SHORT-TERM COMPARISON OF BACKSLAB AND AIRCAST ANKLE BRACE FOR THE MANAGEMENT OF ACUTE LATERAL ANKLE SPRAIN, KIGALI EXPERIENCE

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ABSTRACT

Background: Globally there is a marked burden of ankle injuries, most prevalently ankle sprains in professional athletes. Even though disparities across the globe in management render the choice of treatment difficult, however the use of air cast ankle brace or back slab dominates among others. The loco-regional literature presents a paucity of data in regard to the best choice of treatment.
Objective: Compare the outcomes of grade 2 and 3 acute lateral ankle sprain patients managed with backslab and those with aircast ankle brace at two tertiary referral hospitals.
Methodology: A bi-center prospective cohort study was conducted. The study included patients 18 years of age and above who presented for isolated grade 2 or 3 acute lateral ankle sprain treated by backslab or aircast ankle brace and followed up to six weeks from the time of injury. Results found were analyzed using SPSS 28 by t-test and the study obeyed standard ethical guidelines.
Results: Ninety patients were recruited and divided equitably into backslab and air cast ankle brace arms, the median age was respectively 42 and 45.5 years. The male-to-female ratio was 0.87/1 for backslab and 1.04/1 air cast ankle brace group. Outcomes of two treatment arms were compared and a significant improvement in pain was noted at 3 and 6 weeks favoring aircast ankle brace with a p-value (0.04) using a t-test. Ankle instability was similar in both arms, residual swelling and timing or weight bearing were also favoring ankle braces but not statistically significant.
Conclusion: The occurrence of acute lateral ankle sprain in Rwanda was noted, even in the non-athletic population. The use of aircast ankle brace is superior to backslab in early pain control. The local medical bodies should avail all treatment modalities and foster related research.

Key words: Ankle injuries, Sprains and strains, Braces, Immobilization

INTRODUCTION

Globally, ankle sprains rank at the top among sports-related musculoskeletal injuries and are more prevalent in professional athletes (1–4). This trend is more pronounced in the western world where quite a number of emergency departments are overcrowded with sprain injuries. For instance 3-5% of emergencies received in the UK are ankle sprain cases and majority of them being lateral ankle injuries (5). Once upon lifetime 80% of the general population will have an ankle sprain and the trend is more noticeable in female gender (6). It is a fact that it remains on its peak in sports and variant games have got different rates of ankle sprain. Rugby and soccer are the two most commonly involved games as reported by Fong *et al* (3). Injuries occurring during basketball games were relatively associated with significant rate of ankle sprain recurrence (7). Ankle sprain remain on the top amongst joint injuries accounting for more than 10% of all traumatic joint injuries (8). Besides the clinical challenges associated with the ankle sprains, their management is associated with substantial economic expenditures (9–11). During a soccer tournament in Nairobi, foot and ankle sprain were the commonest sustained injuries at 24%, while ankle sprain at 38% was the most frequent cause of game delay (12). In Rwanda very few data were published on foot and ankle practice; Murwanashyaka *et al.*(13) were interested in the use of Ottawa ankle rules, and found it to be

effective in reducing unnecessary radiography and associated expenditures.

A wide range of diagnostic modalities exists, however the physical examination remains at the top. The physical examination accuracy of detecting grade 3 ankle sprains goes beyond the standard MRI. However, the sensitivity decreases by three quarter for lower grade ankle sprain and this is more credible when the examination is performed at the 5th day. This highlights the need of a thorough and exhaustive physical examination of ankle injuries (2,11). The West point ankle grading system is one of the widely used classification and diagnostic tools for acute lateral ankle sprains (13).

