Supplementary

Appendix 1 Search Strategy

Web of Science—executed 24 May 2025
Database: All Databases (including MEDLINE, Web of Science Core Collection)

Limits/Filters: None
TS = (
("water bead*" OR "water-absorbing bead*" OR "water absorbing bead*" OR "water-expanding bead*" OR "water expanding bead*" OR "superabsorbent polymer*" OR "super absorbent polymer*" OR "hydrogel bead*" OR "crystal bead*" OR "crystal gel ball*"OR "polyacrylate" OR orbeez OR "expanding polymer bead*")
AND
(ingest* OR swallow* OR aspirat* OR inhal* OR "foreign bod*" OR insert* OR "airway obstruction" OR "bowel obstruction" OR "intestinal obstruction" OR "small bowel obstruction" OR ileus OR perforat* OR "nasal foreign bod*" OR "ear foreign bod*" OR otolog* OR otic OR aural OR nasal OR sinonasal OR bronch* OR trache* OR laryng* OR bronchoscopy OR endoscopy OR enterotomy OR bezoar OR orbezoar OR oesophagus OR esophagus OR impaction OR paediatric OR pediatric)

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Table S1 Data dictionary

Parameter	Definition	Possible values
Reference (author, year)	Citation of the included study	Text
Study design	Type of publication (e.g. abstract, grey literature, case report, retrospective series)	Text
Year published	Year the source was published	YYYY
Funding	Whether funding was reported, if so what source	Text
Number of Patients	Number of patients reported for that exposure route	Integer
Age, months	Age at presentation in months	Integer
Sex	Biological sex as reported. M = Male F = Female	Integer
Bead location	Anatomical site of the water bead	Text
Duration of bead *in situ*	Time from exposure to removal	Integer
History of foreign body exposure	Caretaker/child suspicion or witness of foreign body exposure	Yes, No, NR
Exposure details (nasal insertions/ inhalations)	For 'inhalations' specified as inhalations if mentioned in the text or if in lung put into inhalation category. Else if bead present in nasal cavity specified as 'insertion'	Text
Symptom onset to hospital presentation (days)	Days from onset of symptoms (or if asymptomatic, reported ingestion) to hospital presentation	Integer
Number of water beads removed	Number of water beads removed from the patient, if not specified, approximate number ingested	Integer
Maximal bead diameter (mm) reported	Maximal diameter of bead (mm) as reported in the study	Integer
Clinical presentation	Symptoms described on presentation	Text
Diagnosis	Diagnostic modalities used. Depending on data availability, subcategorised into specific modalities and their findings.	Text
Imaging findings (ingestion)	Abdominal XR: abdominal X-Ray (XR) underwent Signs of obstruction: signs of intestinal obstruction on abdominal XR Visualised bead: bead visualised on abdominal XR Ultrasound: ultrasound underwent Visualised bead: bead visualised on ultrasound CT scan: CT scan underwent Visualised bead: bead visualised on CT	0 = no, 1 = yes
Management	Management described in the text. Or depending on data availability subcategorised as conservative/endoscopic/surgical as below	Text
Conservative	Number of patients with non-operative/endoscopic management (observation, fluids, antiemetics, or specified as per text)	Integer or text
Medical management	Including enemas and specified as per text	Text
Endoscopic	Number with endoscopic removal/intervention underwent	Integer
Surgical management	Number with surgical removed/intervention underwent	Integer
Outcomes	Recovery or complications described	Text

NR, not recorded.

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Table S2 Summary of Ear insertion cases involving water-absorbing beads from available literature

