.

3.4 Eligibility criteria

3.4.1 Inclusion Criteria

- All adult patients with chronic headache and referred for head CT scan irrespective of absence or presence of neurological symptoms.
- Those who consented

3.4.2. Exclusion Criteria

- Patients with Trauma related chronic headache
- Patients with already diagnosed cases of intracranial abnormality
- Patient who previously underwent intracranial surgery
- Those who declined to consent.

3.5 Sampling Techniques

3.5.1 Sampling method

Consecutive sampling was used in this study. Every adult patient presenting with chronic headache and referred for head CT scan evaluation was approached and requested for informed consent to participate in the study. This was done until the desired sample size was achieved.

3.5.2 Sample Size

Sample size determination

The sample size was determined using the formula below by Fisher et al (1998). The prevalence of positive head CT scan findings among adults with chronic headache in this study was determined using a similar study done in Abuja, Nigeria in the year

2017 by Okechukwu and Ukamaka I. which showed a prevalence rate of (50.9%) for intracranial lesions.

$$n = \frac{z^2 p (1-p)}{d^2}$$

Where,

n = desired sample size.

z = standard normal distribution for CI of 95%. (1.96)

p = known prevalence of positive intracranial lesions on CT scan (50.9%)

d = the level of precision desired.

When this formula is applied at d = 0.5

$$n = \frac{1.96^2 * 0.509(1 - 0.509)}{0.5^2} = 96.$$

The confidence level was set at 95%, power at 95% and precision at 5%.

Therefore a total sample of 96 patients were recruited

3.5. Sampling Procedure

The figure below illustrates patient recruitment schema. Patients presenting with chronic headache with or without neurological symptoms and referred for head CT scan were recruited. All the head CT scans reports whether positive or negative were recorded.

RECRUITMENT SCHEMA

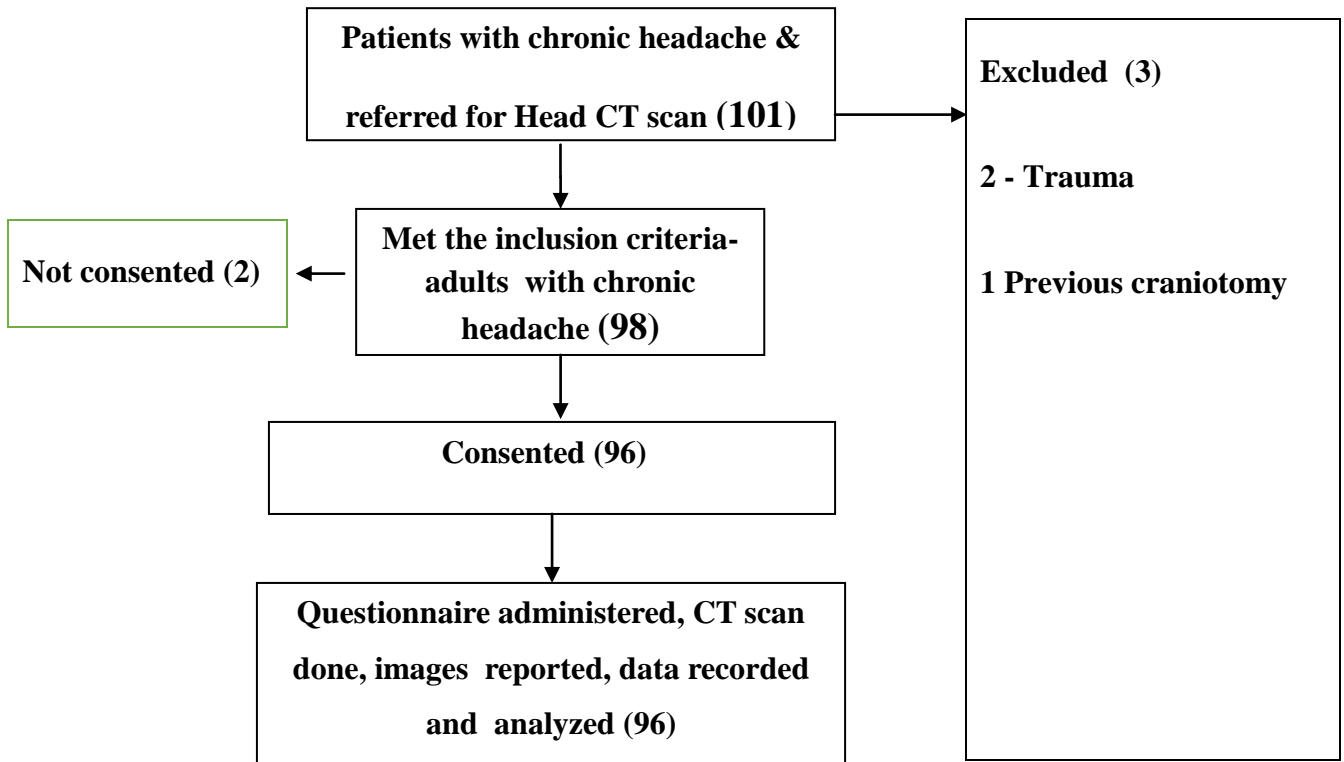


Figure 1. Illustrating the recruitment schema of the study.

3.6. Study procedure.

Clinicians at casualty, Outpatient, Neurosurgery clinic, Medical clinic and Technicians at CT scan room were all sensitized about the study. Adults with chronic headache who were referred for head CT and met the inclusion criteria were recruited into the study after giving an informed consent. Data was collected using structured questionnaires administered to the patient. The participants were taken through neurological symptoms of interest (e. g hemiparesis, dizziness, blurred vision, nausea, vomiting and poor memory). This was undertaken by the principal investigator or a trained assistant. Thereafter Head CT was done, and findings documented

3.7 CT scan head Scanning protocol

The scanning protocol was based on MTRH CT head scanning protocol. Siemens Somatom 32-slice scanner (Siemens Germany) was used to scan all the study participants. Patients were scanned in supine position from base of the skull to the vertex with contiguous axial slices parallel to the inferior orbitomeatal line. Slice thickness of 5mm with a reconstruction at 1.5mm and at a pitch of 1 were employed. Scan parameters were set at 130Kv, 210 mAs and 512x512 matrix.

Contrast was administered to nine (9) cases whose NECT images were inconclusive and therefore required further evaluation using contrast. It was administered based on patients weight (1ml/kg), given at 3.5mls/s using a pump at 3.5 psi, and scan done with a delay scan time of 5sec. Multiplanar reconstructions performed in all cases. Images were reviewed by primary investigator and further verified by two consultant radiologists. Images were electronically sent to PACS. All protocols regarding imaging techniques and radiation safety protection were observed.

