

ORIGINAL PAPER

How is the COVID-19 pandemic related to ingestion and aspiration of foreign bodies among children – single-institution experience

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ABSTRACT

Introduction: This study aimed to evaluate the relevance of the COVID-19 pandemic and the consequent isolation policy on foreign body aspiration (FBA) or ingestion (FBI) reports among children.

Material and methods: A retrospective review of medical records between January 2018 and September 2021 was carried out to identify patients younger than 18 years who were admitted to the Paediatric Surgery and Urology Department, University Hospital in Wrocław, due to suspicion of a foreign body (FB) in their digestive or respiratory system. For each patient: age, sex, hospitalisation time, type of foreign body, its localisation, time and means for removal, and diagnostic approach were assessed.

Results: The study group comprised 236 children. The patients were divided into 2 groups including children that were admitted before and after the declaration of the state of pandemics in Poland (20 March 2020), which gives periods of 26 and 20 months, respectively. Those related to general admission number (as a percentage of all admissions) equal an average of 1.92% (of 6300) and 2.03% (of 3802), respectively. This resulted in 122 children before and 114 after the beginning of the pandemic. The age ranges were 6–203 months (median 30) and 8–211 months (median 35), respectively. The most common types of foreign bodies were food, batteries, and coins. The new ones comprised magnetic pieces found in 12 children. Surgical intervention, which mostly included gastroscopy or rigid bronchoscopy, was undertaken in 186 cases – for the groups, 70 (57.4%) and 69 (60.5%) FBs, respectively, were removed. The assessed success rate was 71.43% and 78.41%, respectively.

Conclusions: The pandemic isolation policy seems to have had no major impact on FBI and FBA events.

KEY WORDS:

foreign body ingestions, foreign body aspirations, foreign bodies children, bronchoscopy in children, gastroscopy in children.

INTRODUCTION

The COVID-19 pandemic changed the lives for all of us very rapidly. The first known case in Poland was described on 4 March 2020. Two weeks later (on 20 March 2020) the outbreak was described as a pandemic. Despite major inconveniences, the Paediatric Surgery and Urology Department of one of clinical hospitals in Po-

land continued to provide medical care for children. In this study we aimed to analyse impact of the COVID-19 pandemic on foreign bodies (FB) of the digestive and respiratory tracts among children.

Foreign body ingestion (FBI) or aspiration (FBA) is a common challenge encountered by paediatric providers. Due to lockdown policies, the amount of time spent at home increased significantly, which, theoretically, could

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increase risk of home accidents among children, because they seem to happen mainly at home. Those 2 factors combined could have become a serious problem for health-care professionals in that time. In this study we aimed to evaluate the relevance of the COVID-19 pandemic and the consequent isolation policy on FB cases among children.

Our department is a third degree reference hospital that ensures a wide range of treatment options. With high experience in endoscopic procedures and equipment available around the clock, we are the ones who provide needed treatment for children with FB ingestions or aspirations. Because there are no strict guidelines, we assess every patient individually, estimating the risk on the base of FB type, its localisation, and general symptoms.

MATERIAL AND METHODS

We retrospectively analysed the medical electronic records of our hospital for all patients assigned to group T17 and T18 ICD-10 diagnoses, who were hospitalised in the Paediatric Surgery and Urology Department of one of the clinical hospitals in Poland between January 2018 and November 2021. The demographic data, hospitalisation time, type of foreign body, its localisation, time and means for removal, and imaging process were extracted in

TABLE 1. Foreign body localisation for pre-COVID-19 (January 2018 – 20 March 2020) and during COVID-19 (20 March 2020 – November 2021)

Foreign body localisation	Pre-COVID	During COVID
	<i>N</i> = 122 (%)	<i>N</i> = 114 (%)
Respiratory tract	29 (23.77)	31 (27.19)
Pharynx	3 (2.46)	1 (0.88)
Larynx and trachea	4 (3.28)	1 (0.88)
Right main bronchi	8 (6.56)	8 (7.02)
Left main bronchi	7 (5.74)	5 (4.39)
Lower right lobe bronchi	2 (1.64)	4 (3.51)
Lower left lobe bronchi	2 (1.64)	4 (3.51)
Right intermediate bronchi	0	2 (1.75)
Left intermediate bronchi	1 (0.82)	2 (1.75)
Multiple or other respiratory localizations	2 (1.64)	6 (5.26)
Digestive tract	51 (41.8)	46 (40.35)
Oesophagus	23 (18.85)	20 (17.54)
Stomach	18 (14.75)	12 (10.5)
Duodenum	2 (1.64)	1 (0.88)
Intestines	6 (4.92)	3 (2.63)
Colon and rectum	2 (1.64)	3 (2.63)
Multiple or other digestive localizations	0	6 (5.26)
Freely in peritoneum cavity	0	1 (0.88)
Unknown localisation	42 (34.42)	37 (32.46)

each case. Foreign body types were grouped as food (with distinction for nuts), sharp objects, coins, batteries, magnets, toy parts, and others. Localisation was assessed based on radiological examination and during the intervention, as shown in Table 1. The time before removal was withdrawn and specified into 7 period groups – the division is purely empirical. Impact time was estimated on the basis of anamnesis, which makes exact statistics invaluable.

