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Ankle Sprain Injuries in the ED: Assessing Quality of Discharge Instructions and Compliance of Physicians with Ottawa Ankle Rules

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Introduction

The ankle is a major weight-bearing joint in the body and is thus at high risk for recreational injury. Reports show that anywhere from 675,000 to as many as 4,000,000 ankle sprains occur each year in the United States, with 85 – 90% of them being lateral ankle sprains[1-4]. Ankle sprains represent approximately 10% of emergency department (ED) visits[4]. They are among the most commonly seen musculoskeletal injuries in EDs[5]. The cost of treating these injuries ranges from $318 to $914 per sprain, with an annual aggregate cost in the United States of $2 billion[6].

Overview of Ankle Injuries

There are three types of ankle injuries– strains, fractures and sprains. A strain results when muscles or tendons in the ankle are injured. A fracture occurs if any of the three bones that make up the ankle break. An ankle sprain results when ligaments, that connect the bones in the ankle, become overextended. These sprains are generally classified into three groups based on severity and symptoms[7]:

Grade I: Partial tear of a ligament (Mild Sprain)

Symptoms:

- Mild tenderness and swelling
- Slight or no functional loss (i.e., patient is able to bear weight and ambulate with minimal pain)

- No mechanical instability (negative clinical stress examination)

Grade II: Incomplete tear of a ligament with moderate functional impairment (Moderate Sprain)

Symptoms:

- Moderate pain and swelling, mild to moderate ecchymosis (or bruising)
- Tenderness over involved structures
- Some loss of motion and function (i.e., patient has pain with weight-bearing and ambulation)
- Mild to moderate instability (mild unilateral positivity of clinical stress examination)

Grade III: Complete tear and loss of integrity of a ligament (Severe Sprain)

Symptoms:

- Severe swelling (more than 4 cm about the fibula)
- Severe ecchymosis (bruising)
- Loss of function and motion (i.e., patient is unable to bear weight or ambulate)
- Mechanical instability (moderate to severe positivity of clinical stress examination)

Treatment of ankle sprains

An ankle injury is painful and incapacitating and even the most minor weight bearing can often be difficult for the patient to tolerate[8]. If inadequately treated, chronic ankle complaints of pain, instability, and stiffness can occur[9]. New research shows that an ankle sprain may even increase the risk of the formation of a potentially deadly blood clot by three fold[10]. The danger is that a clot can travel to the lungs and cause severe breathing difficulties or, in some cases, death of the patient. Hence, treatment and rehabilitation of ankle sprains cannot be taken lightly.

The typical ED treatment for ankle sprains is the application of an elastic bandage and discharging patients on crutches. Research has shown that instead of immobilization, early mobilization and functional rehabilitation is more effective in resolving swelling and instability[9]. The four components of recommended rehabilitation strategies are: range-of-motion rehabilitation, progressive muscle-strengthening exercises, proprioceptive (balance and agility) training and activity-specific training[7]. The mnemonic PRICEMMS also includes all the essential components for early mobilization and functional rehabilitation (see Table 1 below).

Table 1. Essential Components of Early Mobilization[9]

Proprioception or balance exercises
Rest/alteration of activity/use of crutches/progressive weight bearing
Icing
Compression wrap/brace/tubigrip
Elevation
Medications for analgesia
Range of **M**otion exercises—active or passive
Strengthening exercises—isometric or against a movable resistance

Importance of Discharge Instructions

Ankle sprains need progressive rehabilitation which cannot be completed in a single clinical visit thus scheduled follow up with a primary care provider, specialist, and/or physical therapist is necessary to complete the recovery from injury[9]. The discharge instructions given to patients with ankle sprains are crucial for recovery/treatment to be effective as inadequate rehabilitation can result in decreased strength which may lead to instability and recurrent injury[5,9]. Discharge instructions must include anticipatory guidance, symptomatic management, recommended activity level, restrictions advised, time frame for restrictions, and recommendations for follow-up care including with whom and in what time frame.