3.8 Data Collection and Management

3.8.1 Data collection

Data was collected between September 2017 and August 2018. Entry was made in the questionnaires and later transferred to a computer database. Double entry was used to ensure accuracy of the data. All patient details were kept confidential and data was only available to the investigator and the supervisors via password protection.

Participants were given a copy of their results and had an absolute autonomy over who else their results could be disclosed to. Serial numbers were used in order to

protect patients' identity. At the end of each day data collection forms were verified for completeness and coded (assigning numerical meanings).

3.8.2 Quality control

All CT scans were done at MTRH CT scan room using an internal standardized imaging protocol. The scans were done by the Principle Investigator conducting the study or trained assistants (Radiographers). The images were reviewed by Principal Investigator and verified by two consultant radiologists and result recorded after consensus on the appropriate diagnosis. Images were saved in computer discs and sent Picture Archiving and Communication System (PACS) for further clarification and future reference.

3.8.3 Data Analysis and Presentation

Data was entered in a computerized data base designed in Stata/MP version 13.0. Descriptive statistics was carried out for continuous variables using mean, median and standard deviation. Frequency tables were generated for categorical variables. Inferential statistics were done using Chi-square test to test for significance of socio-demographic characteristics in patients presenting with chronic headache. P-value less than 0.05 was considered significant at the 95 % confidence. Data was presented in Tables, Graphs and Pie-charts

3.8.4 Ethical considerations

Ethical clearance was sought and obtained from IREC and CEO-MTRH before the commencement of data collection. Only the standard imaging protocol for head CT scan was applied to all patients. No additional examination was done on a patient other than the one requested by the primary physician. A consent form explaining the rationale and benefits of the study to the public health system was used to seek

informed consent from potential interviewees. Participation in the study was on a voluntary basis, the participants were at liberty to withdraw from the study at any stage without being penalized. There were no incentives for participating.

The interviews were conducted in a confidential manner; participant names were not recorded. No study participant was identified by name in any report or publication derived from information collected for the study. Data collected was stored in lockable cabinets; databases created were password protected to avoid unauthorized access.

3.8.5 Dissemination of Information

The information from the CT head examination was shared with the patient's primary physician in the form of a written report and images which were printed out, a copy was given to the participant after explanation of the findings.

CHAPTER FOUR

4.0 RESULTS

4.1 Demographics

Data from a total of 96 participants were analysed and showed an age range of 18 – 80 years with a mean age of 41.1 ± 15.9 years. There was a slight female preponderance (54.2%) with male to female ratio of 1: 1.2. More than half (63.5%) of the patients were aged below 41 years with majority of all patients in the 36-41years age range as shown in **Figure 1**.

On the average, the female patients who came for CT scan were older ($\bar{X}=43.5$, SD 2.2) than males ($\bar{X}=38.4$, SD 2.3) however the difference in these averages was not statistically significant ($p = 0.116$).

Those who had abnormal head CT scan findings were significantly ($p= 0.013$) older ($\bar{X}= 45.5$ years, SD =17.8) as compared to those with normal CT scan head findings ($\bar{X} =37.5$ years, SD = 13.3). This was statistically significant as illustrated in **Table 1**

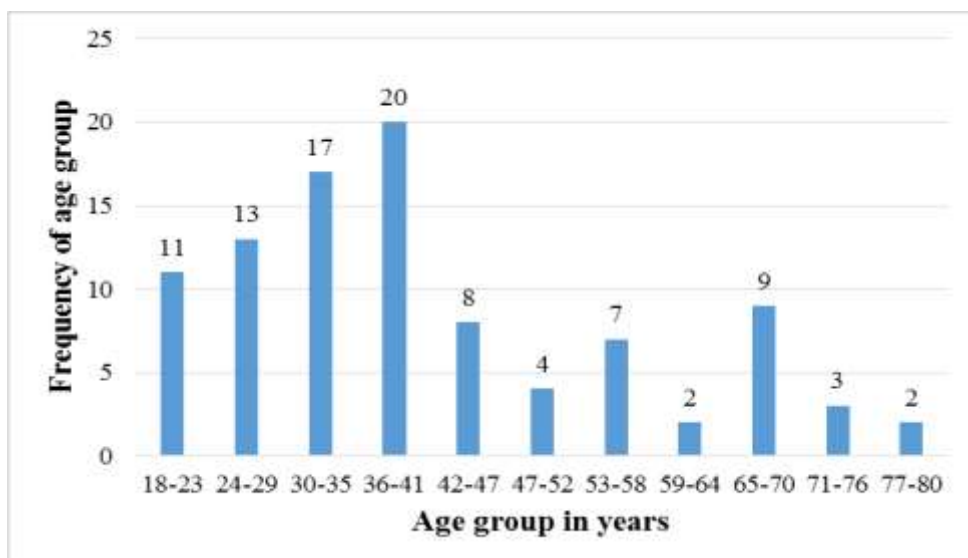


Figure 2: Age group distribution

Table 1: Showing significance of difference in mean age with respect to CT scan findings.

CT findings	N	Mean	SD	p-value
Normal	52	37.46	13.27	0.013
Abnormal	44	45.5	17.78	

Objective 1:

4.2 Pattern of the CT scan findings of the participants

More than half 52 (54.2%) of the patients included in the study had normal head CT scan examination while 44 (45.8%) participants demonstrated abnormal head CT scan.

Of the participants with abnormal CT findings, the most prevalent diagnosis overall was sinusitis, 19(43.2%) cases with maxillary sinus being the commonest paranasal sinus involved. One of the patients with maxillary sinusitis additionally had a hyperpneumatized sphenoid sinus. Other extracranial abnormal CT findings were polyps in 4 patients (9.1%).

Intracranial abnormalities accounted for 21 (47.7%) cases of the abnormal CT examination with brain atrophy 6 (13.6%) being the most prevalent finding. With the exception of one case the rest were age related though. Suspected intracranial tumours were 4(9.1%) cases and 1 (2.3%) case of hydrocephalus. Haemorrhagic events detected in 5(11.4%) patients. There were 2(4.5%) cases of ischemic CVA while infective/inflammatory lesions occurred in 3 (6.8%) patients with a single case of meningitis and 2 cases of cerebritis. See **figures 3, 4, 5** and **Table 2**

Table 2: Distribution of CT scan findings

Final CT diagnosis	Frequency	Percent
Normal	52	54.17
Intracranial lesions		
Tumours (Radiological diagnosis)		
Diffuse astrocytoma	1	1.04
Meningioma	2	2.08
Pituitary macroadenoma	1	1.04
Inflammatory		
Cerebritis	2	2.08
Meningitis	1	1.04
Vascular(Infarcts/Haemorrhagic)		
Ischaemic infarcts	2	2.08
Haemorrhagic		
Intracerebral haemorrhage	1	1.04
Subarachnoid haemorrhage	2	2.08
Subdural haematoma	2	2.08
Degenerative		
Brain atrophy	6	6.25
Others		
Hydrocephalus	1	1.04
Paranasal sinus lesions		
Sinusitis	19	19.79
Polyp	4	4.17
Total	96	100

