ADDIS ABABA UNEVERSITY, DEPARTMENT OF SURGERY, NEUROSURGERY UNIT

PATTERNS AND PRESENTATION OF SURGICALLY TREATED PATIENTS WITH SPINE TRAUMA IN TWO TEACHING HOSPITALS, ADDIS ABABA, ETHIOPIA

For Partial Fulfillment of Graduate Course in Neurosurgery Specialty

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ACRONYMS

AAU- Addis Ababa University

AO- Arbeitsgemeinschaft für Osteosynthesefragen Classification of Vertebral Fractures

ASIA- American Spinal Injury Association

AIS- ASIA Impairment Scale

ACDF- Anterior Cervical Discectomy and Fusion

C1-C7- Vertebral Segment from First Cervical Level, Axis to Seventh Cervical Level

C3-C7- Vertebral Segment from Third Cervical Level, Axis to Seventh Cervical Level

MCM- Myungsung Christian Medical Center

NT- Not Testable

PSF- Pedicle Screw Fixation

ROM- Range of Movement

RTA- Road Traffic Accident

SCI- Spinal cord injury

S4- Fourth Sacral Spinal Nerve Root

S5- Fifth Sacral Spinal Nerve Root

TASH- Tikur Anbessa Specialized Hospital

TSCI- Traumatic Spinal Cord injury

T1-T10- Vertebral Segment from First Thoracic level to Tenth Thoracic Level

T11-L2- Vertebral Segment from Eleventh Thoracic Level to Second Lumbar Level

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ABSTRACT

Introduction: Acute injuries of the spine and spinal cord are among the most causes of severe disability and death after trauma.

Objectives: To determine demographics of surgically treated spine trauma in two spine trauma centers in Addis Ababa, Ethiopia and determine association of neurologic deficit with the type of fracture.

Patients and methods: Hospital based retrospective study undertaken at TASH & MCM in Addis Ababa on patients operated for spine traumas from January 1, 2011 to December 31, 2014. One hundred eighty patient records were investigated from both hospitals.

Results: There were 180 patients with male preponderance (77.8%) and a mean age of 32.5 years. The most common cause of spine injury was road traffic injury (52.8%). Thoracolumbar (36.1%) and cervical (33.3%) spine injuries were the commonest levels to be affected. The majority of patients (55.4%) sustained a type A fracture, 23.2% a type B fracture, and 21.5% patients experienced a type C fracture. Three patients (1.7%) had odontoid and hangman fractures. Thoracolumbar spine injury accounted for the highest number of cases with complete neurologic deficit (43.4%). One hundred forty one (78.3%) patients had neurologic deficits. Pedicle screw and rods fixation (66.7%) & anterior cervical discectomy/corpectomy and fusion with plating (28.9%) were the two common procedures done. There greater likelihood for rotational type (Type C) fracture to cause neurologic deficit (92.3%) than either compression (Type A) (30.8) or distraction (Type B) (76.9%) fractures. This association was statistically significant ($P = 0.023$, $Chi^2 = 17.7$).

Conclusions: This study demonstrates basic epidemiologic distribution of spine injury patients who are surgically managed at the two major

neurotrauma centers. Young men were the most common victims of spine injury. As RTA is the major and avoidable cause. We were able to confirm that type of fracture according to AO classification predicts the likelihood of neurologic deficit.

Keywords: Spine fracture, AO classification, Neurological deficit, Trauma, Spinal cord injury

INTRODUCTION

Spinal cord injury (SCI) is a serious condition that has an impact on quality of life, life expectancy and economic burden. There are no effective restorative therapies for SCI as yet, so prevention is the best medicine at present. Epidemiological research of SCI is very important because characteristics of a specified region described in epidemiology can provide the basis for appropriate preventive measures in order to reduce the incidence of SCI.[1,2,3,4] Acute injuries of the spine and spinal cord are among the most causes of severe disability and death after trauma.[4, 5, 6, 7, 8]

Retrospective analysis of 562 patients with a traumatic fracture of the spine at level 1 trauma center in Germany by Philipp Leucht & associates revealed the most common cause of accident was a high-energy fall (39%), followed by traffic accidents (26.5%). While fall related fractures were evenly distributed over the whole spine, traffic accidents induced significantly more fractures of the cervical and thoracic spine. Sixty-three (11.2%) patients exhibited a complete motor and sensory deficit, 76 (13.5%) an incomplete and 423 (75.3%) no neurological deficit. The highest number of complete motor and sensory neurological deficits was found in cervical spine fractures (19.7%). The majority of patients, 308 (54.8%), sustained a compression fracture, 95 (16.9%) a distraction fracture, and 104 (18.5%) patients experienced a rotational fracture.[9]

Cripps RA. and associates reviewed total of 377 abstracts on traumatic spinal cord injury & reported as global prevalence of TSCI is insufficient (236–1009 per million). Incidence data was comparable only for regions in North America (39 per million), Western Europe (15 per million) and Australia (16 per million). The major cause of TSCI in these regions involves four-wheeled motor vehicles, in contrast to South-east Asia where two-wheeled (and non-standard) road transport predominates.

Southern Asia and Oceania have falls from rooftops and trees as the primary cause. High fall rates are also seen in developed regions with aged populations (Japan/Western Europe). Violence/ self-harm (mainly firearm-related) was higher in North America (15%) than either Western Europe (6%) or Australia (2%). Sub-Saharan Africa has the highest reported violence-related TSCI in the world (38%). Rates are also high in north Africa/Middle East (24%) and Latin America (22%).[11] Another review by Angelo V. Vasiliadis stated as the incidence rates varied greatly among continents. [12]

A systematic review of 64 studies from 28 developing countries reported incidence of SCI in developing is 25.5/million/year (95% CI: 21.7–29.4/million/year) and ranges from 2.1 to 130.7/million/year. Males comprised 82.8% (95% CI: 80.3– 85.2) of all SCIs with a mean age of 32.4 years (95% CI: 29.7–35.2). The two leading causes of SCI were found to be motor vehicle crashes (41.4%; 95% CI: 35.4–47.4) and falls (34.9%; 95% CI: 26.7–43.1). Complete SCIs were found to be more common than incomplete injuries (complete SCI: 56.5%; 95% CI: 47.6–65.3; incomplete SCI: 43.0%; 95% CI: 34.1–52.0). Similarly, paraplegia was found to be more common than tetraplegia (paraplegia: 58.7%; 95% CI: 51.5–66.0; tetraplegia: 40.6%; 95% CI: 33.3–48.0).[25]

When we consider African setup, spinal trauma in Nigeria is an age-old problem.[13, 14, 15, 16, 17, 18, 19.] Although spine fractures represent only a minority in all trauma patients, their influence on the patients' social and financial environment is more significant than other injuries.[20] The major cause of spine injury is road traffic injury (RTI). [21, 22, 23]

