TITLE

THE UTILITY OF COMPUTED TOMOGRAPHY SCAN IN EVALUATION OF PATIENTS WITH NON ACUTE HEADACHE AND NORMAL NEUROLOGIC EXAMINATION IN NAIROBI.

RESEARCHER

DR. DANIEL NTHAKYO NGAYAI SOMBA, MBchB (UON),

UNIVERSITY OF NAIROBI,

DEPARTMENT OF DIAGNOSTIC IMAGING AND RADIATION MEDICINE.


THIS DISSERTATION WILL BE SUBMITTED AS PART OF FULFILMENT FOR THE DEGREE OF MASTER OF MEDICINE IN DIAGNOSTIC IMAGING AND RADIATION MEDICINE.
DECLARATION

I, DR. DANIEL NTHAKYO NGAYAI SOMBA declare that the work contained herein is my original idea and has not been presented at any other place to the best of my knowledge.

Signature…………………………….

Date………………………………
APPROVAL BY SUPERVISOR

This research proposal has been submitted with my approval as a university supervisor.

SUPERVISORS:

DR. WAMBUGU MILCAH NDUNGE, MBchB(Makerere), MMed(UON)

SENIOR LECTURER, UNIVERSITY OF NAIROBI,

DEPARTMENT OF DIAGNOSTIC IMAGING AND RADIATION MEDICINE.

SIGN---------------------------------------------

DATE---------------------------------------------

DR NELSON KIMANI, MBchB, MMed (UON),

LECTURER, UNIVERSITY OF NAIROBI,

DEPARTMENT OF DIAGNOSTIC IMAGING AND RADIATION MEDICINE.

SIGN---------------------------------------------

DATE---------------------------------------------
DEDICATION

I dedicate this work to my wife Phoebe and sons Davis and Denel for their continued support and prayers during my period of study.
ACKNOWLEDGEMENTS

I wish to acknowledge the following persons who assisted me during the period I was working on this thesis.

My supervisors: Dr Wambugu and Dr. Kimani for their gentle and sustained pressure to ensure I completed this work on time.

The CEO Kenyatta National Hospital and chairperson radiology department Dr. Nyabada for permitting me to collect data in this facility.

The CEO of Plaza Imaging Solutions Dr. Alfred Odhiambo for permitting me to collect data at his facility.

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My parents Agnes and David Somba for their prayers and continued encouragement to me.

Barbara Brand for laying strong foundation in my life.

Cathy and Douglas Lowe for their support with academic materials.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE</td>
<td>i</td>
</tr>
<tr>
<td>THE UTILITY OF COMPUTED TOMOGRAPHY SCAN IN EVALUATION OF PATIENTS WITH NON ACUTE HEADACHE AND NORMAL NEUROLOGIC EXAMINATION IN NAIROBI</td>
<td>i</td>
</tr>
<tr>
<td>RESEARCHER</td>
<td>i</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>ii</td>
</tr>
<tr>
<td>APPROVAL BY SUPERVISOR</td>
<td>iii</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>iv</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>v</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>vi</td>
</tr>
<tr>
<td>ABBREVIATIONS</td>
<td>viii</td>
</tr>
<tr>
<td>CHAPTER 1: LITERATURE REVIEW</td>
<td>3</td>
</tr>
<tr>
<td>DEFINITION</td>
<td>3</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>3</td>
</tr>
<tr>
<td>BACKGROUND INFORMATION</td>
<td>4</td>
</tr>
<tr>
<td>BURDEN OF THE ILLNESS AND SIMILAR STUDIES</td>
<td>8</td>
</tr>
<tr>
<td>USE OF HEAD CT SCAN AS A DIAGNOSTIC TOOL</td>
<td>17</td>
</tr>
<tr>
<td>CHAPTER 2: STATEMENT OF RESEARCH PROBLEM</td>
<td>18</td>
</tr>
<tr>
<td>PROBLEM STATEMENT</td>
<td>18</td>
</tr>
<tr>
<td>BROAD OBJECTIVE</td>
<td>18</td>
</tr>
<tr>
<td>SPECIFIC OBJECTIVES</td>
<td>18</td>
</tr>
<tr>
<td>THE SCOPE OF THE STUDY</td>
<td>19</td>
</tr>
<tr>
<td>STUDY AREA</td>
<td>19</td>
</tr>
<tr>
<td>CHAPTER 3: RESEARCH METHODOLOGY</td>
<td>20</td>
</tr>
<tr>
<td>STUDY POPULATION</td>
<td>20</td>
</tr>
<tr>
<td>INCLUSION CRITERIA</td>
<td>20</td>
</tr>
<tr>
<td>EXCLUSION CRITERIA</td>
<td>20</td>
</tr>
<tr>
<td>STUDY DESIGN</td>
<td>20</td>
</tr>
<tr>
<td>SAMPLING TECHNIQUE</td>
<td>20</td>
</tr>
</tbody>
</table>
### ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACR</td>
<td>Appropriateness Criteria for Headache</td>
</tr>
<tr>
<td>ALARA</td>
<td>As Low As Reasonably Achievable</td>
</tr>
<tr>
<td></td>
<td>(WHO principle to keep ionizing radiation low)</td>
</tr>
<tr>
<td>CECT</td>
<td>Contrast Enhanced Computed Tomogram</td>
</tr>
<tr>
<td>CT</td>
<td>Computed Tomogram</td>
</tr>
<tr>
<td>KNH</td>
<td>Kenyatta National Hospital</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>IP/OP NO</td>
<td>In Patient/Out Patient Number</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immuno Deficiency Virus</td>
</tr>
<tr>
<td>IHS</td>
<td>International Headache Society</td>
</tr>
<tr>
<td>ICHD-II</td>
<td>The International Headache Classification 2nd edition.</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenous</td>
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<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
</tr>
<tr>
<td>mSv</td>
<td>Millisieverts</td>
</tr>
<tr>
<td>MOH</td>
<td>Medication Overuse headache</td>
</tr>
<tr>
<td>NECT</td>
<td>Non Enhanced Computed Tomogram</td>
</tr>
<tr>
<td>SAH</td>
<td>Sub Arachnoid Hemorrhage</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Scientists</td>
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<tr>
<td>PIS</td>
<td>Plaza Imaging Solutions</td>
</tr>
<tr>
<td>US</td>
<td>United State</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>WHO</td>
<td>World Health Organization.</td>
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<td>HT_{1B/1D}</td>
<td>5-Hydroxytryptamine receptor 1B and 1D</td>
</tr>
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ABSTRACT

OBJECTIVE
To assess the utility of computed tomogram scan (CT scan) in neuroimaging of patients presenting with non acute headache and normal neurologic examination, and to determine the pathological yield in terms of qualifications of referring doctor, age, sex, duration of headache and type of clinically diagnosed headache syndromes.

BACKGROUND:
Headache is one of the most common reasons why patients go to see a doctor. Majority may not have a serious cause for the headache but a minority will. Headache is majorly classified into primary and secondary headache. Primary headache is a type of headache which is not associated with any demonstrable organic disease or structural neurologic abnormality, on the other hand, secondary headaches include those headaches caused by underlying medical condition. Primary headache is the commonest type of headache. Neuroimaging for primary headaches yields very low intracranial positive results for pathology. Despite this being the fact, patients with primary headache are referred indiscriminatively for head CT scan. There is no local study done on use of CT scan as part of investing patients with non acute headache and normal neurological examination.

It is important to study the pattern of patient referrals in Nairobi for Head CT scan in patients with primary headache and find out whether the primary clinicians do make a specific clinical diagnosis before referring. The level of positive pathological yields will be a good indicator on whether this examination is necessary, hence provide basis for the development of a guideline to be followed before doing neuroimaging on these patients in Nairobi.

METHOD:
One hundred cases that were referred to Kenyatta national hospital and Plaza imaging solutions for head CT scans with complaints of non acute headaches without focal neurological deficit, were recruited into the study after signing an informed consent. The patients were recruited through convenient sampling. The researcher went through the request forms and administered the questionnaire to the patients before including them into the study. This was done prior to doing the CT scan examination. The patients were recruited randomly from all the patients send
for imaging in these facilities during the period of study. The researcher reviewed the images with a qualified specialist Radiologist. All these variables were analyzed to find out the proportion and characteristics of study cases that had identifiable abnormalities. Age, sex, duration of headache, type of headache, qualification of referring doctors and the distribution of CT findings were described from a frequency table.

RESULTS

Mean age of the cases was 36.7 (SD 16.6) years. Majority were female making 65%. 78% were referrals from medical officers and Only two patients (2%) had findings of solid intracranial and base of skull pathological lesions. The two were referrals from consultant neurologists. 44% had normal head CT scan findings, 43% rhino sinusitis, 8% had brain atrophy and 3% had mastoiditis.

CONCLUSION:
In patients with non acute headache and normal neurological examination, intra cranial pathological yield was too low. Therefore, there is need to establish a guideline to be followed before referring these patients for head CT scan.

Significant extra cranial pathologies were detected. Most of the patients did not have definite clinical diagnosis. If clinicians did adequate clinical examination and took thorough clinical history, they would have requested for more focused imaging examination like paranasal sinus CT scan or high resolution temporal bone CT scan examination and not head CT scan.
CHAPTER 1: LITERATURE REVIEW

DEFINITION:
Headache or cephalalgia 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\(^1\). In non acute headache, the patient should have had headache symptoms for at least four weeks\(^2\).