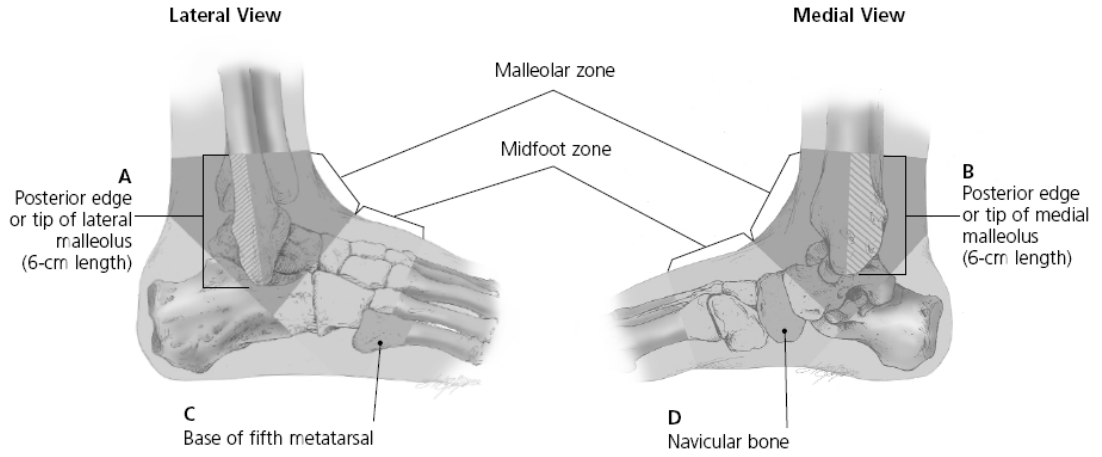
Ottawa Ankle Rules

Clinical decision rules (also known as clinical prediction rules) are designed to help doctors diagnose a medical condition and provide necessary treatment to the patient. Clinical decision rules are defined as decision making tools that incorporate three or more variables from the history, physical examination, or

simple tests done on the patient. These rules are developed from systematic evaluation of evidence of their effectiveness and are selected on the strength of their sensitivity (high positive predictive value) and specificity (high negative predictive value). These rules help clinicians cope with the uncertainty of medical decision making and help clinicians improve their efficiency, an important issue as health care systems demand more cost-effective medical practice[11].

Prior to 1992, the standard of care for ankle sprains required that all suspected ankle injuries would be radiographed, irrespective of ultimate diagnosis (fractured vs. non-fractured). However, only about 15% of patients would actually have a fracture. Thus, many patients would needlessly be exposed to radiation and its related costs. In 1992, Stiell et al. proposed the Ottawa Ankle Rules (OAR) to aid clinicians in determining the need for radiography for ankle injuries (see Figure 1 below).

Figure 1. The Ottawa Ankle Rules



Ottawa ankle and foot rules. An ankle radiographic series is indicated if a patient has pain in the malleolar zone and any of these findings: bone tenderness at A, bone tenderness at B or inability to bear weight immediately and in the emergency department (or physician's office). A foot radiographic series is indicated if a patient has pain in the midfoot zone and any of these findings: bone tenderness at C, bone tenderness at D or inability to bear weight immediately and in the emergency department (or physician's office).

Information from Stiell IG, McKnight RD, Greenberg GH, McDowell I, Nair RC, Wells GA, et al. Implementation of the Ottawa ankle rules. JAMA 1994;271:827-32.

The Ottawa Ankle Rules (OAR), are clinical decision rules for the use of radiography in acute ankle injury. These rules have been rigorously derived, validated and widely implemented in emergency departments[12]. The rules are aimed to assist physicians in determining whether a patient presenting with an ankle injury has sustained a fracture. Based on clinical findings – tenderness in specified zones and/or patient's inability to bear weight – the physician can evaluate a need for X-ray of the ankle[13].

The OAR have very high sensitivity[13, 14], that is, these rules are very accurate in identifying a fracture and, thus, indicating the need for x-ray. When appropriately implemented, OAR can reduce the number of X-rays by up to

35%. In the United States alone, medical expenses savings was found to range between $614,226 and $3,145,910 per 100,000 patients, depending on the charge rate for radiography[15]. According to a study done to assess the cost-effectiveness of the OAR, patients who had been discharged without radiography spent 36 *fewer* minutes in the ED but did not differ in their satisfaction with ED care or rate of subsequent radiography[15]. For instance, at the University Sports Medicine Clinic in Buffalo, NY, thirty-five percent of radiographic series were foregone for a cost savings of almost $6000 because of implementation of OAR. Moreover, follow-up on x-rayed patients found that they were satisfied with their care and that there were no missed fractures[12].