Kawu A. *et al* studied 202 patients with male preponderance and a mean age of 38.9 [+ or -] 11.4 years over the 11-year period. The most common cause of spine injury was road traffic injury (79.7%). Cervical spine injury (10.4%) accounted for the highest number of cases with

complete neurologic deficit. The majority of patients, 119 (58.9%) sustained a type A fracture, 37 (18.3%) a type B fracture, and 41(20.3%) patients experienced a type C fracture. All patients had neurologic deficits. The predictors of fracture types are age and road traffic injury while age, road traffic injury, and cervical spine fractures predict neurologic deficit.[24]

In Ethiopian setup there are two recently published papers. Martin A. et al study on Outcome in patients undergoing surgery for spinal injury in an Ethiopian hospital, Myunsung Christian Medical Center (MCM), on 146 patients (129 males, 17 females). Their mean age was 31.7 years (range 15–81 years). The leading cause of injury was motor vehicle accidents (54.1%), and this was followed by falls (26.7%). The most common injury sites were lumbar (41.1%) and cervical (34.2%) regions of the spine. In 21.2% of patients, no neurological deficit was present before surgery. Patients showed surprisingly good recovery considering the limited resources. [26]

Hagos B. et al studied 385 patients of spine & spinal cord injuries at Tikur Anbessa Specialized Hospital (TASH), Ethiopia. Most (84.9%) were males & mean age was 32.8 years. Fall from height (36.4%) & RTA (32.9%) were the common cause of injury. Cervical (33.0%) spine was the most commonly involved level followed by thoracic (25.7%), lumbar (19.2%) and thoracolumbar (13.0%). Only 10.2% had no neurologic deficits. [27]

The above two studies have provided some basic epidemiologic data regarding spine injury with some contradictory results. In this study we have combined data from both hospitals and investigated epidemiologic distribution regarding age, sex and causes of spine trauma patients surgically treated in TASH and MCM, the major Neurotrauma centers as the country. This has filled the gap seen. We

have also determined patterns of distribution of type of fractures on specific anatomic spinal segments and resulting neurologic deficit according to ASIA impairment scale. We have defined association between type of fracture and resulting neurologic deficit.

PATIENTS AND METHODS

This is a retrospective study of all patients with spine fractures treated surgically from January 1, 2011 to December 31, 2014 at TASH and MCM. One hundred eighty patients with complete medical records and who met all the inclusion criteria were included in the study.

Data regarding patients such as age, gender, cause of accident fracture location, and fracture type, and neurological deficit were collected from individual charts the patients by the investigator. Level of injury was defined as cervical (C1-C7); thoracic (T1-T10), thoracolumbar (T11-L1), lumbar (L2-L5) and sacral (below L5). AO and ASIA classificayion of spine injured patients were used to classify spine fractures andspinal cord injury respectively. See below (Table 1 & 2).

Three patients with a fracture of the 1st or 2nd cervical vertebra were not included in the classification because those fractures were separately grouped due to the unique anatomical shape of these two vertebrae.

For statistical analysis IBM SPSS version 20 software is used to calculate chi-squared test, the chi-squared distribution. Values for $p < 0.05$ will be regarded as significant

Surgical management of vertebral fractures includes ACDF with plating, lateral mass screw & rods and wiring for cervical fractures, pedicle screw & rod fixation for thoracic and lumbar fractures.

Table 1

AO classification of spine fractures[13].

Type A. Vertebral body compression
A1. Impaction fractures
A2. Split fractures
A3. Burst fractures
Type B. Anterior and posterior element injury with distraction
B1. Posterior disruption predominantly ligamentous (flexion–distraction injury)
B2. Posterior disruption predominantly osseous (flexion–distraction injury)
B3. Anterior disruption through the disc (hyperextension-shear injury)
Type C. Anterior and posterior element injury with rotation
C1. Type A injuries with rotation (compression injuries with rotation)
C2. Type B injuries with rotation
C3. Rotational-shear injuries

Table 2

Frankel (ASIA impairment scale) classification of spinal cord injury[5].

	Frankel classification of neurologic deficits due to spine fractures
Frankel A	Complete spinal cord lesion, no motor function, no sensation (inquire the perianal reflex)
Frankel B	Incomplete spinal cord lesion, no motor function, sensation preserved
Frankel C	Nonfunctional preserved motor function
Frankel D	Limited motor function; the patient is able to move with support
Frankel E	No spinal cord lesion

RESULTS

Sociodemographic Distribution

Total of 180 patients were included in the study. One hundred twenty nine (71.7%) were from MCM hospital whereas 51 (28.3%) were from TASH. One hundred forty patients (77.8%) were male and 40 patients (22.2%) were females, making male to female ratio 3.5:1.

Mean age at presentation was 32.5 +/- 12.5 years while median was 38.5 years; mode being 25 years. The majority of patients who sustained the spinal injuries were between 20 and 45 years of age.

