Medical Council of Canada

GUIDELINES FOR THE

DEVELOPMENT

OF KEY FEATURE

PROBLEMS & TEST CASES

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PREFACE

Dear reader-user:

As a member of one of the Medical Council of Canada (MCC) Test Committees or as a participant of a workshop, one of the tasks assigned to you will be the development or review of key features problems in your general area of expertise for the clinical decision-making (CDM) section of the MCC Qualifying Examination (MCCQE) Part I. Although this may appear as a daunting task, it is a skill for which the MCC provides general guidelines to create well-constructed, reliable and valid items for the CDM component of the MCCQE Part I.

This booklet will help guide you towards developing good CDM problems and test cases by reviewing basic rules pertaining to key features, clinical scenarios, write-in and short-menu questions, and scoring keys.

I would like to gratefully express my appreciation for the thorough review and editorial comments provided by Drs. Gordon Page and Georges Bordage.

I trust that you will find this guide useful. If you have any comments or suggestions for improving this set of guidelines, please forward them to me through the MCC CDM Test Committee.

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Chair, MCC CDM Examination Committee

1. INTRODUCTION

The key features problem format, first discussed at the Cambridge Conference in 1984, was originally included in the MCC's Qualifying Examination (MCCQE) Part I in 1992 to replace Patient Management Problems (PMPs) and to avoid a sole reliance on multiple-choice questions as the basis for judging qualification for licensure. Key features problems have subsequently been adopted by other groups, including medical schools for in-house examinations and colleges of physicians for use in certification and fellowship examinations.

The key features problem format is based on the concept of "case specificity", namely that clinical performance on one problem is not a good predictor of performance on other problems. Typically, less than 10 to 15% of the variance in performance in one problem is shared with any other problem. Consequently, assessments of clinical performance need to sample broadly because skills do not generalize across problems. In order to sample broadly in a fixed amount of time (3-4 hours), assessment is best served by focusing exclusively on the unique challenges, that is, the key features, in the resolution of each problem, be they essential issues or specific difficulties.

When the key features approach was implemented in 1992, four main benefits were envisioned:

1. Broader sampling of cases with increased reliability (compared to PMPs);
2. More focused assessment of case-specific clinical decisions, that is, the key features;
3. Varied response formats to accommodate question types compared to the unique latent-image format of PMPs; and
4. Defensible pass-fail decisions.

The development of key features problems for the Clinical Decision Making (CDM), formerly Clinical Reasoning Skills (CRS), part of the MCCQE Part I has been guided by psychometric considerations of content validity and test score reliability, and by sound principles of test construction. Key features problems provide a great deal of flexibility on issues of question format, multiple responses to questions, and scoring criteria.

Although not as reliable overall as multiple-choice questions (MCQ), which can be delivered in much larger sample sizes within the same amount of time, key features problems have nevertheless been found to be useful in the assessment of clinical decision-making skills that require not only medical knowledge but the ability to apply that knowledge within clinical scenarios requiring critical decisions at specific decision points during the assessment and management of the case. These specific critical decision points are what constitute the "key features" of the case.

Since November 2000, the MCCQE Part I is a computer-based examination. The multiple-choice question component is an adaptive test during which decisions are made by a computer-based algorithm to present less difficult or more difficult questions depending on whether or not an examinee has answered correctly or not. In the change from a paper-and-pencil examination, the clinical decision-making component was transformed into a multi-form examination whereby examinees are administered one of several parallel forms, each form containing a certain number of cases. A statistical equating design was chosen to construct the groupings of clinical cases based on content as well as psychometric criteria. Clinical cases are grouped in sets of cases called caselets. Caselets are comprised of 6 clinical cases covering the following major areas of medicine: medicine, obstetrics-gynecology, pediatrics, psychiatry, surgery, and population health, ethical, legal, and organizational aspects of medicine.

In developing key features problems for the MCCQE Part I, the following context must be kept in mind when preparing test items:

"The Medical Council of Canada Qualifying Examination Part I assesses the competency of candidates after obtaining the MD degree for entry into <u>supervised</u> clinical practice in postgraduate training programs with respect to their knowledge, clinical decision-making skills and attitudes as defined by the MCC Objectives."

2. TESTING CLINICAL DECISION-MAKING VERSUS KNOWLEDGE

Key features problems are designed to specifically assess decision-making skills rather than recall of factual knowledge. While knowledge is obviously a very important requisite for effective problem-solving, the challenge posed by key features problems is the application of knowledge to the resolution of a problem — that is, the use of knowledge to guide decisions to elicit clinical clues, to formulate diagnostic impressions, to order investigative or follow-up procedures, to acquire data to monitor a course of action or evaluate the severity or probability of an outcome, or to select a management course. For example, key features problems should not assess examinees' ability "to describe features of delirium tremens" (a knowledge issue); rather, they should assess their ability "to recognize delirium tremens in a specific patient" (a clinical reasoning issue) and "to prescribe appropriate therapeutic measures" (a clinical decision issue). The distinction is not just semantic but focuses on different skills. While it may be easier to list the cardinal features of delirium tremens, it may be altogether different and more challenging to recognize delirium tremens within a clinical scenario and to prescribe an appropriate course of action.

The line between testing knowledge and testing clinical decision making may become thin when a particular key feature hinges on the possession of a single piece of factual knowledge. For example, the key feature "Prescribe the appropriate dose of diazepam for a prolonged convulsion (status epilepticus)", is an example of this situation. If this clinical action is recognized as a critical step in the resolution of the problem of prolonged convulsion, that is, a key feature for this problem, then it may be tested using a key features problem format.

The following example provides an illustration of questions that test only recall of knowledge versus clinical decisions and actions. Such "recall of knowledge" questions should not be used in a key features problem.

A 20-year-old nulliparous type I diabetic woman presents to your office to discuss the complications of diabetes in pregnancy.