The radiographic evaluation of ankle injuries in the ED has been greatly improved through the institution of the Ottawa Ankle Rules for radiographs. However, use by physicians in emergency departments is reported to be infrequent and often poorly implemented[16]. In a study to assess use of OAR in five countries, it was found that only 31% of US physicians reported using OAR frequently[17].

Study aims:

We conducted a two-part study to:

1) Determine and evaluate the current quality and content of discharge instruction and treatments given to patients diagnosed with an ankle sprain upon discharge from the University Hospital Emergency department.

2) Determine physician compliance with the Ottawa Ankle rules for ordering x-rays in patients diagnosed with an ankle sprain.

Methods

This retrospective chart review was approved by the SUNY Upstate Medical University and the Syracuse University Institutional Review Boards for Human Research Subjects.

Patient Population

This study was conducted by examining patient records from the emergency department of University Hospital, a 350-bed hospital located in Syracuse, NY. Medical records of male and female patients 12-40 years of age diagnosed with ankle sprains from January 1, 2006 – December 31, 2006 were used. This age group was selected to obtain a homogeneous study population in terms of type of ankle sprain (in younger children it is also more common that they sustain an injury to their growth plate rather than spraining ligaments. Moreover, in 2005, 67% of patients diagnosed with ankle sprains in the emergency department were between these ages). Individuals not within this age range, with no indication of an ankle sprain, were pregnant and/or were transported from the Justice Center were excluded.

Data Abstraction

A list of appropriate medical records for data abstraction was generated using ICD-9 codes for ankle sprain (845.00-845.03). ICD codes were developed by the World Health Organization to describe signs, symptoms, causes and severity of disease. The ICD codes are in public domain. Data was abstracted

from these records using a standardized data abstraction form (see appendix A). Each patient was given a unique study ID number. The link between study ID and medical record number was kept separately and destroyed upon completion of data abstraction to maintain patient privacy.

Data from the abstracted records was entered into an MS Excel™ spreadsheet. Patient notes were used to determine whether OAR was used and if the patient needed an x-ray based on the OAR. Based on information in patient notes, we interpreted whether the sprain was mild, moderate or severe.

Any discharge instructions listed on patient notes were extracted. Discharge instructions were scored from 0-5 for **adequacy** based on the following criteria:

1) Control of symptoms (medications, RICE, ACE or Aircast)
2) Guidance for return to ED
3) Specific restrictions
4) Early mobilization (progressive weight bearing, strengthening/ROM/balance exercises)
5) Follow-up care

Similarly, instructions that documented either **RICE** (Rest, Ice, Compression, Elevation); **RICEM** (Rest, Ice, Compression, Elevation, Medication); or **PRICEMMS** were scored from 0-4, 0-5 and 0-8 for the presence of each of the components of the instructions, respectively.

