Case Report
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Diagnosing Micro Foreign Bodies with the Microscope

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The microscope is a surgical instrument with wide use in plastic surgeries more often than other departments due to the high rate of microscopic surgeries. Unfortunately, because the microscope is used mainly for digital replantations and free flaps, the utilization rate is low compared to the price and usability of the microscope itself. From September 2013 to March 2014, a foreign body which was untraceable with radiology in a patient who desired surgical exploration (one case), and a foreign body which was detected but was smaller than 3 mm (two cases) were removed using the microscope. All foreign bodies, which were fish bone, thin metals, or wooden objects, matching the history of the patients, were completely removed without damage. There were no complications and patient satisfaction was high through follow-up. We have described the microscope as the last and optimal examination tool in removal of micro foreign bodies. A simple change of thought, so that the microscope can be used as a second diagnostic tool will decrease complications by foreign bodies.

Key Words: Microscopy, Foreign bodies, Disgnosis

The microscope is commonly used in plastic surgery. Most of the hospitals with a plastic surgery department have surgical microscopes and in order to become a plastic surgeon, it is essential to learn and train oneself in microscopic surgeries. However, the use of microscope is rather limited due to the difficulty of the surgery and lower accessibility from its large size. Therefore, it is only applied in some sorts of surgery such as finger replantation and free flap. When considering its usefulness and economic feasibility, the microsurgery should be applied in many other kinds of surgeries. In here, we report three cases using the microscope to remove foreign bodies (FBs) in hands and discuss about the merits of microscope in diagnosis and treatment of FB removal.

CASE REPORT

From September 2013 to March 2014, three patients have visited our plastic surgery department with FB in hands and had undergone the microsurgery. One case was initially not detected by the plain radiography but the other two cases had found FBs in the initial radiographs with the sizes less than 3 mm (Fig. 1). The undetected case was asymptomatic, but the other two cases complained of swelling, redness, tenderness and the FB sensation. In these latter two cases, the plain radiographic exam was done again with two or three 26-gauge needle inserted to the estimated point of the entry to confirm the exact location of the FB (Fig. 2). After the exam, all the patients were sent to operation room with immobilization of the injured hand. By the guide of inserted needle, a small incision was done and the FB was searched under ×12 magnification by Surgical microscope (OPMI®Vario; Carl Zeiss, Oberkochen, Germany). All procedures were done with microsurgical instruments. The FB was located by the surrounding hematoma and the removal was carefully done with microsurgical instruments to minimize

iatrogenic damage and destruction of the FB. In all cases, FB was removed without damaging the surrounding structures and the FB itself. The removed FB was a fish bone, a chipped metal and a small piece of wood (Fig. 3). And it all matched to the patients' history of the injury when they first visited our department.

The surgery was done one day, three days and ten days after the onset of the injury, respectively. The average surgical time was about 25 minutes. All the patients were discharged shortly after the surgery and no complications were reported in the follow-up period. The patients' satisfaction was high as well.

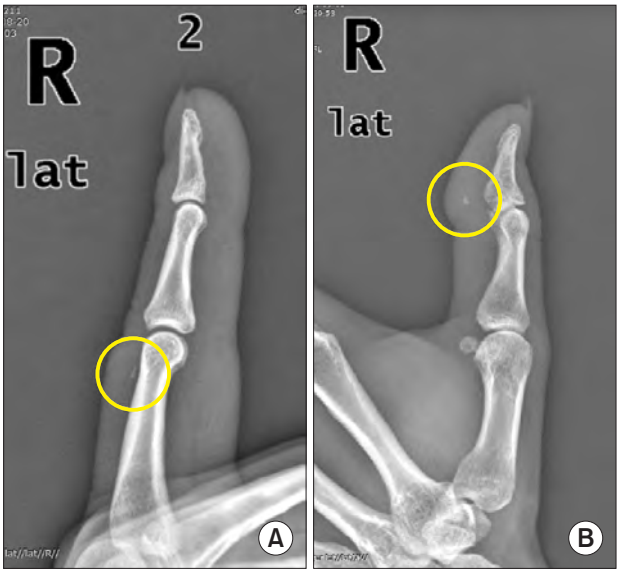

Fig. 1. Preoperative X-ray findings. (A) Foreign body of right second finger. (B) Foreign body of right thumb.