INTRODUCTION
The commonest neurological symptom seen by general practitioner and neurologist is headache. Consultations by women are higher as compared to men and is highest at 15-24 years age group\(^3\).

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\(^4\).

Headaches are therapeutically and diagnostically classified into two categories: Primary and secondary\(^5\).

Primary headaches are not associated with any demonstrable organic disease or structural neurologic abnormality and so all laboratory and imaging test results are generally normal. It is by far commoner than secondary headache accounting to 90% of all headache complains\(^6\).

Secondary headaches include those headaches caused by underlying medical conditions\(^7\). Neuroimaging and laboratory investigations are crucial in making a concrete diagnosis of the cause of secondary headache unlike primary headache.

Many clinicians are over cautious and end up requesting unnecessary neuroimaging examinations because of non medical reasons like medico-legal concerns and anxious patients or relatives\(^8\). A study done in the USA showed that 62 million CT scans are done per year in the united states. One third of CT scans done are done `unnecessarily’ by cautious doctors in fear of medical legal actions or worried patients in the emergency department \(^9\).
Information obtained by clinicians from proper history taking and physical examination can guide them in making confident decision on who requires neuroimaging. This means that the clinicians must have adequate knowledge on headache classification system and how to do proper and complete neurological examination. Headache classification system is too cumbersome for most primary care or general physicians to apply because it is too detailed. Clinicians are often uncomfortable diagnosing specific headache disorders. Before requesting for neuroimaging, clinicians should have high suspicion index for secondary headache disorder based on history and physical examination.

Patients with non acute headache and abnormal neurologic examination will have a higher probability of significant abnormality on neuroimaging.

CT scan uses ionizing radiation, unnecessary use leads to unnecessary radiation to patients. This coupled with financial burden to clients, government and insurance companies as well as unjustifiable utilization of scarce resource in this part of the world, it is important to come up with a guideline to be followed before doing head CT scans on patients with non acute headache and normal neurologic examination.

**BACKGROUND INFORMATION**

Classification of headache is very important for both scientific and clinical purposes. First edition of headache classification by International Headache Society (IHS) was published in 1988. The main objective was to promote a worldwide unity in the way headache is classified, diagnosed and treated. This initial edition was based on the experience of the experts of the committee in the absence of sufficient published data.

Second edition was published in 2003 and revised in 2005. In this edition, medication over use headache and its subtypes were comprehensively covered. A chapter on headaches attributed to psychiatric disorders was introduced. Ophthalmoplegic ‘migraine’ was moved from chapter of migraine to cranial neuralgias and central causes of facial headache. All headaches attributed to infection were placed in the same chapter. Headache attributed to homeostasis, hyonic headache and primary thunder clap headache were also added. It is more precise on secondary headaches which are now described as "attributed to" rather than "associated with" in the first edition.
Headache disorders are now classified into major groups which are subdivided into types, then subtypes and ultimately into sub forms. Practising general family physician may only need to diagnose the first level, but a neurologist and headache specialist should normally diagnose the precise sub form of each headache up to level three or four\textsuperscript{12}.

No research studies on headache are likely to be accepted in international journals without adhering to this classification\textsuperscript{12}.

The classification was revised in 2005 and is very detailed and comprehensive as shown in appendix A.

**HOW TO USE THE HEADACHE CLASSIFICATION\textsuperscript{12}.

It’s difficult to memorize the whole classification as shown in appendix A. One should frequently consult the document from time to time to know how to use the diagnostic criteria for each type of headache.

In research project, every patient entered with a specific headache diagnosis should fulfill the set diagnostic criteria. Diagnosis should be made according to headache phenotypes which patients present with or they had within a period of one year.

Each distinct headache type must be diagnosed separately and coded. Some patients may receive two or more distinct types of headache, in such cases, the diagnosis should be listed in the order of importance to the patient. In cases where one type of headache in a particular patient fulfills two different sets of explicit diagnostic criteria, the clinician should use all the available information to decide the correct or more likely diagnosis is.

Before making a particular headache diagnosis, the patient must in many cases experience a minimum number of attacks of that headache. Primary headache disorders have frequencies varying from a single attack in every one or two years to daily attacks. It is recommended that frequency and severity be specified as given in patient's history.

If a headache occurs for the first time with a short time after diagnosing another disorder that is a known cause of headache, the new headache is coded according to the causative disorder as a
secondary headache. This remains true even when the headache has characteristics of a primary headache.

When a pre-existing primary headache worsens within a short time after diagnosing another disorder which is a known cause of a headache, then there are two possibilities which require clinician's judgment. The patient can either be given only the diagnosis of the pre-existing primary headache or be given both primary and secondary headache diagnosis.

Factors that will increase the probability of secondary headache are: If headache worsens within a short time after diagnosing the causative disorder and improvement or disappearance of the headache after relief from the causative disorder is evidence that there was coexisting secondary headache.

To fulfill the criteria for diagnosing most secondary headaches, the headache should greatly improve or resolve within a specified period after relieving the causative disorder.

It is important for a clinician to pick out primary and secondary headaches purely from history and physical examination. Despite the high prevalence of headache, clinicians are often uncomfortable diagnosing specific headache disorders. Fewer than half of patients with migraine are properly diagnosed, and only one third of affected patients receive migraine-specific prescription drugs. The headache classification system shown in appendix A may be too cumbersome for most primary care or general physicians to use properly. As a result, efforts have been made to produce short, practical, memorable, and effective screening tools. It has been found that a patient with non acute headache and abnormal neurologic examination will have a higher probability of significant abnormality on neuroimaging.

British Association for Study of Head came up with guidelines for all healthcare professional in diagnosis and management of migraine, tension-type, cluster and medication overuse headache. They came up with simplified and more friendly to use headache classification given in table 1.
**SIMPLIFIED (IHS) CLASSIFICATION OF HEADACHE DISORDERS**

| PRIMARY HEADACHES | 1. MIGRAINE INCLUDING.  
|                   | A. Migraine without aura.  
|                   | B. Migraine with aura.  
|                   | 2. TENSION TYPE HEADACHE INCLUDING  
|                   | A. Infrequent episodic tension type headache.  
|                   | B. Frequent episodic tension type headache.  
|                   | C. Chronic tension type headache.  
|                   | 3. Cluster headache and other trigeminal autonomic cephalalgias, including cluster headache.  
|                   | 4. Other primary headaches.  
| SECONDARY HEADACHES | 5. Headache attributed to head and/or neck trauma, including chronic post traumatic headache.  
|                   | 6. Headache attributed to cranial or cervical vascular disorder, including headache attributed to subarachnoid haemorrhage and giant cell arteritis.  
|                   | 7. Headache attributed to non vascular intracranial disorder including headache attributed to idiopathic intracranial hypertension and intracranial neoplasm.  
|                   | 8. Headache attributable to a substance or its withdrawal including carbon monoxide induced headache, alcohol induced headache, medication overuse, ergotamine over use triptan over use and analgesic over use headache.  
|                   | 9. Headache attributed to infection, including intracranial infection.  
|                   | 10. Headache attributed to disorder of homeostasis.  
|                   | 11. Headache or facial pain attributed to disorder of cranium, neck, eyes, ears, nose, sinuses, teeth, mouth, or other facial or cranial structures including cervicogenic headache and headache attributed to acute glaucoma.  
|                   | 12. Headache attributed to psychiatric disorder.  
| NEURALGIAS AND OTHER HEADACHES | 13. Cranial neuralgias, central and primary facial pain and other headaches including trigeminal neuralgia.  
|                   | 14. Other headaches, cranial neuralgia, central or primary facial pain.  

**TABLE 1 THE INTERNATIONAL CLASSIFICATION OF HEADACHE DISORDERS SECOND EDITION**

7
BURDEN OF THE ILLNESS AND SIMILAR STUDIES

A study done in the USA on headache analysing all out patient office based care, revealed that between 2007 through 2010, there were 51.1 million adult persons who visited health facilities because of headache, including patients with migraine headache who totaled to 25.4 million. Majority were seen by primary care physicians, 54.8%. Most of the patients were younger than 65 years (88%). Majority were female patients, 78%. Those who had neuroimaging were 12.4% and that costed a total of $3.9 billion, out of the the patients with migraine headache, 9.8% had neuroimaging. Money spend on neuroimaging patients with headache annually was about $ 1 billion15.

The use of neuroimaging for headache in the USA has risen from 5.1% in 1995 to 14.7% in 2010. One out of eight headache patients were referred for neuroimaging. Most patients had a a few visits before they were referred for neuroimaging, the study estimated that around half of all headache patients were referred for neuroimaging15.

The study pointed out that, though it was clear that neuroimaging in primary headache yielded very low results, between 1-3%, referrals were on the increase. The study noted that the main reason for the increased number of neuroimaging despite the presence of several guidelines recommending against neuroimaging was because of patients' need for reassurance and physician fear of medico-legal issues. Lack of clear consensus on exactly which patients should be neuroimaged was part of the problem15.

The study recommended the employment of new strategies like patient education and transferring part of the cost for neuroimaging from insurance companies to the patients15.

