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Prognostic Indicators Influencing Short Term Outcomes among Operated Head Injury Patients at Kilimanjaro Christian Medical Center Northern Zone Tanzania.

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Background: ***Head injury causes significant morbidity and mortalityand accounts for about 10 million cases globally. In Tanzaniait's the most common type of injury contributing about 32% to 50% of all trauma patients. Favorable outcomes for head injury patients depends on initial evaluation and proper timely intervention. This study aimed at determining the prognostic indicators for short term outcomes in operated head injury patients at KCMC.***
Method: Operated head injury patients meeting inclusion criteria were enrolled and followed to the point of discharge.Age, cause of injury, time of injury to surgery, indication for surgery,GCS, ISS were recorded on admission. Outcomes of interest(GOS and hospital stay) were recorded ondischarge. The association between age, GCS on admission, ISS and time of injury to surgery and outcomes was done using Chi square test.
Results: ***A total of 57 patients were enrolled in the study with the median age of 34 years (range 22-44 years). Males accounted for 71.9% of participants. The mean admission GCS 11.9 (+/-3.4) and median ISS of 9(range 4-52). RTA was the leading cause of injuries with 56.1% followed by falls and assaults. The median hospital stay was 5 days (range 1-66) with median GOS of 5 (range 1-5). The overall mortality was 14%.Of those with fatal outcome (n=8), 87.5% had ISS ≥ 16 (P=0.004) and Unfavorable GOS of 84.7% (n=13) (P=0.01). GCS ≤ 8 was associated with mortality of 63% (n=8) (P=0.003), unfavorable GOS in 61.5% (n=13) (P=0.015) and 90% of those who stayed > 8 days had GCS< 13. Time of injury to surgery and social demographic characteristics had no significant association with fatality, GOS and hospital stay.***
Conclusion: ***ISS and GCS were important predictors of outcomes and thus their use in patient assessment should be encouraged. Furthermore GOS may be used as a primary measure of outcomes for patients with head injury.***

Key words: Head injury, outcomes, injury severity score, Glasgow coma score, Glassgow outcome score

Introduction

Head injury is an important global public health problem, being a major cause of morbidity and mortality worldwide[1, 24]. It is estimated around 10 million cases of head injury occur worldwide; of these 1.6 million occur every year in the United States of America necessitating approximately 250000 hospital admissions[2].In Tanzania, head trauma causes significant morbidity .Different studies have highlighted approximately 32% to 50% of all injuries are due to head trauma. [3,4, 25]The incidence of injuries; especially head injuries in developing countries, is on increase due to increased use of motor vehicles.[1]

The causes of head injury have been reported to vary between different areas and settings.They have been listed to range from, road traffic accidents, being the leading cause contributing about 56% of all causes, followed by falls 26 % and assault/violence 5- 10%.[1, 2, 6]

In head injury group of patient, the outcomes are considered among others to be the hospital stay and the state of the patient on recovery. To evaluate the state of the patient on recovery, Glasgow outcome score (GOS) is used, a measure that looks into physical disability of a patient post recovery from head injury.[13, 14, 15] Looking into the association that exists between the impact of injury and outcome for patients who undergo head surgery post head injury gives a breakthrough on better management scheme for the victims. A number of factors previously described pointing out short term outcomes for the head injured patients include timing of surgery post trauma, severity of the injury and other non modifiable factors like age of the victim.[5, 6, 14, 16]Thesehave a great impact on outcome and reflect on the morbidity and mortality.[7]

The severity of injury can be assessed using Glasgow coma score (GCS) and injury severity score (ISS).[1, 8] GCS at admission may help to predict outcome in head injury patients so it is recommended among other prognostic indicators to be assessed for better monitoring of the patient. [9, 10]Injury Severity Score (ISS), it is ananatomical scoring system for patients with multiple injuries and has been found to correlate with mortality, morbidity & hospital stay of patient with head injury[11].A study by Watts et al demonstrated the association of increased ISS and mortality where by patients with high ISS had increased risk of death than those with low score. [12]

Prolonged time to surgical intervention and increasing age of patients have been associated with poor outcome of patients. [16,17, 1819]Further more severe injuries are known to have high rates of unfavorable outcomes. [5, 8, 20, 21]

At KCMC, head injury is leading among emergency surgical admissions, with case fatality of 14% in the surgical unit. [22]The prognostic indicators influencing the outcome in post operative group of head injury patients have not been studied in this population therefore there is limited information on the subject. We sought to determine the prognostic indicators for short term outcomes among operated head injury patients at KCMC.