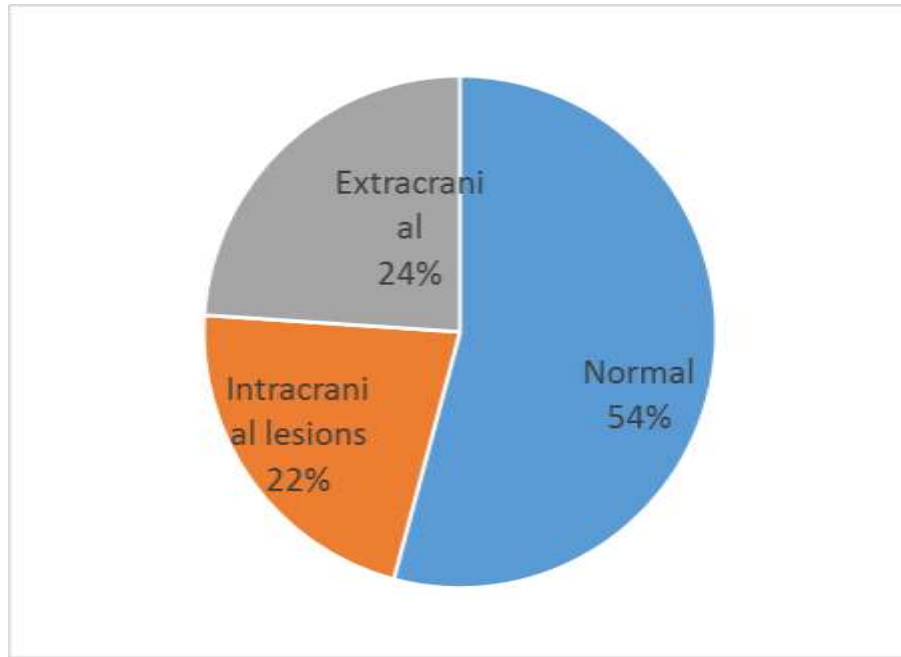


Figure 3: Distribution of normal and abnormal CT scan findings

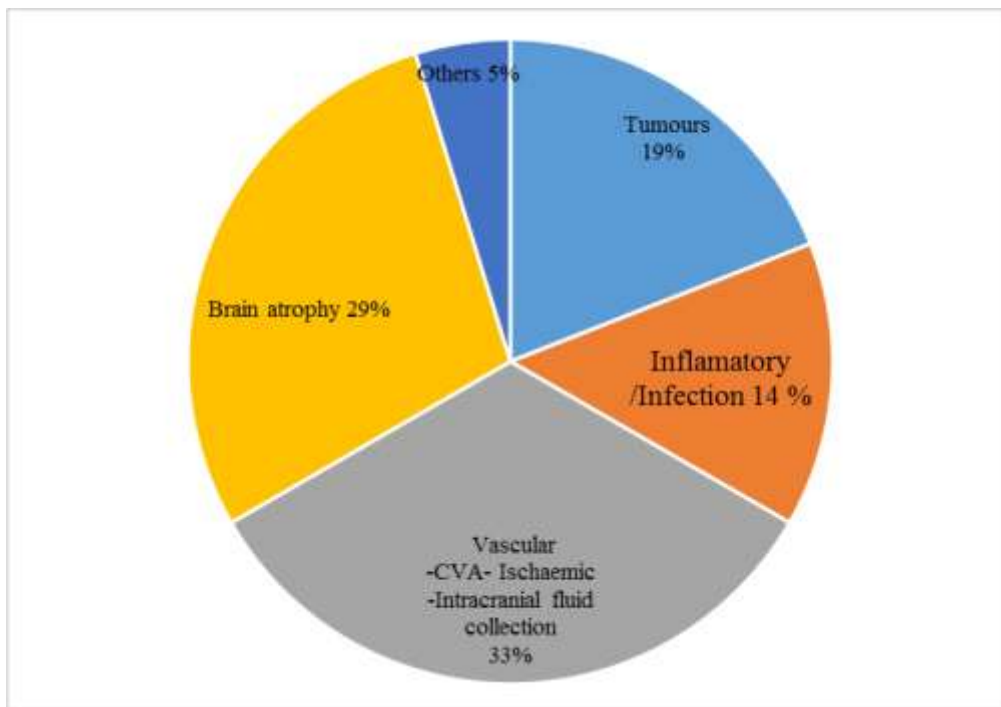


Figure 4: Distribution of abnormal intracranial CT scan findings

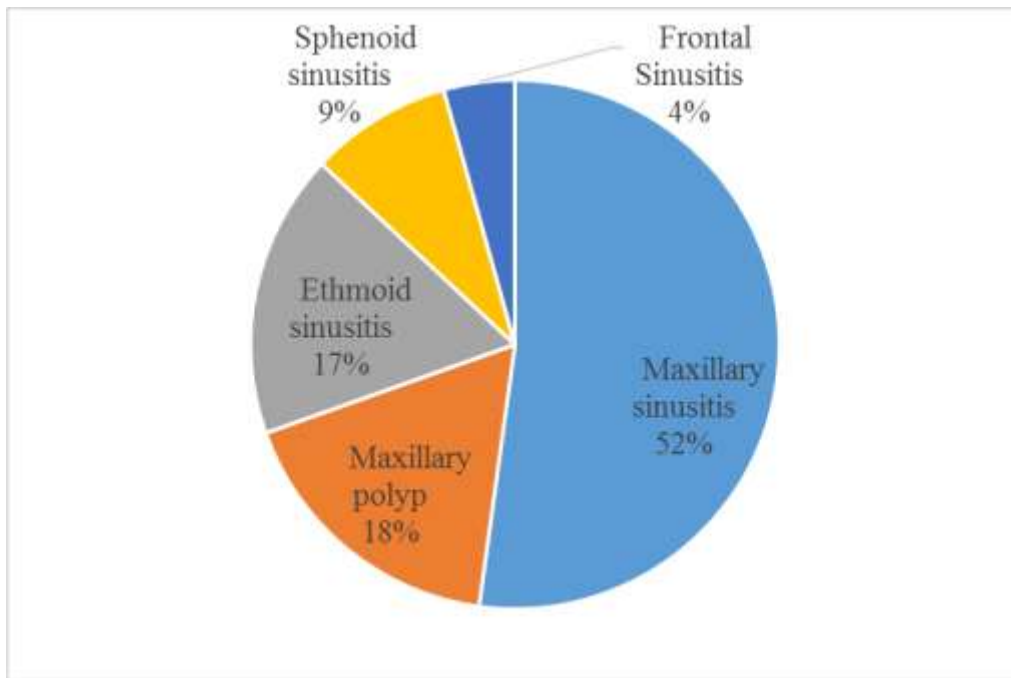


Figure 5: Distribution of paranasal sinus abnormal CT scan findings.