1. What are the maternal complications of type I diabetes in pregnancy? List up to four.

    1. _____

    2. _____

    3. _____

    4. _____

2. What are the fetal complications of type I diabetes in pregnancy? List up to two.

    1. _____

    2. _____

The concerns with such questions are that they only test the recall of factual information and that they could in fact be presented independently of the case. That is, the clinical scenario is not necessary to answer the questions. To improve this situation, the case could be re-written to present a poorly controlled diabetic pregnancy. The first question could then ask, "Which investigations would you order at this time?". A general rule to keep in mind when developing a key features problem is that if the question asked can be answered without reference to the attached clinical scenario, then it is not a good question and is likely not measuring clinical decision making.

3. KEY FEATURES CONCEPT

The term "key features" was introduced by Bordage and Page following a review and analysis by Norman et al (1985) of the research on the nature and assessment of CDM skills. A key feature is defined as:

1. a critical or essential step(s) in the resolution of a problem,
2. a step(s) in which examinees (in our case, graduating medical students) are most likely to make errors in the resolution of the problem, or
3. a difficult or challenging aspect in the identification and management of the problem in practice.

The use of key features facilitates the development of clinical problems that are more discriminating measures of competence. The definition of a key feature highlights the fact that not all steps in the resolution of a problem are equally important and that testing time is better spent by focusing on evaluating the critical or challenging steps, the key features. The key features represent discriminating features between successful and unsuccessful candidates.

The concept of key features represents two important shifts from traditional positions in the assessment of clinical competence. First, it shifts emphasis from the methods of assessment to the object of assessment. The first question to be addressed in developing a key features problem is, **"What is the problem that is to be assessed?"**; selection of the problem must be guided by and directly linked to the MCCQE objectives. Once the MCCQE objective-linked problem has been selected, the next question to tackle is, **"What are the critical, essential, or challenging elements in the resolution of this problem?**," that is, "What are this problem's key features that should be assessed?". The subsequent question is then, "Which method or methods are best suited to measure the key features for this particular problem?" Thus, the object of assessment is clearly linked to the MCCQE objectives and the methods are adapted to the object. Second, key features shift the emphasis from assessing all aspects of solving a problem to assessing only the essential elements relative to each problem. This shift recognizes that the essential elements in resolving a problem are unique or specific to each problem (referred to as "case specificity"). For some problems, the key features may pertain to data gathering or data interpretation while for others they may focus on choosing an appropriate therapeutic or follow-up plan.

Key features are often unique to different cases or presentations of a clinical problem, as they may vary relative to the clinical presentation of the problem and relative to other issues such as the patient's age and gender. It is therefore unusual to have a "generic" set of key features for a specific clinical problem. For example, the critical elements in the resolution of a diabetic problem as a life-threatening event (e.g., coma) are quite different from those of a diabetic problem presenting as an undifferentiated complaint (e.g., fatigue in an adolescent); and the critical elements in resolving a problem of respiratory failure in a 18-year-old man may differ from those for a similar problem in a 70-year-old woman.

The key features problem format is appealing for assessing CDM skills. The clinical problems are relatively short and focus only on a few critical elements of problem resolution (i.e., the key features), permitting more problems to be included on an examination within a fixed period of time (e.g., 30-40 key feature cases compared to 10-12 PMPs in a half-day exam). This broader sampling of problems has direct implications for improving the reliability of examination scores. The key features problem format also permits a flexible approach to question format, the number of options to choose from, and instructions regarding the number of allowable responses. More specifically, the short-answer question format is available for situations where cueing from a list of options would compromise measurement of the decision-making process of the examinee, or where listing options would provide too great a crutch to weaker examinees, the individuals to whom the entire examination process is most often directed. Finally, the scoring keys are flexible in terms of the number and configuration of correct responses to a question and can accommodate the complexity and configurations of actions often required in the resolution of clinical problems.

A focus on critical steps and broad sampling of problems (36 cases with respect to the MCCQE Part I) provide a foundation for the content validity of a key features problem examination format. That is, if such an examination is constructed from a carefully developed blueprint, it will consist of a representative and adequate sample of clinical problems from the domain of problems for which examinees are responsible and the questions within each problem will test only the important steps in its resolution—each problem's key features. Flexibility in formats and scoring keys emphasizes the strengths of this problem-based examination format in accommodating the realities and complexities of clinical medicine.

4. WRITING KEY FEATURE PROBLEMS

4.1 PROBLEM DEFINITION

To ensure content validity of a key features-based clinical decision-making examination, it is imperative to select a representative sample of problems from the entire spectrum of clinical problems for which the candidates are held accountable. For the MCCQE Part I, this spectrum is provided by the statements of discipline-based objectives that the MCC produces for its Qualifying Examination (MCCQE objectives). Within these objectives are lists of clinical presentations and problems that a graduating student should be competent in assessing. Each presentation or problem is expressed as a presenting complaint (e.g., abdominal pain) or a clinical problem (e.g., abdominal mass) and is accompanied by a list of pertinent diagnoses such as appendicitis, myocardial infarction, pneumothorax, migraine, cystitis, acute gastroenteritis, etc. Collectively the clinical presentations and problems listed in the MCCQE objectives are those from which a sample is drawn for the key features-based CDM examination.

The clinical presentations of problems on the CDM examination are described in the way in which the problem would be presented by a patient to a physician and can be classified in one or more of the following clinical situations:

- an undifferentiated complaint;
- a single typical problem;
- a multiple or multi-system problem;
- a life-threatening event; and
- preventive care and health promotion.

One or more of these clinical situations must be chosen for each problem to be assessed. The ones selected will influence the definition of the key features for that problem. At the level of a graduating medical student, it is advisable to select primarily typical presentations of clinical problems. When atypical presentations are used, most students will fail to effectively resolve them and the problem loses its discrimination capability.

Occasionally, there are also population (public) health, ethical, legal, or organizational aspects of medicine decisions or actions that represent key steps in the problem's resolution. Using the MCCQE C$_2$LEO objectives, these decisions may be included in the statement of the problem's key features and questions can be developed to test these decisions.

Hence, the problem definition process should begin with selection of an appropriate problem from the list of MCCQE objectives (e.g., Abdominal Pain, Acute), followed by selection of a patient life span period (e.g., adult) and a clinical situation (e.g., life-threatening event). Only once these elements have been selected can the development of key features proceed.

