

POCUS Reverse Pericardiocentesis using Novel Subxiphoid-right Sternoclavicular Joint Approach with GAX-specimen and BriteVu Contrast for Medical Student and Resident Training

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ABSTRACT

INTRODUCTION. In 1979 echocardiograph revolutionized elective pericardiocentesis (PC). POCUS is now accessible in the 'field' with wireless, waterproof and shock resistant handheld probes for emergency lifesaving what was blind techniques with serious side-effects (SE). There are two recognized classic approaches, subxiphoid to left axilla/shoulder and direct left transthoracic. Recently, Benninger developed a successful blind subxiphoid-right sternoclavicular joint approach (SRSJa). SRSJa appeared anatomically safe and technically simple. However, there have been no follow-up studies. POCUS GE Vscan air probes are being used by the authors teaching medical skills during formal medical school ultrasound curriculum. Donor cadavers are an ideal medium to practice reverse pericardiocentesis which requires the same end result, entering the pericardial space. The objective of this study was to investigate POCUS performing SRSJa to successfully conduct a reverse pericardiocentesis with medical students practicing on novel GAX-Specimens with innovative BriteVu (BV) contrast versus Formalin-fixed cadavers (FFC) in an anatomy dissection lab. **METHODS.** Literature search was conducted regarding PC approaches taught during routine dissection. Medical students (n=4 1st years) with no PC experience but have attended a cardiac ultrasound workshop. They were informed how to perform SRSJa on GAX-specimens (n=6:3-Male:3-Female) and FFC (n=30: 17-Male:13-Female) injecting approximately 50-80mls of fluid into the pericardial space (PS) followed by clamshell dissection to assess fluid placement. **RESULTS.** Literature search revealed no anatomical description of PC techniques in anatomy textbooks. The two classic techniques were explained in specialty texts, atlases, and websites. SRSJa was developed and described in 2011 by Benninger. Dissection revealed students (4/4-100%) using SRSJa were successful placing PC needle into the PS (video and dissection proof) with GE Vscan Air and no obvious injury to other structures post clamshell dissection. FFC (30/30-100%) revealed poor ultrasound cart images. Blind PC was limited versus GAX-specimens due to increased tissue resistance. POCUS and blind emergency PC remain an important lifesaving skill. There is need to have multiple techniques and/or approaches to improved POCUS and blind approach success. Students with no previous PC experience performed SRSJa successfully on novel lifelike cadavers prepared as GAX-specimens. **CONCLUSION.** This study revealed the SRSJa for PC using POCUS Vscan Air probes could be conducted successfully with minimal training and injury to relevant structures on a GAX-specimen of BV contrast prior to clamshell thoracotomy procedure.

OBJECTIVE

The objective of this study was to investigate POCUS performing SRSJa to successfully conduct a reverse pericardiocentesis with medical students practicing on novel GAX-Specimens with innovative BriteVu (BV) contrast versus Formalin-fixed cadavers (FFC) in an anatomy dissection lab.

INTRODUCTION



According to the Cleveland Clinic, more than 25,000 patients receive elective or emergency PC each year in the United States. Exposure to PC training in medical school education may improve muscle memory and technical confidence leading to greater future success when treating emergency/elective pericardial effusions. Accreditation Council for Graduate Medical Education (ACGME) includes SoftPrep cadaver subxiphoid and transthoracic POCUS guided PC training competency required in emergency medicine residency programs.

Current literature is absent of PC exposure offered in medical school curriculums. University of Virginia is one of few medical schools in literature that implement anatomy dissection with clinical procedures such as intubations, fracture repair and arthroscopy, but not PC. There is room for increased implementation of clinical procedures, such as PC in anatomy curriculum in medical schools. GAX-Specimens, with their life-like tissue resistance and realistic imaging capabilities could be implemented in medical school anatomy curriculum to provide students with PC training opportunities.