Four of the patients in the study had more than one abnormal finding on CT. Of the 6 patients with brain atrophy, one additionally had a subdural haematoma; while three of the 20 patients with sinusitis had other findings: 1 had cerebral atrophy, the other had a subdural haematoma while the third had hyperpneumatization of the frontal sinus as documented in **Table 3**

Table 3: Participants with more than 1 abnormal CT findings

CT diagnosis	Brain atrophy	Subdural haemorrhage	Hyperpneumatization	Total
Brain atrophy	0	1	0	1
Sinusitis	1	1	1	3

Objective 2:

4.3 Presented neurological symptoms of the participants

The neurological symptoms associated with chronic headache were invariably many and included relatively common ones such as blurred vision, seizures, hemiparesis loss of memory, dizziness, diplopia and vomiting, among others. See **Table 4**

Table 4: Distribution of presented neurological symptoms.

Symptom	Frequency
Dizziness	16
Vomiting	8
Blurred vision	6
Confusion	4
Poor memory	4
Fatigue	2
Fever	2
Head increasing in size	1
Loss of memory	3
Nausea	6
Irritable	1
Neck pain	2
Photophobia	1
Slurred speech	1
Syncope (sudden fall/faint)	2
Tinnitus (noisy ears)	1
Diplopia (double vision)	2
Convulsion	3
Hemiparesis	6

4.4 Difference in the CT scan findings in patients with chronic headache only and those with chronic headache and other neurological symptoms

Out of 63 participants who presented with chronic headache with no other neurological symptoms and sent for head CT, 49 (77.8%) of them had normal CT examination while only 14(22.2%) study subjects had abnormal CT findings. In contrast, of the 33 study subjects who presented with chronic headache coupled with other neurological symptoms, and referred for head CT, 30 (91%) cases ended up having an abnormal CT findings while the remaining 3 (9%) cases had normal head CT examination.

These findings demonstrate that a remarkably significant proportion of the patients who presented with chronic headache without additional neurological symptoms had normal CT examination. Conversely a contrasting CT scan examination outcome was noted for those patients who presented with chronic headache and other neurological symptoms where most of them had abnormal findings on CT examination. Thus the likelihood of having normal CT scan is high if a patient presents with chronic headache only and the reverse is highly likely for those who present with chronic headache and other neurological symptoms. See **Table 5**

Table 5: CT scan findings of participants with chronic headache only and those with chronic headache and other neurological symptom

Neurological symptoms	CT findings		p-value
	Normal (%)	Abnormal (%)	
Chronic headache only (n=63)	49(77.8)	14(22.2)	1
Chronic headache + other neurological symptoms (n=33)	3(9.1)	30(90.9)	
Total	52	44	

There was association between CT findings and neurological symptoms (dizziness, blurred vision, vomiting, hemiparesis convulsion, confusion, loss of memory etc. $P < 0.001$).

4.5 Sample Images

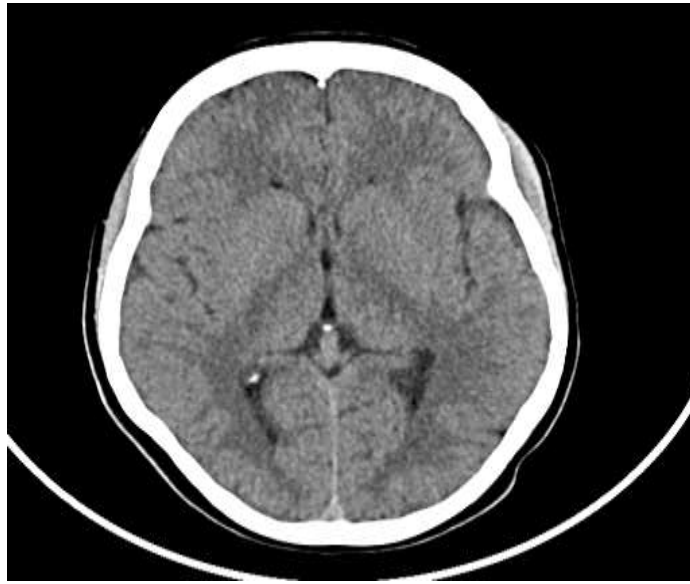


Figure 6: Axial head CT brain window of a 21 year old male who presented with chronic headache. CT scan was unremarkable.

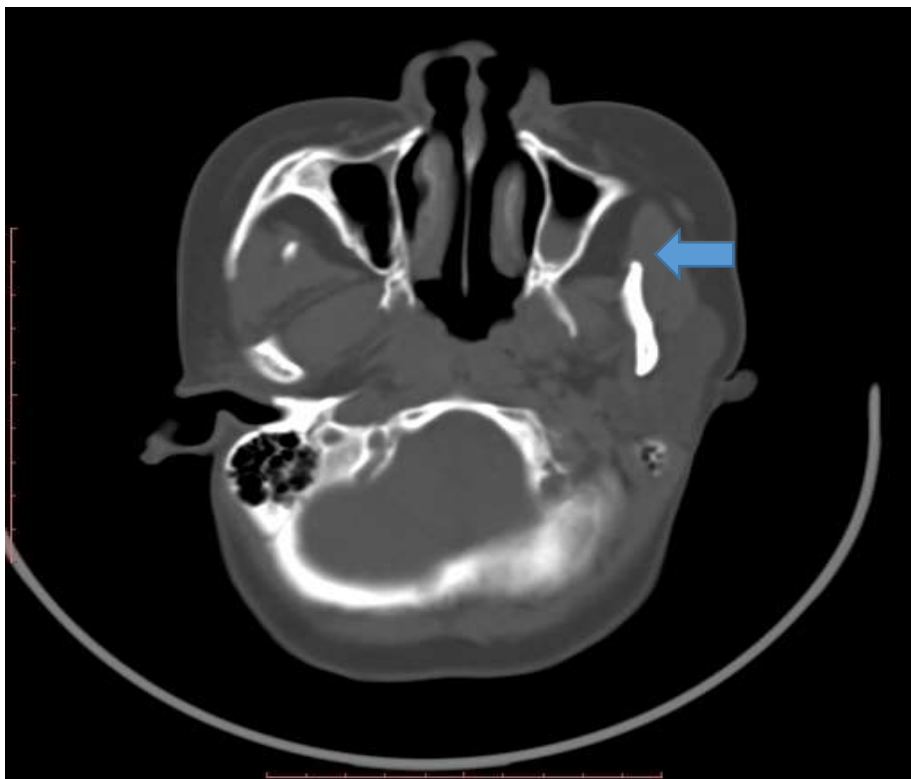


Figure 7: Axial head CT scan bone window of 35 year old female who presented with 8 month history of chronic headache showing bilateral maxillary sinusitis

