The Practice of Ottawa Ankle Rules in radiographs taken for acute ankle and midfoot injury

O Akhmar, A Ezane, N Hisamuddin, I Shuaib

Citation

O Akhmar, A Ezane, N Hisamuddin, I Shuaib. *The Practice of Ottawa Ankle Rules in radiographs taken for acute ankle and midfoot injury*. The Internet Journal of Radiology. 2007 Volume 8 Number 1.

Abstract

A retrospective study was conducted to determine the prevalence of Ottawa Ankle Rules (OAR) practice in the patients with radiographs ordered for the ankle and midfoot injuries and association between AOR practices and fracture detection in Emergency Department (ED), Hospital Universiti Sains Malaysia (HUSM), Health Campus, Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia. A total of 172 subjects with 226 ankle and foot radiographs were analysed for the compliance of OAR on clinical examination from medical record and the presence of foot and/or ankle fracture from radiographs. High percentage radiographs ordered were not based on OAR that was 59.7%. There was a significant difference in detecting fracture in group which practiced OAR, 70.6% compared with 29.4% of patients where the radiographs that were ordered not based on OAR. This can reduce unnecessary radiographs to 62.2%. Significant proportion of the radiographs ordered, 51.3% had improper documentation in the patients' clinical record.

INTRODUCTION

It is common to order radiographs for almost every ankle and foot injuries in Emergency Department (ED). However, only less than 15% of patients have fracture[1]. Ottawa Ankle Rules (OAR) is a world wide well-validated and well accepted clinical practice guideline (CPG) to assess these injuries in making the decision for the need of radiographs. It has shown 100% sensitivity with 40.1% specificity. The final aim would be reducing unnecessary radiographs. This can reduce patient's time in ED and unnecessary radiation exposure. The work load of a radiographer in performing it and an ED doctor in reviewing and interpretating the radiographs can also be reduced. Finally, the total healthcare cost will be reduced without an increased rate of missed fracture.

This study was expected to be a first step in implementing OAR as part of CPG in ED, HUSM. It has been designed to look at the retrospective data on the practice of OAR in ED, HUSM without any prior interventions such as lectures, notes or anything that can disseminate OAR in assessing acute ankle injuries. The objectives of the study were to determine the prevalence of OAR practice in radiographs ordered for acute ankle and foot injury and to determine the association between fracture detection and OAR practice/non OAR practice in acute ankle and foot injury radiographs ED, HUSM.

MATERIALS AND METHODS

This cross sectional study was conducted in HUSM, Kubang Kerian, Kelantan state with a population of 417,714 (National Census 2003). It was a 14-month period study, from 1 May 2003 to 30 June 2004. HUSM is a teaching hospital in Kubang Kerian, with ED census 2003 of 42 207 (Record Office, HUSM). The examining doctors range from junior doctors to Emergency Physicians. This study was approved by the institutional research and ethics committee.

A convenience sampling was made where all patients with ankle or foot radiographs taken from ED after sustaining ankle or foot injury were obtained from PACS database in the Department of Radiology. From this, the registration number (RN) of the patient was then used to look for the clinical records from the record office.

Those patients who were examined in ED and fulfilled the inclusion criteria were included in this study. The inclusion criteria were acute ankle injury, which occurred within 7 days of presentation to ED. In order to get more subjects for this study according to the calculated sample size, we have chosen 15 years old as the lower limit of age. Those who were pregnant, altered sensorium (GCS was not 15/15), sustained open ankle injury which already showed fracture or gross deformity of the ankle, had associated multiple traumas (at least one other organ injury), referred from other

hospitals with radiograph or revisited for the same injury were excluded from this study. A patient with a low GCS could not give a proper history and might not give the accurate response to tenderness on palpation. While a patient who sustained multiple traumas with multiple site of tenderness, might give a false negative or false positive response on palpation of the ankle and midfoot injury.

The history and physical examinations of the patients were documented onto a patient datasheet. From the patient datasheet, the OAR practices were determined and the subjects were divided into two groups; the OAR practice and non OAR practice groups. The OAR practice group was the one had radiograph with positive OAR clinical findings as described the study by Stiell et. al.[3]. For the ankle, the positive OAR was considered in the subjects who had pain at the malleolar region with tenderness at posterior edge of either malleolli including the distal 6 cm of tibia and fibula or inability to bear weight both immediately after the injury and walk four steps unaided in ED. While for the foot, if the subjects had midfoot pain with tenderness at navicular or base of fifth metatarsal or inability to bear weight both immediately after the injury and walk four steps unaided in ED. The subject is grouped into non OAR practice group where the radiographs ordered without positive OAR clinical findings. It was further subdivided into OAR negative and improper documentation. The OAR negative was considered when there was no positive finding as mentioned above and yet the radiographs were ordered. The improper documentation group would be those with vague documentation (e.g. tenderness at the ankle, but the exact location was not stated) or no documentation at all regarding the clinical findings from clinical record. Subjects who had both ankle and foot radiographs were analysed separately.