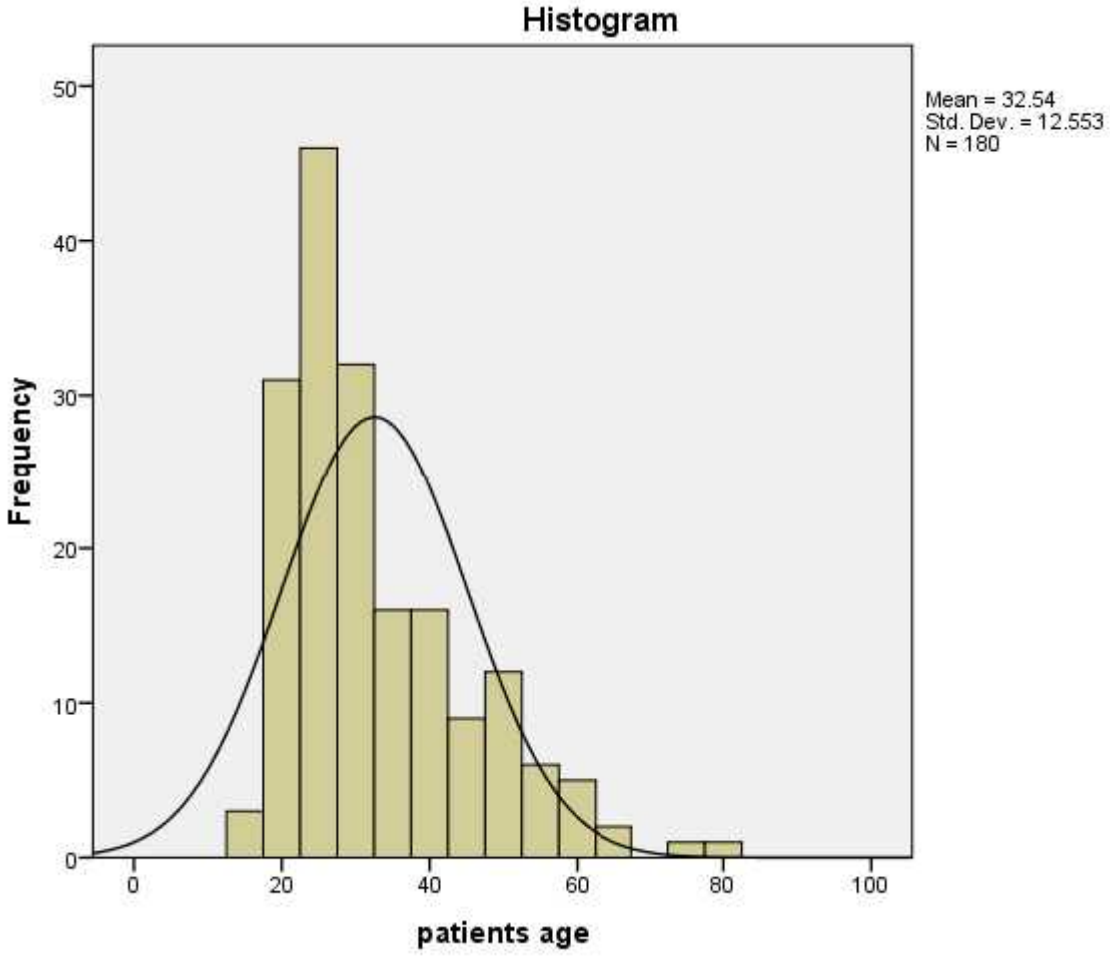

Figure 1 Age distribution of study population

Seventy patients (38.9%) were from Addis Ababa, 54 (30%) were from Oromia while Amhara region constitute 11.1% of patients. Patients from SNNP account for 9.4% of case and the rest the regions account for small number of patients.

Most patients (42.2%) present to the hospitals within 1-7 days of their injury. 0nly 3.9% and 17.8% presented in 6 hours and 6-24 hours of injury respectively.

Figure 2 Time from accident to presentation to hospital

Causes of Accident

Road traffic accident was responsible for most (52.8%) injuries while high falls (>1 meter height) accounted for 31.1% of cases. Only one of assault and sports related accidents were seen for each. Then we wondered if cause of injury could correlate with type of fracture. Analysis revealed all RTA, high falls & low falls, which are the commonest cause of accident, caused mostly compression (Type A) fractures, 48.4%, 71.4% and 70.0% respectively. RTA was found to be the commonest cause of all fracture types, 46.0% of Type A, 64.3% of Type B & 57.9% of Type C, compared to other causes of accident.

Table 3 Relationship between cause of accident and type of fracture

Mechanism of injury * fracture type according to AO classification Crosstabulation

			fracture type according to AO classification			Total
			COMPRESSION	DISTRACTION	ROTATIONAL	
mechanism of injury	Road Traffic Accident	Count	46	27	22	95
		%	48.4%	28.4%	23.2%	100.0%
	High Falls (>1m)	Count	40	8	8	56
		%	71.4%	14.3%	14.3%	100.0%
	Low Falls (<1m)	Count	7	1	2	10
		%	70.0%	10.0%	20.0%	100.0%
	Assaults	Count	0	0	1	1
		%	0.0%	0.0%	100.0%	100.0%
	Penetrating	Count	1	1	1	3
		%	33.3%	33.3%	33.3%	100.0%
	Sports Related	Count	0	1	0	1
		%	0.0%	100.0%	0.0%	100.0%
	Others	Count	6	4	4	14
		%	42.9%	28.6%	28.6%	100.0%
Total		Count	100	42	38	180
		%	55.6%	23.3%	21.1%	100.0%

Fracture Localization

Sixty five patients (36.1%) had thoracolumbar fractures making it the most common location to be followed by cervical accounting for 60 patients (33.3%) of cases. Only one case of sacral fracture, which is due to bullet injury, was seen which is least common level. Fifteen (8.3%) patients had thoracic fractures. Three patients (1.7%) sustained atlantoaxial injuries, 2 type II odontoid fractures & 1 hangman fracture. Multilevel involvement if the spine was seen only in 3 patients (1.7%). Observation of relation of causes of accident to the level injury showed

RTA was the commonest cause in all cervical, thoracic, thoracolumbar & lumbar levels of spine.

Most cases didn't have associated other organ system injury (81.7%). Among patients who had associated other system head injury was the most common (8.9%) followed by musculoskeletal system injuries (4.4%). Chest injury accounted for 3.3% and abdominal injury for 1.7%.

