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Emergency imaging of head and cranio-facial injuries: implementing NICE guidelines – a cross sectional analysis from western region of Nepal.

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Abstract

Background

Head injuries cause substantial mortality and morbidity and are largely preventable. Public awareness and prevention programs as well as safety measurements in risky working environment can be adopted to avoid trauma.

Methods

This prospective study was conducted in Radiology Department of a tertiary care center in Pokhara, Nepal over a period of 7 months (May 2014 to Nov 2014). Patients were referred for CT scan procedure from Emergency Department with a history of head injury. Data collection was done on the basis of preformed questionnaires which were set as per the NICE guidelines and were filled up by the physicians in the emergency department.

Results

A total of 200 patients were included in the study. Road traffic accidents (86 cases, 43%) were the most common cause of head and cranio-facial injuries. Males, were more frequently subjected to injuries. 102 cases (51%) followed the NICE guidelines for CT procedure referral and 82 cases (41% of all cases) had positive findings on CT scan. 98 patients (49% of all cases) had no indications for CT scan according to NICE guidelines, however 16 cases among them (8% of all cases) showed positive findings on CT like moderate soft tissue injury and nasal bone fracture.

Conclusion

The overall compliance with NICE guidelines was not achieved as expected; and overtriage with unnecessary CT scan was observed. An educational program to the trauma team of hospitals may help the patients in terms of care and cost.

Key words

Accidents, CT scan, head injury, NICE guideline

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Background

Head and cranio-facial trauma is as old as human race. Economic growth in the society expanded the automobile industry, which in turn increases the number of accidents on the roads. Apart from this, poor conditions of road, nonadherance of traffic rules enhances the chance of road traffic accidents (RTA) leads to morbidity and mortality [1].

Road traffic accidents, falls, interpersonal violence and self inflicted injuries are the primary causes of injuries. Although infectious diseases are predominant in mid socio-economic countries, still head injury is considered as major economic burden comparing with others [2-4]. The traditional view of injuries has neglected this area of public health, however injuries are preventable and there are definite recognized methods of scientific study for the prevention of injuries [5].

Traumatic brain injury is the most common cause of death and permanent disability in trauma patients [6]. Several studies from Asia reported RTA a cause of death and economic loss. A research was carried out in eastern Nepal showed a similar scenario. Most of the trauma victims were students, laborers and farmers. Fall from height, road traffic accident and physical assault were responsible for injuries [7]. Ministry of Health and Family Welfare, Government of India published a report, which documented, over 100,000 people die due to RTA each year and nearly half of them are hospitalized for brain injury [8].

There is no controversy that the computed tomography (CT) scan is one of the best choices for the clinicians to diagnose intracranial lesions. This is also appropriate for the trauma patients who fulfill specified criteria [9]. There are validated clinical prediction rules in emergency medicine and radiology literatures that define the patient population who should undergo CT head study [10].

However, inappropriate use still occurs. Moreover, the economic burden imposed on the patients, especially in the developing countries is not carefully weighted on a routine basis before ordering scans. National Institute for health and Care Excellence (NICE) has set up some guidelines assessing the traumatic condition. Several indicators like loss of consciousness lasting more than 5 minutes and 1-3 or more discrete episodes of vomiting are considered as the most important signs of CT in children group. In adults (16 - 65 years) the indicators are similar. In elderly patients (above 65 years), more than one episode of vomiting and Glasgow coma scale score (GCS) less than 13 on initial assessment in emergency department are major criteria for CT procedure referral [11].

The objective of the current study was to assess the pattern of head and cranio-facial injuries in western region of Nepal and also to compare the referral criteria for CT procedure in Gandaki Medical College Teaching Hospital (GMCTH) with that of NICE guideline.

Material and Methods

Study Period

This prospective study was conducted over a period of 7 months (from May 2014 to Nov. 2014) in the radiology department.

Study design, participants and the response rate

A total number of 200 patients were included in the study. Routine clinical examinations were performed by emergency physicians. The Glasgow Coma Scale was used in this study, taken after resuscitation and stabilization of the patient. CT scan was performed for all cases with moderate and severe head injury. CT scan images were carefully examined through brain and bone windows with multiplanar reconstructions (MPR) in coronal and sagittal planes by Consultant Radiologist and also by a neurosurgeon.

