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Research Article

TRAUMATIC BRAIN INJURY PATIENT MANAGEMENT IN CT SCAN

Prashant Kumar Jha[1], Rajdeep Thidwar[2] and Nitish Virmani[3]*

[1]Department of Allied Health Science Brainware University, Kolkata, West Bengal India
[2]Department of Allied Health Science Sant Baba Bhag Singh University, Jalandhar Punjab
[3]Clinical Application Specialist Medikabazaar Delhi India

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Aims and Objectives: Care the trauma patient in earlier stages during the CT examination with the less complication! To optimize the radiation, lesser scanning time and better data acquisition i.e. application of ALARA (as low as reasonably achievable). Reduce the mortality rate of head trauma patient and increase the survival rate. **Method and Material:** This is a descriptive study on the topic "role of CT scan to management of head trauma patient, on the basis of review of articles with co-relations with observation of patients. **Sample Area and Sample Size:** This study is based on the review of published articles and recently observational study in the department of radio-diagnosis of the SGT hospital Gurgaon and also based on the references of the radiology books. **Observation and Results:** In this study we find out that head injury patients is a major health problem for a human being community. The most of the effective sites of these problems is poor economical condition patient, more industrialized area etc. More using of high speed vehicles causing RTA, physical assaults, more industrialization etc. **Discussion:** In head injury patient management ABCD and GCS play a vital role to their management. Repeat CT scan do not show major significant changing. If a patient admitted with EDH hematoma and we perform a repeat CT scan within 24 or 72 hours there is no major changes show in another CT scanning while in the case of acute head injury. .

INTRODUCTION

Head injury is a most sensitive and life threatening health problems that leads to cause of death, disability and it's also makes a demands of medical services mainly in emergency department of the hospital or clinic. In developing countries the main cause of head injury is heavy traffic, more industrialization, fall from height and road traffic accident is the main sources of head injury cases. Head trauma patient also refer as a traumatic brain injury (TBI) patient. Growing population with increased vehicles use is a generally common cause of head injury (RTA) patient's mainly in young people. It is consider as a second most important cause of death after the cancer.[1] Head injury is define as the damage of skull bone (scalp) or brain tissue damage. Scalp injury leads to skull bone fracture (fig-1), while brain damage leads to hematoma, edema, etc. (fig- 2 & 3)

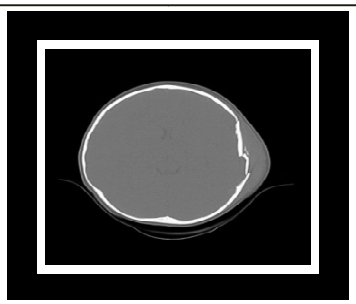

Fig 1 Figure Showing Fronto Perital Bone fracture

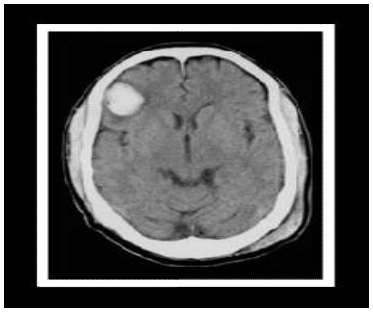

Fig 2 Hematoma

Head injury patients are categorizing into two categories depends upon the type of injury i.e. closed and penetrating

Corresponding author:* **Nitish Virmani
Clinical Application Specialist Medikabazaar Delhi India

head injury. Closed head injury patients suffer from vehicles and motor accident, fall from height, assaults etc. while penetrating head injury patient mainly suffer from gunshot but some time another sharp object can also cause to penetrating head injury.[2] Traumatic head injury patient leads to higher rate of morbidity and mortality in the world, about 10 million people suffering from traumatic head injury in the world. According to the Centers for Disease Control and Prevention about 1.7 million suffer only in USA per year.[3]

