Determinants Of The Outcome On Traumatic Brain Injury Patients At Kenyatta National Hospital

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Summary

INTRODUCTION

Traumatic brain injury (TBI) is among the leading causes of admissions in hospitals globally. TBI has been attributed with significant morbidity, mortality and disability. Most injuries have mainly been attributed to motor accidents and falls from heights.

Traumatic brain injuries represent a significant and growing disease burden in the developing world, and one of the leading causes of death in economically active adults in many low- and middle-income countries.

In Kenya, motor vehicle accidents, assaults and motorcycle are significant causes. Per vehicle mile travelled, motorcycle riders have a 34-fold higher risk of death in a crash than people driving vehicles and 8 times more likely to be injured. neurological injury progresses over hours and days, resulting in a secondary injury. Inflammatory and neurotoxic processes result in vasogenic fluid accumulation within the brain, contributing to raised intracranial pressure, hypoperfusion, and cerebral ischaemia a secondary injury may be amenable to intervention. Almost one-third of patients who die after a TBI will talk or obey commands before their death.

Physiological insults, *Hypoxia, hypotension, hyper* **- or** *hypocapnia, hype***r - or** *hypoglycaemia* **have all been shown to increase the risk of secondary brain injury**

OBJECTIVES:

To determine the patients' factor, clinical care and systems factor affecting outcome of Traumatic Brain Injury (TBI) patients at Kenyatta National Hospital. Which led to a poor outcome of above 40 years, casual laborers, Polytrauma and time lapse from trauma to hospitalization experienced. The clinical care factors indicating good outcome which included; diagnosis and medication, Nursing care and clinical setting A&E, CCU. Length of hospitalization >10 days. Protocols factors; Patients in surgical wards recording poor outcome.

DESIGN

The rationale for using purposive sampling was to be able to distinguish between traumatic brain injury patients, who did not have any neurological problems before the injury, and those who had suffered neurological problems prior to trauma. A descriptive cross-sectional design, Purposive sampling and Quantitative approach to data collection, analysis and presentation was adopted.

SETTING

The study was carried out at the Accident and Emergency department (A&E), Critical care unit (CCU) and surgical wards of Kenyatta National Hospital (KNH).

SUBJECTS

Patients with TBI within 72 hours of injury, aged between 18- 65 years and should have had no previous neurological problem.

RESULTS

Patient factors; that led to poor outcome; above 40 years (p=0.042), casual laborers (p=0.043), Polytrauma (p=0.042) and time lapse from trauma to hospitalization (p=0.051). The clinical care factors indicated good outcome which included; diagnosis and medication (p=0.001), Nursing care (p=0.055) and clinical setting A&E (p=0.051), CCU (p=0.032). Length of hospitalization >10 days (p=0.050). Protocols factors; Patients in surgical wards had poor outcome (p=0.051).

CONCLUSION

Patient factor's influenced outcome of TBI, Intensive care and longer time of hospitalization is paramount for better outcome.

RECOMMENDATION

Setup of a Trauma Neuro Ward and training of Neuro Teams to facilitate professional and quality care to improve outcome of Traumatic Brain Injury patients.

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Introduction

Traumatic brain injury (TBI) is among the leading causes of admissions in hospitals globally. TBI has been attributed with significant morbidity, mortality and disability. It represents a major health and socioeconomic problem (1) (2).

In the United States, over 1.7 million head injuries occurs annually out of which 50,000 die, 90,000 are left with permanent neurological disabilities with resultant long term suffering and financial burden (3) (4)

The injuries have mainly been attributed to motor accidents and falls from heights.

Traumatic brain injuries represent a significant and growing disease burden in the developing world, and one of the leading causes of death in economically active adults in many low- and middle-income countries (5) .

In Kenya, motor vehicle accidents, assaults and motorcycle are significant cause of these traumatic brain injuries (6) (7) (8) (9) .

Increasing number of motorcycles has been associated with escalating number of crashes. Per vehicle mile travelled, motorcycle riders have a 34-fold higher risk of death in a crash than people driving other vehicles and 8 times more likely to be injured (10) .

This mode of transport has become a norm because it is economical, fast and able to circumvent the hustles of city jam in low economical countries. The riders of these two wheeled machines are young men who derive their daily bread from them.