Patients and Methods

This was a hospital based prospective study conducted in General Surgical wards and Surgical icus at Kilimanjaro Christian Medical Center, Moshi Tanzania, for a period of five months,from December 2013 to April 2014. All patients, who were admitted in General surgical wards with the diagnosis of head injury that necessitated surgical intervention, were enrolled in the study. Patients who were admitted after being operated on in other centers were excluded.

Data collection technique
Review of admissions by researcher and research assistants was done. A structured data sheet was used to record age, cause of injury,Glasgow coma score, injury severity score indication for surgery and time of injury to surgery.Post operatively, GOS and

hospital stay were obtained at discharge. In this study GOS 1-3 was considered to be an unfavorable outcome while GOS 4-5 as favorable outcome.

Data processing
Data analysis was done using SPSS version 16.0. Frequency, proportions and percentages were used to summarize categorical variables whilst measure of central tendency (MCT) with respective measure of dispersion (MD) was used to summarize numerical variables. A Chi-square test was used to determine significance of association between dependent and independent variables. A P- value of <0.05 was considered statistically significant.

Ethical Issues
Ethical clearance and approval was obtained from the KCM University College Research Ethical Committee.Permission to collect data from the surgical wards was obtained from the department of General Surgery. Confidentiality and privacy of the information obtained was maintained.

Results

We enrolled 57 operated head injury patients during the study period with the median age of 34 years (22- 44). Male patients constituted the majority (71.9%) of the study participants with two thirds of the patients reported to reside in the Kilimanjaro area. (Table 1.)

Overall mean GCS on admission was 11.9 (+/- 3.4) with about 21% of the participants presenting with severe head injury. More than half (56.2%) of the study participants presented with injury severity score (ISS) above 16 with median score of 9 (4- 52). About 57.9% of patients got surgical intervention within 24 hours post injury and 49.1% of them had intracranial hematoma as an indication for surgery. Motor traffic accident was the leading cause of head injury (56.1%)(Table 1)

For the short term outcomes, the median length of hospital stay was 5 days (1-66) with more than half of all patients (56.1%) staying less than seven days. About 77.2% of patients had favourable GOS. However, the mortality rate was 14% in all the study participants. Citing on the association between age of the study participants and outcomes, longer hospital stay (8 days or more) was observed to increase with age of patients (Figure 1), though this association was not significantly significant (P>0.05).

ISS was significantly associated with mortality (χ^2=10569, P=0.004)and Glasgow Outcome Score (χ^2=13.265, P=0.01). However duration of hospital stay was not significantly associated with Injury severity score (ISS). Majority of patients with unfavourable outcome (84.7%) (11/13) had ISS above 16. Furthermore mortality occurred in 87.5% (7/8) of patients with ISS >16. (Table 3)

GCS on admission were significantly associated with mortality (χ^2=11.513, P=0.003);Glasgow Outcome Score (χ^2=5.875, P=0.015) and duration of hospital stay (χ^2=18.203, P=0.001). About 62% of patients who died had severe category of GCS on admission. Also most(61.5%) of the patients whohad unfavourable GOS at discharge

had GCS below 8 on admission. Majority(90.0%) of the patients who stayed more than 7 days had moderate to severe GCS on admission.(Table 3).

Unfavourable GOS (69.2%), mortality (75.0%) and duration of hospital stay ≤1 day were highly observed among patients whose time of injury to surgery was ≤ 24h hours. However these outcomes had no significant association with time of injury to surgery (P<0.05).

Table 1. Social demographic and Clinical characteristics of the participants (n=57).