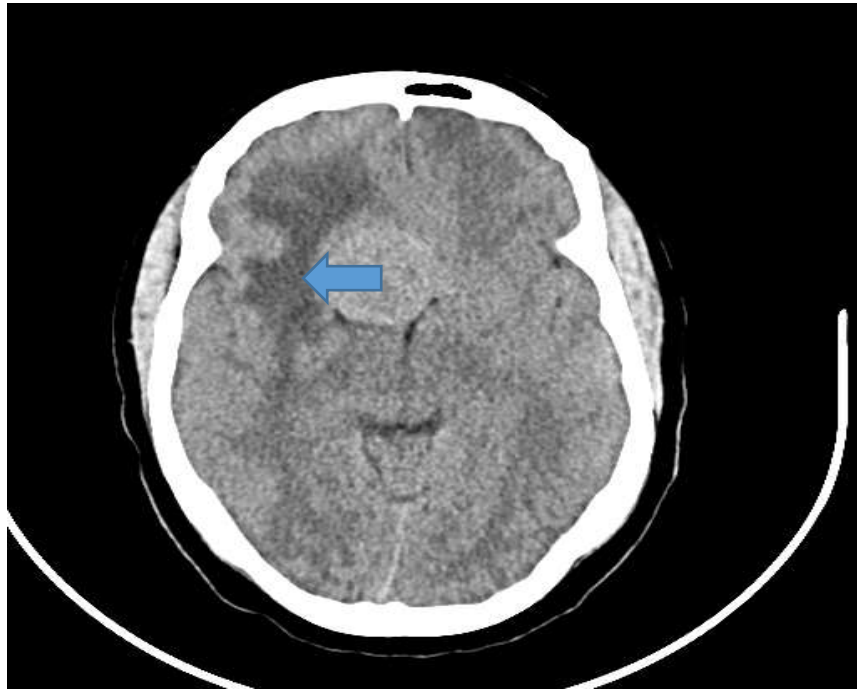
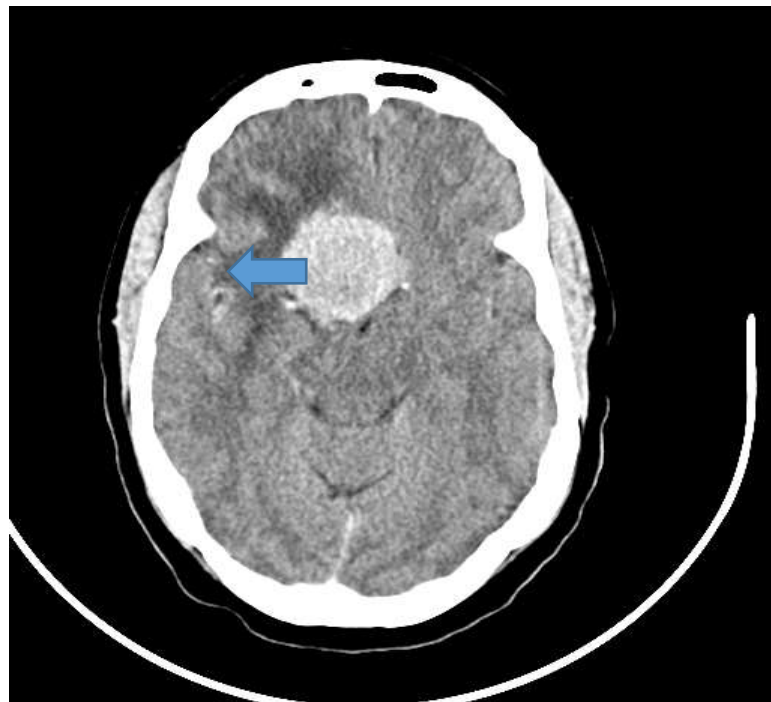


Fig. 8a.



Figures 8a (NECT) and 8b (CECT) : Axial head CT brain window of an 80 year old female with 8 year history of chronic headache showing well defined avidly enhancing sellar and suprasellar mass in keeping with Meningioma. Differentials included pituitary macroadenoma.



Figure 9: Axial head CT brain window of a 35 year old female showing well defined ring enhancing lesion with thick irregular wall and perilesional oedema consistent with late cerebritis (forming abscess)

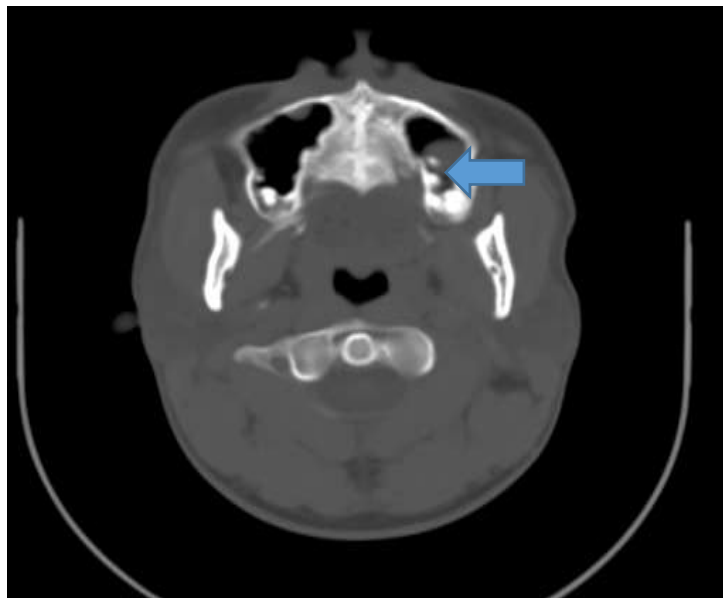


Figure 10: Axial head CT bone window of a 25 year old male who presented with chronic headache and nasal blockage. CT showed a well-defined soft tissue density mass in the floor of left maxillary sinus that was consistent with a polyp

