

# New Technique of Beads Removal by Modifying Alligator Forceps

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## Abstract

**Background:** Removal of spherical object like beads from tracheobronchial tree is very difficult due to their round and slippery nature which makes their grasp impossible by ordinary forceps during rigid bronchoscopy (RG.BR).

**Aim:** The aim of this study was to improve new forceps to achieve an easy and swift technique to remove beads from tracheobronchial tree.

**Patients and method:** This study was conducted at Rizgari teaching and Erbil emergency hospitals between 1984 and 2006 and involved 75 children with bead inhalation. The diagnosis was confirmed by viewing the typical shadow of beads which could be seen on plain chest x-ray accompanied by different initial clinical signs and symptoms such as choking, cough, respiratory distress, stridor, cyanosis and fever. All beads were removed by a modified minute forceps.

**Result:** From the total of 75 patients, 49 patients were males and 26 were females. Forty eight beads were in right main bronchus and 15 were in left main bronchus, while the other 12 beads were in trachea and carina. Most of the patients (85.3%) attended hospital immediately.

**Conclusion:** Despite improvements in technology, there is still no appropriate removal forceps for tracheobronchial tree beads. The new improvised grasping forceps showed excellent success and such improvement can be adopted by the relevant companies to develop a special forceps for this purpose.

**Keywords:** Bead removal, removal of beads by intrahole grasping, new method for removal of beads.

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## الخلاصة

**الخلفية:** إزالة جسم كروي مثل (خرزة السبحة) من شجرة الرغامية القصبية من الصعب جدا نظرا لطبيعتها المنزلفة وشكلها الكروي والدور الذي يجعل من المستحيل التقاطها بالملقط العادي خلال ناظور القصبات (RG.BR).  
**الهدف:** الهدف من هذه الدراسة هو ابتكار ملقط جديدة لتحقيق تقنية سهلة وسريعة لإزالة حبات من شجرة الرغامية القصبية.

**المرضى والطريقة:** أجريت هذه الدراسة في مستشفى رزكري التعليمي ومستشفى اربيل للطوارئ بين عامي ١٩٨٤ - ٢٠٠٦ وشملت ٧٥ طفلا قد استنشق (خرزة). شخصت بصورة الفحص الشعاعي (للخرز) التي يمكن أن ترى بالأشعة السينية الاعتيادية. ومن خلال الاعراض السريرية المختلفة مثل الاختناق وضيق التنفس، والسعال، صرير، الازرقاق والحمى، جميع الخرز ازيلت بواسطة الملقط المحور.

**النتائج:** من إجمالي ٧٥ مريضا، ٤٩ مريضا من الذكور و ٢٦ من الإناث. ٨٤ (خرزة) وجدت في قسبة الرئيسية اليمنى و ١٥ (خرزة) وجدت في القسبة الهوائية الرئيسية اليسرى، في حين أن الأخرى ١٢ (خرزة) وجدت في القسبة الأساسية وزاوية ((كارين)). (٨٥.٣٪) من المرضى حضرو المستشفى على الفور.

**الخلاصة:** على الرغم من التطور في التكنولوجيا، لا يوجد حتى الآن ملقط مناسب لازالة الخرز من الشجرة الرغامية القصبية. لقد أظهر الملقط المبتكر الجديد ملقط استيعاب يمكن اعتمادها نجاح ممتازة وهذا التحسين من قبل الشركات ذات الصلة لوضع ملقط خاص لهذا الغرض. نجاحا واضحا وهذا ممكن ان تعتمد الشركات ذات العلاقة لانتاج مثل هذا الملقط.