Patients were, divided into different age groups; <16 years, 16 – 65 years, >65 years. Pattern of cranial lesions which was taken into consideration includes head injury, cranial and intra-cranial positive findings, moderate soft tissue injuries, skull and facial bone fracture, Extradural hematoma (EDH), sub-dural hematoma (SDH), sub-arachnoid hemorrhage (SAH), pneumocephalus *etc.* After the CT scan, based on the condition of the patients were either admitted to GMCTH or discharged home after normal findings. In some complicated cases patients were referred to higher centre for neuro-services.

Data collection

Data collection was done on the basis of preformed questionnaires which were set as per the NICE guidelines and were filled up by the physicians in the Emergency Department. CT was performed in Toshiba Asteion 4 slice scanner, Japan. The protocol used for this scanning was contiguous axial 4mm sections for posterior fossa and 6mm sections for supratentorium from the level of C1 vertebra to vertex.

Questionnaire included sociodemographic details of the patient like age, gender, and detailed information about time, cause of injury and clinical classification of injury, GCS, CT findings, source of referral *etc*.

Inclusion criteria

Patients who were referred for CT scan from emergency department of GMCTH, fulfilling the criteria like having definite history of head injury and cases registered in casualty register were set up as inclusion criteria for this research purpose.

Exclusion criteria

Admitted inpatients and OPD patients who had were admitted for cerebrovascular accidents and other head injuries were excluded from the study to avoid biasness.

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Ethical committee approval
Ethical committee approval was taken from the college authority. This research was done according to the declaration of Helsinki (Latest version).

Outcome variable
Different pattern of cranial lesions were considered as outcome variable, which includes head injury, cranial and intra-cranial positive findings, moderate soft tissue injuries, skull and facial bone fracture, Extradural hematoma (EDH), sub-dural hematoma (SDH), Extradural hematoma (EDH), sub-arachnoid hemorrhage (SAH), pneumocephalus *etc.*

Explanatory variables
The demographic factors and common cause of head and cranio-facial injuries were defined at individual level. Factors at individual level were, patients age, gender, cause of injury - fall injury, physical assault *etc*.

Data management and statistical analysis
The data were collected and statistical analyses were performed using software SPSS (version 17).

Results

Table – 1 Age distribution and number of RTA cases n(%)

Age group	RTA cases
< 16 years	36(18)
16 - 65 years	134(67)
> 65 years	30(15)
Total	200

The most common group vulnerable for RTA in this study was 16-65years, followed by <16 years, >65years (Table - 1).
Road traffic accidents (RTA) were the most common cause of head and cranio-facial injuries (86 cases, 43%), followed by fall injury (56 cases, 28%), physical assault (44 cases, 22%) and others (14 cases, 7%).
Fig. 1 illustrates the distribution pattern of different types of head injuries in different age groups. Results showed that males were more frequently prone to injuries like RTA, physical assault, falls and others. Male to female ratio was 1.86:1 in RTA, 1.54:1 in falls, and 4.5:1 in physical assault and 1.33:1 in others forms of injury.
In <16 yrs age group, 26 out of 36 followed the NICE guidelines and 24 out of them had positive findings. Whereas in 16-65 yrs group 58 out of 134 followed NICE guidelines and only 26 of them had positive findings. Among elderly patients (above 65 years), 18 out of 30 followed NICE guidelines and 16 had positive findings (Table 2).

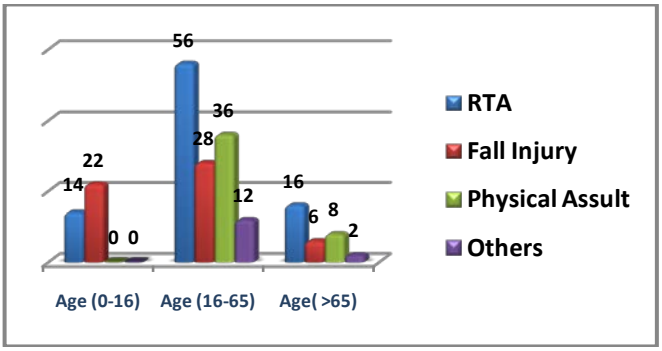

Figure - 1 - Distribution pattern of different types of head injuries in different age groups

Table – 2 Positive and negative findings on CT scan in cases which followed NICE guideline.

