Case report

Generalised urticaria following ingestion of a nickel-plated coin in a 4-year-old girl

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SUMMARY

We report the case of a 4-year-old girl who presented to the emergency department after ingestion of a nickel-plated coin. Abdominal radiographs confirmed the presence of a coin in her stomach but she was otherwise asymptomatic. She was discharged with assurances that the foreign body would pass spontaneously. The patient developed significant generalised urticaria the next day, which became progressively more severe. Her symptoms prompted endoscopic removal of the nickel-plated coin and a postoperative course of corticosteroids and antihistamine therapy. This is the first reported case of generalised urticaria secondary to ingestion of a coin with nickel plating only (2% nickel content overall). A review of similar cases is provided.

BACKGROUND

Metal ions are the most common triggers of allergic contact dermatitis, with nickel being the most frequent metal sensitiser.[1] These materials, however, rarely cause major allergic reactions. Generalised urticaria following ingestion of a coin with nickel plating only (2% nickel content overall) has never been reported. There are only a few other cases in the literature that describe patients suffering from various systemic allergic symptoms after ingestion of predominantly nickel-based coins.[2–5] These patients required either endoscopic or surgical intervention with eventual symptom resolution. Adjunct pharmacotherapy was not used consistently postprocedure.

CASE PRESENTATION

A previously healthy 4-year-old girl presented to the emergency department after accidental coin ingestion. Her vital signs were within normal limits, and there were no signs of oesophageal obstruction or respiratory distress. An abdominal radiograph demonstrated that the coin was present within the stomach. The patient was tolerated a trial of oral fluids and was discharged home with assurances that the foreign body would likely pass spontaneously.

The next day, however, the patient developed urticaria and pruritus on her neck and chest. She had no respiratory difficulties, and her parents elected to treat her at home with oral diphenhydramine. The patient had previously developed contact dermatitis after having her ears pierced as an infant. She had a family history of asthma and eczema but had no other allergies and had never experienced anaphylaxis.

The next day, the patient presented again to the emergency department with urticarial wheals that had spread to the face, neck, chest, abdomen and legs. Her vitals remained stable, and she had no signs of anaphylaxis or respiratory distress. Physical examination revealed a diffuse maculopapular eruption. The lesions were raised and erythematous. An abdominal radiograph confirmed that the coin remained in the stomach. As such, the paediatric surgery service was consulted for consideration of endoscopic removal. The patient's symptoms were successfully managed with oral diphenhydramine. We suspected that the coin would pass spontaneously and recommended that the patient be discharged home with a reassessment in the clinic the following day.

The patient's symptoms worsened despite routine antihistamine therapy. By the following day (approximately 48 hours postingestion), the patient had ongoing diffuse urticaria and pruritus (figures 1 and 2) as well as oedema around the eyes. She had not experienced any respiratory difficulties, nor did she have any fever, nausea, abdominal pain or signs of gastrointestinal obstruction.

TREATMENT

Repeat abdominal radiography again showed that the coin remained in the stomach. As such, the patient was brought to the operating room for urgent flexible upper gastrointestinal endoscopy. The coin was found near the pylorus and was successfully removed with a Roth net.[6] Interestingly, there were no signs of inflammation of the gastric mucosa. The foreign body was a nickel-plated, five-cent Canadian coin from the year 2008 (which contains 2% nickel). The superficial coating of the coin appeared to be partially dissolved but the text and insignia remained legible.

Postoperatively, the patient had ongoing urticaria and pruritus. The Paediatrics team was consulted and recommended a 4-day course of corticosteroids. This consisted of one dose of intravenous methylprednisone (1 mg/kg) followed by a 3-day course of oral prednisone (1 mg/kg/day). The patient also received routine diphenhydramine and oral hydroxyzine.

OUTCOME AND FOLLOW-UP

The urticaria resolved approximately 48–72 hours after the coin was removed and she was eventually discharged home. The patient was assessed by a Paediatric Allergist on an outpatient basis. The

Figure 1 Urticarial wheals (temporarily raised, erythematous and pruritic plaques) on the superior and anterior aspect of the left thigh of a 4-year-old girl immediately prior to coin removal by flexible endoscopy.

cause of the generalised urticaria was determined to be due to nickel ingestion and no further testing was recommended.

