MS case 1

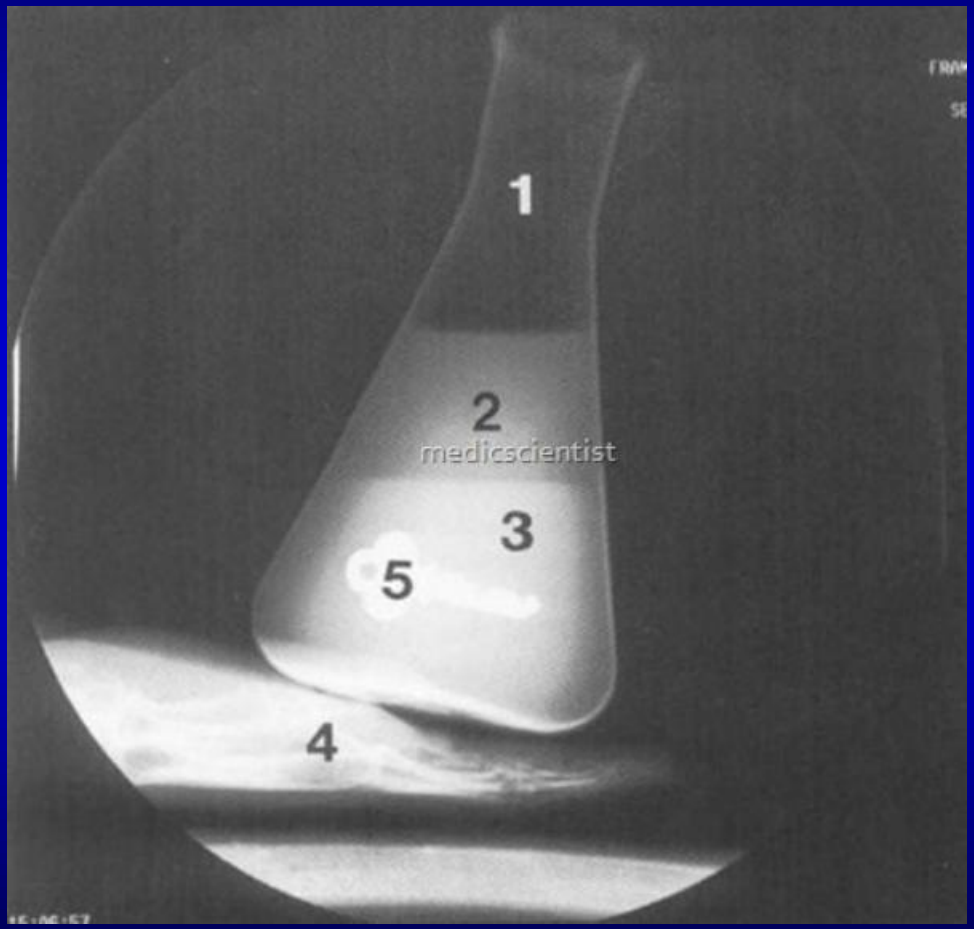
Five Basic Densities

Introduction

- Let's learn some basics about radiography!
- After reviewing the cases, you will see a brief introduction into how radiographs are created and why we see the different densities described in the cases.

The 5 different radiographic densities

- 1 = air
- 2 = fat (or in this case, olive oil)
- 3 = water
- 4 = bone (some poor guy's hand -- not good radiation safety technique!)
- 5 = metal



Case 1: This in an 8 year old boy – he swallowed something...

- What density is the foreign body? What do you think it is?

