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**Rabinarayan Tripathy**  
Professor and HOD, Department  
of Shalya Tantra, Amrita School  
of Ayurveda, Kollam, Kerala,  
India

**Lakshmy C Senan**  
MS Scholar, Amrita School of  
Ayurveda, Kollam, Kerala, India

**Balaji S**  
Consultant physician, Sree  
Chitra Ayurveda Pharmacy,  
Kollam, Kerala, India

## Diagnostic methods of foreign body in Sushruta Samhita: A review

**Rabinarayan Tripathy, Lakshmy C Senan and Balaji S**

### Abstract

In ancient India, when battle field injuries were common, locating the impacted weapons, splints, stones or other foreign body from the body of the patients was a challenge to, the then surgeons. Even in the absence of any modern diagnostic tools the ancient physicians could exactly diagnose it and save the patient by expelling the foreign body. Some of these methods have strong scientific background whereas some others are quite difficult to substantiate. But in a developing country like India where a large section of the population live in remote areas, inaccessible to proper diagnostic centers these methods have a wide range of application.

Sushruta Samhita is a voluminous text of ancient surgical skill contributed a specialized chapter for the diagnosis and management of lost foreign body in the body tissue. Here an attempt was made to analyze its relevance in the present era with scientific validation.

**Keywords:** Pranashta shalya, foreign body diagnosis, shalya, Salya sthana jnaanopayasya

### 1. Introduction

While a foreign body is impacted, the prime aim should be to locate and to expel it out from the body. When there was no X ray, MRI, CT, or USG - a time when radiology was not at all known to the world, about 2000 years ago, Sushruta, the legend surgeon of ancient India had wonderfully traced out those foreign substances lost in the body. Even now some of these methods have scientific relevance and can be adopted in our daily OPDs. A parent coming with the complaint of their child crying of swallowing a button or a pin or a bead got stuck into their nose is a common event in all our clinical practice. Sometimes we confront with simple cases ranging from an impacted small fish bone in the tonsils, a broken glass fragment impacted in the foot, a busted balloon or bubblegum in the mouth which has gone inside the respiratory tract, a swallowed blade or a safety pin, or even the most complicated cases of air embolism or fat embolism or a cardio-respiratory embarrassment. According to Ayurveda, even a renal calculi, or a plaque in an artery can be considered as a foreign body <sup>[1]</sup>.

### 2. Sushruta's concept of shalya

Sushruta defines '*shalya tantra*' as the science that deals mainly with impacted foreign bodies and their removal <sup>[2]</sup>. It can broadly be classified into two *shaareera* (derived from body) and *aaganthuka* (external) <sup>[3]</sup>. Thus *shalya* can be considered as anything that produces trouble or pain for the body <sup>[4]</sup> Sushruta Samhita gives descriptive evidences of foreign body its retrieval, treatment of wound and ulcer, effect of injury to vital organs, warfare injuries as well as the political scenario of the period. Battle field injuries were may be the common cases encountered by a surgeon of his time. Hence, in the *Sutra sthana* 26<sup>th</sup> chapter of Sushruta Samhita - Sushruta explains the techniques to locate the concealed foreign body in different body parts and in 27<sup>th</sup> chapter, various techniques to extract. In relation to the military medicine, specifically it is mentioned that an accelerated foreign material like arrow, when enters the body either can get impacted or move in upward, downward, obliquely, transverse or straight <sup>[5]</sup> being obstructed by the body tissue. So that, any material that moves faster and as result creates pain can also be a *shalya*.? Ref.

### 3. Diagnostics in Sushruta Samhita

The foreign body after entering into the body tissue may get lodged at any part irrespective of depth, tissue and systems of the human body. In Sushruta Samhita, the signs and symptoms of foreign body impacted in various parts of the body and their diagnostic methodology have been mentioned according to its area of lodgment.

### Correspondence

**Rabinarayan Tripathy**  
Professor and HOD, Department  
of Shalya Tantra, Amrita School  
of Ayurveda, Kollam, Kerala,  
India

General methods to determine the site of the foreign body are riding on an elephant or a horse, climbing a hill or a tree, bending a bow, fast riding, wrestling, walking long distance, long jumps, high jump, swimming, physical exercises, yawning, belching, coughing, sneezing, spitting, laughing, controlling breathing, eliminating flatus, urine, feces, or semen- the place where swelling or pain develop during the above activities that may be understood as the site of the foreign body. With these strenuous activities or by simple valsalva technique the foreign body gets stuck well to a tissue and with increased body metabolism the body temperature will also increase resulting in generating a strong inflammation mechanism. This inflammation will generate severe pain and swelling at the site of foreign body.

