Calcaneus varus deformity

Department of Orthopaedic Surgery, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, ThailandThe articles of Thossart HarnroongrojDepartment of Orthopaedic Surgery, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, ThailandTuifin articles by Akegapon TangmanasakulDepartment of Orthopaedic Surgery, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, ThailandTacétations by Nattapol ChoursamranDepartment of Orthopaedic Surgery, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, ThailandRetas by Narumol Sudjaipartment of Orthopaedic Surgery, Faculty of Medicine, Mahidol University, Bangkok, ThailandRetassed by Narumol Sudjaipartment of Orthopaedic Surgery , Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, ThailandThe articles of Thos HarnroongrojAuthor information The medial displaced posterior calcaneal tuber creates varus deformation of an intraarticular calcaneal fracture. The fracture involves the posterior calcaneal facet and the calcaneal body so we developed a measurement technique representing the angle between the posterior facet and the long calcaneus axis using the lateral malleolus and longitudinal longitudinal bone trabeculae of the posterior calcaneal tubercle as references to obtain the angle of calcaneal varus.52 calcaneal x-rays of calcaneal view. The angles between the posterior facet and the long axis of calcaneus were measured using measures 1 and 2. Measurement angle 1, as a gold standard, was obtained from a long axis and posterior facet of the calcaneus, while Measure 2 was obtained from a line, perpendicular to the upper curve of the lateral cortex of the lateral malleolus and a line parallel to the longitudinal trabeculae of the posterior calcanal bone. No more than 3 degrees difference in the angle of the two measures was accepted. The reliability of Measure 2 has been statistically tested. Measurement angles 1 and 2 were 90.04 degrees ± 4.00 degrees and 90.58 degrees ± 3.78 degrees. The average of the different degrees of the two measurements was 0.54 degrees ± 2.31 degrees with 95% confidence interval: 0.10-1.88 degrees. Statistical analysis of Measures 1 and 2 showed more than 0.75 OF the CCI and 0.826 of the Pearson correlation coefficient. Measurement technique 2 using lateral malleolus and longitudinal posterior calcaneal tuber bone trabeculae as references has a strong reliability to represent the angle between the long axis and the posterior facet of calcaneus to reach the calcaneal varus angle. Keywords: Intraarticular calcanal fracture, lateral malleolus, longitudinal bone trabeculae, posterior calcaneal, posterior calcanated facetKeywords: Ankle fractures, X-rays, posterior calcane tubercle moved bone from intraartic calcicular fracture creates a calcaneus deformation.1,2 Deformation will cause the ankle and back foot to malfunction. Preoperative evaluations of postoperative calcaneal varus are required for fracture treatment. Axial sight x-ray is routinely taken in a calcaneal rupture. However, the tibial or fibular shaft is not seen in the x-ray. Therefore, measuring the calcaneal varus angle of axial radiography using the tibial or fibular tree as a reference is impractical. In fact, the long anatomical axis of the weight bearing bone such as the tibia is perpendicular to the joint surface.3,4 Therefore, the long calcaneus axis is also perpendicular to the joint surface of the posterior calcanated facet. So that the varus angle of a calcaneal fracture is obtained from 90 degrees less the angle between the long anatomical axis and the joint surface of the posterior facet of calcaneus. The displaced intraarticular rupture of the calcaneus involves the calcaneal body and intraarticular rupture of the posterior calcanated facet. These results that the identifications of the long anatomical axis of calcaneus and the joint surface of the posterior calcaneal facet using the calcaneal body and the posterior calcanate facet for angle measurement are impractical. Therefore, we developed a technique to represent the angle between the long calcaneus anatomical axis and the joint surface of the posterior calcaneal facet using the lateral malleolus and longitudinal bone trabeculae of the posterior calcaneal tuber as references to calculate the varus angle of the intraarticular calcaneal fracture. The study was conducted to assess the reliability of the measurement technique. The study was approved by the Institutional Review Board. On the plantar surface of each foot, the MN line was drawn from the middle of the heel (M) to the middle of the base of the second toe (N). The MN line represented the long axis of the foot [Figure 1a].5 The axial (radiography) view