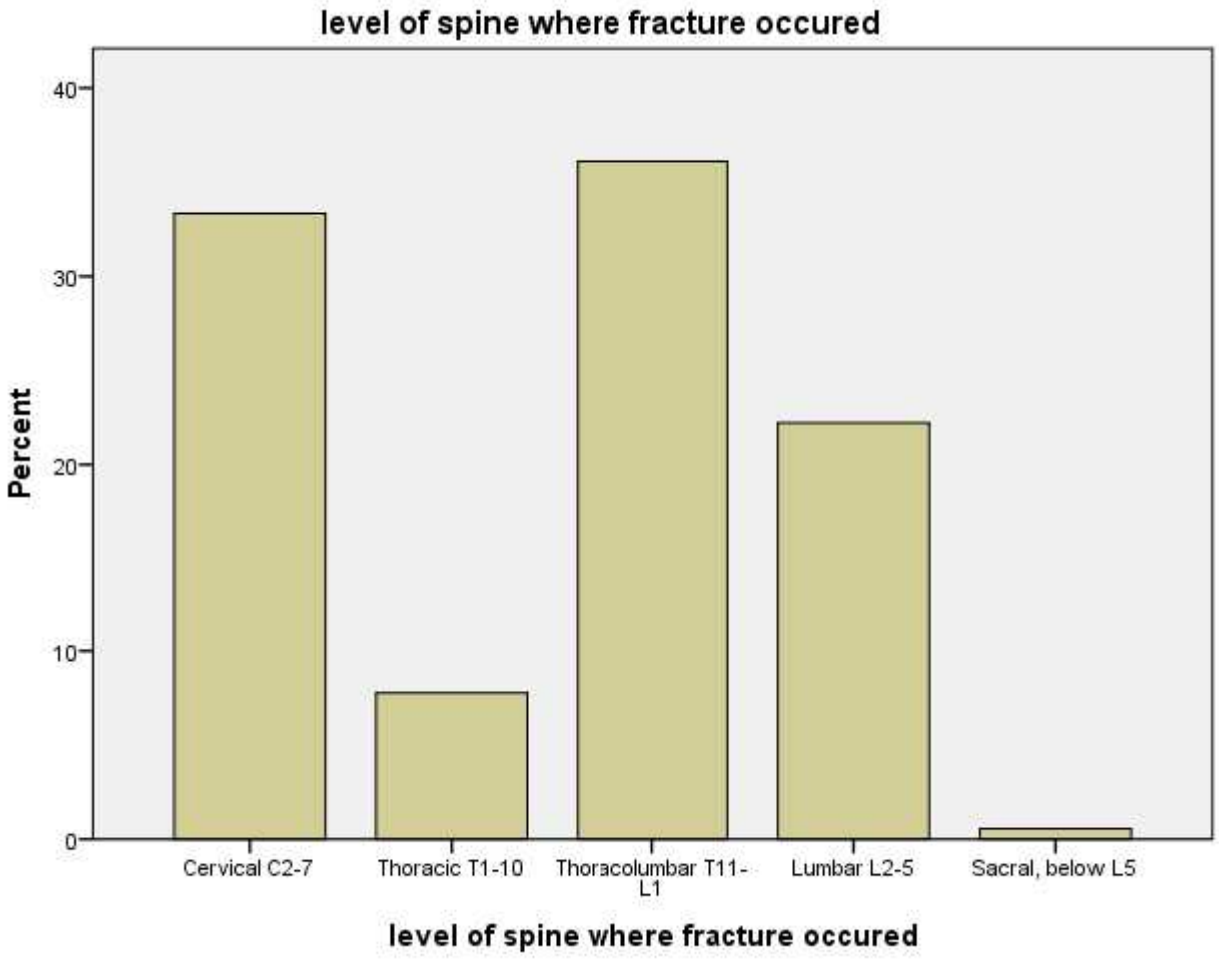

Figure 3 Distribution of fractures on spine levels

Incidence of Fracture Types

AO type A fracture, Compression fractures represented the commonest type of fracture occurring in 98 patients (55.4%). AO type C fracture, rotational/translational fractures were seen in 38 patients (21.5%) while 41 patients (23.2%) sustained AO type B, distraction fractures. Our data revealed that specific spinal sections were more prone to certain fracture mechanisms. For example, the majority of compression fractures (Type A) were found at the thoracolumbar junction (43.9%), whereas fractures caused by a distraction (Type B) and rotational (Type C) mechanisms more frequently occurred in the cervical spine, 63.4% and 44.7% respectively. Then we considered if there is gender difference in distribution of these fracture types. It showed compression fracture (Type A) was the most common in both sexes. Distraction fractures (Type B) were the least common type in females while rotational injuries (Type C) were the least in males. All the fracture types showed male predominance.

Table 4 Fracture type distribution

Fracture type according to AO classification		
	Frequency	Percent
COMPRESSION	98	55.4
DISTRACTION	41	23.2
ROTATIONAL	38	21.5
Total	177	100.0

Table 5 Fracture type distribution according to sex

Gender * fracture type according to AO classification Crosstabulation

			fracture type according to AO classification			Total
			COMPRESSION	DISTRACTION	ROTATIONAL	
sex	FEMALE	Count	25	6	9	40
		%	62.5%	15.0%	22.5%	100.0%
	MALE	Count	73	35	29	137
		%	53.3%	25.5%	21.2%	100.0%
Total		Count	98	41	38	177
		%	55.4%	23.2%	21.5%	100.0%

Neurologic Deficit

Using ASIA impairment scale, 38 patients (21.7%) has no neurologic deficit on presentation (AIS E) while 53 (29.4%) patients exhibited a complete motor and sensory deficit (AIS A). AIS D accounted for 22.2% of cases, AIS C represented for 18.3% of cases and AIS B patients were the least common representing only 8.3% of cases.

The highest number of complete motor and sensory neurological deficits was diagnosed in conjunction with thoracolumbar spine fractures (43.4%). Most patients without neurologic deficit were seen in lumbar spine fractures (25%).

Analyzing each group of the AO classification for the incidence of a neurological deficit revealed the lowest incidence of spinal cord injury for type A fractures with 30.8%, followed by distraction fractures (type B) with a neurological deficit in 76.9% of the patients. Type C fractures were associated with the highest incidence of spinal cord injuries (92.3%).

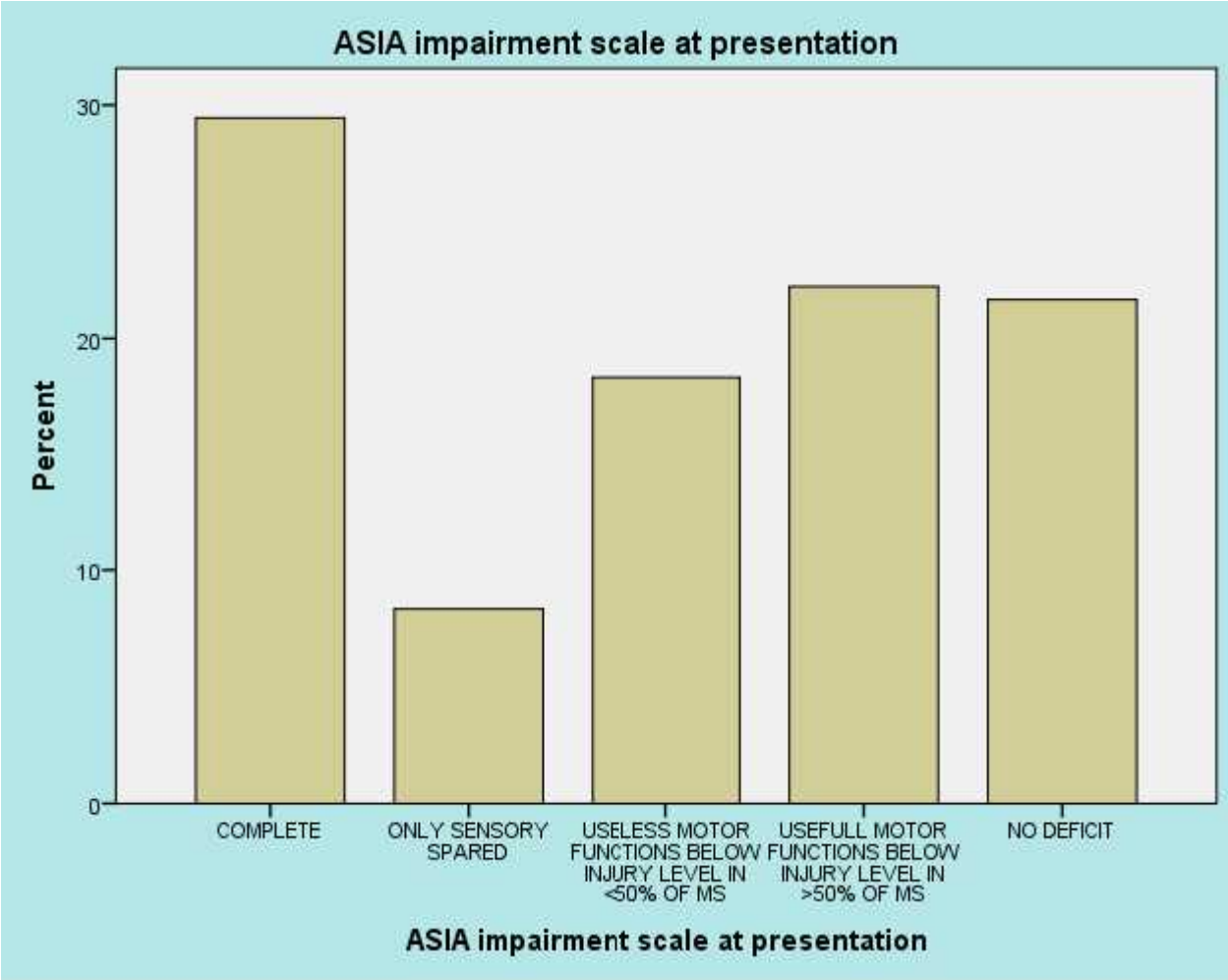

Figure 4 AIS distribution

Pedicle screw and rod fixation was the most common surgical procedure done representing for two third cases (66.7%); followed by anterior cervical discectomy/corpectomy and fusion, ACDF with plating

which accounted for 28.9%. lateral mass screws with rod fixation & posterior cervical wiring was done for 1.7% of cases each. One case of craniocervical fusion, another case of atlantoaxial fusion and one more case of odontoid screw were done.