**كلمات البحث:** إزالة حبة، وإزالة حبات من استيعاب intrahole، طريقة جديدة لإزالة الخرز.

## Introduction

Most airways foreign body (FB) inhalation occur in patients younger than 15 years of age and the highest incidence occurs between 1 and 3 years of age [1]. Foreign body removal from the tracheobronchial tree in children is very serious and dangerous [2]. Despite the improvement in technology of instruments for removal of most organic and inorganic materials, clinicians are still facing difficulties when removing spherical FBs like rosary beads (tasbih) prayers beads that are used by Muslims [3]. Beads are common in Middle East and Islamic countries; it is the cause of most dangerous aspirated FBs in children. There are still significant risk of morbidity and mortality among children younger than 4 years of age group due to lack of special forceps for removal of beads [4]. Inhalation of FBs such beads were not common in the past. Several authors like Gibson W S Jr et al and Jan I A and Mirza et al, have described beads as unusual FBs [5], but nowadays beads are freely available in the form of tasbih and cheap jewelry. Their threads can be easily broken and pieces are scattered everywhere on the floor at home and some of the beads may get lost and not found during collection. Infants and children have the habit of picking up everything and putting them in their mouth to determine their texture and taste and chewing them during teething period [6]. The FB (beads) may be inhaled into the tracheobronchial tree from the mouth by sudden laugh or cry or accidentally falling down or being pushed by other children to have or to obtain the object. These unfortunate possibly lethal events lead to the FBs be inhaled into the tracheobronchial tree [7]. Removal of beads needs great challenge because of their typical rounded slippery nature. Therefore, it might be difficult to remove them by the usual ordinary bronchoscopic forceps which is content Karl Storz bronchoscopy set, and on

occasions it could require a specially designed forceps for this purpose even with the presence of an experienced bronchoscopist [8]. A wide variety of techniques and procedures were attempted and used to remove beads from tracheobronchial tree [9]. Below some trials to remove beads from tracheobronchial tree :\_

1. Passing minute biopsy forceps of flexible bronchoscopy through the beads hole by rigid bronchoscope [10].
2. Using dental wire as metal loop for extraction of FBs through the rigid bronchoscope [11].
3. Passing Fogarty catheter balloon which is useful for removing of beads, the catheters tip will be threaded through the hole then inflated (this method used since 1968) it is successful method in few cases because there is no smaller tip than 3F gauge of catheter [12].
4. Dormia basket used by urologists to remove uretric calculi may also be used in a similar manner passing it through a rigid bronchoscope [13].
5. Rigid bronchoscopy was the therapeutic method of choice during the last several years for FBs removal and should be regarded as a procedure which requires a high level of experience due to its serious and potentially lethal complications. The success rate of FB removal by rigid bronchoscopy could reach up to 99% and the morbidity and mortality has decreased from 1.8% to 0% [14]. Removal of FBs requires prompt intervention and less invasive modality to achieve easily and quickly interventional procedures [15, 16]. Extracting FBs impacted for a long time are notoriously difficult especially in infants and young children, due to the anatomy of the tracheobronchial tree being much smaller, narrower and shorter than adults [17], (Table7).

In the previous centuries, the mortality rate of FB inhalation was very high about 30% because most of the patients were treated by

thoracotomy due to non existence and unavailability of adequate instruments for removal of these FBs., In the twentieth century, the mortality and morbidity rate from FB. inhalation were reduced due to advances of the technique and instruments used. The first Endoscope used in 1890 by Mackenzie, later improved by Jackson, Ingal and Mosher. The first rigid Bronchoesophagoscope done by Jackson & Ingal on a wake patient in sitting position.

The advances in modern technology of removal of FB inhalation started by the introduction of the rod- Lens telescope in 1970 which greatly improved the Bronchoscopic removal of FB. [18.19.23] .If the airway obstruction subsides after initial phase of FB inhalation, the a symptomatic phase (last phase) starts when the FBs become lodged and the reflex is fatigued. This phase could last for hours or weeks. Complications occur in the third phase when obstruction, erosion or infection causes pneumonia, atelectasis, abscess or fever. Most patients who have arrived to the hospital with FBs have survived the acute phase and no longer in respiratory distress and there will be enough time to obtain medical history with no immediate risks to the patient's life. Although the role of otolaryngologist begins after the child has been evaluated initially by emergency staff or primary care. The child should be approached thoughtfully with full physiological and mechanical factors in mind. The principles, techniques, equipments and instruments should be accordingly designed for extraction of beads due to their round and slippery specification [24].

