Meta Analysis of the Leech as a Live Foreign Body: Detection, Precaution and Treatment

N. Saki, F. Rahim, S. Nikaghlagh and G. Saki

1Department of ENT, Imam Hospital, Ahwaz Jondishapour University of Medical Sciences, Ahwaz, Iran
2Apadana Clinical Research Center, Apadana Hospital, Ahwaz, Iran
3Physiology Research Center, Ahwaz Jondishapour University of Medical Sciences, Ahwaz, Iran
4Department of Anatomy and Histology, Faculty of Medical, Ahwaz Jondishapour University of Medical Sciences, Ahwaz, Iran

Abstract: Foreign body in the esophagus is a common emergency presentation. Foreign body aspirations comprise the majority of accidental deaths in childhood. Conventional x-ray imaging is usually obtained to aid the diagnosis during the initial evaluation. The decision for surgical intervention is usually based on a suspicious history, physical examination and radiologic findings. Rigid bronchoscopy is very effective procedure for inhaled foreign body removal with fewer complications. Proper use of diagnostic techniques provides a high degree of success and the treatment modality to be used depending on the type of the foreign body is mostly satisfactory. Live foreign body is a rare entity but common emergency presentation. The approach towards a patient with leech infestation comprises a thorough history and systematic examination followed by relevant investigations. However, there is considerable debate over the most appropriate treatment option for such patients. A living foreign body, or parasite, in the oro-or naso-pharynx is rare in Western countries, but in other parts of the world is a fairly common cause of problems. In the past 10 years 28 cases of foreign bodies due to infestation with leeches were treated in our departments. In all patients, 2-70 years old, the complaint was of recurrent episodes of epistaxis, blood-spitting, odynophagia, dysphagia, dyspnea and hemoptysis several days before admission. Examination showed a green-brown mass protruding from different naso- and oro-pharyngeal areas, which in every case, was a blood-engorged leech. Treatment consisted of removing the leech by applying a forceps to the middle of the leech's body and giving a quick pull. Bleeding ceased immediately after removal of the leech. This review aims to develop a comprehensive approach towards patients presenting with foreign body ingestion by developing clinical practice guidelines. These guidelines address not only the initial evaluation of the patient but also the various management alternatives and their advantages, limitations and applicability in various scenarios, based upon a review of the literature.

Key words: Foreign bodies, leech, review literature, endoscopy, observation

INTRODUCTION

Foreign body in the esophagus is a common emergency presentation. Foreign body aspirations comprise the majority of accidental deaths in childhood (Nikaghlagh and Saki, 2003; Saki et al., 2007). Conventional x-ray imaging is usually obtained to aid the diagnosis during the initial evaluation. The decision for surgical intervention is usually based on a suspicious history, physical examination and radiologic findings (Saki et al., 2008). Rigid bronchoscopy is very effective procedure for inhaled foreign body removal with fewer complications. Proper use of diagnostic techniques provides a high degree of success, and the treatment modality to be used depending on the type of the foreign body is mostly satisfactory (Saki et al., 2009).

Leeches are segmented worms and closely related to earthworms, that have been known as an ecto-parasitism to humans for thousands of years (Uygur et al., 2003). They are blood-sucking hermaphroditic parasites that attach themselves to vertebrate hosts, bite through the skin and suck out a quantity of blood. When leeches feed, they secrete an anticoagulant, which helps them obtain a full meal of blood (Guerrant et al., 2005). However, some cases of endo-parasitism are also seen particularly in rural population. In addition to the classic picture of leeches as an external parasite, these organisms can also reach internal body organs and cavities, including the upper respiratory, esophagus and gastro-intestinal tract (Bergua et al., 1993; Kaygusuz et al., 2001; Ghazzawi et al., 2005). Infestation usually occurs by drinking infested water from quite streams, pools and springs.