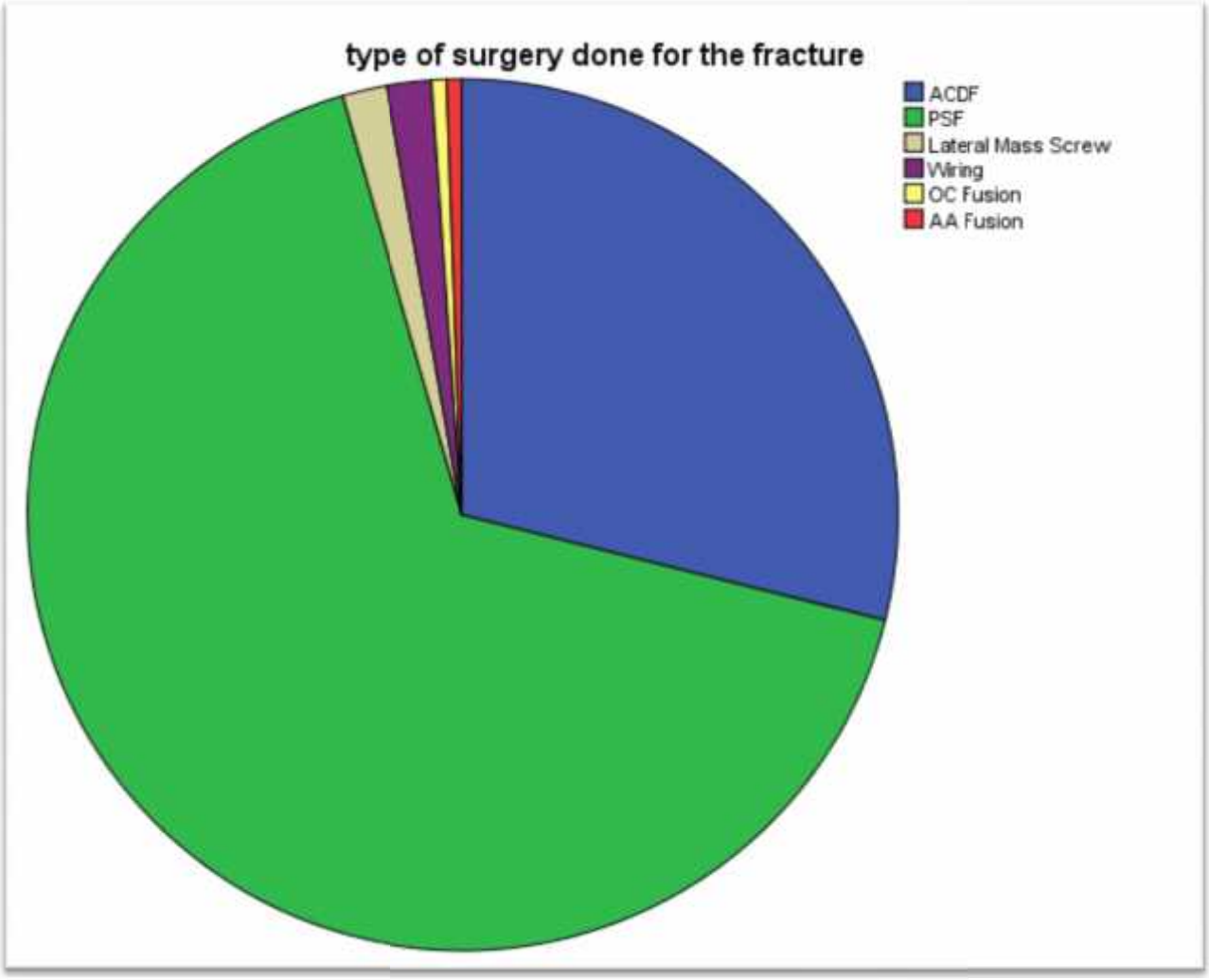

Figure 5 Type of procedures done

Considering duration of inpatient admission, most (43.3%) cases were admitted for duration of 1-2 weeks, 32.2% stayed in hospital for > 2 weeks while 24.4% were admitted for < 1 week duration.

Table 6 duration of inpatient admission

Duration of inpatient admission

	Frequency	Percent	Cumulative Percent
<1 week	44	24.4	24.4
1-2 weeks	78	43.3	67.8
>3 weeks	58	32.2	100.0
Total	180	100.0	

Association Between Type of Fracture to Likelihood of Neurologic Deficit

Crosstabulation of type of fracture in AO Classification system and neurologic deficit in AIS showed serial increment in possibility of complete spinal cord injury (AIS A) patients as we go from type A fractures to type C. The reverse was right for no neurologic deficit (AIS E) group. To see the significance of this relationship we run chi-square test which showed significant relationship exist with ($p = 0.023$, $Chi^2 = 17.7$).

Table 7 relationship between type of fracture and neurologic deficit

Fracture type according to AO classification * ASIA impairment scale at presentation Crosstabulation

			ASIA impairment scale at presentation					Total
			A	B	C	D	E	
fracture type according to AO classification	A	Count	26	3	17	25	27	98
		%	26.5%	3.1%	17.3%	25.5%	27.6%	100.0%
	B	Count	12	4	8	8	9	41
		%	29.3%	9.8%	19.5%	19.5%	22.0%	100.0%
	C	Count	14	8	7	6	3	38
		%	36.8%	21.1%	18.4%	15.8%	7.9%	100.0%
Total		Count	52	15	32	39	39	177
		%	29.4%	8.5%	18.1%	22.0%	22.0%	100.0%

Table 8 Chi square Test

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.762[a]	8	.023
Likelihood Ratio	17.822	8	.023
N of Valid Cases	177		

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Then we used multivariate analysis to see if this association could apply when we use one more variable such as mechanism of injury, spine level where the fracture has occurred, existence of concomitant other system injury. The relation was more strong in patients presenting after RTA ($p = 0.007$, $Chi^2 = 21.0$) and for fractures occurring at thoracolumbar, T11 – L1 level ($p = 0.008$, $Chi^2 = 20.6$). It was also stronger in patients without other organ injury than those with ($p = 0.011$, $Chi^2 = 19.8$).