American College of Radiology has launched a campaign against unnecessary neuroimaging for uncomplicated headache. They have joined, "choose wisely campaign", and have placed "Don't do imaging for uncomplicated headache" on it's top five list of things physicians and patients should question. American headache Society has also joined the "choose wisely campaign" and have advised against neuroimaging studies in patients with stable primary headaches15-16.
In other studies, prevalence of headache has been estimated to have frequency of 11%-48% in children and 47% in adults. Migraine headache has a high, age, gender, and case definition variance. Higher prevalence of headache has been found by surveys in Europe and North America than by those in Asia and South American countries. A survey of Canadian population showed that only about 20% of people there are headache free. Prevalence of migraine shows a clear cut gender imbalance, as well as genetic factors, affecting about 15% - 18% of women and 6% of men. It occurs most commonly in men and women 25-55 years of age. Muscle contraction or tension headache accounts for most of the non migraine headaches encountered in population surveys with a prevalence of 1-3%.

In Kenya, a study done on prevalence of headache among medical students in Kenyatta National Hospital between 1994-1995 showed that, 87% of students surveyed had at least one episode of headaches within a period of months. Out of that number, 50% was tension type headache, 38% migraine and 12% unclassified headache.

Among those who suffered headache, 85% of the students reported that, their social life was affected by the headache, 86% had their work disturbed, and 23.6% had missed one day of work or class within a period of one year due to headache.

The study showed that, there was association between headache severity with working ability, and social effect concluding that, headache is a prevalent condition with disability in both working and social activities among medical students.

In Nigeria a study was done in 2011 where the objective was to establish whether patients with non acute and recurrent headaches should have neuroimaging before being referred to a neurologist. The study revealed 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.
CLINICAL PRESENTATION AND STUDIES DONE ON COMMONEST TYPES OF PRIMARY HEADACHES.

1. MIGRAINE HEADACHE.

Migraine headache is a recurrent episodic headache whose severity ranges from moderate to severe. It may be unilateral or pulsating lasting for a day or up to several days. It is associated with gastrointestinal symptoms. During the attack, patients will prefer a dark, quiet environment and will have limited activity. In between the attacks, the patients are symptomless. Migraine with aura affects one third of migraine sufferers and is diagnosed easily because of the occurrence of a typical aura\textsuperscript{14,31}.

Chronic migraine headache presenting with daily attacks is classified as complicated and should be referred to a specialist because diagnosis and management is difficult\textsuperscript{32}.

In patients diagnosed with migraine headache and have normal neurological examination, the prevalence of significant intracranial abnormalities on neuroimaging ranges from 0.2 \% to 0.6\%\textsuperscript{33}.

Autopsy done on patients who had been on treatment for migraine revealed arteriovenous malformation prevalence of 0.8\% and 2.4\% saccular aneurysms\textsuperscript{34,35}.

2. TENSION TYPE HEADACHE.

This type of headache occurs in episodic attacks with variable and often very low frequency and mostly lasts for a short time, not more than several hours. The headache is mostly generalised but can be unilateral. Patients usually describe a feeling of pressure or tightness. They would feel like a vice or tight band is around the head which commonly spreads to or arises from the neck. This type of headache lacks specific features but may be related to stress, functional or musculoskeletal abnormalities\textsuperscript{14}.

Studies done on patients with tension type headache and normal neurological examination reported no patient with any significant intracranial abnormalities after neuroimaging\textsuperscript{36,37}. 
3. CLUSTER HEADACHE.

Cluster headache affects men more than women. Male to female ratio is 6:1. It is commoner in males in their twenties and above who are smokers. It typically occurs in bouts for six to twelve weeks once a year or two years often at the same time each year. The pain is usually intense comparable to renal colic and is strictly unilateral. Patients may experience background headache. It occurs daily at a similar time each day and diminishes usually after thirty to sixty minutes.

4. MEDICATION OVERUSE HEADACHE (MOH).

It is estimated that one out of every fifty adults suffer from medication overuse headache. Female to male ratio is 5:1. This type of headache is commonly diagnosed in patients who overuse migraine drugs. These patients experience relapse after acute therapy, mechanism is not yet clear.

After chronic usage of these drugs, it is thought that headache results from down regulation of 5-HT$\textsubscript{1B/1D}$ receptors. MOH can also arise as a result of chronic overuse of combination of analgesics like barbiturates, caffeine and codeine. This could be as a result of addictive properties of these drugs. Simple analgesics like aspirin and paracetamol can also cause MOH.

Clinical presentation of MOH is highly variable. It often causes awakening in the morning and is aggravated by physical exertion. It is associated with nausea and vomiting. Patients will tend to seek for stronger analgesics. A very important key factor in MOH is patients tend to premedicate themselves in anticipation for a headache attack rather than take medication whenever they have an attack.

MOH rarely develops when analgesics are taken regularly for treatment of another condition like chronic backache except in the presence of a primary headache.

Diagnosis of MOH is initially presumptive based on symptoms and history of drug use, this is usually confirmed when symptoms improve after medication is withdrawn.

The remaining types of headaches, both primary and secondary are captured in appendix A.
DIAGNOSIS OF HEADACHE

HISTORY TAKING.

Patients with primary headache, laboratory tests and neuroimaging will reveal no abnormality at all. Proper history taking plays extremely important role in diagnosing primary headaches. This calls for the clinician to take time to elicit comprehensive history. Incomplete history taking is probably the commonest cause of most misdiagnosis.

It is usually recommended to have the patients keep a headache diary over a few weeks. The clinician needs to pick the pattern of attacks and review it from time to time.

According to the Scottish Intercollegiate Guidelines Network (SIGN), the patient’s history is of the utmost importance in evaluating headache in order to classify the headache type(s) and screen for secondary headache. It is very important to rule out any possibility of underlying secondary cause of headache. Secondary headache should be considered in patients presenting with new onset headache or headache whose presentation and pattern of attacks differ from the usual. According to SIGN, observational studies have highlighted warning signs, called red flags, for potential secondary headache which requires further investigation. These red flags include:

1. New onset or change in headache in patients who are aged over 50 years.
2. Thunderclap: rapid time to peak headache intensity lasting seconds to 5 minutes.
3. Focal neurological symptoms like limb weakness, aura less than five minutes or more than one hour.
4. Non-focal neurological symptoms like cognitive disturbance.
5. Change in headache frequency, characteristics or associated symptoms.
6. Abnormal neurological examination.
7. Headache that changes with posture.
8. Headache wakening the patient up.

9. Headache precipitated by physical exertion or valsalva manoeuvre.


11. Jaw claudication or visual disturbance.


13. Fever.


15. New onset of headache in a patient with a history of cancer.

Presence of any of these red flags increase the chances of getting a positive finding in patients with non acute headaches.

The following Organizations agree with the findings of the study, and recommed one to establish the presence of red flags before neuroimaging:

1. European Federation of Neurosurgical Societies- 2010.


10. American Heart Association 2009 Guidelines for the management of aneurysmal SAH.

There is no local policy on the application of the red flags before neuroimaging.
British association for the study of headache stresses on the importance of taking comprehensive clinical history. They recommend a systematic approach to headache. Table one is a sample of a systematic history taking approach recommended by the association. This will help the clinicians make a sound diagnosis of the type of headache their patients have without missing any danger signs pointing to a possible secondary headache\textsuperscript{14}.

**TABLE 1: AN APPROACH TO HEADACHE HISTORY\textsuperscript{14}**

<table>
<thead>
<tr>
<th>1. How many different headache types does the patient experience?</th>
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<tbody>
<tr>
<td>Separate histories are necessary for each, it is reasonable to concentrate on the most bothersome to the patient but others should always attract some enquiry in case they are clinically important.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Time questions</th>
<th>A. Why consulting now?</th>
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<tbody>
<tr>
<td></td>
<td>B. How recent in onset?</td>
</tr>
<tr>
<td></td>
<td>C. How frequent and what temporal pattern (especially distinguishing between episodic and daily or unremitting)?</td>
</tr>
<tr>
<td></td>
<td>D. How long lasting?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Character questions</th>
<th>A. Intensity of pain.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B. Nature and quality of pain.</td>
</tr>
<tr>
<td></td>
<td>C. Site and spread of pain.</td>
</tr>
<tr>
<td></td>
<td>D. Associated symptoms.</td>
</tr>
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<tr>
<th>4. Cause questions.</th>
<th>A. Predisposing and/ or trigger factors.</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>B. Aggravating and/ or relieving factors.</td>
</tr>
<tr>
<td></td>
<td>C. Family history or similar headache.</td>
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<tr>
<th>5. Response questions.</th>
<th>A. What does the patient do during the headache?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B. How much is activity (function) limited or prevented?</td>
</tr>
<tr>
<td></td>
<td>C. What medication has been and is used in what manner?</td>
</tr>
</tbody>
</table>

| 6. State of health between the attacks. | A. Completely well, or residual or persisting symptoms?Concerns, anxieties, fears about recurrent attacks and/ or their cause. |

*British association for study of headache. Guidelines for all healthcare professional in the diagnosis and management of headache 3rd edition (1st revision) 2010*
PHYSICAL EXAMINATION

Primary headaches are diagnosed solely on history. The main purpose of physical examination is to rule out any possibility of secondary headache. It is important to do systematic physical examination in all systems\textsuperscript{14,31}.

Fundoscopy, blood pressure check up, head and neck examination for muscular tenderness, stiffness, limited range of movement and crepitations form a very important part of physical examination in headache patients. Thorough physical examination by itself is reassuring to the patients\textsuperscript{14,31}.