In general, there is a lack of standardized management protocol for ankle sprain management (6,15). The current trend in the treatment of ankle sprain relies on limb rest with a time of immobilization followed by a session of physical therapy and weight-bearing (2). The initial management of ankle sprain consists of reducing or limiting pain and edema; some studies advocate for the use of compressive ice with limb elevation whereas others recommend intermittent ice application or ice in combination with physical therapy. The role of immobilization is still very debatable in different RCTs; some recommend the use 10 days cast immobilization and others recommend the immobilization with a short leg cast for up to 4 weeks, while others recommend functional therapy using rigid or semi-rigid ankle braces and the latter seems to gain more popularity and advantageous, although not always affordable in resources limited settings (14). Standard cast or semi-rigid cast is a good restraint to coronal forces and hence recommended in the management of ankle sprains (15), moreover the study done by Martin *et al.* (7) and Raikin *et al.* (18) through their systematic review recommended use of cast in management of grade 3 ankle sprain. Use of a walking boot has well been documented to be less effective due to patients' poor compliance and it remains expensive when comparable to the backslab or aircast ankle brace, aircast ankle brace (air stirrup ankle brace) is a preferred treatment modality over the tubular bandage since there is quick restoration of ankle function (16). Among documented complications ankle sprain is associated with a high rate of chronic ankle instability resulting from suboptimal management (1,2,17), the rate of chronic ankle sprain following the first ankle sprain is reported to be nearly twice that of general population (18).

To the best of our knowledge there is disparities in treatment and local scarcity of data with regards to the best option when comparing a backslab to the use of ankle brace in acute ankle sprain management. Hence we opted to conduct this study in order to know the best treatment modality for grade 2 and 3 acute lateral ankle sprain between backslab and air cast ankle brace. The study focused on early pain, swelling, recurrence rate and timing of activity restoration.

MATERIALS AND METHODS

This was a prospective cohort study conducted at King Faisal Hospital (KFH) and the University Teaching Hospital of Kigali (CHUK), in their Accident and Emergency and Orthopaedic Departments. Those hospitals are teaching hospitals receiving a large number of trauma and orthopaedic cases.

Inclusion criteria: Patients aged 18 years and above presenting to the A&E and outpatient department (OPD) of the above-mentioned tertiary centers, with grade 2 and 3 acute lateral ankle sprain were included in the study.

Exclusion criteria: Patients in the following categories were excluded:

- Patients with complex injury (open, associated with fractures or DVT)
- Patients with a recurrent ankle sprain
- Patients with associated major distracting injuries (eg: moderate to severe traumatic brain injury)
- Incompetent patients like associated major psychiatric disorder

Patients recruitment and data collection: Patients who sustained sports, road traffic and subtle fall injuries of the ankle and mid foot were thoroughly examined at the day of injury and more specifically the ankle examination done primarily by the principal investigator or the research assistant. The Ottawa ankle rule was used to assess the need for radiography. The West Point grading was applied to retain only grade 2 and 3 acute lateral ankle sprain. Upon confirmation of the diagnosis, patients were sent to be treated by the A/E or OPD treating medical doctor without the influence of a primary investigator or research assistant. The sample size for this study was obtained using the formula used to estimate sample sizes in cohort studies (21,22). The power set at 90% and level of significance at 5%. Ninety patients were recruited and were divided into ankle brace and backslab groups. There was no randomization order, only the treating doctor was assigning patients to one of the groups depending on his choice.

Patients were followed up to 6 weeks for evaluation of the outcomes. A data collection form where different types of data were recorded including demographic data such as age, gender and phone number was used, then clinical data such as the mechanism of injury and pain score using a numerical rating pain scale at 3 and 6-week intervals, ankle instability features, range of motion, limping, edema, anterior drawer test and sign evaluated on arrival and in follow-up sessions and West point classification by Gerber *et al.* (13). Moreover, we evaluated the timing of return to daily activities (sports/work) as part of outcomes. Residual pain and swelling were primary outcomes while timing of weight bearing and activity restoration were secondary outcomes. Pain grading was done referring to numeric pain rating by Jensen *et al.*(19).

