Abstract: Foreign body aspiration (FBA) is the most common cause of accidental death at home in children. In general foreign body can be describing as the component which is not belonging to the human body. Diagnosis of a foreign body as size, shape and location without history of aspiration has always been a challenge to pediatricians. The evidence has to interpret in a timely and accurate manner to benefit health care of children. Image processing plays major role to resolve this issue. The image processing techniques such as image enhancement and segmentation techniques of are helps to improve the accuracy in the early diagnosis and treatment management process of foreign body aspiration. This paper presents a review of identification FBA with it is location. To bring more efficient way of treatment procedure in FBA, a new methodology is proposed. Some of the recent incidents proved the significance of early identification of location, size and shape of the aspired foreign body. With help a proposed methodology, the complication of treatment procedure of FBA and also percentage of fatal ratio will be reduced.

Key words: Foreign body aspiration - Medical image processing

INTRODUCTION

Foreign body (FB) aspiration is a common problem in children, requiring on time recognition and early treatment to minimize the serious and fatal consequences. The role of radiology is more important to study the anatomical structures and other regions of the human body, especially in case of pediatric foreign body aspiration the localization of interested region extraction is more important for early diagnosis. X-ray is an electromagnetic radiation, which differentially penetrates structures within the body and creates images of these structures on photographic film or a fluorescent screen. Improper way of image acquisition process leads to image with noise and some time irrelevant information, intensity problems in images and partial volume effect, data saturation which makes the task of locating and analyzing suspicious area difficult by the doctor. When we adopt image processing methodology, we can bring good quality of image in which diagnosis process of foreign body aspiration more accurate.

Related Works: Vijay G. Yaliwal et al. [1] presented a case study of a 21'year'old female accidental swallowing of double coin. X-ray radiographic before and after oesophagoscopy were made repeatedly to find the missing coin. O. Tariq et al. [2] discussed the clinical findings, sites and types of FBs and outcomes in children who undergone endoscopic management of ingested FBs. H. Rizk et al. [3] presented a review to assess the incidence of foreign body aspiration in pediatric population to improve prevention, early diagnosis of location and shape and suggested that the physician and especially parental education are more important to reduce this pathology. H. Mohammed et al. [4] presented an analytical study of 62 patient’s records with different age group. The age of the patients plays major role for initial radiography image diagnosis. Eti V. Upadhyaya et al. [5] discussed the rare case of multiple coins swallowing with its diagnosis and removal technique. The X-ray radiographic technique was used for the diagnosis and the treatment was given by esophagotomy. M.M. Shaariyah et al. [6] were presented a review of surgical management of foreign body ingestion and conclude that the plain radiograph is helpful to determine surgical removal. A. M. Shivakumar et al. [7] reviewed 152 patients (104 children and 48 adults) history with ingested foreign body. X-ray radiological examination was helped for all the patients to find the location of foreign body and removed using the endoscopic for all cases.
From the literature, it is clear that the radiography plays a major role and proved the significance of early diagnosis process of location size and shape of the aspired foreign body.

Sample Statistical Data Analysis about FBA: The National Electronic Injury Surveillance System-All Injury Program (NEISS-AIP) of India reported that of an estimated 17537 children aged 14 years or younger who were treated for nonfatal choking, more than half (59.5%) were treated for food-related choking, one third (31.4%) were treated for choking on nonfood items, 13% were associated with coins and 19% were caused by candy or gum. [8] Accidents occurring commonly in children among one to six years include, poisoning (90%), falls (80.7%) burns and scalds (62.5%) and foreign body aspiration and drowning (42%). [9] Data from the National Security Council reported that approximately 80 percent of cases occur in patients younger than 15 years of age, 20 percent presenting over the age of 15 years. Overall, death from FBA is the fourth leading cause of accidental home and community deaths in the United States with over 4600 fatal episodes of FBA reported during 2014 [10].

Sample Case Study: Foreign body aspiration (FBA) is frequently encountered and is a life-threatening condition in children. The diagnosis of foreign body has always been a challenge for the pediatricians, as the aspiration incident do not have any initial witness and delayed symptoms notification. Some of the recent incidents proved the significance of early identification of location, size and shape of the aspired foreign body.
Case 1: the Failure Story: November 13 2015, A 5-year-old girl named Dhamini from Ratnagiri dies thinking that eating unexploded crackers as chocolate during Deepavali festival that ends up with tragedy of death. The doctor’s reports that the fatal is because of delayed diagnosis of symptoms and lack of identifying foreign body location. [11]. Figure 3 shows the paper news reports this incident.

