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FOREIGN BODIES IN THE TRACHEA, BRONCHI AND ÆSOPHAGUS.—THE AID OF ÆSOPHAGOSCOPY, BRONCHOSCOPY, AND MAGNETISM IN THEIR EXTRACTION.*

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FREQUENCY. No adequate statistics are available, but it is certain that the frequency is greater than the reports show. Many cases doubtless inspire a foreign body unknown to the parents and the true cause of the fatal lung lesion is never suspected. In cases of doubt the fluoroscope is called into requisition and, as in case VIII shows nothing and the case is discharged with parents and physician happy in the thought that the foreign body was not inhaled. Later the patient is suddenly taken off with pneumonia or bronchitis attributed to the more usual causes. Foreign bodies are doubtless swallowed by children unknown to the parents, and the resulting gastritis attributed to the usual causes. Undoubtedly, as pointed out by Halstead, infants often cough up and swallow foreign bodies that have entered the trachea and bronchi without the fact ever being known.

DIAGNOSIS AND LOCALIZATION.

Before the days of the X-ray much skill was displayed in exploration. The tendency to-day is to ignore everything other than X-rays. We will do well, however, to get the aid of a skilled physical diagnostician.

Röntgen rays are of use in three ways: For diagnosis of the presence of the foreign body, to locate its exact position, to enable

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the direction of instruments by observing the shadow of the instrument on the screen. There is practically no foreign that will not show opaque to rays if a plate be made, and exposure be of sufficient duration. If the patient cannot, or will not, hold still sufficiently long, anesthesia must be used. A fluoroscopic negative report is dangerously unreliable. The shadow of the heart or of the vertebra may render even a metallic body invisible to the eye, as in case V and VII. A negative should be made in each of two planes at right angles to each other; ordinarily one antero-posterior and the other lateral.

PROGNOSIS

In oesophageal cases depends largely on the nature of the foreign body. Rounded smooth bodies, if not too large, proportionate to the age of the patient, may be removed even through tightly wedged, without injury to the gullet. If smaller they pass on into the stomach, and remain there without injury for a long time, or may be passed without harm. If, however, the body be sharp or pointed, to remove it may produce fatal injury. For instance, in cases such as case IV, it is certainly better to risk gastrotomy than to rip the esophagus open.

The prognosis of oesophagotomized cases is good—far better than cases where the oesophagus is only lacerated in removal of pointed objects. This of course is largely a matter of location. Oesophagotomies are always necessarily high up.

In tracheal and bronchial cases with early removal, the prognosis is good. In tracheal cases the foreign body can always be removed by tracheotomy, if not by tracheoscopy. If not seen early, or if operative permission be refused, the prognosis is bad. In bronchial cases the chance of removal, if seen at once, is good. After twelve hours, when the body becomes buried in the swollen mucosa, the chances are less. If not removed, the patient has only a fair chance of escaping fatal abscess, bronchitis, broncho-pneumonia, and traumatic infective pneumonitis.

Undoubtedly cases are not infrequent where even sharp bodies become encysted, in other cases the body will slough loose from its bed in the swollen mucosa and be coughed out or into the trachea or larger bronchi.

In prognosis this loosening must be considered as risking laryngeal spasm, which is prognostically bad in the absence of skilled aid. With a physician at hand to stab the crico-thyroid membrane,

the prognosis is good, as an extension downward of the crico-thyro-laryngotomy wound will enable the removal of the foreign body.

TREATMENT.

The indications for treatment are simple. Locate and remove the foreign body at once. But numerous questions arise. Having located the foreign body by X-rays and determined its nature, the laryngologist is often confronted with the problem as to whether the patient will be safer by removal or by let alone methods. The decision will rest on the points indicated under prognosis. A rough or sharp foreign body in any location should be removed, provided probably fatal traumatism be not inflicted in removal. In a class of cases indicated by case IV where an open safety pin pointed upward and its removal would rip open the tissues, a reasonably safe method of removal must be devised, but removal by some method must be done at all hazards.

In the trachea or bronchi a foreign body of whatever nature must be removed at all hazards short of mediastinotomy or similar procedure. While many cases do become encysted or are coughed up, the risk of waiting for this is great, while the risk of exploration is practically nil. This last is a point the writer wishes particularly to emphasize. He has tracheotomized eighteen cases for foreign bodies, without a single fatality, or even a pneumonia, within three weeks, which might be fairly considered a reasonable limit of time for the development of symptoms of exploratory damage the tracheotomy wound having always healed within two weeks. Two of the eighteen cases died, both of pulmonary abscess, developed around the unremoved foreign body. One death was six weeks, the other at two months after the exploration, to which it could not for this reason be attributed. The deeper air passages, by cough and by ciliary action are maintained in a fairly aseptic condition. With gentleness and careful aseptic technique, exploration through the tracheal wound is quite safe.