However, they are poorly trained, do not wear protective gear and ride dangerous predisposing themselves to body injuries with orthopedic and traumatic brain injuries being a common cause for their hospital admissions (11) (12).

The etiology, severity, and outcome of TBI vary. TBI is best classified on its severity based on the level of consciousness as assessed by the Glasgow Coma Scale (GCS) after resuscitation of the patient. The GCS comprises the sum score of the values from three components namely eye, motor, and verbal scales. TBI is classified as mild (GCS 15–13), moderate (GCS 13–9), and severe (GCS < 8).

However, factors such as hypoxia, hypotension, and alcohol intoxication can affect GCS, leading to diagnostic problem. Therefore patient should be resuscitated and reversible causes corrected before GCS assessment.

The ability to assess eye opening and verbal response is influenced by sedative agents or tracheal intubation, leading some to suggest the use of the motor score alone (1). Neurotrauma investigators have identified preadmission functionalability, comorbidities, sex, and other factors such as cerebral perfusion pressure on recovery after illness or injury assignificant prognostic indicators (12) (13) (14) (15).

TBI has been categorized into primary or secondary brain injury. The former is due to consequences of the initial physical insult whose pattern and extent of damage depends on the nature, intensity, and duration of the impact (1) .

Compression and shearing forces may result in skull fracture, contusions, intracranial haematoma, cerebral oedema, and diffuse brain injury. Microscopically there is cell wall disruption and increased membrane permeability disrupting ionic homeostasis.

Axonal tissue is particularly susceptible to injury. On the other hand, neurological injury progresses over hours and days, resulting in a secondary injury. Inflammatory and neurotoxic processes result in vasogenic fluid accumulation within the brain, contributing to raised intracranial pressure, hypoperfusion, and cerebral ischaemia.

Much of this secondary injury may be amenable to intervention, as almost one-third of patients who die after a TBI will talk or obey commands before their death. Secondary injury also occurs as a result of further physiological insults. Hypoxia, hypotension, hyper- or hypocapnia, hyper- or hypoglycaemia have all been shown to increase the risk of secondary brain injury (1).

TBI is a neurosurgical emergency and timely intervention is critical for favorable outcome. Acute management should be promptly and rigorously instituted. This is a critical period when mortality and morbidity can be influenced by interventions to prevent secondary brain injury (8).

Targeted resuscitation and early specialist management have been shown to reduce mortality (1). At Kenyatta National Hospital patients admitted in Critical Care Unit (CCU) with TBI account for 62% bed occupancy and an average of six casualties in 24 hours are attended to at Accident and Emergency (A&E) department.

Severity of TBI patients and timely management by the clinical team are critical factors in determining outcome (16).

The delays of turnaround time of up to 3 hours, if minimized through prompt management of head injury patients may results in reduction of TBI consequences. This may be possible by creation of a neuro intensive treatment facility and capacity building for the health care providers. We sought to determine the factors that influence outcome of traumatic brain injury patients at Kenyatta National Hospital.

Methods

A descriptive cross-sectional study was done at CCU, A&E and surgical wards of KNH. Study population was Traumatic Brain Injury patients and purposive sampling method was used to select 91 subjects.

A data collection chart was used through clinical assessment and patients data files. Descriptive and inferential statistics were used in analysis of data.

Ethical principles:

This was adhered to throughout the research process. Informed consent was sort from the guardians and benefits were explained to guardians. There were no risks in the study.

Results

4.1Biographic characteristics

4.1.1 Age

The respondents were aged between 18 and 65 years. Majority of the respondents were aged between 21-30 years 52.7% (n=48) followed by 31-40 years 17.6% (n=16) and 41-50 years 13.2% (n=12). The age groups of 51-65years and the less than 20 years tied at 6.6% (n=6) respectively. Those above 60 were the least with 3.3% (n=3).

4.1.2 Gender

Majority of the traumatic brain injury patients evaluated in this study were male at 89% (n=81) and the female were 11% (n=10).

4.1.3 Marital status

The marital status of most of the respondents was single at 51% (n=45), married at 39% (n=35) and slightly more than 10% were previously married.

4.1.4 Education level

The study findings showed that the educational level of most of the TBI patients interviewed had attained tertiary level of education 74.1% (n=66) and secondary level 21.3% (n=19) with slightly less than 5% had primary education level.