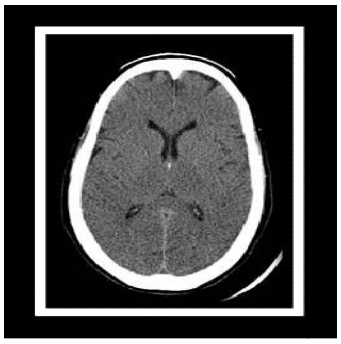

Fig 3 Contusion

Trauma: - According to Merriam Webster Trauma is define as a physically, mental or emotional injury. Basic reason of trauma is the RTA (Road Traffic Accident) but another cause may be occur like fall from height, assault etc. The most important things in traumatic head injury patient is their management, proper handling of patient during shifting and other diagnostic as well as therapeutic procedure of patient on the CT table . It is very urgent do diagnose in early stages to treat them in right way and help to physician to proper plan their management/treatment. With the growing population and more uses of vehicles leads to the traumatic head injury. In the case of multiple trauma or poly- trauma head examination is the most effective part of injury. Head injury is most common in pediatric community. Head trauma patient is also categorized in three category mild moderate and severe on their clinical examination like GCS scoring

Traumatic head injury patients lead to higher no of hospitalization especially in emergency department. With head injury patients About 1.2 million people sustain from head injury in United States. Off these 50000 die, 230000 leads to hospitalization and. about 80000 to 900000 suffer from long term disability.[5]On the pathophysiological view of traumatic head injury patients are categorized into two group, primary injury and secondary injury. Primary injury like hematoma and traumatic axonal hematoma, as a result of immediate effect of injury. Secondary injury developed delayed after days, weeks or month. e.g. brain swelling, infract etc. its show that head injury is not a single and immediate time effect but it may cause long term effectiveness.[3]

Imaging is a very essential part of traumatic head injury patients, diagnostic view as well as their management. For the diagnostic purpose acute head trauma patients undergo examination of non-contrast CT examination as a choice of imaging modality due to the minimum scanning time ,quickly and accurately identification of pathology that leads to help the neurological doctors. Other than CT modalities also a good scanning method for a certain types of injury that was not shown on the CT scan like MRI, PET, USG etc. , but it more time consuming and every patient cannot lies for a long time in MRI gantry.

Head trauma patient also refer as a traumatic brain injury (TBI) patient. It consist of skull bone fracture, brain tissue damage like edema, swelling, contusion, hematoma (SDH, EDH, ICH, IVH, SAH) etc. and mid line shift. TBI patients lead to the large no of hospitalization and also lead to high rate of mortality worldwide. CT is a choice of early diagnostic and management purpose for TBI patient because of lower scan time, lack of contraindication, and early evaluation of hemorrhages.[2] Head trauma patient is a the most common and having critical health problem. Neuro imaging modality such as CT scan is a good and choice of equipment in such patient suffering from head injury. It help in acute management planning like surgical or other planning of the patient.

Head trauma patient is the one of the most common cause of death and physically damage in child's and adult human being worldwide. Neurological trauma is a most of the effective indication of head scan, if they suffering from nasal, mouth or ear bleeding then it is more urgent. About 10% of head injury patient suffer from fetal injury, 5-10% suffering from permanent neurological defect, and 20-40% survive with the moderate severity.[6] Initially it must be require to proper management of the head injury patient. Neurological examination of patient, and also provide cervical caller to stabilized the unwanted movement of head and neck.

Fig 4 This figure showing Siemens somatom scope 16 slice CT scan equipment

Aims and Objectives

The aims and objectives of this study are:

- Role of CT scan in head injury patients to early diagnose.
- Care the trauma patient in earlier stages during the CT examination with the less complication.
- To optimize the radiation, lesser scanning time and better data acquisition i.e. application of ALARA "as low as reasonably achievable".
- And also find out any pathology that may cause severity in patient's life and help in their proper treatment/management in clinic or hospital.
- To find out the localization of pathology like fracture, heamarrge at acute stage etc.
- Reduce the radiation dose through the minimum repeat scan.
- Reduce the mortality rate of head trauma patient and increase the survival rate

METHOD AND MATERIAL

Method and methodology is the very essential parts of a research project. It deals how we collect raw data and materials to complete the project. This is a descriptive study on the topic "role of CT scan to management of head trauma patient. Descriptive study is defines the type of study method

in which we observe and analysis the previous articles or project that were already done. Descriptive study frequently used in medical and health science study project. There are following types of descriptive studies are occurs:-

- Observational study:- Its define as the viewing and recordings of participants (persons and materials)
- Case study: - deeply study of materials.
- Survey: -It's defined as the brief study of an individuals or group of individuals related to a particular topic.