Corresponding Author: Fakher Rahim, Physiology Research Center, Ahwaz Jondishapour University of Medical Sciences, Ahwaz, Iran Td: +986113362411 Fax: +986113737248
1556
Serious complications are expected like dyspnoea, hemoptysis or hematemesis (Bilgen et al., 2002). Reports of internal infestation include the post-nasal space, nose, larynx, oro-pharynx, vagina, bladder, rectum and hypopharynx (Khan et al., 2004; Labadi and Jamal, 1997; Mohammad et al., 2002; Pandy et al., 2000; Foonamit et al., 2006; Ghimire and Acharya, 2008; Paul and Islam, 2005). Leeches vary in shape from elongated and cylindrical to broad or ovoid. They may be black, brightly colored, or mottled; they have muscular suckers at both their anterior and posterior ends (Stickland, 2000). Their length varies from 5 mm to 45 cm (Guerrant et al., 2005). Many different types of leeches occur worldwide. By attaching to mucous membranes and feeding inside these spaces, leeches cause the clinical syndrome known as internal hirudiniasis.

For over 2000 years, leeches were applied for many disorders as an adjunct to blood letting. In Europe the peak of their use falls between 1830 and 1890, but subsequent shortages led to a decline in their use. Today there is a real clinical application in that they are of great value to plastic surgeons when venous congestion of skin and muscle flaps is a problem (Wells et al., 1993). Medical use of leeches also includes treatment of black eyes and hirudin in used in the treatment of inflammation of the middle ear (Selezneva et al., 1992). Hirudin is also being developed for experimental use as a systemic anticoagulant and may prove useful in in vitro blood sampling.

**MATERIALS AND METHODS**

**Data collection:** The literature was primarily searched through some databases: (PUBMED, OVID, EBSCO, WILEY, SCOPUS, COCHRANE, and PROQUEST) using a number of reported cases worldwide. The terms leech, hirudiniasis and foreign body were utilized in the search, to obtain the list of relevant articles. Most of the results came from PubMed (64 articles), while Wiley produced 5 results and the Cochrane database did not reveal any results of significant relevance (Table 1). The articles with relevant and significant findings were then adapted and used in writing this review. The aim of this review was report the leech infestation in past 10 years who were treated in our departments as we as discuss internal hirudiniasis and related differential diagnoses and review medical literature related to this condition.

**Pathophysiology:** The effects of leech infestation are dependent on the site of lodgment, degree and duration of obstruction. Upper airway involvement varies from complete obstruction with hypoxia and cardio-respiratory compromise to partial obstruction with coughing, wheezing, drooling, stridor and respiratory distress. This pathological condition is extremely rare in urban areas, but endemic in rural regions; and it may have serious, even lethal complications. Leeches generally live in fresh water lakes, ponds or rivers. Much different type of leeches occurs worldwide. Those that attack man divided into two classes: land leeches and aquatic leeches (Guerrant et al., 2005). Land or terrestrial leeches commonly live in tropical rain forest, where they may be found on stones and leaves (Bilgen et al., 2002). Aquatic leeches live exclusively in fresh water. Infesting people drunk from these streams. Leech infestation commonly occurs in low socioeconomic class, particularly in people mostly use cupped palm of their hand to drink water directly from ponds and marshes. Land leeches have powerful jaws that can penetrate the skin in order to attach themselves anywhere on the external surface of the body. They are in contrast to aquatic leeches, which have weak jaws and require soft tissue, such as the mucous membrane of the upper aero-digestive tract, to feed on. Aquatic leeches are rare foreign bodies in the upper respiratory tract (White, 2003).

**Diagnosis approach towards patients:** Leech has been found in the nose, nasopharynx and oral cavity. The most common mode of presentation is nasal infestation causing intermittent epistaxis and nasal obstruction (Bergua et al., 1993). Fatal dyspnioea, haemoptysis or haematemesis can occur due to endoparasitic infestation (Khan et al., 2004; Iraqi and Squall, 1999). The leeches have been taken with contaminated drinking water and colonized at upper respiratory tract causing difficulty in breathing, respiratory stridor and blood stained saliva (Ghazawie et al., 2005; Mohammad et al., 2002). Hoarseness of voices, pain and sensation of foreign body in the throat is also possible with leech infestation in the larynx (Mohammad et al., 2002). A leech in the oral cavity usually presents with spitting of blood and a feeling of foreign body as that of present case. Examination under anaesthesia (direct laryngoscopy and pharyngoscopy) is essential and performed as an emergency for diagnosis and removal of the leech.