Between 11 May 2020 and 31 May 2022, every patient underwent real-time polymerase chain reaction (RT-PCR) SARS-CoV-2 test before admission to the ward. For children with positive results additional management was provided: strict isolation, FFP3 face masks, biohazard suits, face shields or goggles, and double gloves. Those were used both on the hospital ward and in the operating theatre.

Statistical analysis parameters in the groups were expressed as medians, means, and percentages. The statistical significance between data was calculated with the χ^2 test df (degrees of freedom). A *p*-value of less than 0.05 was required to reject the null hypothesis – a higher *p*-value meant no statistical significance of the thesis. Statistical analysis was performed using the PaST software package.

RESULTS

In the study period there were a total of 236 children admitted with suspicion or diagnosis of FBI or FBA. Data for those patients were divided into 2 groups: pre-COVID and during the pandemic, comprising 122 and 114, respectively. Presented as the percentage of monthly admissions, FBs were 0.39–4.98% (mean 1.92% of 6300 admissions) before the pandemic and 0.51–4.94% (mean 2.03% of 3802 hospitalisations) during COVID-19. For the first quarter of 2018 and 2021, FB admissions were responsible for 2.84% and 2.85% of all hospitalisations, respectively. Specific demographic data did not differ significantly, and they are presented below (Table 2). Most of the children

TABLE 2. Foreign body demographic data compared for pre-COVID-19 (January 2018 – 20 March 2020) and during COVID-19 (20 March 2020 – November 2021)

Demographics data	Total <i>N</i> = 236 (100%)	Pre-COVID <i>n</i> = 122 (51.7%)	During COVID <i>n</i> = 114 (48.3%)
	Age (months)		
Min	6	6	8
Max	211	203	211
Median	32	30	35
25%	19	19	20
75%	65.5	63	70
Sex, <i>n</i> (%)			
Female	95 (40.25)	48 (39.34)	47 (41.23)
Male	141 (59.75)	74 (60.66)	67 (58.77)

TABLE 3. Type of foreign body ingested or aspirated

Parameters	Pre-COVID-19 (%)			During COVID-19 (%)			Post hoc test for total
	Total, N = 122 (100%)	FBI (% of type)	FBA (% of type)	Total, N = 114 (100%)	FBI (% of type)	FBA (% of type)	
Type							
Food	14 (11.48)	6 (42.86)	8 (57.14)	23 (20.18)	6 (26.09)	17 (73.91)	1.0000
Nuts	18 (14.75)	–	18 (100)	14 (12.28)	–	14 (100)	1.0000
Sharp objects	14 (11.48)	12 (85.71)	2 (14.29)	9 (7.89)	6 (66.67)	3 (33.33)	1.0000
Coins	24 (19.67)	24 (100)	–	12 (10.53)	12 (100)	–	0.8136
Battery	24 (19.67)	24 (100)	–	17 (14.91)	17 (100)	–	1.0000
Magnets	0 (0)	–	–	12 (10.53)	12 (100)	–	1.0000
Toys (parts)	8 (6.65)	3 (37.5)	5 (62.5)	6 (5.26)	3 (50)	3 (50)	0.0038
Other	20 (16.39)	14 (70)	6 (30)	21 (18.42)	17 (80.95)	4 (19.05)	1.0000

FBA – foreign body aspiration, FBI – foreign body ingestion

TABLE 4. Times: foreign body impact (time that it was ingested or aspirated) and time spent in hospital

Parameters	Pre-COVID-19	During COVID-19	Post hoc test
Impact time (hours)			
< 4	5	7	1.0000
4–12	46	26	0.0418
12–24	6	14	0.6676
24–48	20	16	1.0000
48–168 (2–7 days)	13	20	1.0000
> 168 (more than 7 days)	7	13	1.0000
Time unknown	25	18	–
Hospitalisation time			
Less than a day	59	53	–
1–2 days	51	41	–
2–5 days	10	16	–
More than 5 days	2	4	–
Hospitalisation time (hours)			
Min	1.95	0.83	–
Max	122.55	186.1	–
Median	24.66	27.45	–
25%	16.77	16.25	–
75%	40.95	40.57	–

were below 5 years old (68.03% vs. 64.04%, respectively), but there were also teenagers (10.66% vs. 14.04% older than 10 years). Males more frequently presented with FBs ($n = 74$, 60.66% before 20 March 2020 vs. $n = 67$, 58.77% after the outbreak of the pandemic in Poland) than females ($n = 48$ vs. $n = 47$).