DISCUSSION

Injuries of the hands caused by FBs are commonly encountered in the emergency room or in the outpatient clinic of the plastic surgery department. However, many cases remain unnoticed and the failure to diagnose retained FBs is among top ten claims for malpractice carriers, resulting in the fifth highest amount of indemnity awards to patients in the USA. McNicholl et al.[1] reported that nearly half of the patients with hand and forearm injuries were asymptomatic. This is due to anatomical characteristics of the hand easily masking the deep structure injuries or FBs. In another study,[2] 61.6% of the patients with FBs in their hands were not aware of the injury for they belonged to poor labor class who frequently got injured and have tendency to ignore the injuries to avoid disturbance in their daily routine. Therefore, surgeon's particular effort is essential for the diagnosis and treatment of the injuries cause by the FBs.

The diagnosis is generally done with the history taking, physical examination and imaging studies. The detection of the FBs by the imaging studies is closely related to the size of the FB. Courter[3] reported that the detection rate of glass fragments in plain radiography was 61% for 0.5 mm objects, 83% for 1 mm objects and 99% for 2 mm objects. When the FB is suspected

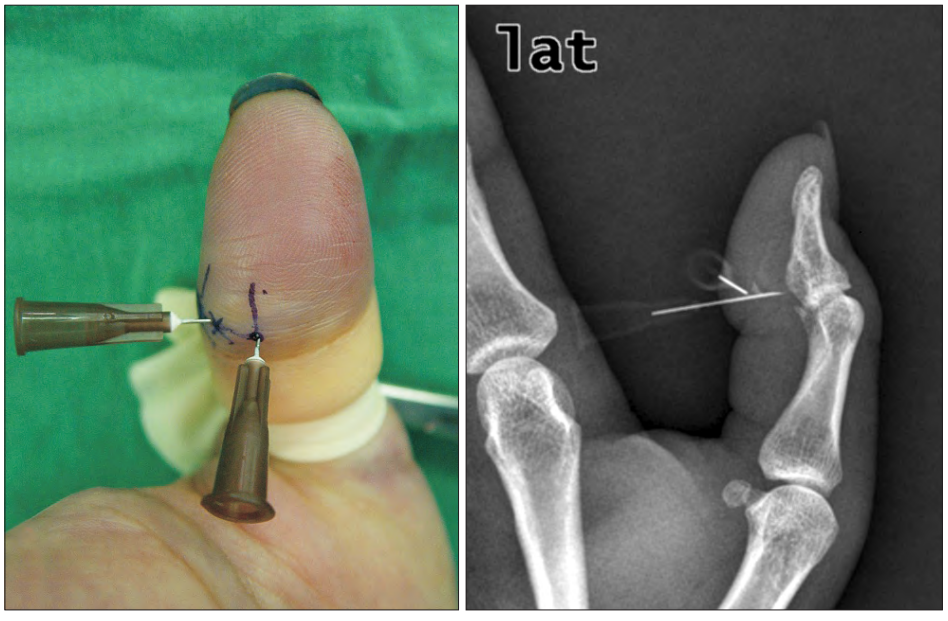

Fig. 2. Two or three 26-gauge needles are used to find radio-opaque foreign bodies.

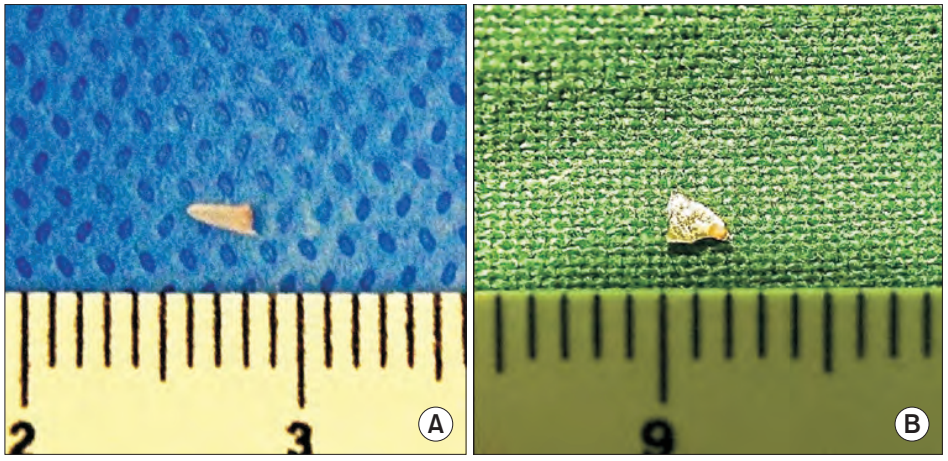

Fig. 3. Removed foreign bodies. (A) Fish bone. (B) Metal sheet.

to be organic, such as a piece of wood, it can provide more ideal environment for the microorganisms to grow. In these cases, the removal is essential. Since organic FBs are mostly radiolucent, ultrasonography (USG) should be considered as one of the initial diagnostic methods.

