



ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE

FUNCTIONAL OUTCOME FOLLOWING OPERATIVE TREATMENT OF ANKLE
FRACTURES AT ADDIS ABABA BURN, EMERGENCY AND TRAUMA HOSPITAL IN
PATIENTS TREATED FROM AUGUST 2015 TO MARCH 2019.

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St. Paul's Hospital Millennium Medical College

Functional outcome following operative treatment of ankle fractures at Addis Ababa Burn,
Emergency and Trauma Hospital in patient treated from August 2015 to March 2019.

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II

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ABSTRARCT

Background: Ankle fracture is one of common fractures treated in Addis Ababa Burn, Emergency and Trauma Hospital. International studies show that there are mixed functional outcomes.

Methods: Orthopedics Operation registration books for Addis Ababa Burn, Emergency and Trauma Hospital were retrospectively reviewed to gain a population of patients who sustained ankle fractures for the period August 2015 – March 2019. MRN registered on OR log book is used to access patients chart and relevant data about the fracture will be collected with structured data collection format. These patients were asked about their current ankle function, 2 - 5 years after fracturing their ankle.

Results: Of 240 patients that sustained ankle fractures, 122 were selected meting the inclusion criteria. 76 of them are evaluated for outcome (62.3 %). OMAS is used to evaluate functional outcome which scores outcome from 0 – 100. Score of 0-30 is ‘poor’, 31-60 is ‘Fair’, 61 -90 is ‘Good’, 91 – 100 is; Excellent’. All fracture type averaged Olerud-Molander ankle scores of 76.5. Those patients of age younger than 40 has statistically better outcome than above age of 40, and those operated within 24 hour for closed ankle fracture has better outcome than those with closed fracture and operated after of 24 hour of sustaining ankle fracture. Five patients (4%) achieved ‘poor’ results, 8 (7%) patients achieved a ‘fair’ result, 51 (42%) patients gained a ‘good’ result, and 12 (10 %) patients’ attained ‘excellent’ results. Fourty seven patients (39 %) think they didn’t recover fully while the rest claimed they did.

Conclusion: - Patients who sustain ankle fractures can be expected to be still experiencing functional difficulties two years posttreatment.

Key words: Ankle fractures, SPMMC, Orthopedics, Outcome assessment, Retrospective study.

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Acronyms & Abbreviations

AaBET – Addis Ababa burn, emergency and trauma

Dr. - Doctor

G.C- Gregorian Calander

MD - Medical doctor

MRN – Medical record number

OMAS – Orelud and molander score

OPD – Out patient department

OR – Operation room

ORIF- Open reduction and internal fixation

PAB – Pronation abduction

PER – Pronation external rotation

RTA – Road traffic accident

SAD – Supination adduction

SER – Supination external rotation

SPHMMC - Saint Paul Hospital millennium medical colleague

SPSS statistical package for social science

1.Introduction:

1 Background

Ankle is a precisely aligned joint with little soft tissue coverage. As a result, severe injury combined with inadequate or inappropriate treatment can lead to severe complications and major disability. As a weight-bearing joint, the ankle is exposed to forces that transiently exceed 1.25 times body weight with normal gait, and that may exceed 5.5 times body weight with vigorous activities. Normal gait requires adequate dorsiflexion and plantar flexion. Inversion and eversion, as well as accommodation to rotational stresses, are provided by the subtalar joint, whose function is linked closely with that of the ankle. The ankle is not intrinsically stable in any position and requires support from the muscles that cross it. (1)

Ankle fractures are common fractures of the lower limb, accounting for 10% of the total fractures reported in the emergency units(2). However, the rate of these fractures seems to be on the rise (3). In these conditions, one or several bones of the ankle joint are fractured, which may be associated with damage to the ligaments. In these injuries, the greater the trauma to the bones or the damage to the ligaments, the more instability of the fractures. The conventional method to treat malleolar fractures is open reduction and internal fixation (ORIF). However, the stable ankle fractures are treated today with conservative techniques(4).

Around 2% of ankle fractures are open fractures(3). Ankle fractures usually affect young men and older women(5), however, below the age of 50; ankle fractures are the commonest in men. After this age, females become predominant. Alcohol and slippery surfaces are each involved in nearly a third of the cases(6). Anatomic restoration of the joint is the goal of management in fractures about the ankle. Open reduction and internal fixation is the standard of care for unstable ankle fractures. The most common causes of ankle fractures are twisting injuries and falls, followed by sports injuries. (3,7)

1.2 Statement of the problem

Fractures around the ankle are one of the more commonly occurring forms of trauma managed by orthopaedic teams worldwide, with Australian data citing an incidence of 43.5 fractures per 100,000 persons per year(8,9). In Scotland ankle fractures represent 10% of all fractures with an incidence of around 137/100,000/year (3) making these the second most common lower limb fractures after hip fractures.(2) The already high incidence of ankle fractures is increasing sharply in line with the ageing demographic of most Western populations. A study done in Finland by Kannus et al. reported an increase of 319% in the overall annual number of low-energy ankle fractures in elderly patients admitted to hospital over the three decades between 1970 and 2000. From this data they predicted that the number of low-energy ankle fractures could be expected to triple by 2030. (10)

Despite their high incidence, ankle fractures may be considered by some to be a 'lesser' injury in comparison to other fractures (such as multiple traumas, hip fractures or fractures of the axial skeleton) and have attracted less research in comparison to other common fracture types(11–15). This potential consideration of ankle fractures as a lesser injury may be due to a perception that ankle fractures are localized in nature and have a high success rate of fracture reduction and union with established treatment protocols (11,16).

However, any perception that ankle fractures have a low rate of sub-optimal outcome and negligible negative long-term consequence are not founded in data. Prior empirical research has indicated the impact of ankle fractures may not be restricted to pain and disability caused at the time of the incident but continue for an extended duration (11,16)

Long term effects of ankle fractures have been reported to include physical, psychological, and social consequences (11). It has been reported that physical impairments following ankle fractures may include pain and functional impairment (17). Negative social consequences have included difficulty returning to work and dependence on disability benefits (11). These types of negative consequences are comparable to those that have been reported among other severe fracture type (15,18,19).

There is some controversy as to the proportion of patients who recover well following ankle fractures (20) Some studies have identified that 52% to 87% of patients have good to

excellent clinical outcomes after an ankle fracture (9,21). In contrast, some studies looking at patient outcomes between 14 months and 6 years following fracture have found that few patients reported a full recovery in most areas (11,22). Nilsson, Nyberg et al. (23) found that 51% self-report poor function with complaints of ongoing stiffness and swelling, pain with walking, and an impaired ability to climb stairs. Other study of systematic review of long-term outcomes from 1822 ankle fractures across 18 studies (4 to 14 years follow up) reported that approximately one in five did not result in a good or excellent outcome (16).

AaBET Hospital is one of the hospitals overloaded by trauma patients. Among these trauma patients, ankle fracture constitute significant percentage and department of orthopedics and traumatology needs to know the functional outcome measuring parameters like pain, swelling, walking, running and return to previous activity after operatively treated ankle fracture. As this research in our hospital is the first of its kind , the result of this research will help in the hospital have the status of the patient after having treated long before and need for further treatment and support of the patients.