Regarding FB types (Table 3): coins, batteries, and magnets are specific for ingestions; on the other hand, nuts are aspirated only. 29.24% of all foreign bodies were ingested during meals, which seems to be the main activity connected with this type of home accident. Magnets (especially magnetic balls) were diagnosed only among children during the pandemic, and that seems to be statistically significant ($p = 0.0038$). However, before 2018 magnet ingestions were encountered as well.

The times of the presence of foreign bodies in children are summarised in Table 4. They were collected during anamnesis based on the possible time of ingestion or aspiration. Some were unknown because of late symptoms onset or hospitalisation without intervention. They stated a statistically significant difference ($p = 0.02519$), which could be related to a slight shift towards hospitalisation periods longer than 12 hours. This can be caused by SARS-CoV-2 RT-PCR tests, which patients had to undergo during the time of the pandemic. Hospitalisation times were slightly longer during the pandemic than before (range [in hours] 1.95–122.55 compared to 0.83–186.1). Some of our patients needed Intensive Care Unit care because of their general condition (7 vs. 2), and all of them had foreign bodies removed from their respiratory tract.

Imaging as a diagnostic measure was performed mainly at the Emergency Department; sometimes it was outsourced when a child was referred from another hospital. The shift towards more imaging in general during the pandemic was statistically significant ($p = 0.0042$). Complete data are shown in Table 5. It is worth pointing out that not every patient had imaging done (19 pre-COVID and 10 during the pandemic). Some children had a history of radiolucent FBs, such as plastic blocks or organic matter. From those, 15 (78.95%) and 8 (80%) underwent some kind of intervention that was connected with the presented symptoms (dyspnoea, dysphagia), and with an obvious need for intervention such as removal or damage assessment after caustic ingestions.

TABLE 5. Imaging undertaken

Parameters	Pre-COVID-19 <i>n</i> (%)	During COVID-19 <i>n</i> (%)
Imaging		
X-ray	90 (73.77)	89 (78.07)
Multiple X-ray	4 (3.28)	2 (1.75)
Contrast X-ray	4 (3.28)	4 (3.51)
US	0	2 (1.75)
CT	3 (2.46)	0
X-ray with CT	1 (0.82)	3 (2.63)
X-ray with US	1 (0.82)	4 (3.51)
None	19 (15.57)	10 (8.77)

TABLE 6. Surgical management – time from admission to intervention, type of intervention, and its effectiveness

Parameters	Pre-COVID-19	During COVID-19
Time from admission to intervention (h : min)		
Min	0 : 28	0 : 05
Max	28 : 51	50 : 33
Median	3 : 27	2 : 42
25%	1 : 47	1 : 09
75%	7 : 07	7 : 37
Intervention urgency, <i>n</i> (%)		
Emergency	6 (6.12)	17 (19.32)
Urgent	62 (63.27)	42 (47.73)
Semi-urgent	30 (30.61)	29 (32.95)
Intervention undertaken ($p = 0.5051$), <i>n</i> (%)		
Gastroscopy	55 (45.08)	43 (37.72)
Bronchoscopy	32 (26.23)	33 (28.95)
Gastroscopy and bronchoscopy	3 (2.46)	3 (2.63)
Others	8 (6.56)	9 (7.89)
No intervention	24 (19.67)	26 (22.81)
Effectiveness, <i>n</i> (%)		
Foreign body removed	70 (71.43)	69 (78.41)
Foreign body seen and not removed	0	3 (3.41)
Foreign body not seen during endoscopy	28 (28.57)	16 (18.18)

Most children were qualified for interventional treatment (Table 6); 98 (80.33%) vs. 88 (77.19%) underwent some kind of medical procedure under general anaesthesia. The degree of urgency was defined on the basis of in-hospital procedures (emergency < 1 hour, urgent 1–6 hours, semi-urgent 6–168 hours). The median time

for intervention shortened during the pandemic, from 3 h 27 m to 2 h 42 m. More interventions were provided in less than one hour (6.12% vs. 19.32%). Specific data are presented in Table 6. Indications were as follows: aspiration, dyspnoea, stridor, FB in oesophagus, anamnesis for sharp objects, battery or multiple magnets, dysphagia, and radiological signs for gastrointestinal perforation. We could assess an effectiveness rate of 71.43% and 78.41%, respectively. A successful intervention was defined as the use of an intervention that led to removal of the FB. Among interventional means, the majority were endoscopic procedures (gastroscopy, bronchoscopy). It should be pointed out that there were 3 laparotomies performed – all in the pandemic group, 2 caused by perforation by magnetic pieces and one because of an enormous trichobezoar. Few foreign bodies were spontaneously expelled during hospital stay (6 vs. 2). Of those patients, 2 vs. 1, respectively, underwent gastroscopy – in one of them an AAA battery was seen passing through the pylorus. The remaining 5 children were treated conservatively because in imaging the foreign bodies were thought to be further than the pylorus.

