

Is It Relevant



- ▶ Will the test taker think so?

Constructing Good MC Questions



- ▶ 1. Write a good "stem".

Test recall of important facts!



- ▶ "What contrast material should be used for an esophagogram if perforation is suspected?"
- ▶ "What is the typical enhancement pattern of hepatocellular carcinoma on MRI?"

Don't be fancy:



- ▶ "What is the most likely diagnosis?"



So it's relevant, now what?



Writing a Good Stem



- ▶ Keep it well focused!

Writing a Good Stem

- ▶ The central idea of the question should be in the stem.
 - The stem should be longer than the responses.
 - A lead in statement is often helpful
 - A 65-year-old man has difficulty rising from a seated position and straightening his trunk, but he has no difficulty flexing his leg. Which of the following muscles is most likely to have been injured?

The Unfocused Stem

A Mortal Sin

Writing a Good Stem

Image based questions need not be complicated

What is the diagnosis for the images provided?

- A. NSIP
- B. **UIP**
- C. HP
- D. LIP



Some Nicely Focused Stems

- ▶ “What segment of the small bowel is most frequently involved by lymphoma?”
- ▶ “What mechanism of injury is the most frequent cause of a Jefferson fracture.”

Some unfocused stems

- ▶ “Which of the following is true regarding.....”
- ▶ “It is correct that:”
 - Just becomes 4 unrelated true-false questions.
 - Leaves the answer choices open to all sorts of disparate options.

The Cover Test

- ▶ Can I put my hand over all of the options and still answer the question?

From the May 2016 Radiology

- Routine whole-body MR imaging protocols used to detect skeletal involvement in metastatic cancer or multiple myeloma
-
- A. Should cover the body from head to toes
 - B. Should include contrast-enhanced sequences
 - C. Should include both anatomic (e.g. T1-weighted, short tau inversion recovery) and functional diffusion-weighted imaging sequences
 - D. Should use the machine-integrated body coil

RSNA Instructions for authors

- The stem:
- (1) Should be “focused”: that is, contain the main idea of the question. Use the “cover test”:

Can you cover the options and still answer the question?

From the May 2016 Radiology

- Routine whole-body MR imaging protocols used to detect skeletal involvement in metastatic cancer or multiple myeloma
-
- ?????????????????????????????????

RSNA Instructions for authors

- Focused stem:
- What is the most common site of hematogenous metastases from colon carcinoma?
- Unfocused stem:
- Which of the following is true regarding autoimmune pancreatitis?

So what do you think?

Unfocused!

A Random CME Sample from RadioGraphics

- Which of the following statements best describes DBT?
- Which of the following statements most accurately describes retroperitoneal fasciitis?
- Which of the following statements best characterizes use of head CT in geriatric trauma patients?

A Random CME Sample from RadioGraphics



- ▶ What is wrong with those stems:
 - They are all simply multiple True/False questions.

Another Example from RadioGraphics



- ▶ “Numbness of the left side of the lower lip of a 45 year old man with facial trauma due to a motor vehicle collision is most likely caused by a fractured mandible with displacement of the ____.”

Writing a Good Stem



- ▶ Keep it well-focused
- ▶ **No extraneous material and no red herrings.**

How about just?



- ▶ Get rid of the superfluous info:

“With mandibular fracture, numbness of the lower lip is most likely caused by displacement of what structure.”

Just the facts, please



- ▶ If you’re going to tell me that “A 32 year old woman on oral contraceptives develops hypotension, and chest and abdomen pain”.....
 - Bleeding hepatic adenoma
 - Venous thrombosis and a PE

Writing a Good Stem



- ▶ Keep it well-focused.
- ▶ No extraneous info and no red herrings.
- ▶ **Stay away from “negative” constructions:**
 - “What finding is NOT associated with...”
 - “...all of the following EXCEPT...”
 - “Which of the following is LEAST likely...”

