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Radiodiagnosis

ROLE OF MDCT FOR EVALUATION OF HEAD INJURIES IN ROAD TRAFFIC ACCIDENTS

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ABSTRACT Road traffic accidents(RTA) have emerged as an important public health issue which needs to be tackled by a multidisciplinary approach. The leading cause of death in RTA is due to head trauma. Craniocerebral injuries are a common cause of hospital admission following trauma, and are associated with significant long-term morbidity and mortality. CT remains essential for detecting lesions that require immediate neurosurgical intervention as well as those that require in-hospital observation and medical management.

Objectives: To study various clinical and radiological patterns of head injuries on MDCT and to correlate with operative findings

To identify the risk factors and to predict the outcome of head injuries in RTA

Materials and methods: A descriptive MDCT study was undertaken in 120 patients of both sexes and all age groups with head injuries involved in RTA admitted in department of neurosurgery .all the scans in the study are performed by GE Revolution ACT 32 slice in ASRAMS Medical College

Duration of study: The study was carried out over a period of One Year from June 2015 to June 2016

KEYWORDS : MDCT- Multi Detector Computed Tomography, RTA- Road Traffic Accident, SDH- Subdural Hemorrhage, EDH- Extra Dural Hemorrhage, SAH- Subarachnoid Hemorrhage, MLS- Mid Line Shift

Introduction:

RTA led to 3 deaths every 10 minutes and claims 1.4 lakhs lives every year in India with head injuries playing a dominant role in fatalities. CT is the first and routine investigation of choice for head injury patients in emergency department.

Classification of craniocerebral injuries

A. Craniocerebral injuries

1. injury to scalp
2. Injury to the vault of skull
3. Injury to the base of skull
4. cerebral injury
5. intracranial vascular injury and hematomas
6. pneumocephalus/aerocele

B. Maxillofascial injuries

1. Injury to scalp: most of the times it is an open injury. sometimes there may be an hematoma which may be subcutaneous, subaponeurotic or subpericranial. subpericranial or subperiosteal hematoma is widely known as cephalhematoma which is confined to sutural margins whereas other hematomas are diffuse. Osteomyelitis is complication of cephalhematomas of scalp, giving raise to potts puffy tumour.
2. Injury to the vault of skull: Fracture of skull vault bones are further classified as

A. Simple or compound: simple fracture is not exposed outside through scalp injury whereas compound fracture is communicated outside through breech over the scalp

According to shape and orientation of fragment as:

I. Linear fractures: Compression of the skull against a hard flat surface produces linear fracture

II. Depressed fracture: Heavy object with a small striking surface will fracture the fragment of bone and drive it into intracranial cavity. if the level of outer table of fracture fragment is interior to the level of inner table of rest of the cranium, the fracture is termed as depressed fracture

III. Horse shoe shaped fracture: Tangentially directed violence over an area of skull vault produces a horseshoe shaped fracture-a rare type of fracture

IV. Sutural diastasis: Coronal and saggital sutures are no wider than 2 mm. traumatic separation of diastasis of suture said when the width of the suture is more than 3 mm. coronal suture fuses at around 30 yrs, lambdoid suture at 60 years of age. lambdoid suture diastasis is common

3. Injury to base of skull: Features which suggest basilar skull fractures are

A. Presence of blood behind tympanic membrane without direct ear trauma

B. Evidence of otorrhea or rhinorrhea or a subcutaneous hematoma surrounding mastoid process-battle sign

C. Ecchymoses surrounding the orbits without direct orbital racoon sign

The indirect signs of basilar skull fractures are the presence of intracranial air and fluid level in basilar sinuses.

Nerves at risk of damage:1^{st} cranial nerve is frequently damaged and if it is bilateral, there will be anosmia. The optic nerve usually escapes injury. The 3^{rd} ,4^{th} and 1^{st} division of fifth sixth cervical nerves may be injured at the sphenoidal fissure

6^{th} nerve may be injured in middle cranial fossa The 9^{th} ,10^{th} and 11^{th} nerves are occasionally injured at the jugular foramen. The 12^{th} cranial nerve usually escapes from injury as it is protected by strong bony buttresses.

4. Cerebral injury:

A. Cerebral concussion: This is temporary physiological paralysis of function without any organic structural damage .The patient becomes unconscious immediately after the injury for a short period followed by complete recovery.

