Gallstones (Part 2/2)

Cholesterol stones are the most common type of gallstones. These gallstones are typically radiolucent, meaning they cannot be visualized on an x-ray. There are two kinds of pigmented gallstones: black and brown. Black pigment stones typically result from hemolysis, while brown pigment stones are typically associated with infections. There is some variable radiopacity in pigment stones- black pigment stones are typically radiopaque and brown stones are typically radiolucent.

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Cholesterol Stones

Cholesterol Stones are the Most Common Type

Cholesterol-burger Gold-stones with #1 Foam-Finger

Gallstones can occur due to the precipitation of cholesterol. Under normal conditions, bile can dissolve all the cholesterol excreted by the liver. If the liver produces more cholesterol than bile can dissolve, the excess cholesterol may precipitate as crystals, which are then trapped in gallbladder mucus, producing sludge. This process is known as cholesterol supersaturation. These crystals may grow and form stones. Cholesterol stones are the most common type of gallstone (80-90%), especially in Western countries.

Radiolucent

Radio-translucent

Cholesterol stones are usually radiolucent, meaning they are not readily visible on X-ray imaging (10% are radiopaque due to associated calcium).

Pigmented Stones

Black Pigment Stones

Black Pig Stones

Black pigment stones result from hemolysis and consist primarily of calcium bilirubinate. These stones can develop with hemolytic disorders like sickle cell anemia.

Hemolysis

Hemolytic-RBCs

Extravascular hemolysis increases bilirubin in the bile, increasing the risk of pigmented (black) gallstone formation. These gallstones are commonly seen in patients with sickle cell disease or trait.

Brown Pigment Stones

Brown Pig Stones

Another type of pigmented gallstone is brown stones. These stones are associated with bacterial or parasitic infection of the biliary system.

Infection

Infectious-bacteria

Brown stones are radiolucent and associated with infections. Brown pigment stones are associated with bacterial and parasitic infections affecting the biliary tract. Infection causes the release of beta-glucuronidase (a lysosomal enzyme that deconjugates direct bilirubin) by injured hepatocytes and bacteria, which hydrolyzes conjugated bilirubin and lecithin in the bile, increasing unconjugated bilirubin and fatty acids. This process leads to the precipitation of calcium carbonate, cholesterol, and calcium bilirubinate (dark color) in bile.

Variable Radiopacity

Varied Radio-opacity

While black pigment stones are radiopaque due to high calcium content, brown pigment stones are typically radiolucent. Black stones are associated with hemolysis, while brown stones are associated with infection.