CRITICALCAREPRACTITIONER

# Chest X Ray

Interpretation

T Technicals

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D Diaphragm

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# Technicals

There are a number of technical aspects to consider when looking at the Chest X Ray.

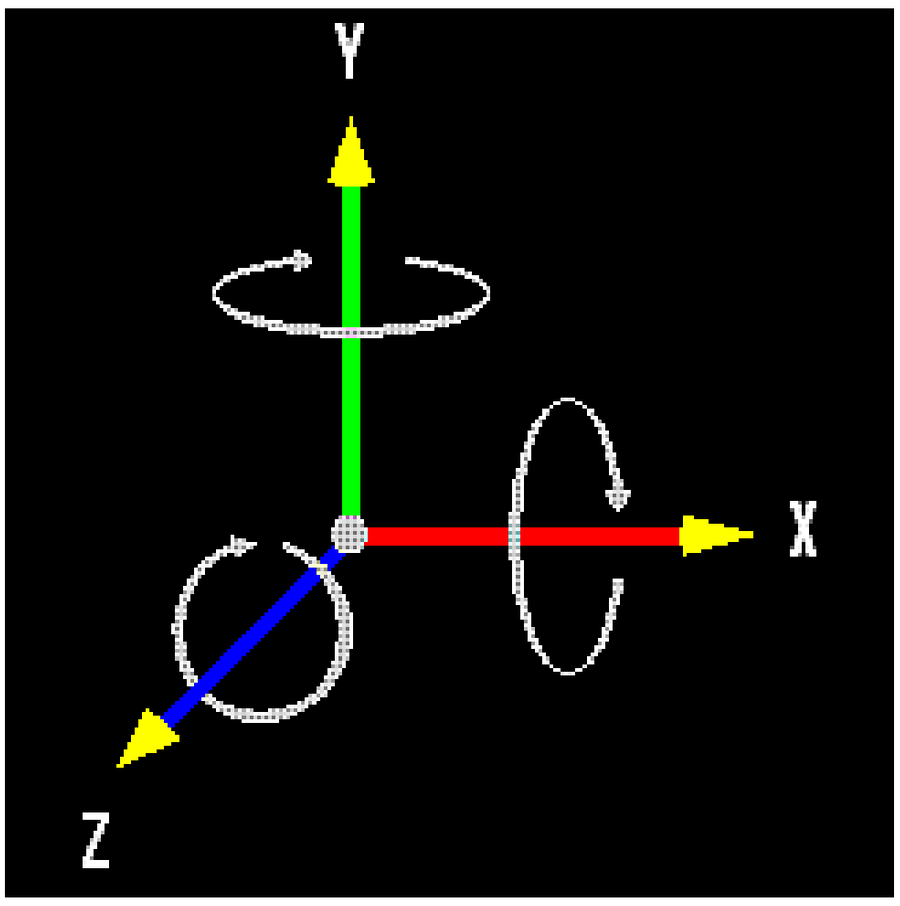
- Right X Ray/Right Patient
- Rotation
- Penetration
- PA or AP

**Right X Ray/Right Patient**

With todays technology, most of the time you will be looking at the Chest X Ray via a computer screen. It is still just as important however to be sure that you are looking at the X Ray you think you are.
You must therefore check the name, date of birth and hospital number of the patient with the x ray you are seeing.
You should also reassure yourself that you are not looking at an old Chest X Ray, but are indeed looking at the one taken most recently if that is what you want- so check the date.

**Rotation**

The Chest X Ray is taken ideally from a very specific angle. If this angle changes, either due to the operator or due to the patients body position, then interpretation of the Chest X Ray is also going to be affected. There are going to be three ways in which the X Ray could be rotated:

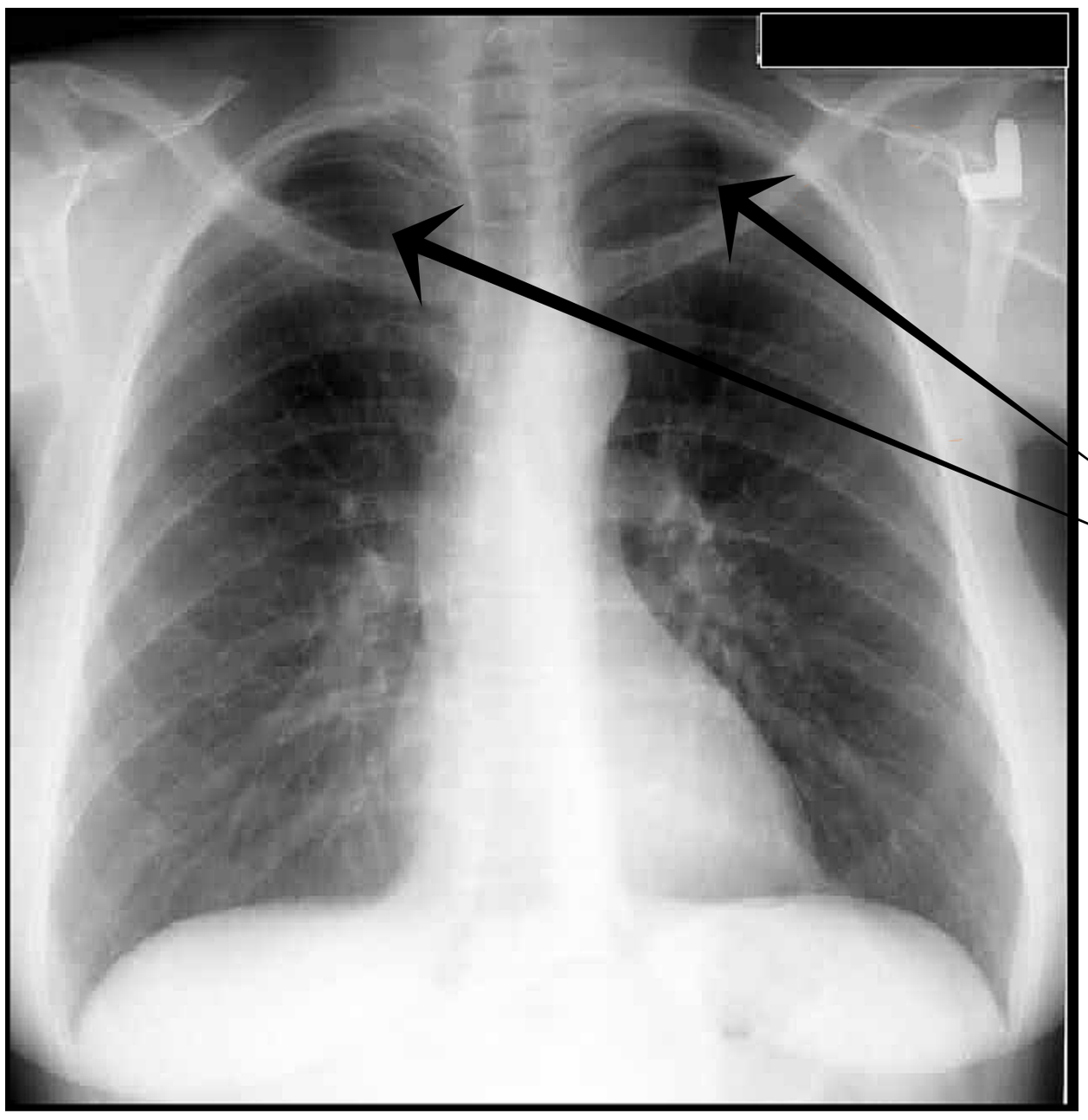



X-axis

Z-axis

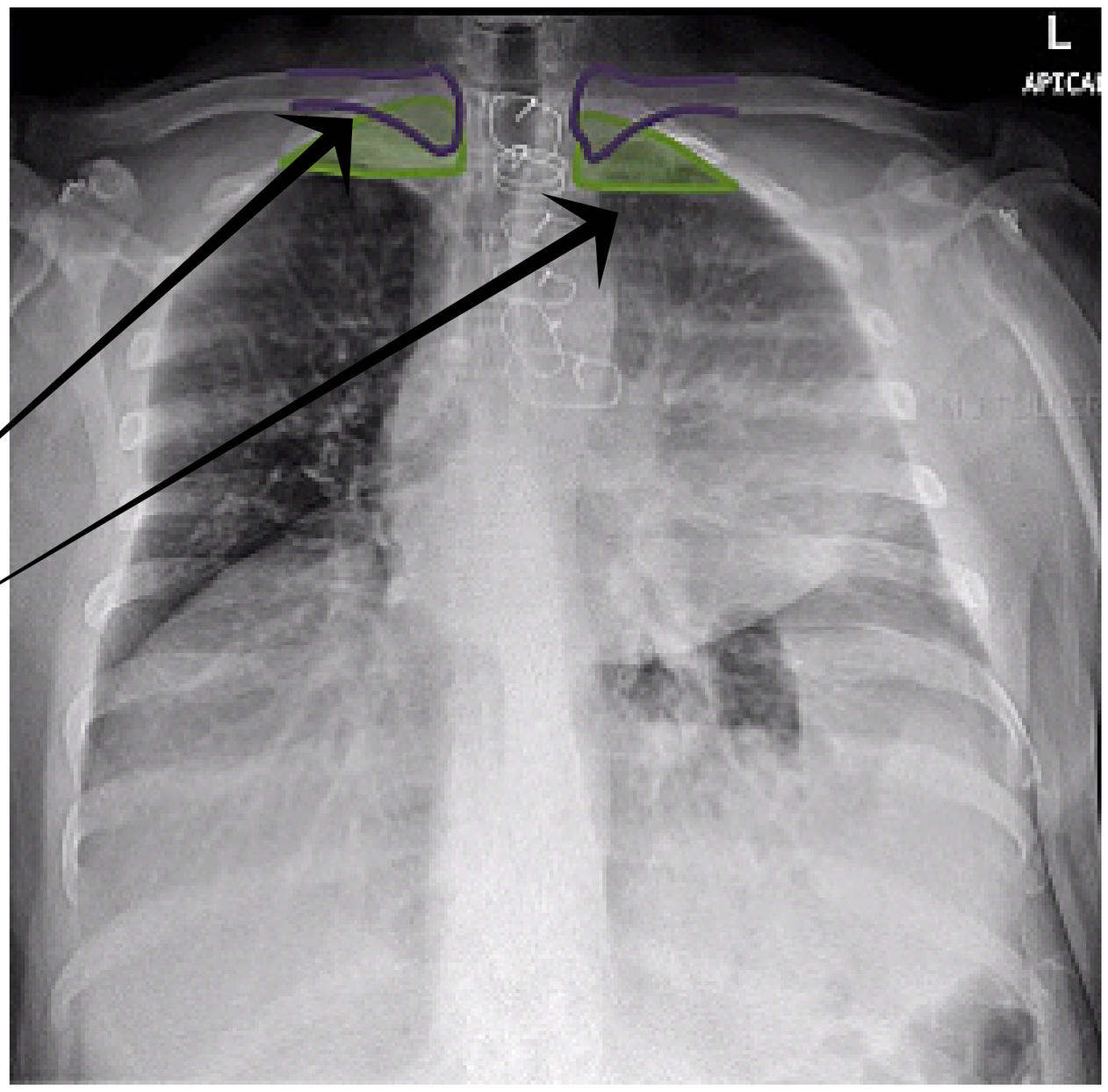
Y-axis

X-axis.
The Chest X Ray is taken with the patient either standing upright or sitting but in the most upright position possible. The objective is to get the X Rays to hit the patients chest square on and ideally not coming from either above or below.