Inversion of the patient is a time-honored procedure, but had better not be done unless preparations have been made for immediate tracheotomy. In the writer's opinion it should never be done until after a tracheotomy preliminarily done with aseptic precautions and time for hemostasis.

For all bodies within reach of the finger, nothing is more successful than the *trained touch* for finding. If we educate our finger-touch as much as the gynecologist, we would often find it useful.

Kirstein's autoscopy occasionally is useful in cases of foreign bodies in the larynx or introitus oesophagi superioris. Better still is an Escat epiglottis lifter as modified by Grant, held by a skilled assistant, patient being in Rosen's position, while the operator kneels at the head of the table with a miniature hand lamp between his eyes (not on his forehead).

Laryngoscopy. A universal error in the literature of laryngology is the statement that indirect (ordinary mirror) laryngoscopy is difficult in children and infants. No mention is made of the ease of laryngoscopy under chloroform anesthesia. Of course the ordinary head mirror is not convenient for this—it requires either a miniature forehead lamp or one of the now common self-illuminating laryngoscopes. If we examine the larynx and find it free from obstruction and we have cyanosis or dyspnoea, especially if in addition the temperature be normal, and we have a history of choking on a foreign body—under these conditions the writer would make a diagnosis of foreign body, though the X-ray examination were negative. For laryngoscopy under anesthesia a silk worm gut loop through the tongue will not cause the after soreness and irritation that a tongue forcep or hemostat will, and is a trivial procedure considered in contrast to the danger by less careful procedure, of pushing downward a pharyngeally or laryngeally lodged foreign body into less accessible and more dangerous regions.

OESOPHAGOSCOPY.

Anesthesia may be local in adults, as the oesophagus is not particularly sensitive, but the cocaine solution must not be less than 20 per cent, and the laryngo-pharynx will need it particularly. The patient should be in Rosen's position, with the head very slightly to one side and the tube coming out the opposite side of the mouth. Killian and others have used the erect posture in some of their cases, the patient sitting on a low stool, but this requires the operator to stand, and is needlessly tiresome; and besides is less advantageous in the aspiration of secretions and manipulation of instruments, and the patient is not so easily steadied and controlled.

Technic. The tube, obturator in place, is warmed and oiled with sterile vaseline, passed back into the pharynx, using the index finger as a guide. The finger in the lead closes down the epiglottis and the tube passes over it, entering the introitus oesophagi. As soon as the tube has passed below the cricoid the obturator is removed and the tube passed by sight.

There is one important point in the technique of œsophagoscopy, and that is, not to interfere with an ample glottic respiratory aperture, especially if too large a tube be used. In using the smaller tubes in which there is no hope of applying the forceps under ocular inspection, the length of the tube should be marked upon the forceps by a rubber band, as suggested by Ingalls, so that when the forceps is inserted (with the opening in the proper direction) the depth of insertion can be seen by the rubber band arriving at the proximal end of the tube. Beyond this point the forceps must be inserted the distance required to seize the foreign body if the body is beyond the distal end of the tube. If within the distal orifice, insertion can be gauged accordingly. The writer feels certain of the utility of the permanent rod magnets instead of forceps in case of a magnetic foreign body.

Tracheoscopy and *bronchoscopy by mouth* may be done under cocaine if the patient be stolid. In sensitive men, and in women and children, deep, relaxing, general anesthesia will always be required, and thus must usually be supplemented with cocaine locally. The cocainization is easily accomplished in the trachea and right bronchus with a brush or cotton swab, but the left bronchus can usually only be cocainized after the tube has been passed down to the bronchial entrance. If attempted with local anesthesia, the preliminary hypodermatic injection of morphine will lessen excitability, probably as much by the stimulative increase of fortitude as by analgesia. Atropin may well be given with the morphin as not only synergistic but as an inhibitor of secretion. Atropin as suggested by Ingalls has a value in checking secretion.

The best time if selection be possible is in the morning before breakfast; otherwise, as long after meals as possible.

The bronchoscopes should be warmed and oiled with sterile vaseline. The obturator, if used, must be removed by an assistant the instant the end of the tube has passed the epiglottis. To the writer, as with Ingalls, the intubation habit is so strong that passing the tube with the index finger of the left hand as a guide as with an O'Dwyer tube, is easier. Killian, however, passes the tube under direct inspection, looking through it and using Kirstein's spatula. This precludes the use of an obturator.

The aspirator and swabs of cotton are used frequently to clear the tube of secretions.