1.3 Significance of the study

There is lack study conducted about ankle fracture and the outcome of the treatment in AaBET hospital. The purpose of this study was therefore to determine the functional outcome of ankle fracture in our setting and to compare ours with that of other published information.

The findings of this study will contribute to wider understanding of outcome of treatment in regard ankle fracture.

This research will also have the following significance: -

- ☐ It helps the AaBET hospital concerned bodies by providing necessary information.
- ☐ It provides base line information for other researcher who wants to conduct further study on this area.

2. Literature's review

In Malaysia Ahmad Hafiz Z, et al. did a retrospective study on 80 ankle fracture patients to evaluate the operative outcome. There were 65 male (81.3%) and 15(18.7%) female patients with an age range from 13 to 71 years old (mean age, 32.3y). Motor vehicle accident (MVA) was the most common cause of ankle fractures (70.4% of all study subjects). The most common operative method was open reduction and internal fixation (ORIF) in 73 patients (91.2%) with open reduction followed by external fixation in only 7 patients (8.8%). ORIF is the treatment of choice for patients with displaced fractures of both the lateral and medial malleolus. The most common implants used in medial malleolus fractures were screws (71.6%), whereas for lateral malleolus fractures, plates were the common choice (56.1%). There were no implants used for the posterior malleolus fractures in our study(24)

He used the Olerud and Molander scoring system (maximum 100 points), he noted that 93.8% of patients had excellent and good outcomes. There were 3 patients (3.7%) with poor results, 2 (2.5%) fair, one good (1.3%) and 74 (92.4%) excellent results. Two cases of poor results were due to deep infection, and the other case was a 71-year-old with stiffness and ankle pain when walking. (24)

In study done in New Zealand by Lash et al on 141 patients, (74 (52%) achieved follow up) 2 years after being treated operatively for ankle fracture. Mean age is 49 years, 22 were men and 52 were women. The mean OMA score was 71.1 (S.D. = 22.2), ranging from 15 to 100. Overall, 77% of all fractures gained a 'good' to 'excellent' outcome.(9)

In a study done in Sweden on 54 patients with ankle fracture evaluated after 14 months post operatively by Nilsson et al, the median value obtained for OMAS was 75 (range 10–100). On the OMAS, 16 patients scored 90–100 points, 18 scored 70–85 points, 14 scored 50–65 points and six scored <50 points. Twenty-one patients were completely free of pain, whereas 33 experienced some sort of pain Stiffness and swelling were reported by 33 and 31 patie. Walking on stairs caused problems for 28 patients, whereas jumping, squatting or running were possible for 70–75%. Nine patients used tape or wrapping and none was in need of a walking aid. Two patients reported severely impaired work capacity. (25)

Egol et al did a one year follow up study on 232 patients operated for ankle fracture in New York to find out short term predictor of functional outcome of ankle fracture. 130 (56%)

Were male and 102 (44%) were female, and their average age was 42 years (range, 16 - 89 years). The mechanisms of injury included 165 falls (71%), 16 pedestrian-motor vehicle accidents (7%), 28 sports injuries (12%), and 23 motor-vehicle collisions (10%). 49 patients (21%) were currently cigarette smokers, and 31 patients (13%) had diabetes. At one year, 174 patients (88%) had either no or mild ankle pain and 178 patients (90%) had either no limitations or limitations only in recreational activities (26)

An age of less than 40 years was a predictor of recovery but this association was not significant. The type of fracture, an associated dislocation, and a history of smoking had no influence on functional recovery. As measured with the AOFAS score, 90% (178) of the 198 patients had $\geq 90\%$ functional recovery. 95 % (105) of the 111 men recovered 90% of functional ability compared with only 85% (seventy-four) of the eighty-seven women, this difference was significant ($p = 0.02$). Age also was a predictor of the ability to recover $\geq 90\%$ of function at one year, with 72% (sixty-one) of the eighty-five patients who were younger than 40 years of age and 52% (fifty-nine) of the 113 patients who were older than 40 recovering such function ($p = 0.004$). Overall, 92% (154) of the 167 patients without diabetes recovered $\geq 90\%$ of function, whereas only 71% (twenty-two) of the thirty-one patients with diabetes did so ($p = 0.02$). (26)

Another study done as a Five-year retrospective functional outcome analysis by N.H. Shah et al. in United kingdom on 69 patients. Forty-three (62%) patients were females and 26 (38%) were males. The mean age of the patients was 50.7 years (range 20—81 years). 35 (50.7%) patients were still complaining of some sort of pain. Thirty-one (44.9%) patients were still reporting swelling. Forty-four (63%) patients were still complaining of stiffness at 5years. Twenty-seven (39%) patients still thought that they had not fully recovered; of these 27 patients, 4, 11 and 13 patients had poor, fair and good or excellent OMAS, respectively.(27)

To identify any predictors for a poor prognosis after ankle fracture surgery, Shah et al. compared OMAS as the outcome against the gender, age, type of fracture and delay in surgery. Like Egol et al. they used age of 40 years as a benchmark, while for the delay in surgery, they used 24 h post-injury as cut off point. Patients with age below 40 years have significantly better outcome than those older than 40 years. Men have a slightly better functional outcome than women at 5 years, but not significant. The timing of the surgery for fixation made no significant difference in the OMAS at 5 years.(27)

Most patients do well following an ankle fracture. Eighty-eight percent are pain free or have only mild pain at 1 year, and 90% have no restrictions or only mild recreational limitations. A substantial improvement is generally seen between 6 months and 1 year after injury. (26)

3. Objective of the study

3.1 General objective: -

- ☐ To assess functional outcome of ankle fracture at AaBET Hospital in Addis Ababa

3.2 Specific objective: -

- ☐ To assess the functional outcome of ankle fracture in the study setting
- ☐ To identify associated factors with functional outcome of ankle fractures in AaBET Hospital

4. Methods

4. 1 Study setting:

The study was conducted in Orthopedics and Traumatology department of AaBET Hospital. AaBET hospital is an affiliate of SPHMMC, one of the largest tertiary hospitals in the country. It is found in Addis Ababa. It is the first trauma hospital established in Ethiopia in 2015. It has been giving neurosurgery, orthopedics, trauma, burn, emergency and critical care services since its establishment. It has a total 145 beds for all departments, 4 OR tables and 2 recovery rooms. There are 12 orthopedic surgeons and 5 plastics & reconstruction surgeons. Orthopedics & Traumatology department provides service 710 patients per month from which 460 in emergency basis and 127 major operations per month on average, Plastics & reconstruction surgery department and general surgery perform about 28 major surgeries monthly by each department.

4.2. Study design & period:

The study design was Institution based retrospective and cross-sectional study in AaBET hospital of SPMMC from August 2015 to March 2019. The study participants were identified using the hospital operation registration logbook. Operation room registration book was used to get MRN of ankle fracture patients who were treated for ankle fractures.