4.1.5 Occupation

The occupation of the traumatic brain injury patients was varied. The unemployed were many at 31.8% (n=28), followed by29.2% (n=26) being casual laborers (Jua Kali and industries) which was slightly more than professionals at 25.8% (n=23). The self employed were the least with 13.5% (n=12) as shown in ***table 1.***

Figure 1: *shows the distribution of Age in years*

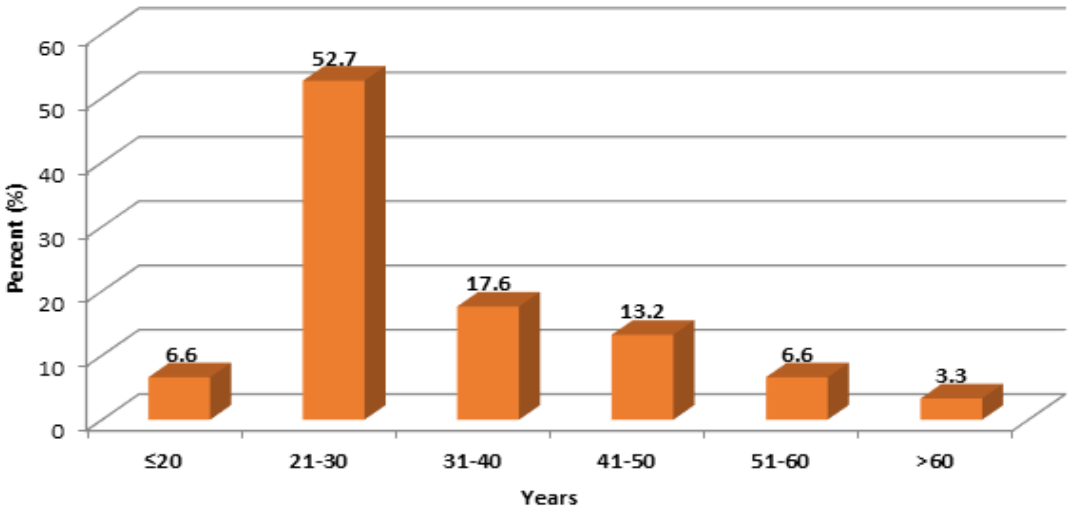

Figure2: *Marital Status*

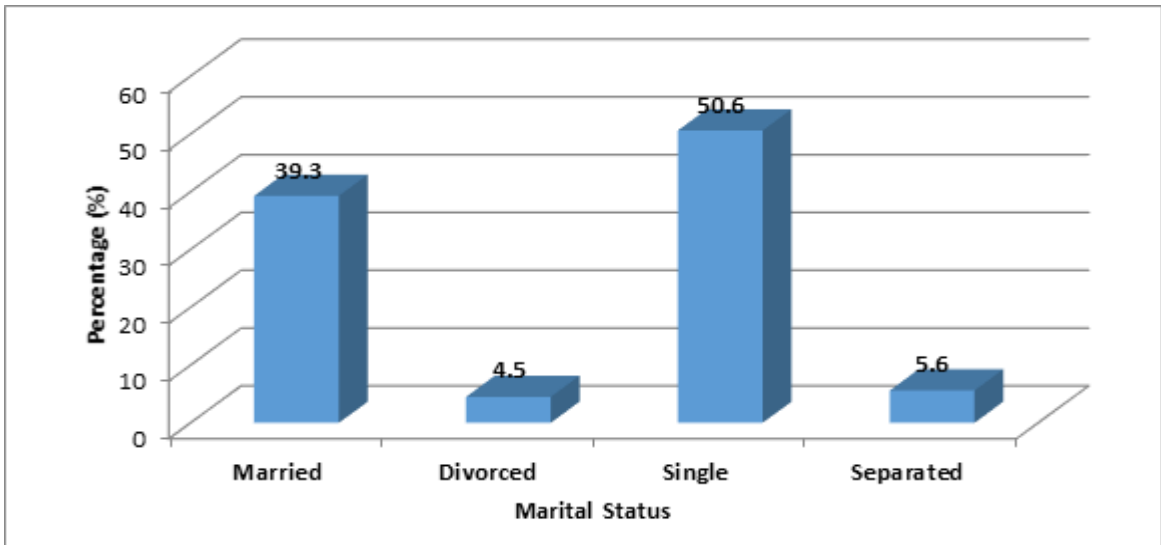

Table 1: Socio- demographic characteristics

CHARACTERISTICS	FREQUENCY (N)	PERCENTAGE %
Gender		
Female	10	11
Male	81	89
EDUCATIONAL LEVEL		
Primary	4	4.5
Secondary	19	21.3
College/polytechnic	36	40.4
University	32	33.7
OCCUPATION		
Professional	24	25.8
Casual laborer (industries)	13	14.6
Unemployed	29	31.5
Casual laborer (Jua Kali)	13	14.6
Self employed	12	13.5