Position of the patient. The writer has never used these or any other bronchoscope under local anesthesia, so that he has never

tried bronchoscopy with the patient in the erect position. He can, however, see no advantage in it to justify the risks of general anesthesia in the erect position. Chloroform anesthesia, with the patient in the recumbent position, the head hanging over the end of the table in Rosen's position, offers so many advantages that he does not feel inclined to try any other. The "sword swallowing" position of the head and neck is ideal. The head of the patient in the firm grasp of an assistant, is turned slightly to one side and the bronchoscope is allowed to pass out the opposite corner of the

Fig. A.

mouth. Care must be exercised that adequate respiration is going on:

As Ingalls points out, it may be going so quietly as to lead to the inference that it is suspended. In view of this it is necessary to have the undivided attention of one competent man to watch the respiration, and nothing else. The pulse must be in charge of another. The operator should have one primary assistant and a second to turn on and off electric currents and similar unsterile duties.

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chloroform. Profound chloroform narcosis, never a safe condition, especially if long continued, becomes less so by the introduction of a fresh element of danger in the abolition of the cough reflex. For this reason the writer prefers tracheotomy under partial chloroform anesthesia, as a first procedure, followed by careful probing with the patient in the inverted position to obtain the assistance of gravity. If the foreign body be magnetizable the magnet is passed, the patient being still inverted. All this time the assistance of the cough reflex is assured by partial anesthesia. Failing in these procedures, the writer advises bronchoscopy through the wound with the least possible anesthesia consistent with safety. Of course, violent straining and coughing, with a rigid bronchoscope in a secondary or tertiary bronchus, introduces a risk of traumatism and is vastly more difficult and unsatisfactory than when this reflex is totally abolished with chloroform and cocaine. When this abolition is necessary, it is a comfort to know that the distal end of the bronchoscope deep down in the bronchi is clean—not having passed through the mouth, which is hopelessly septic.

There is another danger in bronchoscopy *per orem*. Prolonged pressure and possibly traumatism of the glottic boundaries may result in œdema that will require tracheotomy anyway, as in a case reported by Nehr Korn. And in such a case the wound would have to be kept open for several days, instead of immediate closure, as would have been the case had tracheotomy been done in the beginning.

TRACHEOTOMY.

Tracheotomy is a safe procedure if:

- (a) The anesthesia be partial so that cough may help to keep passages clear.
- (b) The patient be kept in the Trendelenberg position during the operation and after.
- (c) If it be done aseptically and intra tracheal exploration be gentle.
- (d) If the plan of dressing here recommended be followed.
- (e) If a canula be not inserted without necessity.
- (f) If ethyl chloride and ether be not used.

Do not leave in a tracheal canula because there seems to be slight dyspnoea after the removal of a foreign body from the larynx and trachea. Put an aseptic dressing on the tracheotomy wound without stitching and station a nurse accustomed to tracheotomy cases, ready to dilate the tracheal wound should cyanosis appear. Generally it will not be needed.

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The œsophagoscopes and bronchoscope are made with slightly bell-mouthed extremities. The purpose of this is to facilitate the entrance of a foreign body, especially a point. If made like the ordinary urethroscope or Einhorn's œsophagoscope, there would be a strong tendency to override the point, or even the entire body, if like a needle. The œsophagoscope of Einhorn is for examination of the œsophageal lining and for this purpose its narrowed, coned extremity is well adapted. Obturators are fitted to all the instruments, though they should not be used for foreign body work ordinarily. If desired, they may be used to start the instruments, in the case of a foreign body definitely located in deeper structures. If used in tracheoscopes or bronchoscopes they must be, of course, immediately withdrawn as soon as the tube has passed the glottis.

Fig. D.

The *hooks*, and the *secretion aspirator* are Killian's. The cotton carrier is an elongation of the common instrument with a threaded end that will insure against losing the cotton. The pump is the most satisfactory for the removal of abundant secretions, while swabbing brings everything out clearly to view. For forceps the writer uses Seiler's, Boecker's and von Schroetter's tube forceps of various lengths.

The *laryngo-pharyngeal speculum* is simply a short œsophagoscope, which, with the aid of an Escat's or Kirstein's epiglottis lifter, held by an assistant, the writer has found of greater convenience than Kristein's autoscope. With bodies located to one side of the laryngo-pharynx or introitus œsopagi superioris, the

speculum is inserted from the opposite side of the mouth, the angle of which is pulled backward to the extreme limit, while the head hangs over the edge of the table in the "sword swallowing" position. This is the position in which all tracheal and œsophageal instruments are inserted.

With all these self-illuminating instruments the ordinary street currents are unsafe for the patients. There is always a possibility of grounding, the one "live" side of the instrument through the patient, which though harmless through the skin, becomes dangerous if good contact with moist mucosa of deep passages should be made. Dry batteries are the best source of electricity for the purpose.