In the USG, the FBs appear as hyperechoic structure with a hypoechoic shadow beneath. Secondary changes such as edema may appear as hypoechoic areas. If the size of FB is too small to be detected by the USG, these secondary changes with hypoechoic areas can be helpful in detecting the FB. But for these changes to develop, it takes at least two days. If the FB cannot be located by the USG, computed tomography (CT) or magnetic resonance imaging (MRI) is recommended. The CT has an advantage in that it can detect both metallic and wooden FBs. But, the soft tissue calcification, neuropathy, venous stasis can be mistaken as FBs in CT. The MRI is also useful in detecting the FBs and is a safe method in that it does not emit radiation. But the exam is expensive and wooden or too small FBs without any inflammation may not be detected on MRI. Also when the inflammation surrounding FB is too severe, it may be mistaken as tendons, scar tissue or calcification. Therefore, if the FB is too small or have secondary conditions as described above, these imaging techniques may not be able to detect the presence of the FB.

The large FB located in the surface can be easily detected only with the physical examinations, but the FBs that are smaller and deeper may not be detected by the imaging studies and may need surgical exploration. Still, there is controversy whether the removal of the FBs by surgical exploration is essential or not. And there are no strict indications for the surgical exploration. Lamb and Kuczynski[4] recommended that the removal of the FB in hands should not be done for the risk of iatrogenic damage. But the Humzah and Moss[5] reported when the presence of the FB is suspected, removal should be done to prevent further possible damages. Kurtulmuş et al.[6] also stated that when the patient complains of the FB sensation, removal surgery should be done. But the prospective study done by Steele et al.[7] tested the predictive value of a patient's FB sensation and the result showed only 31% of positive predictive value. This result supports that the patients' FB sensation should not be the absolute indication for the surgical approach. Anyhow, the surgical exploration can reduce the psychological discomfort regardless of the actual presence of the FB.

In current literatures, the indications for the removal of the FBs are the neurovascular injury, tendon laceration, cosmetic deformity, functional impairment and chronic pain. Contraindications to removal include inaccessibility, possibility of iatrogenic risks to neurovascular structures and minute size.[8] However, these indications are not supported by the definite grounds and individual approach is recommended. If the FB is not removed or only partially removed, the left piece may lead to complications such as infection, delayed healing, osteomyelitis, cellulitis, pyogenic granuloma, necrotizing fasciitis and when left for long time it may develop pseudo capsule surrounding the FB and appear as tumor-like lesions.[9]

If the FB is not found by the imaging studies, surgical exploration with the microscope should be considered as the next approach. The thought of using the microscope to find the FB may not come to mind and even when you do, there can be psychological resistance. The naked eye or even loupe may not

be enough to find the FB and only increase the possibility of iatrogenic damages.

In our department, if the FBs were not found by the imaging studies or if its size was less than 2 mm, most of the cases were left for observation. In these cases, few patients have returned to the emergency room or to the out patient department complaining of physical or psychological discomforts. By using the microscope, the detection and the removal of the FB was done without difficulty. And for these reasons, the indication of the microsurgery in removal of the FB can be summarized as when the FB is less than 3 mm and cannot be seen by the naked eye or the loupe but the likelihood of the complication is foreseen or if the patient have strong intention for the removal or exploration of the FB.

In addition, the authors inserted 26-gauge needle to exactly locate the FB in the preoperation radiography. This is because the intraoperative imaging devices provide low resolution images and for the most of the time it cannot provide proper guidance. Mardel[10] stated when removing the FB of the foot, the Trendelenburg position may reduce the blood flow to the lower extremity, providing clearer view and making the removal easier. In the same aspect, the removal of FB in upper extremity can be done with the affected limb elevated and applying the Esmarch bandage to provide clearer view. But in this position, the FB can migrate proximally for the upper extremity has less resistance than the lower extremity due to abundant tendon sheath and fascia.

The authors think that the use of microscope is the better alternative option in both detecting and removing of the FBs. More approaches using the microscope as a diagnostic tool should be considered for it can reduce possible complications caused by the FBs.

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