

Reading Hospital School of Health Sciences  
Medical Imaging Program  
Clinical Case Study-Ribs & Sternum

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Each student will be assigned clinical a seminar case study for each procedure taught within the semester. The case study will allow the student to practice their knowledge of image critique, anatomical structure identification and pathology identification. Students will submit answers to the below questions for each projection within the case study. **Completed answers to the questions below and the pathology and anatomical structure labeling within the PowerPoint must be uploaded into the Edvance 360 dropbox.** Yes because we orient the images as if the patient was looking at us and they are in anatomical position. The marker is on the patients right side and we are seeing that marker in the correct position.

**Answer #1-#9 for each assigned projection**

**PA/RAO Sternum**

1. Is orientation of the image correct? **Yes**
  - a. If orientation is incorrect, explain why. **Yes because we orient the images as if the patient was looking at us and they are in anatomical position. The marker is on the patients right side and we are seeing that marker in the correct position.**
  - b. State how to modify the orientation. **N/A**
2. Is all necessary anatomy included? **Yes**
  - a. Explain the anatomy required by evaluation criteria. **The entire sternum from jugular notch to xiphoid process is included.**
  - b. Drag the arrows with letters on the Case Study slides to identify anatomical structures within each slide.
3. Is the body part centered appropriately? **Yes**
  - a. Identify the correct location for centering. **The centering should be entering the side away from the board (left), at the level of T7 and about 1 inch from the MSP. This centering is adequate.**
  - b. If centering is incorrect, explain how you would move the central ray to achieve proper centering. **N/A**
4. Is the body part positioned accurately? **No**
  - a. If the body part is not positioned accurately:
    - i. Explain what anatomy demonstrates inaccurate positioning (over or under-rotation etc). **This sternum in the RAO position is underrotated because the right clavicle is still superimposed on the spine which means part of the sternum is being superimposed as well by the spine.**
    - ii. State the modification of positioning necessary to meet evaluation criteria. **This should be corrected by pulling the patients left shoulder away from the board to ensure that the clavicle is coming off of the spine a little bit so that the entire sternum is off the spine.**
5. Is the collimation and IR orientation as required? **Yes**

- a. State the proper collimation size to be used. **The collimation for this image is 11x14.**
  - b. State how the IR should be oriented to the patient. **The IR should be portrait to the patient.**
6. Is the proper marker(s)/annotation(s) utilized on the image? **Yes**
- a. State if the marker was placed in the proper location. **The marker was placed in the correct position. We place it at the top of the light field on the side of the patient that is against the IR.**
  - b. State if any additional marker(s)/annotation(s) are required. **No, sternum images do not need an erect annotation like ribs do.**
7. Is the exposure within the appropriate EI range? **Yes**
- a. Identify the correct technique. **81 kVp at center cell if AEC, or 3.2 mAs if not AEC.**
  - b. If not within the appropriate EI range, explain specifically how to adjust the technical factors to bring the EI into range. **N/A**
8. Are there any artifacts present on the image? **No**
- a. If an artifact is present, list which artifact(s) would make the image not acceptable and an additional exposure to the patient. **N/A**
9. Overall, is this image ACCEPTABLE or NOT ACCEPTABLE? **NOT ACCEPTABLE**
- a. State the reasons this image will require the patient to have a second exposure. **This image should be repeated because it is underrotated, so it should be fixed by turning the patients left shoulder away from the IR slightly.**

## Lateral Sternum

10. Is orientation of the image correct? **Yes**
- a. If orientation is incorrect, explain why. **Because sternums are similar to lateral chest, meaning we mark the side against the IR, and if you look at this image and imagine your left side against the computer screen, the sternum should match your own.**
  - b. State how to modify the orientation. **N/A**
11. Is all necessary anatomy included? **Yes**
- a. Explain the anatomy required by evaluation criteria. **This image should also include the entire sternum from jugular notch to the xiphoid process.**
  - b. Drag the arrows with letters on the Case Study slides to identify anatomical structures within each slide.
12. Is the body part centered appropriately? **Yes**
- a. Identify the correct location for centering. **The centering should be entering the lateral side of the mid sternum, which it is.**
  - b. If centering is incorrect, explain how you would move the central ray to achieve proper centering. **N/A**
13. Is the body part positioned accurately? **Yes**
- a. If the body part is not positioned accurately:
    - i. Explain what anatomy demonstrates inaccurate positioning (over or under-rotation etc). **N/A**
    - ii. State the modification of positioning necessary to meet evaluation criteria. **The only thing that could be improved could be having the patient pull their shoulder posteriorly more to ensure the soft tissue and clavicles are moved as best as possible from the sternum. (Not repeatable in this image).**
14. Is the collimation and IR orientation as required? **Yes**
- a. State the proper collimation size to be used. **10x12**