The aim of this study was to improvise a new forceps to achieve easily and quickly technique to remove beads from tracheobronchial tree.

## Materials and Methods

This study summarizes the experience of more than 25 years in working with and trying to improvise a solution for proper beads removal.

This study was conducted on 75 patients who had history of beads inhalation confirmed by typical shadow of the bead in tracheobronchial tree shown on plain chest x-ray (AP and Lat. views). During the period between 1984 - 2006 at both Rizgary and Erbil Teaching/Emergency Hospitals, all these patients were attend to the emergency department by their parents or referred by other colleagues or from pediatric hospital as cases of chest infection not responding to medical treatment. For each patient a data information sheet was filled including signs and symptoms like choking, spasmodic sudden cough started at home, shortness of breath, respiratory distress, stridor and time of presentation to hospital. Clinical examination of the patients was done at the time of history taking and chest auscultation was performed meticulously, then radiological examination was done by plain chest x-ray for all patients, (Figure 1). In preparation for operation, 50-100 mg/kg body weight IV hydrocortisone was given to all patients (first dose) before sending them to the operating theater to decrease bronchial edema or reaction of bronchial mucosa because they had severe respiratory distress and spasmodic cough.

In the operating room, immediate emergency bronchoscopy was performed under general anesthesia by ventilating rigid bronchoscopy (Karl Storz, Germany). Until now, no conventional forceps could extract beads easily. The researcher tried through personal efforts to procure minute grasping mouth alligator forceps (2 mm diameter sheath U shape model no.103384 action diameter) which is able to pass through most bead holes, except very smaller ones. This forceps

solved many problems and made the extraction of the beads much easier (Figure 2).

Still the researcher faced problems during inserting the forceps through beads hole. For example causing injury to the tracheobronchial lining mucous membrane and even bronchial wall when trying to open the prongs after passing through the bead hole (Figure 2). The diameter of the prongs have to be opened to at least 10 mm which is much wider than the diameter of the bronchus of children as the widest diameter of bronchus in children is about 7.9 mm (Table 7) . Children are in fact the usual victims of this condition.

In an effort to avoid damaging the mucous membrane by the opened prongs of the forceps, the researcher improvised the idea of using the forceps while still in the hole and not passing through (grasping from inside, opening the prongs inside the hole) . This proved useful in some cases but still the slippery character of the beads hole and smooth surface of the forceps prongs were big challenges for forceps slippery. This led the researcher to modify the design of the existing tool. In order for forceps to grasp the inner part (inside) of the beads, several serrations (Fig. 4) were made to make the outer surface of the forceps prongs rough and grasp the inner surface of the beads hole as shown in (Fig. 3). In addition to making the serrations, the diameter of the forceps was also made narrower by coursing the sheath of jaw forceps without damaging the hinge system. These modifications of making the prongs surfaces rougher and diameter narrower has proven to be useful in most of the cases and the problem of the extracting beads become easier in the later years.

The second dose of IV hydrocortisone is given as a protocol in order to reduce risks of

possible complications. The anaesthetist is notified before withdrawal of (BROS) to deal with and consider if the effect of muscle relaxant is over.

