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Lazer Navigating System: A New System for Finding and Removing Forigner Bodies

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Finding Foreign Bodies (FB) inside different parts of the body have been difficult for all of the surgeons. Although at first it seems easy to remove these FB but during operation many problem for their removing can occurs, the most important of them is that they can not be find. Many orthopedists, general surgeons and neurosurgeons had experienced with this problem. In this study we are trying to show the efficacy of Lazer Navigating System (LNS) a new system that we have designed for finding and removing FB inside different parts of the body. In this study we have operated 30 patients with FB such as missile, needle, particles of glasses and small pieces of metal in different parts of their bodies. In our series 18 patients were male and 12 patients were female. All of the patients were admitted from emergency ward and were transferred to operating room for operation. General anesthesia and C-arm radiography were used during finding and removing these FB and except one patient all of the bodies were successfully removed. Small skin incision, short duration of operation and less manipulation of tissues are the most important advantages of LNS.

Key words: Foreign bodies, navigation, finding and removing

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INTRODUCTION

Is there any orthopedist, general surgeon or neurosurgeons who can claim that he or she has been able to find and remove all of the FB during operation? The answer is certainly "negative". Finding and removing FB (e.g. glass, missile, metal and...) is a problem for all of the specialists. Many of surgeons have especial skills for this but they are not always successful. Although FB are frequent but studies for them are few. In some of these studies they have been trying to find them by X-ray, CT-scan and even MRI[1].

In other studies finding of these bodies during operation were so difficult that made the surgeons to use especial technique for them[2]. Other articles have shown that the same problems exist for finding FB inside the brain[3]. Sometimes skin marker has been used for localizing and removing FB[4]. The main problem here is that the surgeons can not see or find FB during operation when these are between different parts of tissues and so surgeons can not see them.

MATERIALS AND METHODS

This study has been done with LNS on 30 patients with FB in different parts of their bodies. The patients were admitted to operating room and with general anesthesia and C-arm the surgeons have tried to find and remove them. The LNS is a simple system and consist of the following parts (Fig. 1):

- Attachment part of the system with C-arm tube. The shape of this part can be changed according to the shape and dimension of C-arm (part-1)
- The place for Laser Pointer (part-2), which can be connected or disconnected from the first part.
- Laser pointer (part-3).
- Tube that the light of laser pointer pass through it (part-4).

All parts of the system are from plastic (because it should not prevent the passage of X-ray beam) except two metal rings over two end of the tube (part-4), that are used as a external marker (Fig. 2). During process the attachment part (part-1) of the system is attached to the C-arm and is firmly fixated. The source of the laser (part-2) which is simply a laser pointer that can be inserted or removed from its place (part-3) during processing (during localization of the FB laser pointer should be removed because it can prevent the passage of X-ray beam but when the surgeon wishes to localize the light of laser pointer over the skin it should be placed over it's place. The end tube (part-4) has two metal rings that after

Fig. 1: Four main parts of LNS
From left to right: Laser pointer (part-3), Tube that has two metal rings at it's two ends (part-4)
Place for laser pointer (part-2) and Attachment to C-arm (part-1)

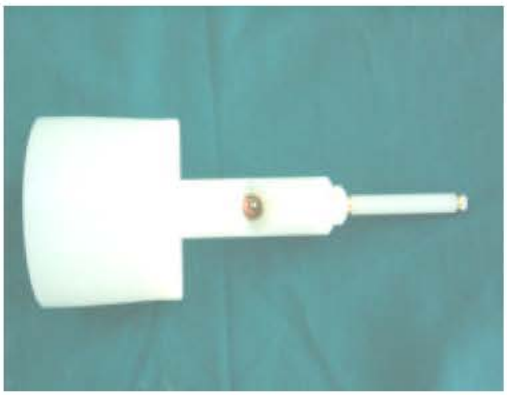

Fig. 2: The arrangement of different parts of LNS
This system is attached to C-arm and during operation laser pointer can be placed and removed

expose of X-ray beam can be seen as two circles over the monitor of the C-arm. During operation the interested region of the patient's body is placed between the two arms of C-arm. LNS is attached to the C-arm. After the expose of X-ray beam the image of LNS is seen only like two circles over each other, because all parts of the system are from plastic and therefore non radio-opaque. The interested part of the body of the patients should be completely fixated and any movement of the patient can change the data.

During operation the surgeon with changing the position of the C-arm will try to place the image of two circles (that is the image of the metal rings) and foreign object seen on monitor, over each others. Now the laser pointer (part-3) is inserted at its place (part-2). Now if the laser pointer light is turned on the red light of the laser pointer pass in a straight line directly towards the tube

(part-4) and pass exactly towards the direction of the foreign body. Over the skin of the patient red light of laser pointer show the location and direction of the foreign object. Surgeon can make the incision over the light of the laser pointer and follow it until approaching to the FB. Because of this property of LNS it's a navigation system for showing the FB location.

RESULTS

In this study we operated 30 patients; 17 male and 13 female. All of the patients were admitted from clinic or emergency ward and were operated in operation room under general anesthesia. Any displacement of the patients should be avoided after adjustment of the system. The FB were small pieces of metal, needle and fragments of glasses and particles of shrapnel. For all of the patients LNS with C-arm was used. The FB were in the upper limb (6 case), lower limb (13 case), cervical region (2 case), skull (8 case) and posterior parts of vertebral column (3 case). Two patients have more than one FB. All of the FB were successfully removed except one in the cervical area (♂-18 yr). Before and during operation with LNS and C-arm two to four expose of X-ray were needed for localizing, finding and removing the FB. All of the patients were discharged from hospital one day after operation and no complication including infection or hemorrhage was noted.

DISCUSSION

All of surgeons have some times difficult experience with FB finding and removing. They also claim that removing these FB can be easy or difficult. Most of the surgeons have especial technique of their own for it, but they are not always successful for finding and removing FB. With radiography and C-arm imaging it's easier to find them but still problem exists. The main problem for FB is that they sometimes can not be found during operation. Sometimes they are under the tendons or inside the muscle or bone and surgeon can not see them. Often peripheral markers over the skin that normally use by some surgeons to find FB are not effective. According to these problems we have designed a new system based on properties of LASER to find and localize the FB during operation. With LNS the surgeons have more chance to find the location of the FB before and during operation. With this system we were able to find all of the FB (except in one patient). The skin incisions were small (2 to 4 cm), manipulation of the tissue was as little as possible and the duration of the operation was 5 to 30 min. During operation 2 to 4 expose of X-ray with C-arm was used with LNS. No skin marker was needed. The colour of the laser pointer is red and after adjustment of the system over the region that FB were entered it was easy to follow the ray of laser for approaching FB. Sometimes during operation the FB can move and the surgeon can simply find them with one more expose of X-ray.

In one patient we were not able to find its FB of cervical region. It was very deep and we thought that it's very dangerous for trying to find and remove it. This system is very useful especially when the surgeon wishes to remove FB from area where the diameter of surgical incisions are cosmetically important for example over the face. Small skin incision, short duration of operation and less manipulation of tissues are the most important advantages of LNS.

We hope that this system will be used in the future for operation of the stone in the kidney or even all of the radio-opaque pathology inside whole body that different surgeons wish to remove them.

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