About 0.9\% of consecutive headache out patients without neurological signs have a significant pathology\textsuperscript{45}. This reinforces the importance of physical examination in ruling out serious causes of headache\textsuperscript{14}.

NEUROIMAGING

In diagnosing primary headache, neuroimaging plays a role of exclusion of secondary headaches\textsuperscript{46,47}. The risk of finding pathology increases with age. Neuroimaging in primary headache yields very low results, between 1-3\%\textsuperscript{15}. In Rotterdam population, study done on incidental brain MRI findings showed that, one out seven people above age 47 years in general population had brain abnormality\textsuperscript{48}. 
USE OF HEAD CT SCAN AS A DIAGNOSTIC TOOL
Computed tomography is a medical imaging technique used to aid diagnosis and to guide interventional and therapeutic procedures. It uses ionizing radiation to produce high resolution three dimensional images of a person’s anatomy. Computed tomography examinations are non invasive although an intravenous contrast agent is sometimes required to enhance images. 

Radiation exposure occurs with every CT scan and the amount of radiation depends on which part of the body is being scanned. For a typical head CT scan, a CT scanner may emit a radiation dose of 2-4 millisieverts, while a skull x ray is 0.01 to 0.02 mSv.

It is important to limit the use of head CT scans done because of:

1. Radiation exposure.
2. Contrast exposure.
3. Risk of false positive.
4. Cost burden to the patients and institutions.

As mentioned earlier, study done in the USA showed that 62 million CT scans are done per year in the USA. One third are done ‘unnecessarily’ by cautious doctors in fear of medical legal actions on worried patients in the emergency department. The unnecessary radiation dose is quite high given that a complete non enhanced head CT scan emits radiation dose of 2mSv, and contrast enhanced 4mSv.
CHAPTER 2: STATEMENT OF RESEARCH PROBLEM.

PROBLEM STATEMENT.
Most computed tomography scans of the head in patients presenting with non acute headache and normal neurological examinations reveal normal intracranial findings. Computed tomography scans utilizes ionizing radiations and cumulative radiation dose could be a problem if proper screening is not done. CT scan is also expensive and this could be an economic burden to the patient and the state.

BROAD OBJECTIVE
To find out the utility of head CT scan in patients presenting with non acute headache and have normal neurological examination.

SPECIFIC OBJECTIVES
1. To find out the head CT scan findings in these patients.
2. To determine the proportion of positive head CT scan findings.
3. To determine the distribution of positive findings in terms of qualifications of the referring clinician, age, duration of headache and gender of the patient.
4. To determine which types of clinically diagnosed headache, yields positive findings.

JUSTIFICATION
Most patients presenting with headache in our health facilities do not have a serious underlying conditions. Secondary headaches are rare compared with the large number of patients with primary headache. There is general concern on whether head CT scans should be done routinely to exclude underlying causes of headache. Studies done elsewhere where reveal that neuroimaging does no play any role in diagnosis primary headache. The clinicians should also be cautious enough no to miss any brain pathology responsible for the headache.

It’s very important to find out whether the frequency of head CT scan done in our local population is justifiable. Studies have been done elsewhere in different settings, however no similar study has been recorded locally.
This study will lay a foundation of formulating a guideline to be followed before neuroimaging patients with non acute headache and normal neurological examination.

THE SCOPE OF THE STUDY
Head CT scans done on patients with non acute headache and normal neurological examination referred by their primary physicians to Plaza Imaging Solutions(PIS) and KNH were evaluated. Data was collected within a period of six months after the approval of the study.

STUDY AREA
The study was conducted at KNH radiology department and PIS both located in Nairobi.

KNH is the oldest hospital in Kenya having been founded in 1901 as the Native Civil Hospital and then renamed King George VI in 1952. It was there after renamed again as KNH after Kenya gained independence in 1963. It is currently the largest national referral, teaching and research hospital.

The hospital is organised into various specialized departments. Among these departments is the relatively well equiped radiology department. The radiology department has a sixteen slice CT scanner among other modern and routine imaging modalities. The hospital serves mostly low and middle class population, and afew upper class social status patients.

PIS, is a private imaging institution located at General Accident House on Ralph Bunche Road, slightly off central business area, not far from the KNH, and the Nairobi Hospital. It has six hundred and fourty slice CT scanner among other modern imaging machines. The patient population here comprises patients referred from private clinics, some private hospitals and afew from KNH and other public hospitals when their units are not functioning or are being serviced.
CHAPTER 3: RESEARCH METHODOLOGY

STUDY POPULATION
Patients included in the study were aged between 13-87 years sent by referring physicians with history of non acute headache with normal neurological examination for head CT scan to KNH and PIS during the period of study.

INCLUSION CRITERIA
Outpatient aged 5-98 years population with non acute headache and normal neurological examination sent by attending physicians for head CT scan, and accepted to consent for the study. During the study period, the available patient population send for head CT scan with non acute headache and normal neurological examination was aged between 13-18 years.

EXCLUSION CRITERIA
Persons with a clinical diagnosis of a secondary headache from a known organic cause or presence of neurological deficit or with recent history of seizures, any form of neurological symptoms, and headache due to trauma. This information was obtained from clinical summary in the request form. The researcher also obtained clinical information from the patients in the process of filling the questionnaire and signing of the consent.

Those who did not give consent for inclusion.

STUDY DESIGN
Prospective cross-sectional survey.

SAMPLING TECHNIQUE
Convenient sampling was used. All patients age 5-98 years sent by referring physicians to the two facilities for head CT scan with non acute headache and normal neurological exam were included.

QUALITY CONTROL
All Head CT scan examinations were analysed by the researcher and the results where verified by a qualified radiologist before their inclusion into the study.
VARIABLES ANALYSED

1. Duration of headache.

Previous studies done, suggests that the duration of a headache disorder may be a useful predictor of significant abnormalities among patients with recent onset headache\textsuperscript{52}.

2. Age.

It has been shown that, increasing age is strongly associated with finding an abnormality. As people age, they are prone to getting brain atrophy and cerebral infarcts\textsuperscript{53}.

3. Level of qualification of the referring clinician.

Inadequate knowledge on headache classification may lead to wrong clinical diagnosis leading to unnecessary radiological examination. Inadequate clinical history taking and examination could as well lead to unnecessary radiological examination. The study has compared CT scan findings with the qualifications of the referring clinician.

4. Type of headache.

Clinically diagnosed headache types were analysed to show which type yielded more positive intracranial pathologies. In cases where no specific diagnosis of the headache type is made, then it was just analysed as unclassified headache.

5. Sex

The study analysed positive intracranial findings in terms of gender distribution.
SAMPLE SIZE DETERMINATION
The sample size will be determined by the following formula by Fisher et al (1998)\(^{54}\).

The prevalence of positive intracranial lesion findings on neuroimaging in patients with non-acute headache and normal neurological examination was determined from a similar study done in Nigeria 2010 which showed a prevalence rate of 47.3\%\(^{30}\).

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

Where \( n \) = desired sample size.

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

\( p \) = known prevalence of positive intracranial lesions on neuroimaging (47.3\%)

\( d \) = the level of precision desired. When this formula is applied at \( d = 0.1 \)

\[ n = \frac{(1.96)^2 \times 0.473 \times (1-0.473)}{0.1^2} = 96 \]

Therefore a minimum sample of 96 patients will be recruited.

DATA MANAGEMENT
Data analysis was done using statistical package for social science research (SPSS) and excel computer software. Results are presented in form of frequency distributions and descriptive statistics. Pathology demonstrative images will be sampled and presented.
ETHICAL CONSIDERATIONS

1. Only patients sent by the referring physicians with history of non acute headache and normal neurological examination were included after signing an informed consent.

2. The patient’s names are not included anywhere in the data collections forms in order to maintain confidentiality. Instead the patients were coded with serial numbers. For referral purposes only Out Patient or X ray numbers were recorded.

3. The ALARA principle that is keeping the radiation exposure As Low As Reasonably Achievable were maintained for all the patients. Only the standard radiological procedures for head CT scan were applied to all patients. No additional examination were done on a patient other than the one requested by the primary physician.

4. For all children, consent was sought from the parents/ guardians.

5. Permission to carry out the study was sought from the Ethical and Research Committee of Kenyatta National Hospital. The study commenced as soon as it was approved by the committee.

6. The study findings in bound form will be submitted to the University of Nairobi for its intended purpose, there after the findings will be used to facilitate improvements in patient management.
CHAPTER 4: RESULTS.
The study recruited 100 patients with clinical diagnosis of primary headache described as non acute headaches and normal findings on neurological examination referred for head CT scan at Kenyatta Nation Hospital and Plaza Imaging solutions during the period of study. The mean age of the patients was 36.7 years (SD = 16.6) with a range of 13 years to 87 years.

The majority of patients were aged between 30 and 39 years (26%) followed by 20 and 29 years (24%).

Female patients presenting with headaches accounted for 65% of participants yielding a female-to-male ratio of 1.9: 1

Seventy-eight percent of all referrals for head CT scans were referred by medical officers, 16% of referred by general consultants and (6%) were from consultant neurologists.