Using those MRN, Patients chart was retrieved and the necessary clinical data was collected from the charts of the patients using a structured data collection form. The patients' functional outcome was assessed by OMAS which was done by phone call-based interview. The ankle specific outcome score devised by Olerud and Molander. Olerud - Molander Ankle Score (OMAS) is a well-established self-reported questionnaire, which is considered functionally oriented and is a valid ankle specific outcome scoring system (25,28). The maximum score is 100 and is equivalent to normal function. According to the Olerud and Molander, a score of 0—30 corresponds to a poor result, 31—60 a fair result, 61—90 a good result and scores 91-100 an excellent.

Two trials will be made (after a week and two weeks of the first trial) to those who did not respond on first call. It was planned to call a repeat after one week and four week of the first call but due to time constraint it was changed as such. Data entry and analysis was done using SPSS version 26. The budget for this research project was 25,280.5 birr and it was obtained from Saint Paul Hospital Millennium Medical Collage (SPHMMC).

Olerud and Molander score was used to assess the functional outcome by phone call.

Table 1. The Olerud and Molander ankle outcome score

Table 1 The Olerud and Molander score		
Parameter	Degree	Score (100 max)
Pain	None	25
	While walking on uneven surface	20
	While walking on even surface	10
	While walking indoors	5
	Constant and severe	0
Stiffness	None	10
	Present	0
Swelling	None	10
	Only evenings	5
	Constant	0
Stair climbing	No problem	10
	Impaired	5
	Impossible	0
Running	Possible	5
	Impossible	0
Jumping	Possible	5
	Impossible	0
Squatting	No problem	5
	Impossible	0
Supports	None	10
	Strapping used	5
	Stick or crutch	0
Work and activities of daily livings	Same as before injury	20
	Loss of tempo	15
	Change to a simple job	10
	Severely impaired work capacity	0

4. 3. Source population

The source population included all patients who was operatively treated for ankle fracture at AaBET hospital under orthopedic and traumatology department.

4. 4. Study population:

The study population included all patients who were treated operatively for ankle fracture at AaBET hospital under orthopedic and traumatology department from August 2015 to March 2019.

4.5. Sample Size & Sampling procedure

A single population proportion sample size determination formula was used based on confidence interval approach. There is no determined proportion of ankle fracture functional outcome treated operatively from previous similar study. Hence, p is taken to be 50%, with 95% confidence interval ($Z_{\alpha/2}=1.96$) and 5% margin of error ($d= 0.05$).

$$no = \frac{(Z_{\alpha/2})^2 \times p(1-p)}{d^2} \quad no = \frac{(1.96)^2 \times 0.5(1 - 0.5)}{(0.05)^2} \quad no=384$$

There were 240 patients operated for ankle fracture in the study period (as counted from OR registration logbook).

Because sampling is from finite population size $N = 162$, the final sample size is calculated using formula;

$$n = \frac{n_0}{\left(1 + \frac{n_0}{N}\right)}$$

The final sample size is therefore 107.

However; the study aims to include all eligible patients during the study period to make this study more powerful.

4.6 Measurement

4.6.1. Study Variables:

4.6.1.1 Dependent variable

Functional outcome of ankle fracture

4.6.1.2. Independent variables

Age

Gender

Type of fracture

Timing of surgery

Comorbid illness

Smoking

4.7. Operational Definitions

- Old age is age greater than 40 years.
- Young age is age less than 40 years of age.
- Early definitive surgery is a surgery done for ankle fracture within 24 hours of ankle fracture.
- Late definitive surgery is a a definitive operative surgery done after 24 hours of sustaining ankle fracture.
- Non respondent is a patient who does not respond to phone call which will be made on study time then after a week and lastly after 2 weeks (a total of 3trials).

- Initial treatment means the first treatment to immobilize ankle fracture until the patient undergoes definitive operative treatment.
- Definitive operative treatment means the final operative modality done for an ankle fracture.

4. 8 Data Collection Instruments and procedure:

Study participants MRN was collected from operation log books in study period then patients charts is collected. Data was collected by two trained junior orthopedics resident. The principal investigator supervised and provided all items necessary for data collection. To assure the quality of data, properly designed data collection format was prepared; training was given for data collectors about research objective, the data collection format, how to review chart and fill the data to assure the quality of data. After fulfilling the inclusion criteria the patient was called on phone and verbal consent was taken and OMAS format will be filled. This format involved four sections (A–D), which asked the patient questions about pain, stiffness, swelling, and physical functioning (i.e. the ability to climb stairs, run, jump, squat, and to perform activities of daily living). One section asked about the need for supports (i.e. taping/strapping or crutches/walking sticks). Some of the questions were phrased differently to make the question easier to understand. From these sections a score was generated by allocating points for each answer. The sum of the points gave the Olerud–Molander ankle (OMA) score. According to Olerud and Molander, a score of 0–30 rendered a ‘poor’ result, 31–60 a ‘fair’ result, 61–90 a ‘good’ result, and scores of 91–100 an ‘excellent’ result..

4.9 Data Quality control

Five junior orthopaedic residents’ collected data after taking one day training. A pretest is conducted on 12 patients at AaBET Hospital to check consistency and clarity of the data collection format.. The result of pretest is to make modification to the data collection format. The completeness and consistency of collected data was checked daily by principal investigator. The principal investigator was in control of all activities daily for the collected data completeness and clarity, then the data is entered to SPSS V 26 by the investigator.

4.8. Inclusion criteria:

- ☐ Adult Patients who had ankle fractures treated operatively in AaBET hospital during the study period.

4.9 Exclusion criteria

- ☐ Patients with concomitant injuries other than ankle fracture
- ☐ patients with pathological fractures
- ☐ Patients with incomplete medical charts.
- ☐ Patients who are not willing for interview

4.8 Data Analysis Procedures:

The collected data was coded, entered and analyzed using SPSS Version 26 for windows. It was checked for its completeness cleaned, processed and analyzed accordingly. Technique of Surgical stabilization had been performed with one of the three technique, open reduction then internal fixation, External fixation, or External fixation in combination with pinning of the malleolus/malleoli or rush rodding of the lateral malleolus. When screw was used for medial malleolus and plating was used for lateral malleolus it is done as described by the AO group. Other form of ORIF for lateral and medial malleolus is pinning, TBW and stitch suturing . External fixator is ankle spanning external fixator of different type. For syndesmotic injury it is diagnosed with radiographic examination and it is done as of the surgeons decision as there are controversies around the preferred way of fixation.

Both descriptive and inferential statistics were applied in the analysis. Frequency and percentage was used to summarize descriptive statistics. In order to identify any predictors for a poor prognosis after ankle fracture surgery, we compared OMAS as the outcome against the gender, age and timing surgery. Like Egol and Shah age of 40 years was used as a benchmark, while for the delay in surgery, 24 h post-injury was used as a benchmark.(29)(30)

Statistical analysis was performed using the SPSS V.26. Mann-Whitney U test was used to determine significance in the OMAS between gender, age and the timing of surgery.Kruskal-

Wallis H Test was used to compare OMAS as the outcome against types of fracture (classified as lateral malleolus, medial malleolus, medial/lateral malleolus, and medial/lateral/posterior rimalleous). Graphs, pie charts and tables was used as appropriate for data presentation and dissemination.