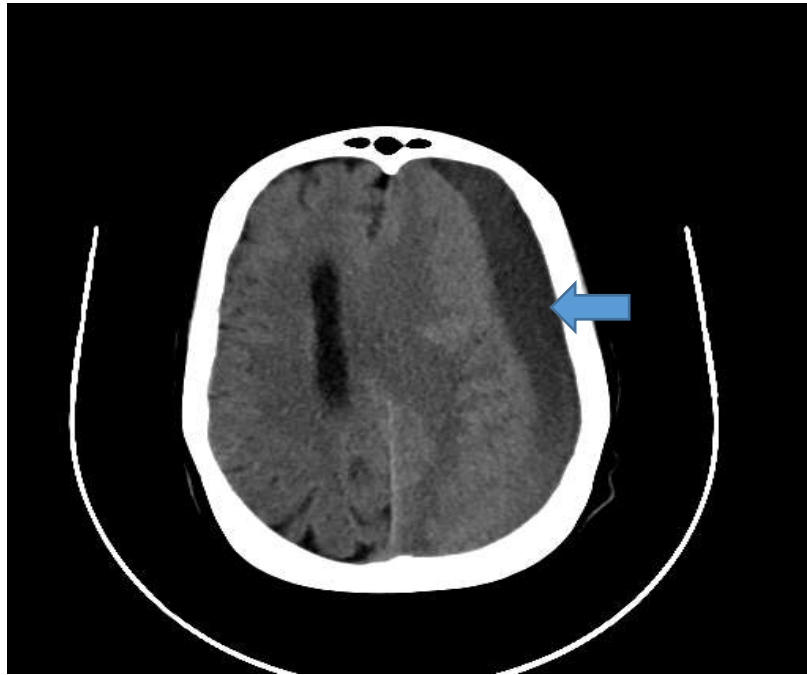


Figure 11: Brain window, NE axial CT of a 77 year old female who presented with chronic headache confusion and diminished memory. CT showed left frontoparietotemporal crescent shaped hypodense lesion with significantly associated mass effect in keeping with chronic subdural haematoma.

CHAPTER FIVE

5.0 DISCUSSION

5.1 Introduction

Studies that are currently available in Africa and locally offer only limited guidance on neuroimaging of chronic headache patients. The aim of this study is to estimate the frequency of significant intracranial lesions in patients with chronic headache and to determine the likelihood of identifying abnormal findings on CT head in patients with chronic headache only vis-à-vis those with chronic headache in addition to other neurological symptoms

5.2. Discussion of the findings

5.2.1 Demographics

A total of 96 Participants were recruited into the study with age range of 18 - 80 years and mean age (\bar{X} = 41.1 years SD, 15.9). The majority were females (54.2%) with female to male ratio of 1.2:1. Majority of the participants were below 41 years.

Similar findings (\bar{X} = 40.74 years SD, 12.87) were noted by Eziela Adikaibe et al, 2011 in Nigeria. On the average, the female patients who came for CT scan were slightly older (\bar{X} = 43.5 years, SD = 2.2) than the males (\bar{X} = 38.4 years, SD = 2.3)

A comparable study was that done in Nigeria by Ukamaka et al in which the participant's age range was 5-75 years with a mean of 37.3±15.3 years and slight female preponderance (64% vs 54%) with a female to male ratio of 1.2 :1 Majority of patients in the 45-55 age range.

Our study is quite in agreement with the above studies on the fact that females were more than males with actually same female to male ratio. According to some authors

the general observation of more female suffering from headache compared to their male counterpart could be explained by hormonal factors.

However there is slight variation in age range and the mean age of participants between this study and ours and this could be explained by the difference in the sample composition where the sample contained children as young as 5 years while we were only recruiting adults. Also their sample size was larger (126) than ours (96)

This study noted the preponderance of cases with normal CT findings (n=52, 54.2%), and the mean age (\bar{X} = 37.5 years, SD=13.3) of those with normal CT findings was significantly (p=0.013) lower compared to mean age (\bar{X} = 45.5 years, SD=17.8) of cases with abnormal CT findings. as shown in **Table 1** suggesting that the advancing age may be an indicator for neuroimaging in patients presenting with chronic headache.

These findings agree with the findings of a related study done by (Kahn, Sanders et al. 1993) that showed identifiable lesions were commoner in those above 40 years among those who presented with non-traumatic chronic headache.

5.2.2 Pattern of the CT scan head findings of the participants

Extracranial (mainly paranasal sinus lesions) and intracranial lesions were nearly equal in the abnormal CT findings in this study. The paranasal sinus lesions occurred in 23 (52.3%) cases while the intracranial lesions accounted for 21 (47.7%) cases. The majority of the paranasal sinus lesions and overall commonest abnormal CT findings was sinusitis involving all the paranasal sinuses albeit maxillary sinus preponderance.

This finding resonates with an outcome of a similar study (unpublished) done in the year 2012 by Margaret W at Muhimbili National Hospital, in Dares-salaam, Tanzania in which sinusitis occurred in 18.5% of the total 31.9% of the abnormal CT findings.

The higher abnormality rate of intracranial findings (47.7%) in this study compared to previous studies notably Sanju et al 2014, who found only (5.7%), in Nepal could be as a result of difference in the characteristics of recruited participants where patients with chronic headache only with normal neurological examination were included into the study whereas in our study we recruited all adult patients with chronic headache irrespective of absence or presence of neurological or other abnormal symptoms.

Other extracranial lesions included 4 cases of maxillary polyps and a case of hyperpneumatized dilated sphenoid sinus. Majority of these patients presented with facial pain or heaviness and nasal blockage or congestion besides the chronic headache complaint. The commonest intracranial lesions were vascular events with extra-axial fluid collection and ischaemic stroke (n=7, 16%) with 2 cases of ischaemic infarct and 5 cases of intracranial haemorrhage

A relatively high rate of abnormal (45.8%) CT findings was noted in this study similar to a couple of other studies done in Nigeria by Ezeala et al (46%) and Imarhiagbe FA (47.3%), both in the year 2011. A third study in Nigeria by Ukamaka et al also had significantly high rate of abnormal CT (49.2%) findings.

But contrasting greatly to this study and the ones in Nigeria is an earlier but similar study by Michel et al 1994 in which 373 patients with chronic headache irrespective of presence or absence of neurological symptoms. A total of 402 head CT scans were done in this study. Of the 402 scans, only 18 (4.47%) cases of abnormal CT findings in which only 4 (0.98%) patients were concluded as significant CT findings that could

potentially be attributed to the chronic headache and alter the management or need a further follow up. These were 2 cases of osteoma, one (1) case of low grade glioma and a single case of aneurysm. The other 14 (3.5%) cases were termed as minor or clinically insignificant findings.

The glaring disparity between my study and that of Michel et al could be explained by method of selection in which my case, cadres with subspecialty (Neurosurgeon and Physician) were involved. The other plausible explanation with respect to the higher abnormality rate in my study could be as a result of better resolution scanners which acquire volumetric data compared to the older generation CT scanners.

In our study radiologically suspected intracranial tumours were noted in 4 (9%) cases with predominance of meningioma based on the imaging features. The study by Ukamaka et al noted a significantly high number of intracranial tumours 11 (17.7%) cases with predominance of Pituitary macroadenoma. The higher rate of intracranial tumours, unlike this study could be attributed to first, a larger sample size (126) against (96) in our study, secondly and more importantly the study design which was retrospective, involving review of CT scans and also a longer duration (3 years) of the study.

