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Management of Ankle Fractures – a Survey of Practices of Orthopaedic Surgeons in Nigeria

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ABSTRACT

Background: Ankle fractures are fairly common worldwide but there is scanty literature on the management of these fractures from sub-Saharan Africa. This study provides a broad picture of the practices of orthopaedic surgeons in Nigeria in managing ankle fractures. Consequently, these practices can be updated, areas for further research highlighted and subsequently, guidelines developed concerning the contextual management of these fractures in Nigeria.

Methods: This survey was carried out using online and hard copy questionnaires, distributed at an annual conference of the Nigerian Orthopaedic Association and sent to three regional centres of orthopaedic practice, respectively. The data was analysed to determine frequencies.

Results: There were 114 male and 16 female respondents. Sixty-one percent of the respondents preferred the Danis-Weber classification. While fifty-six percent of the cohort noted that most of these patients present to traditional bone setters before seeking orthodox care, seventy percent considered arrival to hospital in 1 – 4 weeks post injury to be the norm. The Ottawa ankle rules are applied by most (56%) of the participants. About a sixth (17.5%) of our cohort apply syndesmosis screws routinely, while twenty-eight percent of them do not remove these screws. The commonest post-operative complications encountered were chronic pain, flap necrosis and local sepsis. Sixty percent of the surgeons regarded post-operative physiotherapy as beneficial.

Conclusions: While a preference for traditional bone setter care and delayed presentation hampers formal care of ankle fractures, orthopaedic surgeons in Nigeria tend to apply nonoperative approaches. Patient assessment and any surgical intervention are usually based on modern principles.

Key words: Ankle, Fractures, Management, Survey, Nigeria, Traditional bonesetters

1. INTRODUCTION

Nigeria is a diverse developing country with a large population, but a notable inadequacy of medical professionals and especially of orthopaedic surgeons.[1] There is also a lack of local data about the orthopaedic approach to the management of ankle fractures. Generally, fractures of the ankle are relatively common, with an annual incidence between 104 and 184 per 100,000 persons and a prevalence of 9% of all fractures.[2]

The talocrural joint consists of the dome of the talus which is wider anteriorly than posteriorly and the articulating surfaces of the tibial plafond with its medial malleolus and the distal fibula, at the lateral malleolus, with the inferior transverse tibio-fibular ligament.[3] The syndesmosis of the ankle consists of the tibio-fibular ligaments (anterior and posterior) and the interosseus ligament. The movements of this joint can be described as plantarflexion, dorsiflexion, gliding and rolling.[4,5]

These fractures are more common in females between the ages of 30 and 60 years and in males, more common below 50 years.[2,6] In the developed world the lateral malleolus is affected in 55% of cases and the aetiology is mostly due to low energy trauma from torsional injuries due to falls in older people (61%), followed by sports injuries in the younger age group (22%).[2,7] The majority of these fractures are caused by high energy injury from road traffic accidents in the developing world and the

Weber type B fracture was the commonest pattern noted.[8,9]

The commonly used classifications of ankle fractures are the AO Danis-Weber and Lauge-Hansen schemes; the former being more common due its ease of clinical application though it does not provide a measure of severity or mechanism of injury.[10]

It has been noted that most ankle radiographs for ankle injury (up to 85% in some series) do not reveal a fracture.[11] Use of the Ottawa Ankle Rules reduced the need for an ankle radiograph by 28% and these patients spent less time in the emergency department, lowering the cost of care and limiting exposure to radiation.[11]

Most ankle injuries in resource constrained settings are treated non-operatively due to economic reasons.[8,9] The commonest indication for ankle arthrodesis in Nigeria was noted to be post traumatic arthritis, and usually, with the use of the Charnley external fixator.[12,13]

Ankle fractures are fairly common and the established guidelines for their treatment are known to orthopaedic surgeons. The British Orthopaedic Association in tandem with the British Orthopaedic Foot and Ankle Society, have developed the British Orthopaedic Association Standards for Trauma (BOAST) ankle guidelines, partly based on guidelines developed by the National Institute for Care and Health Excellence (NICE).[17] In an overview of studies on ankle fractures from sub-Saharan Africa, there was a notable absence of data on co-morbidities in the studies included in the final results, one of which was from Nigeria.[14] The paucity of and lack of standardization in studies on ankle fractures from this environment were also noted.