There was no statistically significant association between neurologic deficit and demographic factors or mechanism of injury.

DISCUSSION

The aim of this investigation was to present an overview of epidemiological features of surgically managed spine fractures. Both male and female patients of all age groups were included in order to prevent statistical bias. While it was our intention not to exclude any population, nor fracture type in an effort to present an objective and broad overview, but we were obliged to stick to operated cases for possibility to access their data and difficulty in getting all the relevant information from records of all patients presenting to the hospitals, which includes those managed conservatively, as this is a retrospective study.

The population involved in this study shows male predominance and a young age group. This agreed with findings in other reports. [8, 9, 13, 14, 15, 16, 17, 18, 23, 24, 25,26,27] The mean age of 32.5 years and male predominance of 77.1% in our study is almost similar to the mean (32.4 years) and male proportion of 82.1% from the largest systematic review of 65 studies from 28 countries[25] and to the two recent reports from Ethiopia[26,27].

In this study, all type of fracture showed male predominance unlike that in the study of Leucht et al. [9] that found a nearly balanced gender distribution in Type A fractures. The reason may be the small number of female population in this study and the relative young age of the females in this study group which precludes osteoporosis, in which compression fractures (Type A) are common.

The fact the most patients are from Addis Ababa and Oromia which doesn't go with expected frequency as compared to total population in each region may be due to nearness of these two regions to the study hospitals. Also, most patients (78.3%) presented to the hospitals late,

within 1-7 days and then after. This could be due to difficulty in transportation especially for patients from far regions.

Road traffic injury is found to be the most common cause of spinal column injury in this study. This was noted in previous studies reviewed. [8, 10, 13, 14, 15, 16, 17, 18, 19, 25] This finding goes with Martin A. et al[26] report & is in contrast to the study of Hagos B. et al[27]. which reported falls as commonest cause followed by RTA. Both of these reports were done in our setup. Considering our study has taken data from both hospitals on which previous reports were separate from each, we believe this report has made conclusion as both RTA & falls are the major causes of injury, RTA probably being the commonest. Also RTA was the major cause of injury in all types of fracture in our study. Leucht et al. from Germany, on the other hand, found high falls as major causes of injury in Type A fractures & RTA was the major cause in Type B & C fractures. This goes with different epidemiology of causes of accident between developed and developing countries.[9]

Thoracolumbar level (T11-L1) the commonest level involved followed by cervical level (C1-C7). This has similarity with study by Martin A. et al[26] though it was in contrary to report by Hagos B. et al[27] which reported cervical be the commonest followed by thoracic, lumbar & thoracolumbar. Further review in literature showed similar results to ours from study of Leucht et al. from Germany. So we believe our result has filled the gap seen previously. Regarding cause of injury at specific level of spine, our study found RTA to be the major cause in almost all levels in contrast to the investigation of Leucht et al. which found major causes of injury as: RTA & sports related in cervical, RTA in thoracic and falls in thoracolumbar & lumbar levels. Involvement non contiguous multilevel and other organ system injury (17.3%) was comparable to

finding from Martin A. et al & Hagos B. et al. However, very small compared to finding seen in Leucht et al (54.4%) [9].

Compression fractures (Type A) fractures were the most common type of fractures seen as it was proven from previous studies. Distraction fracture (Type B) takes the next rank, rotational fracture (Type C) being the last. Type B & C the reverse order of rank in previous reports.[9, 24] Type A fracture tend to occur at thoracolumbar level while Type B & C are mostly seen at cervical level as seen in study of Leucht et al. [9]

Neurologic deficit was found in about 14-38% of all vertebral fractures. [9, 20] In this study the neurologic deficit found was 78.3%. This is similar to reports from Hagos B. et al & Martin A. et al. Study hospitals were referral centers within Ethiopia that deal with different patient stock compared to other hospitals. Therefore, patients with spinal cord injury associated with spinal trauma might have been overrepresented in this current study compared to 24.7% reported by Leucht et al. [9] The other reason is the absence of prehospital care in our country. Hence, patients with spinal trauma rescued by bystanders without knowledge of basic life support, the unconventional evacuation, poor transport to primary healthcare, and multiple hospital visits before admission into a tertiary institution may complicate spinal trauma with neurologic deficit. This could explain this high rate of neurologic deficit in patients with spinal column injury in this study. [9, 20]

The lowest number of neurological deficits was seen in the type A fractures and highest in type C fractures, as has been previously reported. [9, 24] Majority of complete spinal cord injury was seen with thoracolumbar fractures which are in contrary to previous reports

which showed decrement in frequency of spinal cord injury in cranio-caudal direction. [9, 24]

Regarding surgical procedures done, PSF was the commonest (66.7%) followed by ACDF with plating (28.9%) which is similar with report by Martin A. et al, 65.8% and 23.3% respectively.

Our data showed the relationship between type of fracture, and the occurrence of a neurological deficit, with a greater significance in patients presenting after RTA and thoracolumbar fracture, which was most likely due to the increased number of high-energy trauma. This finding has been previously reported. [9, 24]

There wasn't statistically significant correlation between likelihood of having neurologic deficit and other variables such as patients' age, sex, mechanism of injury, or existence of other organ system injury or other spine level injury as opposed to previous reports. [9, 24] This could be due to lack of whole inclusiveness of our study population as previous reports included all spine injuries while our study is on surgically managed spine injury patients only.

Overall, this study has revealed more or less similar epidemiological distribution spine injury in terms of age, sex and causes of injury with previous report by Kawu et al and Leucht et al. [9, 24] Its has also filled some epidemiologic gaps seen on previous reports in our setup. We were able confirm that type of fracture according to AO classification predicts the likelihood of neurologic deficit as it was reported previously. [9, 24]

LIMITATION OF THE STUDY

- The retrospective nature of our work goes along with its limitations, the most obvious being the dependence upon the quality of the data recorded in the medical records.
- Lost medical records were major limitation on actual data collection and there were difficulties in classifying fractures according to AO classification A to C in subaxial cervical fractures.
- The predominance MCM hospital as data source than TASH which could represent those patients who can afford to pay at private hospital. This creates a bias on projecting our results to the general population.

CONCLUSION

Our data has provided basic epidemiologic results about spine injury patients who are surgically managed at the two major neurotrauma centers in the country. Male accounted for more than two third of cases and most patients were young adults, 20–45 years. RTA was by far the commonest cause of injury and thoracolumbar fractures were the most frequently seen. It has also filled the gaps seen on previous reports from our country. We were able confirm that type of fracture according to AO classification predicts the likelihood of neurologic deficit as it was reported previously.

We believe this study has provided a profound baseline data regarding spine injury in our setup including filling gaps seen on previous reports. This will serve as a significant reference for upcoming further studies on the study matter.

