CASE REPORT

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Bullet Hole Identification Kit: Case Report

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ABSTRACT: A field kit for the identification of bullet holes using chemical spot tests for lead and copper was used in an investigation of an accidental wounding during a military exercise. Based upon the results obtained using the kit, it was possible to detect the bullet holes in question, and thus, reconstruct the path and direction of the bullet. It was further possible to estimate the type and diameter of the bullet.

KEYWORDS: criminalistics, ballistics, field kits

Bullet hole identification is based on, besides the morphology of the hole in question, the presence of metals, powder residues, and blackening in the vicinity of the hole.

In cases of shots fired from relatively long distances, the bullet hole identification process is generally reduced to the examination of metals present around the suspect hole. There are two generally accepted methods for this examination:

(1) extraction of the metals from the perimeter of the hole in question and concentration determination using atomic absorption spectrophotometery, [*1,2*] and

(2) chemical spot tests, which are predominately qualitative, for the presence of lead or copper or both [*3,4*].

Also mentioned in the literature are methods using neutron activation analysis (NAA) and scanning electron microscopy (SEM/EDS) [*5,6*].

A previous work published by this laboratory presented a field kit used for the identification of bullet holes ("BTK"-Bullet Hole Testing Kit). This kit is based on the use of spot tests for the identification of lead and copper [*7*].

The case we are reporting demonstrates the advantages and importance of results obtained using this kit, both during the preliminary investigative stages and later, during the presentation of evidence in court.

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Case Summary

During a military exercise using live ammunition, a soldier, sitting in his tent situated about 600 m from the area of the exercise, was seriously wounded. A physician determined that the wound had been caused by a bullet; however, no bullet was recovered. The question facing the investigators was to demonstrate that the source of the undiscovered bullet was the nearby military exercise, and thus, support a charge of negligence against the commanders of the exercise.

The investigators attempted to identify the bullet holes (entrance and exit) in the sides of the soldier's tent to reconstruct the bullet's possible path and determine whether or not the path lay on a straight line between the point of impact and the location of the military exercise.

This, however, was more difficult than expected; over the years, the tent had accumulated many holes in its sides, most of them about the size of a bullet hole.

At this point, it was decided to send the soldier's tent and the neighboring one for examination in our laboratory.

Method

After the initial investigation, it was apparent from the accounts of several eyewitnesses that there was no possibility the soldier had been shot from close range. It was decided that there was no point in trying to make a quantitative examination of the metals around the suspect bullet holes. Instead, the Bullet Hole Testing Kit (BTK) was used to differentiate between the holes, bullet and other, in the sides of the tents.

Each tent had 2 sidewalls made of canvas (see Fig. 1). All holes in each wall of the two tents were examined (up to 20 holes in each wall). Each hole was examined from both sides of the wall.

Results and Discussion

A positive reaction was received on only one hole in each wall, which was apparently the bullet hole in question. From the fact that a positive reaction was received on the same hole for both lead and copper, it was possible to surmise that the bullet in question was a copper jacketed lead bullet.

The test results received using the BTK are summarized in Table 1. Using these results, several conclusions may be reached regarding the bullet's path and caliber.

When we use the BTK, we observe a positive color reaction predominately on the side of the medium from which the bullet enters. On the side of the bullet's exit, the color reaction is much weaker.

From Table 1, it can be ascertained that there are indeed differences between the strengths of the reactions received for the two sides of each tent wall. These differences enable use to determine with a reasonable amount of certainty the sides from which the bullet entered and exited.

On further examination of Fig. 1 and Table 1, we can learn that the path of the bullet in question may indeed be from the area of the military exercise, through tent side 1-a, 2-a, 1-b, and exiting 2-b. This determination is further supported by the fact that the strength of the color reaction weakens from one hole to the next along this proposed path.

The third possible conclusion pertains to the caliber of the bullet that caused the holes. In Table 1, we see that the diameters of the colored rings obtained in the positive reactions were all approximately 5.5 mm. This diameter was about the same as the caliber of the guns used in the adjacent military exercise. As was reported in another work [*8*], there exists a strong

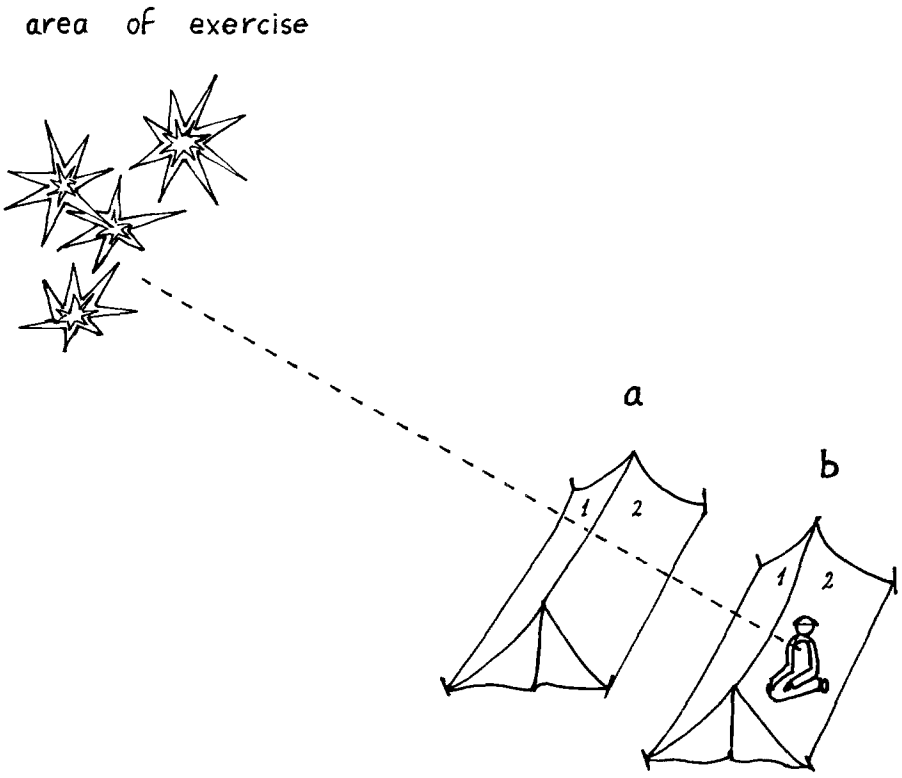

FIG. 1—*Recreation of shooting accident.*

TABLE 1—*Spot test results.*[a]

Tent Wall	Lead (Pb)	Diameter (d)	Copper (Cu)	Diameter (d)
a-1 outer side	+	5.55	+	5.50
a-1 inner side	+/−	*	+/− −	*
a-2 inner side	+	5.50	+	5.50
a-2 outer side	−	*	−	*
b-1 outer side	−	*	+/−	*
b-1 inner side	−	*	−	*
b-2 inner side	−	*	+/− −	*
b-2 outer side	−	*	−	*

[a]Legend to results:

d diameter of color ring, mm
+ positive reaction
− negative reaction
* no defined color ring
+/− weak reaction
+/− − very weak reaction

correlation between the diameter of the colored rings observed on a cloth medium when we use the BTK and the caliber of the bullet that caused the hole tested.

The combination of the three above results, when presented in court, provided a convincing tie between the wounding of the soldier and the adjacent military exercise. The court's decision, which found the commanders of the military exercise guilty of negligence, used the above evidence as a strong basis for reaching their decision.

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