



Research

# Radiologic Spectrum of Foreign Body Introduction into the Body among Paediatric Patients seen at the Rivers State University Teaching Hospital, Port Harcourt

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## Abstract

**Background:** Foreign body ingestion in children is a common domestic accident and so vigilance cannot always prevent the introduction of foreign body into one of their natural orifices. Foreign body can be any object originating from outside and intruding through any of the body's orifices. The aim of this research is to evaluate the radiologic spectrum of foreign body introduction into the body amongst paediatric patients.

**Method:** This is a cross-sectional descriptive study design was adopted for the study from patients referred for radiologic investigation for suspected foreign body in the body from July 2020 to December 2020. The variables were collated, documented, and analysed using Statistical Package for the Social Sciences (SPSS) windows version 23.0 statistical software (SPSS Inc, Chicago, IL) and presented in tables, charts and graphs.

**Results:** Females constituted 47.46% (n=28) while males were 52.54% (n=31) with a female to male ratio of 1:1.127. Age range of participants was 10 months to 72 months, with a mean age of 38.66  $\pm$  15.84 months. Oral route was the most frequent route of introduction of foreign bodies into the body accounting for 74.58% (n = 44), with earrings (22.03%) been the most common materials followed by wedding rings 18.64% (n=11). Batteries, coins, rings, and keys were also ingested or inhaled.

**Conclusion:** Appropriate radiologic investigation is essential as radiology remains a veritable tool in the diagnosis and treatment of foreign body introduction into body through the body orifices.

**Keywords:** Foreign body, foreign body ingestion, foreign body inhalation, foreign body in children, Port Harcourt

## Introduction

Foreign body ingestion in children is a common domestic accident and so vigilance cannot always prevent the introduction of foreign body into one of their natural orifices. Foreign body can be any object originating from outside and intruding through any of the body's orifices e.g., nostrils, eyes, mouth, anus into hollow organs etc. These occur in children especially under 3years of age. In 2000, the American Association of Poison Control Centres documented that 75% of the >116,000 foreign body ingestion cases reportedly occurred in children  $\leq$  5years in the USA.<sup>1</sup> Most of the affected children are between 6months -3years. There is a male: female ratio of at least 2:1.<sup>2-5</sup> This is said to be due to their playing and running around during feeding,

lack of molars for mastication, and occasionally during forced feeding by some care givers these result in incoordination in swallowing and glottis closure<sup>6</sup>, which could lead to accidental death at home or school.

The exact incidence is not known in our environment because records of occurrences in the rural areas are not documented.<sup>7</sup> However, in developing countries especially sub-Saharan Africa, the mortality rate is variable and ranges from 2.7% to 8.3%,<sup>8</sup> while in developed countries, the mortality rate has reduced from 24% to 3% or even less with the advent of skilled personnel, ventilating bronchoscope and better anaesthetic procedures<sup>9</sup>. Foreign body ingestion is the 4<sup>th</sup> leading cause of accidental death among children



under the age of 3 years, thus accounting for the loss of thousands of lives yearly.<sup>10</sup>

Foreign body could be found in any of the natural orifices like the eye (cornea, conjunctival sac, and outer part of the eye), ear (auditory canal) nose (nostrils and nasal cavity), pharynx, larynx, trachea, bronchi and lungs (hypopharynx, nasopharynx and bronchioles). The foreign body could be tiny pieces of toys, beads, screws, buttons, pebbles, and food particles with the latter being the commonest, especially peanuts.<sup>4</sup> Foreign body could also be lodged in the oesophagus, stomach, bowel, anus, urethra, penis, vagina and even bladder.

Radiology plays a vital role in the evaluation of foreign bodies introduced into the body. Plain radiography computed tomographic scans, ultrasonography, and magnetic resonance imaging as well as fluoroscopic contrast studies can be used to evaluate foreign body introduction into the body. The type and extent of the investigation depends on the clinical presentation, route of introduction or ingestion as well as substance introduced if known by the parents or guidance. Plain radiography and ultrasonography are the commonest radiologic imaging modalities used in the evaluation of foreign bodies.

