J Forensic Sci, Jul. 1979, Vol. 24, No. 3

TECHNICAL NOTE

C. V. Wetli,[1] *M.D.*

Application of the Tri-Ess Mini Metal Detector to Forensic Autopsies (or, How to Find the Elusive Projectile)

Locating and recovering projectiles and projectile fragments from cadavers can sometimes be difficult, frustrating, and time-consuming. Precisely locating a projectile by X-ray is usually not accomplished because of the difficulty in obtaining accurate oblique and lateral projections. The forensic pathologist is thus occasionally faced with a situation where the general location of a projectile is known but the track is lost or becomes inapparent during the course of dissection. Further X-rays are generally useless, and one must then embark on a lengthy and frequently mutilating dissection to locate and retrieve the projectile. In such autopsy situations, we have found the Tri-ess metal detector to be of definite help. This instrument was initially chosen because of its purported sensitivity, small size, and low cost.

Description

The Tri-ess mini metal detector is 13.1 cm long, 4.5 cm high, 2.2 cm wide, and weighs 120 g with the single 9-V battery needed for its operation. It has a rough-textured gray plastic case with a central seam and is tapered for easy handling. Battery replacement is facilitated by a side panel. A thumb-operated dial near the front turns the instrument on and adjusts for sensitivity and depth of metal detection. At the front is a neon bulb with a red plastic cover. A red light appears when metal is detected.

Operation

After the battery has been inserted an adjustment must be made for ambient temperature. This is easily accomplished by prying open the plastic case and turning a screw to the proper setting. This takes about 1 min and in our experience the adjustment is not often needed.

To detect a metallic object, the instrument is switched on with the thumb-operated dial on the side until the bulb just barely glows. This sets the instrument for greatest depth and sensitivity. The light glows bright red when a metallic object is approached.

Sensitivity

Two detectors were evaluated by placing metallic objects on a table and slowly bringing the detector into proximity. Both detectors gave virtually identical results. Relatively large

Received for publication 22 Dec. 1978; accepted for publication 13 Jan. 1978.

[1] Associate medical examiner, Dade County Medical Examiner Office, Miami, Fla.

projectiles, such as rifled slugs and .38-caliber bullets, were detected at a distance of 3.0 to 3.5 cm. The smaller .22-caliber bullet was detected at 1.5 to 2.0 cm. A single #8 lead pellet (birdshot) was barely detectable at 0.1 to 0.2 cm, while two pellets were readily detected at 0.5 cm. During autopsy, projectiles of all shapes and sizes were readily detected through soft tissue at distances of 2.5 to 3.5 cm, and through bone at 1.5 to 2.5 cm. Small shotgun pellets, however, were detected with difficulty unless the pellets were within 0.5 cm of the instrument's surface. Although all forms of metal were detected, pure lead projectiles did not seem to be detected quite as readily as copper or ferrous metals.

Practical Use During the Autopsy

The mini metal detector was used for three months in this office to help locate projectiles in cases to be autopsied. In general, the instrument proved to be quite helpful in minimizing the time spent in searching for elusive projectiles and virtually eliminated mutilating dissections and repeat X-rays. Also, we have found there is less chance of inadvertently scratching the projectile with a cutting instrument once the precise location of the projectile was detected.

Two examples of the utility of this instrument during the course of a forensic autopsy are illustrated. In Fig. 1, the X-ray reveals a fragmented projectile in the leg. One fragment was easily retrieved without further ado, but the other could not be readily traced. The prosector knew the fragment was somewhere in the gastrocnemius or soleus muscles. The metal detector readily located the fragment and thwarted a potentially mutilating and lengthy dissection. In another circumstance the X-ray revealed a projectile in the chest and examination of the victim revealed an entrance-type gunshot wound in the anterior chest wall. The projectile track was traced through the heart and aorta to the thoracic spine. It could not readily be determined if the projectile had lodged in the spine or had gone through it and had come to rest in the subcutaneous tissues of the back. Inspection and palpation of the back gave no further clues. The metal detector, however, indicated the projectile was slightly lateral to the spine. A single incision and reinspection with the detector isolated the projectile to the paraspinal muscles and permitted easy retrieval (Fig. 2).