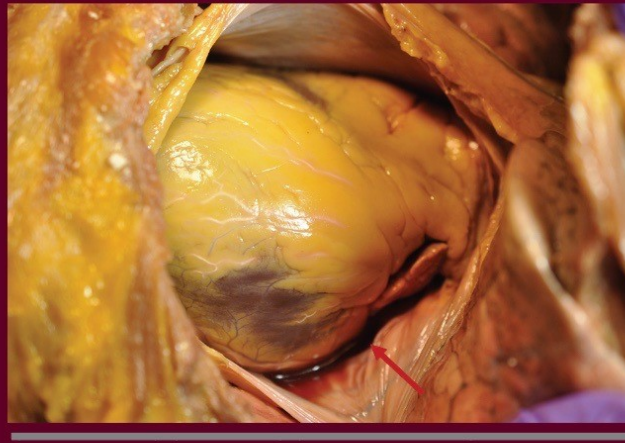
METHODS

Literature search was conducted regarding PC approaches taught during routine dissection. Medical students (n=4 1st years) with no PC experience but have attended a cardiac ultrasound workshop. They were informed how to perform SRSJa on GAX-specimens (n=6:3-Male:3-Female) and FFC (n=30: 17-Male:13-Female) injecting approximately 50-80mls of fluid into the pericardial space (PS) followed by clamshell dissection to assess fluid placement.



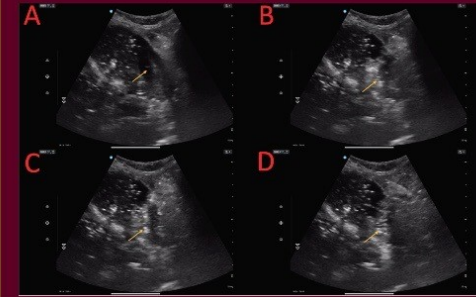
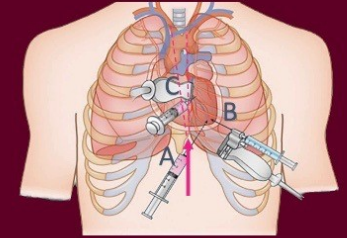
RESULTS

Literature search revealed no anatomical description of PC techniques in anatomy textbooks. The two classic techniques were explained in specialty texts, atlases, and websites. SRSJa was developed and described in 2011 by Benninger. Dissection revealed students (4/4-100%) using SRSJa were successful placing PC needle into the PS (video and dissection proof) with GE Vscan Air and no obvious injury to other structures post clamshell dissection. FFC (30/30-100%) revealed poor ultrasound cart images. Blind PC was limited versus GAX-specimens due to increased tissue resistance. POCUS and blind emergency PC remain an important lifesaving skill. There is need to have multiple techniques and/or approaches to improved POCUS and blind approach success. Students with no previous PC experience performed SRSJa successfully on novel lifelike cadavers prepared as GAX-specimens.



RESULTS CONTINUED

PC studies regarding complications can be misleading if the PC is not identified as emergency or elective. Controversy exists between subxiphoid versus transthoracic approaches. Ultimately, various conditions afflicting the patient will determine whether subxiphoid or transthoracic is the ideal approach surrounding the circumstances. Complication rates vary depending on the study, however subxiphoid appears to have higher complication rates than transthoracic. Transthoracic complication can lend itself to increased pneumothorax incidence. Subxiphoid approach can cause injury to lung, internal thoracic artery, left anterior descending artery, and stomach. Authors feel the subxiphoid approach if not practiced may cause damage to abdominal structures. Nevertheless, if the PC needle is introduced at the xiphoid process at an angle which is between 15-45 degrees then as the needle is advanced 1-2 cm it will be entering the thoracic cavity and be so shallow in the abdominal cavity. Thus it would decrease complications within the abdomen. If the SRSJa is conducted, then injury to the internal thoracic artery and pneumothorax would be unlikely if the anatomy is within predicted norm. The authors believe that POCUS guided subxiphoid practice on GAX-specimens is lifelike regarding image acquisition and tissue resistance as the needle is advanced. Trainees should learn both approaches in order to provide the best opportunity of survival for their patients.



Formalin-fixed cadavers (FFC) reveal unacceptable POCUS image quality and for blind approaches tissue resistance is not lifelike and thus not ideal. GAX-specimens allow a trainee to conduct transthoracic and subxiphoid approaches with acceptable POCUS image quality and lifelike tissue resistance.

CONCLUSION

This study revealed the SRSJa for PC using POCUS could be conducted successfully with minimal training and injury to relevant structures on a GAX-specimen of BV contrast prior to clamshell thoracotomy procedure.

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REFERENCES

References available upon request