The peculiarities of managing these fractures in a resource-constrained environment require contextual literature to scaffold and set up relevant guidelines. Unfortunately, there is a dearth of published work on ankle injuries from sub-Saharan Africa, including Nigeria.[14]

The aim of this study was to obtain an overview of the current status of the management of ankle injuries and its sequelae in Nigeria and thus serve as an initial step in the development of contemporary and contextual guidelines for their management in this and other resource constrained settings. The data provided by this study would provide targeted areas for further research and could eventually result in practical guidelines suited to this context.

2. METHODOLOGY

The study was a questionnaire-based survey, which was conducted over twenty-five months from July 2020 to July 2022, after ethical clearance had been obtained from the Human Research Ethics Committee of Ibom multispecialist Hospital, Uyo Akwa-Ibom State.

2.1 Study Design/Setting

This cross-sectional survey was carried out, using cluster sampling – the cluster was orthopaedic surgeons on the Telegram group for the Nigerian Orthopaedic Association (NOA). It was disseminated as both an online form using Google forms based on the Nigerian Orthopaedic Association Telegram group at that time, and as a hard copy survey at the 44th NOA annual (in-person) conference which held in November 2021, in Calabar, southern Nigeria and also to three regional orthopaedic centres National Orthopaedic Hospital, Lagos (south-west); University College Hospital, Ibadan (south-west); National Orthopaedic Hospital, Kano (north-central)) in Nigeria. The items in the survey are as shown in appendix 1. The respondents were orthopaedic surgeons and senior residents in orthopaedics.

2.2 Sample Size

This was calculated using the online tool by Survey Monkey. The margin of error was placed at 6% with a confidence level of 95% and an estimated population of 251 (the total number of members in the telegram group of the NOA at the time). The calculated sample size was 130 participants. At the time this study commenced, the number of orthopaedic and trauma surgeons in Nigeria was not known with certainty, but undocumented estimates put the total at about 500 still in practice.

2.3 Handling missing data

In total, 139 responses were obtained. There were some incomplete responses, so a decision was taken by the authors to apply complete case analysis by excluding all responses that had more than 20% of the items unanswered - thus, respondents with more than 6 items unanswered were excluded.[15] . This threshold excluded 5 respondents. The remaining 134 responses were uploaded onto Google forms, for data collation. In addition, the data were uploaded onto Excel spreadsheets for calculation of proportions and presentation in figures and a table.

It was noted that all the data sets in the 134 responses collated had some unanswered items and this was related to the paper questionnaire aspect of the study. A second tier threshold of 5% of the proposed sample size of 130 was used for item level deletion. Thus items that had less than 123 responses were removed from consideration. This item level deletion was applied to five out of six demographic data items (retaining gender) and three out of 25 items on ankle fracture management i.e. items 12, 13 and 18 (appendix 1).

2.4 Data availability statement

The data that support the findings of this study are openly available in Zenodo at http://doi.org/10.5281/zenodo.11671513.

3. RESULT

There were 114 (87.7%) male and 16 (12.3%) female respondents - a male to female ratio of 7:1 (n=130). Of the 16 female participants, a quarter of them opted to fix ankle fractures operatively.

While close to two-thirds (64.6%;n=130 and 67.1%;n=128 respectively) of our respondents recalled that the time to union for ankle

Figure 1: Ankle Fracture Treatment Methods Applied in Practice

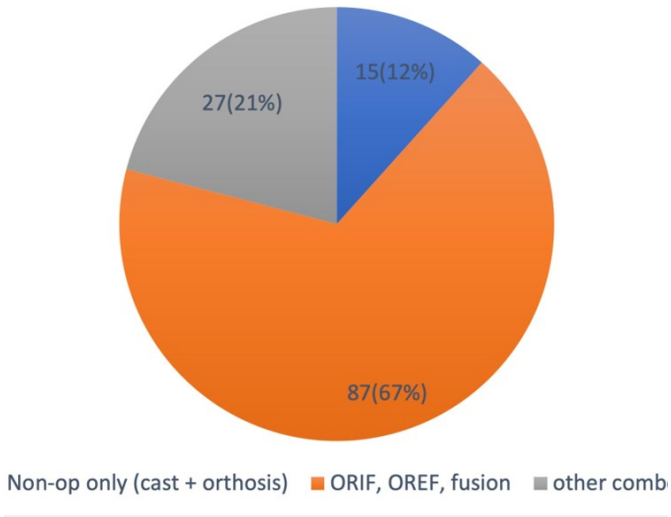

Table 1: Estimated Annual Frequency of Applying Specific Procedures to Treat Patients with Ankle Fractures

