ABSTRACT: With growing population, rapid urbanization and industrialization associated with high materialistic mind of human beings, incidence of unnatural deaths increasing in geometrical progression. Out of all unnatural deaths trauma plays the major role and head is the most vulnerable part to receive injuries in different manners. Intracranial hemorrhage being one of the major entities amongst all types of intracranial lesions is not only responsible for death but also impart numerous complications in life. Though many authors highlighted deaths and complications of Intracranial hemorrhages in details still no appropriate attempt had been made to evaluate such lesions in relation to different causative agents. Very little information regarding the epidemiology of ICH in head injuries with reference to causative agents is available. This present study focuses on variability of intracranial hemorrhage in relation to different causative agents and it is observed that RTA was found to be most common cause of head injuries revealing ICH (51.68%) whereas hard and blunt instrument was used to cause ICH in most of assault related head injuries. Mixed type of ICH was detected in 35.74% followed by solitary SDH in 28.01%.

KEYWORDS: Trauma, Intracranial hemorrhage, EDH, SDH, RTA.

INTRODUCTION: With growing population, rapid urbanization and industrialization associated with high materialistic mind of human beings, incidence of unnatural deaths increasing in geometrical progression throughout world and now becomes a major health problem. Out of all unnatural deaths trauma plays the major role. Head is the most vulnerable part to receive injuries in different manners. During last decade there has been considerable increase in deaths due to head injuries in Southern Orissa in general and Berhampur Zone in particular both from accidents and assaults. ICH being one of the major entities amongst all types of intracranial lesions is not only responsible for death but also impart numerous complications in life. Patients with head injuries sustaining sub lethal intracranial damage normally tend to recover unless secondary complications set in. These are often referred as epiphenomena or the second accidents. These epiphenomena signify the onset and perpetuation of post traumatic intracranial hypertension. A common and treatable cause of post traumatic intracranial hypertension is an expanding intracranial hematoma which also ranks the number one lesion among the trauma to the intracranial structures. It is stated that a small amount of hemorrhage i.e. a drop in Pons or 50 ml. of free blood in subdural space is sufficient to cause death. The different types of intracranial hemorrhage like EDH, SDH, SAH and Intra cerebral Hemorrhage are of complex and diversity in nature to occur in traumatic head injuries. The survival rate of the victims sustaining such type of intracranial injuries depends to a large extent on the timely reorganization and treatment of ICH.
Though many authors highlighted deaths and complications of ICH in details still no appropriate attempt had been made to evaluate such lesions in relation to different causative agents. Very little information regarding the epidemiology of ICH in head injuries with reference to causative agents is available. Hemorrhage inside the skull cavity may occur at different levels, at different sites, and by different manners. It may also be due to violence, disease or the effects of injuries upon the disease. In such cases the nature of trauma, site and extent of hemorrhage, the causative agents need to be thoroughly evaluated to form any conclusive opinion.

**MATERIALS & METHODS:** The present work on “Variability of head injury & intracranial hemorrhage in relation to causative agents” was conducted in the department of Forensic Medicine & Toxicology of M.K.C.G Medical College, Berhampur during the period from 01.01.2004 to 31.12.2005. 207 cases of head injuries brought for postmortem examination were taken into consideration as study materials. Each individual case was analyzed thoroughly with special attention to different types of intracranial hemorrhage with relation to nature of trauma & other modified intrinsic and extrinsic factors. The circumstances of sustaining the injuries were collected from the relatives accompanying the corpse, from the investigating police officers and from available hospital records. The collected information and data were individually complied and collectively evaluated to find out a specific conclusion.

**OBSERVATION:** The Present study “Pattern of Intracranial Hemorrhage in relation to causative agents” was taken up on 1077 number of medico legal autopsies conducted in the Morgue of Forensic Medicine and Toxicology Department of M.K.C.G. Medical College, Berhampur during period starting from 01.01.2004 to 31.12.2005 out of which 207 cases were isolated who died due to Head Injuries.