The classical symptoms are an episode of choking with subsequent wheezing or stridor, cough and decreased or abnormal breath sounds on examination<sup>11</sup>. The commonest site of impaction along the tracheobronchial tree is the right main bronchus; this is because the right main bronchus is in line with the trachea creating a straight pathway from larynx to bronchus.<sup>6</sup>

However, the site could also depend on patient's position at the time of ingestion; the right main bronchus is commoner in the erect position and right lateral position while foreign bodies which are small preferentially lodge in the left main bronchus in the left lateral position. This may also account for the difference in distribution of the site of lodgement between adults, adolescents and children.<sup>11</sup>

The study is therefore aimed at evaluating the radiologic spectrum of foreign bodies introduction into the body among paediatric patients in our environment and to educate parents and caregivers on proper handling and dropping of objects to reduce risk of ingestion or inhalation.

## Materials and methods

A cross sectional descriptive study design was adopted for the study to evaluate the radiologic spectrum of foreign bodies introduction into the body amongst paediatric patients in a tertiary government hospital in

Port Harcourt. Samples were collected from consecutive patients who presented at the Radiology Department of the Rivers State University Teaching Hospital from July 2020 to December 2020. Radiographs of patients referred for radiographic investigation with a clinical diagnosis of suspected foreign body ingestion or inhalation or introduction into the body were evaluated. Incidental findings of foreign bodies following other radiologic investigations were also included into the study. Radiographs were evaluated by two radiologists with a minimum of 5 years post fellowship qualifications from the National Postgraduate Medical College of Nigeria or the West African College of Surgeon. Institutional ethical clearance was obtained from the ethical committee of the Rivers State Health research ethics committee in line with the Helsinki declaration.

All variables obtained were collated, documented, and analysed using Statistical Package for the Social Sciences (SPSS) windows version 23.0 statistical software (SPSS Inc, Chicago, IL). The results were presented in tables, charts, and graphs while a descriptive statistical tool was used to determine central tendencies and frequencies.

## Result

The gender distribution of participants shows that 47.46% (n=28) are females while 52.54% (n=31) were males; giving a female to male ratio of 1:1.127 (figure 1). The age of the participants ranged from 10months to 72months, with a mean age of  $38.66 \pm 15.84$  months whereas age group 36months to 47months was the peak age group accounting for 11.21% (n=19) as illustrated in table 1. Table 1 also shows that above 72 months age group was the least frequent with 0.56 % (n=1).

The oral route was the most frequent route accounting for 74.58%(n=44) followed by the nasobroncheal route 15.25% (n=9) as shown in table 2. As illustrated in table 3, earring was the most common substance introduced into the body 22.03% (n=13), followed by wedding rings which accounts for 18.64% (n=11). Both radio-opaque and non-radio-opaque substances were introduced into body (table 3).

As shown in figure 2, 81% (n=48) of the findings were diagnostic investigation while 19% (n=9) accounts for incidental findings. The imaging findings were shown in figure 3 to 9. Figures 3, 4, 5 and 6 showed the ingestion of a battery, coin, insertion of ring into the nostrils and ingestion of a key respectively. Figure 7 are plain chest radiographs showing complete left lung collapse secondary to bronchiopulmonary obstruction (7A), a week after bronchoscopy and removal of the obstruction (7B) the cause of the obstruction seen to be

a non-radioopaque pair of beans seeds inserted through the left nostril to the left main bronchus (7C). Whereas figure 8 demonstrated opacity of metallic density in the colon of a 4-year-old boy who swallowed a nail while a rounded lesion with a central lucency was seen in the splenic flexure of a baby girl who swallowed an earring (figure 9).