4.2 SELECTING KEY FEATURES

The process of defining key features for a problem can be approached in several ways. One straightforward approach, as described above, is to select a clinical problem (e.g., shortness of breath on exertion), an age group (e.g., adult), and a clinical situation (e.g., an undifferentiated complaint), and then address the question, "What are the critical steps in the resolution of this problem for patients of this age group presenting in this way?" This approach often leads to a narrow statement of a problem's key features, as it is specific to only one presentation of the problem.

It may also be useful to take a more general approach to defining key features and address the following question for a selected problem and age group, "What are the critical steps in the resolution of this problem for patients in this age group?" In answering this question, it is extremely useful to think of instances of patients in which the clinical problem presented in different ways (e.g., as an undifferentiated complaint, as a life threatening event, as a multiple problem, etc). This second approach to defining key features may be more productive in defining a broader set of key features, some of which are common to different clinical presentations of the problem. Furthermore, this approach can be further generalized by not specifying an age group and then including age as part of the "given clinical information" in the statement of the key features. When key features are more broadly defined in these ways, and a case is developed to portray this problem on the examination, it may turn out that not all key features defined are relevant to the case, and thus cannot be tested. Experience has shown that two to three key features can typically be tested by one case - that is, there are two to three critical steps in its resolution. Some cases have been found to possess as few as one key feature (and may risk not being very effective for testing clinical decision-making skills) and others may have as many as five. From a psychometric perspective, 2 to 3 key features (or questions) per case optimizes reliability and efficient use of limited examination time (Norman et al, 2006).

The second more general approach to defining key features outlined above is preferable. In summary, it entails the following steps:

1. Select a clinical problem from the list of MCCQE objectives (and an age group).
2. Pose the question, "**What are the critical steps in the resolution of this problem (for patients in this age group)?**"
3. Think of instances — patients who present in different clinical situations (i.e., an undifferentiated complaint; a single typical problem; a multiple or multi-system problem; a life-threatening event; or preventive care and health promotion) with this problem.
4. List the key features for these patients, some that will be unique to specific patients, others that will be common across patients.
5. Using 2 to 3 key features, select a case and write the case scenario (see 4.3 Developing Case Scenarios).
6. Write questions and scoring keys that test the key features of the case (see 4.4 Question Formats and 4.5 Scoring Keys).

The development of good key features can be challenging and the opportunity to present key features for review and refinement to colleagues or to other test committee members is a necessary step in the process, especially for authors inexperienced in defining key features. Novice authors often possess an initial reluctance to give up testing all aspects of the problem, from presenting complaint to follow-up, in contrast to selectively focusing on only the few critical decisions and actions and consequently giving credit only for those decisions or actions. Discussions of key features with colleagues should focus on such questions as, "Is the critical issue in this problem one of interpreting the data, or is it one of eliciting the data?" This distinction will result in asking very different questions on the examination. If interpretation is the issue, then clinical data are given and the examinee is asked questions aimed at interpretation (see Example **5.1 Clinical Problem** #1). If data acquisition is the issue, then a complaint is given and the examinee is asked to identify the specific data that would be elicited from the patient (see Example **5.2 Clinical Problem** #2). The clarity of a key feature is as important as the clarity of a research question in a research study or an instructional objective in a teaching session. If the key feature is clear, all other aspects of case development will readily unfold.

The process of defining key features can be frustrating if problems are defined too broadly. For example, it would be difficult to define key features for the general problem areas "cardiovascular ischemic disorder" and "alcohol abuse," but not for the problems "stable and unstable angina" and "alcohol withdrawal." Alternately, selecting a single patient as the basis for defining key features provides too narrow a view of the problem and may inappropriately restrict the definition of key features.

Each key-feature statement should contain two or three components:

- initial clinical information (i.e., "Given an adult patient presenting with …"),
- a clinical task (e.g., "… the examination candidate will order investigations including …"), and
- if necessary, a qualifier(s) may be added (e.g., "order initial investigations").

The "initial clinical information" can consist of signs or symptoms, diagnoses, or laboratory test results (e.g., "Given a patient complaining of a swollen and/or painful leg …") depending on the nature of the key features tested. The "clinical task" is a critical step, decision, or action, that is, the key feature, in the diagnosis and/or management of the problem (e.g., "… include DVT in a differential diagnosis" or "… elicit risk factors" or "… order a venogram"). A statement of a key feature may also contain a third component that is a qualifier for the clinical task; for example, "… identify the **initial** action that would be taken" or "… select the **most important** investigation(s)" or "… list the **most likely** diagnosis(es)".

One should avoid non-specific description of steps or actions in key features, such as "manage appropriately" or "order appropriate investigations". Rather, key feature steps or actions should be stated as specifically as possible (e.g., "prescribe morphine" or "order an arterial blood gas"). In additions, avoid combining key features into one statement, such as "include DVT in a differential diagnosis and order a venogram". This statement should be separated into two distinct key features that should be measured by two separate questions.

4.3   DEVELOPING CASE SCENARIOS

After defining the problem's key features, a clinical case scenario must be developed to represent the problem and its key features on the examination. Case scenarios can vary considerably in length. For problems whose key features emphasize the diagnostic work-up of the patient, the scenario is often very brief. For problems in which the critical steps focus on laboratory or management issues, the scenario will typically be longer and contain clinical data derived from history taking, physical examination, and/or initial laboratory data.

The usual elements common to any case scenario include the patient's age and gender, the setting of the encounter, and the patient's presenting condition or reason for seeking care, followed by whatever clinical details are required prior to the presentation of the first question.

Use of lay language descriptions are also preferred over use of medical terminology or jargon ("medicalese"). In real life the information available to the candidates are lay terms (e.g., coughing up blood), not medicalese (i.e., hemoptysis). When clinical scenarios are presented using medicalese (such as "Homan's sign"), candidates are more likely to accurately identify the correct responses. The use of "medicalese" has the effect of "cueing" and decreases the discriminating ability of the clinical decision-making examination format. The use of lay language descriptions (such as "painful calf muscle") is more challenging for weaker candidates and increases the discrimination factor of the key feature being measured.