The standard requirements in HUSM are AP and lateral view for the ankle and AP and oblique for the foot radiographs. The radiographs were evaluated using the diagnostic workstation (Pathspeed 8.1, GE Medical Systems, Milwaukee, USA) with 3 megapixel grey-scale monitor by one radiologist and one emergency physician independently where they were blinded to the patient datasheet. The presence or absence of fracture was determined based on consensus between the radiologist and the emergency physician. No fracture or insignificant fracture was defined as avulsion of 3 mm or less across, which was similar as in Stiell study. This fracture is considered insignificant, as it is not treated with plaster immobilisation or any reduction.

The patient datasheet and results of fracture were entered into Microsoft Excel for Windows (Microsoft Inc., Redmond, WA) and analysed using SPSS 10.0 for Windows (Chicago, IL) for statistical analysis.

RESULTS

Out of 938 subjects with ankle and foot radiographs ordered from ED, only 172 subjects with a total of 226 ankle and foot radiographs were included. This was due to unavailability of records and/or missing images and not fulfilled other inclusion criteria.

Majority of the patients (153) in this study were Malays (89%). Chinese constituted about 9.9% (17) and Indians of 1.1% (2). This study was predominated by male, 111 subjects who constituted of 64.5%. The patients' age in this study ranged from 15 to 81 years old and mean age was 30.22 (SD 13.97) years old. The median age was 23 (IQR 21.75) years old. Table 1 depicts the age group with relation to gender distribution.

Figure 1

Table 1: Age group with relation to gender distribution

Age (years old)	Male		Female	
	Frequency	Percentage (%)	Frequency	Percentage (%)
15-24	61	55.0	28	45.9
25-34	17	15.3	5	8.2
35-44	21	18.9	9	14.8
45-54	9	8.1	9	14.8
More than 55	3	2.7	10	16.4
Total	111	100.0	61	100.0

Majority of patients (88.9%) came to ED within 24 hours of injury. The mean duration of ankle and foot injury on presentation to the ED was 1.2 day with mode of 1 day. The commonest cause of injury was motor vehicle accident (44.2%), followed by fall or slipped (27.9%), sports (23%) and others such as falling object (14.5%). There were total of 226 radiographs ordered with 101 of ankle series and 125 of foot series.

In ankle and foot radiographs taken for ankle and foot injuries, 40.3% (95% CI: 33.9%, 46.7%) were practicing OAR and 59.7% (95% CI: 53.3%, 66.1%) were not. Of 59.7% of non OAR practice group, the proportion for OAR negative was 8.4% (95% CI: 4.8%, 12.0%) and the proportion for improper or inadequate documentation was 51.3% (95% CI: 44.8%, 57.8%), as summarised in Table 2.

Figure 2

Table 2: Proportion of radiographs according to OAR

OAR		Frequency	Percentage
OAR practice		91	40.3%
Non OAR practice	OAR negative	19	8.4%
	Improper documentation	116	51.3%
Total		226	100%

There were a total of 17 (7.5%) radiographs shows significant fractures. Table 3 shows the proportion of fractures detected in 226 radiographs of ankle and foot series.

Figure 3

Table 3: Proportion radiographs and fractures detection

Radiographs	No. of Radiograph (n =226)			
	Fracture		No fracture	
	Frequency	Percentage	Frequency	Percentage
Ankle	10	4.4	91	40.3
Foot	7	3.1	118	52.2
Total	17	7.5	209	92.5

The OAR practice group detected 70.6% fractures compared to 29.4% in non OAR practice group. The radiographs and fracture detection in OAR practice and non OAR practice group is shown in Table 4.

Figure 4

Table 4: Proportion of radiographs and fracture detection in OAR practice and non OAR practice groups

	Fracture	No fracture
OAR practice	12	79
Non OAR practice	5	130

Using Chi-square analysis with degree of freedom of 1, the calculated p value was 0.007. Therefore, there is significant difference between fracture detection in OAR practice and non OAR practice group. There was no fracture detected in the radiographs from the OAR negative subgroup. On comparison between the OAR practice groups with OAR negative, it would give roughly 100% sensitivity, 19.4% specificity with positive predictive value of 13.2%.

DISCUSSION

Malaysia is unique for its multiracial country consisting of three major races that are Malay, Chinese and Indian. This study of OAR related was a pioneer for Malaysia with Malays as the largest population, although it was not a validation study. Previous studies of OAR in Singapore and Hong Kong have Chinese as the majorities [4,5] while many other studies had whites preponderance [1,6,7].