To evaluate association/ correlation between variables was tried. To test correlation between outcome score as a scale variable against age of the patient as a scale variable Pearson's product-moment correlation. But the variables fail one important assumption, linear relationship between the variables. Then the two variables is categorized as ordinal variables to use other measure of strength and direction of association. Spearman's Rank-Order, Kendall's Tau-b, Somers' delta or Goodman and Kruskal's Gamma measure of strength and direction for outcome against age and timing of surgery is tried but the relation of the variables is not monotonic.

So chi square test was used to evaluate whether there is association at all when OMAS as ordinal outcome score is tested against age, gender, fracture type , smoking habit, presence or absence of DM and delay of surgery from time of injury was used. Comparing the mean was not planned but added after proposal was done.

4.9 Ethical Clearance

Ethical clearance was obtained from the research review board of SPHMMC. Official letter for cooperation was sent to AaBET hospital. Approval for use of patient records was obtained from the AaBET Hospital medical director. Confidentiality was maintained when handling each case files support letter was obtained from Bahir Dar University, department of applied human nutrition. Ethical clearance was also issued from the Amhara Public health institute office and delivered to the respective health institutions. In addition, informed consent was obtained from the study participant to confirm their willingness for participation after explaining the objective of the study. Respondents were told that their name will not be mentioned and information provided by them kept confidential. They were given the chance to ask anything about the study and free to refuse or stop the questionnaire any moment they want.

5.Result and Discussion

5.1 Result

There were a total of 240 patients with ankle fracture who were treated operatively at AaBET Hospital from August 2015 to March 2019. Twenty patients have unclear documentation or wrong of the MRN on the OR registration book, 9 cards of the patient are not found while 3 patients are below the age of 18. Seventy-six patients have associated concomitant injury. On 10 patients chart the phone number is not documented.

At the end 122 patients are eligible to be included. From the patients chart the needed data and the phone number address is retrieved. The following descriptive data is collected and analyzed.

Almost two third of the patient is Male. Male are 88 (72.1 %) and Females are 34 (27.9%). The age of the patients ranges from 18 years to 80 years, mean of 38 years and SD 14.7.

Table 2 . A Sociodemographic background characteristic of participants

variables		N	%
Gender	Female	34	27.9%
	Male	88	72.1 %
Age	< 40 years	72	59%
	>= 40 years	50	41%
Residency	Addis Ababa	60	50%
	Oromiya	50	41%
	Amhara	3	0.03%
	SNNP	3	0.03%
	BenishangulGumuz	2	0.02 %
	Affar	2	0.02 %
	Dire Dawa	1	0.01%

Approximately 91% of the patients were from Addis Ababa and Oromia. 60 (50%) of the patients were from Addis Ababa, 50 (41%) from Oromia. 3 patients from Amhara, 3 from SNNP, 2 from benishangul, 2 from Affar and 1 from Dire Dawa. Most of the patients presented to our hospital on the same day of injury, 87 patients (74.4 %). 94 % the patients presented within 7 days of sustaining ankle fracture. Three patients presented to our hospital with unusually longer period after sustaining ankle fracture (1 patient after 210 days, 1 patient after 80 days and the other one after 30 days). This patient are considered to be the outlier in calculating mean of time of presentation which is 1.86 days with minimum of 1 and maximum of 15.

Table 3. Age and Delay in presentation to Our AaBET Hospital

	Age	Delay in presentation in day
Mean	37.8	1.86
Median	34	1
Mode	20	1
SD	14.698	2.12
Minimum	18	1
Maximum	80	15
Range	62	14

Fall down accident and road traffic accident accounts for 82 % of mechanism of the injury. Fall down accident 38.5 %(47 patients), pedestrian road traffic accident accounts for 24.6 %(30 patients), passenger Road traffic accident 11.5 %(11 patients). Violence or fighting injury accounts for 12.3 %(15 patients) of the ankle fracture while only one patient has ankle fracture secondary to sport injury. 6 patients (5%) claimed they sustained ankle fracture after being hit on the limb by heavy object and 5 patients (4.1 %) sustained motorbike accident. 2 patients (1.6%) mechanism of injury was unknown.

Pattern and Site of ankle fractures

Almost two-third of all ankle fractures cases were closed fractures (77 cases, 63.1%) and there were 45 cases of open ankle fractures (36.9%). The left side (50.8%, 62 patients) was affected slightly more than the right (49.2%, 60 patients). The combined medial and lateral malleolus fracture (62 %,76 patients) was the most commonly injured bone of the ankle treated operatively and the least common was isolated lateral malleoli fracture (7 %). Medial malleolar fracture accounts for 17 patients (14 %) , Trimalleolar fracture makes up 16.4%(20 patients).

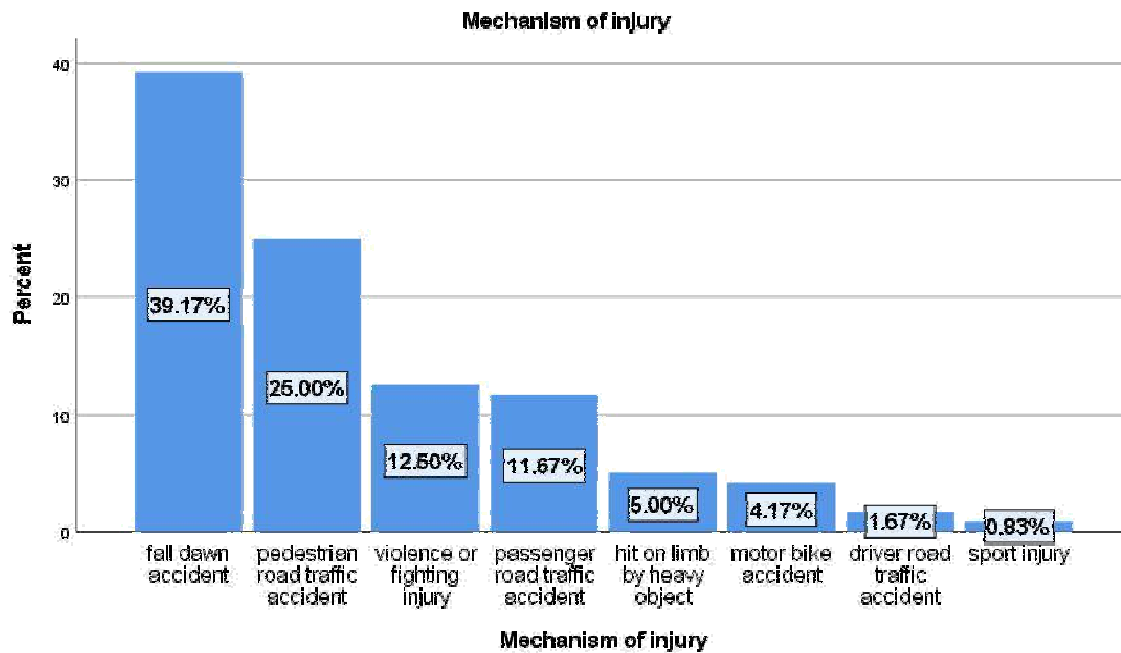


Figure 1. Ankle fracture mechanism of injury

Nineteen patients (15.6 %) had syndesmotic injury while 103 (84.4 %) had no syndesmotic injury. Except for one patient for whom no instrument is used, for all 18 (95 %) patients screw fixation was done for syndesmotic injury

