Assessing the Pre-Analytic Phase of Laboratory Testing and Measuring the Impact of an Educational Knowledge Translation Strategy on Medical Imaging Teams

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Citation

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Abstract

Purpose: The purpose of this study is to assess the knowledge base of the radiology team regarding preanalytic laboratory specimen collection and to determine the effectiveness of an educational knowledge translation seminar on improving the understanding of these core concepts. Materials & Methods: 30 examinations sets were distributed to eligible personnel who participated in an educational seminar presented by three diagnostic laboratory physicians. Following the seminar the same written examination was completed anonymously and the post-seminar examinations were collected and tallied. Results: 24 of these examination sets were complete sets (80%) and used for data analysis. The breakdown of respondents were 2 radiologists (8%), 3 registered nurses (12.5%) and 19 technologists (79.2%). Before the seminar the range of scores of the written examination ranged from 0-57.1%. The mean pre-seminar score was 40%. Following the educational session the range of scores of the written examination were from 57% - 100% and the mean score was 88.5%. Conclusion: Based on the authors' results of this study there is a need for additional training regarding proper specimen collection. The study also suggests that a knowledge translation strategy, such as an educational seminar addressing institutional specific specimen collection protocols, can be an effective tool to address deficiencies.

INTRODUCTION

Specimen collection for diagnostic laboratories is a common task performed by many general and interventional radiology departments. The total testing process of laboratory medicine comprises of three traditional steps: pre-analytic, analytic and post-analytic phases. The pre-analytic stage of the total testing process includes specimen collection by the medical imaging team. Technological advances in hospital medical laboratories have substantially improved laboratory medicine outcomes leaving the pre-analytic phase, primarily specimen collection, as the leading cause of error in the total testing process. An assessment of the knowledge base, specific to laboratory sample collection, of the radiology team comprising of radiologists, registered nurses and medical imaging technologists was conducted to determine the level of understanding of sample collection at our institution in the format of a written examination. Following this these radiology personnel participated in an educational training seminar addressing specimen preparation and collection learning objectives. The written examination was retaken after the session to determine the effectiveness of this knowledge translation strategy. The purpose of this study is to assess the knowledge base of the radiology team regarding pre-analytic laboratory specimen collection and to determine the effectiveness of a laboratory training seminar on improving the understanding of these core concepts.

MATERIALS & METHODS

Our departmental team responsible for pre-analytic laboratory specimen collection involves a multidisciplinary group comprising of radiologists, registered nurses and medical imaging technologists consisting of 35 fulltime personnel. Each written examination comprised of 2 copies of a 2 page, 7 multiple choice question examination in multiple choice format. 30 examinations sets were distributed to eligible personnel. Eligibility criteria include full-time medical imaging personnel (radiologists, registered nurses and technologists) involved with sample collection in our department and those who attended the educational seminar and those who completed the examination sets. The educational seminar was presented by three diagnostic laboratory physicians from our institution. The training seminar was presented as two repeat sessions on the same

day to accommodate the radiology personnel's work schedule. No participants attended both seminars. The duration of each session was one hour ,and they were presented consecutively during the mid-day. Prior to each session the participants undertook a short instructional presentation explaining the purpose and format of the examination process and seminar. The written examination was distributed to the study participants anonymously prior to the seminar and once completed the pre-seminar examinations were collected anonymously. The healthcare personnel then participated in the didactic educational seminar. Following the seminar the same written examination was completed anonymously and the post-seminar examinations were collected. Each examination was coded with a unique identifier to ensure correct matching of each participant's pre- and post- seminar examinations. A team of three medical staff from our institution's diagnostic laboratory, consisting of a microbiologist and two pathologists, created the examination and answer key (Exhibit A). Each question was equally weighted. The questions were intended to sample the knowledge of general specimen collection techniques for a radiology service and to follow the protocols specific to our institution. All three laboratory physicians also created and presented the educational seminar. Approval from the Institution review board is not required for this study.

RESULTS

Our medical imaging team consists of 35 fulltime personnel comprised of 4 radiologists, 5 registered nurses, and 26 medical imaging technologists. There are three staff interventional radiologists and one interventional radiology fellow at our institution. The 5 registered nurses are dedicated to the interventional radiology division of medical imaging. The medical imaging technologists include 7 ultrasound technologists as well as 19 computed tomography (CT) and angiographic technologists. The minimum number of full-time years of clinical experience for the radiologists, nurses and technologists are 6 months to 27 years (mean 13.8 years), 13 years to 39 years (mean 26 years) and 1 year to 26 years (mean 13.5 years) respectively.

A total of 30 written examinations sets were collected prior to and after the educational seminar. 24 of these examination sets were complete sets (80%) and used for data analysis. Six sets of written examinations were incomplete and excluded from the analysis. The breakdown of respondents were 2 radiologists (8%), 3 registered nurses (12.5%) and 19 technologists (79.2%). Before the seminar the range of scores of the written examination ranged from 0 /7 to 4/7 (0-57.1%). The mean pre-seminar score was 2.8/7 (40%). Following the educational session the scores of the written examination ranged from 4/7 to 7/7 (57% - 100%) and the mean score was 6.2/7 (88.5%). A subgroup analysis based on the participant's professional role in the radiology team was also performed. The 2 radiologists scored a mean score of 4/7 (57.1%) prior to the educational seminar and 6/7 (85.7%) after the seminar. The 3 nurses scored a mean of 2.6/7 (37.1%) and 5.3/7 (76.1%) pre- and post-seminar respectively. The technologists scored a mean of 2.7/7 (38.5%) and 6.3/7 (90%) pre- and post-seminar respectively. An analysis of the pre- and post examination results for the individual questions was also performed and is summarized in Table 1. Of note is the percentage of respondent answers which were correct on the pre-seminar examination that remained correct, 64 of 168 answers (38.1%), and the percentage of incorrect answers which became correct on the post-seminar examination, 84 out of 168 answers (50%).