4.2: Time lapse between Trauma & Hospitalization

Many of the respondents of TBI patients arrived at A&E department between 3-4 hours 36.3% followed closely by 1-2 hours at 35.2%. It was noted that only about 15.4% arrived at A&E within an hour (< 1 hour) and 13.2% arrived after 4 hours.

Figure 3: Time Lapse to Hospitalization

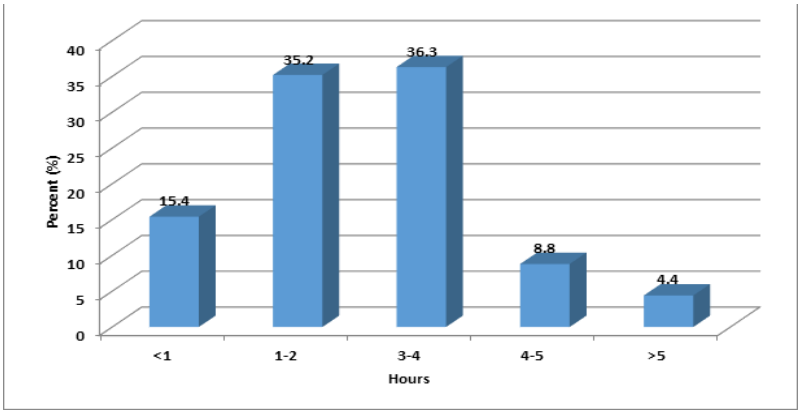

Table 2: *Patient characteristics & Glasgow coma scale assessment on admission*

PATIENT CHARACTERISTICS	Glasgow coma scale score at admission		χ^2	P- value	OR
	Severe head injury n(%)	Moderate head injury n(%)			
AGE					
18-30 years	48(88.9)	6(11.1)		0.324	1
31-40 years	12(75)	4(25)	2.4	0.174	0.375
41-70 years	19(90.5)	2(9.5)		0.042*	1.187
GENDER					
Female	9(90)	1(10)			1
Male	70(86.4)	11(13.6)	0.1	0.753	0.707
Marital status					
Married	32(88.6)	4(11..4)	3.38	0.22	1
Single	41(88.9)	5(11.1)		0.103	0.25
Previously married (separated, divorced)	6(66.7)	3(3.33)		0.964	0.969
EDUCATIONAL LEVEL					
Secondary or less	22(91.3)	2(8.7)		0.705	1
College /polytechnic	32(86.1)	5(13.9)	0.718	0.551	0.59
University	25(83.3)	5(16.7)		0.403	0.476
OCCUPATION					
Casual laborer	17(70.2)	9(29.8)		**0.043***	1
Unemployed	26(89.3)	3(10.7)	5.49	0.355	3
Professional	17(73.9)	6(26.1)		0.163	0.34
Self employed	11(88.3)	2(16.7)		0.605	0.6

*= Significant *P Value*

Table 2 above shows the results of association between patient characteristics and Glasgow coma score. The patient characteristics were associated with Glasgow coma score on admission. The results depicts that majority of the patients had severe head injury (n=79). Based on age, majority who were aged between18-30 and above 40 years with 88.9% and 90.5% respectively had severe head injury. There was a significant relationship

between age above 40 years, low GCS and severity of brain injury (P= 0.042). However occupation yielded a significant association of severe brain injury with casual laborers having the lowest GCS (P=0.042). The patient characteristics were significant to assessment of traumatic brain injury on admission.

4.3 Causes of Injury

Table 3 gives the distribution of causes of injury of the respondents. Many of the respondents were reported to be due to motor vehicle accident 42.9% (n=39) followed by assault 36.3% (n=33) and then falling from height 15.4% (n=14). Other causes included fall of object which was 4.4% (n=4) and unknown cause of injury was 1.1% (n=1).