MAGNETIC EXTRACTION.

Dr. de Roaldes in 1900 suggested the use of the Haab giant ophthalmic electro-magnet in extraction of magnetic foreign bodies from the trachea and bronchi. Independently, the next year, Dr. Garel, of Lyons, reported the removal of a nail from the trachea, its probable location being less than three inches from the tracheotomy wound. Later, Dr. de Roaldes made experiments on the cadaver, by which he demonstrated that the limitation of magnetic extraction with the Haab magnet is about five inches below its point inserted in the tracheal wound—a point at which (in the adult at least) forceps extraction is easy. He tried extending this limitation with picture wire but failed and suggested vertebrated probes to be energized by contact with the point of the Haab magnet. He also demonstrated the slight utility of a miniature magnet an inch and a half long lowered into the trachea. A method is suggested by Dr. de Roaldes in which the Haab magnet is used to bring the foreign body up to the chink of the glottis through which it is drawn by a second smaller magnet introduced through the mouth, the Haab magnet being demagnetized when the second magnet is in contact. This ingenious suggestion has never been used by any one.

My own experiments have led to the development of four forms of magnets, which are herewith exhibited:

(a) Permanent magnets long enough for insertion into the trachea and bronchi.

(b) Electro magnets of small diameter but great length to be passed bodily into the air passages.

(c) A very powerful electro-magnet with a core extension. Fig. E.

(d) A ring magnet, technically a solenoid, into which the inverted patient is lowered bodily. Fig. F.

One great trouble with magnetic extraction is the necessarily small size of the foreign body. Practically the magnetic force you can apply is in inverse ratio to the size of the foreign body. In other words the magnet can exert no more attraction on the foreign body than the foreign body does on the magnet. If a railroad spike could be inhaled, it would be easy to design a magnet

Fig. E.

to pull it out, pull it through the patient, or lift him off his feet. Further in order to exert any attraction it must magnetize the foreign body, hence you must have either a small magnet closely approached to the foreign body, or otherwise a very large magnetic field.

One great advantage of magnetic extraction over forceps extraction is that the magnet will pull the free end of the foreign body, as a tack; while the point sticking into the tissues comes last, so no traumatism is inflicted.

Fig. F.

Limitations. For a magnet to be of service, it must be remembered, that:

1. The body must be of iron or steel, partly or wholly.
2. The body must be free to move.
3. The attraction of the magnet for the former body is no greater than the body for the magnet, hence:
4. The probabilities of magnetic removal are inversely as the size of the foreign body, within the limits of size permitting mobility.

5. The magnetic force diminishes almost as the square of the distance, hence:

6. The location must be such that the core of the magnet can be brought within reasonable distance of the foreign body. Therefore:

7. The magnet is of undoubted utility for magnetic bodies located in the trachea.

8. Prolongation of the core lessens only to a small degree the loss as the square of the distance, but to a limited extent is valuable if it enables contact.

9. Beyond contact the effective distance between foreign body and the magnet increases directly, as the size of the foreign body.

10. Magnets of small diameter for insertion bodily into the air passages can be made of only very limited power because of the necessarily small area of core cross section.

11. By inversion of the patient, gravity may assist a weak magnetic action.

Magnetic extraction is not adapted to removal of bodies from the esophagus for the reason given under 2. The body is practically never free to move. The collapsing walls would wipe it off. So would the vocal cords if the attempt were made to remove magnetically a body located in the trachea. It could not be readily brought through the glottis. If however, the oesophagoscope or bronchoscope be used through which to pass the permanent rod magnets devised by the writer, this wiping off does not occur.

Even with foreign bodies reachable by forceps, magnets, especially the permanent or the solenoid forms, offer such an easy, quick and harmless means that they deserve first trial.

Projected Core Magnet. To secure the greatest possible magnetic projection with the drawback of so slender a core projected so far from the coil a large pole piece at the back is used, and the core and projections are solid. Of course the loss is great. If the core were cut off close to the coil the magnet would suspend about 100 pounds of iron, whereas the suspension at the end of the projected core is only a few ounces.

Permanent magnets. The advantage of the permanent magnet is its aseptability and its ease of manipulation. Its power is not great and it requires actual contact, but in a body like a tack, perfectly free to move, or at most hindered only by viscid secretions, it will certainly bring the body to the glottis or tracheal wound as the case may be. To invert the patient just about doubles

the pull by calling in the *aid* of gravity, while at the same time annihilating its *opposition*.

In using a permanent magnet, be careful to always use the same end. In these days nearly everything made from iron ore is steel—rarely iron, unless it be cast iron. With any of these except the softest wrought iron, contact of a magnet leaves a residual magnetism in the object. If then the permanent magnet be reversed, the object will be repelled instead of attracted.

