

Situation awareness and decision-making assessment of medical students in crisis management using key features questions

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Abstract

Objective: This study aimed to assess situation awareness and decision-making for perioperative crisis management in fifth-year medical students using key-features questions (KFQs) by applying the anesthetists' non-technical skills and medical students' non-technical skills framework as the key answers.

Materials and Methods: Two-hundred and sixty 5th year medical students rotated to anesthesia clerkship from March 2013 to January 2014, all were assessed the approach to perioperative crisis management by KFQs. Two researchers made the scorecard and passing level to assess cognitive part of non-technical skills based on Anesthetists' non-technical skills and Medical Students' non-technical skills behavioral marker system. The KFQs answers were independently and retrospectively reviewed by 2 raters using the predefined scorecard. The answers that passed the passing standard for both raters were counted as passed.

Results: Two-hundred and sixty KFQs answers were reviewed and scored. Two-hundred and eleven KFQs answers (81.2%) were able to pass the standard in level I of situation awareness; gathering information. While the level II (recognizing and understanding information) and III (anticipating) was reported as passed in 247 (95%) and 139 answers (53.5%) respectively. The passed answers for the decision-making category was 169 (65%), 77 (29.6%) and 134 (51.5%) for identifying options, balancing risks and selecting options and reviewing decisions respectively. The passed answers for escalating concerns was 62 (23.8%).

Conclusions: Key-features questions can be used to assess cognitive parts of non-technical skills. Fifth-year medical students demonstrated sufficient level of situation awareness level I and II, while level III and all level of decision making are low.

Keywords: decision making assessment, key-features questions, non-technical skills assessment, situation awareness assessment

Introduction

Non-technical skills (NTS) training has been systematically implemented in postgraduate training programs to enhance patient safety and outcome^{1,2}. The training in anesthesia and perioperative settings has been well recognized using the anesthetists' (A)NTS framework^{3,4}, whereas the NTS intervention in the undergraduate medical curriculum is varied due to diversity of the framework^{5,6}.

The NTS are divided into the two main skills of cognitive and interpersonal skills⁷. The training and assessing of interpersonal skills by simulation- and workplace-based training and assessment has proved to be effective^{8,9,10}. However, the cognitive skills, such as situation awareness and decision making, are difficult to train and assess. Situation awareness and decision making are cognitive skills that simultaneously occur in a crisis situation^{11,12}, and are also closely related to the medical knowledge and clinical reasoning skills^{12,13}. Therefore, the assessment process must be context specific and able to explore the thinking process of the students¹¹. Situation awareness and decision-making skills are usually assessed using behavioral marker systems in the workplace or in simulation-based settings^{3,4}. However, the ability of these assessment methods to explore the thinking processes of the students is still inadequate^{7,13}.

Key-features questions (KFQs) have proved to be effective in the assessment of clinical reasoning skills by providing clinical vignettes and asking the focus approach to the problems^{14, 15}. However, the use of KFQs to assess situation awareness and decision making is still limited. This study aimed to explore the situation awareness and decision-making skills for perioperative crisis management in medical students using KFQs by applying the ANTS and MSNTS frameworks as the key answers.

Materials and Methods

The protocol was approved by the local ethical committee (SIRB 425/2014) and the consent was waived due to the retrospective nature of the study. The study was based upon 260 5th year medical students rotated to an anesthesia clerkship from March 2013 to January 2014. One of the objectives of the 2-week rotation was to be able to diagnose and manage a simple perioperative crisis, which was taught by clinical attachment with anesthesia supervisors and six simulation sessions for groups of 3–4 medical students. The assessment of clinical reasoning skills was performed by the KFQs about the crisis management of either the cardiovascular system (CVS) or respiratory system (RS).

Sample questions

1. At the surgical ward, the postoperative colectomy patient was feeling restless and sweating. The monitoring is shown in this picture. What would you do to take care of this patient?

2. Ten minutes after arrival at the post-anesthesia care unit, you are called to see a 70-y-old woman after hip fracture surgery under general anesthesia. The nurse said she has 'noisy breathing' and the SpO₂ went down from 98 to 92. What would you do to approach to this patient's problem?

Two researchers made this framework together to assess the medical students' NTS based on the ANTS and MSNTS behavioral marker systems^{3,6}, by selecting only the cognitive parts that could be assessed by KFQs. The detailed answer, score, and passing standards in each element was specified in the scorecard. Situation awareness was assessed, in terms of how the students gathered information by history taking, assessed the patient's condition, essential physical examination, and detection of the problems. Decision making was assessed in terms of the differential diagnosis answered, the



Figure 1 An example question on a cardiovascular crisis episode.

initial management, and specific management. The consultation and calling for help noted in the answers was also counted as part of the decision-making process. The detailed answers according to NTS category and element were demonstrated in Table 1.

The KFQ answers were independently and retrospectively reviewed by two raters using the predefined scorecard. The answers that met the pass standard of both raters were counted as passed.

All statistical analyses were performed using SPSS Statistics version 21 for Windows (SPSS, Inc., Chicago, IL, USA). Categorical data are shown as the number and percentage.

Results

From the 260 KFQs answers that were reviewed and scored, there were 153 and 107 KFQs for a CVS crisis and a RS crisis, respectively. Of these, 211 KFQs answers (81.2%) met the pass the standard at level I of situation awareness (gathering information), while 247 (95%) and 139 answers (53.5%) met the pass standard at levels II (recognizing and understanding information) and III (anticipating), respectively. In the decision making category, 169 (65.0%), 77 (29.6%), and 134 (51.5%) answers met the pass standard for identifying options, balancing risks and selecting options, and reviewing decisions, respectively. The KFQs were also divided into the CVS and RS crisis managements, with the number and percentage of the answers that passed the standard being shown in Table 2.