## Result

Seventy five children had emergency RG.BR with their age ranged from 1-12 years and a mean of 4.72 years, 49 (65.3%) of patients were male and 26 (34.7%) were female. Majority of patients were under 6 years of age, 4-6 (48%), (Table 1). The most common location of beads was seen in the right main bronchus 48 (64%); 39 (67.2%) males and 9 (52.9%) females. Fifteen (20%) beads were in the left main bronchus; 10 (17.2%) males and 5 (29.4%) females. The other 12 (16%) beads were seen in trachea and carina; 9 (15.5%) males and 3 (17.6%) females, (Table 3). The time of presentation to hospitals, 64 (85.3%) children were seen immediately, 7 (9.3%) patients in 1-2 days after inhalation, 3 (4%) patients in one week, 1 (1.3%) patients after first week and up, (Table 2). Radiological and bronchoscopical finding confirmed the above mentioned figures regarding site of FB (Table 3). Most initial clinical symptoms were spasmodic cough in 60 (80%) children, respiratory distress in 55 (73.3%) patients, symptoms such choking in 30 (40%) patients, stridor in 25 (33.3%) patients, cyanosis in 4 (5.3%) patients, and fever in 2 (2.6%) patients, (Table 4). Radiography of chest revealed unilateral hyperinflation in 8 (10.6%) patients, atelectasis in 7 (9.3%) patients, emphysema in 7 (9.3%) patients and mediastinal shift in 3 (4%) patients, (Table 5). Post bronchoscopic mild stridor in 3 (4%), irritated cough in 2 (2.6%) patients seen, (Table 6), all are controlled at recovery room and sent home after 1-2 hours, no serious complication (tracheostomy or other complications) were seen.

**Table(1):** Age and sex distribution.

Years	Male		Femal		Total	
	No.	%	No.	%	No.	%
1-3	20	83.3	4	16.7	24	100
4-6	24	66.7	12	33.3	36	100
7-8	3	30.0	7	70.0	10	100
9-up12	2	40.0	3	60.0	5	100
total	49	65.3	26	34.7	75	100

**Table(2):** Time of presentation to hospital.

Time of presentation	No.	%
Immediate	64	85.3%
In 1-2 days	7	9.3%
In 1 week	3	4%
1 week-up	1	1.3%
Total	75	100%

**Table (3):** Location of foreign body proved by chest x-ray and bronchoscopy.

Side	Male		Femal		Total	
	No.	%	No.	%	No.	%
Rt	39	67.2	9	52.9	48	64.0
Lt	10	17.2	5	29.4	15	20.0
Trachea and Carina	9	15.5	3	17.6	12	16.0
total	58		17	100.0	75	100.0

**Table (4):** Initial clinical symptoms (n=75).

Symptoms	No.	%
Choking	30	40%
Spasmodic cough	60	80%
Respiratcay distredyspss (dyspnea)	55	73.3%
Stridor	25	33.3%
Cyanosis	4	5.3%
Fever	2	2.6%

**Table (5):** Plain radiographic findings (n=75).

Radiological appearance	No.	%
Radio-opaque F.B.	75	100%
Atelectasis	7	9.3%
Unilateral hyperinflation	8	10.6%
Normal chest	3	4%
Unilateral Emphysema	7	9.3%
Mediastinal shift	3	4%

**Table(6):** Complication after bronchoscopy.

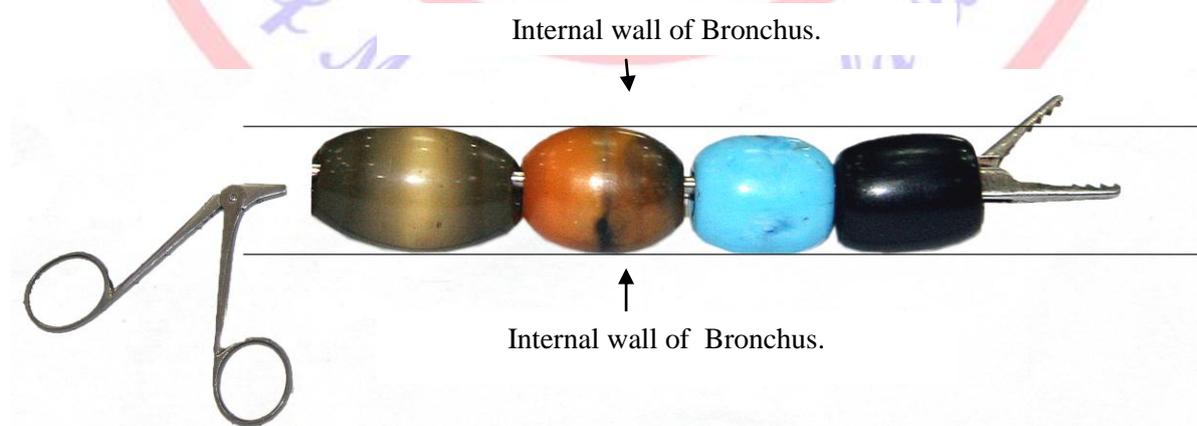
Symptoms	No.	%
Mild stridor	3	4%
Irritated cough	2	2.6%

