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Projection radiography of the ankle; the views used for different indications vary between medical imaging departments

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Abstract

Plain radiographs are used for initial evaluation of many conditions of the ankle. Many different radiographic views are described in positioning textbooks but evidence on which views to use, and in which case, is scarce. The aim of this study was to map imaging procedures related to four indications for ankle projection radiography. A questionnaire was sent to all medical imaging departments in Iceland with questions about acquisition technique for ankle radiography views and which views were used for selected indications. Answers were received from 14 of the 28 departments. All departments gave very similar descriptions of the four most common views. In the case of trauma, all but one department used four views but for control of trauma or operation, four different combinations of views were found using from two to four images. For detrition and osteomyelitis, four views were more common in the larger departments but there was not a statistically significant difference. Eight different combinations of the number of views for the four indications were found. The study indicates that there is a room for optimization in image acquisition protocols. More studies are needed to support decisions about how many views are necessary for the most common ankle radiography indications.

Which views are used in projection radiography of the ankle?

Introduction

Plain radiographs are used for initial evaluation of many conditions of the ankle [1]. Eight standard views of the ankle and subtalar joints have been described, for optimal visualization of different parts of anatomy: antero-posterior [AP] view, mortise view, subtalar view and four different Broden views) [2]. In addition, there are oblique views (internal and external), stress studies (inversion and eversion), oblique lateral and weight bearing images [3-7].

Fractures, control after operation, degenerative disease, and osteomyelitis are possible indications for ankle radiography [1, 8, 9]. The literature provides more studies on ankle radiography for fracture diagnosis than other indications. When a fracture is suspected, studies have shown that more fractures are found with three views than two [10] and recent studies suggest that three views are common practice [11]. It has also been acknowledged that standard views may not clearly show some fractures [12]. An Icelandic book on radiographic positioning, which has been an important source for radiographers the last three decades, describes four ankle views: AP, mortise, lateral and oblique lateral, but directions about when to use each view are not provided [13].

The aim of this study was to map imaging procedures related to four indications for ankle radiography.

Materials and methods

A questionnaire was designed and sent to all license holders for medical imaging x-ray equipment in Iceland, using a contact list provided by the Icelandic Radiation Safety Authority (IRSA). Questions in the questionnaire were about 1) the ankle views used in the department, 2) the views acquired if the indication was a) trauma/fracture, b) control after fracture or operation, c) detrition (degenerative disease) and d) osteomyelitis and 3) positioning and centering for each view. In the questionnaire, participants were asked to describe the views used in order to avoid misunderstanding based on different use of Icelandic names for the views. In addition, there were two questions where the contact person was asked to evaluate how well the answers reflected the practice in the department (since there was only one answer from each department) and open space for comments.

A survey tool available within the University of Iceland, Uglu K2, was used. A link to the questionnaire was e-mailed to the contact persons in February 2021 and a friendly reminder to answer was sent a week later. The questionnaire was open for a total of two weeks.

Departments were grouped by size, based on information about examination frequency available from the IRSA into categories A = departments where there were 1000 or more examinations per year and B = departments where examinations were fewer than 1000.

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Chi Squared test was used to evaluate if there was a significant difference in the number of views used between departments in size categories A and B. Microsoft Excel was used for descriptive and inferential statistical analysis.

Results

A link to the questionnaire was sent to contacts in all 28 medical imaging departments in Iceland and answers were received from 14 of them (50%), eight in category A and six in category B. All departments gave very similar descriptions of the four most common views, which are shown in Table 1, along with short names that are used in the remainder of the article.

Table 1

The four most common views used in ankle radiography in Iceland, with description and a short name for each.

Short name	Description
AP	Supine position, extended leg, dorsiflexed foot, perpendicular central ray midway between the malleoli
Mortise	Supine position, extended leg, dorsiflexed foot, entire leg rotated internally 15 – 25°, perpendicular central ray midway between the malleoli
Lateral	Lateral recumbent position, extended leg, dorsiflexed foot, central ray perpendicular to the medial malleolus
Oblique lateral	Lateral recumbent position, extended leg, dorsiflexed foot, calcaneus elevated 30 – 45° from the lateral position

An example was given of additional views by four departments, including stress study, subtalar views and Broden views.

In the case of trauma, all but one department used four views (Trauma 1 in Table 2) and one used three views (Trauma 2). For control of trauma, from two to four views were used, as shown in Table 2 (Control 1 – 4). The most common procedure was to use four views (43% of departments). When two views were used there were two different combinations, i.e. AP and lateral or mortise and lateral. For trauma and control there was no recognizable difference between departments in size category A and B.

