

Nasal Foreign Body Removal in Children

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Abstract: Nasal foreign bodies in children are often managed in the pediatric emergency department. The child is usually between 2 and 4 years old, and the foreign body is most commonly a plastic toy or bead. Nasal foreign bodies are removed by a number of techniques. Positive-pressure expulsion is accomplished by orally applied pressure via a parent's mouth or an Ambu bag or by nasally applied pressure via a catheter or an oxygen source. The object can be washed out with nasally applied saline. Direct mechanical extraction is possible with a variety of tools, including forceps, hooks, or balloon-tipped catheters. Each method carries its own risks and benefits. Serious complications of nasal foreign bodies include posterior dislodgement and aspiration, trauma caused by the object itself or removal attempts, infection, and choanal stenosis. Magnets and button batteries require emergent removal as they carry the risk of septal perforation or necrosis, which may develop within a relatively short time.

Key Words: foreign body, nose, removal

TARGET AUDIENCE

This CME activity is intended for physicians and nurses who practice in an emergency department.

LEARNING OBJECTIVES

After completion of this article, the reader should be able to:

1. Identify demographic and clinical characteristics of pediatric nasal foreign bodies.
2. Distinguish the procedures and equipment commonly used to remove nasal foreign bodies.
3. Identify the complications of nasal foreign bodies in children.

Although foreign bodies in the nose are not common and only make up approximately 0.1% of pediatric emergency department visits, management of nasal foreign bodies can be challenging and potentially life threatening.¹ The most common age of presentation is from 2 to 4 years.¹⁻⁴ The

male-to-female distribution seems to be related to the type of foreign body. In 1 study, hair beads were the most common foreign body, and the male-to-female ratio was 1:1.9.¹ However, in another study, when the most common foreign body was a plastic toy, the male-to-female ratio was 1:1.³ On presentation, most patients are asymptomatic and give a history of nasal foreign body, which has been either noted by a caregiver or reported by the child.^{2,3} Of those who present with symptomatic complaints, pain and discomfort are the most common.¹ Unilateral foul-smelling nasal discharge also occurs in 14% to 36% of patients. In 1 study, 50% of patients with nasal foreign body and unilateral foul-smelling discharge had no history of foreign body given at presentation.² A small percentage of children will present with epistaxis, but this is usually associated with failed attempts to remove the foreign body before presentation.¹

The types of foreign bodies can be categorized into food, toys, and others. Food is the foreign body in 12% to 27% of cases, toys in 23% to 46%, and others in 35% to 65%.¹⁻³ Magnets and button batteries require emergent removal because of the risk of nasal septal perforation. Immediate identification of these is critical to successful management.^{5,6}

Foreign bodies also display a wide variety of shapes, including spherical, cylindrical, discoid, and irregular. The size of the foreign body obviously will determine the degree of obstruction. Type, shape, and size are important factors to consider when choosing the removal procedure and equipment. Removal of nasal foreign bodies by pediatric emergency department physicians has been reported to be successful in 92% and 98% of cases.^{1,2} The purpose of this review article is to discuss the removal procedures, equipment required, and complications of nasal foreign bodies in children.

REMOVAL TECHNIQUES

Preparation

For each of the following removal techniques, consider administering topical anesthesia for pain control. Because it is readily available in emergency departments, lidocaine without epinephrine is recommended.² For topical administration, the maximum dose of lidocaine is 3 mg/kg per dose or 0.3 mL/kg body weight of 1% lidocaine. Allow approximately 10 minutes for lidocaine to take effect before performing one of the following removal techniques. The routine use of a topical vasoconstrictor to reduce nasal mucosal swelling and improve the likelihood of successful foreign body removal is not recommended. Topical vasoconstrictors increase the risk for posterior displacement and possible aspiration of the foreign body. Precautions to consider after administration of a topical vasoconstrictor are discussed later.