The same thing will occur in using an electro-magnet if the polarity of the current be reversed. This is important in case of powerful electro-magnets, as commercial electric circuits are sometimes reversed. Small iron toys, “jack-stones” and the like, which we are so apt to meet with as foreign bodies in children, are cast iron or cast steel. These become magnetized from contact with a magnet, either permanent or electro, and if the polarity of the magnet be reversed, the attraction is lessened until the magnet and body have been sufficiently long in contact to reverse the polarity of the foreign body.

These permanent magnets are exceedingly convenient for use though the bronchoscopes, œsophagoscopes, etc., or they may be used alone. All parts of the tubes and lamps being of brass are in no way affected. A long body like a needle or tack found cross-wise the tube, will range itself so as to come out clinging to the magnet, if the latter be moved back and forth a few times. If grasped with forceps, body and tube would have to be withdrawn together ripping the walls.

A New Magnet. The writer has devised a solenoid magnet as shown in Fig F. It consists of an enormous coil of magnet wire, which when energized by a suitable current will throw any iron or steel body to its center and suspend it there. If the body be approached to one or the other side of the ring, in the plane of the ring, it will rush to that side. When such a body is approached to the magnet it is pulled directly to its central axis and drawn in, just as a floating block of wood is drawn into the vortex of a whirlpool. When the center of the magnet is reached the axial traction is at a minimum (satisfied, so to speak) and lateral traction is at its maximum.

The patient is suspended inverted over the center, and lowered head first into the coil until the plane of the foreign body (as marked on the skin at a previous X-ray examination) corresponds to the plane of the upper edge of the coil. The patient is then

drawn upward while the foreign body, if of iron or steel, and free, will tend to stand still, while the patient is lifted clear of it. When the foreign body reaches the level of the tracheotomy wound, the wound is approached closely to the side of the magnet, when lateral traction will be exerted by the magnet. From experiments it would seem that as soon as the inverted patient is lowered into the magnet to the level of the tracheotomy wound (no lower) a magnetic foreign body, if in the trachea and free to move, should jump to the tracheal wound, and then out when the wound is approached to one side of the magnet. Or, if preferred, the body can be lifted out of the wound with *brass* forceps. (Steel instruments of any kind must not be used near the magnet). If preferred, extraction may be attempted without a previous tracheotomy, but the probability of spasmodic glottic closure must be borne in mind, and preparations for a stabbing tracheotomy should be made. The solenoid has no action on a sphere. A steel ball such as used in bicycle bearings is uninfluenced by it. Such a body would have to be removed by the following method: After the surgeon has become sufficiently familiar with the lines of force of the magnet, an iron probe can be passed down into the air passages, and it will become so strongly magnetized as to enable removal of any body it comes in contact with. This method, however, is not available, nor even safe, until the surgeon is so well acquainted with the lines of force of the solenoid as to prevent the jerking of the iron probe out of his hands and injuring either himself or the patient. The patient and the probe must be placed in proper position before the current is turned on. This is the most powerful way in which to use the magnet, but it requires an accurate knowledge of the force lines, while the previous method is easy, perfectly safe, and sufficiently powerful for all bodies not spheres.

In cases of elongated bodies such as tacks, nails, needles, etc., they are fortunately laid straight in the axes of the magnet, which in use corresponds to the axis of the tracheal lumen. Were they turned crosswise the magnet would be useless.

The power of this solenoid magnet is sufficient to remove any susceptible foreign body that is free to move. Of course it may not be capable of tearing out a body fixed by being buried in the swollen mucosa. Such a body can only be removed in the event of its later sloughing or ulcerating loose and being coughed up into the trachea or larger bronchi.

The power of this magnet used on small bodies, is not so enormous that we can afford to ignore the aid of coughing and of

gravity. With the latter especially, we must reckon. By inverting the patient we get double the force of gravity. Erect, we have it so many milligrams against us, according to its weight; while by inversion of the patient we have it twice that number of milligrams in favor of the magnet.

Case I. Double-pointed pin in the introitis oesophagi superioris. Failure of Oesphagoscopy. Removal by aid of touch. Mr. M. brought to Dr. Ewing W. Day by Dr. J. Clinton Atwell, of Butler, Pa., with a history of lodgment of a duck bone in the throat while eating a piece of breast of duck two weeks previously. Laryngoscopy showed a fungous granulation on the right glosso-epiglottic fold which was odematous, but there were no signs of a foreign body. Dr. Atwell had seen a needle-like foreign body with his own fluoroscope. Dr. Day sent the patient to Dr. Russell H. Boggs and had two skiagraphs made, one lateral, one antero-posterior.