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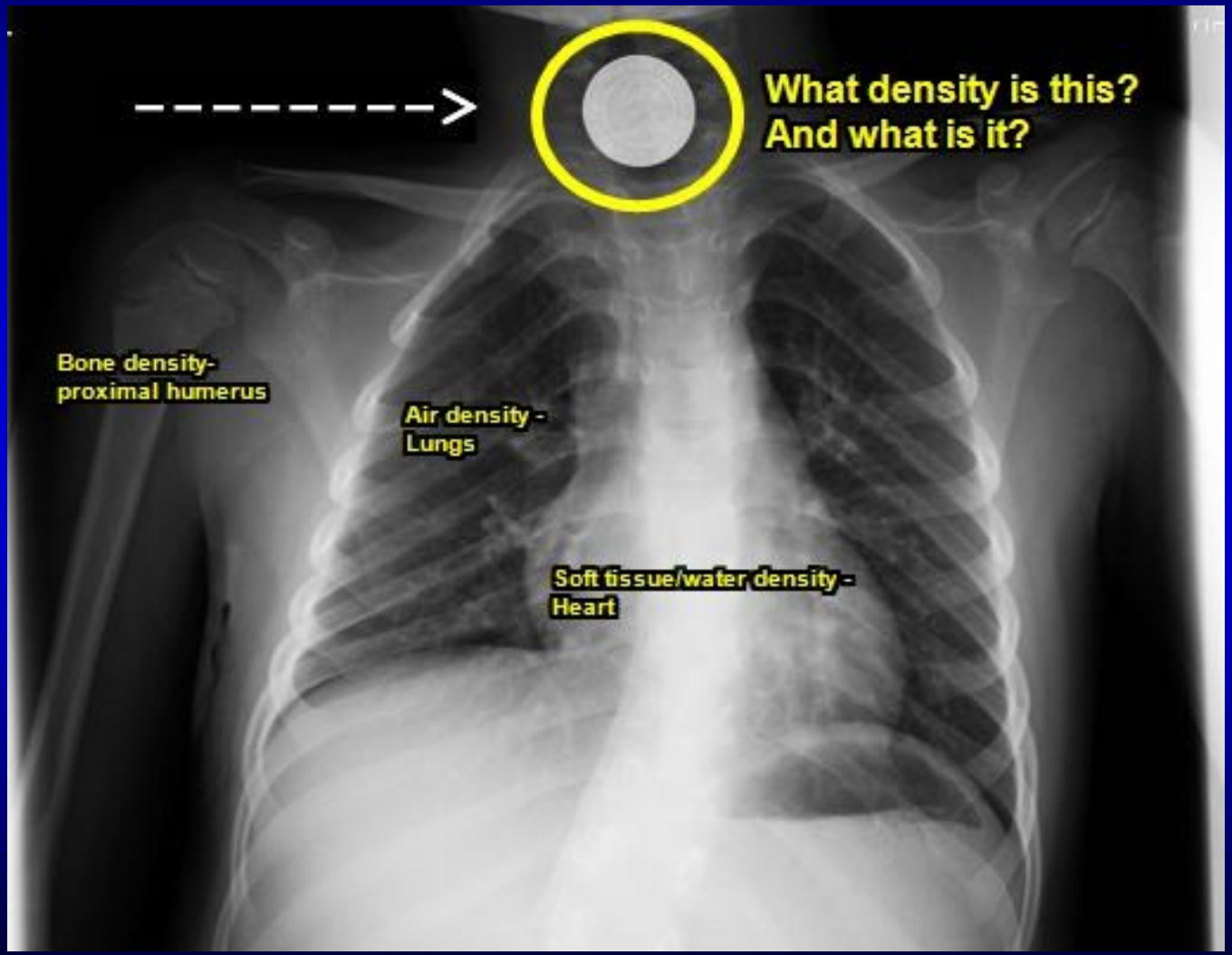
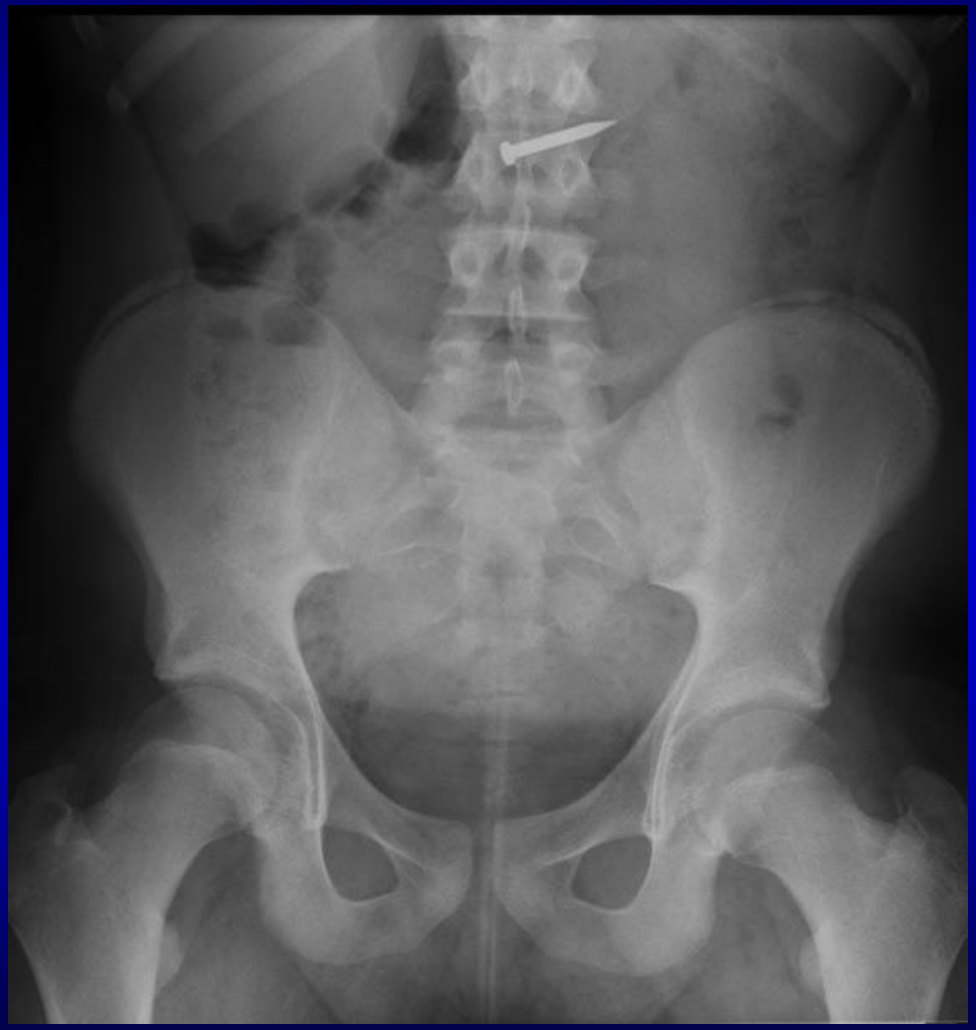