Research Design

This is a descriptive type of study related to the topic of "role of CT scan in head trauma patient management" between the dates of October 2017 to march 2018 in the SGT hospital Gurgaon. This study is based on the review of different types of articles and observational study in SGT hospital in the department of radio-diagnosis. The CT scan is a most effective and useful radio imaging technique which play a vital role in head trauma patient and also play a essential role in other type of traumatic patient.

India is the second highest population countries in the world about 1.27 billion (2014-2015) population[7.] The head injury patient leads to scalp and skull or brain injury. The symptoms of TBI may occur immediately or after certain period .Traumatic head injury patient leads to the higher emergency department occupancy in the hospital. Most of the cases TBI patient involving child and adult's patient .The common cause of head trauma is RTA falls from height, more industrialization etc. Brain is work as monitor in our bodies so it means if brain is affected then all body parts are affected either partially or fully, like paralysis, coma LOC etc. CT scanner takes very less time to scan and clear the findings .Hemorrhage like EDH, SDH, SAH, ICH, ECH, and scalp fracture are the most common findings in CT scan reports. Traumatic head injury is the very critical health problems associated in India as well as worldwide. Increment of economic status, industrialization, motor bike and motor cars play a major role in traumatic head injury patients. It leads to the death, disability with all age groups but more in younger, more in male than female. The most common cause of head injury patient in India is due to RTA (60%0, FALL (25%), and assaults (10%). In India[7.] Time management in head trauma patient is very essential, more time consuming scan may leads to more elaborate cases and sometimes it may be fetal or irreversible. Head injury patient initially required about 72 hours monitoring of patient.

While we handling the Head injury patient then it must require watching the patient's GCS score. Normal patient possess 15/15 GCS score while TBI patient Below the 15 GCS it could be found clinically poor patient. GCS score below 8 is very critical, and its need to urgent and CT scanning and diagnosis for their management in right way.

A radio technologist must have the knowledge of basic life support (BLS), ATLS, management in any emergency in CT scanner room. If a critically ill neurological patient come to CT investigation than it must be required to carefully reading of file , case notes, and advised investigation and also suspected pathology ,because it may help to minimize the repeat CT scan and radiation dose. Sometimes we avoid the CT scan in the case of minimal head injury patient it could be found very dangerous and life threatening in patient's future, if they have shown the following symptoms:-

- Vomiting
- Loss of consciousness(LOC) or amnesia
- Post traumatic seizure.
- Skull fracture or contusion.
- Past history such as alcohol intoxication or coagulopathy,
- Age more than 60 years.

Sample Area and Sample Size

This study is based on the review of published articles and recently observational study in the department of radio-diagnosis of the SGT hospital Gurgaon and also based on the references of the radiology books. Data collected around the hospital campus of radiology department and contents of review articles.

Inclusion Criteria

- Review of articles consisting of different traumatic head injury patient's data.
- Observational data of head injury patient around the SGT hospital of radio- Diagnosis department guru gram.
- References of radiology books.
- Most of the cases studied were traumatic head injury through the source of RTA.

Exclusion Criteria

- No questionaries' forms are filled by any patient and radio technologist.
- Patients who were not come in hospital after RTA.
- Patients were died before admission in hospital.
- Patient who was not seen by neurosurgeon or Neuro physician.
- Patient with multiple traumatic injuries.

The first CT scan s performed as an admission point of view to rule out the present condition of patient at the time of admission .it is a non-contrast CT scan .after certain period or emergency management we performed the another CT scan if required to seen the effectiveness of treatment ,it may be contrast enhancing CT scan

Some common neurological pathology concern with traumatic head injury patients are following

Diffuse brain swelling(DBS):- It occur due to the loss of cerebral auto regulation which leads to the increase the blood flow and blood volume that forcing out the CSF from the ventricles and subarachnoid spaces. DBS is commonly reported in pediatric and children head trauma patients.

Fig 5 diffuse brain swelling

Localized brain edema (LBO):- It is define as the ill hypodence area with the shifting of mid line of brain.

