Technical note

Medicolegal X-Ray and CT of standard size mobile phone cards (SIM card)

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ABSTRACT

Background. Foreign body ingestion typically affects children or adults with mental conditions. SIM (subscriber identity module) card ingestion is extremely rare. As their particularly X-Ray dense metal parts are sized about 9 x 12 mm x 50−80 μ, they can be difficult to capture on plain radiographs. We were asked by investigative authorities to point out the best method to document intentionally swallowed SIM cards. Method and material. A case of a 23 year female who had swallowed a SIM card when she was arrested for murder was followed up with four abdomen radiographs and CT (computed tomography) of the abdomen. Experimentally, SIM cards were examined in CT. SIM card object contrast against surrounding background was quantified through CNR (contrast-to-noise ratio). Results. SIM card orientation perpendicular to plain film X-Ray beams resulted in relatively low CNR values of 1.6−2.5. SIM cards in CT scans yielded considerably better CNR values exceeding 9. Discussion. While plain abdomen radiographs have a lower X-Ray dose than abdomen CT scans, more frequent possibly negative results may lead to repetitive exposure. We recommend to consider drug trafficking as possible problem in conjunction with any observed SIM card swallowing, particularly in context of police arrests or a suspect's detention. We recommend to consider CT of the abdomen, if possible with a low dose, rather than plain abdomen radiographs.

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1. Introduction

Foreign body ingestion is well known in emergency medicine. It typically affects children between 6 months and 3 years, and far less often, adults with a mental or psychiatric condition as well as impairment due to alcohol ingestion [1].

Among foreign body ingestion, swallowing of mobile phone cards (the acronym SIM stands for subscriber identity module) is rarely reported. A typical SIM card's metal part consists of copper beryllium alloys or similar, it contains external gold contact pads and a semiconductor device made from silicone and cobalt compounds wired to the contact pads; the semiconductor die contains aluminum, titanium nitride, polycrystalline silicone films, tungsten, silicone oxide and silicone nitride [2]. The device is sized a standard 25 x 15 x 0.76 mm or, relative to maximal edge length, 100 x 60 x 3%; the metal parts are about 9 x 12 mm and 50−80 μ thick.

We could identify only one publication in the scientific literature covering SIM card ingestion. There, a case of a 14 year old boy is described. He apparently had suffered initial coughing after swallowing a phone card. As a Heimlich maneuver had remained unsuccessful in producing the SIM card, he was presented at the local emergency department for further evaluation. No imaging was performed as there was no apparent medical indication at the time. Due to an uneventful further course, no indication to perform medical imaging arose later [3].

Suspects who are arrested by airport security or police for further investigation might take advantage even of short intervals of time in attempting to hide or permanently damage their SIM card. Thus, intentional SIM card ingestion may affect people who use devices such as cell phones also in relation to an assumed or known particular crime.

1.1. Problem

In our jurisdiction, an airport detainee suspected of swallowing their SIM card was suspected to cover up possibly criminal activities. In that context, we obtained a request of our investigative authorities to recommend the best clinical examination technique for swallowed SIM cards.