4.4 Associated Injuries

The most common associated injuries were maxillofacial at 41.3 % (n=50) followed by limbs which were 38% (n=46), chest trauma 7.4% (n=9), frictional burns 6.6% (n=8), abdominal trauma 5% (n=6) and spinal trauma at 1.7% (n=2).

4.5 Associated features

It was noted that hemorrhage around the eyes (raccoon eyes) was positive at 71.4% (n=65) for majority of the patients. No CSF Rhinorrhea and ottorrhoea at 75% (n=72) and the level of consciousness at injury according to eye witness was unknown 76.7% (n=69).

Figure 4: *The causes of injury*

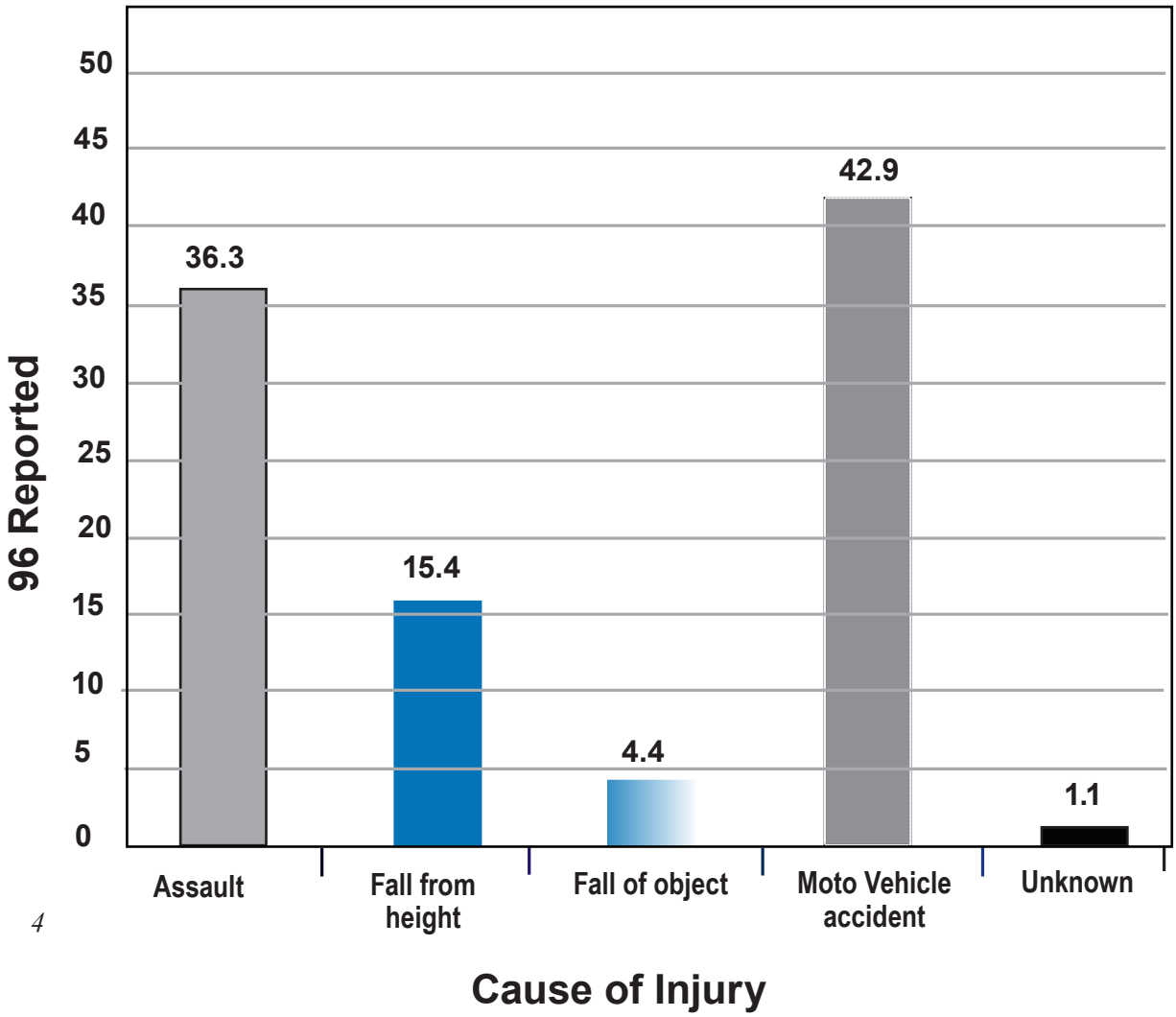

Table 3: *Causes of injuries, associated injury and the neurological outcome*

INJURIES	FREQUENCY	PERCENTAGE %
CAUSE OF INJURY		
Assault	33	36.3
Fall From Height	14	15.4
Fall Of Object	4	4.4
Motor Vehicle Accident	39	42.9
Unknown	1	1.1
ASSOCIATED INJURY		
Frictional Burns	8	6.6
Spinal	2	1.7
Limbs	46	38.0
Abdominal Trauma	6	5.0
Chest Trauma	9	7.4
Maxillofacial	50	41.3
CSF LEAKAGE		
No Csf Rhinorrhea	72	75.0
Csf Rhinorrhea	13	13.5
Csf Ottorrhoea	11	11.5
NEUROLOGICAL STATUS AT INJURY (EYE WITNESS)		