- Mild: pain from 1 to 4
- Moderate: pain from 5 to 6
- Severe: pain from 7 to 10

Data analysis: Data obtained in patient's data collection form were entered in the computer by Excel and analyzed using SPSS version 28 statistical software. Patients' demographics and mechanism of injury were compared in both ankle brace and backslab groups and summarized in tables with descriptive statistics. The t-test was the statistical test used and represented as p-value, moreover our dichotomous and ordinal categorical data were analyzed and represented into the mean value, mode and standard deviation. Primary and secondary outcomes were presented in comparative manner aiming to identify the statistical significance among the two treatment groups. Residual pain at 3 weeks was reported comparing two treatment arms and considering initial west point grading.

Ethical consideration: There was minimal risk to retained patients since there is no new intervention adopted rather patients were treated according to the usual practice. We ensured confidentiality in patients' information storage which was only seen by the research team. Data collection sheets were enclosed in a filing cabinet only accessed by investigators. No reimbursements were expected for participants in this study since it is purely voluntary. Moreover, we sought consent from each individual participant, and a consent form was signed after enough explanation to the patient. We obtained ethical approval from the College of Medicine and Health Sciences and respective hospitals before patients' recruitment, data collection, and progress upon further steps of the study.

RESULTS

The cohort from the two centers were 90 patients referring to the sample size. Seventy one patients were recruited from CHUK and 19 patients form KFH over 6 months. Patients demographics are summarized in Table 1. When comparing both treatment arms, the median age was 42 and 45.5 years respectively for backslab and ankle brace group. The male to female ration was 0.87 for BS versus 1.04 AB. Using the t-test and reported as p value in tables there was no difference among age distribution and male to female ratio in the two groups. Among the patients recruited in both arms there were 36 patients grade 2 ankle sprain injuries and 9 patients as grade 3 on west point grading system, this was similar to both treatment arms.

Patients' demographics

Table 1A
Age

Variables	Mean age (σ)	Range (years)	Significance
Backslab group (BS)	35.76 (10.428)	19-65	P-value <0.05
Ankle brace group (AB)	35.18 (12.721)	18-73	

Table 1B
Gender

Variables	Male	Female	Significance
Backslab group (BS)	21	24	P-value >0.05
Ankle brace group (AB)	23	22	

Table 1C
Patients by hospital

	CHUK	KFH
Backslab group (BS)	37	8
Ankle brace group (AB)	34	11

Table 1D
West point grading

	Grade 2	Grade 3
Backslab group (BS)	36	9
Ankle brace group (AB)	36	9

Mechanism of injury: The mechanisms of injury were summarized in Table 2. The commonest mechanism was twisting and rolling ankle among 66 (73.3%) patients. This represents 36 patients of ankle brace group and 30 patients of backslab group. The least reported mechanism was moto-moto collision where 2.2% were involved as passengers.

Table 2
Mechanism of injury

Mechanism of injury	Backslab	Ankle brace	Total number (%)
Twisting and rolling ankle	30	36	66 (73.3)
Fall from height	12	6	18 (20)
Moto-pedestrian collision	3	1	4 (4.4)
Moto-moto collision	0	2	2 (2.2)

Primary outcomes

Patients with grade 2 and 3 acute lateral ankle sprain outcomes are summarized in Table 3a. We identified that after 3 weeks 26.7% of the patients treated with aircast ankle brace had moderate or severe pain while 55.5% of backslab cohort had the same pain. After 6 weeks from the timing of injury, a small proportion of patients treated with ankle brace were having mild to moderate pain compared to the backslab cohort. The p-value calculated referring to the t-test, pain improvement was statistically significant. Hence these findings favor ankle brace to be effective in early pain control.

Table 3A
Pain after treatment

	3 weeks Pain moderate	6 weeks Pain mild	Significance (t-test)
Ankle brace	12 (26.70%)	6 (13.3%)	$P < 0.05$
Backslab	25 (55.5%)	16 (35.60%)	

Patients with grade 2 and 3 acute lateral ankle sprain outcomes are summarized in Table 3b. Moderate to severe swelling was found to be present at 26.7% and 48.8% respectively for ankle brace and backslab. After 6 weeks from the timing of injury a small proportion of patients treated with ankle brace were having mild to moderate swelling compared to backslab group. The difference identified was not statistically significant when swelling resolution was taken into consideration among the 2 groups.