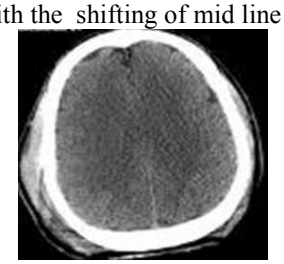

Fig 6 localized brain edema

Intra cerebral hematoma (ICH):- It is a life threatening CT finding on the head CT scan image. It may be bilateral or multiple lesion .mostly appears with SAH and SDH pathology. It appear at the immediate CT finding at the time of injury or some times delayed within 48 hours. On the ct findings it appear as a homogenous higher density with approx. 50-70 HU value.

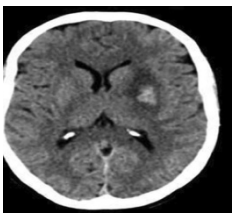

Fig 7 intra cerebral hematoma

Brain contusion:- it's a most common intra cranial lesion of head injury. On CT scan findings it may be appear as a focal, multiple poorly defined area having lower attenuation .contusion may be hemorrhagic or non-hemorrhagic. It appears as a hypo-intense lesion on the CT scan imaging. More commonly this pathology occurs with the patient of blunt head trauma or poly- trauma ,or even poor GCS score . Sometimes old age head trauma patient also suffering from brain contusion.

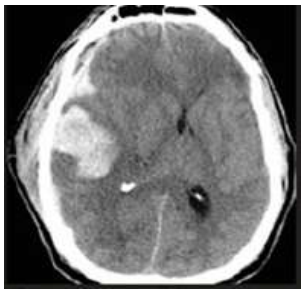

Fig 8 brain contusion

Sub-dural hematoma (SDH):- It appears as a hyperintence lesion between the dura and arachnoid matter on the head CT scan images. In the case of trauma it may be filled with CSF while tear in arachnoid space occur it is called CSF hygroma. It appears as a concave medial and laterally convex, occasionally it may be appears as a biconcave.

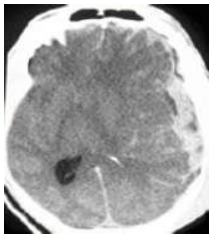

Fig 9 acute subdural hematoma

Epidural hematoma (EDH):- epidural hematoma is defined as a collection of blood between the space of skull and the stripped-off dural membrane. EDH results from the traumatic head injury, usually associated with the skull bone fracture. Appears as extra dural a biconvex, elliptical hyperintence lesion on the CT scan images. On the CT findings it appears as a acute, sub acute and chronic.

- Acute epidural hematoma:- appears as a uniformly and higher in density. It also shows homogenous attenuation.
- Sub-acute epidural hematoma: - it's appear as a homogenously hyperdense lesion.
- Chronic epidural hematoma: - its appears as decreased hetrogeneous attenuation and it also membrane enhancing lesion.

Fig 10 epidural hematoma

Sub arachnoid hematoma (SAH):- It is most common finding in CT scan associated with child and elders patient having large arachnoid spaces due to the blood vessels damage in the pain-arachnoid spaces. It appears just like contusion. On the CT scan image it appears as a area of hyperdensity in the basal cistern.

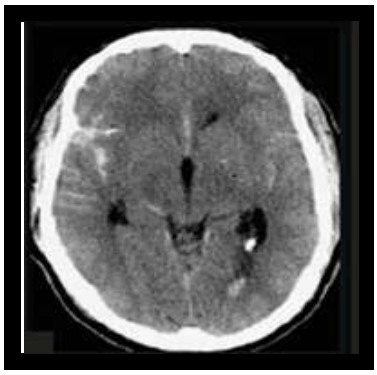

Fig 11 sub arachnoid hematoma

Intra ventricular hematoma (IVH):- IVH is a more life threatening head CT pathology in case of head injury patient. Sometimes it may be suffering from midline shifting, compressed normal bran parenchyma, or diffuse cerebral edema etc. CT finding associated with the high density intraventricular blood lesion.

Fig 12 intra ventricular hematoma.