Conscious	22	23.3
Unknown	69	76.7
BATTLES SIGN (RACCOON EYES)		
Positive	65	71.4
Negative	26	28.6

Figure 5: *Associated injury*

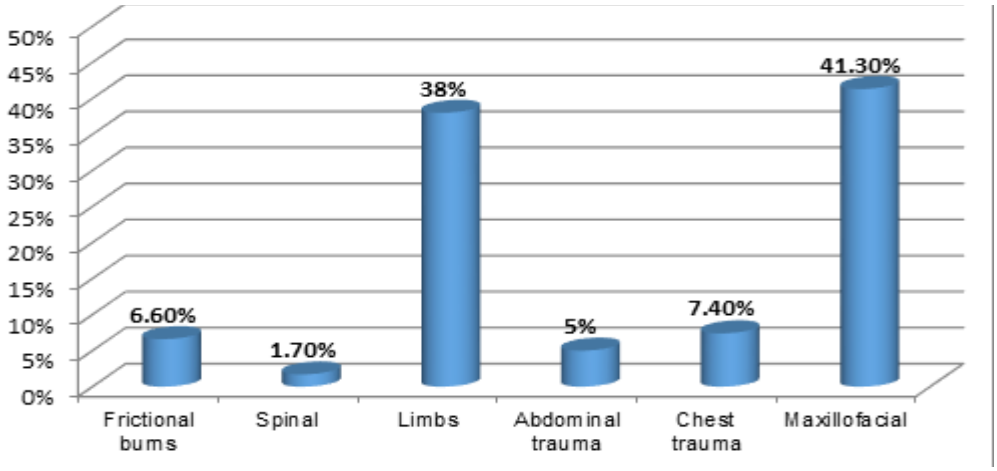

Table 4: *Injuries and GCS at admission*

VARIABLES	GCS AT ADMISSION					
	SEVERE TBI (<7)		MODERATE TBI (8>)			P-VALUE
	n	%	n	%	x^2	
MECHANISMS OF INJURY						
Assault	29	87.9	4	12.1		
Fall from height	13	92.9	1	7.1		
Fall of object	4	100	0	0		
Motor vehicle accident	32	82.1	7	17.9	2.01	0.73
Unknown	1	100	0	0		
ASSOCIATED INJURY						
Frictional Burns	7	87.5	1	12.5		
Spinal	2	100	0	0		
Limbs	40	87	6	13	0.189	0.042*
Abdominal trauma	6	100	0	0		
chest trauma	8	88.9	1	11.1		
Maxillofacial	45	90	5	10		
NEUROLOGICAL STATUS AT INJURY						
Conscious	18	85.7	3	21	0.022	0.880
Unknown	60	87	9	13		
CEREBRAL SPINAL LEAKAGE						
No CSF leakage	63	87.5	9	12.5	1.09	0.632
CSF Rhinorrhea	12	92.3	1	7.7		
CSF Ottorrhoea	9	81.8	2	18.2		

** = Significant P value*

Table 2: Illustrates the relationship of multiple injuries on GCS at admission. Majority of patients who had polytrauma had severe TBI at admission as shown by use of GCS. (P 0.042)