Age group	Cases followed NICE guideline (n= 102)	
	Positive findings on CT	Negative findings on CT
< 16 years	24	2
16 - 65 years	26	32
> 65 years	16	2
Total	66	36

Out of the total 200 cases, only in 102 cases (51%), the NICE guidelines for CT procedure referral were followed.
Among them, 82 cases (41% of all cases) had positive findings on CT such as fractures, subdural, epidural, sub-arachnoid hemorrhage, contusions, pneumocephalus and some conditions like moderate soft tissue injuries e.g. scalp hematomas, subcutaneous emphysema and deep lacerations requiring surgical intervention (Table 3).

Table – 3 Pattern of cranial lesions

Injury type		n (%)	
a) Head injury		82 (41)	
i)	Head injury with positive Cranial and intra-cranial findings	48 (24)	n=200
	i) Skull and facial bone fracture	24(50)	(n= 48 cases with positive cranial and intracranial findings)
	ii) EDH + SDH + SAH + Contusions	30(62.5)	
	iii) Pneumocephalus	12(25)	
ii)	Head injury with Moderate soft tissue injuries	34(17)	n=200
b)	Non traumatic incidental positive findings such as calcified granulomas, arachnoid granulations, intra-cerebral lipomas, lacunar infarctions, neurocysticercosis)	16(8)	

Out of these 82 patients, 48 cases had fractures and intra-cranial findings and remaining 34 had moderate soft tissue injuries. 20 patients (10% of all cases), although had indications for CT as per the guideline, showed normal scan.

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98 patients (49% of all cases) had no indications according to NICE guidelines, however 16 cases among them (8% of all cases) showed positive findings on CT (Table 4).

Table – 4 Positive and Negative findings on CT scan n(%)

	Cases followed NICE guidelines	Cases not followed NICE guidelines	P value
Positive cases	82(41)	16(8)	0.04*
Negative cases	20(10)	82(41)	
Total	102	98	

*P<0.05 statistically significant

The positive findings include moderate soft tissue injury in 12 patients, cerebral hemorrhage in 2 patients and nasal bone fracture in 2 patients.

Amongst 200 trauma patients, 62 cases (31%) were admitted to GMCTH for observation and were managed by general surgeons, 94 cases (47%) were discharged home after CT scan revealed normal findings and 44 cases (22%) were referred to other centers where neurosurgery services were available. None of the patient deceased within the hospital.

Amongst 62 admitted cases, 24 patients had positive CT findings including moderate soft tissue injuries in 20 patients, followed by 2 cases of nasal bone fracture and 2 cases of linear non displaced fracture of cranial bones (frontal, parietal bone). Of the admitted patients, 58 cases had GCS 15, 2 had GCS 14 and 2 had GCS 10.

Discussion

Influence of age

We found, 16-65years was the most commonest group vulnerable for RTA, corroborating most of the other researches, where the mortality rate for all grades of injury increases from 1% in the age group <20 years to almost 11% in the age group <70 years [12]. An African study revealed 20-49 years constitute high-risk groups of road-traffic crashes [13]. A study in India showed that age group 18- 37 years was responsible for 75% of the accidents [14]. The reason may be people are more exposed to traffic because they are going schools, colleges, workplaces, markets *etc*.

Following NICE guidelines – a scenario

In our study 51% of the cases followed NICE guidelines. This is in accordance with the Scandinavian trial where authors recorded that 51% had followed the guidelines for CT head laid down in 2003 [15]. However study by Mooney *et al* at Salford Royal Foundation NHS trust (SRFT) showed the compliance 94.2% pre implementation of NICE guideline which increased to 98.8% post guidelines implementation in adults. Authors also reported lack of enthusiasm by physicians to follow NICE recommendations in children after head injury [16]. This disparity could be due to the fact that we included children and elderly patients. Furthermore, due to physicians' risk tolerance and malpractice fear, the frequency of use of CT head as a defensive practice in trauma patients may be different in Europe and Asia which could lead to this discrepancy. In the current study, significant number of cases did not follow the referral guidelines - in these cases, CT was performed on the request of the patient and patient's attendants. This trend is due to the local social system where, the plaintiff tries to get all the possible investigations done at the expense of the offender driver. Scenario was quite similar with the cases of physical assault. In few cases, due to lack of proper counseling, patients themselves insisted for CT scan. In addition, for mass casualties, patients were sometimes exposed to over-triage which involves unnecessary radiation from CT examinations [15]. The combination of above factors definitely has led to irrational use CT scan in trauma patients. If CT procedure were done on the background of expert's clinical judgment alone; the compliance rate with NICE guidelines would be somewhat higher [17].