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ISSN: 0749-5161/08/2411/0785

Positive Pressure

One of the simplest ways to remove a nasal foreign body is for the child to exhale forcibly through the nostril containing the object. To accomplish this, the opposite nostril must be occluded and the mouth closed. This sequence of events may be difficult or impossible for many of the young patients to accomplish on their own. Techniques have been developed that replicate the increase in nasal pressure that occurs during nose blowing.

Several authors have described a technique of nasal foreign body removal in which a parent uses his or her mouth to apply positive pressure into the patient's mouth with simultaneous occlusion of the contralateral nostril.⁷⁻¹¹ After reassuring the child, possibly by saying that they are going to give a "big kiss," the parent holds the child's mouth open with a hand on the chin and occludes the nostril opposite the foreign body with the other hand. The parent then delivers a short sharp mouth-to-mouth breath, attempting to create a good seal between his or her mouth and the child's. The main advantage of this method is that it is potentially less emotionally traumatic for the child than direct physical removal of the object. A known caregiver is directly involved, and the child may require less restraint and less sedation than with instrumentation. However, the technique of creating a good mouth-to-mouth seal may be difficult to master by some parents. In addition, the child may still view the act as out-of-the-ordinary and distressing, especially in the stressful setting of the emergency department.

A prospective study of the "parent's kiss" technique in an emergency department setting evaluated the technique on 19 children between 1 and 5 years old.¹¹ The technique was successful in expelling the foreign body in 15 of these 19 cases. Importantly, the parents uniformly preferred the technique to restraining the child for instrument removal. In addition, in the cases in which this method was unsuccessful, the initial use of this technique did not hinder further attempts at instrumentation. In another evaluation, a 2-year chart review found the parent's kiss technique used in 8 of 64 cases presenting to a community hospital.⁹ In all cases in which it was attempted, the technique was successful, with no adverse outcomes.

A modification to the parent's kiss technique, which children may find more natural and parents may master more easily, involves placing a drinking straw, or similar tubing, between the parent's mouth and child's mouth.⁸ The child is instructed to make a tight seal, as if drinking, and the parent delivers a quick puff. The resulting oral positive pressure should be the same, but this modification is more dependent on the child's ability to create an adequate seal on the straw or tube.

Alternatively, one may attempt to create the necessary positive pressure by means of oral insufflation with an ordinary Ambu bag. In a small study of 3 patients, this technique resulted in quick dislodgement of the foreign body with a minimum of patient discomfort.¹² This would seem to be a reasonable alternative in instances when the parent and child have difficulty cooperating with the parent-applied mouth-to-mouth positive pressure.

Two articles have suggested creating positive pressure in the contralateral nostril instead of in the mouth.^{13,14} Sorrells¹³ reports personal experience using a rubber catheter placed at, or in, the nostril opposite to the foreign body, with the physician blowing directly into the other end of the catheter. This requires occluding the child's mouth (with a hand) and restraint by a parent or a papoose board. The author claims more than 40 successful removals with this technique, and only 1 failure. A similar technique described by Navitsky et al¹⁴ removes the potential for disease transmission inherent in the Sorrells technique. This method calls for a wall oxygen source (turned to 10-15 L/min flow) to be directed into the contralateral nostril. A male-to-male adapter at the end of the oxygen tubing is used to direct the flow into the nostril. Nine patients who received this technique had good results and no complications. In addition, parents who could be reached for follow-up uniformly described the experience as less traumatic than a vaccine injection.

A possible adjunct to the removal methods previously described is the use of intranasal epinephrine to reduce mucosal swelling and thereby facilitate the expulsion of the foreign body. An application of 1 to 2 mL of 1:1000 epinephrine has been used in the ipsilateral nostril after direct visualization of the object. This has been found to increase the likelihood of the child being able to expel the object with a forceful nose blow.¹⁵ However, this is only recommended if the object is well visualized and is of large enough size that a posterior displacement of the object is unlikely. The risk of aspiration after the administration of the epinephrine dictates that this should only be performed under circumstances where intubation and bronchoscopy would be possible. To reduce the risk of aspiration, consider keeping the patient in an upright position after vasoconstrictor administration. Others have also suggested the use of a small quantity of epinephrine or other local vasoconstrictor (0.5% phenylephrine) to increase the effectiveness of any of the described positive-pressure techniques.^{9,13} However, no studies have been done to compare the effectiveness of positive pressure with a vasoconstrictor with that without a vasoconstrictor. The potential for posterior displacement and/or aspiration would suggest that at least initial attempts with positive-pressure techniques should be used without a vasoconstrictor.