	Frequency	Percent
Ankle Casts		
1 - 5	22	16.4
6 - 10	28	20.9
11 - 15	21	15.7
> 15	59	44.0
Total	130	100.0
External Fixation		
Nil	11	8.2
1 - 5	53	39.6
6 - 10	32	23.9
11 - 15	15	11.2
> 15	18	13.4
Total	129	100.0
Ankle ORIF		
1 - 5	23	17.2
6 - 10	42	31.3
11 - 15	24	17.9
> 15	41	30.6
Total	130	100.0
Ankle Fusion		
Nil	8	6.0
1 - 5	72	53.7
6 - 10	25	18.7
11 - 15	7	5.2
> 15	12	9.0
Total	124	100.0

fractures was about 3 – 4 months for those treated with casts and internal fixation, it was more than half (55.6%; n=126) of them who opined that it took about the same time for ankle arthrodeses to unite.

More than half of the respondents (56%) subscribe to the impression that most patients present initially to TBS (traditional bone setters) after injury (n=131).

Ottawa rules were employed by fifty-six percent of the respondents to determine the need for radiographs in patients with ankle fractures (n=126). A hundred and four respondents (82.5%; n=126) employed syndesmosis screws only when indicated while the remainder did so routinely. Seventy-eight (60%;n=130) purchase 3 cortices while the rest purchase all four. Fifty-eight respondents (46%) favour no weight-bearing while the syndesmosis screw is in situ, 38 (30%) allow initial partial progressing to full weight-bearing with the screw while 30 (23.8%) employ partial

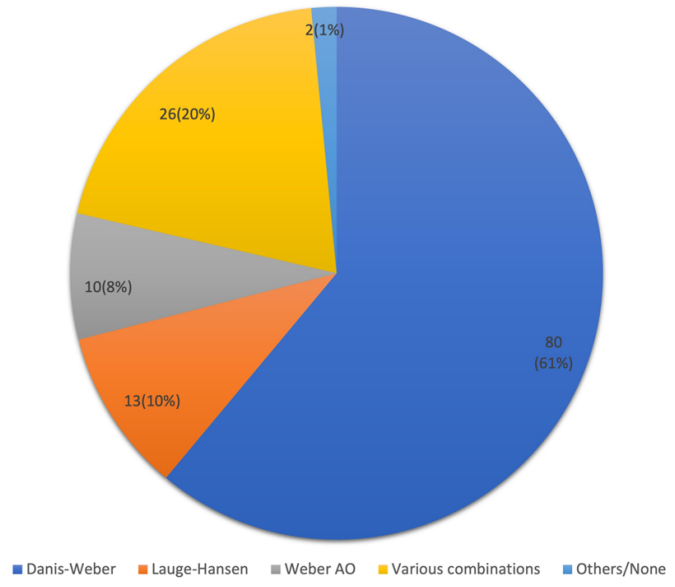

Figure 2: Preferred Classification of Ankle Fractures (n=131)

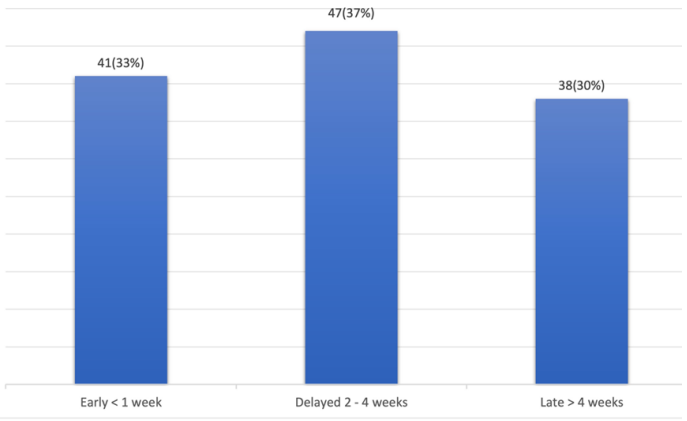

Figure 3: Duration in Weeks From Injury to Arrival in Hospital (n=126)