From our study, there was a low rate of OAR practice (40.3%) based on radiographs ordered in ED HUSM. There could be a few reasons to this such as behaviour or attitudes of the physicians and knowledge of OAR itself. A review made on 76 published articles regarding the barriers to physician adherence to CPG showed some of the potential barriers are awareness, familiarity, agreement, self efficacy, outcome expectancy and ability to overcome the inertia of previous practice[8].

A physician must be aware first of a CPG, like in this case the OAR. Thereafter an awareness, would be followed by the behaviour of physicians whether they agree to accept and comfortable enough to utilize it in their daily practice. In our institution, the OAR has been taught in the Emergency Medicine postgraduate program. Our ED HUSM has varieties of medical practitioners comprising of emergency physicians, post graduate trainees and service medical officers. Because there is high turn over among post graduate trainees from other department and service medical officers, not all doctors working in ED are aware of OAR. As we know, knowledge of OAR is paramount in applying it accurately in ankle and foot injury assessment. Therefore, active dissemination of this knowledge among doctors in ED especially to juniors is still considered the most important factor for it successfulness.

Some studies had showed that despite active dissemination of OAR, they still failed to reduce the use of radiography[12, 13]. Although these studies demonstrated drawback despite of active dissemination of OAR, we should not make a generalization to this. We should give a try to impart knowledge of OAR in HUSM, and if possible during undergraduate training. In developing country like Malaysia, we believe that we should give a trial in imparting the awareness and knowledge of OAR to our physicians, in order to give better quality of care to the patients by increasing the efficacy of management. At the end of the day, the cost of health care can be abridged. Although the cost of an ankle and/or foot radiographs are not as high as other big gadgets of radiology such as CT and MRI, the reduction of radiography utilization would be beneficial in the long term for the hospital administration.

In the study by Stiell et. al., they found that different

physicians in many settings could apply it[3]. In fact, nursing practitioners can also apply it appropriately. There was a significant difference in request rate of radiography between nursing practitioners who applied OAR compared to medical practitioners who did not apply it [11]. However, in Malaysia particularly in our institution, the nurses still have no role in ordering radiographs. With the above study, probably we can empower nursing practitioners i.e. our nurses and medical assistants in OAR practice at triage level. This can reduce the waiting time in ED as the physicians can concentrate on review the radiograph if OAR positive or reassess the indication for radiograph if the assessment in triage was OAR negative. In addition to the benefit of OAR, it will also increase their job satisfaction[11].

Despite the awareness of OAR, there were studies shown that some physicians were not being practicing it. For example less than one third of the physicians in United States (31%), France (31%) and Spain (9%) actually used OAR compared to 89% and 73%, in Canada and United Kingdom respectively [10]. An equivalent survey in New Zealand among general practitioners (GPs) revealed 89% of GPs reported that they never or hardly ever used ankle guidelines[7].

The attitude of physicians of fear of bad reputation or litigation can also sway them in ordering radiographs without OAR practice. Some of the physicians attribute it to the patients' request. In the Stiell et al. study, patients were satisfied with the care that does not include radiography but with adequate communication from the physician and use of printed instruction[3]. In addition to proper communication, proper application and proper documentation is mandatory in putting the litigation aspect into minimum risk. In our study, there were 51.3% of radiographs ordered did not have proper documentation. Similarly, a retrospective study of ankle injury by Vargish & Clarke reported fewer than 25% of cases had adequate clinical evaluation[14]. This is a source of litigation no matter what is the presenting complaint, not merely for ankle and foot injury. In a busy department like ED, a simple protocol as OAR would be quite beneficial, better still if there is a special assessment sheet for it where the physicians can just mark where ever necessary and make a quick decision whether a radiograph is indicated. At the same time, it can guide junior doctors and to ensure that they are adhered to OAR practice.

Our study has shown that only 7.5% of radiographs of acute ankle and foot injuries in ED HUSM had significant fracture. This is almost similar as many other studies where they quoted the incidence of significant fracture in less than 15% of patients[1,,5]. There were a significant numbers of fractures detected in radiographs ordered based on OAR practice compared to non OAR practice. Our preliminary finding indicates that the OAR is a useful screening and diagnostic clinical tool in helping ED HUSM doctors in requesting radiographs for an acutely injured ankle with high sensitivity. However, this study was not a validation study and the sensitivity and specificity obtained are a crude one. Therefore, a proper study to validate the accuracy of OAR with adequate awareness on this practice to ED physician in HUSM is required in the future.