Saline Washout Technique

A technique has been described that effectively uses liquid instead of air as the positive-pressure vehicle in removing foreign bodies.¹⁶ Approximately 7 mL of isotonic sodium chloride solution is introduced into the contralateral nostril with a bulb syringe at high pressure. This technique is similar to that used to collect mucous samples for virology studies. Friable foreign bodies may be especially suited to this technique because they are difficult to remove in their entirety with instrumentation. However, concern has been raised that this method carries undue risk of aspirating the saline wash and potentially the foreign body.¹⁷ Certainly, it does not seem prudent to apply any positive-pressure technique, air or liquid, through the contralateral nostril in situations where the foreign body cannot be well visualized or a second foreign body in the other nostril cannot be excluded.

Mechanical Extraction

The ingenuity of health care workers over the years has led to a number of methods for mechanical extraction of nasal foreign bodies. The most appropriate technique, however, must be determined based upon location of the object within the naris and contour of the object. Many previous authors have described the use of a variety of forceps or hooks to aid in the removal of foreign bodies anteriorly located within the nose. In a review by Baker,¹ 85% of nasal foreign bodies that presented to their emergency department over a 2-year period were removed in one of these fashions. The types of instruments used for removal include straight, bayonet, mosquito, alligator, and surgical forceps. A review by François et al¹⁸ found surgical forceps to be successful in the removal of 35 foreign bodies and to be more effective when the object was soft and irregularly shaped, such as paper, cotton, or foam. If the irregularly shaped object was of hard consistency or the object was spherical, hooks were shown to be more effective.⁷ If such specialized medical equipment is not available, some have found success by fashioning hooks out of paper clips or by bending the wire loops of ear cures.^{19,20} A nasal speculum can assist in maximizing visualization, and if used, should be placed in a cephalad-caudad orientation to avoid the nasal septum.²¹ The tip of the hook should be inserted just beyond the depth of the foreign body then rotated behind the object. Gentle traction is then used to extract the object. Regardless of the method used, if mechanical extraction is to be attempted, good visualization of the object is a requirement. Blind attempts to grasp oddly shaped objects with forceps may result in pushing the object further into the nasopharynx, making eventual removal more difficult.

Hanson and Stephens²² have described the use of cyanoacrylate applied to the end of a plastic swab stick for the removal of nasal foreign bodies. The stick was pressed and held onto a plastic bead for 60 seconds before withdrawn and required 3 attempts before successful removal. The authors advocate this approach for objects that are easily

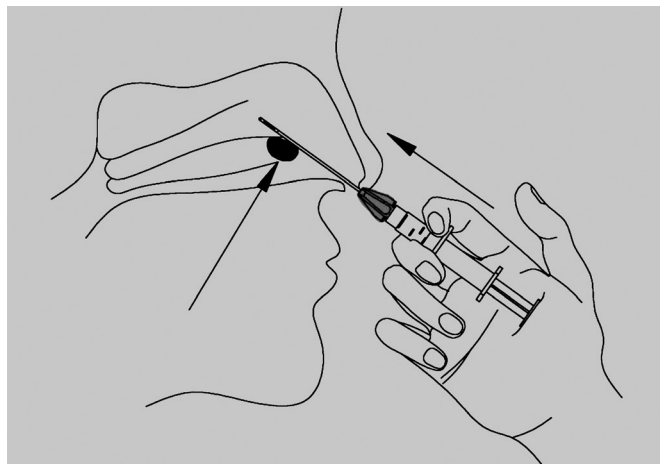


FIGURE 1. Katz extractor catheter passed beyond nasal foreign body. Photograph courtesy of InHealth Technologies, www.inhealth.com.