Kirstein's autoscapy and laryngo-pharyngoscopy by both Dr. Day and myself failed to locate any foreign body, though the granulation before mentioned could be seen. Dr. Day nipped this off with forceps, but no foreign body was hidden in or beneath it. Touch was, however, successful in locating the object under the mucosa in the wall of the oesophageal entrance, whence it was torn out by forceps. It proved to be, not a duck bone, but a double pointed stick pin. How it became imbedded in the ducks breast is unknown. Failure of the laryngo-pharyngeal speculum here was due to the fact that the sharply pointed pin had traveled from its point of entrance marked by the granulation, to a new location where it was covered with normal mucosa. Nothing but touch could reveal its presence.

Case II. Pin in the oesophagus. Urethroscope serving as oesophagoscope. J. P. sent to me by Dr. W. C. Meanor was admitted to the Western Pennsylvania Hospital, where the pin complained of was located by X-ray examination by Dr. Meanor and Dr. Ralph Duffy. It was sticking point downward high up in the oesophagus. The writer tried removal with the finger as a guide to the forceps, but the finger was not long enough to reach. A self-illuminating urethroscope without obturator was inserted, and the pin appeared crosswise of the end of the tube, neither head or point in sight. No forceps being at hand sufficiently small to pass through the urethroscope, the latter was removed and an antero-posterior forcep of delicate construction introduced. The

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(d) A ring magnet, technically a solenoid, into which the inverted patient is lowered bodily. Fig. F.

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Fig. F.

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entered the œsophagus the loop end of the staple came into view with stems of the tack upward and to the left. By means of the large and serviceable handle the tube was manipulated to the left and slightly withdrawn until the insertion of both points of the tack in the œsophageal wall was located. Then a hook similar to the one exhibited was inserted and the loop of the tack caught, and drawn into the tube through which it was withdrawn. It proved to be the double pointed tack or staple exhibited and would have done serious, probably fatal, damage to the œsophagus had it been forcibly withdrawn with forceps without an œsophagoscope. The probang if it had been successful (and if the tack were there at the time) would have withdrawn it harmlessly, for it would have come loop first if at all. However, the writer feels confident from the history of urgent respiratory symptoms in the beginning of the case that the tack was originally in the bronchi beyond reach of the surgeon, and that later it had been coughed up and swallowed. The writer succeeded in convincing the patient and his mother of the correctness of this view. This double pointed tack points a double moral. Do not rely upon the bristle probang's negative result; and do not fail to warn the patient that, though in the bronchi at the time, it may be coughed up and swallowed, and later be discovered in the alimentary canal.

Case IV. Open Safety pin in the Oesophagus located by œsophagoscope, removed by gastrotomy. Infant L., male; 9 months of age; breast fed, good previous health, though slightly pale. On Dec. 24th at 5 p. m. was lying on a bed, the mother changing the diaper, when it was thought to have picked up and swallowed an open safety pin.

On Dec. 26th at 2 p. m. the writer was called to the Western Pennsylvania Hospital by Dr. George R. Winter and Dr. John D. Milligan to see the infant. With the assistance of Dr. Ralph Duffy, a fluoroscopic examination had already been made and the pin had been located at the level of the thyroid cartilage, point upward. By digital examination two hours previously Dr. John D. Milligan had been able to touch the "keeper" end in the œsophageal entrance barely within reach of the finger. Preparations were immediately made and the child anesthized by Dr. Reineman, when the pin was found to have disappeared beyond sight or reach. An œsophagoscope was passed by the writer, and the pin discovered deep down in the œsophagus, evidently quite near the cardiac orifice. The point could not be seen, though from the visible portion it was

(c) A very powerful electro-magnet with a core extension. Fig. E.

(d) A ring magnet, technically a solenoid, into which the inverted patient is lowered bodily. Fig. F.

One great trouble with magnetic extraction is the necessarily small size of the foreign body. Practically the magnetic force you can apply is in inverse ratio to the size of the foreign body. In other words the magnet can exert no more attraction on the foreign body than the foreign body does on the magnet. If a railroad

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Fig. F.

Limitations. For a magnet to be of service, it must be remembered, that:

1. The body must be of iron or steel, partly or wholly.
2. The body must be free to move.
2. The attraction of the magnet for the former body is no greater than the body for the magnet, hence:
4. The probabilities of magnetic removal are inversely as the size of the foreign body, within the limits of size permitting mobility.

impossible not only on account of its size but because the only part of the pin that could be seized was the flattened spring end, which would prevent rotation when in the grip of the forcep. The temptation to draw it out was great, after searching for a foreign body to find it, and feel it in the forceps grasp. Yet a slight pull on the forceps gave a peculiar sensation which can best be described by a comparison with the sensation of pulling on the line close up, when a fish has swallowed the hook. The sensation was peculiarly convincing that violent removal would have resulted in fatal traumatism to the œsophagus, pericardium, heart or other thoracic viscera.