Our study reveals that 182 cases out of total 207 head injuries were having some form ICH either solitary or in combination which constitutes 87.92 % of the total. It indicates that almost all types of death due to head injuries, ICH are the number one killer. (Table I)

In the present series of 207 head injuries the mixed type (combination of more than one) of hemorrhage variety outnumbered other types constituting 74 cases i.e. 35.74%. But taking individually into consideration sub-dural hemorrhage was the highest one 58 (28.01%) followed by extradural 20(9.66%), and subarachnoid 17(18.21%). The least one is intracerebral hemorrhage 13 (6.28%). In 25 cases 12.07% no hemorrhages were noticed. (Table II)

It is observed that the combination of SDH and SAH is very common in all types of head injuries resulting in death followed by SAH and intracerebral hemorrhage both in accident and assaults in this presents study. Combination of all verities i.e. EDH, SDH, SAH and Intra cerebral type were not detected at all and the combination many verities were also less frequent. Out of 182 cases of ICH 74 are present mixed type hemorrhage (40.65%) and the rest 108(59.34%) present alone. The highest incidence is combination of SDH+SAH which constitutes maximum number 19(25.67%) followed by SAH+Intra cerebral type 14(18.91%), EDH+SDH and SDH+Intracerebral each 11 in number (14.86%) being EDH+Intra cerebral type least common. (Table III)
It is found that majority of Intracranial hemorrhages (ICH) were due to Road Traffic accidents which constitutes 93 cases (86.91%) of total head injuries (107) due to RTA followed by fall from height 30 cases (93.75%) out of 32 cases and railway accidents 25 (80.64%). In assaults, 24 cases of head injuries due to hard and blunt trauma had ICH (i.e. 100%), 8 cases out of 11 (72.72%) are due to cutting weapons had ICH and 2 out of 2 (100%) in case of firearms. (Table IV)

Our work indicates that cortical and sub cortical intra cerebral hemorrhage is the commonest verity (11 in number out of 13) and the predominant cause of such hemorrhage is due to RTA followed by Railway injuries. Petechial hemorrhages are 2 in number out of total 13 intra cerebral hemorrhages and only confined to RTA. These types of injury caused by cutting instruments and firearms are very remote. (Table V)

DISCUSSION: The present study “Pattern of intracranial Hemorrhage in relation to causative agents”, was conducted on 207 cases of head injuries from a total of 1077 bodies brought autopsy which came for postmortem examination to the mortuary of M.K.C.G. Medical College, Hospitals, Berhampur in the Department of FM & T within a period of two years i.e. from 01.01.2004 to 31.12.2005

Since the work was only related to intracranial hemorrhage in relation to pattern of head injuries and the causative agents, 182 cases of traumatic ICH were selected.

From table no – I it was observed that most of the victims undergoing head injuries had some form of intracranial hemorrhage. Out of 207 cases of head injuries 182 cases had ICH i.e. 87.92%. However this observation is somewhat different from the observation of other authors who had made earlier studies, Padhy S.C. et al. (1981) found extradural hematoma in 51.61% of cases of head injuries whereas Anjankar A.J. et al. (1998) on his study of craniocerebral injury on RTA observed ICH in 58.3% of head injury. This variation in the incidence of ICH in acute head injury is of course difficult to explain, however it can be presumed that sometimes no reliable data may be available regarding those cases who die immediately after accident and don’t reach the hospital. In India the pattern of incidence of complications has shown an interesting variation. One decade ago acute subdural and extradural hemorrhages were less frequent as traffic accidents were mostly slow speed injuries according to Ram Murthy, B. (1996). This picture has now changed with increasing number of automobiles and motorized traffic in the cities. The high speeds attain by the vehicles on the highways of the West are not seen in India and other developing countries because of the types of roads and type of traffics. Secondly the previous authors might have neglected to report the small or moderate foci of hemorrhage (petechial hemorrhages) in the brain of head injuries cases during their autopsy studies which were the immediate cause of death.

On analysis of pattern of intracranial hemorrhages it has been observed from table no – II that mixed type of hemorrhage is the commonest type. But taking single type into consideration subdural type of hemorrhage was the highest one 58(28.01%) followed by extradural 20(9.66%) and subarachnoid 17(8.21%). The least one was intracerebral type 13(6.28%). This observation is at par with the observations of Galbraith, S. (1976) who found extradural hemorrhage is 15%, SDH in 23% and intracerebral in 17% cases. Yakamani, I. et al. (1993) found SDH in 33%
cases. Jena, M.K. (5) 1996 found SDH in 49%, EDH in 14.6%, SAH in 7.66% and intra cerebral hemorrhage in 6% of RTA victims. Behera, A. (1988) found EDH in 20%, SDH in 40%, SAH in 10% and intracerebral in 10% of cases. Dayananda, B.R. (6) (1971) who found EDH in 44.75% cases. Rao, N.G. (7) (2000) found SDH in 77% cases of RTAs, except Dixit, P. C. at el (8) (1979) who had classified ICH in a different manner and found SDH in 58.2%, SAH in 66.9%, EDH in 14.2% and intracerebral haemorrhage in 66.9% of cases of RTA victims.