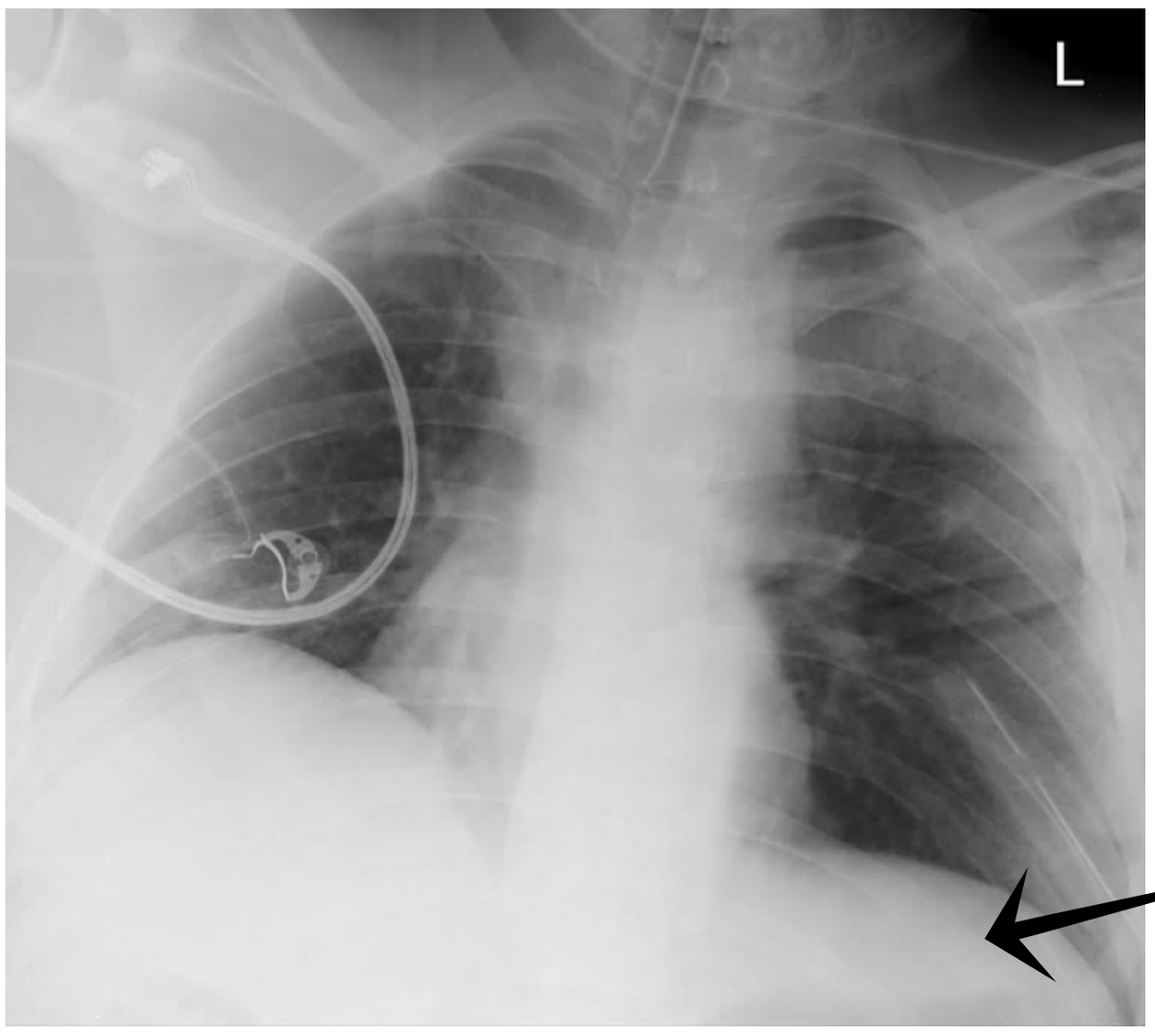


The area above the clavicles should be visible- the apices.

You can see here that the apices cannot be seen. This could be deliberate as we may need to see 'behind' the clavicles for suspicious pathology.

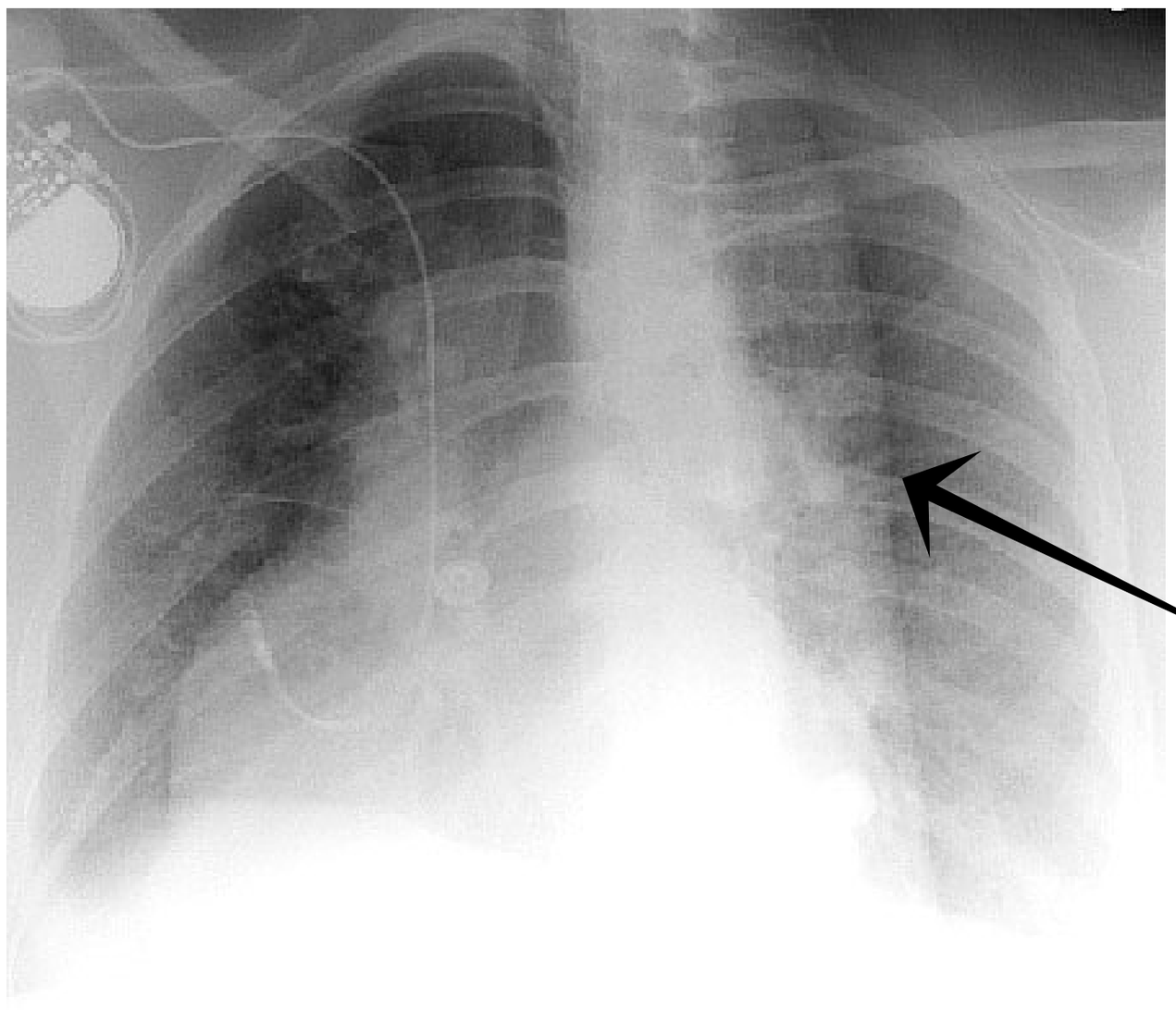



Z-axis.
Neither should the patient be leaning to one side or the other. This would be rotation in the Z-axis. This may also cause some problems when trying to interpret the X Ray.




The patient is leaning over to the left. This potentially means that the base of the lung on that side cannot be examined fully. Also the gastric bubble may not be visible.

Y-axis.
This is probably the most common way the X Ray may be rotated. Here the shoulder of the patient is closer to the X ray machine on one side as compared to the other. This could be because the patient has some spine pathology which makes if difficult for them to sit straight or it could be because the x ray was not taken from the right angle.
Rotation like this does cause some problems in interpretation as some of the mediastinal structures will appear to be enlarged.



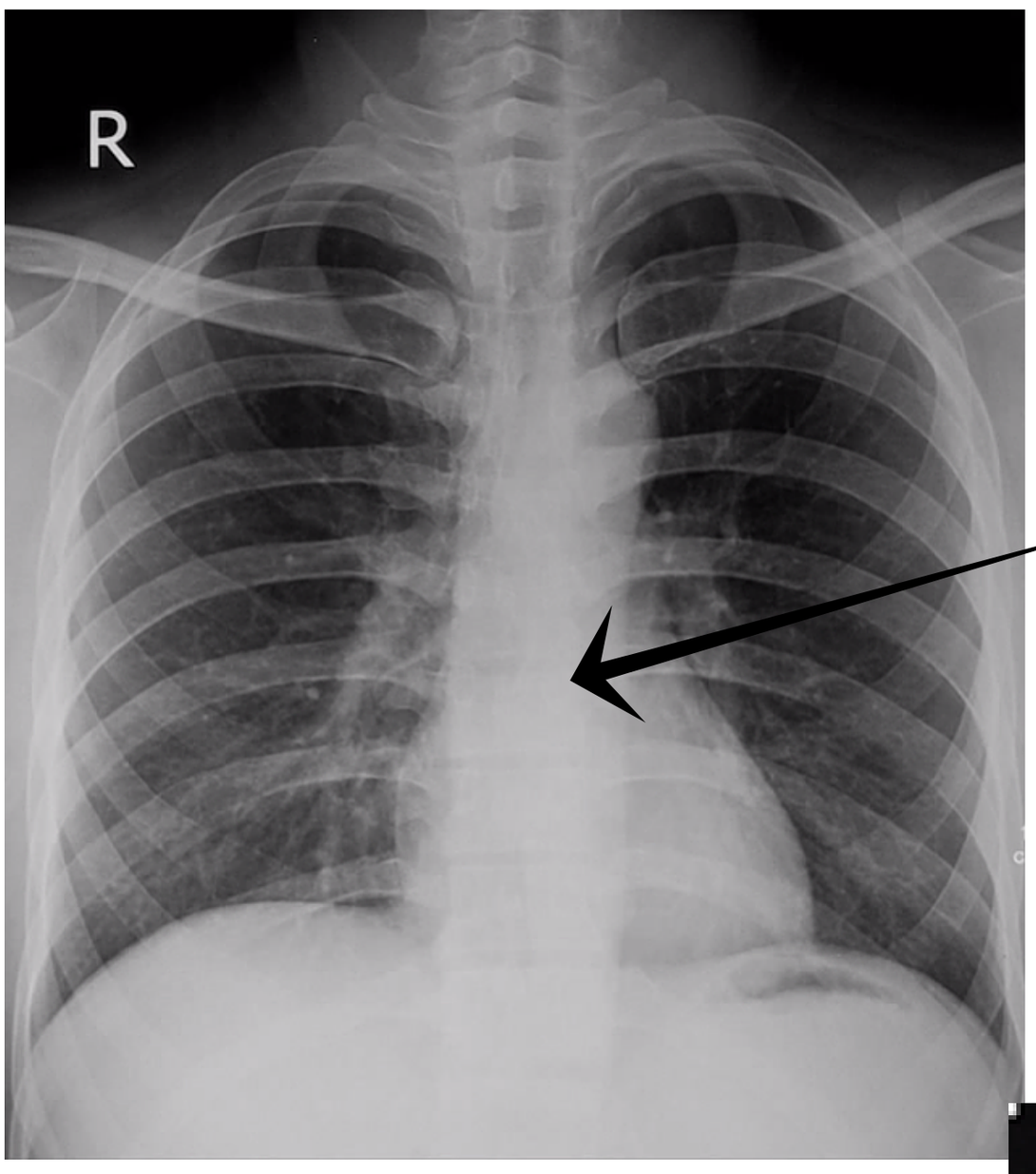
You can see from this image that there are some abnormal appearances. This is an extreme example of rotation, but there is a view of the mediastinum you would not notmally expect to see.