In consultation with Dr. John Milligan and Dr. George Winter it was decided that gastrotomy would be the safer procedure. On Dec. 27th, the child was taken to Dr. Russell H. Boggs to have a

Fig. I.

radiograph made and a half tone of this is shown in Fig. H. Allowing for the angle, the pin was about opposite the body of the tenth dorsal vertebra, in the position demonstrated by the œsophagoscope.

At noon Dr. John D. Milligan assisted by Dr. Brown, Dr. George R. Winter and Dr. Zimmerman with Dr. Reineman as anesthetist, skillfully and rapidly gastrotomized the child. The stomach was empty but was carefully flushed out. The pin was not found in the stomach nor as far up the œsophagus as Dr. Milligan's finger would reach. The writer then passed a Tieman's forceps down the œsophagus, the jaws being partially opened as the location of the pin was reached. When the pin was felt the jaws were spread and the pin seized and pushed down to where Dr. Milligan's skillful fingers with the aid of a hook-bent probe engaged and removed it. The pin is shown actual size in Fig. I.

The secretions in the œsophagus gave no trouble in œsophagoscopy, as is often the case. The writer worked from the head of the patient, with a separate table, instruments and nurse, so as to in no way risk any accident to the aseptic technique of Drs. Milligan and Brown.

A more devilish contrivance than an open safety pin could scarcely be devised, and all parents should be warned against the common habit of allowing infants and children to play with them. In addition to preventing safe withdrawal the spring, while favoring the seriatim action of the swallowing muscles, assists the point in acting as the pawl of a ratchet.

Case V. Carpet tack in left bronchus. Attempted removal by forceps and magnet passed through tracheal wound. Edward J.,

Fig. J.

3 years of age, healthy and well nourished, was brought to me by Dr. Eastman of Brownsville. Two days before the child had been noticed to put a tack in its mouth. The mother saw the tack far back in the mouth and attempted to get it out, but failed because the child naturally jerked away, and at the same instant aspirated the tack. There followed some cough and dyspnoea, but these had subsided at the time the child was brought to the writer. Dr.

Eastman examined the chest and reported a probable atelectasis over the middle portion of the left lung. The writer examined the larynx and found it free from a foreign body or any sign of traumatism. The child was admitted to the Western Pennsylvania Hospital, the tack was seen with the fluoroscope to be located opposite the 5th intercostal space. Allowing for the angle, and considering its axis we believed it to be in one of the left secondary bronchi. It was lying head downwards, the point probably sticking in the bronchial wall preventing expulsion while the head corked up the bronchus preventing the entrance of air. The child was sent to Dr. R. H. Boggs, who made radiograph reproduced in Fig. J. The child jumped after a second's exposure and could not be controlled save by an anesthetic which was deemed unnecessary, as a faint though certain shadow was found on the plate. The child was anesthetized by Dr. Reineman, and with the assistance of Dr. Eastman, Dr. Zimmerman, Dr. Miller and Dr. Wagner the writer opened the trachea and explored the trachea and bronchi in every direction, not omitting the side opposite from that on which the tack had been located, lest it should have been coughed up and fallen back into the other bronchus. During this procedure the child was held inverted, and was allowed to come almost completely out, and hiccough vigorously. The tracheal wound was then tied open with letter U sutures tied back of the neck, and put to bed in Trendelenberg posture. Next day the tack not having been coughed out the writer with the assistance of Dr. Zimmerman and Dr. Boyce, the child being partially anesthetized and inverted, attempted magnetic extraction without avail. It was then decided that the tack was too deeply imbedded in the swollen mucosa to permit of removal until it should have sloughed loose and should have been coughed up into the trachea. Meanwhile the tracheal wound was allowed to close. Dr. Day saw the case at this stage and concurred. Dr. Swope was consulted as to the advisability of a mediastinotomy or other external operation, but advised against it unless an abscess or some such definite focus could be localized. The child had practically no reaction, played and talked, and, except at change of dressings, seemed as well as usual which demonstrates the harmlessness of bronchial exploration by way of an aseptic tracheal wound. A rare feature found in this case is the presence of a foreign body in the left bronchus.

Case VI. Buckshot in trachea. Removed by inversion of patient. Laryngeal spasm. Crico-thyro-laryngotomy. A girl 4 years of age was brought by her father to the dispensary of the Eye, Ear and

Throat Hospital with a history of having choked 3 days before while playing with several shot in her mouth. Three had been subsequently found in the stools, but parent feared some others might be "sticking somewhere." Coarse rales with absence of respiratory murmur and percussive resonance over the lower left lobe. The writer prepared for tracheotomy, then had the father hold the child up by the heels, when deep cyanosis immediately set in. The writer felt certain that the cyanosis was due to the presence of the foreign body at the glottis, and that reversion of patient to the upright position was unwise, lest the foreign body drop back into the bronchi. Not succeeding in clearing the glottis with the finger, and breathing having nearly ceased, the crico-thyroid membrane was stabbed, air entered, spasm ceased, and a buckshot dropped through the mouth onto the floor.