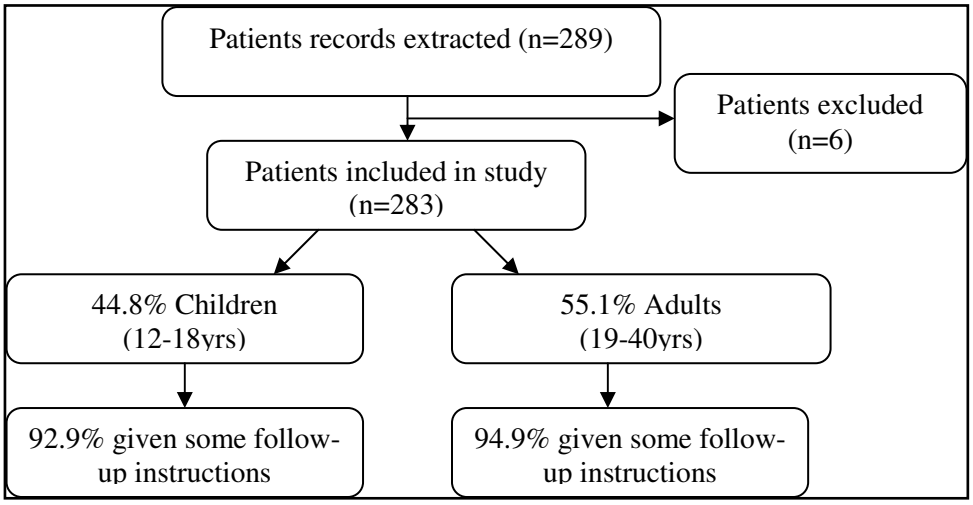
Data Analysis

Pearson's Chi-square test was used to assess differences in the score of discharge instructions and in follow-up instructions by age, gender or severity of sprain. Acceptance levels for significance levels were established a priori for $\alpha<0.05$. Data was analyzed using SPSS-PC version 14.0.

Results

A total of 289 patients were identified with ankle sprain. Six patients met one or more exclusion criteria and eventually, 283 patients were included in the study. Of the patients 143 were males (50.5%) and 140 were females (49.5%). The mean age was 22.5 years and standard deviation was 8.123.

Figure 2. Study CONSORT Chart.



Note: CONSORT is the Consolidated Standards of Reporting Trials. The Consort statement may be found at: http://www.consort-statement.org/ (Accessed April 2008.)

OAR use was clearly documented for 4 (1.4%) of the patients while for 98.6% of patients the rules were either clearly not used or there was no documentation of use. In a total of 176 patients (62.2%) an x-ray was needed. 3 (1.7%) did not receive an x-ray though OAR suggested they needed one, whereas, 15 patients (88.2%) still received an x-ray though OAR suggested they did not need one. For 90 patients (31.8%), we could not determine if an x-ray was needed based on OAR. However, 82 (91.1%) of those were still x-

rayed. Overall, 95.4% (270) patients received an x-ray but only 10 (3.5%) were found to have a fracture. For 17 (6%) patients, there was no documentation of fracture.

We were able to infer the severity of sprain from patient notes 95.8% of the time while for 12 (4.2%) of the cases the severity was not documented. Although 182 (64.3%) of the patients were given medications while in the ED, only 61 (21.6%) received them within the recommended time of 60 minutes.

With respect to follow-up care, 266 (94%) of all patients received some follow-up instructions. 240 (84.8%) were given a follow-up time frame and 262 (92.6%) were given a referral. With respect to age groups, 118 (92.9%) children and 148 (94.9%) adults were given follow-up care. There was no significant difference in the follow-up care given to children when compared with adults ($\chi^2 = 0.5$, $p = 0.49$). Location for follow-up varied from orthopedic referrals to recommendations to return to the ED (see Table 2).

Table 2. Follow-up Care

Location	**Frequency**	**Percent**
Primary Care	130	49.6
Orthopedics	65	24.8
Clinic	43	16.4
Pediatrics	21	8.0
Return to ED/Not Documented	21	7.4
Physical Therapy/Chiropractor	3	1.1
TOTAL	**283**	**100**

There was no significant difference in discharge instructions provided between children and adults as measured by the number of components included for RICE ($\chi^2 = 5.2$, $p = 0.27$) or PRICEMMS ($\chi^2 = 13.9$, $p = 0.05$) or for Adequacy score ($\chi^2 = 5.9$, $p = 0.31$). However, there was some relationship between age and a patient's RICEM score ($\chi^2 = 11.4$, $p = 0.04$). There was also no significant difference found between males and females in RICEM score ($\chi^2 = 6.8$, $p = 0.24$) or adequacy of discharge instructions score ($\chi^2 = 4.5$, $p = 0.47$); or between the severity of sprain and adequacy of discharge instructions ($\chi^2 = 11.8$, $p = 0.29$). Documented discharge instructions can be found in Table 3.