Reference (Author, Year)	Study Design	Year Published	Funding	Number of Patients	Age (Months)	Gender	Location of Bead	Suspected duration of retained water bead	History of foreign body exposure	Clinical Presentation	Outpatient Removal	Otic Antibiotic Drops	Investigations	Index Operation	Subsequent Operations	Outcomes
Ramgopal *et al.* (4)	Case Report	2019	NR	1	48	F	Right	NR	Yes	Otalgia, otorrhea	No	No	NR	EUA—remnants of the object were removed with suction with myringoplasty	No	NR
Sterling *et al.* (15)	Case Series	2016	NR	*1	NR	M	NR	4d	Yes	NR	No	No	NR	EUA—subtotal TM perforation and partial ossicular chain erosion	No	Mild conductive hearing loss and 40% residual perforation
Zalzal *et al.* (16)	Case Series	2023	None	7	84	F	Right	10 weeks	No	Otalgia, otorrhea, fever	No	Yes	CT scan	EUA—vascular-appearing polyp that required subtotal resection	Post-auricular removal with middle ear exploration	Profound sensorineural hearing loss
					84	M	Left	2m	No	Otalgia, otorrhea	No	Yes	Audiogram	Tympanoplasty with ossicular chain reconstruction and middle ear exploration	No	Full recovery
					60	M	Bilateral	1 week	NR	NR	No	No	NR	EUA—water bead had severely eroded the distal EAC, tympanic membrane, and the malleus	Tympanoplasty with temporalis fascia graf	Full recovery
					120	M	Left	2m	No	Otalgia, otorrhea	No	Yes	Audiogram, CT scan	Tympanoplasty	Tympanoplasty with cholesteatoma removal	Mild-moderate conductive hearing loss
					60	M	Bilateral	1d	NR	NR	No	NR	NR	EUA with foreign body removal	No	Full recovery
					84	F	Right	4d	NR	NR	No	NR	NR	EUA with foreign body removal	No	Full recovery
					60	M	Right	5h	NR	NR	Yes	NR	NR	NR	No	Full recovery
U.S. Consumer Product Safety Commission Letter (25)	Letter	2023	NR	NR	120	M	NR	NR	NR	Otalgia	No	NR	NR	Surgery	No	NR
					60	F	NR	NR	NR	NR	Yes	NR	NR	NR	No	NR
					84	F	NR	NR	NR	NR	No	NR	NR	Surgery	No	NR
					60	M	NR	NR	NR	NR	No	NR	NR	Surgery	No	NR
					84	M	NR	NR	NR	NR	No	NR	NR	Surgery	No	NR
					120	M	NR	NR	NR	NR	No	NR	NR	Surgery	No	NR

*, the other patient mentioned in this text is a duplicate patient from another source. EUA, examination under anaesthetic; NR, not reported; CT, computed tomography; EAC, external auditory canal; TM, tympanic membrane; M, male; F, female.

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Table S3 Summary of Nasal insertion/inhalation cases involving water-absorbing beads from available literature

Reference (Author, Year)	Study Design	Year Published	Funding	Number of Patients	Age (Months)	Gender	Exposure Details	Bead Location	Duration of Foreign Body In Situ	History of Foreign Body Exposure	Clinical Features	Diagnosis	Findings	Management	Outcomes
Alharbi *et al.* (18)	Case Report	2020	None	1	36	M	Inhalation	Left lung lower lobe	>1 year	No	Recurrent lower repiratory chest infections	Chest CT	Multiple cystic changes within posterior segment of left lung lower lobe	Flexible bronchoscopy	Persistent bronchiectasis
Gardner *et al.* (26)	Case Report	2021	None	1	36	M	Inhalation	Left mainstem bronchus	Aproximately 1 year	No	Incidental finding	CXR, Chest CT, Diagnostic Bronchoscopy	CXR: opacification CT: atelectasis Bronchoscopy: left mainstem bronchus ended in a blind fibrotic pouch concerning for a chronic foreign body reaction	Rigid bronchoscopy	Recovery
Han *et al.* (17)	Case Series	2021	Shenzhen Municipal Science and Technology Innovation Committee	12	Median 36	7M, 5F	Insertion	8 in right nasal cavity, 4 in left nasal cavity	Min: 4 hrs, Max: 7 days	NR	NR	Transnasal endoscopic examination or nasal CT	Endoscopy: irritation and swelling of nasal mucosa	1 outpatient removal, 11 nasal endoscopy	Recovery
									<1 day (n=4)	Yes	Nasal congestion, runny nose				
									1-3 days (n=3)	No	Severe nasal congestion, runny nose, snorting, nasal pain, agitation, refusal to eat				
									3-7 days (n=5)	No	Severe nasal congestion, runny nose, snorting, nasal pain, agitation, refusal to eat, bleeding (n=2), high fever (n=4)				
Wahl *et al.* (27)	Abstract	2024	NR	1	NR	NR	Inhalation	Left lung	NR	NR	NR	CXR	Left lung atelectasis	Bronchoscopy	NR
U.S. Consumer Product Safety Commission Letter (25)	Letter	2023	NR	4	48	M	Insertion	NR	NR	NR	NR	NR	NR	Endoscopy	Recovery
					108	M	Insertion	NR	NR	NR	NR	NR	NR	Removed at home	Recovery
					36	M	Insertion	NR	2 weeks	NR	Nasal bleeding, congestion, light fever	NR	NR	Removed at home	Recovery
					18	NR	Inhalation	NR	NR	NR	NR	NR	NR	NR	NR

NR, not reported; CT, computed tomography; CXR, chest X-ray; M, male; F, female.

References

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26. Gardner JR, Navuluri S, Small M, et al. Superabsorbent Gel Polymer Aspiration and Erosion Into Mediastinum. OTO Open 2021;5:2473974X211023020.
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