weight-bearing with syndesmosis screws (n=126). While about a quarter, 36 (28%) do not remove syndesmosis screws, 40(31)% would remove at 6 weeks while 52 (41%) remove the screws between 10 – 12 weeks (n=128). Over four-fifths of the respondents, 104 81%;n=129) would fix lateral malleolar fractures with plate and screws while 112 (88%;n=127) employ malleolar screw fixation for the medial malleolus.

Seventy-nine respondents (60%) agree that physiotherapy significantly improves outcome following surgery, 20 (15%) disagree while 32 (25%) believe physiotherapy is sometimes useful (n=131).

4. DISCUSSION

This study surveyed the practices of the management of acute ankle fractures by orthopaedic surgeons in Nigeria. The low proportion of females in our cohort reflects the gender disparities among surgeons and more so in orthopaedic surgery, which has the lowest proportion of women in active surgical specialty roles in the United States and India.[16,17] This disparity has been found to be shaped by the experiences of women in medical school, with respect to exposure to a musculoskeletal rotation and the presence of female role models in the specialty.[18] The factors responsible for this gender difference in Nigeria merit further research.

It was noted that some respondents (11.2%) seem to employ only non-operative methods for treating ankle fractures – figure 1. In a resource poor economy like Nigeria, the populace pays from pocket for healthcare, except those on the National Health Insurance Scheme (which covers only those employed by the Federal Government of Nigeria) and few on other insurance schemes slowly coming into the medical space. The cost of surgery is too high for most people – many borrow or beg to get the funds. It may be that the reality of ankle surgery being beyond the financial means of the

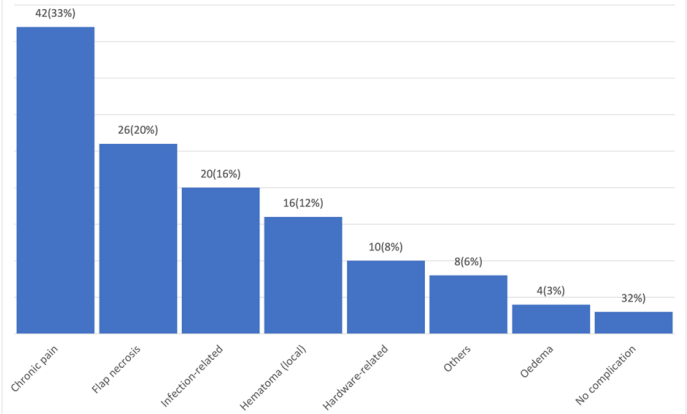

Figure 4: Complications Encountered After Surgical Ankle Fracture Fixation (n=129)

generality, has moved some orthopaedic surgeons to apply non-operative means when not contraindicated, rather than sentence the injured to the care of traditional bone setters (TBS). These local realities resonate with findings by Oluwadiya et al., who noted 16.8% of the patients in their series opted for traditional care, 70.1% of the patients had only casts applied, and of the 32 (23.36%) patients who required surgery, only 5 (15.6%) could afford it.[8] On the other hand, close contact casting has been shown by other studies, to provide equivalent standard of care to surgical fixation, for unstable fractures in persons above 60 years of age.[19] This can provide a safe orthodox alternative to surgical fixation, which is relevant to a resource limited economy and one in which the preference for TBS care is significantly higher than for orthodox fracture care.[20] Research is thus needed on the use of close contact casting for patients in the adult age group – 20years to 59years, with unstable ankle fractures who cannot afford surgery, as opposed to indiscriminate care by TBS.[21]

The commonest procedures applied are casts followed by open reduction and internal fixation, with external fixation and arthrodesis being the least common – table 1. It was noted that a third of our respondents carried out 10 or less internal fixation of ankle fractures per year and the figures for other types of ankle fixation surgery were lower. These findings require further inquiry with respect to the basis for the preference to use casts in the treatment of ankle fractures and the low surgical volume in this regard.