Characteristics	No.	%
Social characteristics		
Age (Range)*	34 (22-44)	
Age (years)		
≤20	14	24.6
21-40	24	42.1
41-60	12	21.1
60+	7	12.3
Sex		
Male	41	71.9
Female	16	28.1
Clinical characteristics		
GCS (SD)**	11.9 (3.4)	
GCS on admission		
Severe	12	21.1
Moderate	21	36.8
Mild	24	42.1
ISS (Range)*	9 (4-52)	
Injury severity score (ISS)		
<16	32	56.2
>16	25	43.8
Time (range)*	24hours(2-1438)	
Time of injury to surgery		
≤ 24 hours	33	57.9
> 24 hours	24	42.1
Causes of injury		
Road traffic accidents	32	56.1
Assault	12	21.1
Fall	12	21.1
Hit by falling object	1	1.8

*Median (IQR) **mean (SD)

Table 2. Short term post operative outcomes among study participants (n=57).

Outcomes	**No.**	**%**
Duration of hospital stay(Range)*	5 (1-66)	
Duration of hospital stay(days):		
≤1 day	5	8.8
2-7 days	32	56.1
8+ days	20	35.1
GOS (Range)*	5 (1-5)	
GOS		
Unfavourable outcome	13	22.8
Favourable outcome	44	77.2
Mortality		
Yes	8	14.0
No	49	86.0

*Median (Range)

Table 3. Association between severity of injury (ISS and GCS) and short term post-operative outcomes (n=57).

Outcome		**Injury severity score N (%)**			**Total**	χ_2	**P-value**
		< 16	≥16				
Mortality							
Yes		1 (12.5)	7 (87.5)		8	10.569	0.004
No		31 (63.2)	18(36.8)		49		
GOS							
Unfavourable		2 (15.4)	11 (84.7)		13	13.265	0.001
Favourable		30 (68.2)	14(31.8)		44		
Duration of hospital stay							
≤1 day		3 (60.0)	2 (40.0)		5	6.645	0.338
2-7 days		21(65.6)	11 (34.4)		32		
8+ days		8 (40.0)	12(60.0)		20		
Outcome		GCS on admission			Total	χ_2	P-value
		N (%)					
		Severe	Moderate	Mild			
Mortality							
Yes		5 (62.5)	3 (37.5)	0 (0.0)	8	11.513	0.003
No		7 (14.3)	18 (36.7)	24 (49.0)	49		
GOS							
Unfavourable		8 (61.5)	5 (38.5)	0 (0.0)	13	5.875	0.015
Favourable		4 (9.1)	16 (36.4)	24 (54.5)	44		
Duration of hospital stay							
≤1 day		2 (40.0)	1 (20.0)	2 (40.0)	5	18.203	0.001
2-7 days		6 (18.8)	6 (18.8)	20 (62.5)	32		
8+ days		4 (20.0)	14 (70.0)	2 (10.0)	20		