Case VII. Coffee berry in the trachea. Removed by tracheotomy. Infant N. Brought to the writer by Dr. McConnell of Galitzin. Four days previously she had choked while playing with an older child who said she had "swallowed" a roasted coffee berry. There had been occasional dyspnoea and cyanosis since; physical examination by Dr. McConnell and Dr. D. Jackson revealed large moist rales audible all over both sides of the chest. Air was present everywhere in the lungs. The breath was very fetid, but without coffee odor. Temperature 101, pulse 120, respirations 30. Fluoroscopic examination both in Altoona and in Pittsburg had been negative, and both radiographists had most positively assured the parents that there was no foreign body in the chest.

Both tracheoscopy and tracheotomy having been prepared for, the child was anesthetized skillfully by Dr. Eyman, the tongue drawn out with a silk-worm gut loop when the writer on laryngoscopic examination found the larynx free from foreign body or any lesion. Pus was seen to well up from the trachea. When the writer saw the vocal cords spread widely at each inspiration, yet considered the intermittent dyspnoea and cyanosis he strongly urged tracheotomy. This was at first refused and had it not been for the firm backing by Dr. MacConnell and Dr. D. Jackson the operation never would have been done and the child would have died.

With the kind assistance and advice of Dr. MacFarlane the writer opened the trachea, held back the tracheal lips with silk-worm gut, and allowed the child to come partially out. A probe passed down into the trachea brought on a paroxysm of coughing during which the foreign body was coughed up to the level of the tracheal wound

where it was quickly seized and removed by the writer before it could be re-inhaled. It was followed by a gush of exceedingly foul pus, which if it had not been liberated must have resulted in death, septic symptoms already being present.

The skin incision healed per primam, but an emphysema with a large sac of air under the skin at the site of the incision required re-incision. Prompt healing followed and the child went home well in a week after admission.

The points of interest are the absence of coffee odor, the nearly fatal result of reliance upon a negative fluoroscopic examination (a coffee berry would have shown on a plate); the correctness of a diagnosis based on intermittent dyspnoea with a free larynx, in the face of opposition by the X-ray men, and the inadvisability of immediate suture of the entire tracheotomy wound. It would have been better to have left in a wick of gauze to drain off the air leaking out of the trachea that caused emphysema.

Case VIII. Bay leaf in trachea. Removal through Killian's tracheoscope. Mr. P. aged 30 was brought to my office from a neighboring restaurant where he had "choked" while eating soup. He could breathe for a few minutes quite normally, then coughing would be followed by deep cyanosis with gasping inspiratory efforts. The largest and shortest Killian tracheoscope was introduced through the glottis, when the edge of a thin object presented at the orifice of the tube. It was readily caught with a Seiler forcep and withdrawn. It was found to be the portion of a leaf herewith exhibited. The presumption is that it is a bay leaf used in flavoring soup.

Case IX. Shoe button in bronchi for 2 years. Removed from trachea with Killian's tracheoscope. Rosina K., aged 18, had a history of choking on a shoe button about 2 years before. Removal at the time by inversion had been tried, but the incident had almost been forgotten as it never seemed to affect the health. A few days prior to bringing her to the writer there had been cough with choking efforts to expectorate, blueness of the face. The patient claimed to feel the button come up and fall back after each unsuccessful effort, which brought away blood streaked, purulent, expectoration. After thorough cocainization the writer had just introduced the distal end of a Killian tracheoscope past the vocal cords, when the button, propelled by cough, shot into and part way up the tube which was then quickly removed with the button in its lumen. As

you will see, the button is covered with incrustations. No Roentgen ray examination was made.

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Suppurative Diseases of the Middle Ear—SAMUEL IGLAUER—
The Cincinnati Lancet-Clinic, April, 1904.

The author believes that early incision of the drum membrane is indicated under the following conditions: 1. Severe, continuous aural pain or tenderness over mastoid. 2. High fever. 3. Extreme restlessness, especially in children. 4. Persistent vomiting. 5. Upon the first symptoms of meningeal irritation or of stupor. 6. Marked swelling or bulging of the drum. 7. If the drum is thick from previous inflammations. 8. If the spontaneous perforation is too small. 9. If the ear becomes involved in the course of scarlet fever or measles (usually.) 10. If in doubt make an incision.

STEIN.