When a leech is present in the nasal cavity or nasopharynx, patients may present with epistaxis, nasal obstruction and the sensation of a moving foreign body in the nasal cavity. When it is in the oral cavity patients present with spitting blood and the feeling of a foreign body. The presence of a leech in the larynx gives rise to airway obstruction and a change in the voice (Mohammad et al., 2002; Curdall et al., 1986). The diagnosis of a leech as a foreign body may be confirmed after extraction and identification of its species. Therefore, otolaryngologists should pay special attention to patients who have these presenting symptoms and who have a history of recent contact with fresh water lakes or streams (Uygur et al., 2003). The possibility of leech
Table 1: Characteristics of included available literatures including technique and patient groups

<table>
<thead>
<tr>
<th>Author/date</th>
<th>No. of patients</th>
<th>Country</th>
<th>Age (years)</th>
<th>Gender</th>
<th>Symptoms</th>
<th>Duration</th>
<th>Site of attachment</th>
<th>Removing technique</th>
<th>Infestation due to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frounart et al. (2000)</td>
<td>1</td>
<td>China</td>
<td>11</td>
<td>M</td>
<td>Congestion in the left nasal cavity and occasional epistaxis</td>
<td>1 day</td>
<td>Nasal cavity</td>
<td>Alligator forces, using a local anesthetic</td>
<td>Swimming in a pond</td>
</tr>
<tr>
<td>Gharbi and Gharbi (2008)</td>
<td>2</td>
<td>Nepal</td>
<td>63/38</td>
<td>M/M</td>
<td>Recurrent, painless, left-sided nasal bleeding</td>
<td>5 months</td>
<td>Nasal cavity</td>
<td>Forces after 10% lidocaine spray</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Montazeri et al. (2009)</td>
<td>1</td>
<td>Iran</td>
<td>11</td>
<td>M</td>
<td>Sore throat and fresh blood in the mouth</td>
<td>2 weeks</td>
<td>Upper pharynx and oesophagus</td>
<td>Blunt forces after 10% lidocaine spray</td>
<td>Swimming in a lake</td>
</tr>
<tr>
<td>Kruger et al. (2004)</td>
<td>1</td>
<td>Germany</td>
<td>15</td>
<td>F</td>
<td>Chest pain, coughing, intermittent hemoptysis; fever, purulent and vomiting</td>
<td>1 week</td>
<td>Larynx</td>
<td>Involuntarily through forceful vomiting</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Krygowski et al. (2001)</td>
<td>4</td>
<td>Turkey</td>
<td>7/35/</td>
<td>M/M/</td>
<td>Spitting blood and inspiratory stridor, dysphagia, and the feeling of a foreign body in his throat</td>
<td>1 day/2 weeks</td>
<td>Nasopharynx</td>
<td>Forceps with local anesthesia in two cases and general anesthesia in the other two</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Razi (2007)</td>
<td>1</td>
<td>Iran</td>
<td>55</td>
<td>M</td>
<td>Oral blood spitting and hemoptysis</td>
<td>2 weeks</td>
<td>Nasal cavity</td>
<td>After applying 5% xylocaine spray by forceps</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Satyawati et al. (2002)</td>
<td>1</td>
<td>India</td>
<td>4</td>
<td>F</td>
<td>Bilateral epistaxis</td>
<td></td>
<td>Nasal cavity</td>
<td>Negative suction</td>
<td>Playing in these water pools</td>
</tr>
<tr>
<td>Mohammadi et al. (2002)</td>
<td>1</td>
<td>Iran</td>
<td>6</td>
<td>M</td>
<td>Cough, hemoptysis, sensation of suffocation and stridor</td>
<td>1 month</td>
<td>Larynx</td>
<td>Blunt forces after general anesthesia</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Bilgen et al. (2002)</td>
<td>1</td>
<td>Turkey</td>
<td>13</td>
<td>M</td>
<td>Nasal obstruction</td>
<td>4 months</td>
<td>Larynx</td>
<td>Dissociated instrumentally and spilled out</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Ghazwani et al. (2005)</td>
