Journal of Orthopaedics 13 (2016) 419–424

Contents lists available at ScienceDirect

Journal of Orthopaedics

journal homepage: www.elsevier.com/locate/jor

Original Article

A novel fresh cadaver model for education and assessment of joint aspiration

Robert Daniel Kay [a], Aditya Manoharan [a], Saman Nematollahi [b], Joseph Nelson [c], Stephen Henry Cummings [d], William Joaquin Adamas Rappaport [e], Richard Amini [f,*]

[a] College of Medicine, University of Arizona, Tucson, AZ, United States
[b] Department of Internal Medicine, Columbia University Medical Center, New York, NY, United States
[c] Department of Orthopedic Surgery, The University of Michigan, Ann Arbor, MI, United States
[d] Tidewater Physicians Multispecialty Group, Williamsburg, VA, United States
[e] Department of Surgery, University of Arizona, Tucson, AZ, United States
[f] Department of Emergency Medicine, University of Arizona, Tucson, AZ, United States

ARTICLE INFO

Article history:
Received 19 May 2016
Received in revised form 5 July 2016
Accepted 2 September 2016
Available online

Keywords:
Joint aspiration
Cadaver
Education
Assessment

ABSTRACT

Objectives: The objective of this study was to describe a novel cadaver model and to determine the utility of this model for teaching and assessing students in performing knee, elbow, and wrist arthrocentesis.
Methods: Third year medical students were evaluated while performing arthrocentesis during a fresh cadaver training sessions.
Results: Sixty-three participants were included in this analysis. There was statistically significant improvement between the pre- and post-test analysis in all aspects assessed in our study of elbow, knee and wrist arthrocentesis.
Conclusions: The use of fresh cadavers for the education and assessment of arthrocenteses is an effective training model.

1. Introduction

Joint aspiration, or arthrocentesis, is a commonly performed procedure used to diagnose and treat numerous joint diseases. The procedure has broad utility and is performed by numerous specialties. Despite the broad utility of this and other technical skills, over the past decade, there has been a reduction in the opportunities for medical students to learn and perform these crucial procedures.[1,2] The reasons for this are complex, but as a consequence, medical students are entering residency with a lack of experience in performing routine but critical procedural skills.[3,4]

This lack of experience has created a demand in the medical education curriculum for discovering alternative approaches, including simulation-based training, which allow students to learn procedural skills in a safe, low stress environment prior to direct patient encounters.[5,6] Although simulation-based instruction can provide high quality training, there are significant differences in the tactile and anatomic features of the human body when compared to the manikin and phantom models that are commonly used.[7,8]

In response to the need for more life-like simulation models, cadaver-based labs are becoming increasingly favored by medical educators.[9–14] This model provides more realistic tissue handling, haptic feedback, preserved tissue planes, and anatomic variation.[9,12] In addition, confidence in performing procedures is heightened as a result of creating more life-like situations, as one would see in clinical practice.[14] Various studies have evaluated the effectiveness of cadaver-based arthrocentesis teaching models.[10,14,15] However, one notable omission in these studies is the lack of pre- and post-testing to evaluate long-term procedural skills and knowledge retention. The objective of this study was to describe a novel cadaver model and to determine the utility of this model for teaching and assessing students in performing knee, elbow, and wrist arthrocentesis.

* Corresponding author at: Department of Emergency Medicine, University of Arizona Medical Center, PO Box 245057, Tucson, AZ 85724-5057, United States.
E-mail addresses: rdk28@email.arizona.edu (R.D. Kay), adityam@email.arizona.edu (A. Manoharan), nematollahi@gmail.com (S. Nematollahi), joeytnelson@gmail.com (J. Nelson), stephenhcummings@gmail.com (S.H. Cummings), cdjpk1@gmail.com (W.J.A. Rappaport), richardamini@gmail.com (R. Amini).

http://dx.doi.org/10.1016/j.jor.2016.09.003
0972-978X/

2. Methods

2.1. Study design and setting

This was a cross-sectional study at an urban academic medical center. The study was reviewed by the Institutional Review Board and determined to be exempt. The study participants were third year medical students with no joint arthrocentesis experience. The population had an average age of 26 of which 52% were men and 48% were female. The hands-on cadaver procedure-lab was conducted during the surgical clerkship and data was gathered from July 2015 until January 2016.

2.2. Cadaver preparation

In order to ensure accurate assessment of successful arthrocentesis, preparation of the joints involved injecting red fluid into the above joints with a 25 gauge needle for the wrist and elbow and a 22 gauge needle for the knee. An anatomic dissection was performed on the opposite extremity of the cadaver by an experienced surgeon in such a manner as to demonstrate the relevant anatomy of the selected joint space and identify the correct boundaries for the procedure (Images A and B).

2.3. Educational curriculum

Students were taught how to appropriately identify the landmarks for each joint on the dissected side of the cadaver.