When the indication was degenerative disease three procedures were used with two to four views (Detrition 1 – 3 in Table 2). It was most common to use three views (64% of departments) and only two (14%) used two views. Two departments answered that there was not a procedure for the indication of osteomyelitis. In the 12 remaining departments, three procedures were used (Osteomyelitis 1 – 3 in Table 2) and it was most common to use three views (66%). Four views were more common in the larger departments for detrition and osteomyelitis, but the observed values were not significantly different from the expected ones (detrition $p=0.054$, osteomyelitis $p=0.092$).

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Table 2

The views used for the different acquisition procedures found in this study, for four ankle radiography indications: Trauma, Control, Detrition and Osteomyelitis. AP = anterior posterior.

	AP view	Mortise view	Lateral view	Oblique lateral view	Views in total	% of departments
Trauma1	x	x	x	x	4	93%
Trauma2	x	x	x		3	7%
Control 1	x	x	x	x	4	43%
Control 2	x		x		2	29%
Control 3	x	x	x		3	14%
Control 4		x	x		2	14%
Detrition 1	x	x	x		3	64%
Detrition 2	x	x	x	x	4	21%
Detrition 3	x		x		2	14%
Osteomyelitis 1	x	x	x		3	67%
Osteomyelitis 2	x		x		2	17%
Osteomyelitis 3	x	x	x	x	4	17%

Three departments (21%) used all four views independent of indication, although one of them did not have a procedure for one of the indications (osteomyelitis). Three other departments used an identical combination of views for all the indications, i.e. four views for trauma and control and three views for detrition and osteomyelitis. Other combinations of views were found only in one or two departments. There were in total eight different combinations of the number of views used for the four indications in the 14 departments.

When asked to evaluate how well the answers reflected the practice in the department, three answered 100%, seven 90%, three 80% and one 30%.

Discussion

The results of this study show a small variation in the image acquisition technique for each view, but the technique was generally consistent with positioning textbooks [3-5, 7, 14]. There were some variations, for example in the angle of inward rotation for the mortise view, which was often given as a range, e.g. 15 – 20°, like in many textbooks [5, 6, 14]. This is in contrast with a recent study which found that the most commonly employed

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techniques in foot radiography no longer match the majority of positions described in textbooks [15].

The variation in combinations of views was more than expected, although previous surveys have indicated such differences in ankle radiography [16]. More recent studies have also revealed a difference in the numbers of views for the same body part and indication [17].

The majority of departments in this study used indication-based protocols and no department routinely used three views for all indications, as seems to be common according to the literature [3, 11].

The ACR practice parameter suggests that the minimum number of views for the ankle is three: AP, mortise and lateral [18]. Fewer, or only two views were used for control images in one third of the departments, and more, or four views, were used for trauma in 93% of the departments. The fourth view, oblique lateral, is not commonly described, but was found in Icelandic and Swedish positioning textbooks [7, 13].

One example of written protocol was acquired during the study, from the University hospital [19]. According to the written protocol, four views were acquired when the indication was trauma (AP, mortise, lateral and oblique lateral), two for control (AP and lateral) and three for detrition (AP, mortise and lateral). The protocol did not contain any references or reasoning explaining the choice of views for the three indications. It could have been expected that more of the other departments followed the University hospital protocol but, on the other hand, it was not readily available for radiographers outside the hospital.

The reasons why different combination of views was preferred for the same indication were not investigated in this study. Although positioning textbooks may advise on routine views [3] or comment on the advantages of specific views [20], evidence on optimal views for different indications is scarce.

The main limitation of this study was the small sample size, but still a large variation in which views were used was seen. The answers received were from heterogenous departments, from the smallest to the largest in Iceland and both from the public and the private sector. There was, on the other hand, a small variation in acquisition technique but more variation would probably be seen in a study in a larger country or in a multinational study.

The large variation in the number of views for the four indications (eight different combinations) implies that there is room for improvement. The lack of standardization in image acquisition techniques has been commented on in other studies [21]. More studies are needed to support decisions about which, and how many, views are necessary for the most common ankle radiography indications. It has also been discussed that projection radiography has not been given the credit it deserves in education and research [22].

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Conclusion

This study indicates that there is room for optimization in image acquisition protocols in projection radiography. More studies are needed to support decisions about which views are necessary for the most common ankle radiography indications.

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