Close up of the same patient

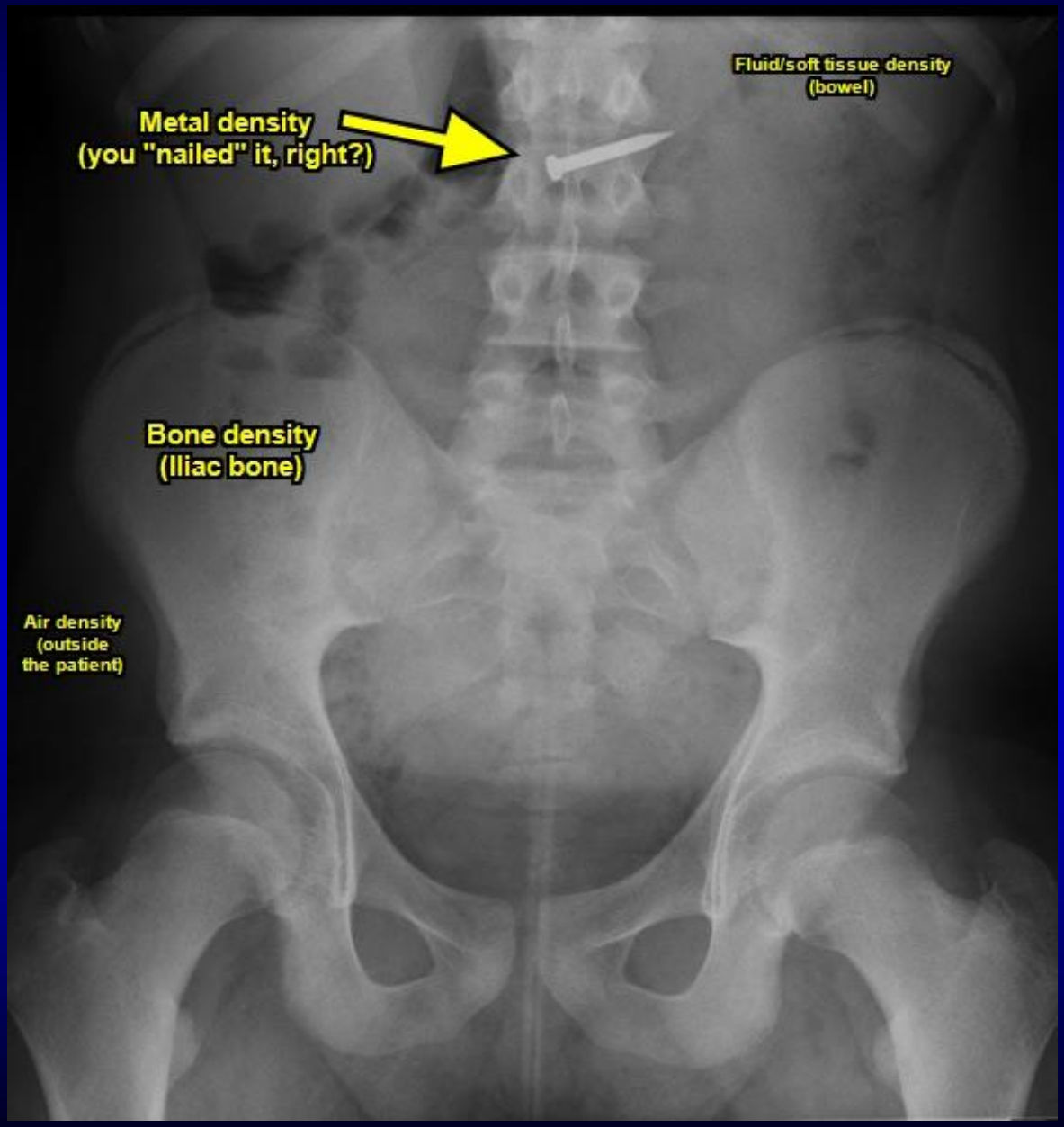
- It is a coin (metal density)
- If you look closely, you can see where this kid ate lunch.

Case 2: 15 year old...also swallowed something

- What densities do you see here?
- Anything that doesn't belong?