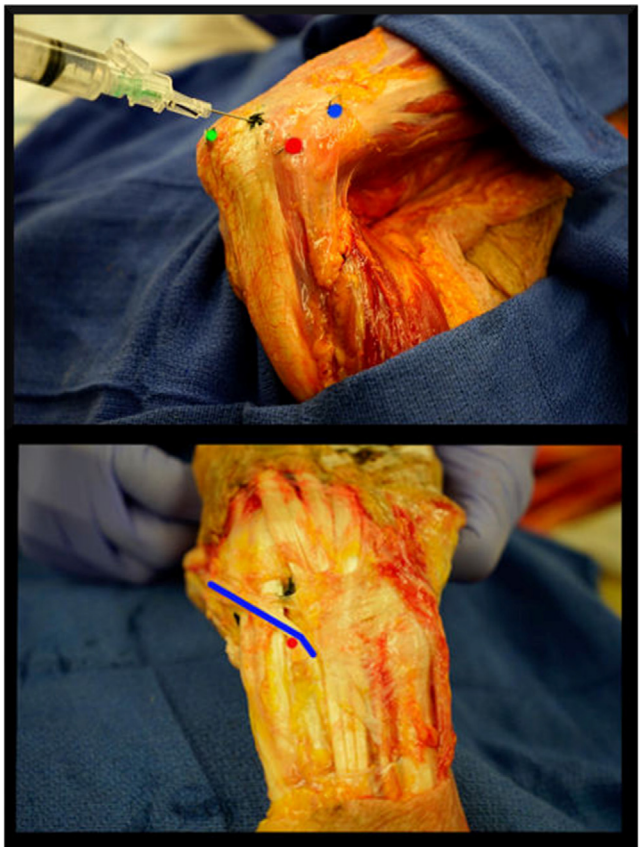

Image A. Elbow and wrist arthrocentesis. Top: image of a fresh cadaver elbow with lables. Blue: lateral epicondyle. Red: radial head. Green: olecranon. Black: soft spot of triangle formed by the above landmarks. Bottom: image of a fresh cadaver wrist. Blue line: extensor pollicis longus. Red dot: Lister tubercle. Black dot: site of aspiration (distal to Lister tubercle and ulnar to extensor pollicis longus tendon). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

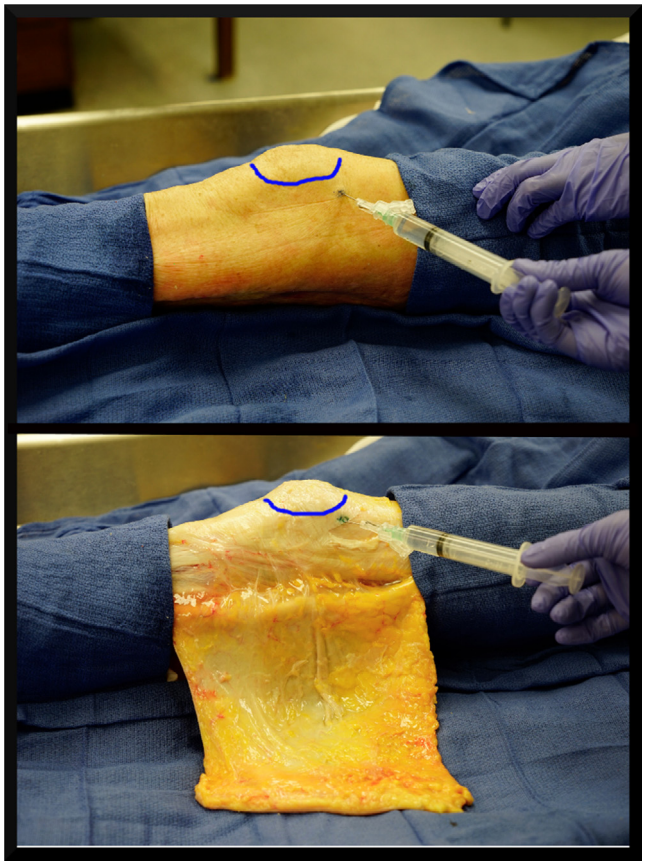

Image B. Knee arthrocentesis (supralateral approach). Image of a fresh cadaver knee. Top: skin flap present. Bottom: skin flap exposed. Blue line outlines patella. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Once they learned the proper location of each landmark they identified the same landmarks on the non-dissected limb. Aspiration of each joint was then demonstrated by a physician on the non-dissected limb with the dissected limb serving as a visual aid. Students were then allowed to practice aspiration on the dissected limb before moving on to the non-dissected limb with the goal of successfully aspirating the red fluid.

2.4. Assessment

During orientation for their clerkship, and prior to the education session, the students were asked to list the indications, contraindications, and complications of joint aspiration. In addition, they were asked to identify the anatomical landmarks required for performing each of the three chosen joint aspirations. A pre-test questionnaire was given to assess student comfort levels prior to the educational session (Table 1). Lastly, students were asked to perform the aspirations without guidance.

Prior to leaving the educational session of the lab each student was capable of listing the indications, contraindications, and complications of joint aspiration. They could also identify the appropriate landmarks and independently perform joint aspirations of the elbow, wrist, and knee. At 5 weeks the lab was repeated and the performance of the students was evaluated, this time with no instruction. A post-test questionnaire was also given to assess student comfort levels and the general utility of the educational session (Table 1).

In addition to the technical aspect of the procedure, knowledge of the indications, contraindications, complications, and anatomic