The estimate that all the relevant methods of treatment take an average of three to four months to union, though based on recall, brings up the older practice of not bearing weight on the ankle till healing has occurred. However, the practice is changing, as shown by the BOAST guidelines, in which weight bearing can be carried out early in the postoperative phase, following a stable fixation.[7] This aspect of the duration till weight bearing after an ankle fracture was not interrogated by this study and is an area for further research.

Two thirds of respondents utilize the Danis-Weber classification for ankle fractures – figure 2. This is congruent with the finding that of the three commonly used classification systems, the Danis-Weber classification has the highest inter-observer agreement index and requires the least detail to apply – these features render it a user-friendly classification in a busy emergency department.[21]

A review of trauma registry data revealed that injured patients arrive at the emergency department in a median time of 3 hours.[22] This was in keeping with a finding by Malomo et al., where about half of the head injured patients presented within 12 hours.[23] While our data was not specific about time to arrival, the delayed / late arrival of patients with ankle fractures in the opinion of more than two-thirds of our cohort, may be due to the injury usually not being life or limb threatening, which appears to afford time to source for funds, or due to the tendency to resort to TBS for initial care of injuries.

Our respondents have observed that ankle fracture victims tend to present to TBS for initial care and this preference for TBS care in this environment is coherent with the body of literature.[20]

The use of Ottawa Ankle Rules by most respondents further illustrates the usefulness of these rules in obviating the need for unnecessary x-rays.[24] The OAR has a negative predictive value of 100, hence the likelihood that a negative result will have an acute ankle fracture and thus require an x-ray, is essentially nil.[25] However, this study suggests that patients with ankle fractures in this environment are likely to present late and thus, not fit the conditions for the OAR, which were developed for the early post ankle injury period (within 24 hours).[25] The usefulness of OAR in patients who present late and possibly having been acted upon by TBS, whether or not they had a fracture, is yet to be determined.

A systematic review by Desouky et al. concluded that there was no overall difference in functional, clinical or radiological outcome in using tricortical or quadrocortical screws, using one or two screws and retaining or removing the screws; rather, two studies they reviewed indicated that the group with a broken screw had a better clinical outcome than those with either retained or removed screws.[26-28] Our study revealed a preference among Nigerian orthopaedic surgeons to apply syndesmosis screws only when indicated. In addition, more than half of our cohort purchase only three cortices. It should be noted that in patients with perceived osteoporosis, it is the opinion of the authors, that quadrocortical syndesmotic screws are more logical, in the absence of suture buttons. The presence of a syndesmosis screw reduces the anatomic movement of the fibula relative to the tibia, especially during ankle dorsiflexion and is therefore recommended only when justified by instability of the syndesmosis following injury. Moon et al. observed no difference in ankle range of motion between those with removed and those with retained screws.[29] Bell et al. noted that there was no difference in outcome between those who had screws removed prior to weight bearing and those who bore weight with retained screws – there was an expectedly higher incidence of screw breakage and loosening in those who bore weight with retained screws.[29,30] Most of our study participants prefer to protect the syndesmosis screw with no weight bearing, while the remainder are split almost half with respect to partial progressing to full weightbearing and only partial weight bearing with the screw in-situ. Our findings indicate a need to update our colleagues about screw breakage due to weight bearing after an appropriate interval having no negative effect on outcome and as Desouky et al. noted, removing the screws not being routinely justified due to the risks of infection, anaesthetic risks and cost.[26] The role of suture buttons in Nigeria was not interrogated in this study, due to background knowledge that they are rarely locally available.

