

Does the addition of ultrasound enhance cardiac anatomy learning in undergraduate medical education?

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Abstract

With the advent of portable hand-held ultrasound units, the use of point of care ultrasound (POCUS) has become increasingly popular amongst a wide array of medical specialists for both diagnostic and therapeutic interventions. Canada-wide surveys demonstrate a desire for increased utilization of POCUS in primary medical education. In this study, we aim to assess the efficacy of an ultrasound based anatomy tutorial and the perspectives of a cohort of first year medical students at Queen's University. Students were recruited, randomized to pre- or post-test analysis, and provided with a supplementary lecture on cardiac anatomy utilizing echocardiography studies. In this study, we were unable to demonstrate a difference between understanding of basic cardiac anatomy between groups. However, we were able to report the opinions and perspectives of a small cohort of first year medical students at Queen's University, illustrating a desire for increased exposure and training towards cardiac POCUS in primary medical education. Further evidence is required to delineate the true value of these experiences.

Introduction

With the advent of portable hand-held ultrasound units, the use of point of care ultrasound (POCUS) has become increasingly popular amongst a wide array of medical specialists for both diagnostic and therapeutic interventions. As a result of bedside ultrasound's widespread use in emergency medicine, internal medicine, anesthesia, obstetrics and gynecology, and surgical specialties, POCUS may provide excellent learning opportunities for medical students in their pre-clinical studies and clerkship. These technologies are being adapted and integrated into undergraduate medical education where they have been utilized to supplement clinical anatomy courses, demonstrate pathophysiology of disease, and are employed as extensions and adjuncts of the physical exam and patient history [1-3]. Studies have demonstrated their efficacy, with better diagnostic accuracy in medical students who utilize POCUS studies as an adjunct to physical examination than compared to their non-POCUS guided counterparts [2]. The results of a national survey across Canadian medical school deans demonstrate that there is a desire for increased ultrasound integration within their scholastic programs, with 77% of those medical schools responding deans indicating that bedside ultrasound education should be integrated into the medical school curriculum [1]. Of those responding medical schools, 13/17 had already integrated some form of bedside ultrasound teaching

to their core undergraduate curriculum [1]. With that in mind, there is currently no formal ultrasound curriculum at the Queen's University School of Medicine for undergraduate medical education. Through the use of supplementary lecture and survey for a group of first year medical students, we aimed to assess a) the efficacy of an ultrasound guided anatomy tutorial and b) current perspectives of Queen's University medical students towards ultrasound and other medical imaging in undergraduate medical education.

Methods

All first year medical students at Queen's University School of Medicine were invited to participate in this study and attend a supplementary one-hour ultrasound based lecture on basic cardiac anatomy and ultrasound physics. Following recruitment, the 33 participating students provided written consent in compliance with the Queen's University Health Sciences and Affiliated Hospitals Research Ethics Board. Students were randomized into two groups. Both groups had previously received the Queen's University School of Medicine traditional core educational component of anatomical teaching in cardiac structures. Prior to the supplementary lecture, all students in Group 1 (n=19) completed a short multiple-choice test on basic cardiac anatomy and responded to survey questions scored on a 5-part Likert scale. One student from Group 1 did not answer the series of Likert scaled perspective questions and was excluded from perspective

analysis (total n= 18). Both groups (n=33) then received a supplementary lecture on cardiac anatomy utilizing echocardiographic studies as the primary teaching tool. Group 2 (n= 14) wrote the same multiple-choice test following this session. Three students in Group 2 did not complete this test and were thus excluded from analysis (total n=11). Tests were collected and scored. Overall test scores were averaged and perspective ratings were tabulated within groups.

Results

Pre- and post-test score averages were 75% and 77%, respectively, for the total of 15 questions directed towards basic cardiac anatomy. There were no significant differences in overall testing scores between pre- and post-test groups. A 5-part Likert scale analysis was used to assess perspectives of medical students with respect to a) the utility of ultrasound imaging in the teaching of clinical anatomy, b) student desire to have increased integration of medical imaging into core educational content, c) personal level of engagement and, d) the belief of the importance of early and broad exposure to imaging studies. These results show that a large proportion of the medical students assessed perceive ultrasound to be useful in teaching clinical anatomy (67% and 64% of pre and post-test groups, respectively). The cohort assessed desired more integration of medical imaging into their core curricular content (61% and 64%, pre and post-test groups, respectively) and felt that it was important to their education to have

early and broad exposure to these imaging studies (44% and 82%, pre and post-test groups, respectively). Finally, the majority of medical students assessed agreed or strongly agreed that lectures integrating imaging tools such as ultrasound improved their level of engagement with the lecture content. Results of Likert scale analysis are summarized in Table 1.

