Limy bile ('milk of Calcium in bile') with radiolucent gallstones within

Clinical History:
A 50-year-old otherwise healthy woman was referred for right upper quadrant pain. Her biochemical markers, including liver function tests, were unremarkable. There was no history of recent administration of hepato-biliary or cholecystographic contrast. Her pain resolved spontaneously. Plain film and subsequent CT evaluation revealed the following.

Imaging Findings:
Initial plain film evaluation demonstrates a dense rounded region opacification overlying the right upper quadrant corresponding to the position as well as conforming to contours of the gallbladder (Figure 1). The opacification is not just confined to the wall of the gallbladder and there is additional suggestion of superimposed radioluencies overlying the radiopaque gallbladder. Subsequent unenhanced CT on standard soft tissue windows confirm the opacification as being within the gallbladder and not just confined to the wall (Figures 2a and 2b). Review of bony windows further demonstrate multiple distinct rounded radioluencies (of Hounsfield values around 100) amongst the background increased radiodensity indicating the presence of cholesterol or pigment stones (Figures 3a - 3d). There is no evidence of any surrounding inflammatory change or any other radiodensity within biliary system elsewhere.

Discussion:
Limy bile (or milk of calcium bile) when it layers, is a rare disorder where the gallbladder lumen becomes filled with a semisolid or paste-like radiopaque material composed primarily of calcium carbonate [1, 9]. The term "limy bile" was initially coined by F Knutson in 1933 [12]. Its exact aetiology is not well known, although gallbladder stasis or obstruction is believed to be a prerequisite [1, 11]. The presence of limy bile can have occasional associations with total parenteral nutrition, hereditary spherocytosis, primary biliary cirrhosis or primary hyperparathyroidism [4, 7]. The gallbladder can fill with a thick, paste-like, radiopaque material [2]. Limy bile can be confined to gallbladder but can also extend to other parts of the biliary system such as the cystic duct and common bile duct. Some patients with limy bile may present with right upper quadrant pain which is then termed the "limy bile syndrome". This entity as a syndrome was first described by Churchman in 1911 [8]. Others can by asymptomatic.

On imaging, the calcium carbonate constituent in limy bile makes the bile radiodense on plain film and CT. When there are no superimposed gallstones, CT may show either the gallbladder +/- common bile duct filling to variable degrees with radiopaque material or dependent layering of radiopaque material within the gallbladder. When superimposed gallstones are also present, the classical layering may not always be present. Recognised
complications can include acute cholecystitis, pancreatitis, or obstructive jaundice [2-3, 5, 9-10]. There are occasional case reports of spontaneous disappearance of limy bile [6]. Varying schools of thought exist on its management which range from observation to surgical therapeutic options such as laparoscopic or open cholecystectomy (with the latter usually opted for in those with the limy bile syndrome or in those with complications). When the gallbladder is radiopaque on plain film or CT, the imaging differentials are cholelithiasis, gallbladder wall calcification (porcelain gallbladder), and prior administration of hepatobiliary contrast or limy bile. In this case, increased radiodensity is not just confined to the gallbladder wall, there has been no previous hepatobiliary contrast administration, and there are additional relatively radiolucent rounded gallstones amongst the radiodense material which make the former three differentials unlikely. This case shows another interesting feature, which is where the added presence of concurrent radiolucent gallbladder calculi as well as the paste-like semisolid consistency of limy bile makes demonstration of dependent layering not always possible on imaging.

**Differential Diagnosis List:** Limy bile (milk of Calcium in bile) with radiolucent gallstones within, Radiopaque hepatobiliary contrast in gallbladder, Porcelain gallbladder, Mixed density cholelithiasis

**Final Diagnosis:** Limy bile (milk of Calcium in bile) with radiolucent gallstones within

**References:**


**Figure 1 a**

**Description:** Supine plain film demonstrates a rounded area of opacification overlying the gallbladder with superimposed areas of radiolucency. **Origin:** SCGH, Perth.
Description: Standard soft tissue axial CT images demonstrate an extremely dense gallbladder with no features of any associated inflammation. Origin: SCGH, Perth
**Description:** Standard soft tissue coronal CT images demonstrate an extremely dense gallbladder with no features of any associated inflammation

**Origin:** SCGH, Perth
Description: Axial CT image with bony windowing demonstrates distinct radiolucent gallstones immersed within the radio-dense biliary material. Origin: SCGH, Perth
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