Happens to the Best of us



- ▶ A question submitted to the Board for the MOC Exam with a negative construct:

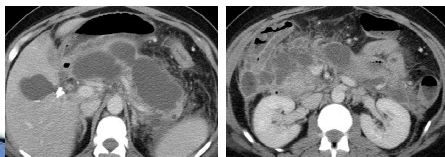
Still another in RadioGraphics



- ▶ In most children aged 12–16 years, ulnar variance is _____.
- ▶ Positive
- ▶ Negative
- ▶ Neutral
- ▶ **No predominant pattern has been observed.**

- ▶ This 38-year-old female underwent laparoscopic cholecystectomy. After four uneventful postoperative days, she developed sudden-onset abdominal pain, nausea, and vomiting. Abdominal CT one week later is shown below. The differential diagnosis should include all of the following EXCEPT:

- A. Severe acute pancreatitis
- B. Pancreatic abscess
- C. Pancreatic necrosis.
- D. Gallstone pancreatitis.



After the Stem



- ▶ Answers and Distractors

Writing a Good Stem



- ▶ Simple wording, both for straightforward questions or clinical vignettes.
- ▶ No jargon or unusual abbreviations.
- ▶ **Make sure the stem and all the choices have matching grammar.**

The Answer




Must be absolutely, 100%, incontrovertibly, everyone-agrees-and-no-room-for-discussion correct.

RSNA
Radiology Society of North America

This patient had abdominal pain for 12 hours, fever, and leukocytosis. The next best step for this patient :

- A. laparoscopic surgery.
- B. CT-directed drainage.
- C. intravenous antibiotics.
- D. **surgery.**
- E. observation for 48 hours.



RSNA
Radiology Society of North America

The Distractors

- ▶ The toughest job of all.
 - How many?
 - 3 is fine
 - That means 4 responses including the key

RSNA
Radiology Society of North America

The Answer

- ▶ Must be absolutely, 100%, incontrovertibly, everyone-agrees-and-no-room-for-discussion correct.
- ▶ We now insist that a reference be included with each question submitted.

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The Distractors

- ▶ **Make sure that they are plausible**

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The Answer

- ▶ Avoid relative terms: often, frequently, rarely.
- ▶ Test takers have wide-ranging opinions on just how frequent is "frequently."
- ▶ And they know that nebulous terms often indicate the right answer

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Make sure they are plausible

16 year-old female in a head-on motor vehicle collision was unresponsive on arrival with a severe closed head injury and degloving injury of the scalp.

Make sure they are plausible

- What is the most likely cause of the appearance of the small bowel?

- A. Hypoperfusion
- B. Mesentery Laceration
- C. Mural Edema
- D. Infection



Keep distractors and key the same length

- After viewing Figure 2, injection of the nasobiliary tube two weeks after interval cholecystectomy, what is the most likely diagnosis?

- A. Suprapancreatic common bile duct stones
- B. Distal common bile duct inflammatory stricture and a few air bubbles.
- C. Sclerosing cholangitis complicated by polypoid cholangiocarcinoma
- D. **Mirizzi syndrome**

What's the implausible choice?

- What is the most likely cause of the appearance of the small bowel?

- A. Hypoperfusion
- B. Mesentery Laceration
- C. Mural Edema
- D. **Infection**



The Distractors

- Make sure they're plausible.
- Keep all of them (and the answer, too) about the same length.
- Like the stem, keep them focused.**

The Distractors

- Make sure they're plausible.
- Keep all of them (and the answer, too) about the same length.**

"Avoid Non-homologous Options"

- They mean: keep 'em in the same ballpark.



- ▶ This 23-year-old woman underwent CT of the abdomen to evaluate right lower quadrant pain. Which clinical question is critical to the differential diagnosis?

- A. Does the patient have an elevated white cell count?
- B. **Does the patient have a history of recent acute pancreatitis?**
- C. Is the patient on birth control pills?
- D. Is the symptom upper rather than lower abdominal pain?