**Table(7):** Diameter of Rt. &Lt. main bronchus in children.

Age (year)	Rt. Bronchial diameter (mm)	Lt. Bronchial diameter (mm)
1-2	5.6	4.3
2-4	6.5	5.0
4-6	6.7	5.3
6-8	7.9	6.1
8-10	7.7	6.0

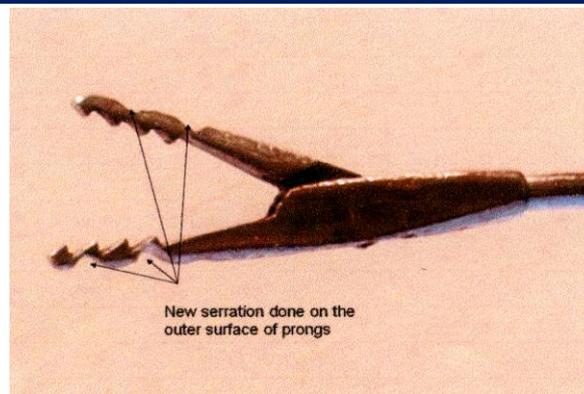


**Fig.(1):** X-Ray Shows bead in Trachea.

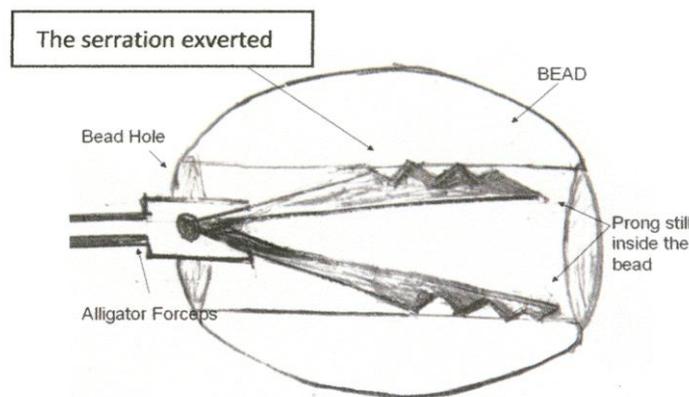


U shape model No. 103384 alligator forceps K.S. Company

**Fig.(2):** Prongs of the forceps outside of the bead in opening position touching bronchus during extraction which may cause tearing of lining mucosa.



**Fig.(3):** Remodulate of the minute alligator grasping forceps. (no.103384).



**Fig. (4):** Remodulate minute alligator grasping forceps inside the bead not passing the hole at the grasping position.

## Discussion

Compared to other conventional studies, this study specifically tried to provide a solution for removal of spherical objects such as beads. Nowadays extraction of beads from tracheobronchial tree represents a huge challenge due to their slippery, round and oval shape and lack of suitable grasping forceps that easily extract these objects.

The study revealed that the beads were in the right main bronchus in 48 (64%) patients, in left main bronchus in 15 (20%) and in the main trachea and main bronchi in 12 (16%). **Naseer Ahmend et al** [10] found that 60% of beads were in trachea and 33.3 % of beads were in right main bronchus, which is more or less consistent with the results of our study.