B. Cerebral contusion : Indicates more severe degree of brain damage with pathological changes which may be diffuse or localized. The changes include bruising and swelling of cortical gyri, localised or generalised oedema,shearing damage to nerve cells and axons, and hemorrhage due to tearing of small blood vessels within brain substance. The injury may be coup or countercoup. The axonal shear strain deformations are induced by sudden acceleration decceeleration of rotational forces on brain. They may be hemorrhagic or non hemorrhagic and ultimately induce morphological changes in brain parenchyma such as scarring, cavitation and atrophy.

C. Cerebral laceration: In this the internal changes are same as those in cerebral contusions. But the brain surface is torn with effusion of blood into csf spaces leading to sub arachnoid hemorrhage.

5. Intracranial vascular injuries and hematomas: Hemorrhage takes some time to develop [,during this period the patient remains conscious and is called lucid interval. The hemorrhage may be supra or infra tentoria but supra tentorial is most common.

A. Extradural hemorrhage: It results from injury to the anterior or posterior branch of middle meningeal artery.EDH may also arise from branches of inter maxillary or anterior meningeal vessels torn by fractures of anteriorcranial fossa. The blood collects in extradural space or may track outward through the fracture to form boggy swelling in soft tissue of scalp. In majority EDH is associated with fracture of skull. With increasing age the dura becomes adherent to the skull. The EDH is less common in old people.

B. Subdural hematoma: It is six times common than the EDH. It is mainly caused by rupture of superior cerebral vein within subdural space. It may also caused by rupture of any cortical vein.

C. Intracerebral hematomas. This is least common intracranial hematomas. They occur immediately after blunt or penetrating injuries. subcortical hematomas occur at grey white matter junctions after shearing injury to cortico medullary vessels and becomes fatal if it ruptures into ventricles. Posterior fossa hematoma is uncommon and shows poor prognosis. There may be massive delayed intracerebral hematomas, which complicate severe head injury.

D. Subarachnoid hemorrhage: It is quite common. It can result from direct pial injury, extension from underlying parenchymal contusion or contiguous extension of intraventicular hemorrhage. The interpeduncular cistern and sylvian fissure are two favourite sites for accumulation of traumatic SAH.

E. Infratentorial hemorrhage: This is less common than supratentorial hemorrhage. They may cause sudden cardio respiratory arrest due to compression on brain stem.

6. Pneumocephalus: Intracranial air can be found within the subarachnoid space, ventricular system, subdural space, epidural spce or within cerebral parenchyma. Ocassionally air expands to produce mass effect, resulting in tension pneumocephalus which is an emergency condition.

Injuries of extra cranial soft tissues:
Acute post traumatic swelling of the scalp may be due to collection of oedema, fluid, blood, csf, air or foreign bodies in the soft tissues of scalp.
A. Subgaleal hemorrhage: Trauma to the subgaleal vessels cause hemorrhage in subgaleal space beneath the galea aponeurotica. CT demonstrates hyperdense collection of blood in subgaleal space.

B. Subgaleal hygroma: A linear fracture of skull bone, which is crossing suture and tearing the underneath dura and extending through the subarachnoid space, will cause accumulation of csf in subgaleal space. CT demonstrates collection of fluid of low density in range of 6-10 HU.

Normal anatomy simulating post trauma changes:
Normal sutures and variant sutures may be misinterpretended as fractures. Sutural or wormian bones may be diagnosed as comminuted fractures. Spheno occipital synchondrosis may be misinterpreted as basilar skull fracture. Calcification in the tentorial inscisura and falx can be confused with sub dural and sub arachnoid hemorrhage.

Basal ganglia and choroid plexus calcification may mimic parenchymal contusions and intraventricular haemorrhages respectively. A pneumatised anterior clinoid process may be mistaken for pneumocephalus. An early large infarct involving an entire hemisphere may be confused with isodense hematoma. A meningioma occurring at the convexity of the cerebral hemisphere may resemble an extra axial hemorrhage.

Selection of patients:
Inclusion criteria:
The criteria for inclusion of patients in the study included those patients who met with road traffic accidents with head injury or with clinical symptoms of head injury.