The Distractors



- ▶ Make sure they're plausible.
- ▶ Keep all of them (and the answer, too) about the same length.
- ▶ Like the stem, keep them focused.
- ▶ **Keep them simple, simple, simple.**



Non-homologous options

- ▶ Does the patient have an elevated white cell count? (**Sign**)
- ▶ Does the patient have a history of recent acute pancreatitis? (**History**)
- ▶ Is the patient on birth control pills? (**History**)
- ▶ Is the symptom upper rather than lower abdominal pain? (**Symptom**)



Keep it simple

- ▶ 49-year-old woman with acute right upper quadrant pain had a CT scan of the abdomen



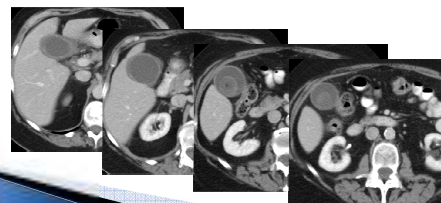
Yet one more RadioGraphics

- ▶ Which of the following best describes Brenner tumors? (**Unfocused**)
- A. They are typically benign (**Prognosis**)
 - B. They rarely show calcifications (**Findings**)
 - C. They represent about 10% of ovarian neoplasms (**Prognosis**)
 - D. They demonstrate little or no enhancement (**Findings**)



Keep it simple

- ▶ What is the most likely diagnosis?
 - A. Gallbladder stone with biliary obstruction
 - B. Acute cholecystitis with gallbladder stone
 - C. Acute acalculous cholecystitis
 - D. Gallbladder stone without cholecystitis



So why toss this question?

- ▶ It's too confusing...
 - It's too confusing...
 - It's too confusing...
 - It's too confusing...

Watch out for inadvertent clues

- ▶ No mutually exclusive options
 - For questions that require a single best answer, options that contradict one another cannot both be correct and therefore mutually exclusive options reduce the number of plausible responses

It's too confusing.

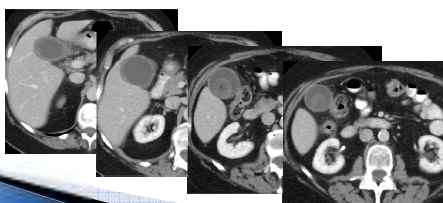
- A. Gallbladder stone **with** biliary obstruction
- B. Acute cholecystitis **with** gallbladder stone
- C. Acute acalculous cholecystitis
- D. Gallbladder stone **without** cholecystitis

- ▶ Which of the following statements best describes digital breast tomosynthesis acquisition?

- A. Multiple low-dose x-ray projection images are obtained in a 15–30° arc
- B. A single x-ray projection image is obtained while the x-ray tube moves in an arc
- C. A CT image of the breast is obtained
- D. Multiple low-dose x-ray projection images are obtained in 360° arc

Keep it simple

- ▶ What is the most likely diagnosis?
 - A. Gallbladder stone with biliary obstruction
 - B. **Acute cholecystitis with gallbladder stone**
 - C. Acute acalculous cholecystitis
 - D. Gallbladder stone without cholecystitis



Mutually exclusive options

- ▶ So can I ever use paired options?
 - Yes, but you need two pairs!

Mutually exclusive options should be paired



- › What is the most common site of Crohn's Disease?
- A. Proximal esophagus
- B. Distal esophagus
- C. Ascending colon
- D. Descending colon

Quick Review



- › Keep it relevant.
- › Keep it clear: focus, focus, focus.
- › No tricks and no clues.
- › Sterling images.

Watch out for inadvertent clues



- › No vague "maybe" terms.
- › No "always". No "never".
- › Don't "highlight" any particular choices.
- › Randomize the position of the answer

Real-life examples



Actual questions submitted to the ABR from 2006 through 2012

Special considerations for tests with images



- › Images have to be technically superb
- › Absolutely classic examples of the diagnosis
- › Readily apparent findings
- › **NOT AN EYE TEST!**

Submitted to ABR

This 50-year-old female underwent an upper gastrointestinal study to evaluate vague abdominal pain. The differential diagnosis includes all of the following EXCEPT:

- A. A stone lodged in the distal common bile duct.
- B. ampullary villous adenoma.
- C. choledochal cyst.
- D. annular pancreas.



So, what's the problem?