TABLE 3

<table>
<thead>
<tr>
<th>Patients age</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 to 19 years</td>
<td>15</td>
<td>15.0</td>
</tr>
<tr>
<td>20 to 29 years</td>
<td>24</td>
<td>24.0</td>
</tr>
<tr>
<td>30 to 39 years</td>
<td>26</td>
<td>26.0</td>
</tr>
<tr>
<td>40 to 49 years</td>
<td>16</td>
<td>16.0</td>
</tr>
<tr>
<td>50 to 59 years</td>
<td>6</td>
<td>6.0</td>
</tr>
<tr>
<td>60 to 89 years</td>
<td>13</td>
<td>13.0</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>65</td>
<td>65.0</td>
</tr>
<tr>
<td>Male</td>
<td>35</td>
<td>35.0</td>
</tr>
<tr>
<td>Source of referral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Officer</td>
<td>78</td>
<td>74.0</td>
</tr>
<tr>
<td>Other Consultants</td>
<td>16</td>
<td>16.0</td>
</tr>
<tr>
<td>Neurologist Consultant</td>
<td>6</td>
<td>6.0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Characteristics of patients who presented to KNH and Plaza Imaging radiology units for head CT scanning with history of non acute headache and normal neurological examination during the period of study.
Primary headache presentation

The median reported duration of headache complaints at presentation for head CT scan was 2 years (interquartile range 1 to 4). The minimum of duration of headache was 2 months and the maximum was 10 years. Sixty-eight percent of patients had had headaches for durations lasting between 1 and 5 years (Figure 1).

![Pie chart showing duration of headaches]

**Figure 1:** Reported duration of headaches in patients (n = 100) referred for head CT scans at KNH and Plaza Imaging solutions.

Out of the 100 patients referred for head CT scans, 5 (5%) had a clinical diagnosis for a primary type of headache (migraine) while the remaining patients did not have any stated clinical diagnosis for the classification of the primary headache for which a head CT scan was being ordered. The clinician used terms like, chronic, recurrent, long standing and severe headache. Four of the clinical diagnoses of migraine were made by medical officers and one diagnosis was made by general consultant. (Table 4). None of the neurologists classified the primary headache type they were referring for CT scan.
### Table 4.

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Number with diagnosis</th>
<th>Total referral</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Officer</td>
<td>4</td>
<td>78</td>
<td>5.13%</td>
</tr>
<tr>
<td>Consultant</td>
<td>1</td>
<td>16</td>
<td>6.25%</td>
</tr>
<tr>
<td>Neurologist</td>
<td>0</td>
<td>6</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Clinical classification of primary headaches referred for head CT scan*

### Table 5

<table>
<thead>
<tr>
<th>Level of qualification</th>
<th>Number without definite diagnosis</th>
<th>Total referral</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical officer</td>
<td>74</td>
<td>78</td>
<td>94.87%</td>
</tr>
<tr>
<td>General consultants</td>
<td>15</td>
<td>16</td>
<td>93.75%</td>
</tr>
<tr>
<td>Consultant</td>
<td>6</td>
<td>6</td>
<td>100%</td>
</tr>
<tr>
<td>Neurologist</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Classification of patients referred without definite headache diagnosis.*
CT SCAN FINDINGS

Head CT scan investigation revealed that majority of the referrals had normal findings (44%) or findings consistent with rhinosinusitis (43%). Among the remaining, 8% had brain atrophy, 3% had mastoiditis and 2% had solid pathological lesions noted.

TABLE 6:

<table>
<thead>
<tr>
<th>Head CT scan finding</th>
<th>Number (n)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal findings</td>
<td>44</td>
<td>44.0</td>
</tr>
<tr>
<td>Rhinosinusitis</td>
<td>43</td>
<td>43.0</td>
</tr>
<tr>
<td>Brain atrophy</td>
<td>8</td>
<td>8.0</td>
</tr>
<tr>
<td>Mastoiditis</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Solid lesions</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Findings of Head CT scans in patients with primary headaches referred to KNH and Plaza Imaging solutions
Among the five cases with a clinical diagnosis of headache, three patients had head CT scans with evidence of rhinosinusitis and two had normal findings.

Table 7.

<table>
<thead>
<tr>
<th>Head CT scan finding</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhinosinusitis</td>
<td>3</td>
<td>60.0</td>
</tr>
<tr>
<td>Normal findings</td>
<td>2</td>
<td>40.0</td>
</tr>
<tr>
<td>Brain atrophy</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mastoiditis</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Solid lesions</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Findings of Head CT scans in patients with definite primary headaches diagnosis referred to KNH and Plaza Imaging

TABLE 8.

<table>
<thead>
<tr>
<th>Head CT scan finding</th>
<th>Duration of headache</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 1 year</td>
<td>1-5 years</td>
</tr>
<tr>
<td>Rhinosinusitis</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>Normal findings</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>Brain atrophy</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Mastoiditis</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Solid lesions</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

CT scan findings according duration of headache
TABLE 9.

<table>
<thead>
<tr>
<th>Head CT scan finding</th>
<th>Number (n)</th>
<th>Mean age</th>
<th>SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhinosinusitis</td>
<td>43</td>
<td>36.3</td>
<td>15.2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Normal findings</td>
<td>44</td>
<td>33.2</td>
<td>12.9</td>
<td></td>
</tr>
<tr>
<td>Brain atrophy</td>
<td>8</td>
<td>62</td>
<td>20.9</td>
<td></td>
</tr>
<tr>
<td>Mastoiditis</td>
<td>3</td>
<td>36.7</td>
<td>27.6</td>
<td></td>
</tr>
<tr>
<td>Solid lesions</td>
<td>2</td>
<td>40</td>
<td>1.4</td>
<td></td>
</tr>
</tbody>
</table>

*CT scan findings and patient age*

TABLE 10.

<table>
<thead>
<tr>
<th></th>
<th>Medical Officer</th>
<th>General Consultant</th>
<th>Consultant neurologist</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhinosinusitis</td>
<td>35</td>
<td>6</td>
<td>2</td>
<td>43</td>
</tr>
<tr>
<td>Normal findings</td>
<td>36</td>
<td>6</td>
<td>2</td>
<td>44</td>
</tr>
<tr>
<td>Brain atrophy</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Mastoiditis</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Solid lesions</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>78</strong></td>
<td><strong>16</strong></td>
<td><strong>6</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Referring clinician and CT findings.*
CHAPTER 5: ILLUSTRATIONS

Figure 2:

A forty four year old female referred by medical officer for head CT scan with a two year history of headache. NECT scan findings were normal.

Figure 3.
A twenty six year old female patient with two month history of severe headache had normal NECT and CECT examination.
A fifty six year old female presented with 9 year history of left sided headache. Head CT scan showed an ill defined non enhancing cortical lesion in right parietal area. CT differential diagnosis of low grade glioma and focal cortical infarct were made. This is a patient who was scanned for with a clinical diagnosis of primary headache symptoms but actually had underlying pathology. Final diagnosis wasn’t established.
A sixty seven year old female presented with two year history of chronic headache. Head CT scan done bone window, showed opacification of right mastoid air cells.
A forty two year old male presented with four year history of persistent headache. Non enhanced head CT scan shows bilateral maxillary mucosal thickening in a case of sinusitis.
A twenty four year old female presented with two year history of chronic headache. Head CT scan done showed a well defined moderately enhancing left jugular fossa mass most likely a Paraganglioma.
A thirty six year old male presented with two years history of severe headache, non enhanced head CT scan done showed left maxillary sinus mucous retention cyst.
CHAPTER 6: DISCUSSION.
The findings in this study show that, head CT scan examination in patients with non acute headache and normal neurological examination yield very low positive findings (2%), this is in agreement with studies done in the USA where yield was in the range of 1 to 3%15. There is therefore a need to come up with a protocol to be followed locally before imaging these patients to avoid unnecessary use of ionizing radiation and cut down on medical expenses. The 2% are patients with clinical diagnosis of primary headache but CT scan examination revealed that, they actually had secondary headache. If clinicians ruled out the presence of above discussed warning signs indicative of a possible presence of intracranial abnormalities, they would probably pick these patients. These are patients the clinician should not miss because of possibility of a critical lesion.

In this study, majority of patients presenting with non acute headache and normal neurological examination were female (65%). A study done in India on prevalence of primary headache on population aged 8-18 years showed primary headache is more common in females at 65.15%56. In the USA, a study on headache analysing all out patient office based care, between 2007 through 2010, revealed that there were 51.1 million adult persons who visited health facilities because of headache. Most of the patients were younger than 65 years (88%). Majority were female patients (78%)15.

In this study, the mean age of the patients was 36.7 years (SD= 16.6). The majority were aged between 30 and 39 years (26%) and 20 and 29 years (24%). This agrees with a study done in the United States which showed that migraine headache, the commonest primary headache diagnosed in primary healthcare setting, peaks between the ages of 25-55 years57.

Most of the patients in this study were referred by medical officers (78%) while general consultants referred 26 patients (26%) and consultant neurologist referred only 6 patients (6%). The study shows that the frequency of referral for CT head imaging reduced significantly as we moved high through the levels of specialization. Studies show that the cause and type of most headaches can be determined by comprehensive history and clinical examination. It is from clinical history that one will be able to recognize warning signs that raise red flags and prompt the need for neuroimaging. A clinician needs to be aware of these warning signs too. If patients
present with atypical features or do not respond to conventional therapy, the diagnosis of primary headache should be questioned and a possibility of secondary disorder should be revisited and consideration for referral to a specialist neurologist made\textsuperscript{58,59}.