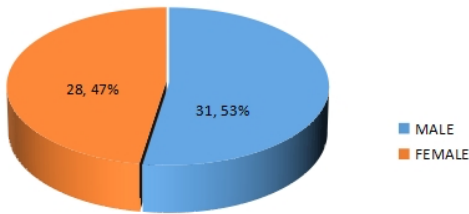


Figure 1: Gender distribution of participants

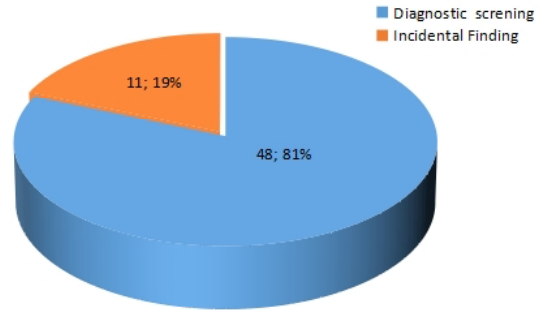


Figure 2 showing incidental and diagnostic screening finding

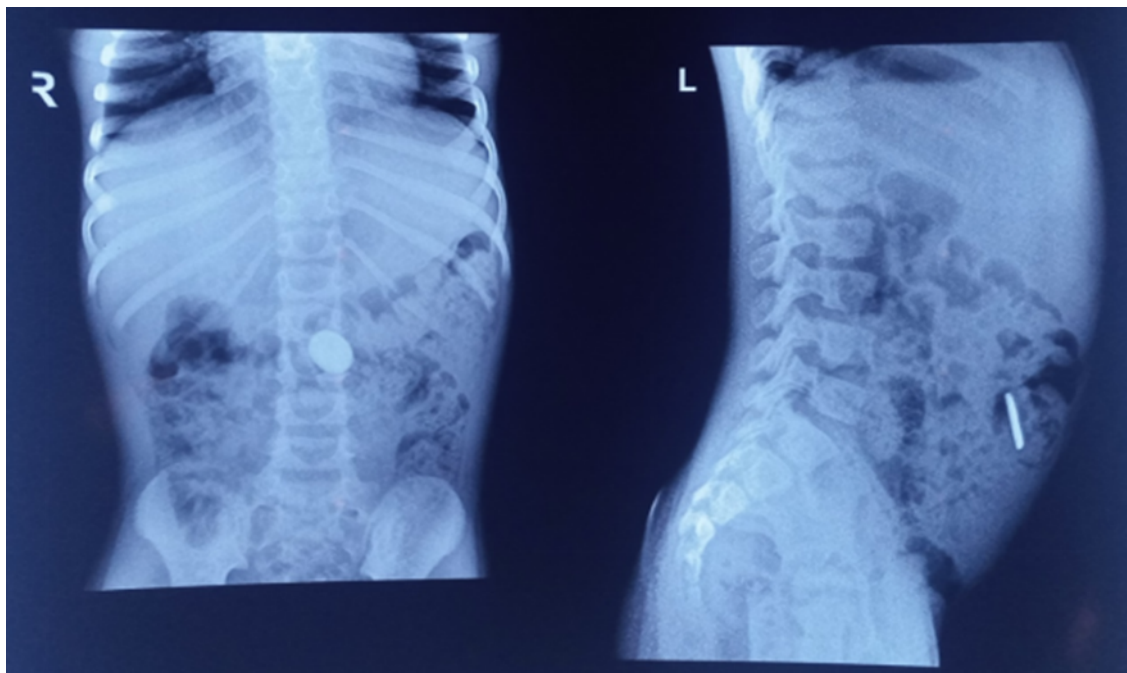
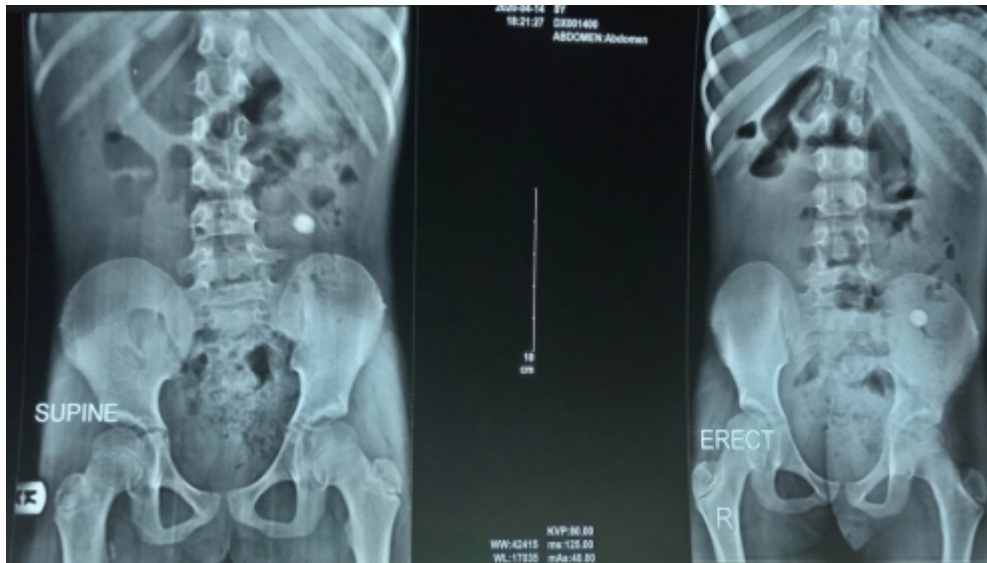
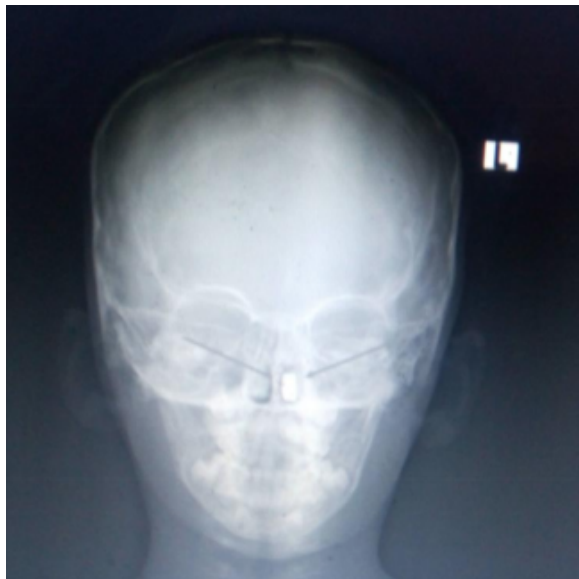