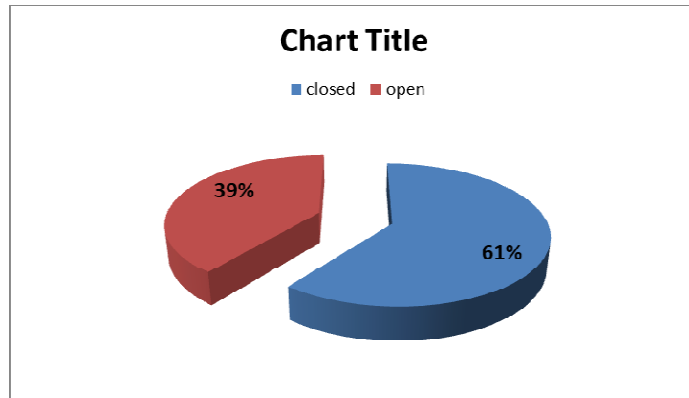


Figure 2 Type of ankle fracture based on soft tissue status of the fracture

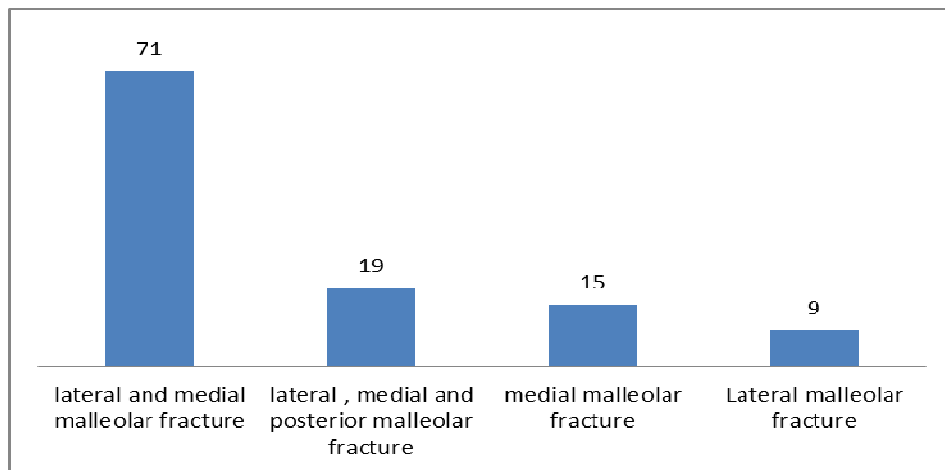


Figure 3 Types of fracture depending on number of malleolus fracture

Types of fixation

The most common way of initial stabilization of the fracture is Splinting 77 %(94 patients), followed by open reduction and internal fixation (ORIF) in 13.9 %(17 patients) and least is external fixation in only 11 patients (9%). ORIF constitutes 84.4 %(103 patients) as a definitive management of operatively treated ankle fracture in our study while splinting is least used method 3.3 %(4 patients).

For the patients treated with ORIF, the most common implants used in medial malleolus fractures were screws (67 %, 66 patients), whereas for lateral malleolus fractures, plates and screw were the common choice (85 %, 78 patients). From the total 15 patients having posterior malleolar fracture, in 12 patients (80 %) no instrument is used in our study.

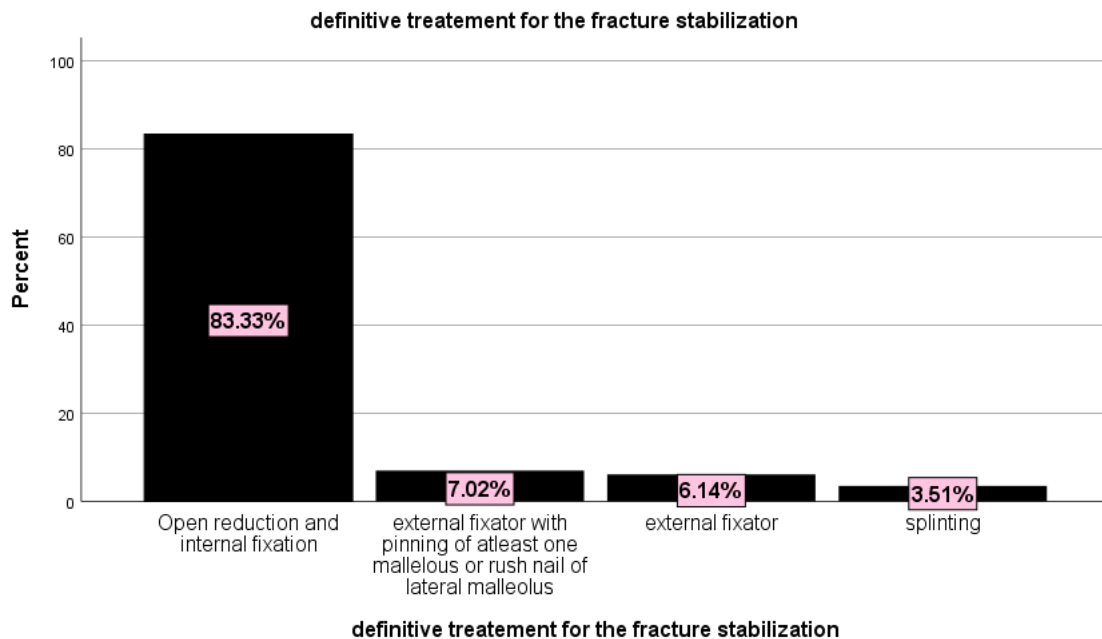


Figure 4. Definitive treatment for the fracture stabilization

Table 4. Type of implant used for lateral, medial and posterior malleolus fracture

	Medial malleolus	Lateral malleolus	Posterior malleolus
Screw	61(67.8	2(2.3%)	1(7.1 %)
Plate and screw	8(8.9 (%)	73(84.9%)	1(7.1 %)
Pinning with K wire	12(13.3%)	4(4.7%)	-
Tension Band Wire	4(4.4%)	1(1.2%)	-
Stitching	1(1.1%)	-	-
No instrument used	2(2.2%)	2(2.3%))	12(85.7%)
Screw and pin	2(2.2%)	-	-
Rush nail	-	4(4.7%)	-
Total	90(100%)	86(100%)	14(100 %)

From the total of 77 patients for which ORIF is done, 71 patients (92.2%) where operated after 24 of the injury while 6 patients (7.8 %) were operated within 24 hours. For open fracture, irrigation and debridement was done within 24 hour of presentation in 53.3 % (24 patients). The mean of delay in for Irrigation and debridement is 2.58 minimum of 1 and maximum of 16 days.