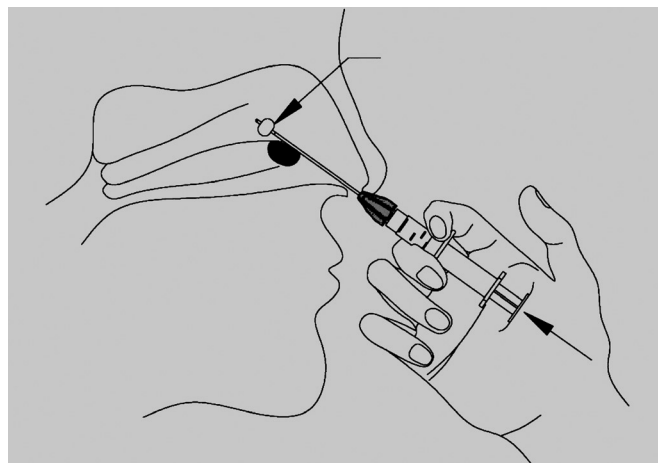


FIGURE 2. Katz extractor balloon inflated with air from connected syringe. Photograph courtesy of InHealth Technologies, www.inhealth.com.

visualized yet difficult to grasp, such as rounded objects. It is recommended that this method only be used when little to no nasal discharge is present and only with medically approved products (ie, no superglues).

For foreign bodies that are more posteriorly placed, many authors have been successful with catheters. These include Foley catheters, Fogarty vascular catheters, or Fogarty biliary balloons.^{23–25} The method for using the catheters is similar regardless of the type used. After ensuring the integrity of the balloon, the catheter is inserted above and distal to the foreign object. Passing the catheter below the object is thought to potentially drive the object into a tighter position. Once beyond the foreign body, the balloon is inflated with a predetermined amount of saline (1 mL for no. 4 Fogarty catheter, 2–3 mL for a no. 6 Fogarty or 8F Foley catheter) and maintained at that size with pressure from the practitioner's thumb. Gentle traction is then applied to remove the object. The success of these tools has led to the development of a disposable catheter made specifically for the removal of foreign bodies from the nose and ear called the Katz extractor.²⁶ The Katz extractor catheter is smaller than the previously mentioned catheters, which results in a greater chance of it being passed beyond the foreign body. The use of the Katz extractor is illustrated in Figures 1, 2, and 3.

Finally, if a metallic foreign body is encountered, the use of a variety of magnets has been implemented. Douglas et al²⁷ describe the removal of a metallic ball bearing with a 10-mm neodymium magnet, whereas McCormick et al⁶ used magnets in removing magnetic jewelry that had adhered across the nasal septum.

COMPLICATIONS

Complications from nasal foreign bodies include pain, obstruction, rhinorrhea, epistaxis, ulceration of the nasal mucosa, perforation of the nasal septum, nasal or choanal stenosis, infection, ingestion, and aspiration.⁷ The risk of complications is associated with many factors. These include the length of time that the foreign body has been lodged in



FIGURE 3. Katz extractor removed with nasal foreign body. Photograph courtesy of InHealth Technologies, www.inhealth.com.

the nose and the characteristics, size, and shape of the foreign body. Other complications are related to the removal of the foreign body. The most serious complications occur from button batteries, magnets, failed removal attempts, and management that results in delayed removal.