According to the Scottish Intercollegiate Guidelines Network (SIGN), patient’s history is of the utmost importance in evaluating headache in order to classify the headache type(s) and screen for secondary headache. It is very important to rule out any possibility of underlying secondary cause of headache. Secondary headache should be considered in patients presenting with new onset headache or headache whose presentation and pattern of attacks differ from the usual. According to SIGN, observational studies have highlighted warning signs, the red flags, for potential secondary headache which requires further investigation\textsuperscript{44}.

The main objective why clinician refer patients for neuroimaging is for detection of significant treatable lesions that can impact on quality of life. There are instances where neuroimaging is done to relieve patients anxiety, fear of litigation and on patient's or family request\textsuperscript{33}.

The findings in this study where the medical officers have the highest number of referrals followed by general consultants and lastly neurologist could be explained by, the possibility that medical officers do not take thorough history and may not know the danger signs which should be looked for before referring these patients for neuroimaging. There is a possibility that their physical examination is deficient and so they would prefer using neuroimaging as a screening tool to help them in picking potentially serious intracranial pathologies without considering cost-benefit implications to the patient.

Neurologist being the highest trained in doing neurological examination and taking thorough clinical history, would pick any danger signs with higher accuracy and would know which patients to send for neuroimaging and which ones would not benefit from it. They are also more aware of the cost-benefit implications to the patients. These are possible explanations of their low referrals for neuroimaging.

Only 5 patients in this study had a clinical diagnosis of the type of primary headache they had. Out of the five cases, four of them were made by medical officers, one by general consultants and non by neurologist. The five had clinical diagnosis of migraine headache. This means that
95% had unclassified diagnosis. A study done in Ireland on management of headache patients in emergency care, 39% of all the patients sampled did not have any clinical diagnosis of the type of headache they were being treated for. In comparison with this study where 95% did not have a clinical diagnosis of the type of headache means that, our level of making clinical diagnosis for the type of headache our patients are suffering from is way too low.

Studies show that, it is important for a clinician to pick out primary and secondary headaches purely from history and physical examination. Medical officers and other consultants in general practice should diagnose headaches up to first and second digit level while neurologist and headache specialist centers should go up to third or fourth digit level.

Despite the high prevalence of headache, clinicians are often uncomfortable diagnosing specific headache disorders. Fewer than half of patients with migraine are properly diagnosed, and only one third of affected patients receive migraine-specific prescription drugs. The headache classification system may be too cumbersome for most primary care or general physicians to use properly.

In an international study done in a primary care setting, it was found that out, that 76% had migraine headache, 18% had migrainous headache, 3% had tension type headache and the other headache subtypes made 3%. Another study showed that migraine headache and tension type headache account for over 90% of the primary headache disorders in clinical practice.

The discrepancy between this study and the above international studies raises the possibility that local clinicians are missing out on diagnosing specific definite headache subtypes as required by International Headache Society possibly due to possible inadequate knowledge on the classification of headache or they find it too cumbersome to follow.

In this study, out of the 5 patients diagnosed to have migraine headache, three had CT scan findings of rhino sinusitis and two had normal CT scan findings. In a different study, it was found that 80% (2393 out of 2991) of patients with physician's diagnosis of or self diagnosis of sinus headache, actually met a clinical diagnostic criteria for migraine headache as defined by International Headache Society. Reasons for this high degree of inaccuracy is attributed to the fact that, patients have pain located in periorbital area and in the presence of nasal autonomic
symptomatology such as rhinorrhea and tearing, led to the clinical diagnosis of sinus headache. However at least one of these symptoms was observed in 87% of the migraine headache patients\(^\text{64}\). In this study, none of the 43 patients with CT scan diagnosis of rhinosinusitis had a clinical diagnosis of the same of patients.

In patients diagnosed with migraine headache and have normal neurological examination, the prevalence of significant intracranial abnormalities on neuroimaging ranges from 0.2% to 0.6%\(^\text{33}\).

Autopsy done on patients who had been on treatment for migraine revealed arteriovenous malformation prevalence of 0.8% and 2.4% saccular aneurysms\(^\text{34,35}\).

In this study two patients (2%), had solid pathological lesions. They were both female patients referred by neurologists with no definite clinical diagnosis. One of the patients was aged 24 years and had history of headache for two years. She had a well defined moderately enhancing mass in left jugular fossa, a differential diagnosis of a paraganglioma was given. The second patient was a 56 years old female patient who presented with a nine year history of right sided headache. Head CT scan done revealed an hypodense cortical lesion in right parietal region which was non enhancing. Differentials of low grade glioma and focal cortical infarct were given. This agrees with studies done in the USA which shows that primary headaches in adults with normal neurologic examinations have very low preverance for significant intracranial patholo-\(^\text{1,3}\). The findings however differ from a study done in Nigeria whose prevalence was 25.6%. This was significantly higher due to the method of selection, all the cases in this study were referrals from a neurologist\(^\text{30}\). This agrees with the fact that all the referrals in this study were also from neurologist. Ruling out the presence of warning signs in patients with primary headaches increases the index of suspicion of the presence of abnormal intracranial pathology. Studies show that Increasing age is strongly associated with findings of abdormality especially old cerebral infarct\(^\text{53}\). This agrees with the case in this study of the cerebral lesion in the elderly lady whose differential diagnosis was a cerebral infarct.
Brain atrophy was seen in eight patients and their mean age was 62 years. This is in keeping with studies done in the past which have shown that cerebral atrophy is a common finding in the elderly\textsuperscript{53}.

In this study, 43\% of the patients had Head CT scan findings of Rhinosinusitis without any other pathology that could be attributed to headache. All these patients had indefinite clinical diagnosis of chronic headache, non of them had a clinical diagnosis of rhinosinusitis. Studies show that sinusitis is one of the most common diseases treated by primary care physicians. Patients with sinus headache describe a sensation of having increased pressure overlying the sinuses and if infected, they will have characteristic features which clinicians should be able to diagnose. Uncomplicated sinusitis do not require radiologic imaging. Plain radiography has a limited role in the management of sinusitis. Non contrast enhanced paranasal CT scan coronal reformats can pick abnormalities up to 40\% of symptomatic adults. Clinical correlation is always needed to avoid over diagnosing of sinusitis\textsuperscript{65}.

If clinicians took comprehensive clinical history and did thorough physical examination, they will be able to pick sinus headache and so they would refer patients for paranasal sinus CT scan rather than head CT scan. The high rate of missing sinus headache clinically in this study could be explained by the high number of patients with CT diagnosis of rhinosinusitis being referred for head CT scan instead of paranasal sinus CT scan hence exposing them to a higher radiation dose.

In this study, three patients (3\%), had Head CT scan findings of mastoiditis. Two were referrals from medical officers and one from a general consultant without a definite clinical headache diagnosis. Clinical presentation of mastoiditis is characteristic and investigation of choice for uncomplicated mastoiditis is high resolution CT scan of temporal bone which gives more details and give the patient lower radiation dose\textsuperscript{66}.

At KNH, radiology department has a protocol where any CT scan examination requested by clinicians, especially medical officers, is scrutinised first by a radiologist consultant or radiology residents and counter signed. This done in order to avoid unnecessary examinations. However, we still have high numbers of unnecessary scans from this facility. This raises the need for more
aggressive campaign possibly to the clinicians to do thorough clinical examination and take comprehensive history, and avoid referring patients for neuroimaging for uncomplicated headaches. In the USA, American College of Radiology has launched a campaign against unnecessary neuroimaging for uncomplicated headache. They have joined, "choose wisely campaign", and have placed, "Don't do imaging for uncomplicated headache" on it's top five list of things physicians and patients should question\textsuperscript{15}. This is an avenue which can be utilised to reduce the number of unnecessary neuroimaging on patients presenting with primary headaches. The low yield of positive intracranial findings after doing head CT scan on patients with primary headache should prompt establishment of a protocol to be followed before neuroimaging.

Contrast enhanced CT scan examinations done on patients without any solid pathological lesions on non enhanced examination did not add any new information after examination. This is an issue which requires further studies in the local settings to find out out whether there is any role in giving IV (Intra Venous) contrast media in patients with normal NECT.

**CONCLUSION**

The study shows that there is limited role of CT scan examination in patients with non acute headache and normal neurological examination.

Possible inadequate knowledge on diagnosing and classifying headaches, inadequate history taking and physical examination are possible causes of high number of neuroimaging cases that are currently being done in Nairobi.
RECOMMENDATIONS

1. Application of warning signs, red flags, should be done just like in other centers on patients with non acute headache and normal neurologic examination before doing Head CT scans.

   Local medical schools should stress this to the students during their training. Radiologists and neurologists should launch a campaign similar to that done in the USA on 'Don't do neuroimaging for uncomplicated headaches' to clinicians locally through seminars and luncheons.

2. Clinicians should obtain comprehensive clinical history and do thorough physical examination and make a definite clinical diagnosis according to International Headache Society before requesting for neuroimaging.

   Headache classification and its application should be well covered by medical schools during the training of doctors. Neurologist should conduct seminars and trainings to sensitize the practicing doctors on importance of comprehensive clinical examination and application of headache classification.