- b. State how the IR should be oriented to the patient. **The IR should be portrait to the patient.**
- 15. Is the proper marker(s)/annotation(s) utilized on the image? **Yes**
  - a. State if the marker was placed in the proper location. **Yes, but they could have moved it closer to the patient to ensure it was on fully, but the L is there so it is adequate.**
  - b. State if any additional marker(s)/annotation(s) are required. **No**
- 16. Is the exposure within the appropriate EI range? **Yes**
  - a. Identify the correct technique. **81 kVp at center cell if AEC, or 10 mAs if not AEC**
  - b. If not within the appropriate EI range, explain specifically how to adjust the technical factors to bring the EI into range. **N/A**
- 17. Are there any artifacts present on the image? **No**
  - a. If an artifact is present, list which artifact(s) would make the image not acceptable and an additional exposure to the patient. **N/A**
- 18. Overall, is this image ACCEPTABLE or NOT ACCEPTABLE? **ACCEPTABLE**
  - a. State the reasons this image will require the patient to have a second exposure. **N/A**

## **AP/PA Unilateral Ribs**

- 19. Is orientation of the image correct? **Yes**
  - a. If orientation is incorrect, explain why. **If the left side is marked, that means that the left side should be on our left if we turn our back to the screen. (As if patient is looking at you).**
  - b. State how to modify the orientation. **N/A**
- 20. Is all necessary anatomy included? **Yes (For the upper image)**
  - a. Explain the anatomy required by evaluation criteria. **For the upper ribs we should see 1-approximately 9 ribs above the diaphragm, which we do in this image.**
  - b. Drag the arrows with letters on the Case Study slides to identify anatomical structures within each slide.
- 21. Is the body part centered appropriately? **Yes**
  - a. Identify the correct location for centering. **This should be centered around level of T7 and centered halfway between the MSP and the lateral aspect of the ribs on the side of interest which this image is.**
  - b. If centering is incorrect, explain how you would move the central ray to achieve proper centering. **N/A**
- 22. Is the body part positioned accurately? **Yes**
  - a. If the body part is not positioned accurately: **N/A**
    - i. Explain what anatomy demonstrates inaccurate positioning (over or under-rotation etc). **N/A**
    - ii. State the modification of positioning necessary to meet evaluation criteria. **N/A**
- 23. Is the collimation and IR orientation as required? **Yes**
  - a. State the proper collimation size to be used. **14x17 and then collimated in side to side slightly.**
  - b. State how the IR should be oriented to the patient. **portrait**
- 24. Is the proper marker(s)/annotation(s) utilized on the image? **No**
  - a. State if the marker was placed in the proper location. **The left marker was correct.**
  - b. State if any additional marker(s)/annotation(s) are required. **This image should have included an erect annotation.**
- 25. Is the exposure within the appropriate EI range? **Yes**
  - a. Identify the correct technique. **81 kVp at center cell for AEC, or 10 mAs for non AEC**
  - b. If not within the appropriate EI range, explain specifically how to adjust the technical factors to bring the EI into range. **N/A**

26. Are there any artifacts present on the image? **No**
- If an artifact is present, list which artifact(s) would make the image not acceptable and an additional exposure to the patient. **N/A**
27. Overall, is this image ACCEPTABLE or NOT ACCEPTABLE? **ACCEPTABLE**
- State the reasons this image will require the patient to have a second exposure. **N/A**