**Penetration**

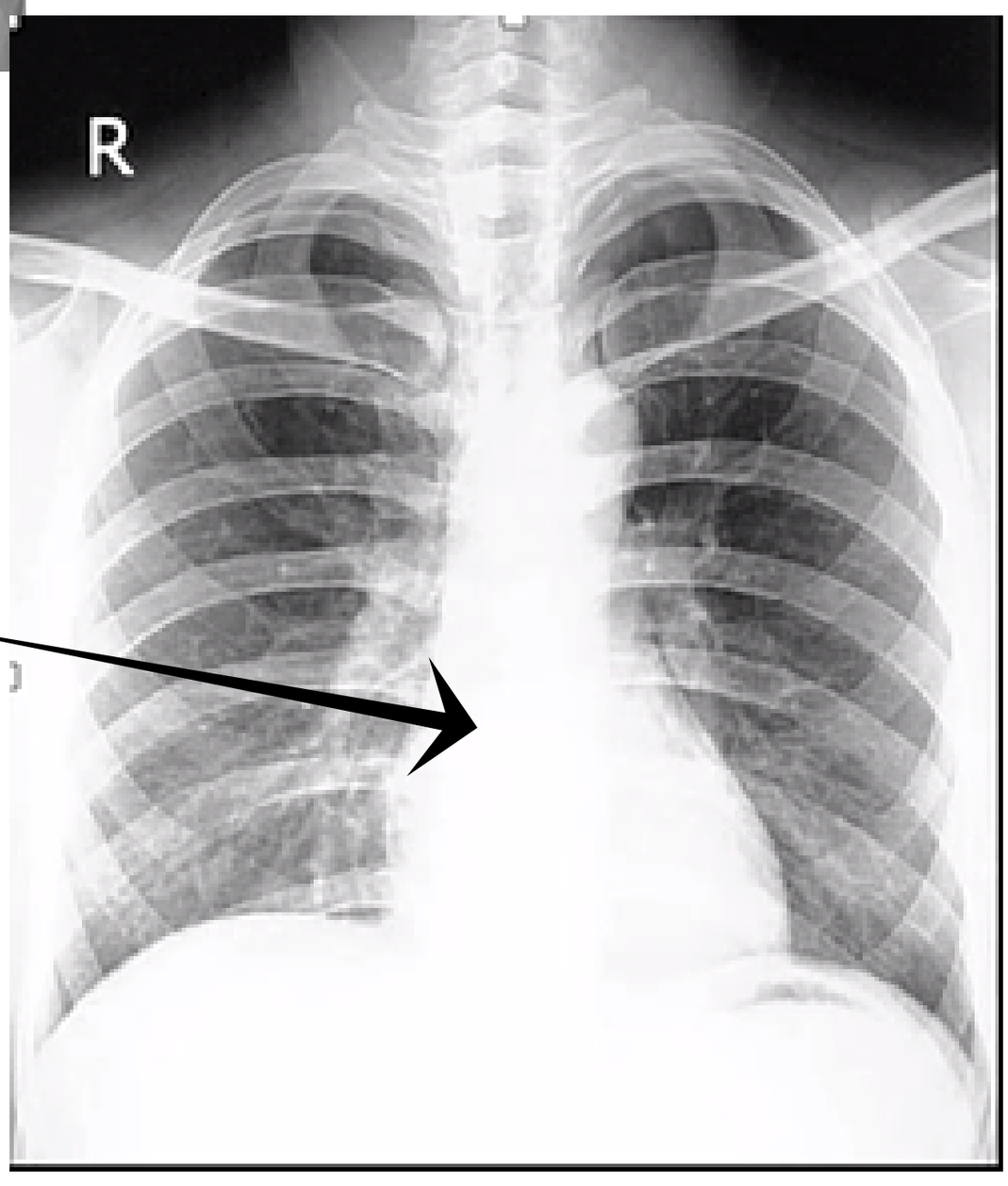
The penetration of the X Ray is determined by the radiographer as they take the picture. They decided how long the patient will be exposed to the X Rays and at what strength.
This combination will then generate an X Ray which the

practitioner will interpret.
A poorly penetrated X Ray is less of a problem in the digital age. The pictures can be easily manipulated by the practitioner to alter the contrast making the important structures visible that otherwise might not have been with a poorly penetrated film.

A well penetrated Chest X-ray is one where the vertebrae are just visible behind the heart. The left hemidiaphragm should be visible to the edge of the spine.




The vertebrae are visible through the heart shadow.

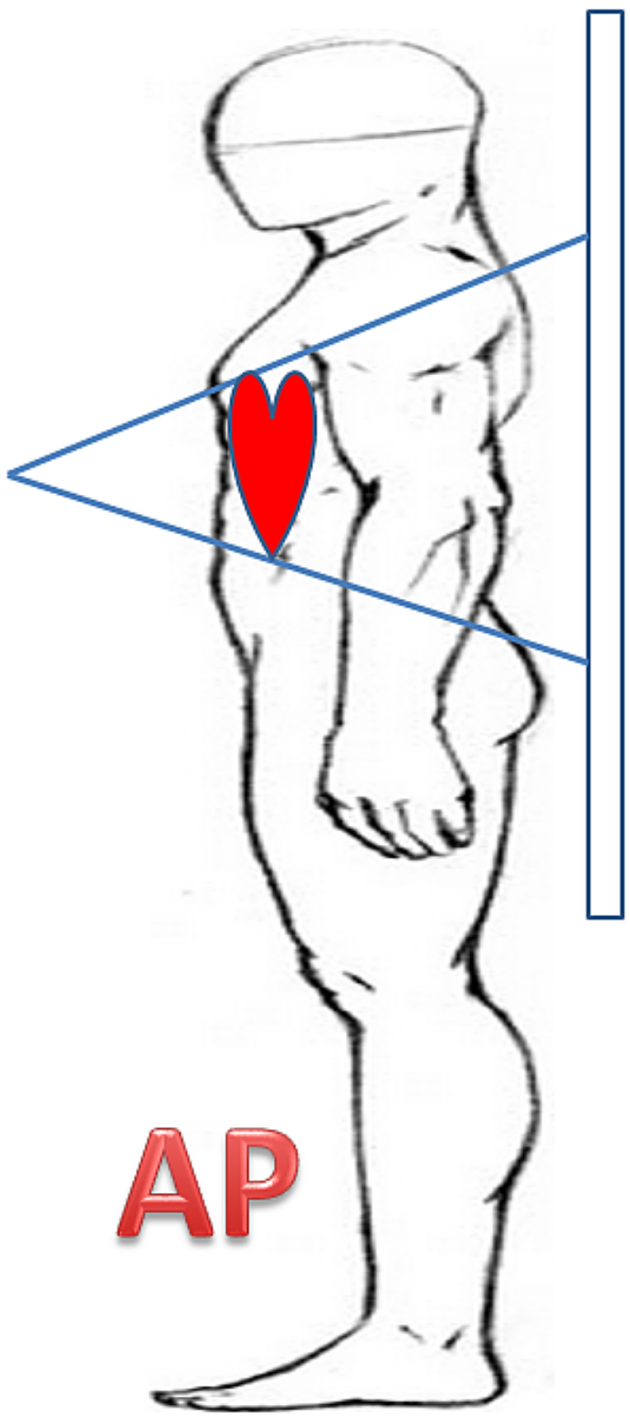



Because of under penetration the vertebrae are not visible through the heart shadow.

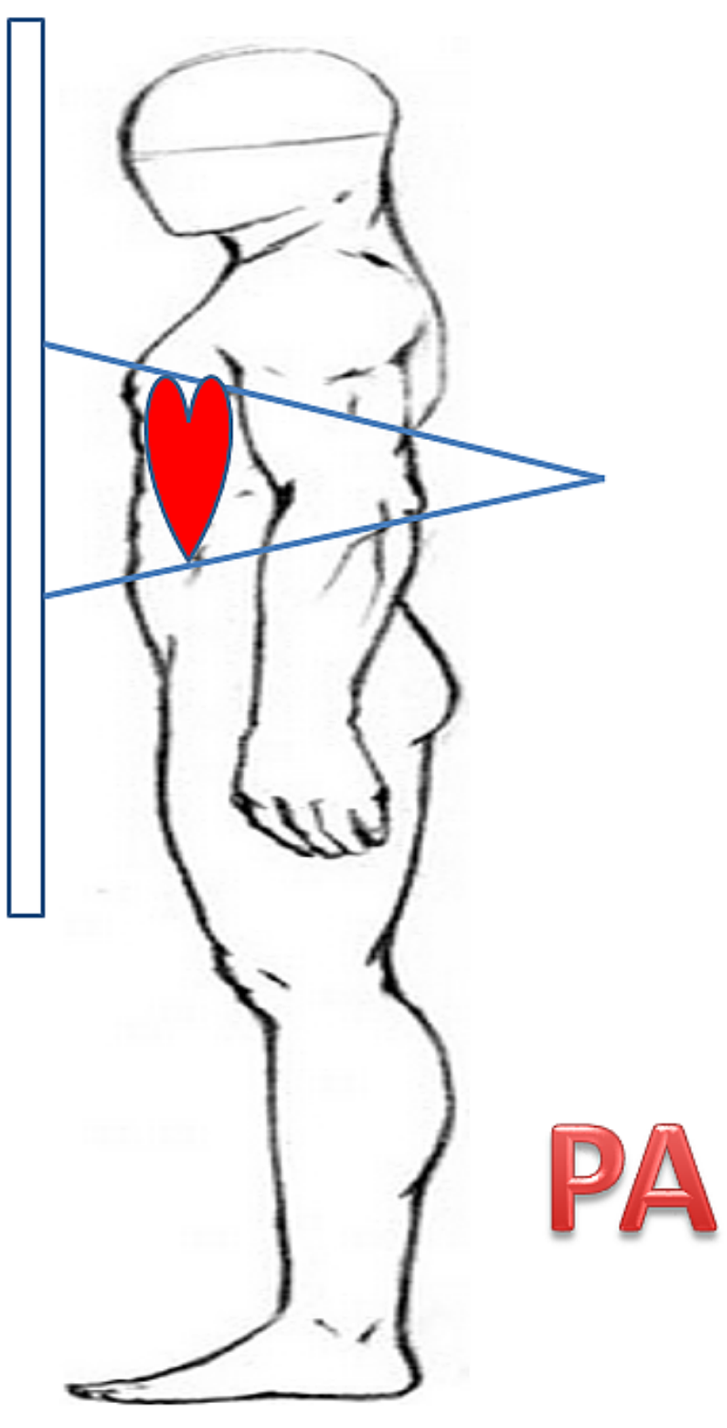
## PA or AP?

There two ways the X Ray can be taken- with the X Ray machine behind the patient and the plate in front of them, or with the X Ray machine in front of the patient and the plate behind them .
The preferred way to take the Chest X Ray is from behind the patient with them standing up almost leaning against the X Ray plate. This ensures that the lungs are well expanded allowing a better view. This is a Posterior-Anterior view or PA.
Sometimes the patient may not be able to stand in this way. If for example they are injured, infirm or unwell. The X Ray will then be taken with the machine in front and they will lie back against the X Ray plate. This then is the Anterior-Posterior view or AP.