4.4   QUESTION FORMATS

Generally, one question tests one key feature. On some occasions a question may be used to test more than one key feature (see Example **5.3 Clinical Problem** #3, Question #2). Also, it is usually possible to test for all key features using one case scenario, but again there are exceptions. Issues of excessive cueing across questions make it necessary, at times, to select a second case and develop a second case scenario to test the remaining key features. The second case would be separated from the first during the delivery of the examination, and presented in such a way that it would not be readily recognized as related to the first.

The question stem consists of a direct formulation; for example, "What is your leading diagnosis at this point in time?", compared to incomplete sentences that would be completed by an examinee's responses (e.g., "Your leading diagnosis at this point in time is _____".). A second sentence provides instructions regarding the number of permissible responses, for example, "List up to four". If the question is not the first in a series of questions pertaining to the clinical scenario, it may also present additional information, for example, "The patient has now been in the hospital for two days, and his condition ... What treatment would you now recommend?". The instructions regarding the number of responses permitted can be stated in several different ways, such as "Select up to x", or "Select only one," or "Select as many as are appropriate". "Select up to x" is a suitable instruction for questions in which one or more answers are sought and for which the number of opportunities for examinees to provide these answers should be capped. The number "x" that is defined in the instruction considers the number of correct keyed responses sought, together with other factors such as responses that would be reasonable but are not keyed (e.g., general screening questions in a history-taking question). Also, the number "x" commonly provides a buffer for examinees to select some incorrect responses (e.g., if four correct responses are sought, five or six responses might be permitted). The instruction "Select only one" is used in questions requesting a single definitive answer, for example, one leading diagnosis. "Select as many as are appropriate" is a more challenging instruction and is used in situations where it is useful to determine how many actions an examinee might take. For example, does the examinee over investigate the patient? For questions using this instruction, a maximum allowable number of responses is stipulated in the question's scoring key, but the examination candidate is blinded to this limit.

Two formats of questions are recommended for clinical decision-making cases: short-answer "write-in" (WI) and "short-menu" (SM). In the WI format, examinees supply their responses. In the SM format, examinees select their responses from prepared lists of options presented with individual questions. The number of options in these lists varies relative to what the questions are testing. In general there are typically 15-20 options, but the numbers can range from as few as 6 to as many as 45. To avoid cueing, the lists of options should be presented in ascending alphabetical order (other methods may also be used; however the presentation should not confuse the candidate). The lists of options must, of course, contain all keyed correct responses plus incorrect responses and common misconceptions (i.e., distractors) in sufficient numbers to reduce guessing effects. The lists may also contain correct options that are not scored as they are not integral to the key feature(s) being assessed. Such correct non-scored options serve as neutral distractors and must be taken into consideration when determining the total allowable number of responses. In general, the total number of options in a SM question should equal two to three times the number of correct keyed responses. An excellent way to generate and refine option lists for SM questions is to pilot test the question as a WI question and then use the examinees' incorrect responses as a source of "distractor" options for the short menu.

The sample problems in the next section of these guidelines illustrate both WI and SM formats. It is recommended that the use of the WI format be limited to questions that test for diagnoses and treatments (see Example **5.3 Clinical Problem #3**, Questions #1 and #2). It is in these questions that cueing provided by lists of options is of most concern. Questions testing for diagnoses and treatments are also most readily marked in the WI format, which is not the case for questions testing issues of history taking and physical examination, to which examinees can phrase responses in many equivalent ways. Questions that test issues of laboratory investigation are naturally presented in a SM "laboratory sheet" format (see Example **5.3 Clinical Problem #3**, Question #4).

Studies of the MCCQE Part I CDM examination data have found that WI questions tend to be more discriminating than SM questions, and therefore are more effective at identifying weaker candidates.

4.5 SCORING KEYS

A scoring key consists of the list of the correct responses to a question and a system of assigning numerical scores to these keyed responses. The correct scored responses should directly reflect the key feature(s) being assessed. All the correct answers appearing in the scoring key should be part of the key feature(s), no more no less. Some scoring keys contain only a single response (see Example **5.1 Clinical Problem #1**, Question #1). Other scoring keys contain several responses and, in addition, the responses may be clustered on the basis of logical considerations regarding the correct clinical actions to be taken (see Examples **5.2 Clinical Problem #2**, Question #2 and **5.3 Clinical Problem #3**, Question #3).

Scoring keys for each question define the responses needed to produce a score of "1" for the question. Scoring keys assign a weight to each correct response – such as the same weight of 0.25 to each of four correct responses. Alternately, some responses could be considered more important than others and assigned larger weights. As a general rule, use of equal weighing is preferred (see Examples **5.3 Clinical Problem #3**, Questions #3 and #4 and **5.4 Clinical Problem #4**, Question #2), since research has shown that differential weighting (see Example **5.3 Clinical Problem #3**, Question #2) does not improve score reliability and is therefore an inefficient use of time determining the weighted scores. Some scoring keys also list responses that result in a score of "0" no matter what other responses an examinee makes (see Examples **5.1 Clinical Problem #1**, Question #2 and **5.4 Clinical Problem #4**, Question #2). These so-called "killer" responses are usually actions that are dangerous or harmful (e.g., unnecessary invasive investigation or harmful treatment) where no safety net exists that would detect and prevent the dangerous/harmful action.

Whatever weights are assigned to keyed correct responses, they should sum to "1" so that each question within a problem is given a maximum score of "1" and a minimum score of "0" (see Example **5.3 Clinical Problem #3**, Question #2). Question scores within problems are then averaged so that each clinical problem on the examination has a maximum score of "1". Examination scores are then the sum of problem scores. This summing procedure ensures that questions have equal weighting within a case and that cases have equal weighting across the entire examination.