## **AP/PA unilateral ribs lower**

28. Is orientation of the image correct? **Yes**
- If orientation is incorrect, explain why. **If the left side is marked, that means that the left side should be on our left if we turn our back to the screen. (As if patient is looking at you).**
  - State how to modify the orientation. **N/A**
29. Is all necessary anatomy included? **Yes**
- Explain the anatomy required by evaluation criteria. **Entirety of Ribs 8-12 should be seen below the diaphragm.**
  - Drag the arrows with letters on the Case Study slides to identify anatomical structures within each slide.
30. Is the body part centered appropriately? **Yes**
- Identify the correct location for centering. **The centering should be halfway between the MSP and the lateral boarder of the ribs, which is good in this image, and should not include any crest, and if it does it should be very minimal.**
  - If centering is incorrect, explain how you would move the central ray to achieve proper centering. **This image could have been centered more superiorly and then collimated a little bit, but not bad enough to repeat because all anatomy is included, and crest is barely on this image.**
31. Is the body part positioned accurately? **No**
- If the body part is not positioned accurately:
    - Explain what anatomy demonstrates inaccurate positioning (over or under-rotation etc). **There is slight rotation of this image, but not enough to repeat.**
    - State the modification of positioning necessary to meet evaluation criteria. **This image seems to have been done on inspiration and not expiration because only ribs 12 and 11 are under diaphragm, and a little over half of the 10th under. This image should show 8 through 12 under the diaphragm. Also, if done PA, this image should include the 10-15 degree angle for this lower image to ensure the lower ribs are below the diaphragm.**
32. Is the collimation and IR orientation as required? **No. This image could have increased collimation.**
- State the proper collimation size to be used. **14 x11**
  - State how the IR should be oriented to the patient. **landscape. This image seems to be portrait. This image should have been collimated down to ensure they had the 14 across and 11 down.**
33. Is the proper marker(s)/annotation(s) utilized on the image? **No**
- State if the marker was placed in the proper location. **This images marker is hard to see but it is on there, but they should have included an annotated L above the lead marker to make it easier to see.**
  - State if any additional marker(s)/annotation(s) are required. **An erect annotation is missing.**
34. Is the exposure within the appropriate EI range? **Yes**

- a. Identify the correct technique. **85 kVp at center cell for AEC, and 12.5 mAs for non AEC.**
  - b. If not within the appropriate EI range, explain specifically how to adjust the technical factors to bring the EI into range. **N/A**
35. Are there any artifacts present on the image? **No**
- a. If an artifact is present, list which artifact(s) would make the image not acceptable and an additional exposure to the patient. **N/A**
36. Overall, is this image ACCEPTABLE or NOT ACCEPTABLE? **NOT ACCEPTABLE**
- a. State the reasons this image will require the patient to have a second exposure. **This image should be centered slightly superior from its current centering, and this should be collimated to a 14x11 landscape, and make sure it is taken on expiration to get the 8th through 12th ribs above the diaphragm.**

## **AP/PA unilateral oblique ribs**

37. Is orientation of the image correct? **Yes**
- a. If orientation is incorrect, explain why. **If the left side is marked, that means that the left side should be on our left if we turn our back to the screen. (As if patient is looking at you).**
  - b. State how to modify the orientation. **N/A**
38. Is all necessary anatomy included? **Yes**
- a. Explain the anatomy required by evaluation criteria. **Ribs 1 through approx. 9 should be able the diaphragm, and this image has 1 through 8 and most of 9 above.**
  - b. Drag the arrows with letters on the Case Study slides to identify anatomical structures within each slide.
39. Is the body part centered appropriately? **No**
- a. Identify the correct location for centering. **This image is centered too far laterally. It looks like this was bisected at the soft tissue to the MSP, but it should be between the MSP and lateral boarder of the ribs. However, I do not believe this centering is inadequate because all anatomy is on this image and the rotation of this oblique is adequate.**
  - b. If centering is incorrect, explain how you would move the central ray to achieve proper centering. **I would try my best to feel the lateral aspect of the ribs and the MSP and bisect to get the appropriate centering. Also this centering could be moved inferiorly to the level of about T7 (Less light above shoulders)**
40. Is the body part positioned accurately? **Yes**
- a. If the body part is not positioned accurately: **N/A**
    - i. Explain what anatomy demonstrates inaccurate positioning (over or under-rotation etc). **N/A**
    - ii. State the modification of positioning necessary to meet evaluation criteria. **N/A**
41. Is the collimation and IR orientation as required? **Yes**
- a. State the proper collimation size to be used. **14x17**
  - b. State how the IR should be oriented to the patient. **Portrait**
42. Is the proper marker(s)/annotation(s) utilized on the image? **No**
- a. State if the marker was placed in the proper location. **The marker should be moved to be at the top of the light field and make sure it is in the light field because in this image the marker was cut off but caught in the scatter of the image.**
  - b. State if any additional marker(s)/annotation(s) are required. **This image should include the erect annotation.**
43. Is the exposure within the appropriate EI range? **Yes**

- a. Identify the correct technique. **81 kVp at center cell for AEC, or 16 mAs for non AEC.**
  - b. If not within the appropriate EI range, explain specifically how to adjust the technical factors to bring the EI into range. **N/A**
44. Are there any artifacts present on the image? **No**
- a. If an artifact is present, list which artifact(s) would make the image not acceptable and an additional exposure to the patient. **N/A**
45. Overall, is this image ACCEPTABLE or NOT ACCEPTABLE? **ACCEPTABLE**
- a. State the reasons this image will require the patient to have a second exposure. **N/A**