This study revealed that 3(75%) out of the 4 patients with solid intracranial lesions radiologically suspected to be tumours were < 40 years with male to female ratio of 1:1, thus no gender predilection. In comparison to this study, Ukamaka et al, in 2011 Nigeria; nearly agreed with these findings where all the cases of intracranial tumours were below 50 years but with male preponderance. In other studies by Levy M J et al age and sex have not been shown to significantly associate with the presence of headache in brain tumours.

In another study by Simpson et al(1999 - 2007) in which a total of 4404 head CT scan reports of patients with chronic headache were reviewed retrospectively to assess the CT positivity, only 461 (10.5%) were reported to have abnormal findings. Of these only 60 (1.4%) cases were thought of having clinically significant findings that could potentially be the cause of headache. The rest (9.1%) were termed as incidental findings.

A couple of other studies notably that of Frishberg et al 1994 and Thomas et al.2010 in US supported the findings by Dumas and Colleagues. These studies demonstrated that a routine CT examination for a chronic headache in the absence of abnormal neurological signs and symptoms or other abnormal clinical symptoms is less likely to have a positive CT scans.

5.2.3 Association between CT scan head findings and neurological symptoms.

Majority 49 (77.8%) of the 63 participants whose presentation was chronic headache only without additional neurological symptoms had normal CT findings whereas the remaining 14(22.2%) cases presented with clinical symptoms attributable to their predominant CT findings (paranasal sinus lesions, notably Sinusitis and polyps) such as nasal blockage, facial pain and post nasal drip. In contrast 30 (91%) out of the 33 participants who presented with chronic headache plus other neurological symptoms had contrastingly higher positive CT yield with majority demonstrating clinically significant intracranial lesions.

The findings of this study is quite in agreement with study by Dumas et al in which they studied participants with chronic headache and normal neurological examination. The positive rate (4.47%) of abnormal CT was far much lower compared to this study

(45.8%), indicating that presence of other neurological symptoms besides chronic headache invariably increases the likelihood of abnormal CT.

A study closely similar to ours was done by (Gupta et al, 2015) in India to a certain the frequency of normal head CT and positive CT findings in patients with chronic headache as chief complaints (Group A) and compared to those with chronic headache and additional neurological symptoms (Group B). A total of 2498 CT reports were evaluated with 1772 patients in Group A and 726 patients in Group B. Over 6% of head CT scans in Group A, had abnormal findings compared to 13.22% in Group B.

The differences in the proportion of normal and abnormal CT scans in both groups were found to be statistically significant ($p < 0.05$). Significant intracranial lesions were higher in Group B compared to Group A.

In comparison the current study, 49 (77.8%) out of the 63 cases who presented with chronic headache only (**Call them group A**) had normal CT with the rest of the cases having abnormal CT and more importantly as the case in the aforementioned study, these findings were statistically significant ($p < 0.001$). The finding resonates well with that of Gupta et al study with majority of the participants in our study who presented with additional neurological symptoms radiologically demonstrating significant intracranial lesions. Albeit this resounding resemblance, there was slight difference in the overall CT findings in the second group of patients who presented with chronic headache and other neurological symptoms (**Group B**). In Gupta and colleagues study, majority (74.5%) of the patients in Group B had normal CT scan study whereas in our study majority, 30(91%) of the cases in similar group had abnormal CT findings with the rest having uneventful CT examination.

This could be due to the difference in the sample size and the fact that the study population included patients aged between 0 – 18 years besides adults and majority were either normal or had clinically insignificant findings. The CT scanners used were also different in that our study used 32 slice scanner where as in Gupta et al study a 16 slice and 4 slice scanners were used thus possibly contributing to the difference.

5.3 Study limitation

A referral bias as it was conducted at a tertiary care center; therefore, the proportion of patients with significant findings on CT head might be higher. This limitation could be mitigated in the future by conducting multicenter based studies

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

1. Sinusitis was the commonest findings in patients with chronic headache without additional neurological symptoms.
2. There was a higher abnormal yield on head CT when a patient presented with chronic headache in addition to other neurological symptoms compared to those presenting with chronic headache only.

6.2 Recommendation

1. Higher index of suspicion of abnormal findings on CT scan of the head when a patient presents with headache plus other neurological symptoms.

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APPENDICES

Appendix I: Questionnaire

**COMPUTERIZED TOMOGRAPHY SCAN HEAD FINDINGS AMONG
ADULTS PRESENTING WITH CHRONIC HEADACHE IN RELATION TO
OTHER NEUROLOGICAL SYMPTOMS AT MOI TEACHING AND
REFERRAL HOSPITAL (MTRH), ELDORET - KENYA**

PART I: DEMOGRAPHIC DATA

Serial number.....

Date.....

Age.....

GenderM F

1. Do you have any of the following symptom(s)/sign

Syncope (Sudden fall/ fainting)	Yes	<input type="checkbox"/>	NO	<input type="checkbox"/>
Dizziness	Yes	<input type="checkbox"/>	NO	<input type="checkbox"/>
Vomiting episodes	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Tinnitus (noisy ears)	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Diplopia (double vision)	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Convulsion	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Hemiparesis (Weakness on one side of the body?)	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Paraparesis (Weakness of the lower limbs?)	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Quadriparesis (Weakness of both upper and lower limbs?)	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Hemiplegia (Complete loss of power on one side of the body?)	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
				<input type="checkbox"/>

Paraplegia (Complete loss of power of lower limbs?) Yes No

Quadriplegia (Complete loss of power of both upper and lower limbs). Yes No

Others specify

.....
.....
.....
.....

PART III CT:

What is the type of head CT scan done?

1. Non-contrast Enhanced Computerized Tomography (NCCT)?

Yes No

2. Contrast-Enhanced Computerized Tomography (CECT)?

Yes No

Final CT diagnosis

.....
.....

Appendix II Patient Consent Form

My name is Dr Dagane Ali Mohamed, a Master of Medicine (M.MED) student in the department of Radiology and Imaging at Moi University.

I am doing a study on computerized tomography (CT) scan findings among adult patients presenting with chronic headache at Moi Teaching and Referral Hospital (MTRH), Eldoret.

I would like to recruit you in this study. Information obtained from you will be treated with utmost confidentiality. Only the hospital number will be used.

Results of the study will be used to improve diagnosis on clinical management of patients.

The researcher will only review images of the investigations ordered by the attending clinicians and any procedure arising from such review will be for the benefit of the patient and not the researcher.

Please note that your participation is voluntary and you have a right to decline or withdraw from the study.

If you have any other questions regarding this study, feel free to contact me, the Investigator, Dr. Dagane Ali through telephone number 0720427364 or email address daganeali@gmail.com.