Table 5*: Care interventions executed within the first 72 hours*

MEDICAL INTERVENTION GIVEN	N(%)	χ^2	P-VALUE
Medication			
Analgesics, Antimenengitics, Dexamethasone, Mannitol	82(89.7)	1.606	0.001*
Analgesics, Antimenengitics, Dexamethasone	4(4.6)		
Analgesics, Antimenengitics	2(2.3)		
Analgesics	1(1.1)		
Analgesics, Dexamethasone, Mannitol	1(1.1)		
Antimenengitics	1(1.1)		
NURSING			
Continuous Monitoring Head Injury Chart, Intubation, Neck Collar, Patient Parameters, Urinary Catheter	2(2.2)	8.02	0.055*
Continuous Monitoring, Head Injury Chart, Intubation; Patient Parameters, Urinary Catheter	84(92.2)		
Continuous Monitoring, Head Injury Chart, Patient Parameters, Urinary Catheter	1(1.1)		
Head Injury Char. Intubation	1(1.1)		
Head Injury Chart, Intubation, Patient Parameters, Urinary Catheter	2(2.2)		
Head Injury Char, Intubation, Urinary Catheter	1(1.1)		
SURGICAL			
Craniotomy	38(65.5)		
Elevation Of Skull Fracture	3(5.2)	0.705	0.703
Surgical Toilet	17(29.3)		

* = Significant P value

Table 3 gives a descriptive analysis of the medical attention to TBI patients at accident and emergency department on arrival. The majority 89.7% (P=0.001) of the trauma patients received treatment. The nursing care intervention at 92.2% (P=0.055) given was standard.

In surgical intervention, Craniotomy was done to most trauma patients 38(65.5%) and 17(29.3%) surgical toileting was done. However this was only done to patients who would benefit from surgery.

The above analysis indicates that clinical team intervention is significant and therefore the outcome of TBI patients is dependent on timely appropriate collaborative management.

Table 6: *Analysis for Glasgow Outcome Scale*

INDEPENDENT VARIABLES	B	OR	95% C.I. FOR OR		P
			LOWER	UPPER	
Age >41 years	-.002	.998	.948	1.051	0.053*
CLINICAL SETTING					
A&E department		1			0.051*
Critical care unit	-1.442	.236	.058	.966	0.032*
Surgical ward	-.513	.599	.035	1.182	0.051
LENGTH OF HOSPITAL STAY					
1-3 days		1			0.723
4-6 days	1.626	5.086	.847	30.545	0.221
7-10 days	2.348	10.467	.957	114.500	0.055*
>10 days	1.261	3.529	.409	30.429	0.050*
TURNAROUND TIME ON PATIENT RECEPTION					
1-2 hours		1			0.051*
2-3 hours	.170	1.185	.224	6.273	1.000
3-4 hours	.088	1.092	.144	8.268	0.842
4-5 hours	-20.228	.000	.000	.	0.932
Constant	-1.279	.278			1.000

OR *= Odds Ratio;* ***B*** *= Regression coefficient;* ***P*** is the p-value **** significance***

In table 4 above, the outcome results reflects that age is correlated with GOS outcome in that when age increases 40 years and above the outcome becomes poor and it was significant to contributing GOS (P=0.05).

It was noted that some of the independent/ predictors of GCS were not significantly associated with GOS. When a patient is admitted to the surgical ward there is a high chance of poor outcome than admission at the A&E department and CCU which was significant (P=0.051), (P=0.032) respectively.

The length of stay was significant in predicting the GOS. Staying in hospital for more than 10 days was likely to have better outcome and was marginally significant (P=0.05).

If a patient stays in the hospital between 7 to 10 days, they are more likely of having better outcome than staying between 1 and 3 days (P=0.05) as indicated. Patients who reported to hospital in less than an hour after injury had good outcome, significance of (P= 0.051).

In summary the results indicate good outcome as 18.7% (n=17) at 72 hours. However at the end of the 8 weeks of data collection most of the patients reported to be in acute persistent vegetative state and acutely disabled improved quite significantly and had good outcome. This is depicted from the results in table 4 above where longer hospitalization resulted to good outcome.

Discussion.

A total number of 91 Traumatic Brain Injury Patients were researched on. The clinical outcome was measured after 72 hours using Glasgow Outcome Scale.