Extramedullary and intramedullary fixation of the fibula are both considered standard of care, especially when the choice of implant takes into cognizance the fracture personality.[31] Current concepts do not consider medial malleolar fixation as a mandatory component of an unstable bi- or trimalleolar fracture – non operative treatment of well reduced fractures in selected cases in which the lateral malleolus is fixed, may have equivalent clinical outcomes with surgical fixation of the medial malleolus.[32,33] Both tension band wiring and screw fixation are established methods of fixing the medial malleolus and have excellent outcomes when used within well-defined indications for each technique.[34]

About two thirds of the respondents opined that physiotherapy either ‘always’ or ‘often’ leads to improved outcomes following surgery. The BOAST guidelines for ankle fractures include rehabilitation for all patients.[35] However, the impact of physiotherapy on outcome following the treatment of ankle fractures is variable – a Cochrane review in 2008, updated in 2012, did not reveal well defined evidence for benefit of early commencement of physiotherapy (during the period of immobilization after commencement of treatment); there was also little evidence to support inter-

ventions like exercise or manual therapy after the period of immobilization.[36] Whereas Zhao et al. noted that initiating physiotherapy in time periods of within two days, ten days and twelve months after surgery, was ideal for reducing postoperative pain, total postoperative rate of complications and overall function of the ankle joint, respectively, Keene et al. found an increase in the occurrence of surgical site infections, fixation failure and removal of hardware in association with early postoperative ankle movement.[37,38] In addition, Grotle and Hagen in their study comparing an advice only home exercise regime with a supervised exercise program, found no difference in activity limitation or quality of life, for patients with uncomplicated and isolated fractures of the ankle.[39] More modern approaches minimize the duration of a full below knee cast and encourage early mobility of the ankle, thus may show a less well-defined benefit from physiotherapy.

Macera et al. reported an overall complication rate of 36% and noted a range of 1 to 40% in the literature, following ankle fracture surgery.[40] The commonest complications in their series were chronic pain (residual pain and posttraumatic osteoarthritis) – 22% and deep infection – 3.4%, which is congruent with our findings. The rather high incidence of chronic pain following ankle fracture surgery may correlate with the thin joint cartilage and consequent high index for a significant joint incongruity – 1mm being the benchmark for a marked increase in joint pressure.[41] The blood supply to the skin about the ankle is notoriously delicate and the difficulty with ankle swelling may also contribute to the tendency for flap necrosis. In addition, empirical interactions among colleagues draw attention to the emollients applied to fractured areas by TBS, some of which may have mummifying effects and predispose to a rather high experience of flap necrosis among our respondents. It is possible that these substances include tannins but more research on these aspects of our local patient experience is needed.[42] These local realities may account for having flap necrosis accounted as more common than wound infection by our respondents. Factors predisposing to complications following operative fixation of ankle fractures have been noted to include peripheral vascular disease, diabetes, smoking and age.[43,44]

In summary, in the management of ankle fractures in Nigeria, there is a major use of non-operative treatment methods, ankle fractures are mostly classified with the Danis-Weber approach and the use of the OAR is prevalent. Most of our respondents opine that physiotherapy improves outcomes after ankle fracture treatment. The commonest complications our respondents encountered were chronic pain and flap necrosis and they mostly employed syndesmosis screws when indicated. Several areas of further research have been highlighted by this study and this may be the first study to document the low proportion of females in the specialty in Nigeria.

The main limitation of this study is the use of recall or opinion, which is a low quality of evidence. It is justified as an initial foray into the topic of interest in a setting where funds for research are hard to come by, such that further research can be targeted, and thus hopefully scarce funds can be applied with more focus and thus yield better results. In addition, one may differentiate between opinions about events removed from the respondents, like time to arrival of injured patients and those centered in the person, like preferred fracture fixation method or use of syndesmosis screws. The quality of evidence can be considered higher in the latter.

Conflicts of Interest

The authors declare that they have no financial or personal relationship (s) which may have inappropriately influenced them in writing this paper.

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APPENDIX 1

Survey on the Management of Ankle Fractures Questionnaire

PLS ANSWER ALL QUESTIONS

Gender □ Female □ Male

Age (years) □ 20 – 39 □ 40 – 59 □ ≥ 60

Qualification

□ Fellowship

□ Associate - pls skip the next two questions

Years of practice post fellowship

□1 – 10 □11 – 20 □20 – 30 □> 30

Type of practice (pls tick only one item)

□ Foot and ankle specialist □ Mostly general Orthopaedic Surgeon

□ Other region specialist

Major domicile of practice (pls tick only one item)

□ Private hospital □ General Hospital / Federal Medical Center

□ National Orthopaedic Hospital □ Teaching Hospital

Procedures applied in your practice (pls tick all that apply)

□Ankle orthosis □Ankle cast □Ankle external fixation (OREF)

□Ankle ORIF □Ankle fusion

Frequency of ankle CASTS per year. (pls Mark only one item.)

