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## Observations and Statistics Relating to Suicide Weapons

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**REFERENCE:** Stone, I. C., Jr., "Observations and Statistics Relating to Suicide Weapons," *Journal of Forensic Sciences*, JFSCA, Vol. 32, No. 3, May 1987, pp. 711-716.

**ABSTRACT:** The weapon at the scene of a suicide provides a resource in addressing such questions as frequency of blood in or on the weapon, location of the weapon with respect to the body, and evidence of firearm discharge residues on the hand. The first 195 weapons were tested for blood by a technique different from the following 202 weapons. Results were obtained which caused procedural changes in blood detection. Data are presented for frequency of blood in and on the muzzle of weapons, relative frequency of location of suicidal gunshot wound, and percent "positive" findings of gunshot residue metals on the hands. It was found that suicidal gunshot wounds were 3 times more frequent to the head than the chest, and that no significant difference was noted between males and females in this study. Scene photographs reveal that the suicide weapon is in or resting on the hand of the decedent 20% of the time with handguns and 11% of the time with long guns.

**KEYWORDS:** criminalistics, suicide, ballistics, wound ballistics

The suicide weapon from the scene provides a rich resource in addressing several questions frequently encountered in other types of death cases by gunshot wound, such as homicides and alleged accidental weapon discharge. Included are data pertaining to the frequency of blood found inside or on the barrel of weapons discharged in contact or near contact with the body, the relationship of caliber and weapon type to the presence of blood, the relative percentage of weapons yielding evidence of firearm discharge residues on the firing hand, and the frequency that the weapon is found still clutched in the hand of the decedent. The same procedures are followed in homicidal deaths but are not included in this study. The first 195 weapons examined were tested for blood by a technique different from the following 202 weapons. Problems encountered and some surprising results are described.

The procedure at the Institute of Forensic Sciences provides that all weapons and apparent suicide notes are taken into custody at the death scenes which appear to be suicide. The data for the cases described in this paper include only those ruled as suicidal deaths by the Office of the Medical Examiner.

### Experimental Procedure

The first step in the examination of weapons by firearm examiners in suicide cases has been to document the physical characteristics of the weapon such as make, model, barrel

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length, trigger pull, and caliber. Before test-firing, the area about  $\frac{1}{2}$  to 1 in. (1.3 to 2.5 cm) inside the muzzle end of the barrel was tested for blood using Hemastix® (Miles Laboratory, Inc., Elkhart, IN) which were used for convenience and relative stability. Hemastix rely on the "peroxidase-like activity of hemoglobin which catalyzes the reaction of cumene hydroperoxide and 3,3',5,5',-tetramethylbenzidine (TMB)." The reaction reportedly is sensitive to about 1 part in 4096 for a color change occurring within 5 s.<sup>2</sup> This is compared with leucomalachite green (LMG), which is sensitive to 1 part in 2048 for a color change within 5 s. The LMG reagent is described by MacPhail [1] as *p,p'*-benzylidenebis (*N,N'*-dimethylaniline) with sodium perborate as the activator solution. The muzzle end of the barrel was tested in similar fashion for the presence of blood.

## Results

Weapons received in suicide cases from June 1984, through April 1985, were used in this study. The format of information inserted into the Xerox 16/8 Personal Computer included caliber and type of weapon, ammunition, gunshot residue analysis of handwipings, blood inside the barrel or on the barrel, the single-action and double-action trigger pull values, and the sex and race of the decedent.

By May 1985, a total of 195 weapons used in suicides had been tested using the Hemastix with TMB, yielding some general results:

- 86% of the guns tested positive for blood on the barrel,
- 63% of the guns tested positive for blood inside the barrel, and
- 59% of the revolvers tested positive for blood inside the barrel.

These frequencies seemed high so a further breakdown was obtained of those with positive evidence of blood inside the barrel:

- 59% of .22-caliber revolvers,
- 69% of .25-caliber pistols,
- 60% of .38-caliber revolvers,
- 60% of shotguns, and
- 76% of rifles.

Inasmuch as these were higher indeed than those given in a limited study reported by DiMaio,<sup>3</sup> a separate series of tests was performed to determine if false indications of blood might be the cause. Eighteen weapons from our reference collection of firearms were swabbed inside the barrel and the cotton swab tested first by TMB and then by the LMG reagents. These weapons were not expected to yield positive indications of blood. The results are given in Table 1.