<td>1</td>
<td>Jordan</td>
<td>35</td>
<td>M</td>
<td>Hemoptysis and blood</td>
<td>2 weeks</td>
<td>Floor of the mouth</td>
<td>A pair of forceps</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Butt et al. (2006)</td>
<td>1</td>
<td>Pakistan</td>
<td>29</td>
<td>M</td>
<td>Sensation of foreign body in the throat, haematemesis, blood stained saliva, sore throat</td>
<td>2 days</td>
<td>Oropharynx</td>
<td>Patient pulled out a leech from the back of the tonsillar bed</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Afin et al. (2008)</td>
<td>1</td>
<td>Turkey</td>
<td>5</td>
<td>F</td>
<td>Vomiting fresh blood, epistaxis and purulent</td>
<td>3 days</td>
<td>Larynx</td>
<td>By an otolaryngologist under local anesthesia</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Garcia et al. (2002)</td>
<td>1</td>
<td>Spain</td>
<td>76</td>
<td>F</td>
<td>Slight blood emissions from the mouth</td>
<td>2 days</td>
<td>Epiglottis</td>
<td>Under local anesthetic via indirect laryngoscope and with a pair of larynx biopsy tweezers</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Tseng and Ho (2002)</td>
<td>2</td>
<td>Taiwan</td>
<td>65/9</td>
<td>M/F</td>
<td>Progressive epistaxis, nasal obstruction and an itchy sensation of a moving foreign body</td>
<td>1 month/3 weeks</td>
<td>Nasal cavity</td>
<td>Injected a lidocaine solution directly into the body of the worm with a syringe and forceps</td>
<td>Washing his face with spring water playing in a stream</td>
</tr>
<tr>
<td>Chow et al. (2005)</td>
<td>1</td>
<td>China</td>
<td>55</td>
<td>F</td>
<td>Unilateral left-sided epistaxis and nasal obstruction</td>
<td>3 weeks</td>
<td>Left nostril</td>
<td>After applying 5% xylocaine spray by forceps</td>
<td>Washing her face in the stream water, but denied any aspiration of stream water during swimming</td>
</tr>
<tr>
<td>Cuddall et al. (1986)</td>
<td>6</td>
<td>Kenya</td>
<td>-</td>
<td>-</td>
<td>Feeling of something in the throat, epistaxis and hemoptysis</td>
<td>-</td>
<td>Pharynx</td>
<td>After applying 5% xylocaine spray by forceps</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Mokaya et al. (1998)</td>
<td>1</td>
<td>Japan</td>
<td>55</td>
<td>M</td>
<td>Nosebleed; copious running sniffs foreign body sensation in the nasal cavity</td>
<td>-</td>
<td>Nasal cavity</td>
<td>Xylocaine spray by forceps</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Ran et al. (1985)</td>
<td>1</td>
<td>India</td>
<td>-</td>
<td>-</td>
<td>Nosebleed, foreign body sensation in the nasal cavity</td>
<td>-</td>
<td>Nasal cavity</td>
<td>After applying 5% xylocaine spray by forceps</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Ruza et al. (2006)</td>
<td>14</td>
<td>Pakistan</td>
<td>26.09*</td>
<td>M</td>
<td>Vomiting fresh blood, epistaxis and purulent</td>
<td>-</td>
<td>Nasal cavity, Hypopharynx, nasopharynx, oesophagus</td>
<td>By an otolaryngologist under local anesthesia</td>
<td>Drinking water directly from marshes</td>
</tr>
<tr>
<td>Demircioğlu and Çalışkan (2003)</td>
<td>1</td>
<td>Turkey</td>
<td>3</td>
<td>M</td>
<td>Severe anemia and a history of hematemesis</td>
<td>2 days</td>
<td>Nasal cavity</td>
<td>After applying 5% xylocaine spray by forceps</td>
<td>Drinking water from the spring</td>
</tr>
<tr>
<td>Boye and Joshi (1994)</td>
<td>1</td>
<td>Saudi Arabia</td>
<td>-</td>
<td>-</td>
<td>Respiratory problems</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Drinking water from the spring</td>
</tr>
</tbody>
</table>
Table 1: (continued)