This study would guide us to reallocate our resource in order that appropriate treatment would be instituted for these patients in a resource challenge country like ours. It looks we are facing mostly thoracolumbar fractures, so focus should be on further achieving PSF instruments.

RECOMMENDATIONS

- This study showed most spine injury patients are getting their surgeries at MCM, a private hospital. The role of TASH, the major government hospital in the country, in this is very small; providing the surgery for only around one forth of patients. We recommend to the concerning body to work on this.
- The commonest cause of spine injury is RTA. We recommend more objective implementations to be done on decreasing rate or if possible eliminating road traffic accident incidents.
- Considering the procedures done for spine traumas, PSF was the commonest as thoracic & lumbar spine fractures are the commonest. While posterior cervical spine procedures very rarely done. We recommend to give more emphasis to pedicle screw and rods on resource allocation & to start to do more of posterior cervical fixation procedure for both patients benefit as well as teaching purpose.
- As there were some contradicting results as compared to previous reports, we recommend further large and possibly prospective studies on the study matter to further define differences seen.

ACKNOWLEDGEMENTS

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CONFLICT OF INTEREST

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article. There are no known financial conflicts of interest associated with this manuscript.

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    1. Primary school — Chole junior school
    2. Secondary school — Hawas preparatory school
    3. Higher education — University of Gondar

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    1. Amharic — Speaking, Reading, Writing
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4. **Qualification** — M.D. University of Gondar
5. **Training & Certificate**
    1. Comprehensive HIV/AIDS training for physicians organized by I-TECH Ethiopia in collaboration with University of Gondar held on Nov, 17-24, 2009 in Gondar
    2. ART Patient Monitoring training for physicians organized by I-TECH Ethiopia in collaboration with University of Gondar held on Nov, 29-30, 2009 in Gondar
    3. HMIS organized by Tulane University & Federal Ministry Of Health in collaboration with University of Gondar held in May of 2009 in Gondar

4. PMTCT organized by I-TECH Ethiopia in collaboration with University of Gondar held in April of 2009 in Gondar
5. Neurosurgical training given by WFNS held in march of 2012 in Addis Ababa
6. The neurosurgery/neuroscience course organize by The Ohio State University-Ethiopia Partnership one health summer institute in collaboration with University of Gondar & Addis Ababa University held on July 12- 19, 2013 in Addis Ababa
7. FK preparatory course given by FK Norway held on Oct, 26- Nov, 7, 2014 in Entebbe, Uganda.
8. Attachment for Advanced Neurosurgical Practices from 1- April to 30- June, 2015 at Christian Medical College, Vellore, India.

6. Work experience

1. Internship at University of Gondar Hospital for 1 year
2. Neurosurgical resident at Black Lion Specialized Hospital Addis Ababa University for past four years

7. Experience in foreign countries

1. Preparatory course for FK Norway exchange program held on Oct, 26- Nov, 7, 2014 in Entebbe, Uganda.

8. Other skills & hobbies

I get satisfied whenever I'm on my work, I also like chatting with friends and reading. Occasionally I watch movies and google internet.

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1-PERSONAL DATA

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Date of birth	September,1966
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Language: Tigrinya (mother tongue) Amharic,	English (Fluent), French (Basic)
Hobbies:	Research, Reading, Movies
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2-ACADEMIC BACK GROUND

2008-2010	AAU, MF, Department of Neurosurgery
f	
	On fellowship for certificate of subspecialty
	AAU, MF, Department of Surgery and
	UiB, Haukeland hospital, Bergen,
	Norway (Certificate awarded)
2007	University of Cape Town, South Africa
	Awarded Post graduate diploma in
International Research Ethics	
1996 – 2000	AAU, MF, Department of Surgery,
	Awarded certificate of specialty

1990:	Rotating Intern in TASH, Ghandi Memorial Hospital, St Pauls Hospital, And Gondar Collage
1984 – 1990	AAU, Gonder College of Medical Sciences
	Awarded degree: MD
1980 – 1984 (High school)	Atse Yohannes Comprehensive
	Secondary School, Mekelle City
1972 – 1980 (Elementary school)	Ilallla Elementary School, Mekelle City
2005.	Grace computers training collage
	Awarded: Diploma

3-WORK EXPERIENCE

Sep – July 1990	Bedessa Health Center (Eastern Ethiopia)
August 1990—Feb. 1991	Ministry of internal Affairs,
	Administration for Refugee and Returnees
	Affairs, Kamaboker Refugee Camp, Jijiga
1991 – 1996	Chiro (Asebeteferi) Hospital (East Ethiopia)
	General medical practitioner
1996-2000	Residency in General Surgery
	AAU, MF Department of Surgery
2000-2001:	Pawi Hospital
	Benshangul Gumuz Region, West Ethiopia
Sept 2003 -2006	AAU MF, Department of Surgery
	Consultant surgeon, TASH,
Sept 2006- 2007	AAU MF, Department of Surgery
	Assistant Professor of surgery,ZMH

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4- MEMBERSHIP OF PROFESSIONAL ASSOCIATIONS

Ethiopian Medical Association (EMA)

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Pan African Bioethics Initiatives (PABIN)

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5- RESEARCH & PUBLICATIONS

1- Chest injuries in Tikur Anbessa Hospital, Addis Ababa: a three years experience East and Central African journal of Surgery, Vol.6.No, 1 Sep 2001

2- Abdominal wall Tumors in Tikur Anbessa Hospital, East and central African Journal of Surgery, Vol 8, No 1, 2003

3- Empyema Thoracis in Tikur Anbessa Hospital 1996-2000. East and Central African journal of Surgery, Vol.8, No 1, 2003

4- Clinico-pathological conference: Tikur Anbessa Hospital, Addis Ababa

Ethiop Med J, Vol 44, and Number 1 Jan 2006.

5- Intramedullary Cavernous Haemangioma of Spinal Cord. Case Report and Literature *East and Central African Journal of Surgery Volume 9 Number 2 - December 2004.*

Volume 2 Number 9, December 2004

6- Experience of Surgical therapy in 72 patients with Thoracic Hydatidosis over a 10-year period *Ethiop Med J,* Vol 43, and Number 1 Jan 2005.

7- Hydatid disease of the liver: A 12 years experience in surgical therapy. ECAJS Volume 11 Number 2, December 2006.

8- Experience of Pericardiectomy in Tikur Anbessa University Hospital, Ethiopia

ECAJS Volume 12 Number 1 April 2007.

9- Surgical treatment of achalasia cardia in Tikur Anbessa Hospital, Ethiopia.