To test the hypothesis that the first series of data contained false positives for blood, we examined and tested weapons in the next 202 suicides from June 1985 to April 1986. These data are summarized in Table 2.

Table 3 gives the results of testing weapons by each technique and broken down by caliber and weapon type. Table 4 depicts comparison of overall results of blood detected.

## Discussion

The unexpectedly high percentage of positive findings of blood inside the barrel of the first 195 suicide weapons prompted a reexamination of the procedure for this identification. The

<sup>2</sup>P. E. Burdett, "Presumptive Tests for Blood—A Comparative Study," CRE Report 201, Home office Central Research Establishment, Aldermaston, U.K., Oct. 1976.

<sup>3</sup>V. J. M. DiMaio, personal communication, 1984.

TABLE 1—TMB and LMG test results of weapons in reference collection.

Caliber	Weapon	TMB	LMG
.22	Beretta pistol	neg	neg
.22	Armsco revolver	pos <sup>a</sup>	neg
.22	RG 10S revolver	pos <sup>a</sup>	neg
.25	Browning pistol	neg	neg
.38	S&W Terrier revolver	neg	neg
.38	S&W Chief revolver	neg	neg
.38	Colt Agent revolver	pos <sup>a</sup>	neg
.38	RG 38 revolver	neg	neg
.38	Charter Arms Undercover revolver	pos <sup>a</sup>	neg
.380	Hi Standard pistol	pos <sup>a</sup>	neg
.357	S&W Model 19 revolver	neg	neg
.357	Colt Lawman MKII revolver	neg	neg
.45	Colt pistol	pos <sup>a</sup>	neg
.45	Colt Combat Commander pistol	pos <sup>a</sup>	neg
.44	Winchester Model 94 rifle	neg	neg
30-30	Marlin Model 336 rifle	pos <sup>b</sup>	pos <sup>b</sup>
20-gauge	H&R Model 088 shotgun	pos <sup>a</sup>	neg

<sup>a</sup>This is a slow "positive" reaction taking more than 30 s and yielding a light yellowish-green color.

<sup>b</sup>After testing, it was discovered that this rifle had, in fact, been used in a suicide several years earlier before being placed into the reference file.

TABLE 2—Results of testing suicide weapons for blood, June 1985 to April 1986.

Weapon Type	Positive Blood Inside Barrel	Positive Blood On Barrel	Weapons Total
revolver	51 (44%)	74 (64%)	116
pistol	19 (46%)	26 (64%)	41
rifle	8 (40%)	13 (65%)	20
shotgun	18 (72%)	21 (84%)	25
Total			202

TABLE 3—Comparison of "positive" blood detected inside muzzle end of barrel.

Weapon Caliber	Total	Percent Positive TMB	Total	Percent Positive LMG
REVOLVER				
22 LR	16	59	25	24
38 special	43	60	46	48
357 magnum	18	44	18	56
44 magnum	4	100	3	33
PISTOL				
22 LR	4	50	9	67
25 auto	17	65	15	47
380 auto	4	75	8	38
9 mm parabellum	3	100	3	33
45 auto	6	50	2	50

TABLE 4—Comparison of overall blood detection results.

	Total Weapons	Percent Positive TMB	Total Weapons	Percent Positive LMG
blood inside barrel	195	63	202	48
blood on muzzle end	195	86	202	66

results in Table 1 show that false positives can be obtained with Hemastix when rigorous requirements for a positive result are not followed. It is recognized that this is analyst interpretation error, rather than defective product. If these reagent strips are used, skill must be attained in recognizing the proper color and the need for rapid color change. The difference between a "slow" color change and a "rapid" color change is difficult to define for Hemastix.

The author had been using the LMG reagent for over ten years in presumptive testing for blood, but had changed to the reagent strips for convenience. Testing by firearm examiners in this laboratory is now done using the LMG reagents because of the experience factor and the more easily recognized color change.

One of the more surprising pieces of information to come from the review of the data is the distribution of the entrance wounds as a function of sex; Table 5 lists the various entrance wound sites. One hears frequently that men seldom shoot themselves in the torso, whereas women seldom shoot themselves in the head. Our results represent preliminary data because of the limited number, but do show surprisingly that men and women choose to dispatch themselves with much the same preference with regard to body location.