5. EXAMPLES OF KEY FEATURES PROBLEMS

5.1 Clinical Problem #1

Author   Dr. X

Problem   1

Clinical Problem   Third Trimester Bleeding

MCC Objective   Antepartum Care (80-1-E)

Discipline   OBGYN

Life Span Period
- ___ pregnancy/neonatal/infant (up to 1 year)
- ___ pediatric (1-11 years)
- ___ adolescence (12-18 years)
- ✓ adult (19-64 years)
- ___ geriatric (over 65 years)

Clinical Situation
- ___ undifferentiated complaint
- ✓ single typical problem
- ___ multiple or multisystem problem
- ___ life-threatening event
- ___ preventive care and health promotion

Location/Setting -   Emergency Department

Patient's Age   **-**   20-30 years

Patient's Gender -   Female

Key Features

Given a pregnant woman experiencing third-trimester vaginal bleeding with no abdominal pain, the candidate will:

1. Consider placenta previa as a leading diagnosis

2. Avoid performing a pelvic examination because it may cause fatal bleeding

3. Avoid discharging home from the emergency department

4. Order pelvic ultrasound to confirm placenta location

Comments

Clinical Tasks – data acquisition, data interpretation.

Case Scenario

A 24-year-old G3P2 woman, 31 weeks pregnant, comes to the emergency room at 8:00 pm complaining of bright red bleeding coming from her vagina for the past two hours. The three sanitary napkins that she used were completely soaked. Her pregnancy has been uneventful, as were the previous ones. She has not had any contractions or abdominal pain. The fetus is moving as usual.

Her BP is 110/70 mm Hg, and her pulse is 92/min. The examination of the abdomen reveals a uterine height of 31 cm with a soft and nontender uterus. The fetus is in a breech position and has a heart rate of 150/min. No active bleeding has occurred since she arrived 25 minutes ago.

Question 1   **Format WI**

What is your leading diagnosis at this time? List only one or write "normal" if you judge Jennifer's situation to be within normal limits.

    1.   _____

Key Feature   1.   Given a pregnant woman experiencing third trimester vaginal bleeding with no abdominal pain, the candidate will consider placenta previa as a leading diagnosis.

Scoring Key

Score	Criteria	Synonyms
1.0	Placenta previa	Marginal placenta, low placenta, low insertion
0	Listing more than one response	

Question 2   **Format SM**

What steps would you take in your immediate assessment and management of this patient? Select as many as are appropriate.

1.   Artificial rupture of membranes
2.   Cervical swab for chlamydia and gonococcus
3.   Complete blood count
4.   Computed tomographic scan of abdomen and pelvis
5.   Cross and match for 2 units of blood
6.   Human immunodeficiency virus serology
7.   Insert large bore intravenous line
8.   Insert fetal scalp monitor to assess status of fetus
9.   International normalized ratio (INR)
10.   Partial thromboplastin time (PTT)
11.   Pelvic ultrasound
12.   Pelvic examination

13. Syphilis serology
14. Ultrasound using vaginal probe
15. Vaginal swab for Group B streptococcus
16. Discharge home with instructions to come back if bleeding starts again

Key Features   Given a pregnant woman experiencing third trimester vaginal bleeding with no abdominal pain, the candidate will:

2. Avoid performing a pelvic examination because it may cause fatal bleeding

3. Avoid discharging home from the emergency department

4. Order pelvic ultrasound to confirm placenta location

Scoring Key

Score	Criteria

1.0   #11.   Pelvic ultrasound

0   #1.   Artificial rupture of membranes
           #2.   Cervical swab for chlamydia and gonococcus
           #8.   Insert fetal scalp monitor to assess status of fetus
           #12.   Pelvic examination
           #14.   Ultrasound using vaginal probe
           #15.   Discharge home with instructions to come back if bleeding starts again
           Selecting more than six items

5.2   Clinical Problem #2

Author   Dr. Y

Problem   2

Clinical Problem   Painful Swollen Leg

MCC Objective   Unilateral/Local Edema (29-2-E)

Discipline   MED

Life Span Period
-    pregnancy/neonatal/infant (up to 1 year)
-    pediatric (1-11 years)
-    adolescence (12-18 years)
- ✓ adult (19-64 years)
-    geriatric (over 65 years)

Clinical Situation
-    undifferentiated complaint
- ✓ single typical problem
-    multiple problem or multisystem problem
-    life-threatening event
-    preventive care and health promotion

Location/Setting -   Outpatient Clinic

Patient's Age   -   55-65 years

Patient's Gender -   Male (or Female)

Key Features

Given an adult patient complaining of a painful, swollen calf, the candidate will:

1.   Include deep venous thrombosis in the differential diagnosis

2.   Elicit risk factors for deep venous thrombosis through the patient's history

Comments

Clinical Tasks – data acquisition

Case Scenario

A 56-year-old man consults you in the outpatient clinic because of pain in his left lower leg that began two days ago and has been getting progressively worse. He states his leg is tender below the knee and swollen around the ankle. He has never had a similar problem. His other leg is fine.

Question 1   Format WI

What diagnosis(es) would you consider at this time? List up to two.

    1.   _____

    2.   _____

            _____

Key Feature   1.   Given an adult patient complaining of a painful, swollen calf, the candidate will include deep venous thrombosis in the differential diagnosis.

Scoring Key

Score	Criteria	Synonyms
1.0	Deep venous thrombosis	Deep vein thrombosis, DVT
0	Listing more than two responses	

Question 2   Format SM

With respect to your diagnosis(es), what elements of his history would you particularly want to elicit? Select up to seven.