<table>
<thead>
<tr>
<th>Author Age</th>
<th>No. of patients</th>
<th>Country</th>
<th>Age (Year)</th>
<th>Gender</th>
<th>Symptoms</th>
<th>Duration</th>
<th>Site of attachment</th>
<th>Removing technique</th>
<th>Infestation due to</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Awad and Nabil (1990)</td>
<td>1</td>
<td>Soviet Arabic</td>
<td>9</td>
<td>Male</td>
<td>Nematocyst and melanoma</td>
<td>-</td>
<td>Posterior pharyngeal wall</td>
<td>After applying 5% xylocaine spray for 5 minutes</td>
<td>Inhaling water from the ferry</td>
</tr>
<tr>
<td>Goz et al (1989)</td>
<td>17</td>
<td>Israel</td>
<td>9-18</td>
<td>Male</td>
<td>Mill spastic and blood-spitting</td>
<td>Several days</td>
<td>Nasopharynx behind the soft palate</td>
<td>After applying 5% xylocaine spray for 5 minutes</td>
<td>Intubation from the bridge</td>
</tr>
<tr>
<td>Present study</td>
<td>30</td>
<td>Iran</td>
<td>2-70</td>
<td>Male/Female</td>
<td>Blood-spitting and swelling, spastic, dysphagia, dyspnea, hemoptysis and melanoma</td>
<td>1-10 days</td>
<td>Larynx with local anesthesia in regimen</td>
<td>Forceps with local anesthesia in regimen and general anesthesia</td>
<td>Intubation from the bridge</td>
</tr>
</tbody>
</table>
the nares or upper pharynx, it can be detached by applying 30% cocaine, 1:10,000 adrenalin, or dimethyl phthalate to it. Another method is irrigation with strong saline, vinegar, turpentine, or alcohol. It is difficult to grasp a leech with forceps because it has a soft and slippery skin, which ruptures easily (Pandy et al., 2000). Firm traction should not be used when pulling a leech off because parts of its mouth may remain behind, leading to continuation of bleeding and secondary infection (Uygur et al., 2003).

Site of infestation: Reported sites of internal infestation include the nose, nasopharynx, larynx, vagina, urethra and bladder, gastrointestinal tract and rectum (Table 3) (Katseb et al., 2006; Shirzadeh, 2005; Alcelik et al., 1997; Aali, 2002; Aribarg and Phupong, 1999; Saha et al., 2005; Uygur et al., 2003). The clinical picture is protean and depends mostly on the exact site of involvement. The nose has been reported to be the most common site of involvement and epistaxis is the most common sign encountered. Laryngeal and hypopharyngeal infestation may manifest as an emergency with signs of acute airway obstruction. Anemia, which may be severe and even life-threatening, is a common finding.

The strong attachment of the leech to the mucous membrane combined with its soft and slippery body make it difficult for the medical practitioner to get a good hold of the leech and remove it with force. If the leech is in the nares or upper pharynx, it can be paralyzed with cocaine and extracted directly. A hypertonic sodium chloride solution or lidocaine can also be administered; the former causes the leech to release its hold and the latter paralyses it (Ardehali et al., 2006). Direct laryngoscopy under general anesthesia is essential for both diagnosis and removal of the leech (Bergua et al., 1993). In adults a rapid and careful surgical intervention under local anesthesia may be successful.