There were some limitations in this study. This study design was a retrospective assessment and the sample size was small. We did not assess the knowledge and awareness of ED doctors on OAR prior to this study. Those with acute ankle and foot injury where radiographs were not ordered, as the OAR was negative were not included in this study. A physician who is practicing the OAR and found it to be negative will not order the radiograph. However, there is also a possibility where a physician who is not practicing the OAR, but based on his own judgement did not order radiograph. The detection of fracture is based solely on radiograph, and no follow-up done or other imaging modality available.

CONCLUSION

In conclusion, there was significant proportion of radiographs ordered, 59.7% that were not based on OAR practice, although it has proved that significant numbers of fractures detected in radiographs ordered based on OAR practice compared to non OAR practice. Significant proportion of the radiographs ordered had improper documentation in the patients' record.

References

1. Stiell, I.G., Greenberg, G.H., McKnight, R.D., Nair, R.C., McDowell, I., Worthington, J.R. (1992) A study to develop clinical decision rules for the use of radiography in acute ankle injuries. Ann Emerg Med. April; 21: 384 -90
2. Sujitkumar, P., Hadfield, J,M,, Yates, D.W. (1986) Sprain or fracture? An analysis of 2000 ankle injuries. Arch Emerg Med . 3: 101-106
3. Stiell, I.G., Wells, G.A., Laupacis, A., Brison, R., Verbeek, R., Vandemheen, K., Naylor, C.D.(1995) Multicentre trial to introduce the Ottawa ankle rules for use of radiography in acute ankle injuries. Bristish Medical Journal 2;311:594-7.
4. Tay, S.Y., Thoo, F.L., Sitoh, Y.Y., Seow, E. and Wong, H.P. (1999) The Ottawa Ankle Rules in Asia: validating a clinical decision rule for requesting X-rays in twisting ankle and foot injuries, Journal of Emergency Medicine.

17:945-947
5. Yuen MC, Sim SW, Lam HS, Tung WK. Validation of the Ottawa ankle rules in a Hong Kong ED. Am J Emerg Med 2001; 19: 429-432
6. Keogh, S.P., Shafie, A., Wijetunge, D.B. (1998) Comparison of Ottawa ankle rules and current local guidelines for use of radiography in acute ankle injuries; J R Coll Surg Edinb. 43: 341-343
7. Thomas, S.W., Love, T., McLeod, D., Vernall, S., Kljakovic, M., Dowell, A., Durham, J. (2002)The Ottawa ankle rules for the use of diagnostic X-ray in after hours medical centres in New Zealand. Journal of New Zealand Medical Association. 115: 11
8. Cabana, M.D., Rand, C.S., Powe, N.R., Wu, A.W., Wilson, M.H., Abboud, P.C., Rubin, H.R.(1999) Why Don't Physicians Follow Clinical Practice Guidelines? A Framework for Impovement. JAMA 282: 1458-1465
9. Bachmann, L.M., Kolb, E., Koller, M.T., Steurer, J. (2003). Accuracy of Ottawa ankle rules to exclude fractures of the ankle and mid-foot: systematic review. British Medical Journal.326: 417-419
10. Graham ID, Stiell, I.G., Laupacis, A., McAuley,L., Howell,M., Clancy,M., Durieux,P., Simon, N, Emparanza, J.I., Aginaga, J.R., O'Connor, A., Wells, G.(2001). Awareness and use of the Ottawa ankle and knee rules in 5 countries: Can publication alone be enough to change practice?, Annals of Emergency Medicine. 37(3): 259-266
11. Allerston, J., Justham, D. (2000). Nurse practitioners and the Ottawa ankle rules: comparisons with medical staff in requesting X-rays for ankle injured patients. Accident Emerg Nurs. 8(2): 110-115.
12. Cameron, C., Naylor, C.D. (1999) No impact from active dissemination of the Ottawa ankle rules: further evidence of the need for local implementation of practice guidelines. Can Med Assoc J.160: 1165-1168
13. Holroyd, B.R., Wilson, D., Rowe, B.H., Mayes, D.C., Noseworthy, T. (2004).Uptake of validated clinical practice guidelines: experience with implementing the Ottawa Ankle Rules. Am J Emerg Med. 22:149-155.
14. Vargish, T., Clarke, W.R., Young, R.A. (1983). The ankle injury: indications for the selective use of x-rays. Injury 1983;14:507-12

Author Information

O. Nurul Akhmar, M. Med. Radiology (USM)
Department of Radiology, School of Medical Sciences, Universiti Sains Malaysia

A.M. Ezane, M. Med. Radiology (USM)
Department of Radiology, School of Medical Sciences, Universiti Sains Malaysia

N.A.R. Nik Hisamuddin, M. Med.Emergency Medicine (USM)
Department of Emergency, School of Medical Sciences, Universiti Sains Malaysia

I.L. Shuaib, FRCR (UK)
Advanced Medical and Dental Institute, Universiti Sains Malaysia