- ▶ A. Negative construction
- ▶ B. Non-homologous choices
- ▶ C. A red herring clue
- ▶ D. Too-complex stem

More to learn from the same question.



▶ Based on your differential, the patient was next evaluated with endoscopic retrograde cholangiopancreatography. Which of the following statements is true?

- A. The patient has an increased risk of developing cholangiocarcinoma.
- B. The patient should undergo pancreatoduodenectomy.
- C. The patient should undergo percutaneous transhepatic stent placement.
- D. No action is necessary unless the lesion grows.



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This 50-year-old female underwent an upper gastrointestinal study to evaluate vague abdominal pain. The differential diagnosis includes all of the following **EXCEPT**:

- A. A stone lodged in the distal common bile duct.
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- D. annular pancreas.



So, what's the problem?



- ▶ A. Unfocused stem
- ▶ B. Disparate length clue
- ▶ C. Mutually exclusive pair
- ▶ D. Don't change a thing

But wait! There's more!



- ▶ The case came with a second question

Based on your differential, the patient was next evaluated with endoscopic retrograde cholangiopancreatography. *Which of the following statements is true?*

Failure of the cover test



More to learn from the same question

And still more to learn from an additional follow-up question

More to learn from the same question.

- ▶ Based on your differential, the patient was next evaluated with endoscopic retrograde cholangiopancreatography. Which of the following statements is true?
 - A. The patient has an increased risk of developing cholangiocarcinoma. **Prognosis**
 - B. The patient should undergo pancreatoduodenectomy. **Treatment**
 - C. The patient should undergo percutaneous transhepatic stent placement. **Treatment**
 - D. No action is necessary unless the lesion grows. **Treatment**



Key = A

Which type of choledochal cyst does the patient have?

- A. Type 1
- B. Type 2
- C. Type 3, choledochocoele
- D. Type 4
- E. Type 5, Caroli disease



Non-homologous choices, with the single outlier as the answer

So what's the pitfall?

Which type of choledochal cyst does the patient have?



- A. Type 1
- B. Type 2
- C. Type 3, choledochocoele
- D. Type 4
- E. Type 5, Caroli disease



Special Considerations for Audience Response



- ▶ “Who is my audience?”
- ▶ Simple and short: ONE idea per question
- ▶ Target the big stuff (less really is more)
- ▶ Groom your images

Which type of choledochal cyst does the patient have?



- A. Type 1
- B. Type 2
- C. Type 3, choledochocoele
- D. Type 4
- E. Type 5, Caroli disease



KEY = C

Having further verbiage for options C & E sets them apart. Can similar wording be added to the other options? Alternately, can the extensions be deleted?

Writing True-False Questions



- ▶ Incontrovertibly true or false
- ▶ Simple language
- ▶ ONE idea per question
- ▶ Phrase it positively
- ▶ Avoid extreme and nebulous modifiers

The Most Important Stuff



- ▶ 1. Relevance
- ▶ 2. Clarity of focus:
 - stem especially
 - answers and distractors, too
- ▶ 3. Keep it positive
- ▶ 4. No “lazy test maker” clues

Reference links



- ▶ Writing Good Multiple-Choice Questions: A Brief Guide for Radiologists
https://dev2.rsna.org/uploadedFiles/RSNA/Content/Science_and_Education/Education_Offerings/Handout-Secrets-of-Good-Question-Writing-DiSantis.pdf
- ▶ Prevalence of Flawed Multiple Choice Questions in Continuing Medical Education Activities of Major Radiology Journals
<http://www.ajronline.org/doi/pdfplus/10.2214/AJR.13.11963?src=recsys&>
- ▶ Developing Multiple Choice Questions for the Royal College Certification Examinations – Royal College of Physicians and Surgeons of Canada
<https://www.mcpeds.com/documents/GuidelinesforDevelopmentMCQRoyalCollege.pdf>
- ▶ A Brief Guide to Writing Good Multiple Choice Questions
http://www.rsna.org/uploadedFiles/RSNA/Content/Science_and_Education/Meetings_and_Workshops/A-Brief-Guide-to-Writing-Good-Multiple-Choice-Questions-Fig.pdf