Fracture:-CT scan is a good choice of study to demonstrate the fracture of cranial bone. It help with 3D reconstruction of cranium bone to better visualization

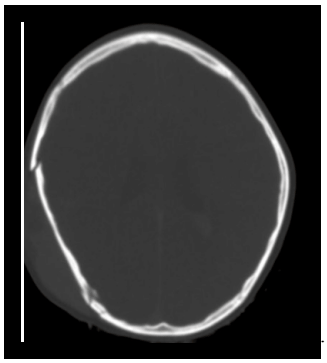

Fig 13 skull bone fracture

Pneumocephalus and: - pneumocephalus leads to low attenuation of radiation with the presence of air on CT scan image.

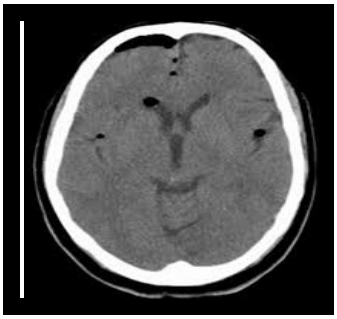

Fig 14 Pneumocephalus

Hydrocephalus:- Hydrocephalus is defined as a pathological condition in which CSF fluid accumulate within the cerebral area, through the abnormal leakage. Its appear as a dark area on the ventricle.

Fig 15 hydrocephalus

Traumatic axonal injury: - it's also known as the diffuse axonal injury or shear injury. This term is used as a injury that do not disturb the whole brain. mild TAI involves the gray white matter junction while moderate TAI involves fibers of the corpus callosum, particularly in selenium, and severe TAI involves the dorsolateral midbrain.

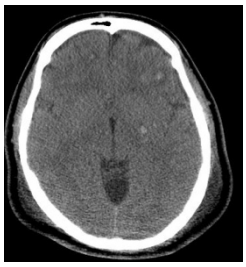

Fig 16 Diffuse axonal injury

Patient with score 13-14 is mild and must undergo head CT scan, 9-13 moderate, and below 8/15 called as a severe head trauma patient and early need to manage the TBI patient. According to WHO the general incidence of traumatic head injury patient in developed countries is 200/100000/year. In the poor countries the mortality rate is higher, because they have lake of technology, economical poor strength etc. To overcome the rate of mortality and increase the rate of survival it must be required to management of early head trauma patient and do not ignore the minimal head injury patient. Sometimes MHI patient do not show any major indication and clinical findings to do CT scan at that time, but after certain period they are suffering from different type of neurological problems like headache, migraine, etc. Therefore it should be mandatory for any hospital either private or government to give the facilities of CAT scan for head trauma patients to manage their life, without any kind of economical disturbances of the patient. Some patients are also suffering from severe neurological problems because they cannot afford the CT scan cost, so this policy will be helpful for this patient. Some useful clinical observation that is help to access the CT head at early stages are:-

1. Contusion
2. Scalp fracture
3. Hematoma
4. Laceration, etc**.**

OBSERVATION AND RESULTS

This is a descriptive study which is done on the Siemens (somatom scope 16 slice) computerized tomographic equipment. We collect the data from different review of articles and observational study during the period of six month of observation in SGT hospital Chandu Budhera Gurgaon and also with the help of the references of different radiology books.

In this study we find out that head injury patients is a major health problem for a human being community. The most of the effective sites of these problems is poor economical condition patient, more industrialized area etc. More using of high speed vehicles causing RTA, physical assaults, more industrialization etc., are the main source of injury. Most of the cases child and young adults suffering from these problems. The number of male patient often more compare to female patients.

Head injury patient also affected from wrong way of handling during the shifting of patient during entire CT procedure. Hospital emergency department occupied most of the cases of traumatic brain injury patients. The source of head injury patient is RTA, fall, etc. RTA is a most common cause of head injury patient, mainly in more developed countries, like USA,

UK, and India also. A proper managed CT scanner installation is significant with emergency handling of these patients. Instrumentation like emergency drugs, emergency anesthetic instruments with qualified specialist doctor, technologist etc. are required. They can also help to management of head injury patient in CT scan, if any complication occurs during scans.

CT scan plays an important role to evaluate the head injury patient. It is a choice of radio imaging scanning modality of a physician, because of there are lott of reason like, minimum scan time, good information about acute brain haemorrhage, no use of contrast media on traumatic HI patient etc. leads to more accurate and choice of scan for a clinician .if a patient comes to CT head with a history of trauma then firstly it should be required to proper handling of patient in the department. Head injury patient CT scan used different type of filming window:-

1. Brain window:- to evaluate the brain anatomy and pathology, like hematoma, contusion, infract etc.
2. Bone window: - it is used to evaluation of skull bone fracture.