2007.*Ethiop Med J Vol. 45 No. 3*

.10- Surgical Treatment of Hydatid disease in Tikur Anbessa Hospital.2007.*Ethiop Med J Vol. 45 No. 3*

11. Outcomes of Colostomy Reversal Procedures in Two Teaching Hospitals In

Addis Ababa, Ethiopia ,East and Central African Journal of Surgery, Vol. 13, Num. 2, 2008, pp. 119-124 pp 119-125

12. SURGICALLY TREATED PULMONARY TUBERCULOSIS: REPORT ON CASES FROM TIKUR ANBESSA HOSPITAL, ADDIS ABABA, ETHIOPIA. 2008. *Ethiop Med J, Vol. 46, No. 3*

13. In- Patient Surgical Mortality in Tikur Anbessa Hospital: a 5-year review, *Ethiop Med J,* January, 2009, vol 47, no 2

14. EVALUATION OF STANDARDS OF INFORMED CONSENT FORMATS IN RESEARCH PROPOSALS APPROVED BY FACULTY OF MEDICINE, Addis Ababa UNIVERSITY, 2009. *Ethiop Med J, Vol. 47, No.3*

6- ONGOING RESEARCH

1. A prospective study on the risk of exposure to HIV during Surgery in Tikur Anbessa Hospital Addis Ababa, proposal submitted to Faculty Research and Publication Committee
2. Frequency of occupational exposure to HIV/AIDS during surgery
3. Surgical treatment of bladder tumors at tash sent for publication to ECAJS
4. Patterns of lumbar disc diseases at Tikur Anbessa Hospital
5. ***Patterns of Spinal Injury in Tikur Anbessa Specialized Hospital. Addis Ababa, Ethiopia***

7-OTHER ACADEMIC AND ADMINISTRATIVE RESPONSINILITIES

1. Acting Medical Director

Bedessa Health Center and Chiro Hospital in 1990,

1992,1993,1994,1995

2. Medical Director (Co-coordinator)

Kamaboker refugee central Jijiga zone, East Ethiopia in 1990-1991

3. Medical Team Leader

4. Awash state farm in 1990(one month)

8- WORKSHOPS, CONFERENCES AND SEMINARS

- Annual EM.A Conference since 1996 EC.
- Annual conference of SSE. Since 1996 EC. Obtained certificate of appreciation recognition of contribution
- Workshop on continuing medical education on clinical epidemiology and biostatistics prepared by clinical epidemiology unit AAU, MF in 1996 and 1998 (TWICE), Certificate Awarded.
- Conference on STD and reproductive health at Pawi Hospital Metekel Zone Benishangul Gumuz national regional state as instructor and lecturer in 2001.
- Leadership training in emergency medicine prepared by Department of emergency medicine; Brigham and women's Hospital Harvard Medical School in partnership with WHO Ethiopia. WHO injuries and violence prevention department Ethiopia Medical Partiers Ethiopia. Sep 2002, Certificate Awarded.
- Sensitization on polio eradication strategies and progress
- Medial Ethics, trainer for health professionals.
- Advanced research ethics workshop , Dec 1-3, 2004, oceanic paradise and blue bay resort Hotels, Zanzibar, Tanzania organized by AMANET, Certificate awarded
- Training workshop on protection of human research participants: Writing of standard operating procedures for ethics review committee in Eastern Africa, 29-31 August 2005 Beachcomber Hotel, Dar es salaam, United Republic of Tanzania, Certificate awarded
- AMREF Workshop, May, 2006, Hilton Hotel, Addis Ababa, Ethiopia Certificate awarded.
- AMREF consultant surgeon, 2006-2009
- Consultative Meeting on Infection Prevention: Advocacy for Safe Health Care Environment. IP Partnership of Health Professional Associations: EPHA, EMA, ENMA & ENA, January 26 – 28, 2007, Adama Mekonnen Hotel, Adama, Ethiopia.
- AFNS: 1st BRAIN DISSECTION COURSE Wednesday 29th- - Friday 31st July 2009, Nairo University Hospital,Nairobi,Kenya,

- ESTHER COURSE 9-10 March 2010: Haukeland University Hospital and Fredskorpset, TUESDAY 9. MARCH 2010
- Scandinavian Course in Neurosurgery 2010 .General and Functional Neurosurgery Radisson Blu Resort, Beitostølen, Norway . 21st March – 26th March 2010
- Fredskorpset Preparatory Course.18th May to 4th June 2010, Hotel Victoria, Fredrikstad (http://www.hotelvictoria.no/): Certificate awarded
- The Annual FK Participants Conference with an after party in Cosmopolite in Oslo,Norway: Certificate awarded
- FK Health Exchange seminar 7 and 8 June at Haukeland Hotel in Bergen.
- Homecoming Seminar ,24-25 June,Thon Slottsparken Hotel, Oslo,Norway

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Profile

I am fifth year neurosurgical resident at Addis Ababa University, School of Medicine, Tikur Anbessa Hospital (AAU/TAH). I served as a general physician and lecturer before starting residency for a period of six months at the same university hospital. I am highly motivated and work well as part of a team.

Key achievements

- Completed my medical school studies in the top tenth centile
- Have been operating on emergency neurosurgical patients without supervision for more than two years
- Currently developing patient database and management guidelines for the unit of neurosurgery of AAU/TAH
- Organizing and running neurosurgical campaign on spina bifida and hydrocephalus pediatric patients
- Developing thematic research on Long term outcome of Traumatic Brain Injury patients which is done in collaboration with the Departments of Emergency Medicine, Pediatrics, Public Health, Anesthesiology, Radiology and Neurosurgery

Work history

- **General physician and lecturer**, AAU/TAH (2009-2010)
- **Neurosurgery resident**, AAU/TAH (2010-Now)

Qualifications and training

- **Bole Community Elementary and Junior High School(1991-1998)**

  Elementary and junior high education

- **Bole Meserete Hiwot High School(1999-2000)**

  Two years of secondary school education

- **Bole Senior Secondary School (2001-2002)**

  Preparatory courses for college

- **AAU/TAH (2003-2009)**

  Undergraduate medical degree

- **AAU/TAH (2010-now)**

  Graduate studies in the unit of Neurosurgery

- **Haukeland University Hospital, University of Bergen, Norway (2012)**

Attachment to departments of Radiology, Neuropathology, Neurosurgery and Neurology for a total of 5 months.

Took part in the annual Scandinavian neurosurgical residents conference

Interests

I am an amateur runner, usually do eight to ten kilometers. I also enjoy hiking and socializing.

Publications

- A two years prospective follow up and outcome of patients operated for carotid body tumors: Experience from Ethiopia; Abebe Bekele, Azarias Kassahun, Seyoum Kassa; Ethiopian Medical Journal 2012, 50 (4): 325-30
- Squamous cell carcinoma of the esophagus presenting with features of intracranial space occupying lesion; Nebyou Seyoum, Kibrom Gebreselassie, Azarias Kassahun; Ethiopian Medical Journal 2012, 50 (2)

Papers being processed for publication

- Case Report: Chronic Subdural Hematoma Evacuation followed by Brainstem hemorrhage; Azarias Kassahun, MD

- Outcome of Ventriculoperitoneal Shunt insertion at Myungsung Christian Medical center in Ethiopia; Hagos Biluts, Azarias Kassahun

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