Does this make a difference? Yes....



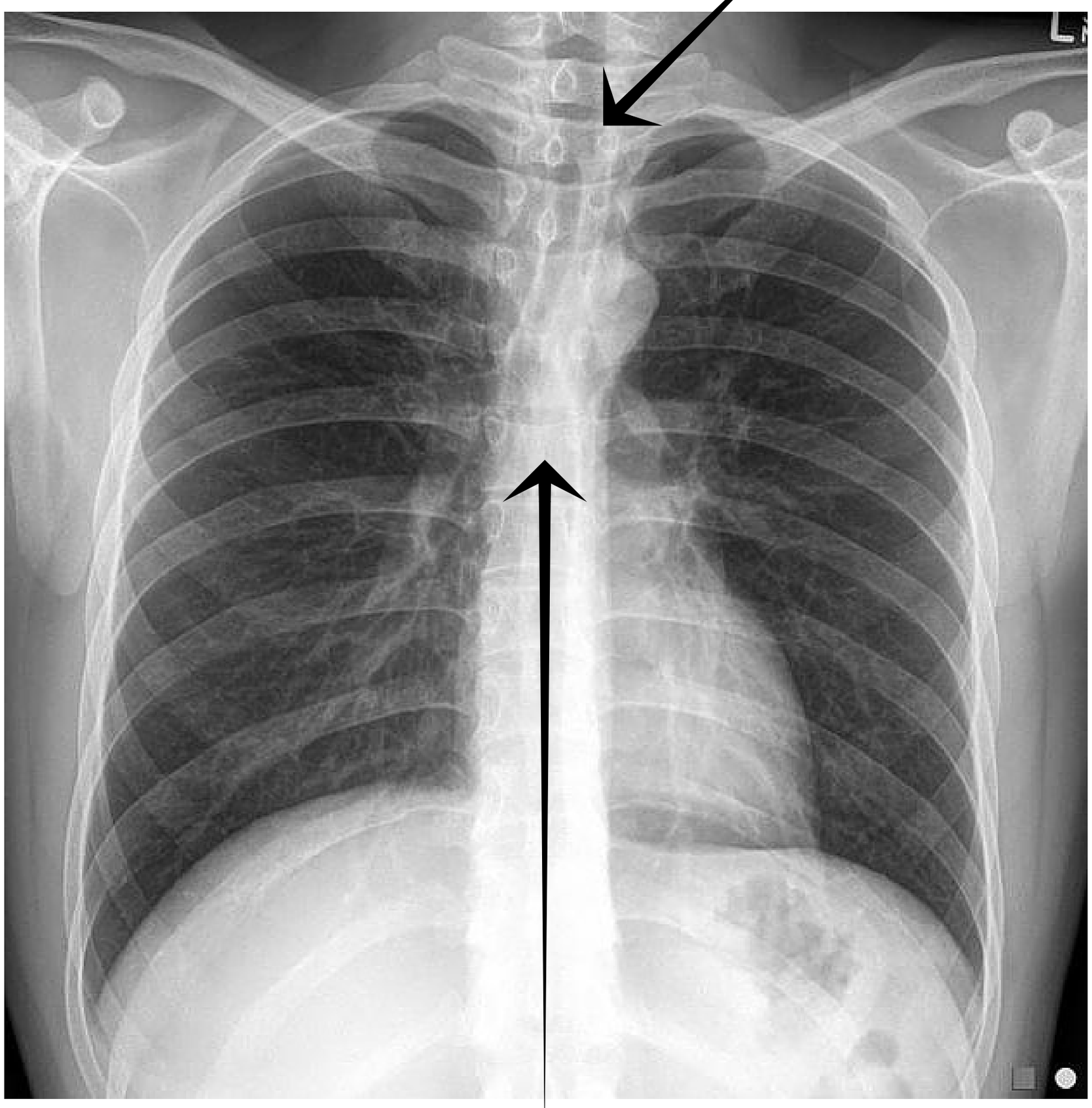

The X Ray plate is further away from the heart in the AP view- the X Rays will then spread out further after passing the heart shadow making the heart appear larger in the AP view. You cannot comment on the heart size in the AP view.



# Airway

There should be three main components of the airway visible- the trachea and the left and right main bronchus. The trachea should be central and not deviated markedly to one side or the other. If it is, this could be due to some problem with the lungs or with any of the surrounding structures.

The trachea should be equidistant from the ends of the clavicles



Angle between left and right main bronchus should be no greater than ninety degrees.

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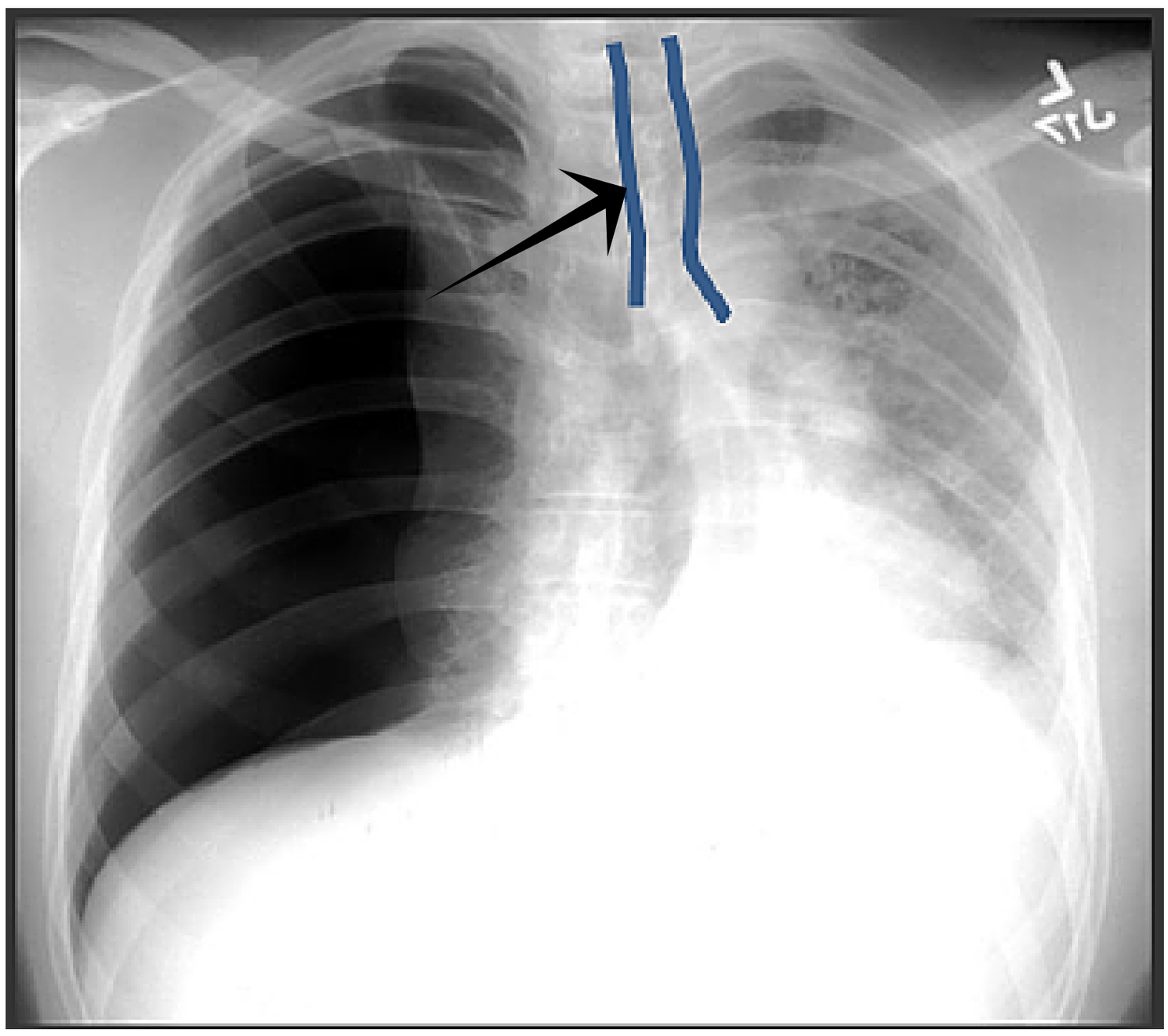
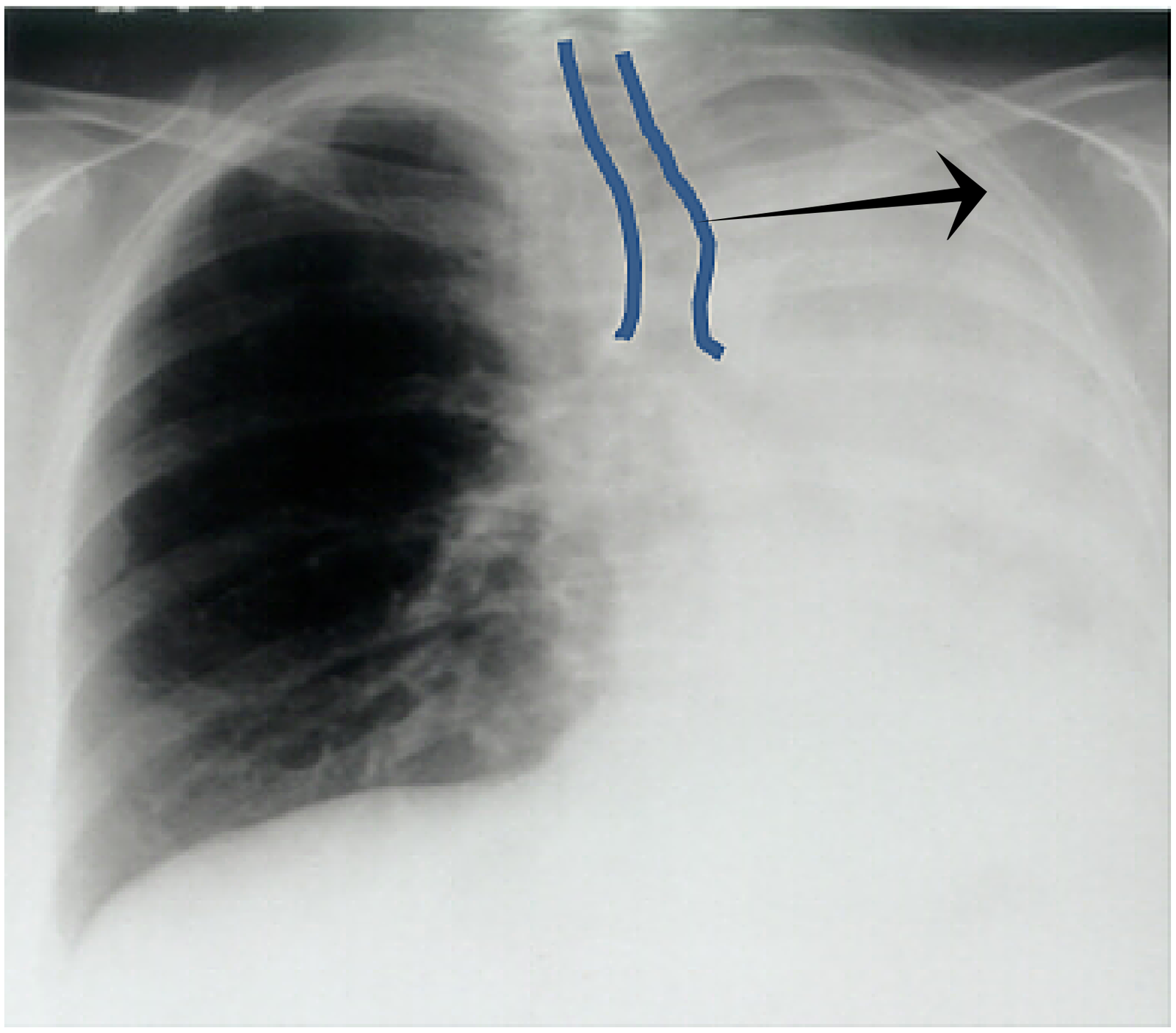


Here the trachea is being PUSHED across by the pneumothorax on the right side.