Discussion

It has been shown that POCUS studies have become increasingly attractive in the teaching of clinical anatomy and as an adjunct to physical examination throughout undergraduate medical education programs across Canada and the United States [1-4,6]. The critics of this trend suggest the perceived benefits of the integration of POCUS technologies are not supported by sufficient research, and lack proof of their value in undergraduate medical education [7]. In this pilot study, we aimed to assess the efficacy of echocardiographic-based anatomy lectures in addition to the perspectives and opinions of Queen's University first year medical students. Although this study was small, we were unable to show a significant difference in overall testing scores between groups receiving ultrasound teaching targeted for anatomic learning. This unexpected finding could be due to a variety of factors including overall test design relating to the difficulty and choice of questions selected, lecture content and style, and the overall small cohort sizes studied. Subjective analyses demonstrated that those medical students who participated within this study strongly believed that ultrasonography was useful as an adjunct to traditional anatomical studies, and stated a desire for more exposure to these imaging tools within their core educational content. A similar but weaker trend was observed with respect to the level of engagement of lecture content. These results must be taken within context, as there is an inherent selection bias in recruitment towards students with a predilection towards medical imaging and cardiology studies.

Table 1. Summary of perspectives of a cohort of medical students. Students were assessed before and after a supplementary lecture utilizing echocardiographic studies to demonstrate cardiac anatomy. Pre-test (n=18), Post-test (n=11).

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
<i>Ultrasound is useful in teaching clinical anatomy</i>					
Pre-test	0% (0/18)	0% (0/18)	11% (2/18)	22% (4/18)	67% (12/18)
Post-test	0% (0/11)	0% (0/11)	0% (0/11)	36% (4/11)	64% (7/11)
<i>There should be more medical imaging integrated into medical education curriculum</i>					
Pre-test	0% (0/18)	0% (0/18)	6% (1/18)	33% (6/18)	61% (11/18)
Post-test	0% (0/11)	0% (0/11)	0% (0/11)	36% (4/11)	64% (7/11)
<i>Lectures integrating imaging such as ultrasound are more engaging than traditional lectures</i>					
Pre-test	0% (0/18)	0% (0/18)	33% (6/18)	28% (5/18)	39% (7/18)
Post-test	0% (0/11)	0% (0/11)	18% (2/11)	45% (5/11)	36% (4/11)
<i>It is important to have early and broad exposure to medical imaging studies</i>					
Pre-test	0% (0/18)	0% (0/18)	6% (1/18)	50% (9/18)	44% (8/18)
Post-test	0% (0/11)	0% (0/11)	0% (0/11)	18% (2/11)	82% (9/11)

Although the learning of anatomy was not enhanced by an objective measure of test performance, medical students subjectively felt that they had a better understanding of content from ultrasonography teaching, and it may be the case that this enhanced understanding cannot be captured by an objective written test. It is unknown whether this sense of enriched training would translate into improved clinical practice. The majority of a Canadian medical student's education, in the pre-clinical years, is largely composed of didactic lecture format, setting the stage for medical students to learn the skills and background knowledge required to be formidable clinicians. This study, in addition to published perspective analyses across Canadian medical institutions, demonstrates an increasing desire to integrate imaging studies such as ultrasound into core medical education [4].

Conclusion

Although we could not demonstrate a direct benefit on test scores of integrating ultrasound teaching to cardiac anatomy learning, medical students nevertheless expressed a desire for increased exposure and teaching directed towards ultrasound in the curriculum. Thus the perceived enhancement of learning appears to be related to enhanced engagement and a broader understanding of imaging rather than a

measurable increase in test scores. Additional research remains to be required to determine the optimal structure for the integration of ultrasound within the medical school core curriculum and its full value to not only enhancing the educational experience but also eventual clinical practice.

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