Although most patients with a nasal foreign body present within 24 hours of the time that the foreign body becomes lodged in the nose, 13% to 27% present beyond 24 hours.¹⁻³ It is surprising that this percentage is not greater because the average age of children with nasal foreign body is 3 years and history of foreign body may not be given. Unilateral nasal discharge with or without foul odor is reported in 14% to 36% of patients.¹⁻³ The amount of local nasal mucosal inflammation and nasal discharge is likely to be greatest with an organic foreign body and with increasing length of time. However, in the cases of button batteries, there is often a much more rapid and serious inflammatory response. When in contact with the moisture of the nasal mucosa, batteries can generate currents and produce thermal burns. In addition, corrosion of the battery casing results in release of alkaline material.²⁸ A nasal septum perforation of 1.5 cm in diameter was reported in a 2-year-old child with a lodged nasal button battery of only 7 hours' duration.⁵

Epistaxis has been reported in up to 6% of children presenting with nasal foreign body.¹ This most commonly occurs with sharp or irregularly edged foreign body. It is also more commonly associated with removal attempts by caregivers before presentation. In a report of ear and nose foreign bodies, 20% of the children had already failed removal attempts by parents.¹ Epistaxis also may occur with removal of a nasal foreign body. As high as 6% of patients are reported experiencing epistaxis during emergency department removal procedures.³ This is also most commonly associated with sharp or irregularly edged foreign bodies, long-standing foreign bodies that have adhered to the nasal mucosa, or with the use of a balloon catheter.

Nasal mucosa ulcerations, nasal septum perforations, and resulting nasal or choanal stenosis are almost always associated with lodged button batteries or minimagnets. In a

report of 118 children with nasal foreign body, 14 (12%) were button batteries.³ Among the 17 patients of this group who experienced complications were all 14 with lodged button batteries, which included 1 septal perforation. Most button batteries are alkaline. The solution used to soak the material that separates the anode from the cathode is either sodium hydroxide or potassium hydroxide. The nasal mucosa may be damaged by leakage of the alkaline solution or by thermal burns from a generated current. Pressure necrosis is not responsible for the damage to the nasal mucosa with button batteries.²⁸ However, pressure necrosis is the mechanism of injury seen with minimagnets. Body piercing is a popular fashion practice. Jewelry with strong magnet backings allows children and teenagers to imitate ear, nose, tongue, cheek, and genital piercing.⁶ In a report of 11 children, pressure necrosis of the nasal septum was caused by 2 magnets, one in each nostril, that adhered to one another across the nasal septum. One child had severe necrosis with exposure of the septal cartilage in both nostrils.⁶ Included in this report was a 9-year-old child who accidentally ingested a number of minimagnets over a period while imitating tongue piercing. This patient presented with bilious emesis and abdominal pain. Laparotomy revealed 5 perforations of the small intestine and one to the cecum. These were secondary to adherence of 2 magnets across adjoining loops of bowel. Although not previously reported, nasal minimagnet foreign bodies could be accidentally ingested and create a similar risk for bowel perforations.

Another serious complication of nasal foreign body is the risk of aspiration. Although such a case has not been published to our knowledge, the risk of aspirating a nasal foreign body is discussed in previously published case series and review articles.^{1,7,14} Because the foreign body is lodged in the nose, the risk of aspiration is likely greater at the time of removal. Procedures that use instruments such as hooks, forceps, or balloon catheters carry the risk of pushing the foreign body posteriorly and potentially into the nasopharynx, creating a risk for aspiration. For this reason, the nasal wash or positive-pressure procedure is recommended especially for foreign bodies located in the posterior portion of the nostril.^{9,12,14,16} Although there is a theoretical risk of barotrauma to the lungs or tympanic membranes with positive-pressure delivery through a male-to-male adapter attached to oxygen at 10 to 15 mL/min, it is unlikely. This positive-pressure method produces pressures of 10 to 15 mm Hg, whereas nose blowing can produce pressures of up to 60 mm Hg.¹⁴ Caution should also be taken when considering attempting to have the patient blow out the foreign body. When asked to breathe in, the younger child may inadvertently inhale through the nose instead of the mouth, and this may result in aspiration of the foreign body, especially if the contralateral nostril is occluded. Therefore, if the self-blow technique is attempted, rehearse the procedure to assure that the child fully understands what to do.