3. Non specialists should always refer patients to neurologist in cases of complicated difficult cases before neuroimaging. These are the cases they are not able to make proper clinical diagnosis and are not responding to the treatment administered.

4. Medical training in local Universities should emphasize on headache classification and importance of systematic approach on taking comprehensive clinical history and physical examination in headache patients who form the highest percentage of outpatient consultations.

5. Patient education on dangers of unnecessary radiation should be started and if it is already in place, it should be enhanced. This should be done by all clinicians as they see their patients more so to patients who demand to be imaged. Informative posters could be put in the patients waiting area and doctors consultation rooms.
REFERENCES


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33. Evidence based guidelines in the primary care setting: Neuroimaging in patients with non acute headache. US headache consortium


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APPENDIX A

CLASSIFICATION

IHS

ICHD-II Code  DIAGNOSIS

1. Migraine

1.1 Migraine without aura
1.2 Migraine with aura
   1.2.1 Typical aura with migraine headache
   1.2.2 Typical aura with non-migraine headache
   1.2.3 Typical aura without headache
   1.2.4 Familial hemiplegic migraine (FHM)
   1.2.5 Sporadic hemiplegic migraine
   1.2.6 Basilar-type migraine
1.3 Childhood periodic syndromes that are commonly precursors of migraine
   1.3.1 Cyclical vomiting
   1.3.2 Abdominal migraine
   1.3.3 Benign paroxysmal vertigo of childhood
1.4 Retinal migraine
1.5 Complications of migraine
   1.5.1 Chronic migraine
   1.5.2 Status migrainous
   1.5.3 Persistent aura without infarction
   1.5.4 Migrainous infarction
   1.5.5 Migraine-triggered seizures
1.6 Probable migraine
   1.6.1 Probable migraine without aura
   1.6.2 Probable migraine with aura
   1.6.5 Probable chronic migraine
2. Tension-type headache (TTH)

2.1 Infrequent episodic tension-type headache
   2.1.1 Infrequent episodic tension-type headache associated with pericranial tenderness
   2.1.2 Infrequent episodic tension-type headache not associated with pericranial tenderness

2.2 Frequent episodic tension-type headache
   2.2.1 Frequent episodic tension-type headache associated with pericranial tenderness
   2.2.2 Frequent episodic tension-type headache not associated with pericranial tenderness

2.3 Chronic tension-type headache
   2.3.1 Chronic tension-type headache associated with pericranial tenderness
   2.3.2 Chronic tension-type headache not associated with pericranial tenderness

2.4 Probable tension-type headache
   2.4.1 Probable infrequent episodic tension-type headache
   2.4.2 Probable frequent episodic tension-type headache
   2.4.3 Probable chronic tension-type headache

3. Cluster headache and other trigeminal autonomic cephalalgias

3.1 Cluster headache
   3.1.1 Episodic cluster headache
   3.1.2 Chronic cluster headache

3.2 Paroxysmal hemicrania
   3.2.1 Episodic paroxysmal hemicrania
   3.2.2 Chronic paroxysmal hemicrania (CPH)

3.3 Short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing (SUNCT)

3.4 Probable trigeminal autonomic cephalalgia
   3.4.1 Probable cluster headache
   3.4.2 Probable paroxysmal hemicrania
   3.4.3 Probable SUNCT
4. Other primary headaches

4.1 Primary stabbing headache
4.2 Primary cough headache
4.3 Primary exertional headache
4.4 Primary headache associated with sexual activity
   4.4.1 Preorgasmic headache
   4.4.2 Orgasmic headache
4.5 Hypnic headache
4.6 Primary thunderclap headache
4.7 Hemicrania continua
4.8 New daily-persistent headache (NDPH)

5. Headache attributed to head and/or neck trauma

5.1 Acute post-traumatic headache
   5.1.1 Acute post-traumatic headache attributed to moderate or severe head injury [S06]
   5.1.2 Acute post-traumatic headache attributed to mild head injury [S09.9]
5.2 Chronic post-traumatic headache
   5.2.1 Chronic post-traumatic headache attributed to moderate or severe head injury [S06]
   5.2.2 Chronic post-traumatic headache attributed to mild head injury [S09.9]
5.3 Acute headache attributed to whiplash injury [S13.4]
5.4 Chronic headache attributed to whiplash injury [S13.4]
5.5 Headache attributed to traumatic intracranial haematoma
   5.5.1 Headache attributed to epidural haematoma [S06.4]
   5.5.2 Headache attributed to subdural haematoma [S06.5]
5.6 Headache attributed to other head and/or neck trauma [S06]
   5.6.1 Acute headache attributed to other head and/or neck trauma [S06]
   5.6.2 Chronic headache attributed to other head and/or neck trauma [S06]
5.7 Post-craniotomy headache
   5.7.1 Acute post-craniotomy headache
   5.7.2 Chronic post-craniotomy headache
6. Headache attributed to cranial or cervical vascular disorder

6.1 Headache attributed to ischaemic stroke or transient ischaemic attack
   6.1.1 Headache attributed to ischaemic stroke (cerebral infarction) [I63]
   6.1.2 Headache attributed to transient ischaemic attack (TIA) [G45]

6.2 Headache attributed to non-traumatic intracranial haemorrhage [I62]
   6.2.1 Headache attributed to intracerebral haemorrhage [I61]
   6.2.2 Headache attributed to subarachnoid haemorrhage (SAH) [I60]

6.3 Headache attributed to unruptured vascular malformation [Q28]
   6.3.1 Headache attributed to saccular aneurysm [Q28.3]
   6.3.2 Headache attributed to arteriovenous malformation (AVM) [Q28.2]
   6.3.3 Headache attributed to dural arteriovenous fistula [I67.1]
   6.3.4 Headache attributed to cavernous angioma [D18.0]
   6.3.5 Headache attributed to encephalotrigeminal or leptomeningeal
      angiomatosis (Sturge Weber syndrome) [Q85.8]

6.4 Headache attributed to arteritis [M31]
   6.4.1 Headache attributed to giant cell arteritis (GCA) [M31.6]
   6.4.2 Headache attributed to primary central nervous system (CNS)angiitis [I67.7]

6.5 Carotid or vertebral artery pain [I63.0, I63.2, I65.0, I65.2 or I67.0]
   6.5.1 [G44.810] Headache or facial or neck pain attributed to arterial dissection [I67.0]
   6.5.2 Post-endarterectomy headache [I97.8]
   6.5.3 Carotid angioplasty headache
   6.5.4 Headache attributed to intracranial endovascular procedures
   6.5.5 Angiography headache

6.6 Headache attributed to cerebral venous thrombosis (CVT) [I63.6]

6.7 Headache attributed to other intracranial vascular disorder
   6.7.1 Cerebral Autosomal Dominant Arteriopathy with Subcortical Infarcts
      and Leukoencephalopathy (CADASIL) [I67.8]
   6.7.2 Mitochondrial Encephalopathy, Lactic Acidosis and Stroke-like
6.7.3 Headache attributed to benign angiopathy of the central nervous system [I99]
6.7.4 Headache attributed to pituitary apoplexy [E23.6]

7. Headache attributed to non-vascular intracranial disorder

7.1 Headache attributed to high cerebrospinal fluid pressure

7.1.1 Headache attributed to idiopathic intracranial hypertension (IIH) [G93.2]
7.1.2 Headache attributed to intracranial hypertension secondary to metabolic, toxic or hormonal causes
7.1.3 Headache attributed to intracranial hypertension secondary to hydrocephalus [G91.8]

7.2 Headache attributed to low cerebrospinal fluid pressure

7.2.1 Post-dural puncture headache [G97.0]
7.2.2 CSF fistula headache [G96.0]
7.2.3 Headache attributed to spontaneous (or idiopathic) low CSF pressure

7.3 Headache attributed to non-infectious inflammatory disease

7.3.1 [G44.823] Headache attributed to neurosarcoidosis [D86.8]
7.3.2 Headache attributed to aseptic (non-infectious) meningitis [code to specify aetiology]
7.3.3 Headache attributed to other non-infectious inflammatory disease [Code to specify aetiology]
7.3.4 Headache attributed to lymphocytic hypophysitis [E23.6]

7.4 Headache attributed to intracranial neoplasm [C00-D48]

7.4.1 Headache attributed to increased intracranial pressure or hydrocephalus caused by neoplasm [code to specify neoplasm]
7.4.2 Headache attributed directly to neoplasm [code to specify neoplasm]
7.4.3 Headache attributed to carcinomatous meningitis [C79.3]
7.4.4 Headache attributed to hypothalamic or pituitary hyper- or hyposecretion [E23.0]

7.5 Headache attributed to intrathecal injection [G97.8]

7.6 Headache attributed to epileptic seizure [G40.x or G41.x to specific seizure type]
7.6.1 Hemicrania epileptica [G40.x or G41.x to specify seizure type]
7.6.2 Post-seizure headache [G40.x or G41.x to specify seizure type]
7.7 Headache attributed to Chiari malformation type I (CM1) [Q07.0]
7.8 Syndrome of transient Headache and Neurological Deficits with cerebrospinal fluid Lymphocytosis (HaNDL)
7.9 Headache attributed to other non-vascular intracranial disorder