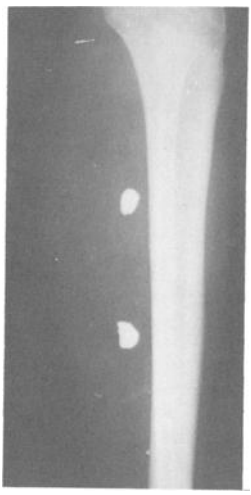

FIG. 1—*X-ray revealing fragmented projectile in muscle of leg.*

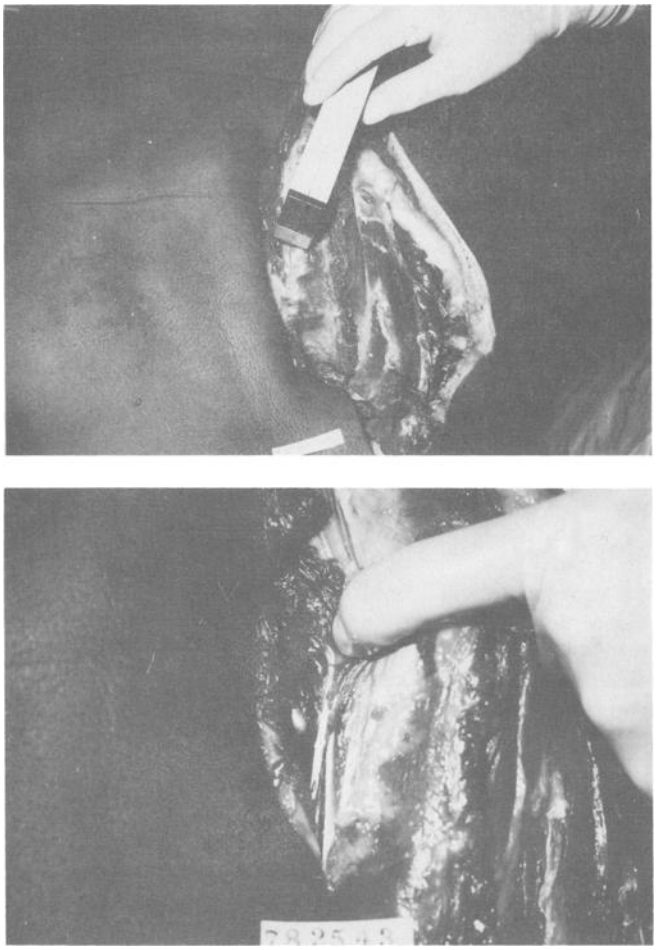

FIG. 2—(top) *Use of the metal detector in locating projectile near the spine.* (bottom) *Reflection of paraspinous muscle to reveal projectile located by the metal detector.*

In addition to its use at the autopsy table, the mini metal detector has proven useful during scene investigations. It was successfully employed, for example, when, at the scene, it was uncertain whether a scalp laceration represented an exit wound from a projectile, a blunt impact injury from falling, or the exit of an accelerated bone fragment. The detector was able to confirm the presence of a projectile beneath the scalp or embedded in the skull and thus saved a fruitless scene search for a projectile which had in fact not exited from the body.

Limitations

During the three-month evaluation certain limitations and disadvantages were encountered. The instrument frequently came into contact with body tissues and hence became bloody. The coarsely textured plastic case made cleaning difficult and the seam between the two halves of the case also permitted blood to enter inside the case. The latter problem was resolved by placing tape over the bottom of the detector. Also, after a month or two of use the red plastic cap covering the neon bulb became loose. The detector has

limited usefulness around the jaw when dental fillings are present. Since most autopsy trays and tables are made of metal, care must be exercised to avoid false readings from the table and surroundings. Simply rotating the body and being cognizant of the metal tray or table usually avoid this type of problem. Probably the most annoying limitation is a drift in sensitivity of the instrument. The sensitivity may drift either way and result in false positive or false negative readings. The problem is usually overcome by simply readjusting the sensitivity dial and confirming the reading before commencing with the dissection.

Cost and Procurement

The Tri-ess mini metal detector costs about $13. It can be purchased from Forensic Science Enterprises, Inc., 622 West Colorado St., Glendale, Calif. 91204.

Conclusion

The Tri-ess mini metal detector has proven to be a valuable and inexpensive aid in the location of metallic projectiles during the course of an autopsy and, occasionally, during scene investigations.

Address requests for reprints or additional information to
Charles V. Wetli, M.D.
Dade County Medical Examiner Office
1050 N. W. 19 St.
Miami, Fla. 33136