Table 3. Percentage of Items Included in Discharge Instructions

Intervention	**Percentage**
Medication	90.5
Rest	85.2
Compression	71.0
Ice	60.4
Elevation	56.5
RICE (score=4)	45.2
RICEM (score=5)	43.5
Computerized Instructions	36.0
RICE (score=0)	7.8
Range of Motion Exercises	4.9
Strengthening Exercises	3.9
PRICEMMS (score=7)	3.2
RICEM (score=0)	1.8
PRICEMMS (score=0)	1.8
Adequate Instructions (score=0)	1.4
Adequate Instructions (score=5)	1.1
Balance Exercises	0
PRICEMMS (score=8)	0

Discussion

The Ottawa Ankle Rules provide physicians a highly sensitive (high positive predictive value) method to predict fractures in patients presenting with ankle sprains. Moreover, validation studies, conducted at both international and national scales, have proved these rules to be very reliable. However, in only 1.4% of patient records from the University Hospital ED physicians stated that they used the OAR to determine the need for radiographic evaluation. For the remaining patients, there was no indication of what, if any, 'rules' were used. Based on clinical findings listed in patient notes alone, we determined that at least 88.2% of patients did not need an x-ray according to OAR but still received one. Moreover, if we pool the 82 patients for whom OAR use was not documented but were still x-rayed with these patients (i.e., patients not needing an x-ray but still receiving one) the figures rise. Thus, we find that 90.7% radiography could have been avoided if the OAR was used. At an average cost of $172 per ankle x-ray series at the University Hospital ED, this suggests a potential cost savings to the health care system of $16,684 for this group of patients if OAR had been implemented.

The treatment and follow-up care for an ankle sprain clearly varies with severity. For instance, during follow-up for Grade-II and -III sprains, physical therapy is usually prescribed, along with strengthening exercises, proprioception (sense of orientation in space) and balance exercises, gait training, and correct footwear. Whereas, for Grade-I sprains, resistance

exercises are recommended[3]. In addition to lack of OAR documentation, we found that even the severity of sprain was not well documented. We also found there to be no relation between severity of sprains (that we were able to infer from patient notes) and adequacy of discharge instructions ($\chi^2 = 11.8$, $p = 0.296$). Proper rehabilitation after an ankle sprain is extremely crucial to full recovery and can be accomplished if patients are given the discharge instructions and follow-up care that is individualized to their specific injury. While most patients received some follow-up instructions, only 1.1% of patients actually received discharge instructions that included all the components that medical evidence based research suggests is adequate for full recovery. No patient received all aspects of PRICEMMS. Very few physicians documented all components we consider to be adequate discharge instructions and fewer than 50% suggested all components of RICE or RICEM. Most patients were given medications (90.5%) but only a few of them were given medications in the emergency department within recommended timeframes. Age was a deciding factor in the use of medications. Physicians were more likely to prescribe medications to adults rather than children in our sample (based on RICEM scores, $\chi^2 = 11.4$, $p = 0.04$). In all other aspects of treatment, we found there to be no significant difference between patients across age or sex.

There are several potential weaknesses of this study. First, it is a retrospective study. We interpreted the patient notes and medical records to assess whether OAR was used (if not clearly stated) and whether an x-ray would be needed according to the rules. It is possible that the physician had used the OAR in evaluating the patient but did not document its use. In a similar fashion, we inferred the severity of sprain, and the adequacy of the discharge instructions given based on data in the records. Any discharge instructions given verbally to the patient could not be included in the study. As we relied entirely on physically documented criteria, there is potential underreporting of the events of the medical encounter.

Many studies have shown the implementation of even widely accepted and proven clinical decision rules to be very difficult at the level of patient-care. Several factors are thought to cause this. One is the potential medico-legal consequence that physicians could face as a result of a missed fracture[11]. It has also been found that physicians sometimes believe their patient will not be satisfied unless some form of diagnostic investigation, in this case radiography, is provided[11, 19]. In addition, unnecessary radiographic examinations may provide indirect medical benefit to physicians causing them to ignore the OAR[18].

The OAR is a handy tool for physicians and the healthcare system and thus their use should be encouraged. Training sessions for both physicians and

nursing staff to detail the application and benefits of these rules may help increase the implementation of OAR in the ED. Pocket-sized cards, posters and memos have been found to be effective reminders of current recommended treatments and follow-up care for primary care and emergency physicians [11]. Easy-to-complete discharge instruction templates can also help physicians give patient discharge instructions in a time-effective manner[9]. Any broad dissemination strategies should be combined with active local implementation strategies in order to successfully encourage physicians to adopt clinical guidelines[20].