DISCUSSION

The immunology of metal ions is a topic that has been extensively studied, as these are the most common triggers of allergic contact dermatitis. Recently, nickel was determined to be the most frequent metal sensitiser to induce allergic contact dermatitis (with a sensitisation rate of approximately 15%), far in front of palladium (8%), cobalt (5%) and chromate (3%).[1]

To the best of our knowledge, this presentation is the first reported case of generalised urticarial reaction following the ingestion of a nickel-plated coin. The overall composition of the coin removed from our patient was 2% nickel, 94.5% steel and 3.5% copper. We are aware of four other case-reports describing similar presentations after ingestion of solid nickel coins. The first was by Lacroix *et al* in 1979 in an 8-year-old boy who ingested a Canadian 25-cent coin from the year 1972 (which contains 98.5% nickel).[2] He developed widespread exfoliative dermatitis. Endoscopic removal was attempted but was not

Figure 2 Urticarial wheals (temporarily raised, erythematous and pruritic plaques) on the face, neck and upper chest of the 4-year-old girl immediately prior to coin removal by flexible endoscopy.

successful due to the coin being embedded between edematous gastric folds. The patient ultimately underwent laparotomy and gastrotomy to facilitate removal.

The second case was reported by Ewing and Miller in 1991 in a 6-year-old boy who ingested a Canadian five-cent coin.[3] This particular coin was minted in 1967 and was specifically formulated with 100% nickel. The patient developed a generalised papular reaction and prompt endoscopic removal was successful. The third case by Boonk and Van Ketel in 1979 reported a 22-year-old woman who ingested a Dutch florin (a coin used in the Netherlands until 2002 and composed of various proportions of nickel since 1967). This patient subsequently suffered from a pompholyx-like dermatitis of the arms and hands.[4] She had previously suffered from relapses of dermatitis from metal jewellery over the past 2 years.

The fourth case by Mahdi *et al* in 1995 reported an 8-year-old girl who ingested a Canadian 25-cent coin and developed a scaly, erythematous and pruritic skin reaction.[5] The histological examination of her gastric antrum showed a focal area of regenerative-appearing mucosa probably representing a healing erosion. The duodenal biopsies showed moderate acute duodenitis.

The Canadian five-cent coin was previously minted almost exclusively with solid nickel. The cost of solid nickel increased, and starting in 1982, the Canadian Mint replaced the coin's composition with a nickel-plated steel design containing a small amount of copper (with only 2% nickel overall). This case report illustrates that even a relatively small amount of nickel is sufficient to induce a generalised allergic reaction when ingested by an immunologically susceptible patient. This is facilitated by the gastric acidic milieu, which allows for the release of some electrolytic nickel, thereby increasing its bioavailability and absorption.

In the second cited case-report, Ewing and Miller reported that their patient's serum nickel level approximately 24 hours after ingestion was markedly elevated at 20.2 µg/L (normal 0.2–3.0 µg/L using atomic absorption and graphite methodology). Madhi *et al* reported their patient's serum nickel levels on day 5 (just before endoscopy) and day 12 (7 days postendoscopy) after ingestion to be >45 µg/L and 2.1 µg/L, respectively. While we were not able to measure our patient's serum

nickel level acutely, we presume that it would have been similarly increased.

In all four previously reported cases, systemic symptoms did not resolve immediately after the removal of the foreign body. In the 8-year-old boy, the initial eruption progressed to vesicles appearing all over the body, despite treatment with antihistamine medications. These lesions became exudative, crusting and scaling. Postoperatively, the erythema subsided after 18 hours and completely disappeared by 6 days. The 6-year-old boy developed peeling of his skin from his generalised papular eczematous reaction 9 days after the eruption appeared. The lesions resolved almost completely 17 days postingestion. The 22-year-old patient's dermatitis healed within 2 weeks of endoscopic retrieval while the 8-year-old girl's symptoms resolved within a week of removal and subsequent treatment with systemic corticosteroids.

In our case, the urticaria faded 3 days postendoscopy. Although the patient's symptoms would likely have persisted without endoscopic intervention, the administration of systemic corticosteroids likely expedited her recovery. The Paediatric Allergist, in this case, concluded that an urticarial reaction was quite unexpected and unusual. His assessment, based on the patient's clinical history, suggested that she suffered from nickel allergy and sensitisation. Of note, skin prick and patch testing were not performed to confirm the diagnosis.