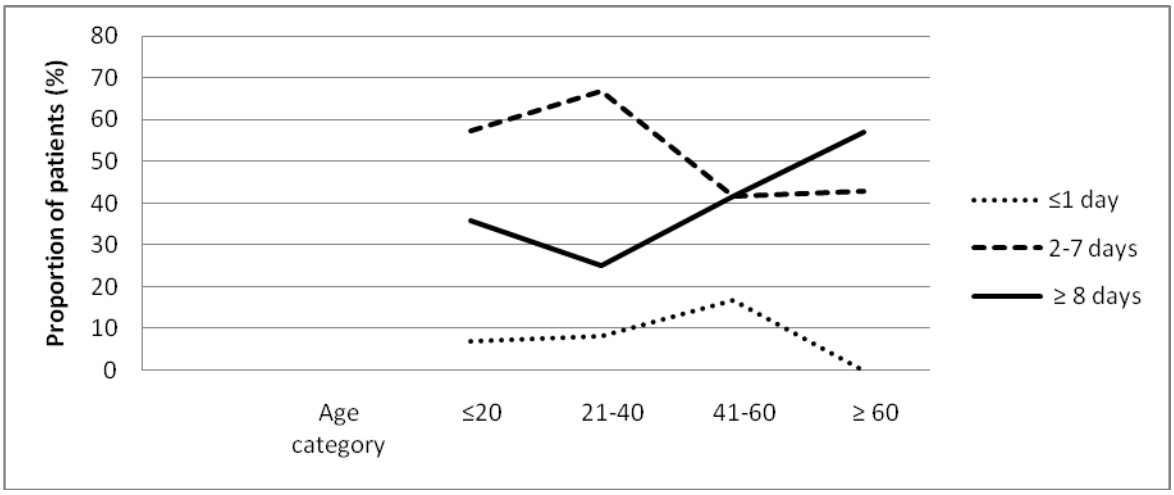

Figure 1. Age of the study participants associated with duration of hospital stay (n=57).

Table 4. Associations between Time of Injury to Surgery and Short Term Post-operative Outcomes (n=57).

Outcome	Total	Time to injury to surgery N (%)		χ^2	P-value
		≤24hrs	>24		
Mortality					
Yes	8	6 (75.0)	2 (25.0)	1.117	0.446
No	49	27 (55.1)	22 (44.9)		
GOS					
Unfavourable	13	9 (69.2)	4 (30.8)	0.888	0.524
Favourable	44	24 (54.5)	20 (45.5)		
Duration of hospital stay					
≤1 day	5	5 (100.0)	0 (0.0)	3.863	0.173
2-7 days	32	17 (53.1)	15 (46.9)		
8+ days	20	11 (55.0)	9 (45.0)		

Discussion

The median age for the study participants was 34 years with male predominance (71.9%). This is not unexpected as young males are noted globally to predominate in all forms of acute injuries from accidents to violence since they are involved in more risk behaviours than their female counterpart. Likewise, the same findings have been observed in other studies where male predominance and a young age were prominent in head injury studies.[5, 22, 23, 24]

This study found road traffic accidents to be the leading cause of head injury comprising 56.1% of all causes. This is followed by assault and falls each contributing 21.1%. A similar pattern was observed in other studies,[2, 5] notably, Chalya et al found road traffic accident to contribute 49.2% of all injuries followed by assault and falls with 30.8% and 16.8% respectively. [5] This speaks to the use of motor vehicles in daily activities and may

be a result of rapid urbanization and poor adherence of road safety regulations. However in Kenya, Kiboi et al found assault (44.8%) to be the leading cause of head injury, accounting for twice that found in this study, followed by road traffic accidents which contributed about half that found in this study population and in the population studied in Mwanza by Chalya et al (24.7%) and falls were the least contributors (30.5%).[18] The findings of these studies to some extent shed light on areas that many need special attention and highlights how the societal structures impact on health overall. The contrasting causes of head injuries, assault in Kenya and majority rtas in Tanzania highlight some underlying safety issues that need to be addressed.

In this study, the mean GCS was calculated to be 11.9 (+/- 3.4). Other studies report a mean of 8.6 (+/- 4.5).[23] This can be explained in part by the differences in the study group characteristics. For example, Barbara and colleagues studied a specific group of head injury cases involving mostly patients with traumatic brain injury who had intracranial haematoma that required surgery while this study dealt with all patients with head injury (SOL inclusive) who required surgery. The fact that intracranial haematoma is more likely to have a worse prognosis than certain other types of head injuries may explain the lower GCS they reported. In this study, the majority, 42.1% presented with mild head injury as measured by GCS. This was followed by moderate consisting of 36.8% while severe head injuries constituted 21.1%. This is consistent with previous studies in similar populations that reported the presentations of mild, moderate and severe to be 46.2% 31.1% and 22.3% respectively.[20] These ratios resembled closely in the results reported in Bugando Medical Centre in Tanzania.[5]

The median ISS was found to be 9. More patients (56.2%) had an ISS below 16 compared to 43.8% who had an ISS above 16. Chalya et al demonstrated the same findings where by 85.7% (48/56) had ISS below16 and 14.3% (8/56) had ISS above 16. [5]This suggests that the majority of the head injuries were not severe and had no associated injuries to other parts of the body.