Information about your rights as a research subject: You may contact Institutional Review Ethics Committee (IREC) **053 33471 Ext.3008**. IREC is a committee that reviews studies for safety to protect the rights of study subjects.

The researcher will have no financial or material gain.

Signature _____

Date _____

I certify that the patient/guardian has understood and consented participation in the study.

Dr Dagane Ali Mohamed.

Signature _____

Appendix III: Consent Form-Swahili Version

FOMU YA RIDHAA YA KUSHIRIKI UTAFITI

Mimi ninaitwa Daktari Dagane Ali ni mwanafunzi wa uzamili chuo kikuu cha tiba

Moi. Nina fanya uchunguzi kwa wagonjwa wenye kusumbuliwa na kuumwa

Kichwa kwa muda mrefu. Dhumuni la utafiti huu ni kuona uwezo wa picha ya CT katika kuonyesha vitu vinavyosababisha kuumwa na kichwa usiokuwa kwa kawaida.

Ukikubali kushiriki katika utafiti huu utaulizwa maswali halafu utapigwa picha ya kichwa.

Taarifa zote kuhusiana na utafiti huu ni siri na mtu yeyote asiyehusika hataruhusiwi

kuziona. Taarifa pamoja na majibu yote yataingizwa kwenye tanakilishi kwa kutumia

namba yako ya utambulisho wala si jina lako. Hatutegemei madhara yoyote yakupate kutokana na utafiti huu.

Ni hiari yako kukubali kushiriki kwenye utafiti huu. Unaweza kujitoa wakati wowote bila

kutakiwa kutoa maelezo hata kama ulishathibitisha kushiriki. Hautaadhibiwa au kunyimwa

haki yako ya matibabu. Kama ukikubali kushiriki katika utafiti huu utafaidika kwa kuchunguzwa kwa kina kamauna ugonjwa wowote utakaonekana utaarifiwa.

Kama una maswali kuhusu utafiti huu wasiliana nami Daktari Dagane Ali, Sanduku la posta **4160 Eldoret**, na nambari ya simu 0720427364 au kwa barua pepe daganeali@gmail.com.

Kama una maswali yoyote juu ya haki zako katika kushiriki utafiti huu, unaweza

kuzungumza na Kamati ya utafiti kuruhusu udhamini wa utafiti- Kwa lugha ya kimombo inaitwa (Institutional Review Ethics Committee -IREC) .Nambari ya simu ni **053 33471**

Ext.3008.

Je, umekubali kushiriki?NDIYO.....

HAPANA.....Mimi..... CAP 17 HAP

17 Kevin Gervin 2/11/16 NEUROLOGY HEADACHE RED FLAGS These suggest the need for further investigation. • New onset or change in headache in patients aged >50

years • Thunderclap headache o Rapid time to peak intensity (secs to 5 mins) • Focal neurological symptoms • Non-focal neurological symptoms e.g. Confusion • Change in headache frequency, characteristics or associated symptoms • Abnormal neurological examination • Changes with posture • Precipitated by physical exertion or Valsalva manoeuvre o Coughing, laughing, straining • Wakes the patient up • Jaw claudication • Visual disturbance • Neck stiffness • Fever • New headache in a patient with HIV • New headache in a patient with cancer • Risk factors for cerebral venous sinus thrombosis o coagulopathies, dehydration, nephrotic syndrome, chronic inflammatory disease, pregnancy, oestrogen containing oral contraceptives, infections (meningitis, sinusitis, mastoiditis), head trauma

Appendix IV: IREC Approval



MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 334711/2/3



MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

Reference: IREC/2016/113
Approval Number: 0001740

26th September, 2016

Dr. Dagane Ali Mohamed,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.



Dear Dr. Dagane,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Computerized Tomography Scan Findings among Patients Presenting with Non Acute Headache at Moi Teaching and Referral Hospital (MTRH), Eldoret".

Your proposal has been granted a Formal Approval Number: **FAN: IREC 1740** on 26th September, 2016. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 25th September, 2017. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc CEO - MTRH Dean - SOP Dean - SOM
Principal - CHS Dean - SON Dean - SOD



MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

Reference: IREC/2016/113

Approval Number: 0001740

Dr. Dagane Ali Mohamed,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

Dear Dr. Dagane,

RE: CONTINUING APPROVAL

The Institutional Research and Ethics Committee has reviewed your request for continuing approval to your study titled:-

"Computerized Tomography Scan Findings among Patients Presenting with Non Acute Headache at Moi Teaching and Referral Hospital (MTRH), Eldoret".

Your proposal has been granted a Continuing Approval with effect from 26th September, 2017. You are therefore permitted to continue with your study.

Note that this approval is for 1 year; it will thus expire on 25th September, 2018. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

**DR. S. NYABERA
DEPUTY-CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE**

cc:	CEO	-	MTRH	Dean	-	SOD
	Principal	-	CHS	Dean	-	SPH
	Dean	-	SOM	Dean	-	SON



MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

26th September, 2017





MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 3347112/3

Reference IREC/2016/113
Approval Number: 0001740

Dr. Dagane Ali Mohamed,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

Dear Dr. Dagane,

RE: APPROVAL OF AMENDMENT

The Institutional Research and Ethics Committee has reviewed the amendment made to your proposal titled:-

"Computed Tomography Head Findings among Adults with Chronic Headache in Relation to other Neurological Symptoms at MTRH, Eldoret, Kenya".

We note that you are seeking to make an amendment as follows:-

- To change the title to above from ***"Computerized Tomography Scan Brain Findings among Adults Presenting with Chronic Headache at Moi Teaching and Referral Hospital, Eldoret, Kenya".***

The amendment has been approved on 11th December, 2018 according to SOP's of IREC. You are therefore permitted to continue with your research.

You are required to submit progress(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change(s) or amendment(s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,


PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc: CEO - MTRH Dean - SPH Dean - SOM
Principal - CHS Dean - SOD Dean - SON



MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
P.O. BOX 4606
ELDORET
Tel: 3347112/3
11th December, 2018



Appendix V: Hospital Approval



MOI TEACHING AND REFERRAL HOSPITAL

Telephone: 2033471/2/3/4

Fax: 61749

Email: director@mtrh.or.ke

Ref: ELD/MTRH/R.6/VOL.II/2008

P. O. Box 3
ELDORET

6th October, 2016

Dr. Dagane Ali Mohamed,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

RE: APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:-

"Computerized Tomography Scan Findings among Patients Presenting with Non Acute Headache at Moi Teaching and Referral Hospital (MTRH), Eldoret".

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

Dagane Ali Mohamed
DR. WILSON ARUASA
CHIEF EXECUTIVE OFFICER
MOI TEACHING AND REFERRAL HOSPITAL

CC - Deputy Director (CS)
- Chief Nurse
- HOD, HRISM