Case 2: the Success Story: September 30, 2015 M. Nitish Kumar 11 year-old boy from Vellanampatti village near Veerkakal ingested a five rupee coin and four-year-old girl T. Keerthika of Karayampatti aspired one rupee coin. A team of doctors, including ENT specialists, at Dindigul government headquarter hospital saved the children using laryngoscopy treatment procedure. Finally the doctors reports that the successful removal of foreign bodies are depended on several factors, including location, shape and the type of material. Figure 3 shows the paper news reports the above incident.

Challenges in Diagnosing of FBA: Most of cases, the symptoms of severe FB aspiration are very noticeable but the localization of aspired foreign body needs radiography assessment. Radio-opaque foreign body like metal, coin, batteries, bones etc., can be seen on X-ray. The challenge is to identify the radiolucent foreign body objects for example carrot, rubber, pencil, eraser because such objects may not be visualized. It is essential to identify the presence of a foreign body before the surgical extraction, with it is anatomic location, for example larynx, trachea, main lobar or segmented bronchus by identifying the shape, composition, position and depth of the granulation tissue to reduce the risk level treatment complication. To reduce the noise rate in X-ray images, it is important to determine whether the aspired foreign body is radio-opaque or not. So this process requires better visualization of interested object region. Shape determination becomes more important for surgical operation that reduces the treatment time. Feature extraction of the intrude object in aspired pediatric FB images Classification of objects reduces the repeated radiation exposure on children and reduces the misinterpretation of early diagnosis process.

Diagnosing FBA Using Image Processing Techniques: Medical Imaging refers to a number of techniques that creates visual representations of the interior of a body for clinical analysis. It can be used to assist diagnosis or treatment of different medical conditions. Image processing plays vital role in medical filed. Especially, Image processing techniques developed for analyzing the outputs of medical imaging systems to get best advantage to analyze symptoms of the patients with ease. The radiographic techniques such as X-ray, Computer Topography (CT), Magnetic Resonance Imaging (MRI), are commonly used techniques to analyze.

Fig. 4: Sample Implementation steps of the proposed work

Table 1: Sample Experimental Results with Suggested Treatment

<table>
<thead>
<tr>
<th>Img id</th>
<th>Size</th>
<th>Shape</th>
<th>Location</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>coin</td>
<td>2.70 cm</td>
<td>Circle Shape</td>
<td>Left Bronchus</td>
<td>Based on size, shape and location it is Suggested to remove the coin by endoscopy [4]</td>
</tr>
</tbody>
</table>

Farzaneh Kaviani et al., (2014),
the interested regions of the human body. Treatment management of foreign body aspiration is depends on the evidence such as size, shape and location of the aspired foreign body. The evidence has to interpret in a timely and accurate manner to benefit health care of children.

Proposed Methodology: A new methodology is proposed to enhance the quality of image and bring more accurate in diagnosis process of foreign body aspiration. The proposed methodology is shown in Figure 4. The steps involved in proposed methodology are enhancement methods, segmentation methods and quantification methods are used to identifying location size and shape of the aspired foreign body in pediatric X-ray images. Enhancement methods such as median filtering and iterative thresholding methods are used to reduce noise and increase the contrast of structure of interest. Segmentation methods are operate based on pixel intensity and texture variations of the images which include Sobel boundary detection and pattern recognition method such as K-Means clustering. Quantification methods are applied to segmented structure to extract the essential diagnostic information such as shape, size, texture and angle. Further using these parameters the procedure of treatment will be predicted.

CONCLUSION

Foreign body aspiration is a life-threatening event in children that requires early diagnosis and prompt successful management. As it is said ‘prevention is better than cure,’ prevention is the most critical or key in reducing morbidity due to foreign body aspiration. Therefore more effort on caregivers’ education is essential. The case study shows the significance of identifying the foreign body location, size, shape and type of material. At present most of the researchers have contributed their works towards identifying the quality of the X-ray image, but no work carried out especially identifying the location and determining the shape of the intrude object in pediatric foreign body aspirated X-ray images. Hence, there is need for an effective methodology to identify the intrude object automatically with less processing time to assist the medical practitioners to make right decision on right time.

REFERENCES