Secondary outcomes

Ankle sprain recurrence at 6 weeks post-injury: Two (4.4%) patients were found to have recurrent acute lateral ankle sprain both on the ankle sprain and backslab group, and this could not make disparities across the groups.

Table 3B
Swelling after treatment

	3 weeks Swelling moderate	6 weeks Swelling mild	Significance (t-test)
Ankle brace	12 (26.70%)	6 (13.3%)	P>0.05
Backslab	22 (48.8%)	13 (28.9%)	

Table 4
Duration to restoration of function

	Ankle brace (N = 45)	Backslab (N = 45)	t-test
Time to weight-bearing (≤28 days)	45 (100%)	40 (88.9%)	P > 0.05
Time to resumption of duties (≤28 days)	43 (95.5%)	34 (75.5%)	

Patients with ankle sprain were expecting to bear weight and return to their daily activities not later than 6 weeks but most of them should resume their activity by the 4th week. Patients were immobilized by ankle brace or backslab for 21 days then physical therapy sessions initiated, initial weight bearing and timing of return to daily activities was considered as secondary outcome and was evaluated at the 28th day. Two groups were elaborated on each intervention one less or equal to 28 days another one above 28 days. One hundred percent of patients treated with aircast ankle brace have resumed weight bearing at by the 28th day from the injury day when compared to 88.9% in the backslab group. Ninety five point five percent could return to daily activities by 28th day in the ankle brace group when compared to 75.5% in the backslab group. Even though the ankle brace group seems to be more efficient in terms of early return to activities and weight bearing, it is not statistically significant since the P-value was equal to 0.05.

DISCUSSION

The present study aimed to assess the best treatment modality for patients consulting with grade 2 and 3 acute lateral ankle sprain between backslab and aircast ankle brace. Early pain and swelling control were primary outcomes, while the recurrence rate of ankle sprain and timing of activity restoration were secondary outcomes. In total we recruited 90 patients referring to the previously calculated sample size, 45 patients were enrolled in each treatment group. Patients' characteristics were reported and not statistically different in both treatment arms, as this was an observational study and the investigators did not influence similarities in patients' characteristics. Patients were recruited from CHUK which receives a large number of trauma cases and KFH which does as well receive a number of trauma and sport injury cases. An above-mentioned sample size recruited in six months may show that ankle sprain is not a rare entity in our setting nor anywhere else in developed countries and this trend of increase is likely to progress.

Epidemiologically ankle sprain is not rare in our setting, since when combining CHUK and KFH findings we could estimate one case of ankle sprain every two days. Our findings are similar to those documented by other authors such as Polzer *et al.* (20) who reported the incidence of ankle sprain to be 1 per 10000 people per day. The US knows this frequency of ankle sprain emergencies as well, in a study by Prado *et al.* (25) they reported daily occurrence of 27,000 ankle sprains. The commonest cause of acute LAS in our cohort was identified as twisting ankle and rolling as reported by patients. Biomechanically the above mechanism of injury may be justified as plantar flexed and inverted foot while landing on the ground which actually is the commonest mechanism of injury leading to acute lateral ankle sprain injury (21,22). Inversion injuries are very common and biomechanically ones leading to lateral ankle sprain hence there is overstretching and tear of lateral ligamentous structures (22). The ankle sprain grading is a scientific way of documenting and communicating about the severity of injury and reporting ligaments involved, however, it was not identified to affect the outcomes and this has previously been documented (23).