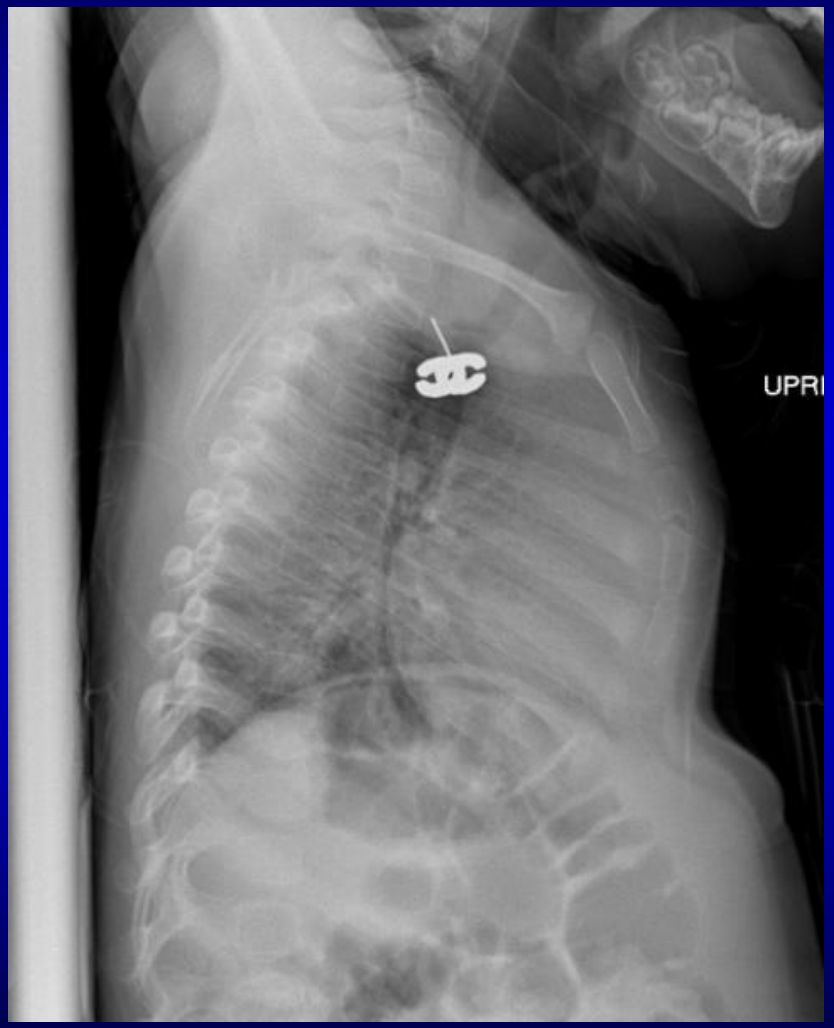


Case 2: 15 year old...also swallowed something

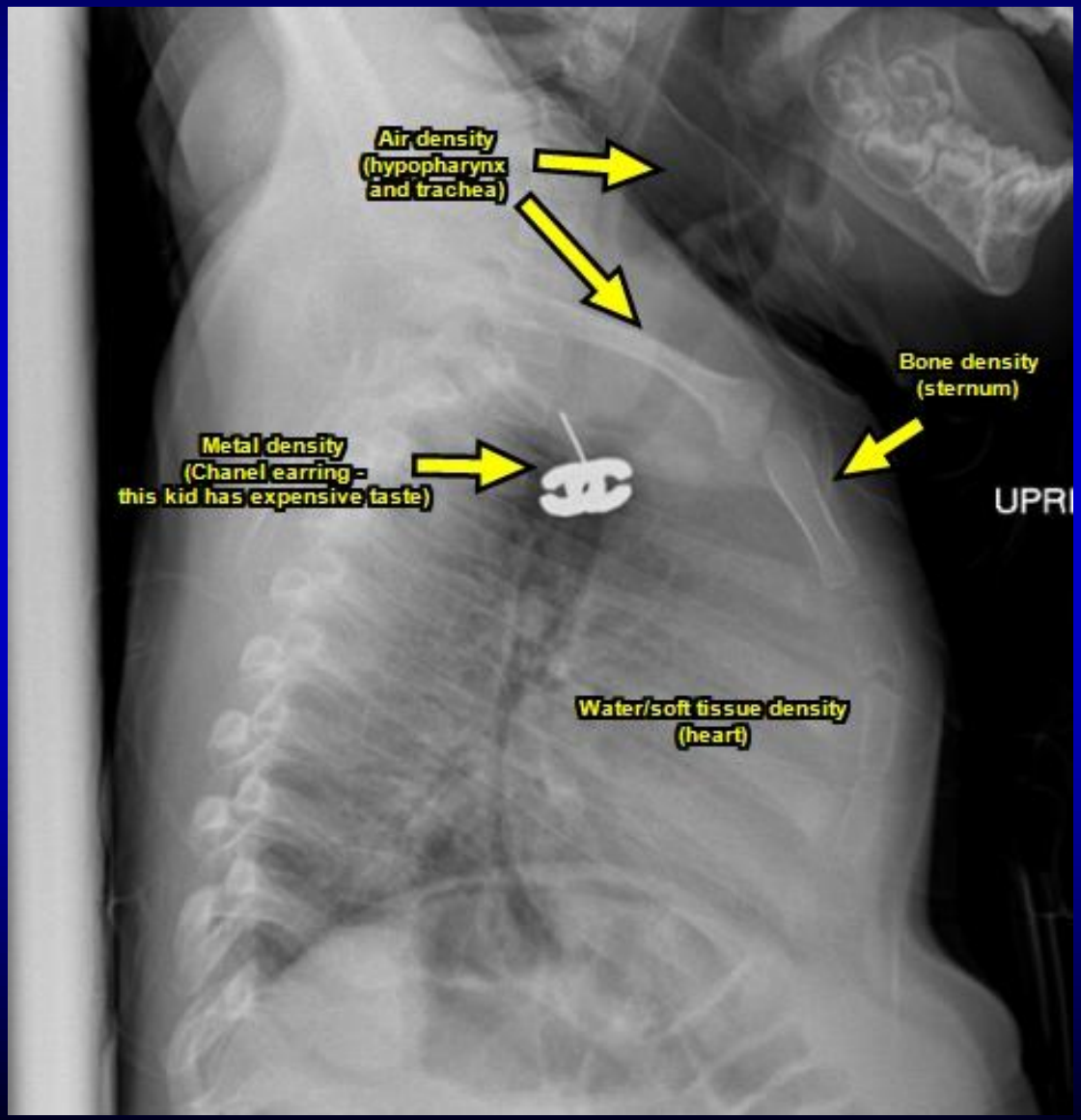


Case 3: Lateral chest x-ray in a toddler - he swallowed something too

- What densities do you see?
- Anything abnormal?



Case 3: Lateral chest x-ray in a toddler - he swallowed something too



The next few slides will discuss how radiographs are made, and then we'll look at a few more examples

Discussion

- How are radiographs (x-rays) made?

- Radiographs are produced when a beam of excited particles (photons) travel through an object and hit a receptor or "plate" on the other side

Discussion

- These photons then either cause a chemical reaction or activate receptors on a digital plate. It is this reaction that ultimately creates an image.

- The number of photons that hit the receptor determines the "density" seen on the image.

Discussion

- The more photons that hit the receptor (i.e. the more photons that travel through the object being imaged), the more "black" the resulting image will be.

- The more photons that are blocked by the object, the more "white" the image will be.

Discussion

- For example:
  - A piece of metal blocks the majority of the photons, therefore the resulting image shows a “white” area where the metal object is.