Discussion

This study demonstrated an adequate level of situation awareness in medical students for crisis management using the ANTS and MSNTS frameworks to analyze the answers of KFQs.

Table 1 Details of the NTS assessment by rating key answers

NTS category	Element	Answers
Situation awareness	Gathering information	History taking Essential physical examination Assess the patient's condition
	Recognizing and understanding information	Detection of problem
	Anticipating	Initial management
Decision making	Identifying options	Differential diagnosis
	Balancing risks and selecting options	Resuscitation and correct the cause
	Re-evaluating	Re-evaluation after the treatment
Escalating care	Incorporates concerns in request for help from senior	Call for help

Table 2 Numbers and percentage of KFQ answers from medical students that met the pass standard

NTS category	Element	N (%) of the answers passed (n = 260)	CVS crisis (n = 153)	RS crisis (n = 107)
Situation awareness	Gathering information	211 (81.2%)	127 (83.0%)	84 (78.5%)
	Recognizing and understanding information	247 (95.0%)	141 (92.2%)	106 (99.0%)
	Anticipating	139 (53.5%)	76 (49.7%)	63 (58.9%)
Decision making	Identifying options	169 (65.0%)	106 (69.3%)	63 (58.9%)
	Balancing risks and selecting options	77 (29.6%)	129 (84.3%)	57 (53.3%)
	Re-evaluating	134 (51.5%)	91 (59.5%)	43 (40.2%)
Escalating care	Incorporates concerns in request for help from senior	62 (23.8%)	54 (35.3%)	8 (7.5%)

However, the decision-making processes in all elements were lacking in medical students.

This study reports the use of KFQs to assess the situation awareness and decision making in 5th year medical students by applying the ANTS and MSNTS frameworks to the KFQs. Previously, KFQs have been shown to be favorable for the assessment of clinical reasoning skills by exploring the cognitive processes of the students^{14,15}. Assessment of the situation awareness and decision-making in medical students is usually performed by simulation- or workplace-based assessment^{16,17}. However, the observed behaviors only measure the product with a limited understanding of the processes of underlying reasons for the behaviors¹⁸. Incorporating a NTS framework within the KFQs could have a beneficial effect on assessing both the process and product of these cognitive skills.

Medical students demonstrated a sufficient a level of situation awareness to meet the pass standard at levels I and II, but not at level III. Gathering and interpreting information in situation

awareness levels I and II was developed from collecting and organizing knowledge as well as retrieving the data as part of the cognitive information processing^{18,19}. However, the limited capability of situation awareness at level III, which was anticipating the problem, which is a higher order of thinking especially in dynamic situations, such as perioperative crisis management, requires the problem to address the curriculum and training program¹⁹. This could be due to the lower level that learners usually focus on for technical skills rather than the NTS^{20,21}. The earlier integration of NTS training in crisis management together with technical skills might improve the students' motivation to learn NTS. Decision making in crisis management is the dynamic process that happens after level III situation awareness^{19,22}. Fifth-year medical students demonstrated an acceptable ability in identifying options for making differential diagnoses. But the further processes of decision making, balancing risk, and then selecting options and re-evaluating were at a low level.

The problem in the decision-making process may be a consequence of a low situation awareness at level III²³. When comparing between experts and novices in making medical decisions, novices tended to use analytical methods over heuristic approaches²³. Using KFQs to assess decision making allowed the students more time with less pressure in the analytic process than with simulation- or workplace-based assessments¹⁴. The assessment process in this study mainly aimed to assess detailed analytic decision making, which makes it more suitable for medical students in practicing decision making²⁴.

The importance of medical students to know their own limitation in escalating concerns and to seek support early has been introduced into the MSNTS framework⁶. This study reported a very low level of escalating concerns by calling for help from seniors. However, the study of Sturman and colleagues revealed newly graduated doctors have a low threshold level to seek help²⁵. Moreover, the study by Wald et al. demonstrated the students' attitude to call for help early in simulation sessions, which could be transferred to clinical settings more easily²⁶. This dissimilarity could be due to the low fidelity of the KFQs settings compared to the higher fidelity of simulation- and workplace-based contexts.

This study has some limitations. First, the retrospective nature of the study in that the previously designed KFQs may have some information that is not relevant to the assessment framework. Moreover, even though we focused on the analytic thinking process, the unreal and low fidelity of the KFQs could make the outcome difficult to transfer to real crisis management settings. Using this method in addition to simulation-based settings would be valuable in learning and assessing situation awareness and decision making skills in crisis management.

Conclusion

The cognitive parts of NTS, such as situation awareness, decision making, and escalating concerns can be assessed by KFQs. Fifth-year medical students demonstrated a sufficient level of situation awareness levels I and II, but their decision making ability was low at all levels.

Author contributions

Busara Sirivanasandha: conception of the work, data collection, data analysis and interpretation, drafting the article, and final approval of the version to be published.

Kasana Raksamani: conception of the work, design of the work, drafting the article, critical revision of the article, and final approval of the version to be published.

Pichaya Waitayawinyu: conception of the work, design of the work, drafting the article, and final approval of the version to be published.

Saowaphak Lapmahapaisan: design of the work, data analysis and interpretation, and final approval of the version to be published.

Patiparn Toomtong: conception of the work, design of the work, data collection, data analysis and interpretation, and final approval of the version to be published.

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