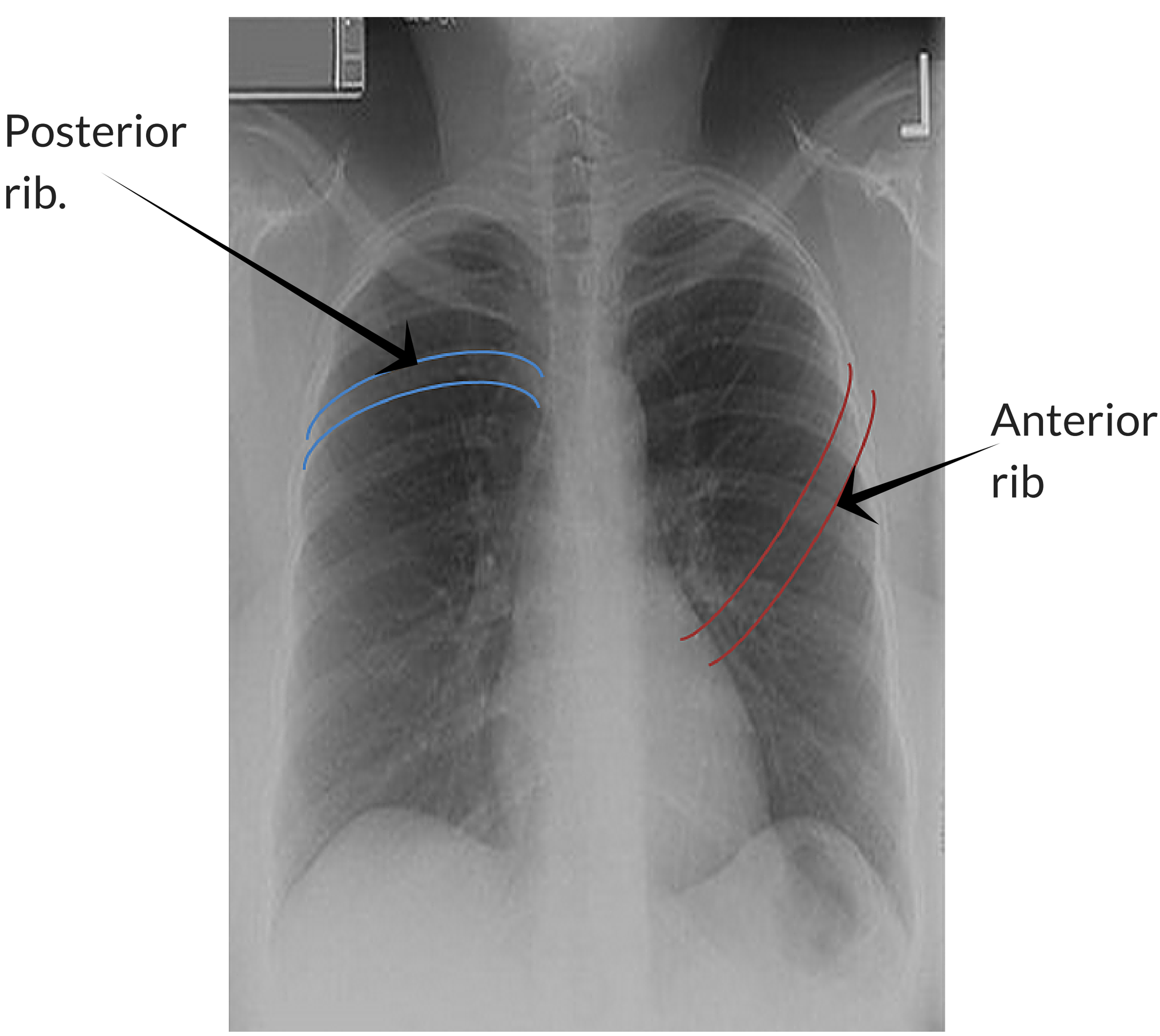
Here the trachea is being PULLED across by the collapsed/con-solidated lung on the left side



# Bones

As well as checking all the visible bones for their own integrety and any pathology, the ribs are also a useful surrogate for evidence of other disease.
You should first work your way along all the visible bones looking for any brighter or darker areas. This may indicate secondaries from a cancer for example. The visible bones will be the ribs, vertebrae, humerus, clavicles and scapula.

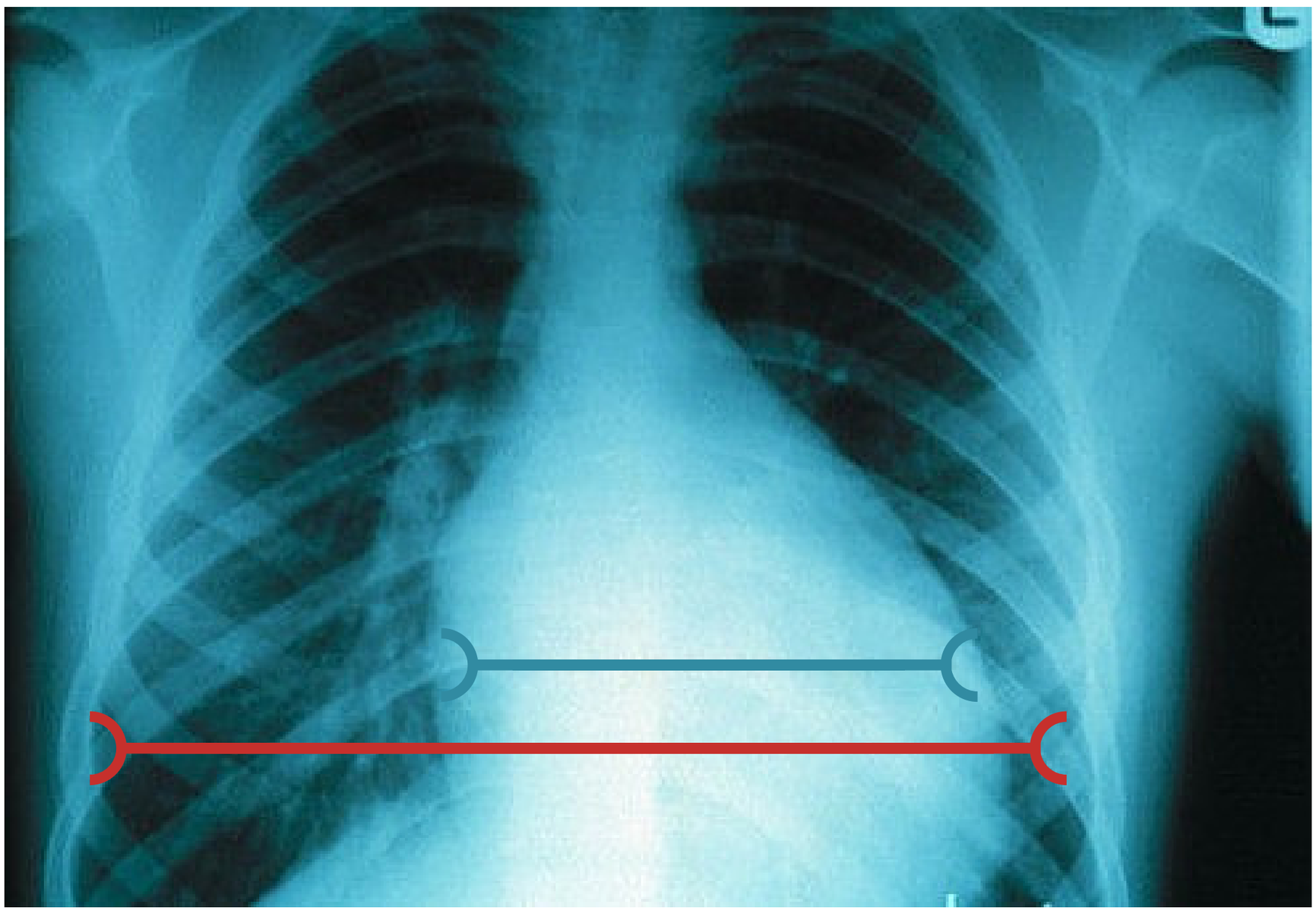
It is important to differentiate between the posterior ribs and the anterior ribs and you will need to count these.



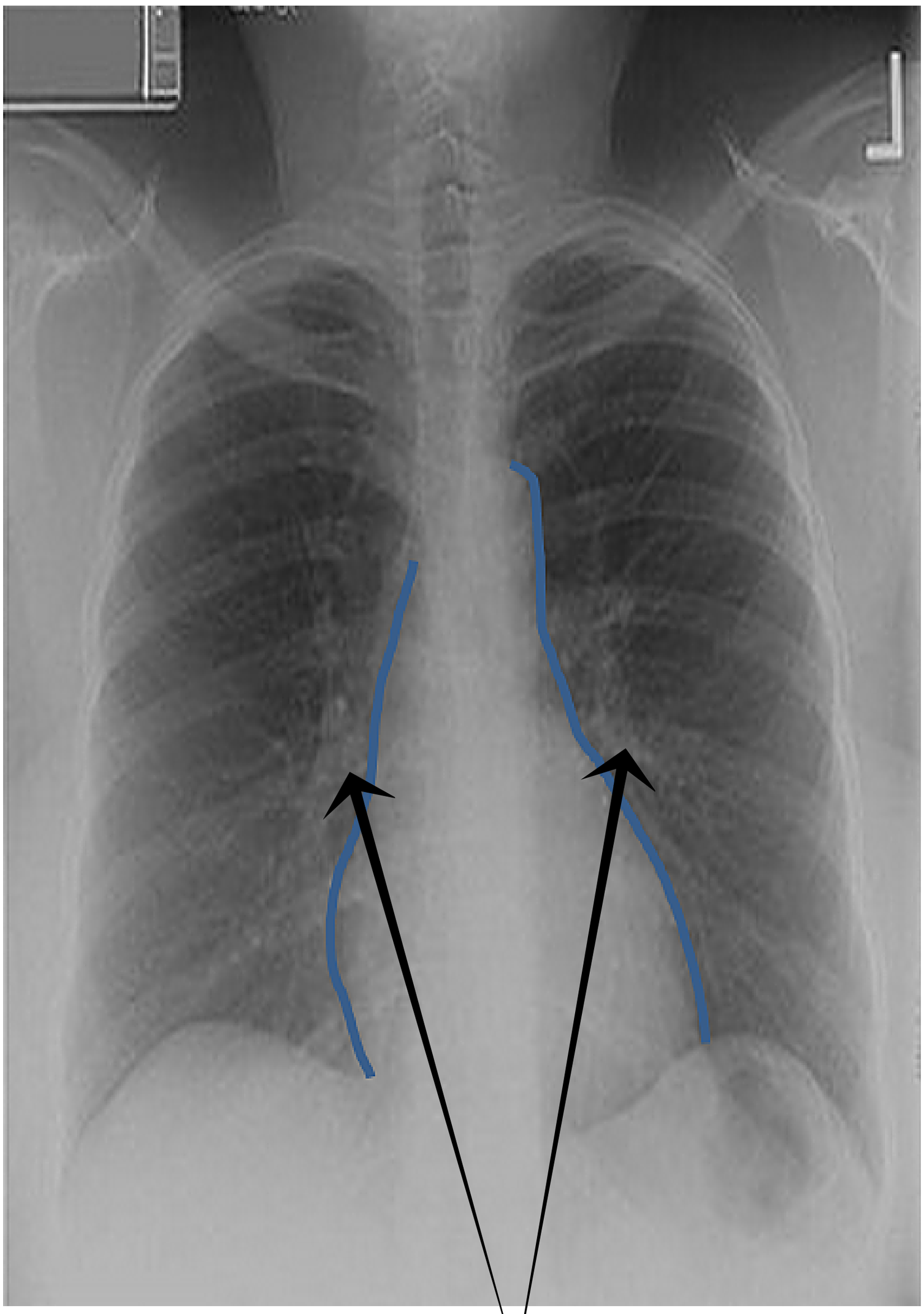
Ideally you should be able to count 9-10 posterior ribs and 6-7 anterior ribs.
This would be considered a normally expanded lung. If you can see fewer ribs it may be that the patient was not able to sit upright or that they were unable to take a deep breath. If you can see more ribs, then that may indicate that the patient has hyperexpanded lungs which could point to COPD.