After the patient was given a local anesthetic, the object was removed using alligator forceps and a rigid
Table 3: Characteristics of included available literature including site of infestation and worldwide reported cases

<table>
<thead>
<tr>
<th>Site of infestation</th>
<th>No. of reported cases (percentage of total)</th>
<th>Gender</th>
<th>Mean age of presentation (year)</th>
<th>Range of presented age (year)</th>
<th>Average duration (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocular</td>
<td>3 (2.7%)</td>
<td>Male</td>
<td>3</td>
<td>37–45</td>
<td>233</td>
</tr>
<tr>
<td>Vaginal</td>
<td>13 (11.8%)</td>
<td>Female</td>
<td>9</td>
<td>5–12</td>
<td>1200</td>
</tr>
<tr>
<td>Rectal</td>
<td>2 (1.8%)</td>
<td></td>
<td>1</td>
<td>3–5</td>
<td>250</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>2 (1.8%)</td>
<td></td>
<td>0</td>
<td>3–35</td>
<td>950</td>
</tr>
<tr>
<td>Urethral</td>
<td>1 (0.9%)</td>
<td></td>
<td>0</td>
<td>2–7</td>
<td>11.50</td>
</tr>
<tr>
<td>Ano-rectalglageal</td>
<td>89 (81%)</td>
<td>27</td>
<td>62</td>
<td>13–69</td>
<td>10000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3. (a) Applied forceps and leech between the forceps; (b) The leech seen in Fig. 2a: it was 3–5 cm long and dark greenish in color (closer view of the parasite).

endoscope. Removal was done by applying a forceps to the middle of the leech’s body and giving a quick pull (Fig. 3a, b).

DISCUSSION

A leech is rare foreign body in the upper respiratory tract. Leeches generally live in brooks, streams or lakes. When water is drunk from these areas the leeches can infest the human body, they can then be located anywhere in the upper respiratory tract from the nose to the larynx, adhering to the mucus. They may enter the body via the orifices of individuals who drink or bathe in infested waters (Makiya et al., 1983; Raza et al., 2006; Gupta, 1980). The nose has been reported to be the most common site of involvement and epistaxis is the most common sign encountered (Al-Hadadi et al., 2000). The presentations of pharyngeal hirudiniasis are sore throat, hematemesis and hemoptysis, sense of having a foreign body, dysphagia and melena. Laryngeal and hypo-pharyngeal infestation may manifest as an emergency with signs of acute airway obstruction (Demiroren and Cakilbas, 2003). Anemia, which may be severe and even life-threatening, is a common finding (Litch and Bishop, 2000).

Our patient experienced passive flow of fresh blood into the oral cavity (without a history of vigorous coughing, epistaxis or gastrointestinal symptoms). Fearless loss of blood into the oral-nasal cavities of our patients was the result of local analgesic substances secreted by the parasite and its site of attachment at the posterior oropharynx. The strong attachment of the leech to the mucous membrane combined with its soft and slippery body make it difficult for the medical practitioner to get a good hold of the leech and remove it with force. If the leech is in the nasal or upper pharynx, it can be paralyzed with cocaine and extracted directly. A hypertonic sodium chloride solution or lidocaine can also be administered; the former causes the leech to release its hold and the latter paralyses it (Ardehali et al., 2000). The leech can then be removed easily. Leech-induced infection is a documented complication of both skin infestation and the therapeutic application of these organisms (Montazeri et al., 2009). However, to the best of our knowledge, there is no report of such infectious complications following internal infestations in the medical literature. Spain was the only European country for which we found cases (four) of this condition reported in the medical literature. Considering this vast geographical distribution and the low socioeconomic
status and relatively low sanitation and healthcare services of most of the countries reporting leech infection, the rarity of the condition seems to be a reflection of under diagnosis rather than a true low prevalence. This report highlights the importance of considering leech infestation and other types of parasitic pharyngitis as possible etiologies in pediatric patients presenting with hemoptysis, sore throat and anemia, especially in areas of poor sanitation.

CONCLUSION

Leech infestation should be considered in the differential diagnosis particular in leech-endemic areas. Every attempt should be made to locate the source of bleeding and discomfort sense that does not respond to simple compression. Endoscopic evaluation of the aero-esophagus cavity is mandatory in recurrent of complications, particularly when the cause is not obvious.

ACKNOWLEDGMENT

The authors would like to thank the patients and parents for participating in this study. This study (No.ACRC01) was supported by Ahwaz Jondishapur University of Medical Sciences (AJUMS).

REFERENCES