Figure 3: Plan anteroposterior and lateral radiographs of the abdomen of a 3-year-old male who swallowed a battery. The images show a tubular opacity of metallic density in the abdomen, the anteroposterior view shows the battery end on.



**Figure 4:** Plan erect and supine radiographs of the abdomen of a 4-year-old boy who swallowed a coin. The images show a rounded well-defined opacity of metallic density in the abdomen.

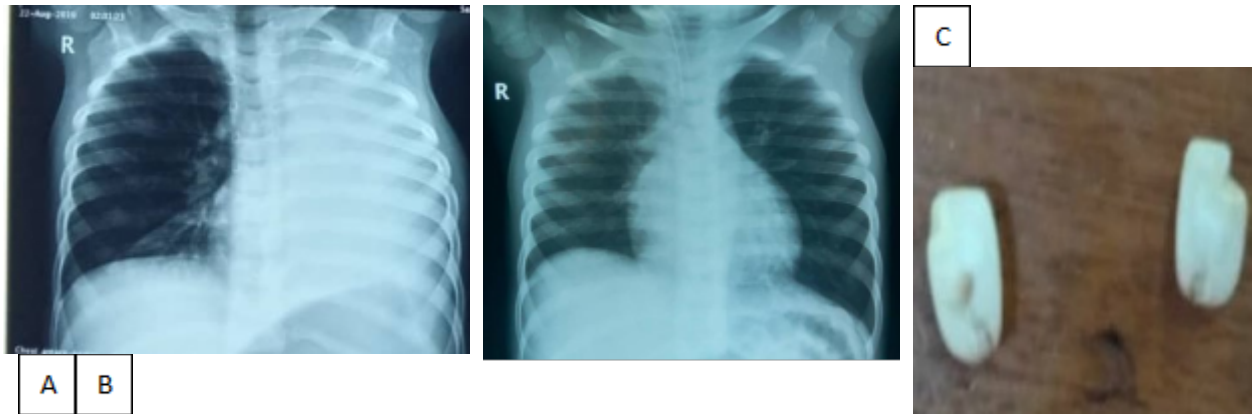


**Figure 5:** Plain anteroposterior radiograph of the face of a 4-year-old female who inserted a metallic ring into her left nostrils. The image shows opacity of metallic density in the left nostrils as depicted by the black arrow.

