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Just Scan It!—Weapon Reconstruction in Computed Tomography on Historical and Current Swiss Military Guns

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Abstract: Cross-sectional imaging, such as computed tomography, has been increasingly implemented in both historic and recent postmortem forensic investigations. It aids in determining cause and manner of death as well as in correlating injuries to possible weapons. This study illuminates the feasibility of reconstructing guns in computed tomography and gives a distinct overview of historic and recent Swiss Army guns.

Key Words: virtopsy, swiss army guns, CT reconstruction, rifle, pistol

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Cross-sectional imaging of human bodies has been increasingly implemented in routine postmortem forensic investigations supporting or even replacing conventional autopsy.[1–6] With modern techniques, such as 3-dimensional imaging and surface scanning, correlations between injuries and possible weapons can be achieved.[7–9] Postmortem computed tomography (CT) has also been applied in several famous archaeological cases, aiding in the reconstruction of skeletal injuries with following derivation of possible weapons that might have caused them.[10,11] In current cases, reconstruction of gunshots in particular has found broad attention in literature.[12–14]

Changing the focus away from injuries toward weapons, this study (1) illuminates the possibilities of reconstructing guns in CT and (2) gives a distinct overview of historic and recent Swiss Army guns.

MATERIALS AND METHODS

Computed Tomography

Computed tomography was performed using a dual-source CT scanner (SOMATOM Flash Definition; Siemens Medical Solutions, Forchheim, Germany): tube voltage was 120 kVp, effective tube current-time product 760 mAs; slice thickness 0.6 mm; increment 0.3 mm, reconstructions in a hard kernel and extended CT scale. Primary image review and 3D reconstructions were performed both on a CT workstation (Leonardo; Siemens Medical Solutions) and on a PACS workstation (IDS7; Sectra AB, Linköping, Sweden). All shown CT images are sagittal reconstructions of the weapons in 7-mm slice thickness.

Swiss Army Weapons

Exemplary for the historic and current standard Swiss army rifles and pistols, a Swiss Karabiner Model 1931, a Sturmgewehr 57, a Sturmgewehr 90, a Parabellum 1906/29, a P49, and a P75 (all possession of the weapon bureau, city police Zurich) were scanned. Weapon handling, including loading and unloading, was safeguarded by the chief of the weapon bureau, city police Zurich.

RESULTS

(a) Handguns[15]

Parabellum 1906/29 (Pist Pat 03/7.65 Parabellum), Eidgenössische Waffenfabrik Bern, Switzerland (Fig. 1, A and B).

The Parabellum was one of the first semiautomatic pistols. It was used in the Swiss Army from approx. 1900 until 1949. Between 1900 and 1949, the pistol underwent several stages of development until completion in the model 1906/29.

The Parabellum 1906/29 works with a toggle-lock action, as opposed to the slide actions of almost every other semi-automatic pistols. It is magazine-fed (one-row magazine, 8 rounds) and has a security switch (2 settings: "S" = locked, no marking = disengaged). Additionally, it has a grip safety analogous to the M1911 system. It can be used in single action (SA) only.

After completion of military service, the Parabellum 1906/29 could be taken over into private possession by the soldier, free of charge. For this, the Parabellum 1906/29 was demilitarized by imprinting a "P" on the gun (on handle or trigger guard).

The military version of the Parabellum 1906/29 can be identified by a plain serial number, the demilitarized version shows the serial number together with the above mentioned additionally imprinted "P" on the gun. The civil version of this weapon exhibits a serial number starting with the letters "P".

The Parabellum 1906/29 was replaced by the Pistole 49.

Pistole 49 (P49; Pist Pat 41/9 mm Luger), SIG, Neuhausen, Switzerland (Fig. 1, C and D).

The P49 (equivalent to the SIG 210-2) was used in the Swiss army from approximately 1949 until 1975. Furthermore, it was used by several police corps of different Swiss cantons.

The P49 is a magazine-fed (one-row magazine, 8 rounds), short-recoil operated, locked-breech pistol (modified Browning/Petter system) with a security switch (2 settings: "S" = locked, "F" = disengaged). It can be used in SA only.

After completion of military service, the P49 could be taken over into private possession by the soldier, free of charge. For this, the P49 was demilitarized by imprinting a "P" on the gun (on handle or trigger guard).

The military version of the P49 can be identified by a serial number starting with an "A," the demilitarized version shows the military serial number together with the above mentioned additionally imprinted "P" on the gun. The civil version of this weapon exhibits a serial number starting with the letter "P."

Pistole 75 (P75) (Pist Pat 41/9 mm Luger), SIG, Neuhausen, Switzerland und SIG Sauer GmbH & Co. KG, Eckernförde, Germany (Fig. 1, E and F).

The P75 was/is produced both by SIG in Switzerland and by SIG Sauer in Germany. It was and is used worldwide, including by the Swiss army from approx. 1975 on until now.