## Cardiac & Mediastinum

The first step should be to estimate the size of the heart. As we said earlier you cannot comment on the heart size on an AP X Ray. If it is a PA X Ray then the width of the heart shadow should not be any more than half the size of the entire thoracic cavity. If it is more, this would be considered an enlarged heart perhaps due to some degree of failure.

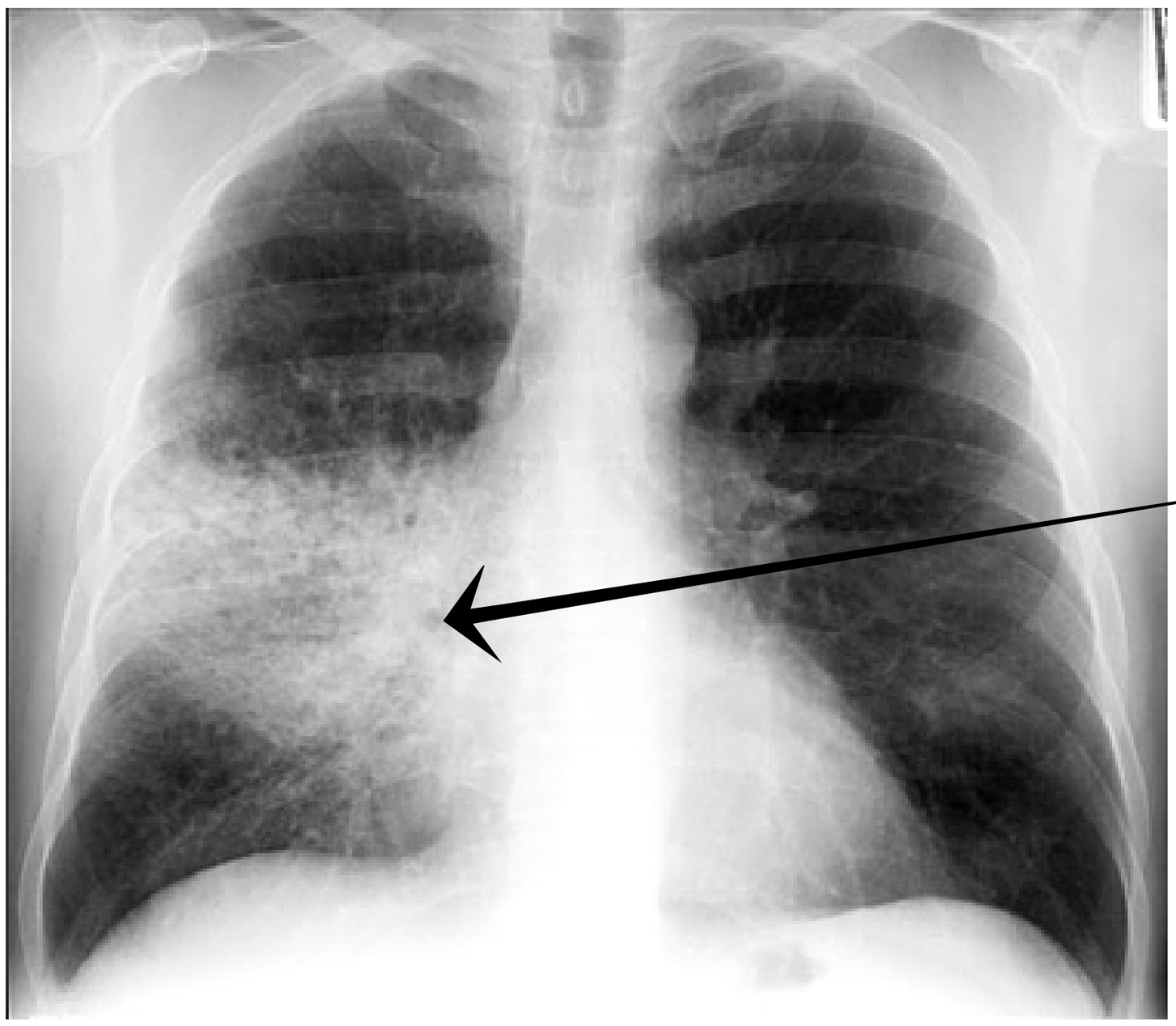


The border betweeen the edges of the heart and the surrounding lung tissue creates a silhouette which can then be used to check for any possible pathology.
With the healthy lung the edge of the heart should be visible all the way round to the diaphragm.



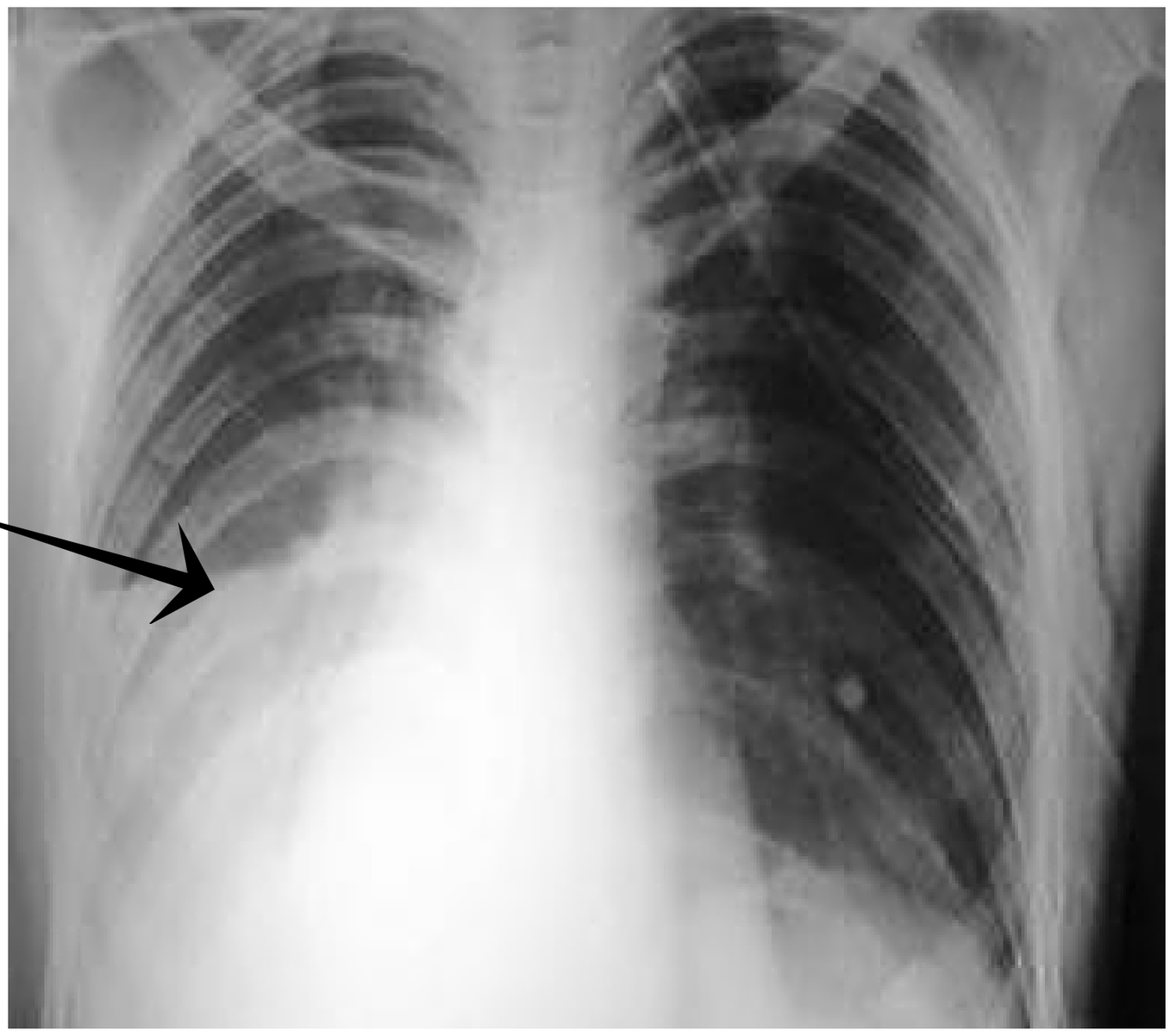
There maybe some shadowing at the levels of the hilum where many of the great vessels exit and enter the heart. This would be normal.

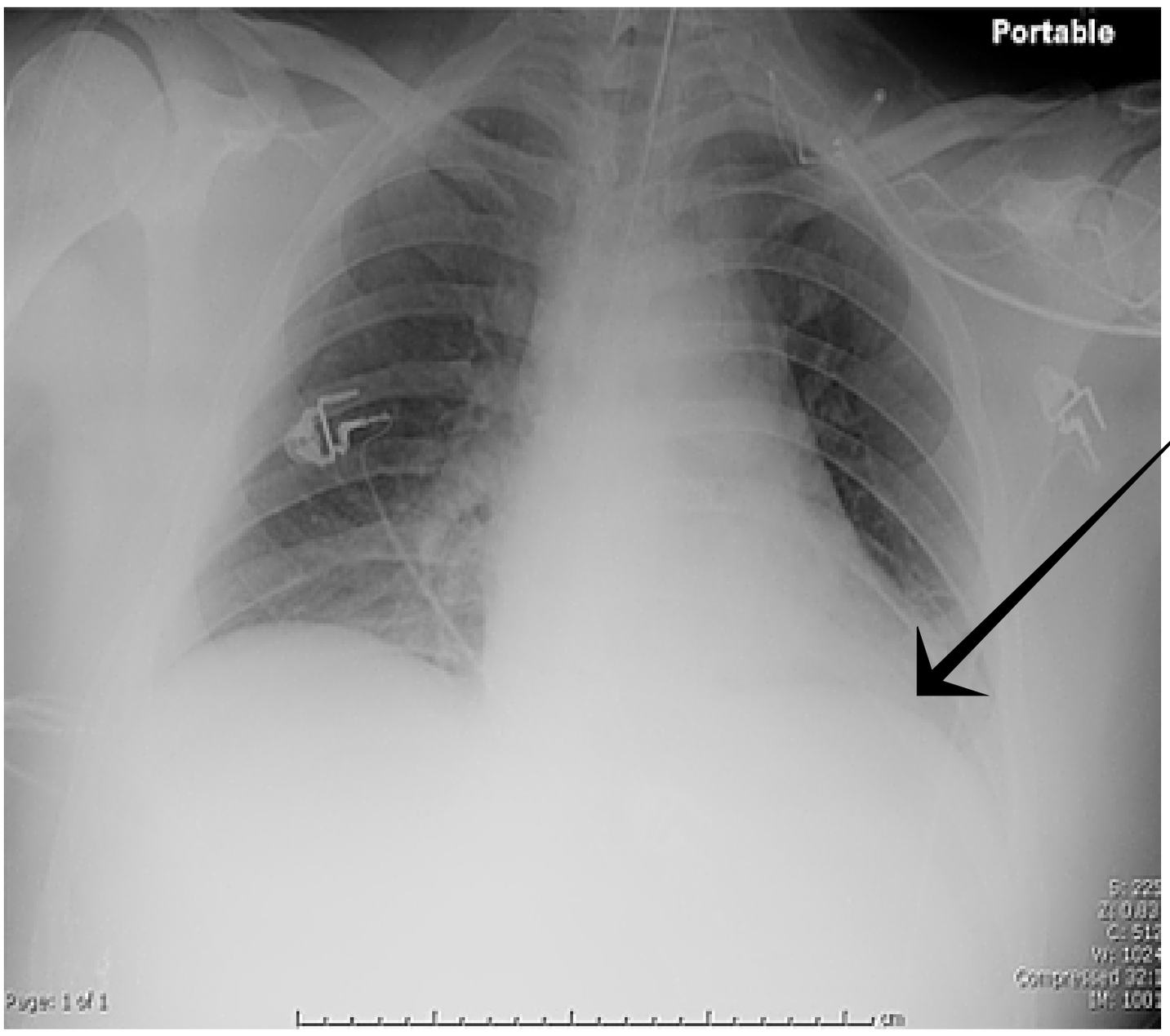
Other shadows around the heart could indicate some disease within the lung. This could be consolidation due to infection, or fluid due to heart failure. The position of that shadow can sometimes help understand which lobe of the lung maybe involved.