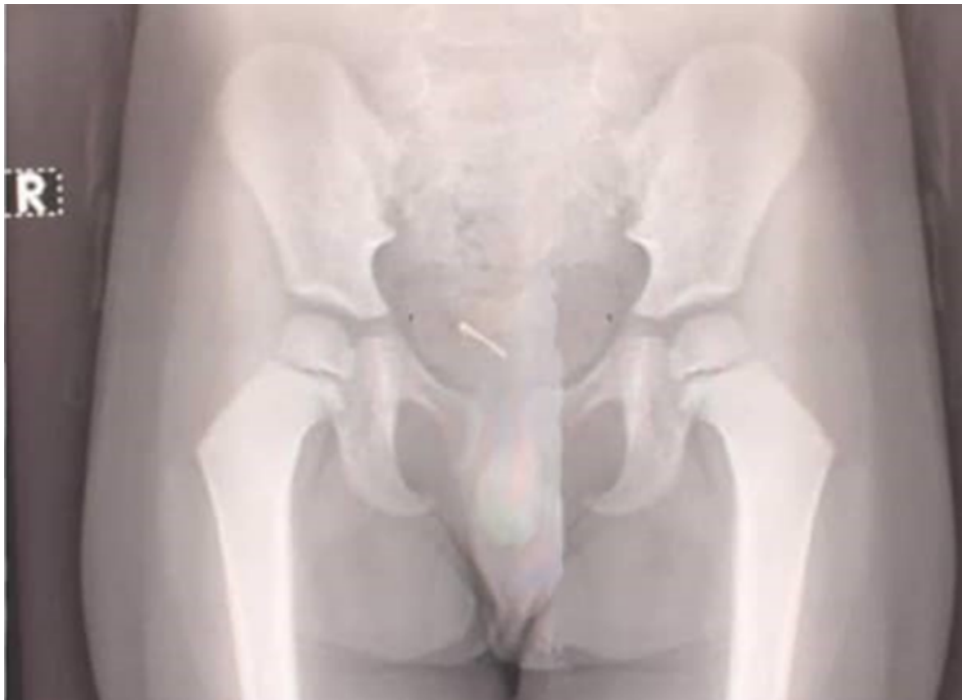


**Figure 6:** Plain anteroposterior and lateral radiographs of the abdomen of a 3-year-old female who swallowed a key. The image shows opacity of metallic density in the in the region of the ascending colon on the abdomen having the configuration of a key with its rounded metallic holder.





**Figure 7:** Showing complete left lung collapse secondary to bronchopulmonary obstruction (A), a week after bronchoscopy and removal of the obstruction (B) the cause of the obstruction was a pair of beans seed inserted through the left nostril to the left main bronchus (C)



**Figure 8:** Showing an opacity of metallic density in the colon of a 4 year old boy who swallowed a nail.



**Figure 9:** Showing a rounded lesion with a central lucency in the splenic flexure of a baby girl that swallowed an earring.

**Table 1:** Age distribution of participant

Age (Months)	Freq (%)	Min	Max	Mean	SD
Up to 11	2 (1.18%)	10.00	11.00	10.50	0.71
12-23	7(4.13%)	12.00	20.00	15.71	3.77
24-35	13 (7.67%)	16.00	35.00	26.77	4.97
36-47	19 (11.21%)	36.00	47.00	40.74	3.89
48-59	13(7.67%)	48.00	59.00	54.54	3.64
60-71	4 (2.36%)	60.00	64.00	61.75	1.71
>72	1(0.56%)	72.00	72.00	72.00	0.00
Total	59 (100%)	10.00	72.00	38.66	15.84

Mini=Minimum; max= Maximum

**Table 2:** Showing the Route(s) of Introduction

Variable	Route(s) of Introduction	
	Frequency	Percent (%)
Mouth	44	74.58
Nostrils/tracheal bronchial tree	9	15.25
Ear	6	10.17

**Table 3:** Radiologic findings of foreign bodies introduce into the body

Variable	Male	Female	Total
Nail	3	1	4
Key	3	0	3
Wedding Ring	7	4	11
Battery	2	1	3
Coin	3	6	9
Denture	6	2	8
Earring	3	10	13
Unclassified radio-opaque	3	3	6
Non-radio opaque Substances	1	1	2
<b>Total</b>	<b>31</b>	<b>28</b>	<b>59</b>



## Discussion

Radiology plays a vital role in the evaluation of foreign bodies introduced into the body either by ingestion, or inhalation into the body. The study evaluates the radiologic spectrum of foreign bodies introduced into the body among paediatric patients considering the type of substance introduced into the body, age and gender distribution and the route/site of introduction. Foreign body introduced (inhalation or ingestion) among children through the body's orifices (e.g nostrils, eyes, mouth, and anus etc) is a common domestic accident.