Of all the 114 patients in the pandemic group, 84 children underwent a RT-PCR SARS-CoV-2 test. That was obligatory for admission between 11 May 2020 and 31 May 2021, excluding people who were diagnosed with COVID-19 in the preceding 12 weeks. Eighty of the results were negative (95.24%). Three patients with a positive test result were isolated and treated with additional precautions (FFP3 face masks, biohazard suits, face shields or goggles, and double gloves). Endoscopies (one bronchoscopy and one gastroscopy) and one surgery (laparotomy) were carried out in single-use operating gowns and the aforementioned barrier equipment. One test was inconclusive, and then negative in a following examination. One child had convalescent status. With the pandemic fading, the policy changed – only people with symptoms of upper respiratory tract infection were tested (none in the study group).

DISCUSSION

Foreign body ingestions and FBAs remain a significant and serious healthcare concern [1–5]. Nationwide databases are being created for better understanding of the subject. Surprisingly, no such study has been carried out for the Polish population in the last 10 years, leaving us without region-specific data. Nonetheless, the demographics seem to be similar and the problem is serious among children younger than 4 years old [6–8]. Despite the hypothesis that isolation policies and home-office movement can be additional risk factors for FBI and FBA [9], our study showed no major changes in the demographic profile of patients admitted for FB and no major impact of COVID-19 on the presented subject [10]. Because most of the authors agreed on the in-

creasing trend in foreign body diagnoses, there are some suggesting that better parental supervision could lead to improvement in that field [10, 11]. There is limited literature in the topic of foreign bodies in children during COVID-19. As we presented a history of 236 children, most of the studies contributed less than 100 patients [10, 12, 13], some of them being case reports [14, 15] and others using national electronic databases [16].

Another concern making that time so special was the use of additional equipment to protect healthcare professionals, such as full-face snorkel masks [17], protective barriers, or even putting patients in separate air-vent bags. All our patients had SARS-CoV-2 RT-PCR tests done. Procedures in a separate operating theatre were performed for children with a positive test result, and additionally disposable personal protective equipment (operating gowns, biohazard suits), FFP-3 face masks, eye-protection (face shields or goggles), and double gloves were used. Patients with a negative PCR test were treated in concordance with standard procedures.

Some authors observed a rise in button battery ingestions [9, 12, 16, 18]; however, that was not observed in our institution. Our study found [9, 16] an increasing presence of magnetic objects in children in this period ($p = 0.0038$). Especially for magnetic balls, there is higher risk of perforation and need for a much more serious intervention [19]. This specific type of FB is substantially more dangerous when ingested in large amounts [20–22]. In our institution we were forced to use a surgical approach (radiological signs of gastrointestinal perforation) only in 16.67% of magnetic piece ingestions, with some authors reporting a more than 5-fold higher rate for laparotomies [23].

Rigid bronchoscopy seems to be a procedure of choice in FBA cases [24, 25] and so is the history of the bronchoscope itself; however, some authors present a rise in the usage of flexible bronchoscopy [10]. During the analysed period we performed 70 rigid bronchoscopies, 13 of which resulted in no FB presence, and all the rest ended successfully with FB removal.

The management of foreign body ingestions and aspirations did not change after the given time period in our department. The vast amount of interventions were carried out urgently according to life-threatening indications. Guidelines available in the literature are recommendations rather than strict management algorithms, and the authors emphasise their low quality of evidence [26–31]. The differences in the degree of urgency between guidelines and the presented article are the result of in-hospital procedures. The decision-making process, however, seems to be compatible with proposed guidelines, and so is the distinction of type and localisation of foreign bodies, especially listing the dangerous ones leading to emergent intervention [27, 32–36].

We are aware that our study limitations come from its retrospective nature and data acquired from a single institution. Further studies are required to work out proper

algorithms and recommendations, and we are preparing for those.

CONCLUSIONS

We state that the primary thought that the outbreak of the pandemic, isolation policy, and boredom might lead to growth of FB diagnosis among children surprisingly turned out to be false.

DISCLOSURE

The authors declare no conflict of interest.

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