**8. Headache attributed to a substance or its withdrawal**

8.1 Headache induced by acute substance use or exposure
   8.1.1 Nitric oxide (NO) donor-induced headache [X44]
   8.1.1.1 Immediate NO donor-induced headache [X44]
   8.1.1.2 Delayed NO donor-headache [X44]
   8.1.2 Phosphodiesterase (PDE) inhibitor-induced headache [X44]
   8.1.3 Carbon monoxide-induced headache [X47]
   8.1.4 Alcohol-induced headache [F10]
   8.1.4.1 Immediate alcohol-induced headache [F10]
   8.1.4.2 Delayed alcohol-induced headache [F10]
   8.1.5 Headache induced by food components and additives
   8.1.5.1 Monosodium glutamate-induced headache [X44]
   8.1.6 Cocaine-induced headache [F14]
   8.1.7 Cannabis-induced headache [F12]
   8.1.8 Histamine-induced headache [X44]
   8.1.8.1 Immediate histamine-induced headache [X44]
   8.1.8.2 Delayed histamine-induced headache [X44]
   8.1.9 Calcitonin gene-related peptide (CGRP)-induced headache [X44]
   8.1.9.1 Immediate CGRP-induced headache [X44]
   8.1.9.2 Delayed CGRP-induced headache [X44]
   8.1.10 Headache as an acute adverse event attributed to medication used for other indications [code to specify substance]

8.1.11 Headache attributed to other acute substance use or exposure
8.2 Medication-overuse headache (MOH)
   8.2.1 Ergotamine-overuse headache [Y52.5]
   8.2.2 Triptan-overuse headache
   8.2.3 Analgesic-overuse headache [F55.2]
   8.2.4 Opioid-overuse headache [F11.2]
   8.2.5 Combination analgesic-overuse headache [F55.2]
   8.2.6 Medication-overuse headache attributed to combination of acute medications
   8.2.7 Headache attributed to other medication overuse [code to specify substance]
   8.2.8 Probable medication-overuse headache [code to specify substance]

8.3 Headache as an adverse event attributed to chronic medication [code to specify substance]
   8.3.1 Exogenous hormone-induced headache [Y42.4]

8.4 Headache attributed to substance withdrawal
   8.4.1 Caffeine-withdrawal headache [F15.3]
   8.4.2 Opioid-withdrawal headache [F11.3]
   8.4.3 Oestrogen-withdrawal headache [Y42.4]
   8.4.4 Headache attributed to withdrawal from chronic use of other substances
      [code to specify substance]

9. Headache attributed to infection

9.1 Headache attributed to intracranial infection [G00-G09]
   9.1.1 Headache attributed to bacterial meningitis [G00.9]
   9.1.2 Headache attributed to lymphocytic meningitis [G03.9]
   9.1.3 Headache attributed to encephalitis [G04.9]
   9.1.4 Headache attributed to brain abscess [G06.0]
   9.1.5 Headache attributed to subdural empyema [G06.2]

9.2 Headache attributed to systemic infection [A00-B97]
   9.2.1 Headache attributed to systemic bacterial infection [code to specific aetiology]
   9.2.2 Headache attributed to systemic viral infection [code to specify aetiology]
   9.2.3 Headache attributed to other systemic infection [code to specify aetiology]
9.3 Headache attributed to HIV/AIDS [B22]
9.4 Chronic post-infection headache [code to specify aetiology]
   9.4.1 Chronic post-bacterial meningitis headache [G00.9]

**10. Headache attributed to disorder of homoeostasis**

10.1 Headache attributed to hypoxia and/or hypercapnia
   10.1.1 High-altitude headache [W94]
10.1.2 Diving headache
   10.1.3 Sleep apnoea headache [G47.3]
10.2 Dialysis headache [Y84.1]
10.3 Headache attributed to arterial hypertension [I10]
   10.3.1 Headache attributed to phaeochromocytoma [D35.0 (benign) or C74.1 (malignant)]
   10.3.2 Headache attributed to hypertensive crisis without hypertensive encephalopathy [I10]
   10.3.3 Headache attributed to hypertensive encephalopathy [I67.4]
   10.3.4 Headache attributed to pre-eclampsia [O13-O14]
   10.3.5 Headache attributed to eclampsia [O15]
   10.3.6 Headache attributed to acute pressor response to an exogenous agent [code to specify aetiology]
10.4 Headache attributed to hypothyroidism [E03.9]
10.5 Headache attributed to fasting [T73.0]
10.6 Cardiac cephalalgia [code to specify aetiology]
10.7 Headache attributed to other disorder of homoeostasis [code to specify aetiology]

**11. Headache or facial pain attributed to disorder of cranium, neck, eyes, ears, nose, sinuses, teeth, mouth or other facial or cranial Structures**

11.1 Headache attributed to disorder of cranial bone [M80-M89.8]
11.2 Headache attributed to disorder of neck [M99]
   11.2.1 Cervicogenic headache [M99]
   11.2.2 Headache attributed to retropharyngeal tendonitis [M79.8]
   11.2.3 Headache attributed to craniocervical dystonia [G24]
11.3 Headache attributed to disorder of eyes
   11.3.1 Headache attributed to acute glaucoma [H40]
   11.3.2 Headache attributed to refractive errors [H52]
   11.3.3 Headache attributed to heterophoria or heterotropia (latent or manifest squint) [H50.3-H50.5]
   11.3.4 Headache attributed to ocular inflammatory disorder [code to specify aetiology]

11.4 Headache attributed to disorder of ears [H60-H95]

11.5 Headache attributed to rhinosinusitis [J01]

11.6 Headache attributed to disorder of teeth, jaws or related structures [K00-K14]

11.7 Headache or facial pain attributed to temporomandibular joint (TMJ) disorder [K07.6]

11.8 Headache attributed to other disorder of cranium, neck, eyes, ears, nose, sinuses, teeth, mouth or other facial or cervical structures [code to specify aetiology]

12. Headache attributed to psychiatric disorder
   12.1 Headache attributed to somatisation disorder [F45.0]
   12.2 Headache attributed to psychotic disorder [code to specify aetiology]

13. Cranial neuralgias and central causes of facial pain
   13.1 Trigeminal neuralgia
      13.1.1 Classical trigeminal neuralgia [G50.00]
      13.1.2 Symptomatic trigeminal neuralgia [G53.80] + [code to specify aetiology]
   13.2 Glossopharyngeal neuralgia
      13.2.1 Classical glossopharyngeal neuralgia [G52.10]
      13.2.2 Symptomatic glossopharyngeal neuralgia [G53.830] + [code to specify aetiology]
   13.3 Nervus intermedius neuralgia [G51.80]
   13.4 Superior laryngeal neuralgia [G52.20]
   13.5 Nasociliary neuralgia [G52.80]
   13.6 Supraorbital neuralgia [G52.80]
   13.7 Other terminal branch neuralgias [G52.80]
   13.8 Occipital neuralgia [G52.80]
   13.9 Neck-tongue syndrome
   13.10 External compression headache
13.11 Cold-stimulus headache
   13.11.1 Headache attributed to external application of a cold stimulus
   13.11.2 Headache attributed to ingestion or inhalation of a cold stimulus

13.12 Constant pain caused by compression, irritation or distortion of cranial
   nerves or upper cervical roots by structural lesions [G53.8] + [code to specify aetiology]

13.13 Optic neuritis [H46]

13.14 Ocular diabetic neuropathy [E10-E14]

13.15 Head or facial pain attributed to herpes zoster
   13.15.1 Head or facial pain attributed to acute herpes zoster [B02.2]
   13.15.2 Post-herpetic neuralgia [B02.2]

13.16 Tolosa-Hunt syndrome

13.17 Ophthalmoplegic “migraine”

13.18 Central causes of facial pain
   13.18.1 Anaesthesia dolorosa [G52.800] + [code to specify aetiology]
   13.18.2 Central post-stroke pain [G46.21]
   13.18.3 Facial pain attributed to multiple sclerosis [G35]
   13.18.4 Persistent idiopathic facial pain [G50.1]
   13.18.5 Burning mouth syndrome [code to specify aetiology]

13.19 Other cranial neuralgia or other centrally mediated facial pain [code to specify aetiology]

14. Other headache, cranial neuralgia, central or primary facial pain

14.1 Headache not elsewhere classified

14.2 Headache unspecified
QUESTIONNAIRE

1. PATIENT’S BIODATA

Serial no …………………..OP NO …………………

Age in years………………

Gender………

Male ……….. Female…………

Source of referral: Clinical officer. ☐

Medical officer. ☐

Registrar (masters in medicine student) ☐

General consultant ☐

Neurologist ☐

Duration of headache-----
Type of headache---------

MODE OF CT:
NECT  

CEPT  

CT FINDINGS:
1. Hydrocephalus-  

2. Space occupying lesion-  

3. Cerebral atrophy-  

4. Intracranial bleed-  

5. Vascular disease-  

6. Nasal polyps-  

61
7. sinusitis-

8. mastoiditis-

9. Any other finding-
PATIENT CONSENT FORM

My name is Dr Daniel Nthakyo Ngayai Somba, a master of medicine student in the department of Diagnostic imaging and Radiation Medicine at the University of Nairobi.

Am doing a study on the utility of head CT scan in patients with non acute head and normal neurologic examination.

I would like to recruit you/your patient in this study. Information obtained from you will be treated with confidentiality. Only the hospital number will be used. Results of the study will be used to improve 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.

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 Daniel Nthakyo Ngayai Somba

Signature  ______________________

Date  ______________________