of the calcane was taken. The volunteer placed supine on the X-ray table and the tape was placed under the heel. The foot was dorsiflexed which allowed the plantar surface to be 90 degrees at the X-ray table in the frontal and sagittal planes [Figure 1b]. The X-ray tube was tilted at 40 degrees and directed towards the middle heel. Using a digital system and programmable measurement tools, Measure 1, which directly measured the angle between the long calcaneus anatomical axis and the joint surface of the posterior calcaneal facet of the axial view radiography, was performed as the control of the comparative study.3,4 The center of the posterior calcaneal tuber was identified and marked by a circle model (O) [Figure 2]. The medial calcaneal wall is between the sustentacular tali and the posterior calcaneal tuber as well as the anterior media of medially wall away from the long axis of calcaneus. Thus, the junction between the posterior medial wall and the posterior calcaneal tuber was identified and marked as line A. AB was previously drawn from A along the right medial wall and and above the post-B calcaneal facet to exclude sustentacular tali [Figure 3]. The lateral calcaneal wall above the lateral calcaneal tuber was identified. Then, a point at the side wall just above the side tuber was marked as C. CD line was drawn from C and perpendicular to AB to D. Medium CD was calculated and marked as E. OP line was drawn from O to E and ended above the calcanian facet after P.The OP represented anatomical long axis of calcaneus.4 FG line was drawn along the posterior facet of calcaneus subchondral bone. Line FG crossed the line OP to H. Then, the O'G angle was measured and recorded as an angle between the long anatomical calcane axis and the joint surface of the posterior calcaneal facet [Figure 3].4 Measure 2 was designed by the first and fifth authors. The posterior calcanated facet was blinded and seen only the lateral malleolus. The apex curve of the lateral cortex of the lateral malleolus was identified and marked as an I line. IJ was pulled perpendicular to the apex curve of the lateral cortex of the lateral malleolus to I [Figure 4]. The IJ represented the joint surface of the posterior calcaneal facet [Figure 5]. The XY line was previously drawn parallel to the longitudinal longitudinal bone trabeculae of the posterior calcaneal tuber and the K-crossed IJ line and ended above the post-Y calcaneal facet. XY represented the long anatomical axis of the calcaneus [Figure 5].3 An angle (XKJ) was measured and recorded and represented the angle between the long anatomical axis of calcaneus and the joint surface of the facsulized aspect [Figure 5]. The measurements were performed by 2 orthopaedic residents at 6-month intervals. Different degrees of the angles of measures 1 and 2, of no more than 3 degrees, were accepted Data were analyzed for the inter-intraobserver reliability of the two measures and the consideration of the IC of more than 0.75 for strong reliability. Measures 1 and 2 were analyzed for Pearson correlation coefficient and more than 0.7 was considered to have a strong correlation.52 normal feet of 26 volunteers (17 males, 9 females) were included in the study, with age ranging from 18 to 36 years. The average angle of Measure 1 was 90.04 degrees ± 4.00 degrees (95% confidence interval [CI]: 88.92 degrees, 91.15 degrees) and Measure 2 was 90.58 degrees ± 3.78 degrees (95% CI 89.53, 91.63 degrees). The different average degrees of measurement 1 and 2 were 0.54 degrees ± 2.31 degrees with 95% OF IC ranged from 0.10 to 1.18 degrees and accepted as no 3 degrees. Inter and intra-observer of Measures 1 and 2 were above 0.75 [Table 1]. The Pearson correlation coefficient for Measures 1 and 2 was 0.826 [Figure 6]. The angle between the long calcaneal anatomical axis and the joint surface of the posterior calcaneal facet by techniques measuring 1 and 2Varus deformation of Intraarticular calcanceal fracture is the result of the medial posterior calcaneus tuber.1,2 Deformation requires pre- and postoperative evaluation and restoration in order to preserve the ankle-back-foot ankle-back-back-foot-foot alignment Functions. There are several techniques for assessing the angle of calcaneus varus.6,7 The techniques are not routine work and some techniques are inappropriate to apply for calcaneal rupture especially techniques using standing position.7 Axial view x-ray of a calcaneal fracture is routinely taken. The tibial and fibular shaft cannot be seen in this x-ray and there was intraarticular rupture of the posterior calcaneal facet and calcaneal body Therefore the posterior calcanated facet is frequently difficult