    1.   Alcohol intake
    2.   Allergies
    3.   Angina pectoris
    4.   Anti-inflammatory medication
    5.   Cigarette smoking
    6.   Colour of stools
    7.   Cough
    8.   Headache
    9.   Hematemesis
    10.   Impotence
    11.   Intermittent claudication
    12.   Low back pain
    13.   Nocturia
    14.   Palpitations
    15.   Paresthesias
    16.   Paroxysmal nocturnal dyspnea
    17.   Polydipsia
    18.   Previous back problems

19. Previous knee problems
20. Previous neoplasia
21. Previous urinary tract infection
22. Recent dental procedure
23. Recent intercontinental air travel
24. Recent sore throat
25. Recent surgery
26. Recent work environment

Key Feature   2.   Given an adult patient complaining of a painful, swollen calf, the candidate will elicit risk factors for deep venous thrombosis through the patient's history

Scoring Key

Score	**Criteria**

1.0   Must select at least five of the following six items:
                  #5.   Cigarette smoking
                  #19.   Previous knee problems
                  #20.   Previous neoplasia
                  #23.   Recent intercontinental air travel
                  #25.   Recent surgery
                  #26.   Recent work environment

0   Not selecting five of the above six items
                or
                Selecting more than seven items

5.3   Clinical Problem #3

Author   Dr. Z

Problem   3

Clinical Problem   Seizures

MCC Objective   Seizures (Epilepsy) (92-E)

Discipline   MED

Life Span Period
- _   pregnancy/neonatal/infant (up to 1 year)
- _   pediatric (1-11 years)
- _   adolescence (12-18 years)
- ✓   adult (19-64 years)
- _   geriatric (over 65 years)

Clinical Situation
- _   undifferentiated complaint
- ✓   single typical problem
- _   multiple problem or multisystem problem
- ✓   life-threatening event
- _   preventive care and health promotion

Location/Setting -   Emergency Department

Patient's Age   -   30-40 years

Patient's Gender -   Male (or Female)

Key Features

Given an adult brought to the emergency room with multiple seizures and without having regained consciousness, the candidate will:

1.   Generate a provisional diagnosis of status epilepticus

2.   Secure and maintain cardio-respiratory functions including monitoring respiration, blood pressure, and pulse (ABCs)

3.   Begin initial therapy including administration of intravenous vitamin B complex (thiamine), hypertonic glucose bolus (50% dextrose), and lorazepam or diazepam or clonazepam or phenobarbital AND phenytoin

4.   Elicit a history to identify possible causes of the seizures (including alcohol use, medications, illicit drugs, and diabetes history)

5. Order immediate investigations to identify potentially treatable causes of the seizures (including electrolytes, glucose, calcium, arterial blood gases, drug screen, and CT or MRI of brain)

Comments

Clinical Tasks – data acquisition, management

Case Scenario

A 36-year-old man is brought to the emergency room by ambulance because he fell onto a sidewalk unconscious while waiting for the bus. A witness immediately called an ambulance and reported to the ambulance crew that before falling to the ground, he seemed confused, agitated, and was arguing with some invisible person. After falling, he began to twitch for a short while, his face became blue, and then he began to have jerky movements all over his body for about a minute. He did not recover consciousness after the episode. During the 10-minute ambulance trip, he presented two other similar episodes, without recovering consciousness, and a third episode that you witnessed on arrival in the emergency room.

His temperature is 37.8 degrees C. He looks neglected and is unconscious. No relatives or friends accompanied the patient.

Question 1   Format WI

What is (are) your leading working diagnosis(es) at this point in time? List up to two.

1. _____

2. _____

Key Feature   1.   Given an adult brought to the emergency room with multiple seizures and without having regained consciousness, the candidate will generate a provisional diagnosis of status epilepticus

Scoring Key

Score	Criteria
1.0	Status epilepticus (Note: both elements required)
0	Listing more than two responses

Question 2   Format WI

What is your immediate management at this point in time (be specific)? List as many as are appropriate.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

Key Features   2.   Given an adult brought to the emergency room with multiple seizures and without having regained consciousness, the candidate will secure and maintain cardio-respiratory functions including monitoring respiration, blood pressure, and pulse (ABCs)

3.   Given an adult brought to the emergency room with multiple seizures and without having regained consciousness, the candidate will begin initial therapy including administration of intravenous vitamin B complex (thiamine), hypertonic glucose bolus (50% dextrose), and lorazepam or diazepam or clonazepam or phenobarbital AND phenytoin

Scoring Key

Score	Criteria	Synonyms
KF-2		
1.0	ABC or Airway-Breathing-Circulation	Monitor respirations AND blood pressure or pulse
KF-3		
0.25	IV Thiamine	IV Vitamin B complex (must mention IV)
0.25	IV Hypertonic glucose	50% dextrose (must mention IV)
0.5	IV Lorazepam	IV Diazepam, IV clonazepam, (must mention IV) IV Ativan, IV Valium, or IV phenobarbital
	AND IV Phenytoin	IV Dilantin (must mention IV)

Question 3　　　Format SM

Ten minutes after arrival, the patient is still unconscious. The nurse found a telephone number in his wallet. What questions will you ask the person answering the phone – assuming that he/she knows the patient? Select up to six questions or select option 33 if you think that it is not appropriate to call at this point in time.

1. Abdominal pain
2. Alcohol history
3. Back pain history
4. Cancer history
5. Cocaine abuse
6. Coronary bypass history
7. Diabetes history
8. Diarrhea
9. Dizziness
10. Drug allergy
11. Family history
12. Food allergy
13. Headache
14. Hearing disability
15. Heroin abuse
16. Joint pain
17. Lung infection
18. Medication history
19. Muscular disease
20. Nausea
21. Palpitation history
22. Pet in household
23. Previous similar problem
24. Profession
25. Sexual history
26. Smoking history
27. Social integration difficulties
28. Surgery
29. Travel history
30. Viral infection
31. Visual impairment
32. Vomiting
33. Not appropriate to call at this point in time

**Key Feature　　4.　　**Given an adult brought to the emergency room with multiple seizures and without having regained consciousness, the candidate will elicit a history to identify possible causes of the seizures (including alcohol use, medications, illicit drugs, and diabetes history)

Scoring Key

Score		Criteria

0.25   #2.   Alcohol history

0.25   #5.   Cocaine abuse
or
            #15.   Heroin abuse

0.25   #7.   Diabetes history

0.25   #18.   Medication history

0   #33.   Not appropriate to call at this point in time
or
Selecting more than six items

Question 4   Format SM

It has now been 15 minutes since the patient's arrival. What investigations would you order at this point? Select as many as are appropriate or select option 34 if you think that investigations are not needed at this point in time.