The TBI patients ranged from age 18 to 65 years old. Majority of the patients were young adults with a median of 29 years. The incidence was seen to decrease with age from 40 years and above, an observation that was noted in two other studies (16) (4) .

The scholars found that majority of patients injured were young adults and the numbers were less at fifty and above years.

Traumatic brain injuries are high among young individuals. In this study the age group 21-30 years was dominant. Traumatic brain injuries represent the leading cases of morbidity and death among a predominantly young and productive population.

Majority of the patients had severe traumatic brain injury. According to age, majority who were aged 21-30 and above 40 years had severe brain injury. In this study it has been noted absence of survivors among the elderly. The conclusion is that combination of age and admission GCS <6 predict poor outcome and can be used to counsel the patients relatives.

Polytrauma has been associated positively with severe TBI at admission and also poor outcome as depicted by use of Glasgow Coma Scale.

Polytrauma will cause the patient to have other *pathophysiologic* reactions following trauma.

This includes *neurogenic* shock due to pain from injuries, *hypovolemia* due to massive hemorrhage, inflammatory reactions and histamine production (17).

It was discovered that, Polytrauma complicated outcome of traumatic brain injury patients who would otherwise have good outcome succeseful.

The number of patients seen at Accident and Emergency department within an hour of arrival were minimal. In the 1970s and early 1980s (16), found that most TBI patients to have been seen within an hour of trauma.

In this study patients who were seen in the first hour of trauma had good outcome. This can be explained by timely diagnosis and management of the patients to prevent secondary brain injury through edema and hypoxia which compromises good outcome of the patients.

In a study by (18) , found out that TBI patients who presented to hospital within the first hour of trauma had high chances of better outcome. This was due to prevention of secondary insults to the brain tissues

Clinical attention and medication given to TBI patients at accident and emergency on arrival was timely and the nursing care intervention was prompt. Both interventions had a significant positive effect on the TBI patients' outcome. Surgical intervention was only done to patients who would benefit from surgery.

This indicates that the clinical teams' interventions having been significant therefore the patients' poor outcome is dependent on the patient factors and the In 72 hours of evaluation poor outcome had majority which included the mortalities and good outcome were less.

The poor outcome in this study can be explained by high frequency of Polytrauma, late presentation to hospital and age above 40 years. Univariate analysis found predictors of mortality in this study to be Glasgow coma scale score less than 6.

It was noted that some of the independent predictors of GCS were significantly associated with GOS. When a patient is admitted to the surgical ward there is a high chance of poor outcome than those admitted at the Accident and Emergency department and Critical Care Unit which was significant.

Ideally these patients should not be managed in the wards during the critical moments. Usually they are admitted to the wards subject to availability of space in A&E and CCU.

This is due to the critical care management, availability of machines for continuous monitoring and evaluation and well trained teams to manage these patients.

The length of stay was significant in predicting the Glasgow Outcome Scale. Staying in hospital for more than 10 days was likely to have better outcome and was marginally significant. TBI patients require intensive care, intubation and may also require surgery. All these interventions require time to investigate, perform, recovery period and evaluation.

In summary it has been shown that patient factors which include age, injury cause, Polytrauma, time lapse from trauma to hospitalization and the GCS on admission would influence the outcome of TBI patients.

Prediction of good outcome of patients with traumatic brain injury is intensive care of these patients which is only available at the accident and emergency department and the critical care unit.

This includes proper medication, critical care nursing and timely surgery for those who would benefit. Measurement of other categories to include longer hospitalization for proper monitoring and evaluation before discharge is important for good outcome.

Conclusion

Patient factors influenced outcome. Age, polytrauma, occupation, time lapse to hospitalization and severity of TBI as per Glasgow coma scale on admission.

Systems factors influenced outcome. Patients admitted to CCU and A&E had better outcome than those in surgical wards. Long hospitalization of TBI patients led to better outcome.

Recommendations

The recommendations include; Set up of neuro intensive treatment area, neurosurgical emergency ward and training of neurosurgical teams.

A study on effects of secondary brain insults following TBI and the outcome should be done since the researcher observed gaps in the course of the study.

Ethical consideration

The research study was approved by the Research and Ethics Committee at the KNH/UON. Permission was obtained from the Kenyatta National Hospital administration. Informed consent was obtained from relatives and guardians of the patients through attachment of a research information brochure and letter to each questionnaire.

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