## **AP/PA unilateral oblique ribs**

46. Is orientation of the image correct? **Yes**
- a. If orientation is incorrect, explain why. **If the left side is marked, that means that the left side should be on our left if we turn our back to the screen. (As if patient is looking at you).**
  - b. State how to modify the orientation. **N/A**
47. Is all necessary anatomy included? **Yes**
- a. Explain the anatomy required by evaluation criteria. **8th through 12th ribs shown below the diaphragm.**
  - b. Drag the arrows with letters on the Case Study slides to identify anatomical structures within each slide.
48. Is the body part centered appropriately? **No**
- a. Identify the correct location for centering. **This image should be the overlap, so it should be centered at the bottom of the light of the last image.**
  - b. If centering is incorrect, explain how you would move the central ray to achieve proper centering. **This image includes too much superiorly that was already imaged, so this image should be centered more inferiorly.**
49. Is the body part positioned accurately? **No**
- a. If the body part is not positioned accurately:
    - i. Explain what anatomy demonstrates inaccurate positioning (over or under-rotation etc). **This oblique lower is underrotated. The ribs are not as elongated as they should be for the oblique image. This looks too much like the AP/PA image.**
    - ii. State the modification of positioning necessary to meet evaluation criteria. **This patient for an AP should have their right side pulled away more from the IR to a 45 degree, and if PA, this patient's left side should be pulled away 45 degrees from the IR because we are imaging the left ribs.**
50. Is the collimation and IR orientation as required? **No**
- a. State the proper collimation size to be used. **This should be collimated to a 14x11 because it is a lower.**
  - b. State how the IR should be oriented to the patient. **Landscape**
51. Is the proper marker(s)/annotation(s) utilized on the image? **No**
- a. State if the marker was placed in the proper location. **Left marker is adequate, but could be moved medially because it is close to being cut off.**
  - b. State if any additional marker(s)/annotation(s) are required. **Erect annotation is missing.**
52. Is the exposure within the appropriate EI range? **No**
- a. Identify the correct technique. **85 kVp at center cell for AEC, and 16 mAs for non AEC**

- b. If not within the appropriate EI range, explain specifically how to adjust the technical factors to bring the EI into range. **This image is underexposed, so you should double the mAs if it is a fixed technique, or if you are using AEC you should increase your density by 2.**
53. Are there any artifacts present on the image? **No**
- a. If an artifact is present, list which artifact(s) would make the image not acceptable and an additional exposure to the patient. **N/A**
54. Overall, is this image ACCEPTABLE or NOT ACCEPTABLE? **NOT ACCEPTABLE**
- a. State the reasons this image will require the patient to have a second exposure. **Although ribs 8-12 are mostly below the diaphragm, this image is underrotated. I would repeat this image by obliquing this patient to a 45 degree, center more inferiorly, and collimate to the 14x11 that is required for a lower, and also double mAs if non AEC, or increase density by 2 if it is AEC.**

## Pathologies

55. Select **ONE** of the following pathologies from **EACH** section below to research and answer the following questions. Then insert an image which best demonstrates the selected pathology into the Case Study PowerPoint.

### Ribs

- 1. **Subcutaneous emphysema**
- b. Define the pathology. **Gas and trapped air that is under the skin.**
  - c. Identify if the pathology is subtractive, additive or neither. **Subtractive**
    - i. Explain if the technique would need be modified. **For this pathology, you could expect to decrease your mAs for non AEC, or density for AEC because of the increased air in this patient.**
  - d. Identify symptoms that a patient would have with this pathology. **Sore throat, neck pain, swelling in chest or neck, difficulty breathing, swallowing, and speaking, wheezing, and crepitus upon touching of the skin.**
  - e. Identify the type of imaging that is obtained for best visualization of this pathology. **Chest X-ray is the best modality.**
    - i. State if there are any other additional non-radiographic studies associated with diagnosis of this pathology : **If there is small gas collections they can only be identified on chest CT scans.**

### Sternum

- 1. **Pectus carinatum**

- b. Define the pathology. Genetic disorder that causes the chest wall to jut outward anteriorly.
- c. Identify if the pathology is subtractive, additive or neither. Neither
  - i. Explain if the technique would need be modified. N/A
- d. Identify symptoms that a patient would have with this pathology. SOB while exercising, chest pain, lateral curve of the spine, absence of curve in upper back, hooked shoulders, and a broad thin chest.
- e. Identify the type of imaging that is obtained for best visualization of this pathology. CT and MRI are most common because they are better for evaluating deformities of the chest wall created by this pathology.
  - i. State if there are any other additional non-radiographic studies associated with diagnosis of this pathology : Chest x-rays can be obtained pre and postoperatively to access the sternum.