1. Alanine aminotransferase (ALT)
2. Alcohol level
3. Aldolase, serum
4. Alkaline phosphatase, serum
5. Amylase, serum
6. Arterial blood gases (ABG)
7. Aspartate aminotransferase (AST)
8. Brain computerized tomographic (CT)-scan
9. Brain magnetic resonance imaging (MRI)
10. Calcium, serum
11. Carotid ultrasound-doppler
12. Cerebral angiography
13. Cerebrospinal fluid examination
14. Complete blood count (CBC)
15. C-reactive protein
16. Creatine phosphokinase, serum
17. Creatinine, serum
18. Drug screening, serum
19. Drug screening, urine
20. Echovirus, serology
21. Electroencephalographic (EEG) recording
22. Electrolytes (Na, K, Cl)
23. gamma-Glutamyl transferase (GGT)
24. Glucose, serum
25. Lactate dehydrogenase, serum (LDH)

26. Lyme disease, serology
27. Protein electrophoresis, plasma
28. Syphilis, serology
29. T4, free
30. Temporal artery biopsy
31. Thyroid stimulating hormone (TSH)
32. Total protein, plasma
33. Urea, serum
34. No investigations needed at this point in time

Key Feature   5.   Given an adult brought to the emergency room with multiple seizures and without having regained consciousness, the candidate will order immediate investigations to identify potentially treatable causes of the seizures (including electrolytes, glucose, calcium, arterial blood gases, drug screen, and CT or MRI of brain)

Scoring Key

Score	Criteria	
0.17	#6.	Arterial blood gases (ABG)
0.17	#8.	Brain computerized tomographic (CT)-scan
	or	
	#9.	Brain magnetic resonance imaging (MRI)
0.17	#10.	Calcium, serum
0.17	#18.	Drug screening, serum
	or	
	#19.	Drug screening, urine
0.17	#22.	Electrolytes (Na, K, Cl)
0.17	#24.	Glucose, serum
0	#34.	No investigations needed at this point in time
	or	
	Selecting more than nine items	

5.4   Clinical Problem #4

Author   Dr. A

Problem   4

Clinical Problem   Diarrhea

MCC Objective   Acute Diarrhea (22-1-E)

Discipline   MED

Life Span Period
    ＿   pregnancy/neonatal/infant (up to 1 year)
    ＿   pediatric (1-11 years)
    ＿   adolescence (12-18 years)
    ✓   adult (19-64 years)
    ＿   geriatric (over 65 years)

Clinical Situation
    ＿   undifferentiated complaint
    ✓   single typical problem
    ＿   multiple problem or multisystem problem
    ＿   life-threatening event
    ✓   preventive care and health promotion

Location/Setting -   Physician's Office

Patient's Age   -   25-45 years

Patient's Gender -   Female (or Male)

Key Features

Given an adult patient with gastroenteritis and dehydration, the candidate will:

    1.   Initiate appropriate oral rehydration

    2.   Recommend infection control and public health measures, that is, collecting clinical specimens and exclusion of food handler from the workplace until asymptomatic

Comments

Clinical Tasks - management

Case Scenario

A 35-year-old mother of three presents to your office at 1700h with complaints of severe, watery diarrhea. On questioning, she indicates that it all started about 24 hours ago. She has had about 15 watery bowel movements in the past 24 hours, has been nauseated, but no vomiting. She works during the day as a cook in a restaurant but left work to come to your office. On her chart, your office nurse notes a resting blood pressure of 105/50 mm Hg supine (a pulse of 110/minute), 90/40 mm Hg standing, and an oral temperature of 36.8 degrees C. On physical examination, you find she has dry mucous membranes and active bowel sounds. A urinalysis (urine microscopy) was normal, with a specific gravity of 1.030.

Question 1   Format SM

How would you manage this patient at this point in time? Select up to three.

1.   Antidiarrheal medication

2.   Antiemetic medication

3.   Intravenous antibiotics

4.   Intravenous fluids

5.   Nasogastric tube and suction

6.   Nothing by mouth

7.   Oral antibiotics

8.   Oral fluids

9.   Rectal tube

10.   Send home with close follow up

11.   Surgical consultation

12.   Transfer to hospital

Key Feature   1.   Given an adult patient with gastroenteritis and dehydration, the candidate will initiate appropriate oral rehydration

Scoring Key

Score	Criteria
1.0	#8. Oral fluids
0	Selecting more than three items

Question 2   Format SM

After management of the patient's acute condition, what additional measures, if any, would you recommend? Select up to four or select "None" if none is appropriate.

1.   Avoid dairy products

2.   Colonoscopy

3.   Frequent handwashing

4.   Gastroenterology consultation

5.   Give immune serum globulin to close family contacts

6.   Infectious disease consultation

7.   Notify Public Health Authority

8.   Stool cultures

9.   Strict isolation of patient

10.   Temporary absence from work

11.   None

Key Feature   2.   Given an adult patient with gastroenteritis and dehydration, the candidate will recommend infection control and public health measures, that is, collecting clinical specimens and exclusion of food handler from the workplace until asymptomatic

Scoring Key

Score	Criteria
Score	**Criteria**
0.5	#8. Stool cultures
0.5	#10. Temporary absence from work
0	#5. Give immune serum globulin to close family contacts #11. None Selecting more than four items

6. CHECKLIST FOR THE DEVELOPMENT OF KEY FEATURES PROBLEMS

Guidelines for Defining the Clinical Problem (Chief Complaint) and the Clinical Situation

☐ Select the clinical problem or presenting complaint from the MCCQE list of objectives.

☐ Select gender and age range of the patient; only specify a precise age (e.g., 27) if that case specifically calls for a precise age, otherwise use a range (e.g., 20-29).

☐ Select a clinical situation(s) best suited to the chosen clinical problem:
1. Undifferentiated problem or complaint
2. Single typical or atypical problem
3. Multiple problem or multisystem involvement
4. Life-threatening situation
5. Preventive care and health promotion.

Guidelines for Developing Key Features

☐ Determine the critical or essential clinical decision-making steps for the resolution of the chosen clinical problem; answer the question, "**What are the critical steps or elements in the resolution of this clinical problem?**"

☐ Think of various patient presentations pertaining to the chosen clinical problem.