Therefore CT is important and very essential radio imaging modality which it's used to evaluation of head injury patients. Early and proper CT findings can cause good patients outcome with a lower rate of morbidity as well as mortality. It also play an important role to decrease the trauma related medical costs in the hospital or clinic.

DISCUSSION

Head injury is the most common life threatening health problems worldwide. It's most common in more developed area, with more industrialization, higher rate of RTA, etc. Developing countries are also major suffering from head injury. CT scan is a choice of radiological study to demonstrate the clinical findings to help the management of the patients. Proper guideline and knowledge is required prior to do repeat the CT scan of a same patient. Any type of neurological trauma is a indication of Neuro imaging and in this way CT scan imaging is a good opportunity for the Neuro imaging technique. Head injury patient in the case of vomiting, bleeding or loss of cociousness, they are more critical and it needs to be immediate head CT scan to evaluate the neurological condition.

Since in some cases like mild to moderate head injury patient and in this condition the sign and symptoms may occurs delayed, so it is very essential to examine the head injury patients prior to undergoing the repeat CT scan. It may leads to cancer, cataract etc. In head injury patient management ABCD and GCS play a vital role to their management. Repeat CT scan do not show major significant changing .If a patient admitted with EDH hematoma and we perform a repeat CT scan within 24 or 72 hours there is no major changes show in another CT scanning while in the case of acute head injury.

CT scan is very useful tool to diagnose and management of head injury patients in the hospital/clinic. While we handling with traumatic head injury patient it must be minded that do not use any contrast media, because in this condition we do not know about the current neurological status and it may cause fatal .in this cases it may leads to instant shock, coma or even sudden death of the patients , so it must be sure. To the point of view to manage the head trauma patient with minimal risk portable computed tomography is most of the useful modalities of imaging tools.it can use in ward, operation theater and also other places whatever it needed. This tool help to time management of head trauma patients also reduce the risk of shifting from one place to other places. The main thing with this equipment is to use minimal exposure factor, accurate FOV that help to reduce the radiation dos e of patient as well as technologist and other patient in the ward.

The Basic Tools to Use the Traumatic Head Injury Patient Evaluation

Traumatic head injury patients are evaluating following method prior to undergoing any radio imaging facilities.1) the first concern is that to stabilized the traumatic patient and reduce the risk of immobilization. Access the ABCDE. 2) After the stabilization complete the fully neurological examination and advised suitable investigation. Traumatic injured patients are classified based up on their GCS score, either mild moderate or severe.

CONCLUSION

Head injury is the vital health problems worldwide, mainly in developed and also developing countries. So it is important to how to manage this patient at early stages in the hospitals. This study mainly provides the information about the management of head injury patients as soon as possible in early stages. Proper neurological examination, handling of patient, use slandered CT protocols etc. help to manage a TBI patient. Because of early management of this patient help to reduce the mortality rate of TBI patient and increase their survival rate. CT scan is the most effective and choice of study precools to evaluate a TBI patient for a clinical physicians .it help to evaluate cross sectional study of brain without any invasive procedure. The time management is very essential in the case of Head injury patient .because of delayed diagnose and their management cannot save their life. Brain tissue is highly sensitive and it is the control unit of whole of the body, so if it damage means whole body lose their normal function. Some pathology like hematoma (SDH, IVH mid line sift etc. may be life threatening lesion. If it cannot manage at earlier phase it affects the surrounding brain tissue and damages them. Head trauma patient categorized on the basis of GCS score and also check their neurological response on the ABCD assessment technique. It gave the idea to severity of patient. In the traumatic head injury patient it must be required to proper clinical examination of patients and also check the GCS score associated risk factors etc. Therefore CT scan imaging technique is the very essential technique to manage the head trauma patient .a radio technologist must having sufficient knowledge about head injury patient management in CT. Use of suitable CT protocols .reducing scan time better resolution , proper windowing etc. must be required in head injury CT images.

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