

Imaging in toxicology

Diagnostic imaging, while commonly used in medicine, is uncommonly recommended in the management of poisoning. Use of computed tomography (CT) for workup of non-toxicologic disease states may identify tablets in the stomach. This may be small or large pill burdens and may or may not be clinically important.

Imaging has a role in evaluation of drug packing, drug stuffing, and ingestion of radiopaque medications. O'Brien and colleagues x-rayed 459 drugs in a 20 cm water bath (*Am J Emerg Med.* 1986(4):302-12). They found that 29 medications were reliably detectable and an additional 136 medications may be detectable in some scenarios. Using this and other studies, clinicians created the mnemonic CHIPES for helping to remember which drugs/chemicals are radiopaque. CHIPES stands for Calcium carbonate and Chloral hydrate; Heavy metals (mercury, lead, or anything in group I or II on the periodic table); Iron and Iodine; Phenothiazines; Enteric coated pills; Solvents (halogenated solvents like chloroform) and Sustained release preparations. O'Brien's study used intact medications. X-ray is probably most sensitive early after the ingestion and loses sensitivity over time because once dissolved, most of the medications will no longer be radiopaque.

Additionally, imaging is performed when there is suspicion of drug packing or drug stuffing. Drug packing is intentional ingestion of illicit drugs (generally large quantities) in packages designed to transport product into the country for eventual distribution and sales. Packaging generally involves multiple layers of wrapping and wax. Drug stuffing is ingestion of small quantities generally intended for personal use, ingested to avoid being apprehended with drug in possession. These might be in small vials, wrapped in paper, or wrapped in aluminum foil. Abdominal x-ray is highly sensitive for identification of large packets in situations of body packing, but not for stuffing. Stuffing may require more advanced imaging like CT. Treatment of drug packing or stuffing may involve repeat imaging, whole bowel irrigation, or surgical removal in select cases.

In a prospective observational study, Cha and colleagues determined the utility of detecting residual medications in the stomach in case of acute overdose (*Clin Toxicol.* 2019;57(7):632-7). They included 140 patients with a life-threatening ingestion presenting between 60 minutes and 12 hours after overdose. Non-contrast CT was performed on all patients with radiologist read. The table lists the time of CT relative to the time of ingestion and the proportion identifying drug in the stomach. Medication classes involved were not classically considered radiopaque.

Time from ingestion to CT	Number of patients	Patients with drug in stomach
1 – 4 hours	76	22 (29%)
4 – 8 hours	29	7 (24%)
8 – 12 hours	35	7 (20%)

Based on current evidence, empiric imaging for all cases of overdose is not recommended. There is not great data that supports the use of imaging to guide subsequent interventions in all comers. Identification of medications, especially a large pill burden in the stomach, should prompt an investigation into the history and treat signs and symptoms of they occur.



Did you know?

One important ingestion that requires immediate imaging is button batteries. When someone ingests a button battery, it can get stuck in their esophagus and rapidly erode tissue. This can result in perforation, infection, and even death. Most common teaching for button battery identification is the double ring or halo sign. Since button batteries are built from two pieces of metal, x-ray will show a circle with a small halo around it. Button batteries in the esophagus require emergent endoscopic removal.

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