The places where various types of pain, numbness, absence of sensation and feeling of heaviness are present, where the patient makes movements frequently, which develops swelling and pain, and the place where the patient himself protects constantly when being massaged- such places may be understood as the site of the foreign body.

### 3.1 Foreign bodies in skin

The presence of a splinter, rock or piece of metal etc. that gets embedded in the in a soft tissue can cause infection and damage to surrounding tissues. Generally a wound which is bluish, studded with eruptions, has swelling and pain, oozing blood frequently, bulged up like bubble, the muscle being soft should be understood as having a foreign body inside. When it is lodged in the skin there is change in the colour of the skin and swelling is found broad and hard. When it is in the snayu (tendon, aponeurosis or ligament) there is lifting, throbbing, and shaking of the network of ligaments, profound swelling and pain.

Methods of diagnosis of foreign bodies are further explained to determine the exact site of a lost foreign body. When foreign body is lost in the skin, the body should be anointed, fomented and then painted either with a paste of mud, flour of green gram, millets, wheat or cow dung is applied on the skin. The site where swelling, redness or pain develops, that is determined as the site of the foreign body. When a lump of ghee, clay or paste of sandal is applied on the body, and if the ghee spreads out, the paste dries up quickly by the heat of the foreign body is considered as the site of lodging. All these features clearly depict an undergoing inflammation. Based on the cardinal symptoms of inflammation- rubor, calor, dolor and tumor the site of foreign body was detected.

In the present days, radiography detects radio-opaque (gravel, glass, metal) foreign bodies with 98% accuracy. It may not detect which are radiolucent (wood, plastic, cactus spine etc.). The false-negative and false-positive rates for radiography were 50% and 1.6%, respectively [6].

### 3.2 Foreign bodies in muscle

Here the foreign body is deeply placed and it becomes difficult to locate. Increased swelling, appearance of new growth, inability to tolerate pressure and putrefactions are the features when it is inside the muscle tissue. The foreign body lost or concealed in the muscles can be determined by administering oleation, sudation, and other therapies which are not harm full to the patient. By these the patient may become emaciated, and the foreign body become loose and non-sticky. When moved, it gives rise to redness and swelling or pain. The area where these symptoms develop may be determined as the site of the foreign body. Radiographic detection for radiopaque materials can be done here also.

### 3.3 Foreign bodies in bone

Different kinds of pain and swelling, filling of the cavity, constant pricking pain in the bone and loss of function are the presenting features when it is lodged in the bone & joints. The patient should be given oleation, anointing, fomentation, and then the bones should be tied with bandage tightly or squeezed hard, the place where redness, swelling or pain develops, that should be determined as the site of the foreign body. When it is concealed in the joints, the joint should be given oleation and sudation and then subjected to movements such as extension and flexion, or bandaged tightly. Thus aggravating the inflammation, the symptoms become more pronounced might be the logic to understand the site of the foreign body.

### 3.4 Foreign bodies in channels (systems)

There is loss of function and qualities of that channel, in general. Specifically, when it is lost in the alimentary canal there is gurgling noise, flatulence, flow of urine, faeces, and food particles from the orifice of the wound. Some ingested foreign bodies cause no symptoms. Alternatively, something being stuck to the throat or esophagus causes drooling and difficulty in swallowing are common symptoms. Larger foreign bodies can partially or completely obstruct the stomach, the small intestine or, the large intestine, causing cramps, bloating, loss of appetite, vomiting, and sometimes fever. A sharp object that pierces the stomach or intestines can cause severe abdominal pain, fever, fainting and shock. In intestinal obstruction mechanical impairment or complete arrest of the passage of contents through the intestine occurs due to the obstruction of the tract with foreign bodies like trichobezoar, faecolith, tumor etc. Symptoms include cramping pain, vomiting, constipation, and obstruction of flatus & fecal matter. Diagnosis is usually clinical, confirmed by abdominal x-rays. Barium -meal X-rays, CT scan, and/or ultrasound. If a mass is identified, biopsy may determine the nature of the mass.