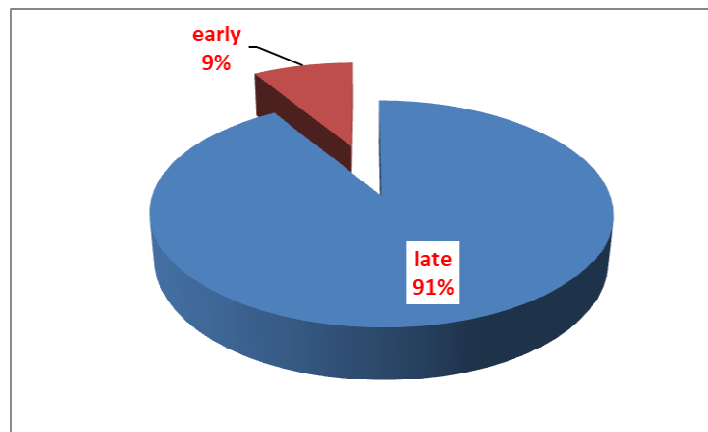


Figure 5 Timing of surgery for closed fracture

Hundred and ten patients (90 %) was evaluated for comorbid illness while for 12 patients not assessed due to different reason. 90 patients (82 %) had no known comorbid illness while 8 patients (6.6 %) had hypertension, 5 patients (4.1 %) had HIV/AIDS, 4 patients (3.3%) had Diabetus Melliutus , 2 patients was a known psychiatric disorder on follow up and treatment.

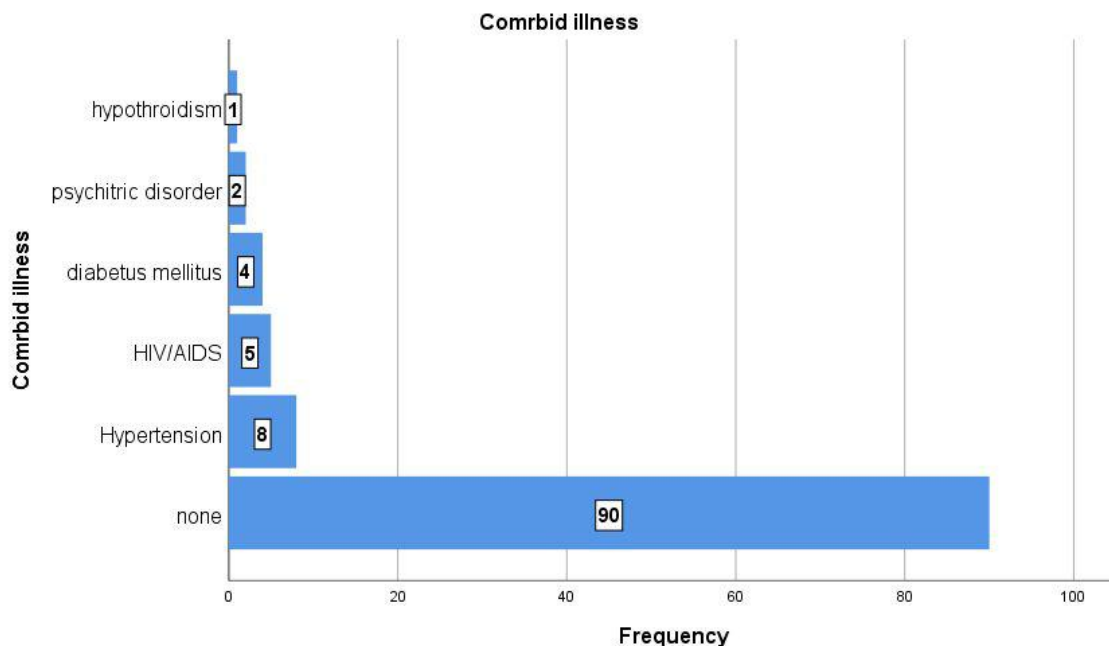


Figure 6 Bar chart showing Comorbid illness distribution.

Patient Functional Outcomes

Functional outcome, measured by OMA score, rates ‘poor’ outcome when a patient’s OMA score falls between 0 and 30, ‘fair’ functional outcome when the OMA score is between 31 and 60, a ‘good’ functional outcome is gained when a patient’s OMA score is between 61 and 90, and an ‘excellent’ functional outcome is when the OMA score is between 91 and 100. From the total of 122 patients, we reached to 76 patients with phone call. From a total of 122 patients 76 (62.3 %) were evaluated for their current status by phone call.

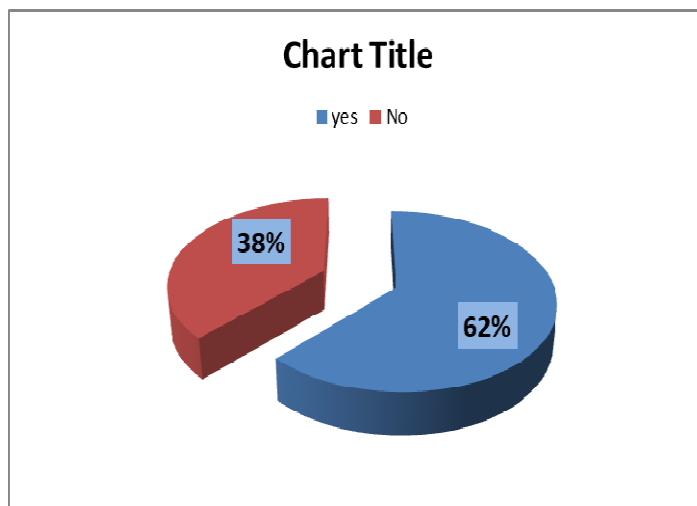


Figure 7 The number of the patients for which OMAS is evaluated

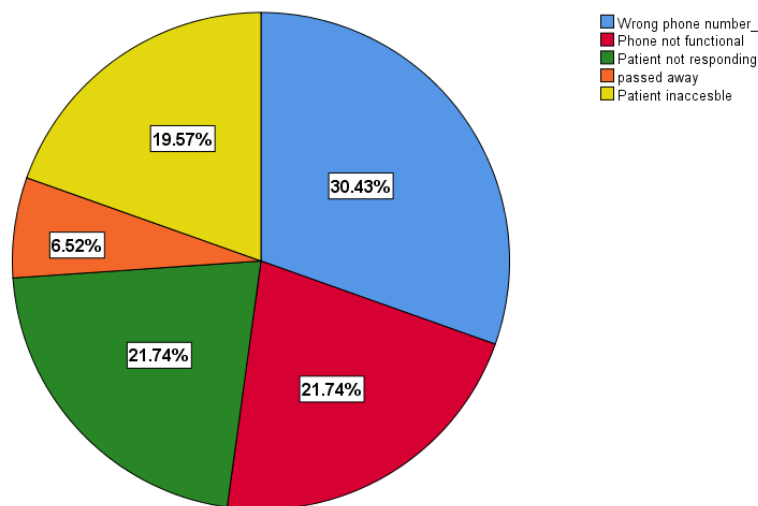


Figure 8 The reason OMAS is not evaluated

Using the Olerud and Molander scoring system (maximum 100 points), we note that 82.9 % of all fractures gained a 'good' to 'excellent' outcome. There were 5 patients (6.6 %) with poor results, 8 (10.5 %) fair, 51 good (67.1 %) and 12 (15.8 %) excellent results.