Also, taking into account the entire 397 suicide cases, the overall results of "positive" findings for evidence of gunshot residue metals on the hand or hands of the decedent are interesting when compared with data from the writer's laboratory just prior to this study. The data reported in May 1984 [2] were for analysis of lead, antimony, and barium utilizing a Varian flameless atomic absorption spectrophotometer (FAAS): 32% tested "positive"

TABLE 5—Location of entrance wound sites by sex of decedent.

Wound Site	Female	Male
head	25	112
chin	...	1
neck	1	1
mouth	2	1
abdomen	3	3
chest	10	41
undetermined	1	1
	42	160

  

SUMMARY				
	Female	%	Male	%
head area	28	67	115	72
abdomen	3	7	3	2
chest	10	24	41	26

with revolvers and 20% with pistols. If all .22-caliber revolvers and pistols are eliminated from the 227 cases reported, the percentages were higher: 39% tested "positive" with revolvers and 25% with pistols.

In the most recent analyses involving gunshot residue metals, a new Perkin-Elmer FAAS has been used, and we have employed a more rigorous dissolution of the hand swabs following a procedure developed at the FBI Laboratory.<sup>4</sup> The data obtained for the 397 suicide cases reveal 44% "positive" results for revolvers and 24% "positive" results for pistols. If all .22-caliber revolvers and pistols are removed from the data, the percentages are 50% "positive" for revolvers<sup>5</sup> and 29% "positive" for pistols.

Before one transfers these figures on suicide deaths with firearms to expected results with live suspects in shooting incidents, several things need to be pointed out. First, the data above for "positive" findings include a significant percentage of cases (25 to 30%) which reveal detectable, significant firearms discharge residues on the steadying hand rather than the firing hand only of the decedent. Secondly, suicide cases represent the best possible case for determination of firearms discharge residues. Other workers have pointed out that residues are easily removed from the hands of a shooter in a matter of only 2 to 3 h [3]. In early 1986, this writer test fired a .25-caliber Raven pistol, and the handwiping analysis yielded elevated lead, antimony, and barium on the back of the firing hand by FAAS. After washing, the same weapon was discharged twice and the writer performed normal office duties away from the laboratory. After 2 h, the hands were tested for metallic residues; the levels detected were not elevated but within normal limits.

Reference was made earlier to the question of how often the weapon used is found still clutched in the hand of the apparent suicide victim. The location of the weapon away from the body seems to be more bothersome for family members than for law enforcement officers. Since no information was found, a series of 212 suicide cases between November 1982 and January 1984 was studied using scene photographs. A total of 20% of the handguns and 11% of the long guns were still in the hand (hands) or resting on the hand (hands) of the decedent.

### Summary

Initial results of testing the barrel of suicide weapons for blood yielded an unexpectedly high frequency of "positive" findings. Subsequent testing of the procedure indicates that strict guidelines are needed if TMB reagent strips are used. The procedure employing TMG is more easily interpreted, is now in use, and the results are more reliable. About 48% of the weapons have detectable blood inside the barrel and 66% have detectable blood on the muzzle end of the weapon. The location of entrance wound sites for suicidal gunshot wounds was determined to be about three times more frequent in the head than to the chest; no significant difference was noted between male and female in this limited study. Firearm discharge metal analysis by FAAS reveals about 44% "positive" findings for revolvers and about 24% "positive" results for pistols. Examination of suicide scene photographs shows that the weapon is in or resting on the hand (hands) of the decedent 20% of the time with handguns and 11% of the time with long guns.

### References

- [1] MacPhail, John D., "Identification of Occult Blood," *Identification News*, Aug.-Sept. 1956, pp. 4-5.

<sup>4</sup>J. Kilty, personal communication, 1984.

<sup>5</sup>A "positive" finding for gunshot residues is defined by metallic levels at or above 1.0-ppm lead, 0.1-ppm antimony, and 0.5-ppm barium.

- [2] Stone, I. C., "Myths and Statistics Regarding Gunshot Residues on the Hands," *The Forensic Science Gazette, New Series*, Vol. 1, No. 2, May 1984, pp. 2-3.
- [3] Wolten, G. M., "Final Report on Particle Analysis for Gunshot Residue Detection," Aerospace Report No. ATR-77(7915)-3, Sept. 1977.

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