In addition to sinusitis and acute otitis media, other more serious infections are also associated with nasal foreign bodies. These include facial cellulitis, periorbital cellulitis, epiglottitis, meningitis, diphtheria, and tetanus.^{5,7,29,30} The

TABLE 1. Nasal Foreign Body Characteristics and Removal Techniques

Procedure	FB Type	Location	Degree of Obstruction
Positive pressure	Any	Ant/post*	Complete
Washout	Friable	Ant/post	Complete
Hooks	Hard	Ant	Incomplete
Forceps	Soft	Ant	Incomplete
Catheter	Any	Ant/post	Incomplete
Magnet	Metallic	Anterior	Complete/incomplete

*Ant indicates anterior; FB, foreign body; post, posterior.

greater the length of time that the foreign body is lodged in the nose, the greater the risk for the previously mentioned infections. For children who have successful removal of nasal foreign body and do not have septal perforation or signs of a secondary bacterial infection, routine treatment with prophylactic antibiotics is not recommended.

To prevent a missed diagnosis of another retained foreign body, examination of the involved nostril after the foreign body removal, as well as the contralateral nostril, ears, mouth, and possibly vagina is recommended.

Complications uniquely associated with the use of procedural sedation and anesthesia in the removal of nasal foreign bodies have not been reported. In a report of 138 patients, procedural sedation was used in 28 (20%) to assist in the removal of nasal foreign bodies.³¹ Ketamine was used in more than 90%, and mechanical extraction techniques were used in all cases. Positive-pressure (air or saline) procedures were not used in these patients. Procedural sedation was reported to have a positive effect on the success rate of foreign body removal, especially in those patients who had failed attempts without sedation.

CONCLUSIONS

Nasal foreign bodies are a problem that can often be treated successfully in the emergency department. We have provided a list of techniques that have been proposed over the years and that are supported mostly by the experience of the physicians who have used them. The technique chosen in any particular situation will depend on the type and location of the foreign body and the degree of obstruction (Table 1). The techniques outlined here have all been used with few reported adverse effects. However, several potential complications need to be considered before attempting any extraction, including most seriously the possibility of aspiration. In addition, the danger and special urgency of cases involving magnets and batteries in the nose need to be familiar to emergency medicine physicians.

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Nasal Foreign Body Removal in Children, *Kiger et al*

1. The most common age at presentation for patients with nasal foreign body is:
 - a. 1 to 2 years old
 - b. 2 to 4 years old
 - c. 4 to 6 years old
 - d. 5 to 10 years old
2. Which of the following is not a recommended use of positive pressure to dislodge a nasal foreign body?
 - a. Mouth-to-mouth pressure by a parent, with occlusion of the contralateral nostril.
 - b. Ambu bag insufflation over the mouth, with closure of the contralateral nostril.
 - c. Pressure applied via a red rubber catheter to the ipsilateral nostril to dislodge the object posteriorly.
 - d. Pressure from a wall oxygen source via a male-to-male adapter to the contralateral nostril, with occlusion of the mouth.
3. The proper technique for removal of a nasal foreign body with a balloon catheter is which of the following?
 - a. Passage of the catheter above and distal to the object, inflation of the balloon, and traction to pull the object forward.
 - b. Passage of the catheter inferior and distal to the object, inflation of the balloon, and traction to pull the object forward.
 - c. Inflation of the balloon, advancement of the balloon to the object, and posterior pressure to dislodge the object into the nasopharynx.
 - d. Advancement of the balloon to lie beside the object, with repeated inflations and deflations of the balloon to dislodge the object.
4. Epistaxis with a nasal foreign body is frequently associated with which of the following?
 - a. Bilateral foreign bodies
 - b. Recent insertion of the object
 - c. Positive-pressure removal techniques
 - d. Prior removal attempts at home
5. Dangers of button batteries in the nose include all but which of the following?
 - a. Thermal burns
 - b. Chemical injury
 - c. Pressure necrosis
 - d. Aspiration

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November 2008

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2. B
3. B
4. B
5. E