The overall mean OMA score was 76.45 with SD of 18.77.

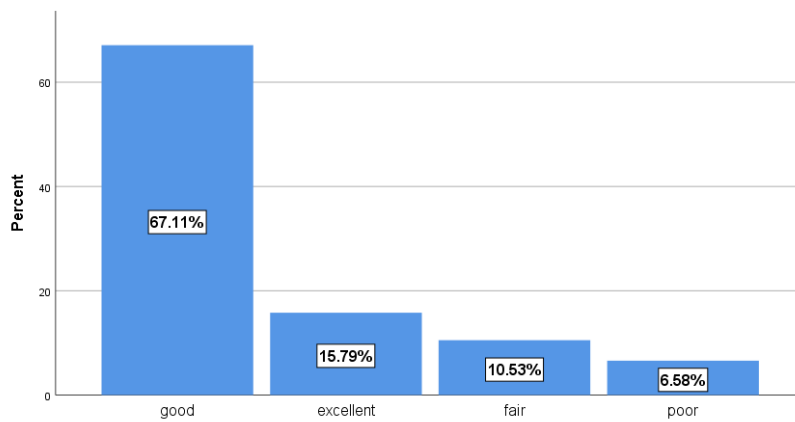


Figure 9 Patient OMA Score

Table5. The OMA Score characteristic

N	76
Mean	76.45
Mode	85
Std. Deviation	18.776
Range	80
Minimum	20
Maximum	100
Sum	5810

First group of data compared OMA scores of ankle fracture patients to the following set of variable; Gender, age, timing of surgery, type of fracture, smoking habit and presence or absence of diabetes mellitus. The mean OMAS for male is 76.79 while for female it is 75.65. The mean OMAS for those of age less than 40 is 80.11 and for age above 40 were 70.52. See Table ----- below

Mann-Whitney U test was used for comparing outcome score difference between gender, time of surgery from injury time, age of the patient, smoking habit, diabetic and non-diabetic patients. Male has better outcome than female but it is not statistically significant (p value of 0.624). A patient who had no DM had better outcome but statistically not significant. (p value of 0.618). There is no statistically significant difference outcome between smoker and non-smoker. (p value of 0.158)

Those who are young had better outcome than those old and it statistically significantly (p value of 0.02). Those who had early surgery had better outcome than those had late surgery and it statistically significantly (p value of 0.022). Reason may be the number of those who had early surgery vs late surgery was small (4 Vs 46).

A Kruskal-Wallis H test for comparing outcome score of between different types of ankle fracture. There were no statistically significant difference in outcome between lateral malleolus, medial malleolus, both lateral and medial malleolar fracture, and all malleolar fracture. (P value of 0.260).

Table 6. Mean OMAS for different variables

		Mean OMAS	SD	<i>P</i> <i>value</i>
Gender	Male	76.79	19.26	0.624
	Female	75.65	17.98	
Age	< 40 years	80.11	16.92	0.02
	40 years and above	70.52	20.37	
Type of fracture	Open	72.12	20.75	0.138
	Closed	78.7	17.46	
Type of fracture	Lateral malleolar	85	14.14	0.260
	Medial malleolar	81.54	13.75	
	Bimalleolar	77.26	17.64	
	Trimalleolar	67.5	23.94	
Time of surgery	Early	77.39	4.78	0.022
	Late	77.39	17.56	
Smoking habit	Smoker	90	8.66	0.158
	Non smoker	75.89	18.89	
Presence of DM	Diabetic	75	18.7	0.618
	Non diabetic	76.55	19.04	

The chi square test of association (pearsons chi square test) is used to discover the association between OMAS outcome score against delay of surgery for ORIF, age, gender, fracture type, diabetic vs non diabetic and smoking habit.. The p value (Pearson chi square) is 0.277 For OMAS and age, P value (pearson chi square) for OMAS and gender is 0.915. p value (pearson chi square) for OMAS and timing of surgery is 0.342. P value for OMAS vs type for fracture involving number of malleolus is 0.343. (pearsons chi square).

The p value for the respective test all is > 0.05 which (CI of 95 %.) shows us there is no statistically significant association between delay of surgery for ORIF and outcome score of OMAS. So we fail to reject the null hypothesis and so, the variables tested are independent of each other.

Table 7. Chi square test of association

Association	<i>P value</i>
OMAS vs gender	0.915
OMAS vs age	0.277
OMAS vs fracture type(number of malleolus)	0.343
OMAS vs smoking habit	0.767
OMAS vs DM	0.686
OMAS vs delay in surgery	0.342

From 76 patients, most of the (64.5%, 49 patients) patients thinks they didn't recover fully after 2- 5 years of operatively treated for ankle fracture. Fourty one patients (54 %) reported they feel some sort pain in their affected ankle currently and 46 %(35 patients) had no pain at all currently. Fifty four patients labeled their current daily activity as the same as that before the injury, while 11 patients changed to simple job, 4 patients with decreased tempo and 6 patients claimed their daily activity capacity is severely impaired currently. Fourty one patients (54 %) reported they feel some sort pain in their affected ankle currently and 46 %(35 patients) had no pain at all currently. Fifty four patients labeled their current daily activity as the same as that before the injury, while 11 patients changed to simple job, 4 patients with decreased tempo and 6 patients claimed their daily activity capacity is severely impaired currently.

DISCUSSION

Operative treatment for ankle fractures restores sufficient stability to allow full mobility at the ankle joint. Makwana et al compared 22 cases of ORIF and 21 cases of conservatively treated patients with ankle fractures and found that ORIF treatment yielded a significantly higher functional outcome score and a significantly better range of movement of the ankle. Although we did not compare the outcome of patients treated conservatively vs. operatively, we were able to achieve excellent and good results in 82.9 % of the cases.(31)

The research done on Functional Outcome and Quality of Life in Patients with Type B Ankle Fractures demonstrated satisfactory outcomes in 76%-83% of operatively treated type-B malleolar injuries (32). Ahmad Hafiz using the Olerud and Molander scoring system, he noted that 93.8% of patients had excellent and good outcomes. (24)

Our study agrees with Egol et al. that patients below 40 years old have significantly better outcome than those older than 40 years.(27) However, no significant differences were shown in the functional outcome between patients aged below 40 years and older than 40 years in the studies performed by Belcher and Lash (33)

Our study also shows that men have a slightly better functional outcome than women at 5 years but this difference was not statistically significant. Lash and Nilsson et al. have that men have a slightly better OMAS scores than women at 2 and 3 years, respectively, but these differences were not significant (34) (25)

The timing of the surgery for fixation made no significant difference in the OMAS at 5 years in report of Shah . in our study it is statistically significant and outcome is better in those operated early. We suggest our outcome should be viewed cautiously because only 6 patients out of 76 (8 %) were operated early while it is 40% for Shah .(27)

There is no difference in outcome between lateral malleolar, medial malleolar , bimalleolar or trimalleolar fractures in our study. This is in the same result with that of Egol .(26)

The history of smoking had no influence on functional recovery. Egol et al also found the same result. (26)

According to lash presence of diabetes was significantly associated with functional recovery at one year.(27) Our study result is that there is no statistically significant association between presence of diabetes and outcome. Our study examines patients at least 2 years after surgery but that of lash et al was 1 year may be the patients may need longer time to achieve better outcome comparable with that of the non-diabetic individuals. Or The small proportion of diabetics to non dibetics in our study (only 3.6 % of the patients are diabetic while for lash et al 13 %,) makes difficulty to detect the difference.