An allergic reaction called systemic nickel allergy syndrome (SNAS) has been described in the literature.[7 8] The entity is different from allergic contact dermatitis due to nickel exposure. SNAS is an immunological syndrome comprised of systemic cutaneous and/or extracutaneous (gastrointestinal, respiratory, neurological, etc) manifestations in areas not in contact with nickel, in patients with previous allergic contact dermatitis to nickel. It is characterised by eczema, urticaria and other skin manifestations, as well as abdominal pain and diarrhoea or constipation after ingestion of nickel-rich food. Currently, a nickel oral challenge is the gold standard for diagnosis of SNAS. The systemic nature of the 4-year-old girl's symptoms would be in line with a presentation of SNAS. The aforementioned oral challenge would be required to confirm this diagnosis.

Some authors have suggested that children with nickel allergy are more susceptible to recurrent infections, and that this may be considered a manifestation of SNAS.[9] Others have suggested that nickel allergy in adults could be associated with worse metabolic parameters, obesity and impaired growth hormone secretion.[10 11] These immunological and endocrine findings suggest that some individuals could experience long-term benefits from desensitisation therapy. Therefore, it is important to consider a diagnosis of SNAS in patients with nickel allergy despite the absence of acute symptoms. Individuals with SNAS can be successfully treated by oral desensitisation.[12] An interesting point about our patient is that she exhibited signs of a systemic reaction without macroscopic signs of gastric inflammation. This does not exclude the presence of microscopic inflammatory changes since no endoscopic biopsies were obtained.

Urticarial dermatitis has been described as a non-specific reaction witnessed in a broad range of conditions. The mechanism is still incompletely understood. One hypothesis is that it is a lymphocyte-mediated (type IV) hypersensitivity reaction.[13] Interestingly, whereas the nature of the reaction (generalised urticaria) in our case report is more suggestive of a type I hypersensitivity reaction (IgE-mediated), the chronology of the reaction (more than 24 hours after exposure) would suggest a type IV hypersensitivity reaction (cell-mediated). If this 4 year-old girl did, in fact, suffer from SNAS, a type IV reaction would be favoured. As described by Turi *et al*, the pathophysiology of SNAS is very distinct, as it involves a significant increase of IL-5 and IL-2 serum levels (Th2 immune response).[7] This is consistent with Ricciardi *et al*, who reported that, 'SNAS has to be considered a form of non-IgE mediated food hypersensitivity'.[12] Performing skin prick and patch testing would be especially important in this scenario to help clarify the type of hypersensitivity reaction.[14]

Most blunt gastric foreign bodies such as coins pass through the digestive tract spontaneously.[15] Urgent endoscopic intervention should be considered in patients who have ingested disc batteries, multiple magnets or sharp objects. Similarly, patients with signs of airway, oesophageal, gastric outlet, or intestinal obstruction should not be treated expectantly. Gastric foreign bodies containing metal rarely cause systemic allergic reactions, but such cases should also be considered an indication for prompt endoscopic removal, with surgical management reserved for endoscopic failures.

Patient's perspective

A short questionnaire was administered to the patient's mother after discharge:

How did you feel when the paediatric surgery team approached you to suggest an endoscopic procedure?

I was nervous as a parent for my child to have this procedure, but with the explanations from the paediatric surgery team I understood that it was the best option since the coin did not pass naturally.

What did you learn through your child's journey in the hospital?

I learned that you have to keep advocating for what you think is best for your child. Indeed, the care team did not initially believe that the allergy was from the swallowed coin even though I was convinced that it was.

What advice/reassurance would you give to parents in your situation?

The endoscopic procedure was simple and easy to recover from. It was the best and safest option for my daughter!

Learning points

- Blunt gastric foreign bodies such as coins usually pass through the digestive tract spontaneously.
- This is the first reported case of generalised urticaria due to ingestion of a coin with nickel plating and may represent a case of systemic nickel allergy syndrome (SNAS).
- SNAS is defined as the constellation of systemic cutaneous and/or extracutaneous (gastrointestinal, respiratory, neurological, etc) manifestations in areas not in contact with nickel in patients with previous nickel allergic contact dermatitis.
- Patients who develop refractory systemic allergic symptoms in response to ingested foreign bodies may require endoscopic or surgical intervention.
- Allergic symptoms may persist for days after foreign body removal and require postprocedure antihistamine and corticosteroid therapy.

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