The gender distribution of patients showed that more males ingest foreign bodies than females. This is in consonance with the study by Oburra et al<sup>2</sup> in Kenyatta National Hospital Kenya. A similar study by Gulshan et al<sup>3</sup> in Saidu group of teaching hospitals, also documented that male children introduce or ingest more foreign bodies into their bodies more than females. In another study to evaluate the impacted foreign bodies in the larynx of Nigerian children by Onotai et al<sup>4</sup> also revealed that foreign body introduction is commoner among males.<sup>4</sup>

In the index study, the age of the patients ranges from 10months to 72months (equivalent to 1-6years) with a mean age of  $38.66 \pm 15.84$  months (which is approximately 3years). This finding in the index study was similar to the documentation of the 2000 annual report of the American Association of Poison Control Centres<sup>1</sup>. The annual report<sup>1</sup> showed that 75% of the >116,000 foreign body ingestion cases reportedly occurred in children  $\leq 5$  years.<sup>1</sup> Similar finding was also documented in the study by Gulshan H et al<sup>3</sup>, Murty et al<sup>12</sup> and Khan et al<sup>13</sup> where highest incidence was found to be among children aged 3 years and below. The highest incidence among children aged 3 years could be attributed to their curiosity and great tendency to put objects into their mouth or orifices<sup>3,10,14</sup>. Similarly, a study in AKTH showed that children below 5 years were more susceptible with a slight male preponderance.

The oral route was the most frequent route of introduction of foreign bodies into the body among the paediatric patients in this study. The oral route was followed by the nasobronchial route into the bronchus. There is paucity of data concerning the introduction of foreign bodies into the gastrointestinal tract. This may be due to low complications associated with ingestion of foreign bodies through the oral route when compared to nasopharyngeal route into the bronchus which may be associated with higher morbidity or mortalities.

Radiologically, some of the objects were radio-opaque while others are non-radio-opaque. The non radioopaque substances will not be detected

radiographically as they will not display a differential image contrast. However, majority of the objects are radiopaque. This was similar to the findings documented by Monte CU.<sup>15</sup> The study in AKTH revealed that whistles and groundnuts were the commoner type of foreign bodies introduced. In a study in Pakistan whistle was also the commonest foreign body introduced while it was also documented in their study that organic foreign bodies were more common than inorganic substances. A recent study done in Kenya revealed that beans as the commonest foreign body. The reason was attributed to the fact that beans are more staple food than groundnuts.

In this study, children with both ingested and inhaled foreign bodies were evaluated in contrast to many other studies that were mostly focused on inhaled foreign bodies alone. The evaluation of both ingested and inhaled foreign bodies may be responsible for some of the variation on the most introduced substances, route of introduction and possible outcome.

The clinical course and outcome of foreign body ingestion largely depends on the nature/type of foreign body, the site of arrest or impaction along the tracheobronchial tree and perhaps availability of skilled manpower especially in developing countries. Unavailability of trained personnel, unavailability of radiologic facility and poor knowledge of when the objects are introduced of inhaled may be a limitation to the study.

## Conclusion

The prevention of complications and even death from foreign bodies ingestion or inhalation lies on appropriate radiologic detection, site of introduction and the type of substance introduced. Radiology remains a veritable tool in the diagnosis and treatment of foreign body introduction into body through the body orifices.

**Recommendations:** Most of the patients in this research were below 5 years and so parents, guardians and caregivers are advised to be up and doing as it concerns the care of their children. Therefore, the study recommends that parents, guardians and caregivers take adequate caution by keeping substances that could easily be introduced into the body out of reach.

**Ethical clearance:** Institutional ethical clearance was obtained from the ethical committee of the Rivers State Health research ethics committee in line with the Helsinki declaration.

**Authors' contribution:** The Authors were involved in the conceptual design of the study, data



collection/analysis/ interpretation of the study as well as revisions.

**Conflict of Interest:** No conflict of interest

**Funding:** No funding

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