FB can be impacted at any site from laryngeal inlet to terminal bronchioles. The side of location depends on patient's age,

physical position and time of inhalation. The angle made by the main stem bronchi with trachea is similar until the age of 15 years so naturally up to this age FB found on either side with equal frequency [11].

In terms of sex distribution, this study showed that 49 (65.3%) patients were male and 26 (34.7%) patients were female. Most of the patients (80%) were under 6 years of age. **Naseer Ahmed et al's** study revealed that 18 (60%) patients were male and 12 (20%) patients were female, while 50% of the patients were under 8 years. This agrees with our study in terms of having a higher number of male patients.

In terms of presentation to the hospital, most of the patients (88%) were presented to the hospital immediately. Therefore, no serious complications were reported in this study. **Naseer Ahmed et al** 10 showed that presentation to the hospital was after 24

hours. Delay in presentation to hospital causes delay in diagnosis which may cause complications, those may be reasons 5 (6.7%) patients of this series had tracheostomy and 3 had thoracotomy.

The initial clinical symptoms before rigid bronchoscopy was cough in 60 (80%) patients and the second initial symptom was respiratory distress in 55 (73%) patients. Hamid Reza Jabbar Darjani [25] revealed that the most common symptoms were cough, haemoptosis and fever. This may be due to long standing of the FBs in tracheobronchial tree (6 days). This study shows that delay in presentation causes initial clinical symptoms.

**Naseer Ahmed et al** [10] used minute biopsy forceps of flexible bronchoscopy and passed it through rigid bronchoscope into the hole of the bead, then opening the small prongs after passing the other side of hole. They removed the beads but there were 5 (6.66%) cases of morbidity, 2 needed tracheostomy and 3 needed thoracotomy, that could be attributed to injury caused by prongs or long standing of bronchoscope in tracheobronchial tree (more than 20 minutes) which causes edema to its mucus membrane.

**Yelcin Kaya I. DEDILER** [12] employed fogarty balloon catheter after they couldn't grasp the beads by usual ordinary forceps of Karl Storz set. They passed a thin fogarty catheter NO. 3F. They suggested that the catheter tip should be smaller to pass easily, which indicates that there was no smaller than 3F fogarty balloon.

**Hamid Reza Jabbar Darjani et al** [25], in a case report of beads in 5 years old boy did RG.BR and they saw the FB covered by granulation tissue. First they removed granulation tissue by cryotherapy around FB then the bead was removed by minute biopsy forceps of flexible bronchoscope through the hole of bead. This granulation tissue may be due to late presentation to hospital (after 6 days).

**Muhammed Ishaq et al** [11]

reported a case report of 8 years old boy presented after 6 days with bilateral wheezy and chest x-ray showed oval FB in the trachea above carina. After many unsuccessful attempts by ordinary forceps of RG.BR, they removed it by improvised presterilized dental wiring hook where they passed the hook in the hole of the bead and hinged against the bead under direct vision. This procedure was complicated by bleeding from the tracheal mucosa.

**Arbabi Sh Ashjaei, Mamisbi** [26] reported a case report of 17 month old infant with x-ray showing pneumonia. They didn't find suitable forceps for the removal of beads. They brought it to carina then by repeated trial by balloon catheter they passed it to the central hole of the bead then the balloon was inflated with 0.1 ml distilled water, then catheter, bronchoscope and the bead was together brought out. The size of the bead was 10 mm in length, 5 mm in diameter.

#### **Recommendation:**

The researcher recommends constructing a forceps that has serrations on the outer surface of the prongs and not in the inner surface of prongs beads extraction with a diameter not larger than 1.1-1.2 mm. This suggested new design can be specially made in order to put an end to this common, challenging and possibly fatal condition of beads inhalation in children.

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