to identify and the long anatomical axis of the calcaneus cannot be obtained from the calcaneal body. This resulted in difficulty in measuring the angle of the calcaneus axial view radiography using the reference as tibial or fibular tree, posterior facet of the calcanea or even calcaneal body. Thus, Measure 2 was developed to better measure the angle that represented an angle between the long anatomical axis of calcaneus and the joint surface of the posterior calcaneal wedge facet of calcaneal axial radiography and advantages in calculating the varus angle of the intra-aesictic calcanic fracture. Measurement 2 technique used a perpendicular apex curve of lateral cortex of the lateral malleolus and posterior posterior tuberculnal posterior bone longitudinal trabeculae as references for the representation of the joint surface of the posterior calcanated facet and the long calcaneus anatomical axis respectively. The reasons for the use of lateral malleolus as a reference are that the lateral malleolus can be seen in axial calcaneus view radiography especially the lateral cortex. The lateral malleolus is the end of the fibula and rotates around the same long axis of the fibular shaft during bending and extension of the ankle joint. Thus, the drawing line perpendicular to the apex curve of the lateral cortex of the lateral malleolus is also perpendicular to the long axis of the perberula and parallel to the joint surfaces of the talocrural and posterior subtalar joint at the level of the posterior calcanated facet.4,8 Thus, this drawing line may represent the joint surface of the posterior calorcanated facet in the event of an intraarticular calcanal fracture. The reasons for using the longitudinal trabeculae of posterior calcane tubers as a reference are that the posterior calcaneal tuber is the posterior end of the calcane and a ground contact area. The posterior calcaneal tuber can be identified in the event of an intraarticular calcaneal fracture. In addition, the direction of the longitudinal bone trabeculae of the posterior calcaneal tuber predates the posterior calcanic facet and parallel to the long anatomical axis of the calcaneus.3 so that medial displacement of the tuber simultaneously changes the direction of the longitudinal tuber bone trabeculae and creates longitudinal bone trabeculae to the longintudial axis of the calcaneus.3,4,5 Therefore, the identification of longitudinal trabeculae of displaced displaced later calcane tubers a long anatomical calcaneal axis of intraarticular calcanal fracture. The study compared measurement 2 to 1 for reliability. Measurement angle 1 was obtained from the long anatomical axis of calcaneus and the joint surface of the posterior calcaneal facet and used as a gold standard to assess the reliability of Measure 2.4 The study showed that Measure 1 and 2 had high reliability with more than 0.750 inter- and intraobserver reliability. The average of the different degrees of angles between measure 1 and 2 was 0.54 degrees (2.31 degrees) with 95% CI of the average difference ranging from 0.10 to 1.18 degrees. The accepted range of the difference was no greater than 3 degrees. The correlation of measures 1 and 2 was analyzed statistically and showed a strong correlation between the two measures with 0.826 of the Pearson correlation coefficient. However, the accuracy of the angle measurement also requires good control of the position of the foot and the tilt of the X-ray tube. In addition, identification and drawing line perpendicular to the apex curve of the lateral cortex of the lateral malleolus must be exercised to acquire measurement skill. In the case of the posterior subtal facet of the slope seen in axial calcaneal radiography, Measure 2 can be simply modified by using the posterior facet of the slope as a reference for the joint surface of the posterior calcaneal facet instead of the line perpendicular to the apex curve of the lateral cortex of the lateral malleolus. In conclusion, the study showed that the angle of measurement 2 has a high reliability to represent the angle between the long anatomical axis of the calcaneus and the joint surface of the posterior calcaneal facet using the lateral maleolus and longitudinal trabeculae bone of the posterior calcaneal tuber as references. Measure 2 benefits for assessing calcaneal varus or valgus angle of intraarticular calcaneal fracture. The levels of varus or valgus of the calcane fracture are obtained at 90 degrees minus the 2.Source of measurement angle: NilConflict of interest: None.1. Harnroongroj T, Chuckpaiwong B, Angthong C, Nanakorn P, Sudjai N, Harnroongroj T. 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