The median hospital stay of 5 days was found in this study. This differs depending on the characteristics of the study participants. Darryl in the USA studied post operative outcomes following closed head injury and craniotomy for evacuation of hematoma in patients older than 80 years and found the mean stay of 10.2 days contrary to this study. [20]

Another outcome of interest was the GOS which had a mean of 4.5 (+/- 1.46). The favourable outcome were found in 77.2% of the participants comparable to Chalya who found favourable outcome in 91.9% (n=56) of his study participants.[5] However some other scholars have found different results where the unfavourable group of participants constituted a bigger percentage compared to the favourable group.[16, 17, 23]This was due to the difference in severity of injury in the study groups whereby participants had low GCS as compared to this study. As a result GOS of 1 occurred in 8 individuals (14%) in this study compared to 22.9% (n=35) in the study by Pollin. [17]

In this study a trend of increasing length of stay with age was observed even though this association didn't show statistical significance. The same trend has been observed in other studies where by older age was associated with increasing hospital stay. In USA Darryl et al found that patients who were older than 50 years stayed longer than those

who were younger.[20] This may be due to adaptation capability differences between ages, however some other confounding factors need to be excluded.

The association between GOS and age of the patient had no statistical significance similar to the study by Aarabi et al in USA (n=50).[8]This is contrary to other studies where this association was so overt, younger ages had better outcomes (GOS) than older ages. [17]This may be due to the small number of the study participants, failing to show the association. High ISS in this study was significantly associated with unfavourable GOS similar to the study by Jerry et al who found that patients with favourable outcomes tend to have low ISS. [21]This is explained by the degree of injury a patient sustains that ultimately influences the outcome. Likewise GCS below 8 was associated with 62% (n=8) mortality rate, and unfavourable GOS in 61.5% (n=13) of the participants. This is similar to Aarabi and Jerryl et al who looked at even lower GCS and found a GCS below 5 to be associated with a mortality rate of 83.3% and 70% of the study participants respectively. [8, 21]Also a GCS below 13 on admission was associated with hospital stay more than one week in 90% (n=20) of the participants, and this was statistically significant.

Time of injury to surgery showed no statistical significance with length of stay and GOS. Literature shows mixed results depending on study population and design. Although our findings are similar to that reported in the USA, [8] it is not the case with results reported in Kenya that demonstrated favourable outcome in 66% of the patients who were operated within 24 hours as compared to those after 24 hours.[18] In this study, they looked at a bigger patient population retrospectively, compared to ours and Aarabi et al in USA and thus could explain the limitations of sample size and the need of having another big study that will involve more participants to elucidate these associations.

High mortality rate occurred in patients who got surgical services within 24 hours. This could be that patients who got attended within 24 hours were more serious than the rest who came later than 24 hours. Also the majority (66.7%) of the study participants were residents of Kilimanjaro region, therefore were within close proximity of the catchment area of the health facility and could have been able to reach the facility soon after injury, shortening the time delays to surgery. This might be one of the reasons for high mortality observed in this group despite the short time to surgery; they probably represented those severely injured.

Conclusion

In conclusion, severity of injury rated by ISS and GCS on admission are important predictors of outcomes (hospital stay, GOS and mortality) in our setting. High ISS (≥16) and Low GCS on admission (≤8) contributed a larger percentage of patients with unfavourable outcomes (GOS). Consistent with other studies, this will help emphasize the importance of evaluation using these scores at admission and inform prognosis and prompt management decisions. Absence of investigative tools for head injuries like Computerized Tomography (CT) Scan in the centre impinged on the diagnostic capability and hence timely intervention for these patients.

We recommend that ISS, in addition to the current used GCS, to be used as initial assessment tools for head injured patients in our settings and thusenable stratification

of patients for an effective management scheme.GOS may be used as a primary measure of outcome in patients with head injury. Another study at a larger scale that will be able to include more patients (larger sample size) and more variables (resuscitative measures, physiological and hemodynamic factors) to establish other parameters associated with outcome is recommended.

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