□Nil □1 – 5 □6 – 10 □11 – 15 □> 15

9. Frequency of ankle EXTERNAL FIXATION per year. (pls Mark only one item.)

□Nil □1 – 5 □6 – 10 □11 – 15 □> 15

Frequency of ankle ORIF per year. (pls Mark only one item.)

□Nil □1 – 5 □6 – 10 □11 – 15 □> 15

Frequency of ankle FUSION per year. (pls Mark only one item.)

□Nil □1 – 5 □6 – 10 □11 – 15 □> 15

Approach preferred for **Ankle fusion**

□Lateral transfibular □Anterior □Posterior

□Other (pls specify):_____

Device usually applied for Ankle fusion. (pls Mark only one item.)

□Charnley's clamps – two pins □Charnley's clamps – three pins □Cancellous screws

□Plates and screws □Retrograde nails □Ilizarov external fixator

□Other:_____

Average estimated time to union for **Arthrodesis** (WEEKS) (pls Mark only one oval)

□ 8 □ 12 – 16 □ 20 – 24 □ >24

Treatment **usually given** for an unstable Ankle fracture (**NOT** treatment that would have been preferred if all facilities were available)

□ Orthosis □ Cast □ Orif □ Fusion

Average estimated time to union with the use of **casts** (WEEKS). (pls Mark only one item)

□ 8 □ 12 – 16 □ 20 – 24 □ >24

Average estimated time to union for **ORIF** (WEEKS). (pls Mark only one item)

□ 8 □ 12 – 16 □ 20 – 24 □ >24

Which Ankle **outcome measures** do you usually apply? (pls Mark only one oval)

□Nil □MFA □FAOS □AAOS Foot/Ankle Scale

□Olerud And Molander □SF – 36 □Other (Pls specify):_____

Most patients with Ankle fractures present to Orthodox care after TBS care

Strongly disagree 1 2 3 4 5 Strongly agree

What is the usual interval between injury and presentation to the hospital/clinic

Early < 1 week

Delayed 2 – 4 weeks Late > 4 weeks

Do you determine the need for ankle radiographs based on Ottawa's rules

□Yes □No

22. Which of the following xray views do you usually request for in treating ankle fractures? (Pls tick only ONE)

□ Ap/Lat □ Ap/Lat/Mortice

□ Mortice/Lat □ Other……

Which of the following classifications do you prefer to use for Ankle fractures?

□ Danis-Weber □ Lauge-Hansen □ None

□ Weber AO □ Stable/unstable Other…….

Which of the following post-operative complications of Ankle fractures are commonly encountered in your practice? (Pls tick all that apply)

□ Wound haematoma □ Persistent ankle pain □ Implant complications

□ Unsatisfied patient □ Flap necrosis □ Infection

Other…….

In which of the following formats do you apply a Syndesmosis screw during ORIF for ankle fractures? (Pls tick only one option)

□ Routine □ As indicated

26. How many cortices do you usually prefer to purchase with a Syndesmosis screw?

□ 3 □ 4

27. What is your general approach to weightbearing with a Syndesmosis screw in-situ?

(Pls tick only one option)

□ No weight bearing □ Partial weight bearing

□ Initial partial weight bearing then full weight bearing with the screw in-situ

28. What is your usual duration before removal of a syndesmosis screw? (Mark only one option).

□ 6 weeks □ 10 weeks □ 3 months □ No removal

29. Which of the following methods do you usually apply in fixing a **lateral Malleolar** fracture?

(Pls mark only ONE)

□ Extramedullary fixation □ Intramedullary fixation

30. Which of the following methods do you usually apply in fixing a **medial Malleolar** fracture?

□ Malleolar screw □ K wires/tension band □ Plate/screws □ Other

31. Physiotherapy intervention improves outcome following surgery.

Strongly disagree 1 2 3 4 5 Strongly agree