☐ Decide if the critical steps in resolving the problem require eliciting data, interpreting data, or managing the condition.

☐ Write specific key features pertaining to the chosen clinical problem.

☐ The key feature statement should be written in two or three parts:
1. The initial clinical information (i.e., "Given an adult patient presenting with …");
2. The clinical task (e.g., "… the examination candidate will order investigations including …"); and
3. If necessary, a qualifier(s) may be added (e.g., "order initial investigations")

☐ Avoid trying to assess all clinical decision-making steps in the resolution of a clinical problem. Focus only on the more challenging or discriminating essential steps, the difficult steps in practice where clinicians tend to go wrong.

☐ Discuss and review key features with colleagues and fellow committee members **before** developing a clinical scenario(s) for the key feature(s).

Guidelines for Developing Clinical Case Scenarios

☐ Case scenario should be based on clinical problem definitions (life span, clinical situation, specified age if applicable, specified gender if applicable) and key feature givens, up to the first key feature.

☐ Write short clinical scenarios if the key feature(s) is(are) primarily eliciting data; write longer clinical scenarios if key feature(s) is(are) requiring data interpretation or management.

☐ Use "real patient data" as much as possible; using factitious data can risk introducing inadvertent inconsistencies (i.e., incompatible laboratory values).

☐ Avoid the use of "medicalese" and technical jargon when writing the clinical scenario; use the words that the patient would actually say or describe the physical findings rather than giving the medical term (e.g., "finger nails and nail beds are normal" instead of "no clubbing.").

☐ Use of photos (i.e., skin rashes, radiographs, etc) is encouraged in the clinical decision-making examination format.

☐ Avoid the use of humor as this can potentially distract examinees.

Guidelines for Writing Questions

☐ Select the appropriate question format (write-in [WI] format preferred for differential diagnosis and treatment questions; short-menu [SM] format preferred for eliciting history or laboratory investigations).

☐ Decide on the appropriate instructions to accompany the question (i.e., "Select up to x", "Select only one," or "Select as many as are appropriate")

☐ In the SM format, there should be 2-3 times the number of choices in the list as there are correct responses; the list of choices may contain correct non-scored responses (i.e., not a key feature element), incorrect distractors, and dangerous options that would automatically give a "0" score if chosen.

☐ Distractors should be plausible; distractors should be developed with the acceptably competent medical graduate in mind; distractors should include content which is reflective of common misconceptions or errors which are not acceptable.

☐ Acceptable distractors:
  - are usually homogeneous in content (e.g., all are investigations or all are therapies)
  - may include correct answers that are not integral to the key feature(s) (i.e., neutral non-scoring distractors)
  - do not contain any hints to the correct answer
  - would seem plausible and attractive to the minimally competent medical graduate or one selecting an inappropriate course of action
  - are similar to the correct answer(s) in construction and length
  - are not mutually exclusive to each other or to information in the clinical scenario.

☐ In the SM format, the list of choices should appear in alphanumeric ascending order.

☐ In the WI format, the total number of allowable answers (y) should be limited to the expectation of how many opportunities (y) a medical graduate should have to include the correct response(s) within y number of opportunities.

☐ Avoid questions which can be answered without reference to the clinical scenario; such questions are likely not measuring clinical decision-making.

Guidelines for Preparing the Scoring Key

☐ All keyed correct scored responses must directly match the key feature(s).

☐ Use equal weighting systems if there is more than one correct response. Avoid use of differential weighting, unless one response is significantly more important than others.

☐ Each question receives a total score of "1"; hence, if more than one correct response within a question, weighted scores should add up to "1".

☐ If more than one key feature is being assessed by a question, the scoring key should give a score of "1" for each key feature that is scored in the answer key.

☐ Use of incorrect dangerous responses ("killers") that automatically receive a score of "0" regardless of other responses for that particular question should be used judiciously, as would be plausible in the given clinical situation and selected by weaker candidates.

☐ Include acceptable synonyms for keyed correct responses in WI questions, to facilitate scoring of such questions.

7. SAMPLE KEY FEATURES PROBLEM TEMPLATE

Key features problem specifications are broken down into 10 sections. Each key feature should link to the MCCQE objective which is being addressed by the problem (e.g., "Consider placenta previa as a leading diagnosis" for the problem of third trimester bleeding covered in MCCQE objective Antepartum Care #80-1-E). This provides information to help in the construction of the examination and helps to determine what clinical problems may be lacking in the item bank.

The following list provides the outline for designing key features problems, for review with committee members. Please refer to section **5. Examples of Key Features Problems** for more details and ideas on constructing key features problems. All committee members should submit key features problem materials using this template.

Author Dr. X

1. **Problem Number**

2. **Title of Clinical Problem**

3. **MCC Objective(s) from which Clinical Problem is derived**

4. **Disclipline** (list discipline/s in which Clinical Problem best fits; include both disciplines if more than one – e.g. MED/PHELO)

5. **Life Span Period** (check one)
   - pregnancy/neonatal/infant (up to 1 year)
   - pediatric (1-11 years)
   - adolescence (12-18 years)
   - adult (19-64 years)
   - geriatric (over 65 years)

6. **Clinical Situation** (check one or more)
   - undifferentiated complaint
   - single typical problem
   - multiple or multisystem problem
   - life-threatening event
   - preventive care and health promotion

7. **Identification of Location/Setting**

8. **Patient's Age** (specify only if essential to the case; otherwise give a range)

9. **Patient's Gender (specify only if essential to the case)**

10. **List of all Key Features for the Clinical Problem** (each key feature should be linked to the MCCQE objective(s) identified in #3 above)

11. **Dates of Revisions** (list all dates including initial date of problem development and any subsequent revision dates by month/year)

12. **Comments** (list all Clinical Tasks that are measured by the problem – e.g. data acquisition, data interpretation, management)

13. **Case Scenario (clinical problem stem required before asking the first question)**

14. **First and Subsequent Questions with Instructions (WI or SM format)**

15. **Scoring Key following each question with accompanying key feature(s) being assessed**

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