Influence of gender

A significant gender disparity is noted in this study, male being more prone towards any injury. The preponderance of males over the females is noted in all modality of injuries. From young age, males are more likely to be involved in road traffic crashes than females. A study by Bordignon *et al* supports the present findings stating the overall male to female ratio 2:1 [18]. In an Indian study, authors reported much higher male predominance male, female ratio was almost 5:1 [19]. Similar other reports also stated that crash rates were significantly higher for male comparing female drivers [20]. In general; the risk taking behavior of males may have predisposed males in more trauma related cases.

Pattern of cranial lesions

In RTA, pedestrians were liable to the brunt of injuries compared to the riders in our study. In RTA pedestrian to vehicle occupant ratio (in number) was 1.52:1 which reflects lack of traffic rules, narrow roads and lack of footpath for the pedestrian. CT is a guide for the clinician to take decision whether patients should be admitted or discharged or transferred to a neurological centre [21, 22].

Positive and Negative findings on CT scan & decisions

In our study 47% (94 cases) of the patients were discharged home without keeping under observation after the CT revealed normal finding. If these group of patients had been kept in observation for 12-24 hours and the request for CT were made later on the basis of their clinical condition, the irrational use of CT-Scans in trauma patients would be relatively less. Considering the large number of non-

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compliance in our study, a substantial number of patients were exposed to over-triage leading to unnecessary radiations from CT examinations and monetary burden related to hospital admissions. The compliance rate of this work with the Scandinavian guidelines was similar; however they managed to increase the compliance rate after educational intervention involving feedback on performance [15]. Mohanty *et al* concluded that routine CT scan for patients with minimal head injury is an inefficient use of personnel and equipment which may add to the ever increasing financial burden on trauma centers [23].

Some investigators stated that following injuries CT scan and observation of the patients are often standard practice. Admission of the patients even after normal findings in CT is often done to avoid severe complications and medicolegal implications [24, 25]. Hence for minimal and moderate head injury cases, CT scan of head may not be an absolute requirement. "Wait and watch" management policy could definitely decrease the numbers of CT scan, leading to low hospital expenditure and less use of radiation to the patients. However CT scans are still widely performed in minimal and moderate head injury cases. This is supported by a recent study among CT ordering physicians that reports fear of missing traumatic intracranial lesion may explain the reason for the unnecessary CT-Scans, although they were aware about the management [26].

Patients with significant neuro-trauma were referred to higher centre from the hospital. These patients transferred to other hospitals are susceptible to inappropriate management at many levels of care like the condition may be aggravated by the distance of travel, weather, geographical and traffic conditions [27]. A study from Nepal found that the patients of rural area took an average 30 hours or longer to obtain definitive neurosurgical care than their urban counterparts [28]. Such effects including on head trauma patients are however beyond the scope of this study.

Conclusion

The overall compliance with NICE guidelines is not achieved as expected; and overtriage with unnecessary CT was observed. We found that there is unwillingness to follow the NICE recommendations indicated for CT head scan after a head injury was observed. An educational intervention of the guidelines to the trauma team of hospitals can be carried out and similar study can be conducted in due course of time so that patients in the Western Region of Nepal will be benefitted in terms of care and cost.

Limitations & future scope of the study

This is a cross-sectional study involving a relatively less number of patients. More insight is required involving other district hospitals for a better understanding. As Pokhara is a relatively small city, so casualties were relatively less, big metropolitan cities like Kathmandu may have more number of cases along with variations in the pattern of injuries. So considering other places will be an opportunity for the future researchers. The present study did not focus on the identification of the responsible factors to follow the guidelines, so further study is required in this context.

Abbreviations

Computed Tomography (CT), Extradural Hematoma (EDH), Gandaki Medical College and Teaching Hospital (GMCTH), Glasgow Coma Scale (GCS), National Institute for health and Care Excellence (NICE), road traffic accidents (RTA), Salford Royal Foundation NHS trust (SRFT), Sub-arachnoid hemorrhage (SAH), Sub-dural Hematoma (SDH).

Competing interests

Authors declare that they do not have any competing interest.

Authors' contribution

Mr. Surendra Dhungana and Dr. Manish Kiran Shrestha designed the study, constructed the questionnaire, interpreted the data, drafted the manuscript, and revised it. Dr. Dilasma Ghartimagar and Dr. Arnab Ghosh conducted the research formulated and analyzed the data. All authors took part in critical revision and finally approved the manuscript.

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