Right Middle Lobe Opacity- obliterates right heart silhouette but not diaphragm

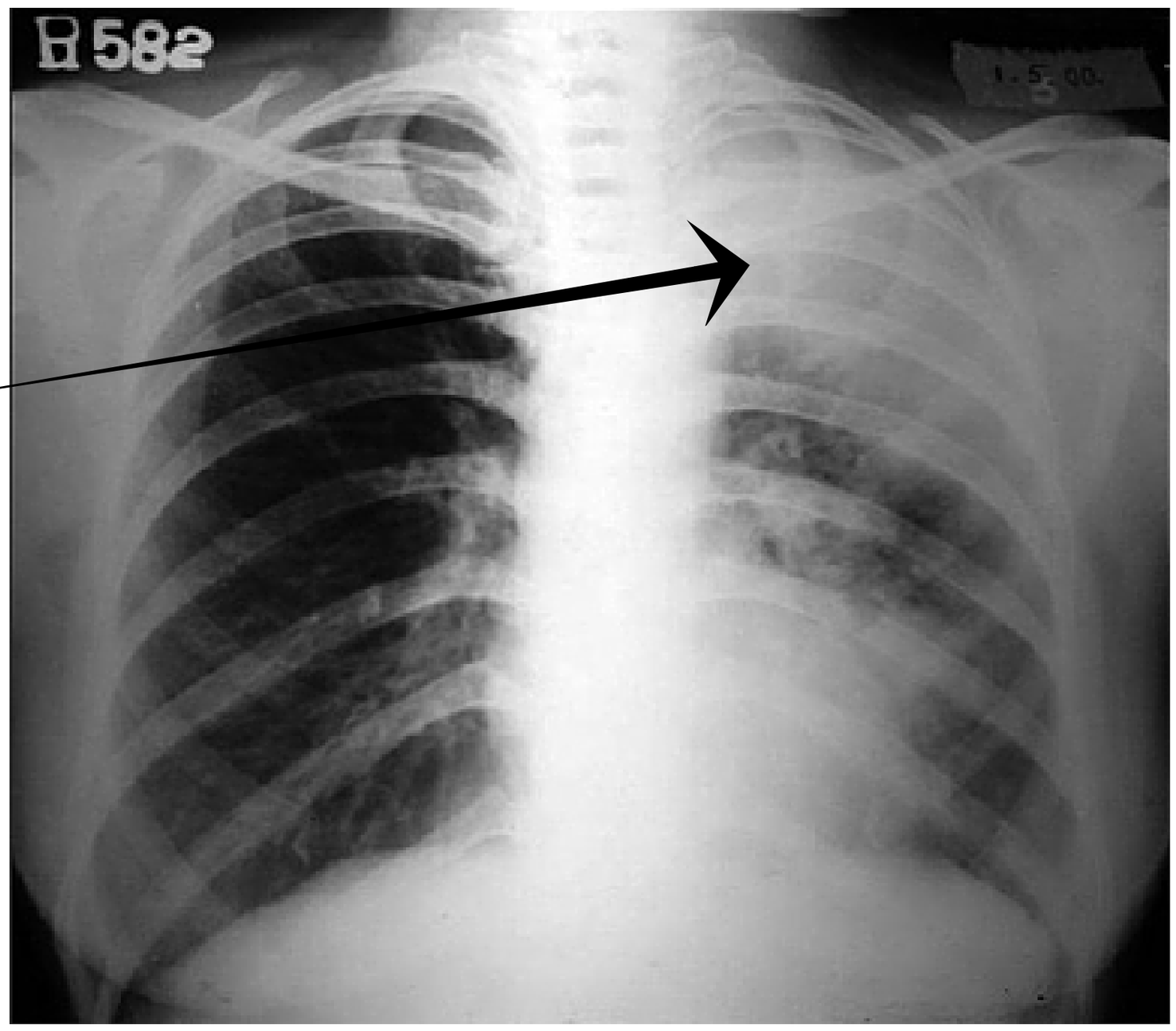
Right Lower Lobe Opacity- obliterates lower right heart silhouette and diaphragm



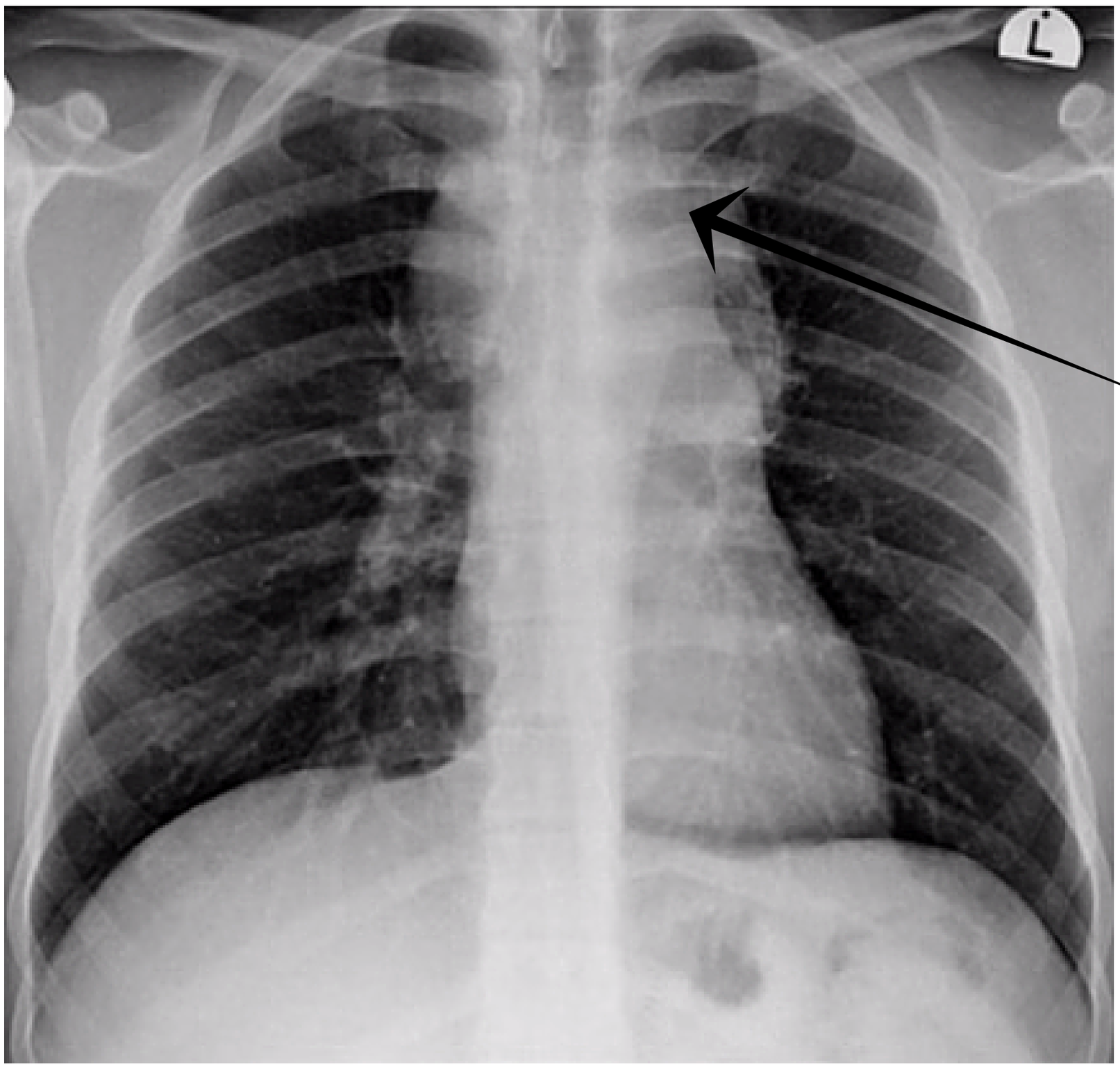



Left Lower Lobe Opacity- covers the left heart border and the left diaphragm

Left Upper Lobe Opacity- Hides the edge of the left mediastinum




The width of the mediastinum should also be estimated. As long as the film is not excessively rotated, this should be no more than 8 cm on a PA film. Again, if it is more than that then there may be some pathology to consider.