| Year/Authors     | EDH   | SDH   | SAH   | ICH   | MIXED |
|------------------|-------|-------|-------|-------|-------|
| Galbraith S.     | 15%   | 23%   | Nil   | 17%   | Nil   |
| Yakamani I.      | Nil   | 33%   | Nil   | Nil   | Nil   |
| Jena M.K.        | 14.6% | 49%   | 7.6%  | 6%    | Nil   |
| Behera A.        | 20%   | 40%   | 10%   | 10%   | Nil   |
| Dayananda B.R.   | 44.75%| Nil   | Nil   | Nil   | Nil   |
| Rao N.G.         | Nil   | 77%   | Nil   | Nil   | Nil   |
| Dixit P.C.       | 14.2% | 58.2% | 66.9% | 66.95 | Nil   |
| Our Study        | 9.66% | 28.01%| 8.21% | 6.28% | 35.74%|

The increasing frequency of SDH is the result of the cerebral shifts within the skull in traumatic head injury. As such a direct or indirect trauma of even a minor degree may lead to subdural bleed. Even a Whiplash injury of the cervical spine may cause a subdural haematoma due to acceleration and deceleration forces (Omaya A.K. et al, (9) 1969) as also fall from a height and landing on the feet or buttock. It can be explained that when the subarachnoid pressure drops due to any cause like the acceleration and deceleration movement of brain in trauma or in rapid lowering of intracranial pressure, the subdural space (the potential space between dura and arachnoid which is usually obliterated due to intracranial pressure) gets open up and the superficial cerebral veins crossing the subdural space before entering into the sinuses will rupture to fill the subdural space with blood.

From the observation of table no. III it is found that the highest incidence in case of combined hemorrhages is SDH & SAH which constitute 25.67% followed by SAH & Intra cerebral, EDH & SDH and least being EDH & Intra cerebral hemorrhage. Anjankar, A. J., Khajuria, B. K. and Tirpude B.H. (1998) (2) also found the combination of SDH & SAH as the commonest of all types of the intracranial lesions. Agarwal.G et al (10) (1997) also detected the combination of SDH & SAH as the most common event present alone in 21% cases. Tyagi et al (11) (1986) found subdural & subarachnoid as the commonest combination (31.8% cases). Our observation is quite similar to the observation of the previous workers.

The analysis of table no. IV focusing on types of ICH in relation to causative agents, reveals ICH is more common in falling from height in the accidental group i.e. 30 out of 33(93.75%) while in the assault group hard & blunt instruments & firearms produce more number of ICH. In RTA SDH is most common form of ICH followed by EDH. So also SDH is found commonest in railway accidents, fall from height, assault with hard and blunt weapons and with cutting weapons. Our observation are at par with Dixit P.C. (12) (1992) who observed that blunt weapons most commonly causes head injuries and ICH. However ICH as a whole is comparatively less common in head injuries caused by cutting instruments.
As regards intracerebral hemorrhage table no. V in few cases of head injuries petechial types of hemorrhage are found in the substance of brain without any cortical or subcortical hemorrhage which is likely to be missed by the autopsy surgeon unless he is very particular during postmortem examinations. In the presents study two such cases were detected which subsequently were confirmed by histological examination as to the cause of death. However, in most of the cases remarkable and macroscopic cortical/subcortical intra cerebral hemorrhages are observed. This peculiar type of petechial hemorrhage into the substance of brain was due to distortion of brain occurring at the time of head injuries with consequent damage to the capillaries. The intracranial vessels are fixed either at the base of this skull or at the dural sinuses while the substance of the brain is soft and floating in CSF. The shearing strain of the injuries causes friction between the fixed vessels and the deformed brain substances i.e. the neurovascular friction causes small foci of hemorrhages in the white matter, Basal ganglia, brain stem, corpus callosum and cerebellum

| TOTAL NO. OF HEAD INJURIES | NO. OF ICH | %  |
|---------------------------|-----------|----|
| 207                       | 182       | 87.92 |

Table I: INCIDENCE OF ICH IN HEAD INJURIES

Table I reveals that 182 cases out of total 207 head injuries were having some form ICH either solitary or in combination which constitutes 87.92% of the total. It indicates that almost all types of death due to head injuries, ICH is the number one killer.