Exclusion criteria:
Patients who met with road traffic accident but not suffered any head injury or do not have any clinical symptoms related to head injury
Patients with pregnancy
Claustrophobic patients

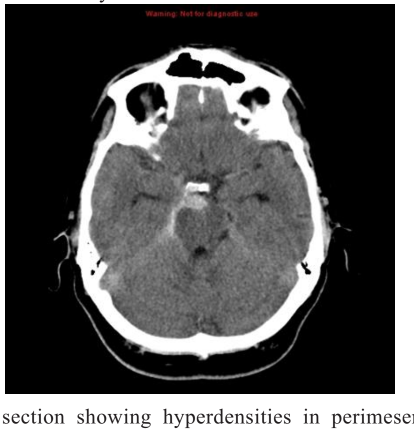
Discussion:
Prognosticvalue of MDCT in patients with head injury caused by RTA: The outcome in the head injury patients could be predicted with the following three CT characteristics;
1. State of basal cisterns
2. Number and size of the lesion of brain parenchyma
3. Degree of shift of midline structures

Basal cisterns: The incidence of normal cisterns with intra or extra cerebral hematoma was (42/120)35% while the incidence of partially obliterated cisterns with intra or extra cerebral hematoma was (14/120)11.6%.The incidence of completely obliterated cisterns, intra or extra cerebral hematoma are (12/120)10%.These figures are in complete contrast to the study by Van Dongen Et Al(1983) which showed 15%,19% and 53% respectively. This can be explained by the fact in their study, they included only comatosed patient.

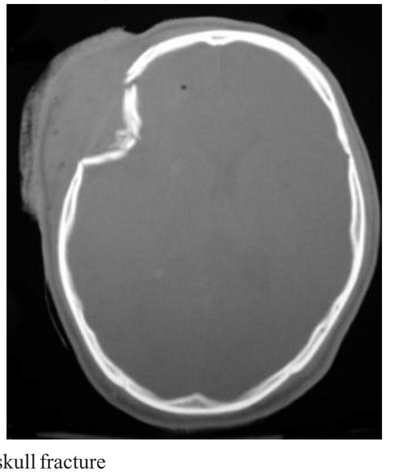
In our study, the highest mortality rate(73%) was seen in completely obliterated cisterns coexisting with intra or extra cerebral hematoma, which is similar to that in Van Dongen Et Al study who showed 93% mortality rate. This shows that, more severe the cerebral oedema, compression by hematoma causing obliteration of cisterns, the greater is the mortality rate.

The mortality rate in our study were varying greatly ranging from 2.1%(for normal scans) to 73%(for completely obliterated cisterns. Van Dongen Et Al also showed a similar figure with a mortality rate of 7%(for normal scans) to 93% (for completely obliterated cisterns) in the presence of intra or extra cerebral hematomas.

Influence of shift of midline structures:
Ross Et Al defined midline shift as amount of displacement of septum pellucidum and pineal gland. Various authors took different criteria to define as midline shift. In our study took the Vollmer Et Al classification of MLS <5mm and >5mm.the incidence of MLS in our series was23/120.out of 23 cases that showed mid line shift in my study,16 cases showed mid line shift of<5mm and rest of the 7 members showed midline shift of >5mm. Of these 7 patients 5 of them are died with a mortality rate of 71%.



CT axial section showing hyperdensities in perimesencephalic subarachnoid hemorrhage.



Depressed skull fracture

Results:

Over the year of collection period 120 patients are presented for CT brain with head injury in road traffic accidents were studied.

The age of patients ranged from 9 months to 82 years. the peak incidence of head injuries in RTA was found in 21-40 years of age group(49%),followed by40-60(22%),above 60 years(20%) and below 20 years(9%) Of 120 patients studied,48 were females and 72 were males.

The CT findings and pre operative findings of these 120 cases are classified into 5 major categories

1.NORMAL SCANS	28
2. ABNORMAL SCANS	92
CONTUSION	36
SDH	28
ICH	20
EDH	19

Discrepancy in total number of abnormal scans is due to multiple types of hematomas in some cases

Conclusion:

MDCT of head helps in assessing the extent of damage to the intracranial structures and there by helps in assessing prognosis by accurate evaluation of size and site of hematoma, extent of midline shift and extent of obliteration of basal cisterns, the age of patient also helps in determining prognosis.

21-40 years age group is most prone for road traffic accidents with mortality rate is highest after 60 years of age.

Of all the intracranial hematomas, contusion was the most frequent type(27%) followed by SDH(17%) next ICH (12.5%) and lastly EDH(8.5%)

In SDH and EDH temporal region was most common site affected (41%) whereas in contusions frontal was the most frequent site(42.6%) Of all the skull fractures temporo parietal fractures were most common and highest mortality rate being with multiple fractures.

State of basal cisterns and the degree of shift of midline structures were the most powerful prognostic indicators determining the outcome of head injured patients.

MDCT head helps in modifying line of management of patients and review scan can be useful in patients who show normal scan initially but suddenly start deteriorating, it can also be used as tool for follow up.

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