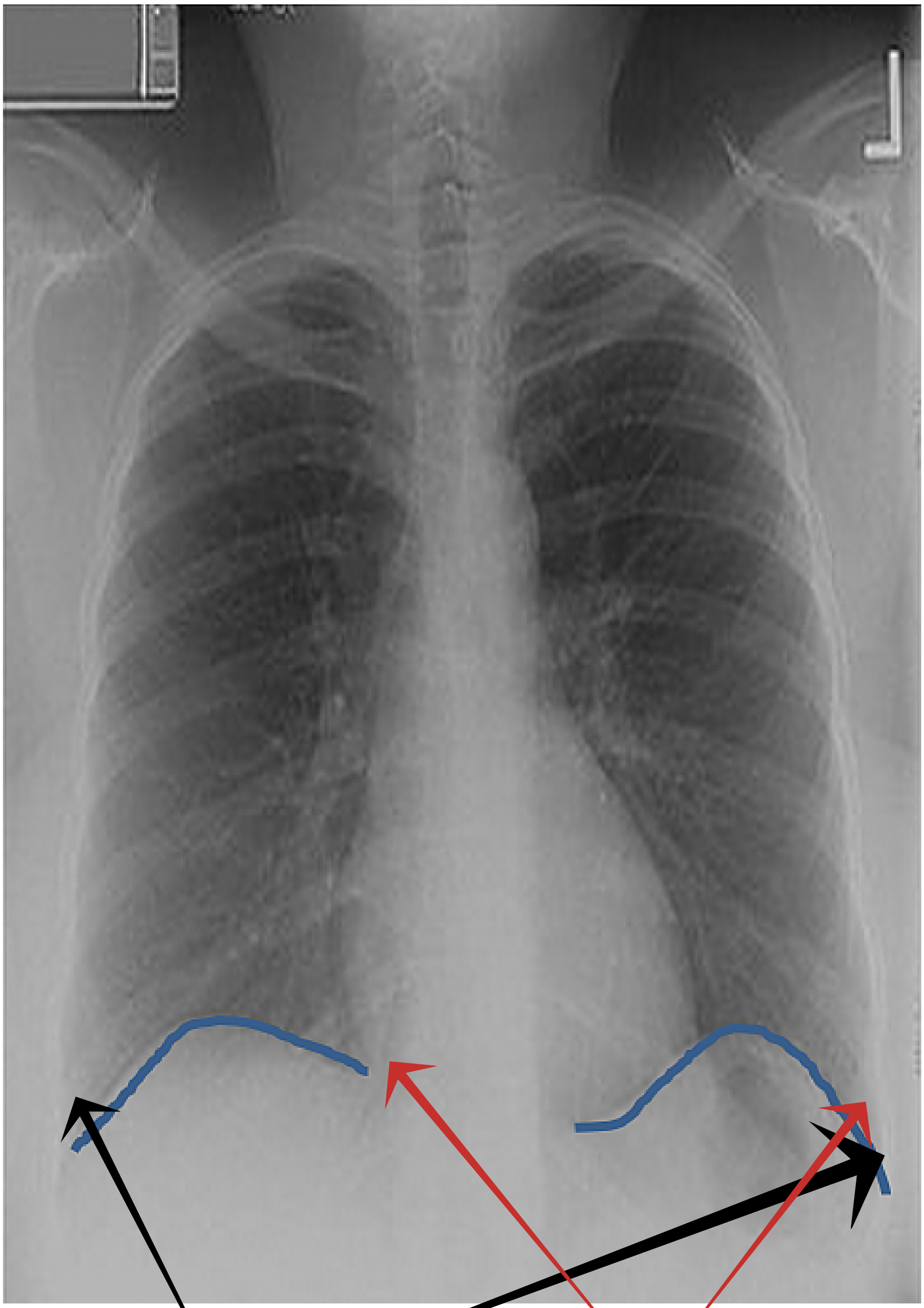

Widened mediastinum due to lymphoma

# Diaphragm

The diaphragm is a muscle sheet that extends across the whole thoracic cavity. It is further divided into the left and the right hemidiaphragms.

Both sides should be slightly dome shaped and the right is often higher than the left due to the presence of the liver under the right and the bulk of the heart lying over the left hemidiaphragm.

Like the heart shadow, there should be clear delineation between the lung and the diaphragm- the silhouette should be obvious.



Costophrenic angles

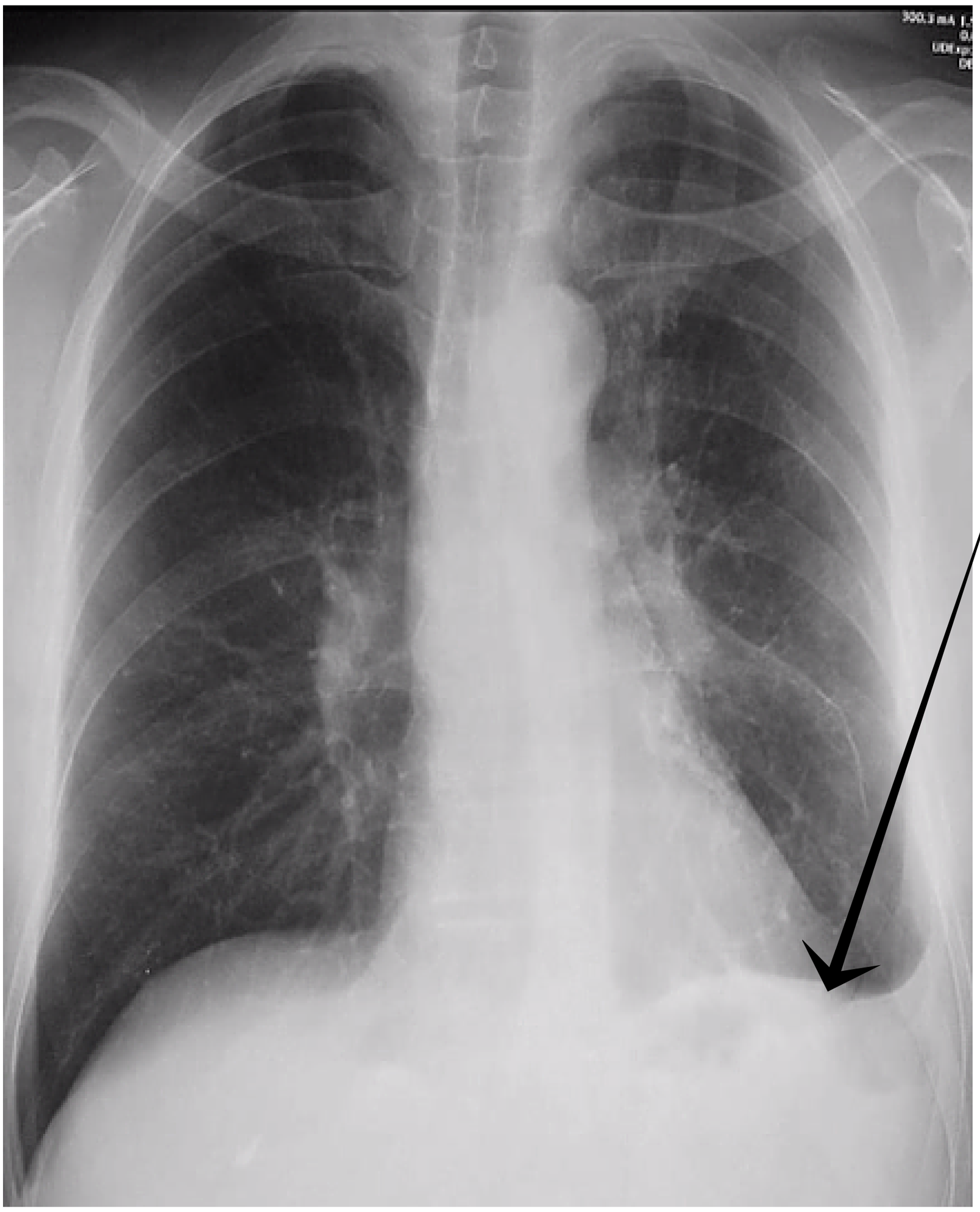
Cardiophrenic angles

Both cardiophrenic and costophrenic angles should be clear. If not there may be some lung pathology involved.

Pneumoperitoneum..

Other than the gastric bubble on the left hand side, which is simply air in the stomach, there should not be any air directly under the diaphragm. Air can only get here if the bowel is perforated or the patient has had some abdominal surgery.
This is known as a pneumoperitoneum.

A pleural effusion may also be evident from looking at the diaphragm. This fluid between the pleural membranes may settle to produce a fluid level which can be seen on X Ray.

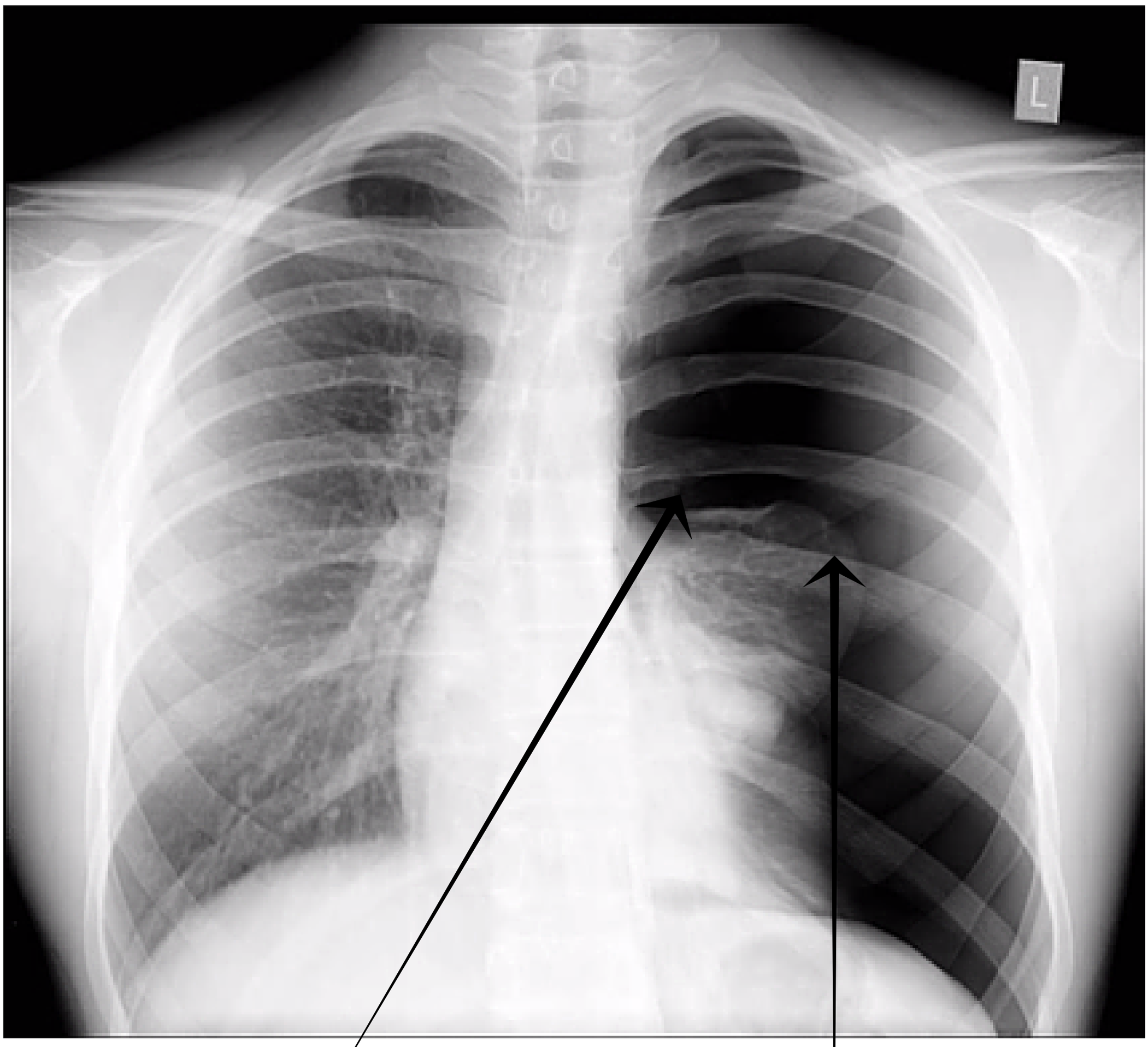


Fluid level with meniscus. As the diaphragm slopes from front to back the fluid level is quite significant already if seen on a PA X Ray

# Equal Lung Fields

Much of the abnormal pathology can be identified by just comparing one lung with another.
We have already looked at some of the lobar consolidations that can be seen. These can be identified by looking at the edges of the heart and the diaphragm. They can also be seen by looking at both lungs to see if there is a difference.
One abnormality not covered yet is the pneumothorax.

This is where air has entered the thoracic cavity and is consequently pushing up against the lung, potentially compromising the breathing.
It is important in this case to examine the lung fields for equal markings and no evidence of air which would be much darker than normal.




Darker area on the left side with a loss of the normal lung markings

Left lung edge

# Conclusion

With a structured approach the interpretation of the Chest X Ray becomes a much easier process. You should go through the same routine with every Chest X Ray- this will hopefully improve your chances of not missing any important pathology.

My final comment is that, for the less experienced eyes, the interpretation can still be a quite subjective one. Trust your judgement, but always seek a second opinion whilst you are still learning.

I hope you find this guide useful. I would be really grateful if you did not pass it around but instead encouraged others to get it the same way you did- that is via my website and giving me your email in exchange.

Thank you- any comments please leave via the website.

Jonathan.