| SL. NO | TYPE OF ICH | TOTAL NO. OF CASES | %  |
|--------|-------------|-------------------|----|
| 1      | EDH         | 20                | 9.66 |
| 2      | SDH         | 58                | 28.01 |
| 3      | SAH         | 17                | 8.21 |
| 4      | ICH         | 13                | 6.28 |
| 5      | MIXED       | 74                | 35.74 |
| 6      | NIL         | 25                | 12.07 |
|        | TOTAL       | 207               | 100 |

TABLE II: PATTERN OF INTRACRANIAL HAEMORRHAGE

In the present series of 207 head injuries the mixed type (combination of more than one) of hemorrhage variety outnumbered other types constituting 74 cases i.e. 35.74%. But taking individually into consideration sub-dural hemorrhage was the highest one 58(28.01%) followed by extradural 20(9.66%), and subarachnoid 17(18.21%). The least one is intra cerebral hemorrhage 13(6.28%). In 25 cases 12.07% no hemorrhages were noticed.

| MIXED ICH     | ACCIDENT | ASSAULT | TOTAL |
|---------------|----------|---------|-------|
| EDH + SDH     | 9        | 2       | 11    |
| EDH+SAH       | 8        | 2       | 10    |
| EDH+Int. Cer. | 1        | 0       | 1     |
Table III shows that the combination of SDH and SAH is very common in all types of head injuries resulting in death followed by SAH and intracerebral hemorrhage both in accident and assaults in this present study. Combination of all varieties i.e. EDH, SDH, SAH, and Intracerebral type were not detected at all and the combination many varieties were also less frequent. Out of 182 cases of ICH 74 are present mixed type hemorrhage (40.65%) and the rest 108(59.34%) present alone. The highest incidence is combination of SDH+SAH which constitutes maximum number 19(25.67%) followed by SAH+Intracerebral type 14(18.91%), EDH+SDH and SDH+Intracerebral each 11 in number (14.86%) being EDH+Intracerebral type least common.

Table IV reveals that majority of Intracranial hemorrhages (ICH) were due to Road Traffic accidents which constitutes 93 cases (86.91%) of total head injuries (107) due to RTA followed by fall from height 30 cases (93.75%) out of 32 cases and railway accidents 25 (80.64%). In assaults, 24 cases of head injuries due to hard and blunt trauma had ICH (i.e. 100%), 8 cases out of 11(72.72%) are due to cutting weapons had ICH and 2 out of 2(100%) in case of firearms.
Table V indicates that cortical and subcortical intracerebral hemorrhage is the commonest variety (11 in number out of 13) and the predominant cause of such hemorrhage is due to RTA followed by Railway injuries. These types of injury caused by cutting instruments and firearms are very remote.

**CONCLUSION:** This study “Pattern of Intracranial Haemorrhage in relation to causative agents.” was based on analysis of 207 cases of death due to Head injuries, out of total no 1077 medico legal autopsies conducted in the Department of Forensic Medicine and Toxicology, M.K.C.G. Medical College, Berhampur for a period of two years from January 2004 to December 2005. ICH was detected in 182 cases i.e. 87.92% of Head injuries. RTA was found to be the most common cause of Head injuries revealing ICH (51.68%) whereas hard and blunt instrument was used to cause ICH in the most of the assault related Head injuries. Mixed type of ICH was detected in 35.74% followed by solitary SDH in 28.01%. Although RTA is the commonest cause of Head Injury, ICH is seen more in falling from height (93.75%) in comparison to RTA (86.91%). ICH comparatively less marked in head injury caused by cutting weapons (72.72%) there found no direct relationship between traumatic ICH and sex of the deceased, male (88.27%) and female (86.66%).

The autopsy surgeons are advised to open the cranial cavity in every case and to inspect the intracranial structures in detail, as there are possibilities of occurrence of ICH without any visible injury to the scalp or skull. This can avoid future allegations and counter allegations.

Whenever a dead body was received for medico legal postmortem examination with alleged history of trauma to the head, the autopsy surgeon when fails to find any injury on the head (either extracranial or intracranial) or any other lesion in any organ of the body for giving a concluding opinion as to the cause of death, he is advised to search for the petechial type of ICH in the selected sites (substances of White matter, Basal ganglia, Brain stem and Corpus callosum) of brain and to preserve tissue from the suspected areas for histological examination and corroboration.

Therefore in all cases of head injuries with or without gross damage to the brain tissue the first and foremost duty of the clinicians is to exclude any type of coexisting ICH to prevent subsequent epiphenomena (second accident).

However as the presents study was conducted over a limited number of cases for a short duration (2 years) an intensive study is suggested on a large scale to highlight more specific guidelines for the autopsy surgeon and the clinicians.
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