Future studies should include a prospective analysis of OAR use and adequacy of discharge instructions within the emergency room setting. An analysis of physician characteristics and belief systems that enhance or inhibit the use of the OAR would also be interesting to examine.

Conclusion

We found there to be inadequate documentation in the medical records to determine appropriate use of OAR. From what was documented, it appeared that OAR was used in a few cases. We estimate that the consistent use of the OAR could have resulted in a health care cost savings of at least $16,684. Although instructions for follow up care were provided to patients, the analysis of documentation from patients' charts suggests that in general discharge instructions often did not meet optimum standards for enhancing the likelihood of best recovery from ankle sprain.

References:

1. Birrer R.B., et al., Managing ankle injuries in the emergency department. *Journal of Emergency Medicine*, 1999. 17(4): p. 651-60.
2. Stanley K.L., Ankle sprains are always more than 'just a sprain'. *Postgraduate Medicine*, 1991. 89(1): p. 251-5.
3. Barry M.E., Emergency. Ankle sprains. *American Journal of Nursing*, 2001. 101(10): p. 40-2.
4. Rourke K., The evaluation and treatment of acute ankle sprains. *Journal of Emergency Nursing*, 1994. 20(6): p. 528-35.
5. Pugia M.L., et al., Comparison of acute swelling and function in subjects with lateral ankle injury. *Journal of Orthopaedic & Sports Physical Therapy*, 2001. 31(7): p. 384-8.
6. Morrison K.E., et al., *Foot* Characteristics in Association With Inversion Ankle Injury. *Journal of Athletic Training*, 2007; 42(1):135–142.
7. Wolfe MW, et al. Management of Ankle Sprain. *American Family Physician*, 2001. 63(1).
8. Cooke MW, at al. A survey of current consultant practice of treatment of severe ankle sprains in emergency departments in the United Kingdom. *Emerg. Med. J.* 2003; 20; 505-507.
9. Chorley JN. Ankle sprain discharge instructions from the emergency department. *Ped. Emer. Care.* 2005; 21(8).

10. Stralen K.J.V., et al., Minor Injuries as a Risk Factor for Venous Thrombosis. *Arch Intern Med*. 2008; 168(1):21-26.
11. Stiell IG, Wells GA. Methodologic standards for the development of clinical decision rules in emergency medicine. *Ann Emerg Med.* April 1999; 33:437-447.
12. Leddy JJ et al. Implementation of the Ottawa ankle rule in a university sports medicine center. *Medicine & Science in Sports & Exercise*. 2000; 57-62.
13. Steill IG. Ottawa Ankle Rules. *Can Fam Physician* 1996; 42:478-480.
14. Bachmann, et al. Accuracy of Ottawa ankle rules to exclude fractures of the ankle and mid-foot: A Systematic review. *BMJ*. 2003; 326.
15. Stiell IG et al. Cost-Effectiveness Analysis of the Ottawa Ankle Rules. *Annals of Emergency Medicine*. 1995. 26:4.
16. Brehaut JC et al. Clinical decision rules "in the real world": how a widely disseminated rule is used in everyday practice. *Acad Emerg Med.* 2005 Oct12(10):948-56.
17. Graham ID et al. Awareness and Use of the Ottawa Ankle and Knee Rules in 5 Countries: Can Publication Alone Be Enough to Change Practice? *Annals of Emergency Medicin.* 2001. 37:3, 259-266.
18. Hall FM. Overutilization of radiological examinations. *Radiology.* 1976. 120, 443-448.

19. Holroyd BR, et al. Uptake of Validated Clinical Practice Guidelines: Experience With Implementing the Ottawa Ankle Rules. *Am J Emerg Med*. 2004. 22:149-155.
20. Cameron C, Naylor C.D. No impact from active dissemination of the Ottawa Ankle Rules: Further evidence of the need for local implementation of practice guidelines. *CMAJ.* 1999. 160:1165-68.