Limitation of the study

- A problem with any type of retrospective clinical study is the availability of data in a secondary data and availability of the patient after the treatment for evaluation.
- It is impossible to know the pos operative management of the patient regarding immobilization, weight bearing status and physical therapy. It is also unlikely the patient remembers what was done years back.
- Lack of a nonoperative control group
- Finally, our study included only short-term follow-up. It is possible that outcomes could decline with time. Future studies are needed to address these concerns.

6. Conclusion and recommendation

Conclusion

Operative treatment for ankle fractures results good functional outcome post operatively, and operative treatment restores good ankle function and allowed good mobility of the ankle joint. We found that most patients were doing well 2 - 5 years after ankle fracture surgery, with most experiencing little or mild pain and few restrictions in functional activities. Pedestrian must be aware of risks of ankle fracture and safety measures should be taken to avoid motor vehicle accident

We identified factors that are significantly associated with a Good functional recovery: young age and and early surgery.

Recommendations

Based on the finding of this study, the following recommendations are forwarded

- It is important to counsel patients and their families with regard to the functional recovery that they can expect after the injury.
- The patient should be counseled on future that they may have some sort of pain.
- The physician may expect relatively poor functional outcome in those who are old and choose surgery cautiously.
- Aability to identify patients who are at risk may allow the treating physician to alter care strategies to maximize good outcome.

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Data collection format

Data collection format on Functional outcome following operative treatment of ankle fractures at Addis Ababa Burn, Emergency and Trauma Hospital from August 2015 to March 2019.

1. Serial Number _____
2. MRN of the patient _____

Socio-demography of the participants

3. Gender of the patient 1. Male _____ 2 Female _____
4. Age of the patients in years _____
5. Area of residency of the patient in region
 - a) Afar _____ g) Benishangulgumuz _____
 - b) Tigray _____ h) Gambella _____
 - c) Amhara _____ i) Somalia _____
 - d) Oromiya _____ j) Harari _____
 - e) SNNP _____ k) Dire dawa _____
 - f) Sidama _____ l) Addis Ababa _____

History of the trauma of patient who presented to AaBET hospital

6. Mechanism of injury
 1. Motor bike accident _____
 2. Twisting injury _____
 3. Sport injury _____
 4. Violence or fight injury _____
 5. Fall down accident _____
 6. Bullet injury _____
 7. Pedestrian Road traffic accident _____

8. Passenger Road traffic accident_____
9. Driver Road traffic accident_____
10. Driver assistant Road traffic accident_____
11. hit on limb by heavy object_____

7. Type of fracture depending on malleolus involved

1. lateral malleolus _____
2. medial malleolus _____
3. posterior malleolus _____
4. lateral malleolus and medial malleolus _____
5. lateral , medial and posterior malleolus _____
6. lateral malleolus and posterior malleolus_____
7. medial malleolus and posterior malleolus_____

8. Type of ankle fracture depending on soft tissue status

1. Closed_____
2. Open_____

9. If open classification as Gustillo and Anderson Classification (If closed, skip to Q.No. 10)

1. Type I
2. Type II
3. Type IIIA
4. Type IIIB
5. Type IIIC

10. Initial treatment for fracture stabilization

1. Splinting_____
2. Open reduction and internal fixation_____

3. External fixator _____
 4. External fixator ,pinning of malleolus/malleoli or rush pin for lateral malleolus_____
11. definitive treatment for the fracture stabilization
1. External fixator_____
 2. Open reduction and internal fixation_____
 3. Splinting_____
 4. External fixator with pinning of at least one malleolous or rush nail of lateral malleolus _____
12. Type of implant used for lateral malleolar fracture in patient treated by ORIF initially or definitively
- A. plate and screw_____ C. rush rod_____
- D. pinning with K wire_____ B. Intramedullary Screw_____E.
- Tension band wiring_____
- F. No instrumentation used_____
13. Type of implant used for medial malleolar fracture in patient treated by ORIF initially or definitively
- A. Malleolar screw_____ C. plate and screw_____
- D. pinning with K wire_____ B. Intramedullary Screw_____
- E. Tension band wiring_____ F. Stitching _____
- G.No instrumentation used _____ H. Screw and pin_____
14. Type of implant used for posterior malleolar fracture in patient treated by ORIF initially or definitively

- A. Screw____ B. plate and screw____
- C. No instrumentation used _____
15. Side of the injured limb injured
- A. Right____ B. Left _____
16. Is there syndesmotic injury ?
- A. Yes _____ B. No _____
- 17.Type of implant used for syndesmotic injury fixation (If No syndesmotic injury, skip to Q.No. 18)
- A. Screw____ B. oblique pinning____ C Stitching ____ D.No instrumentation used _____
18. On which day(s) of injury does the patient presented to AaBET Hospital ? _____
19. Duration of hospital stay in days _____
20. On how many days after presentation does irrigation and debridement done ? _____
21. On how many days after presentation does open reduction and internal fixation done for closed fracture? _____
22. Comrbid illness
- 1.Diabetes mellitus _____ 7. Psychiatric disorder_____
2. peripheral vascular disease____ 8. other(specify)_____
3. Congestive heart failure_____
4. renal disease_____
5. liver disease_____

6. HIV/AIDS_____

23. Is the patient a Smoker?

Yes _____ No _____

For the following question, patient will be accessed through a phone call and asked. The patients response will be filled with “X” sign in the respective row.

24. The patient will be asked for verbal consent and

A. Consent Declined____ B. Consent given _____

Parameter	Degree	Score
Pain	None	25
	While walking on uneven surface	20
	While walking on even surface outdoors	10
	While walking indoors	5
	Constant and severe	0
Stiffness	None	10
	Stiffness	0
Swelling	None	10
	Only evenings	5
	Constant	0
Stair climbing	No problems	10
	Impaired	5
	Impossible	0
Running	Possible	5
	Impossible	0
Jumping	Possible	5
	Impossible	0
Squatting	No problems	5
	Impossible	0
Supports	None	10
	Taping, wrapping	5
	Stick or crutches	0
Work, activities of daily life	Same as before injury	20
	Loss of tempo	15
	Change to a simple job/part-time work	10
	Severely impaired work capacity	0

26. Did you think you recovered fully?

A. Yes _____ B. No _____

27. Is OMAS evaluated?

1. Yes _____ 2. No _____

28. If not evaluated what is the reason

1. Consent not given _____

2. Wrong phone number _____

3. Phone not functional _____

4. Patient not responding _____

5. Patient passed away _____

6. Patient not accessible _____

29. Category of functional outcome as OMAS.

1. Excellent _____

2. Good _____

3. Fair _____

4. Poor _____

Name of data collector _____ signature

date_____

Name of Investigator _____ signature

date_____