Using an ankle brace was advantageous in terms of primary outcomes in our study where we found a lower rate of pain at 3 and 6 weeks intervals post-injury following ankle sprain and this is supported by previously available literature reporting semi-rigid ankle brace to be recommended in grade 2 and 3 acute lateral ankle sprain (20). Using functional braces are not only superior to backslab

but also to walking boot in early return to daily living activities and pain-free weight bearing (24). The west point grading system does predict as well the estimated timing of recovery when related to the injury grade, a study by Davis (4) report restoration of daily activities for Grade 2 and 3 to range from the end of 2nd week to 26th week the upper limit reserved for full recovery of professional athletes. These findings could be related to our findings since most of our patients resumed their daily living activities by the end of the 4th week. Activity restoration is an important indicator in ankle sprain recovery, it was considered in our study and when comparing both treatment arms, 95.5% and 75.5% respectively treated by an ankle sprain and backslab could return to their initial daily activities before or at the 28th day from the injury time. However, this difference is not statistically significant as p-value>0.05. Moreover, in accordance with the recommendation of the above study, all our patients were sent to physical therapy in their treating hospitals for a period of three weeks.

Outcomes in the current study were identified as primary versus secondary outcomes. Primary outcomes were compared when looking at the pain on the 3rd week post-injury. Moderate and severe symptoms were present in the backslab group twice than in the ankle brace group. At the 6th week, the ratio was almost 3 to 1. This could be explained by the biomechanical characteristics of an aircast ankle brace whereby there is a compressive force on the body while bearing weight relieving pain and edema. These findings reported the ankle brace to be a bit superior to the backslab group when looking at the pain, swelling and timing of weight bearing. However, in the study by Beynnon *et al.* (29) this difference couldn't be identified. The difference in findings between two studies could be related to the study design since one is an observational study and the one is a randomized controlled trial.

The rate of ankle instability was equal and low in both groups at 4.4% in each group. This low rate may be due to the shorter time of follow-up, it may also be caused by lack of professional athletes in our cohort. The currently available literature presents differences among findings when considering ankle instability post-lateral ankle sprain, a study by Ferreira *et al.* (30) reported that ankle instability ranges from 0 to 33%. These findings are in line with our current results. However, Cavazos Jr. *et al.* (27) reported ankle instability to be around 40% of patients who sustained an acute lateral ankle sprain. There are notable differences in the causes and mechanism of injuries of our population from the previously reported literature. In our study, the causes were more non-athletic-related injuries and road traffic-related injuries. Whereas a study done by Fong *et al.* (3) reported athletic injuries to lead the list of causes of acute lateral ankle sprain. The majority of the above-mentioned differences could be related to different population characteristics, lifestyles, cultures, and health system structures.

Study limitations

This study was done at CHUK and KFH which are amongst main referral hospitals in Kigali, Rwanda, however, it was an observational study therefore the principal investigator was out of control of some important factors that may have led to bias in the results. Among important aspects we were not able to control we could not decide whom to give ankle brace or backslab, patients who were not able to afford ankle braces were treated with backslab. The primary treating doctors were not always aware of standardized treatment options for acute lateral ankle sprain. Another factor could be working in two hospitals with different settings, at CHUK there was a tendency to give backslab while at KFH they often use functional treatment. A semi-blinded randomized controlled trial could overcome much of those challenges.

CONCLUSIONS

This study showed that ankle sprains are prevalent in our hospitals, with the trend likely to increase given the local development of the athletic industry. The present cohort showed that even older subjects may sustain an ankle sprain. Landing on an inverted and plantar flexed foot was the main mechanism identified in this study reflecting the existing findings in the current literature. The aircast ankle brace was superior to backstab on pain improvement at 3rd and 6th week intervals. The swelling resolution, timing of activity restoration, and recurrence rate were not statistically significant. To extend these findings to the general population we may need to look at long-term outcomes.

Therefore we recommend the following:

(i) Implementation of ankle sprain management protocols in our referral hospitals
(ii) We recommend hospitals to avail of aircast ankle braces
(iii) Ottawa ankle rule should be taught at Accident and Emergencies
(iv) We recommend a semi-blinded randomized controlled trial

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