Figure 1

Table 1. Assessing the Pre-Analytic Phase of Laboratory Testing and Measuring the Impact of an Educational Knowledge Translation Strategy on Medical Imaging Teams

	No of Correct Questions Pre-Seminar Examination	No of Incorrect Questions Pre-Seminar Examination	
No of Correct Questions Post-Seminar Examination	64 (38.1%)	84 (50%)	148 (88.1%)
No of Incorrect Questions Post-Seminar Examination	3 (1.8%)	17 (10.1%)	20 (11.9%)
	67 (39.9%)	101 (60.1%)	168 (100%)

EXHIBIT A

Are you a: _ radiologist _ nurse _ technologist?

An abdominal fat pad aspirate is planned for a patient with multiple myeloma to assess for amyloidosis. Information concerning how to collect, transport and store the specimen to be sent to the laboratory at St. Michael's is best obtained by:

A cavitary lung mass is detected in a patient with a history of emphysema. What specimens are preferable?

Which of the following is true concerning the minimum quantity of tissue is required for flow cytometry?

A liver core biopsy is taken for grading and staging of

chronic hepatitis C. What information should be stated on the requisition to ensure that the specimen is processed appropriately by histology?

The following information is REQUIRED on every patient specimen sent to the lab?

Which tube of Cerebrospinal fluid should be sent to microbiology?

How much abscess fluid should be sent to the microbiology lab?

DISCUSSION

Error reduction and improvement of quality of care are central to effective laboratory medicine. The total testing process of laboratory medicine comprises of three traditional steps: pre-analytic, analytic and post-analytic phases. Medical imaging, specifically interventional radiology departments, have become major stakeholders in the process of specimen collection for laboratory analysis. Our medical imaging department functions as a team based approach in the pre-analytic phase of laboratory specimen collection. The team involves radiologists, registered nurses and medical imaging technologists in the pre-analytic specimen collection for microbiology, cytology and pathology samples. All three groups of healthcare professionals are essential members in the specimen collection process and subsequently require involvement in quality improvement strategies to improve effectiveness of the pre-analytic phase. The laboratory medicine literature cites technological advances as having improved the quality of laboratory testing and that analytical errors are no longer the main factor influencing laboratories (1,2). Subsequently, the extra-analytic phase has become the leading area of concern and need for quality improvement. Multiple laboratory medicine sources state that the extra-analytical phases, including sample collection, patient preparation, handling and storage, account for up to 93% of the errors in the total testing process (1,3,4). The medical imaging team has a significant role to play in the reduction of these errors since the medical imaging team, especially the interventional radiology team, are frequently requested to provide samples in hospital based practices. A review of the literature did not demonstrate assessments of the effectiveness of medical imaging teams in the pre-analytic phase of specimen collection. Because medical imaging teams are frequently involved with the specimen collection process more investigation into this issue is required. Not only should there be additional research but our study indicates that there is potential for improvement of the medical imaging team's knowledge base of pre-analytical sample collection. Although there is no baseline level of competence which can be determined from a short multiple choice examination there is evidence that an interdepartmental educational approach does improve the knowledge of those personnel collecting the samples. The authors recognize the limitations to this study in adequately assessing the competence of the medical imaging team’s knowledge of proper specimen collection. First, the number of questions in the written examination was limited to seven which may not accurately assess the knowledge base of the radiology personnel. Although these seven questions were created to address specific points in the specimen collection process, some of which highlight past issues specific to our institution, a more robust examination would provide additional accuracy to reflect the knowledge of the personnel. But the authors also believe that a longer examination would substantially decrease the overall response rate. An additional limitation to this study is that the content of the examination and the seminar are not completely transferrable to different institutions. Each laboratory has specific institutional protocols which prevents standardized content for examination purposes. This makes identification of deficiencies difficult to compare across institutions and also limits the creation of a standardized testing system and knowledge translation strategy unless a regional or national set of standards are created. The authors of this study recommend that that it would be excellent practice to routinely review the specimen collection protocols performed by hospital based radiology teams to identify deficiencies and minimize error in the pre-analytic phase. Because each hospital utilizes institution specific laboratory techniques for specimen analysis a collaborative review with the institutional laboratory staff is recommended. Once a review has been completed and deficiencies identified a knowledge translation strategy should be created like didactic educational seminars. Developing a quality indicator, like periodic examinations to gauge the knowledge base of those involved with the pre-analytic phase, would help ensure proper specimen collection to increase diagnostic yield and improve patient outcomes.

CONCLUSION

Given the advancements of laboratory technology, the focus for quality improvement has shifted away from the laboratory to the pre-analytic phase of specimen preparation

and collection. Radiology teams are frequently providing specimen collection at the request of referring clinicians in the hospital based setting. This emphasizes the need for proper education and adherence to institutional protocols for laboratory specimen collection by medical imaging teams. Based on the authors' results of this study there is a need for additional training regarding proper specimen collection. The study also suggests that a knowledge translation strategy, such as an educational seminar addressing institutional specific specimen collection protocols, can be an effective tool to address deficiencies.

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