

How to write an image challenge multiple choice question

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THE PURPOSE OF THE IMAGE CHALLENGE

In each issue of *Heart*, we publish an image challenge which consists of a brief clinical vignette, an image and an accompanying multiple choice question (MCQ), followed by a short discussion. The goal of the image challenge is to make an educational point, so authors must reflect on what they wish to teach. The clarity of the educational point is often what distinguishes a strong image challenge which is accepted for publication from those that are not.

Even though the importance of a clearly defined teaching and testing point is self-evident, it is natural that the inspiration to write an image challenge occurs when an author encounters a remarkable image in clinical practice and wishes to share it. High-quality and engaging images are critical, but the best image challenge submissions are not show-and-tell, in which the image is primary and the MCQ and teaching point are perfunctory. Rather, the image should be used to augment a well-crafted MCQ.

MCQs, often maligned, can be effective educational tools; they require active learning, or what cognitive psychologists call 'retrieval practice', in which the reader deliberately recalls information which has been previously learnt.¹ Retrieval practice improves long-term retention of information and allows clinicians to later recall that information in 'real life' and apply that information to a variety of clinical scenarios.² For these reasons, question-based teaching helps readers retain and apply information and can facilitate the application of knowledge in ways that reading a case report does not.

THE COMPONENTS OF THE IMAGE CHALLENGE

Writing a high-quality MCQ is difficult. Fortunately, extensive scholarship details the best ways to write MCQs and the pitfalls to avoid. The National Board of Medical Examiners (NBME) publishes a

PDF (portable document format) on how to write MCQs which is a practical and accessible resource.³

As anyone who has taken a licensing or certification examination knows, medical MCQs follow a familiar format: a clinical vignette is followed by a lead-in and then five answer options are offered, with one being the 'most correct'. Let us review each of these components and describe how to write each of them effectively (table 1). The purpose of the question is to focus on realistic patient care scenarios and test clinical decision making that reflect the real-world challenges faced by practising cardiologists. For image challenge submissions, accurate interpretation of an image is integral to this process. Can the reader interpret the image correctly and figure out the next steps?

The *vignette* is a short clinical case which forms the basis of the question. The vignette introduces the patient (eg, 'A man in his 60s'), the care environment (eg, 'presents to the emergency department') and the presenting symptoms and the duration (eg, 'with chest pain lasting 2 hours'). The remainder of the case presentation should provide only the information required to answer the question; extraneous information should be eliminated as overly long questions test reading speed and comprehension instead of the application of medical knowledge.

Image challenge articles must adhere to BMJ's patient consent policy. All identifying information must be removed from the images, and the text also cannot contain any identifying information (including a specific age). If the article cannot be sufficiently anonymised, patient consent will be required (see https://heart.bmj.com/pages/authors/#image_challenge).

The *image* should be of high quality, clear and integral to answering the question. The legend should not explain the findings. Accompanying video is encouraged, but we require a still image for print.

The *lead-in* is the question. It should be straightforward, concrete and answerable, asking the reader to choose the single best option. Avoid negative phrasing ('All of the following are true except'). Ideally, the lead-in can be answered even without reading the options, sometimes referred to as the 'cover-the-options' rule because a test-taker should be able to guess the

correct answer while 'covering' the options (ie, not seeing them). For this reason, following a vignette 'Which of the following is the most likely cause of this patient's chest pain?' is a much better lead-in than 'Which of the following statements about chest pain are true?'

The *answer options* should be short, homogenous and concrete. The answer options should all be plausible answers to the lead-in. The distractors (incorrect options) can be partially correct, as long as they are *less correct* than the correct answer. Whenever possible the answer options should be similar to one another (eg, five drugs used to treat arrhythmia or five causes of chest pain). The options should not require interpretation and therefore words such as 'frequently', 'is associated with' or 'is important' must be avoided.³ If the answer options are long or convoluted it usually means that the lead-in was not well formulated. Do not include explanatory or didactic information in the answer options; explanation is reserved for the subsequent discussion. For example, 'C: Metoprolol' is a good answer option, whereas 'C: Metoprolol to slow the heart rate and promote ventricular remodeling' is not.

The *discussion* provides an opportunity to articulate the teaching point, provide explanation and expound on the rationale that supports the correct option. The discussion explains why the correct option is correct and why the other options are not. Supplementary figures and videos can be included. Authors should cite relevant contemporary literature to support the teaching point.

The NBME provides five basic rules for writing one-best-answer items which are all relevant for authors of image challenge³:

- ▶ Rule 1: Each item should focus on an important concept or testing point.
- ▶ Rule 2: Each item should assess application of knowledge, not recall of an isolated fact.
- ▶ Rule 3: The item lead-in should be focused, closed and clear; the test-taker should be able to answer the item based on the vignette and lead-in alone.
- ▶ Rule 4: All options should be homogenous and plausible to avoid cueing to the correct option.
- ▶ Rule 5: Each item should be reviewed to identify and remove technical flaws

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Table 1 Key components of an image challenge question

	Purpose	What to include	What to avoid
Vignette	Introduce the clinical scenario.	<ul style="list-style-type: none"> ▶ Up to 200 words with only the amount of information required to answer the question. ▶ Approximate age to protect patient privacy, for example, 'A man in his 60s'. 	<ul style="list-style-type: none"> ▶ Patient characteristics such as race, disability or socioeconomic status unless critical for the correct diagnosis. ▶ Extraneous details in the history or physical examination. ▶ Red herrings, or intentionally misleading information.
Figure	Show the relevant finding.	<ul style="list-style-type: none"> ▶ High-quality, still single image or multipanel figure, ideally coloured. ▶ Accompanying video for online version. ▶ Very brief legend (eg, 'Transthoracic echocardiogram in the parasternal-long axis orientation' or '12-lead ECG'). 	<ul style="list-style-type: none"> ▶ Identifying patient information (names, medical record numbers). ▶ Interpretation of the image in the legend.
Lead-in	Ask the question.	<ul style="list-style-type: none"> ▶ A single clear question which allows the test-taker to answer even before looking at the options. 	<ul style="list-style-type: none"> ▶ Negatively phrased lead-ins. ▶ Questions which ask the reader to choose more than one correct answer. ▶ True/false questions (which sometimes masquerade as 'which of the following statements are true').
Answer options	Provide a set of plausible answers to the lead-in.	<ul style="list-style-type: none"> ▶ Four or five short homogenous options. ▶ Plausible distractors which need to be less correct than the right answer. 	<ul style="list-style-type: none"> ▶ Explanations of 'why' in the answer options. ▶ Long or complicated answer choices. ▶ Ambiguous terms such as usually, often or useful. ▶ Brand-name drugs or devices.
Explanation	Provide the correct answer and teach.	<ul style="list-style-type: none"> ▶ Up to 200 words. ▶ Reasons why one option is the most correct and the others are less correct. ▶ Interpretation of the image. ▶ Supplementary figures or videos. ▶ Brief clinical pearls which expound on the teaching point. ▶ Up to five references, ideally contemporary. 	<ul style="list-style-type: none"> ▶ Clinical information which was needed to answer the question correctly. ▶ Personal or institutional opinion which deviates from standards of practice.

that add irrelevant difficulty or benefit savvy test-takers.

Following these steps, and the advice in [table 1](#), provides a framework that allows a medical image to be used to create an effective teaching case, and we welcome your submissions.

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