Radiological signs of bowel obstruction include bowel distension and the presence of multiple (more than six) gas-fluid levels on supine and erect abdominal radiographs. Contrast enema or small bowel series or CT scan can be used to define the level of obstruction, whether the obstruction is partial or complete, and to help define the cause of the obstruction. Colonoscopy, small bowel investigation with ingested camera or push endoscopy and laparoscopy are other diagnostic options.

In the case of a foreign body in respiratory tract, most foreign bodies are usually expelled through coughing. However, some foreign bodies in the airway may move from the throat into the bronchial branches. This can cause the patient to cough, but the foreign body remains trapped in the lung. This typically occurs in children and requires removal by bronchoscopy [7]. Diagnostic tools include bronchoscopy, laryngoscopy and X-rays.

Foreign bodies of the pharynx usually include fish and chicken bones which lodge themselves in the pharyngeal / lingual tonsils or in the piriform sinuses. The patient feels a globus sensation or sharp pain when attempting to swallow. The foreign bodies are actually identified on endoscopy in only 25% of patients [8]. Most of the time the foreign body passes, and mucosal trauma from the passage of the body produces symptoms for several days. Simple examination with a head mirror and/or a nasopharyngoscope should be performed always. Usually, the pharyngeal foreign body can be detected and removed at the same time. Serious

complications can result from persistent foreign bodies. These include retropharyngeal abscess (the most common cause of which is a fish bone in the retropharyngeal space), perforation, and cellulites<sup>[9]</sup>.

Majority of foreign bodies of trachea-bronchial tree are found in children between the ages of 1 & 2 years. The course of illness after a foreign body lodges in the air passages depends upon the characteristics of the foreign body and its length of stay. Unsuspected, longstanding foreign bodies may lead to complications such as recurrent pneumonia, bronchiectasis, atelectasis, and even death. Direct identification of trachea-bronchial foreign bodies on chest radiographs is possible in case of metallic objects. But most of the inhaled foreign bodies are not radiopaque and their presence is suggested only by secondary changes including segmental or lobar collapse, air trapping in unilateral hyper-lucent lung, and post-obstructive lobar or segmental infiltrates. However, these findings are nonspecific and have low accuracy. CT enhances the detection of intra-bronchial foreign body and secondary parenchymal changes; this is particularly true for multidetector-row CT which allows rapid imaging speed and thinner slices with better spatial resolution for three dimensional reconstructions including virtual bronchoscopy<sup>[10]</sup>.

### 3.5 Shalya in blood vessels

When lodged in dhamanis vata getting aggravated causes flow of frothy blood associated with sound, pain all over the body, thirst and nausea. When it is concealed in the veins, arteries, channels of tissue and ligaments, the patient should be made to sit in a chariot with broken wheels and taken for a fast ride. Then the place where swelling, redness and pain develop should be understood as the site of the foreign body. The exact logic behind these methods is obscure to us. But with this method acharya tries to aggravate the doshakopa which ultimately produces a tridosha vitiated sign of swelling (kapha), redness (pitta) and pain (vata).

In present scenario external foreign body rarely gets entrapped in the blood vessels. A thrombus or emboli are the most common form of vascular foreign body. An embolus (plural emboli) is any detached, traveling intravascular mass (solid, liquid, or gaseous) carried by circulation, which is capable of clogging arterial capillary beds (create an arterial occlusion) at a site distant from its point of origin<sup>[11]</sup>. Deep vein thrombosis (DVT) is an example for a shalya in vein. A Doppler study or angiogram is required to detect these. In venous obstructions Doppler studies and phlethismography are usually done.

### 3.6 Shalya lodged in marma

Marmas are the site of conglomeration of joints vessels ligaments and tendons of the body where the vital power is located. When these are injured the symptoms of injury to that marma is exhibited. When it is concealed in the vital spots, which are also tissues, the same methods described so far may be adopted for determination of the site of the foreign body. Head Heart and Urinary bladder are considered as the three most important marmas in our body. The commonest foreign bodies in these are emboli, plaque and renal stone respectively. The diagnosis and treatment are done according to the signs and symptoms and site of lodgment.

### 4. Conclusion

Even in the absence of any of the most modern sophisticated tools the ancient Indian physicians were able to identify,

locate, and retrieve those missing foreign bodies from the body. Through their keen observation and with the knowledge in the primary signs and symptoms of inflammation several diagnostic tools were developed by them to identify those foreign substances lost in the body. These techniques based on the principles of inflammation and suppuration was successful in determining the lodged foreign body and has stood the test of time. It depicts the exemplary skill and intelligence of the ancient Indian physicians.

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