  - A piece of water or soft tissue (for our purposes, they are the same thing) blocks many of the photons, but not nearly as many as metal, therefore the resulting image is light gray.
  - Air essentially blocks none of the photons, so the resulting image is black.

- The number of photons that are blocked by an object can be altered by increasing or decreasing the "energy" of the x-ray beam
  - The more energy, the more photons pass through the object.
  - This can result in images being "overexposed" or "underexposed“

- As radiologists, we use the different radiographic densities to help us distinguish both normal anatomic structures, and different pathological processes.

- For example:
  - If a patient has pneumonia, we may see water/soft tissue density in the lung where we would normally expect to see air density (the lung normally contains enough air to essentially be "air density" on radiographs).

- This is the essence of all of radiography (and computed tomography - CT). We exploit the different radiographic densities to let us see what is going on

REMEMBER:
There are 5 basic radiographic densities!

1) AIR
2) FAT
3) WATER/SOFT TISSUE
4) BONE
5) METAL

Finally, two examples of what can go wrong…

CXR with improper technique

- TOO FEW PHOTONS GETTING THROUGH
- THE IMAGE IS TOO 'WHITE'

Chest x-ray with improper technique

- TOO MANY PHOTONS GETTING THROUGH
- THE IMAGE IS TOO 'BLACK'