

Resident Accuracy of Joint Line Palpation Using Ultrasound Verification

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Objective: To determine the accuracy of knee and acromioclavicular (AC) joint line palpation in Physical Medicine and Rehabilitation (PM&R) residents using ultrasound (US) verification.

Design: Cohort study.

Setting: PM&R residency program at an academic institution.

Participants: Twenty-four PM&R residents participating in a musculoskeletal US course (7 PGY-2, 8 PGY-3, and 9 PGY4 residents).

Methods: Twenty-four PM&R residents participating in an US course were asked to palpate the AC joint and lateral joint line of the knee in a female and male model before the start of the course. Once the presumed joint line was localized, the residents were asked to tape an 18-gauge, 1.5-inch, blunt-tip needle parallel to the joint line on the overlying skin. The accuracy of needle placement over the joint line was verified using US.

Main Outcome Measures: US verification of correct needle placement over the joint line.

Results: Overall AC joint palpation accuracy was 16.7%, and knee lateral joint line palpation accuracy was 58.3%. Based on the resident level of education, using a value of $P < .05$, there were no statistically significant differences in the accuracy of joint line palpation.

Conclusions: Residents in this study demonstrate poor accuracy of AC joint and lateral knee joint line identification by palpation, using US as the criterion standard for verification. There were no statistically significant differences in the accuracy rates of joint line palpation based on resident level of education. US may be a useful tool to use to advance the current methods of teaching the physical examination in medical education.

PM R 2014;6:920-925

INTRODUCTION

Palpation and correct identification of joints and bony landmarks during the physical examination is an essential skill to develop as a physician. This is particularly true for diagnosing musculoskeletal injuries and identifying landmarks for non-image-guided invasive procedures such as joint injections. The teaching of the physical examination to medical students has traditionally taken place both in the classroom and through bedside examination of patients during clinical rotations. Many institutions have also integrated the use of standardized patient models, objective structure clinical examinations, and simulation-based teaching for additional education and evaluation of physical examination skills [1-3]. However, several studies have demonstrated a decline in physical examination skills among medical students and residents [4-6]. This has been attributed to various factors, including an increased reliance on high-technology diagnostic testing and a decrease in supervised bedside instruction [7-9].

The advancements and accessibility of ultrasound (US) in the last 15 years have the potential to change the way in which we teach physical examination skills and to provide direct feedback to learners. Recently, there have been a multitude of publications investigating the novel use of US in medical education, specifically for teaching physical examination techniques. Pilot projects have demonstrated that basic US skills can be taught to

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Disclosures outside this publication: grants/grants pending (money to institution), Foundation of PM&R (New Investigator Award) and NIH K12 Award

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Disclosure: nothing to disclose

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Disclosure: nothing to disclose

Submitted for publication November 25, 2013; accepted February 12, 2014.

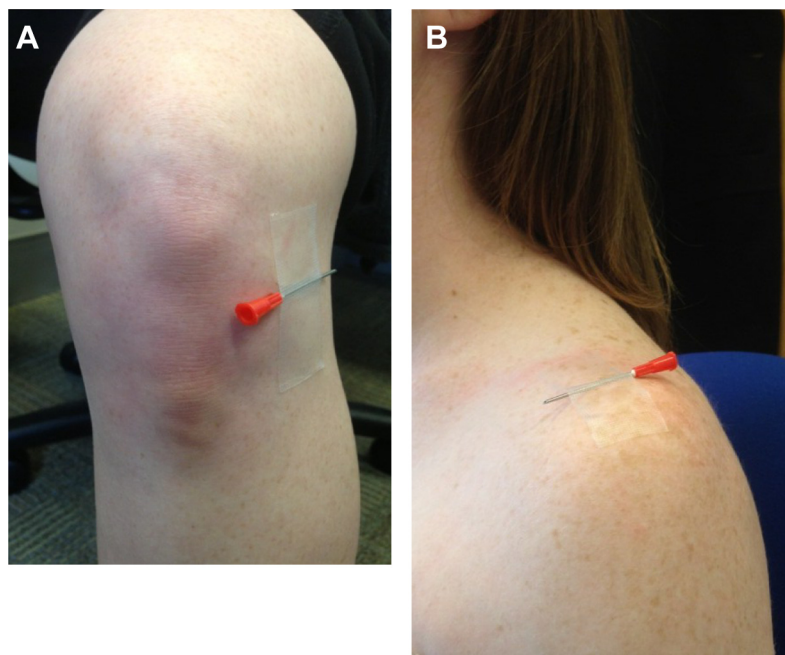


Figure 1. (A) Needle placement parallel to left knee lateral joint line. (B) Needle placement parallel to left acromioclavicular (AC) joint line.

medical students in a short amount of time and can also improve their physical examination skills [10]. US has also been used in medical school to teach abdominal physical examination [11], thyroid palpation [12], lung percussion [12], liver percussion [12], cardiac examination [13,14], and musculoskeletal anatomy [15,16]. Although there have been several studies involving the use of US to teach anatomy and various parts of the abdominal, cardiac, and pulmonary physical examinations, there have been limited studies on the use of US in evaluating and teaching the musculoskeletal (MSK) physical examination. Before using US to teach improvements in an MSK examination, it is important to identify the current gaps that exist within traditional means of teaching the MSK examination. Beran et al, in 2012, exposed deficiencies in the physical examination knowledge and skills in their orthopedic residents, and concluded that MSK physical examination skills are underemphasized in training [17]. A 2011 study by Smith et al was performed to determine the accuracy of palpation of the long head of the biceps tendon using US for verification. The authors reported that a sports medicine board-certified attending physician, a sports medicine fellow, and a physical medicine and rehabilitation (PM&R) resident were able to correctly palpate and identify the long head of the biceps tendon only 5.3%, 12%, and 0% of the time, respectively, as verified by US [18]. We believe that the traditional means of teaching certain MSK physical examination maneuvers does not allow for direct feedback to the learner, particularly with joint line palpation, which is a vital skill for diagnosis and joint

injections for the MSK physician. The objective of this study was to investigate the accuracy of knee and acromioclavicular (AC) joint line palpation in PM&R residents using US verification.

METHODS

This study was approved by the Northwestern University Institutional Review Board. Twenty-four PM&R resident physicians at a single institution participated in a 1-day musculoskeletal US course in 2012. As part of the curriculum, resident performance was recorded regarding accuracy of palpation of bony landmarks before the start of the course, specifically the AC joint and the lateral joint line of the knee. There were 2 asymptomatic physical examination models, one male and one female, who had different body mass indices (BMI). The BMI of the male physical examination model was 27.32 kg/m², and the BMI of the female physical examination model was 19.74 kg/m². Both models were in a seated position with exposed knees and shoulders for palpation. The knee was flexed at 90°. Residents were asked to palpate and to identify the left AC joint and left lateral joint line of the knee on the male physical examination model, and the right AC joint and right lateral joint line of the knee on the female physical examination model. They were then asked to place a 1.5-inch, 18-gauge blunt tip needle flat on the surface of the skin parallel to the specified joint line and as close to the center of the joint line as possible (Figure 1A and B). The needle was then secured

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