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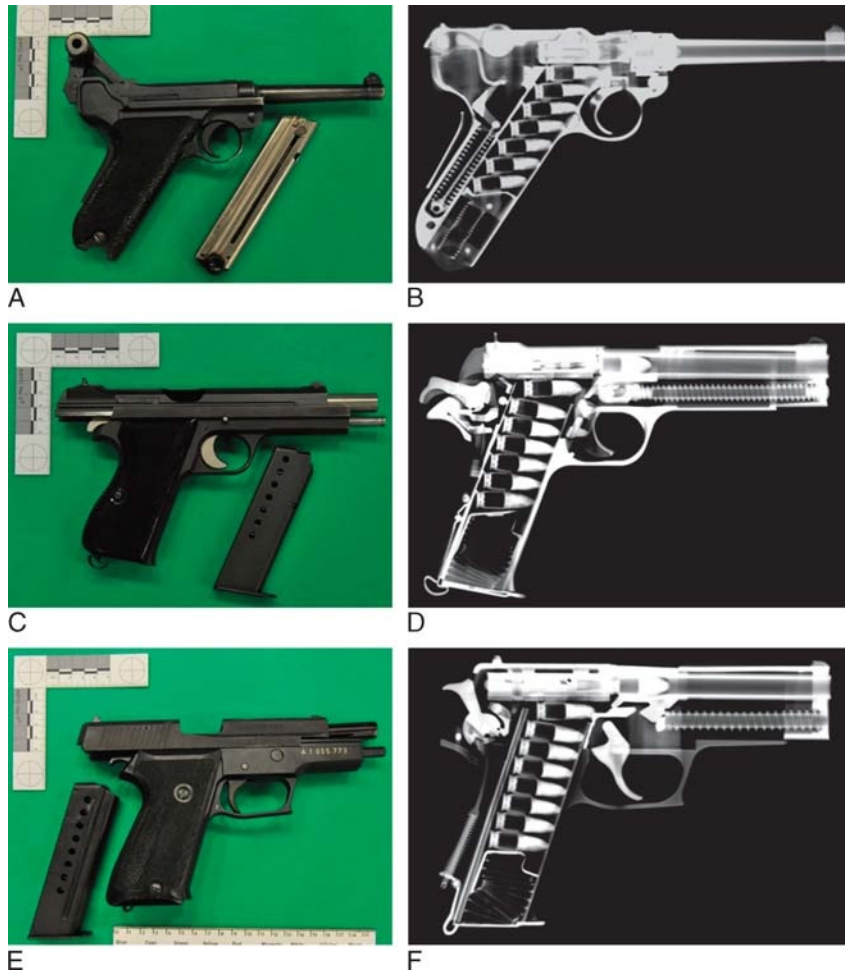

FIGURE 1. Pistols of the Swiss Army. A, Photography and (B) CT reconstruction of the Parabellum 1906/29. C, Photography and (D) CT reconstruction of the P49. E, Photography and (F) CT reconstruction of the P75.

The P75 is a magazine-fed (one row magazine, 9 rounds), short-recoil operated, locked-breech pistol (Browning/Petter/SIG system). It has a double action (first shot from uncocked hammer)/SA (after shots from cocked hammer) mechanism. Additionally, it possesses a decocking lever.

After completion of military service, the P 75 can be taken over into private possession by the soldier for 30 Swiss Franc (approx. 30 USD) and a Waffenerwerbsschein (weapon permit). For this, the P 75 was demilitarized by imprinting a "P" on the gun (on handle or trigger guard). The military version of the P 75 can be identified by a serial number starting with an "A", the demilitarized version shows the military serial number together with the above mentioned additionally imprinted "P" on the gun. The civil version of this weapon exhibits a serial number starting with the letters "G".

(b) Rifles[15,16]

Swiss Karabiner Model 1931 (K31) (GP11/7.5 x 55 Suisse), Eidgenössische Waffenfabrik Bern, Bern Switzerland (Fig. 2, A and B).

The K31 was the standard rifle of the Swiss army from approx. 1933 until approx. 1957. It is a magazine-fed (6-rounds, removable magazine), straight-pull bolt-action rifle (Schmidt-Rubin system).

After completion of military service, the K31 could be taken over into private possession by the soldier, free of charge. For this, the K31 would be demilitarized by imprinting a "P" on the barrel surface Laufband.

The military version of the K31 can be identified by a plain serial number, the demilitarized version shows a serial number together with the above mentioned additionally imprinted "P" and the civil version of this weapon exhibits a serial number starting with the letter "P".

In Switzerland, all versions of the K31 are allowed on civil shooting ranges.

The K31 was replaced by the Sturmgewehr 57.

Sturmgewehr 57 (Stgw57) (GP11/7.5 × 55 mm Swiss), Schweizerische Industrie-Gesellschaft (SIG), Neuhausen, Switzerland (Fig. 2, C and D).

The Sturmgewehr 57 (equivalent to the SG [Sturmgewehr/assault rifle] 510) was the standard army rifle of the Swiss army from approximately 1957 until the 1990s. It is a magazine-fed (24 rounds, removable magazine), recoil-operated weapon with roller locking system which can be adjusted to single shot or automatic fire via a fire selector switch with 3 settings ("S" = save/"E" = single shot/"M" = automatic fire). There is a charging indicator on top of the gun. Additionally, the Stgw57 possesses a fold-out winter trigger which allows shooting with gloves. Furthermore, it has an integrated bipod.

FIGURE 2. Rifles of the Swiss Army. A, Photography and (B) CT-reconstruction of the Karabiner 1931. C, Photography and (D) CT reconstruction of the Sturmgewehr 57. E, Photography and (F) CT reconstruction of the Sturmgewehr 90.

After completion of military service, the Stgw57 could be taken home into private possession free of charge by the soldier. For this, the Stgw57 would be demilitarized by removing and modifying the automatic fire function and imprinting a "P" on top of the upper receiver and on the left side of the lower receiver.

The military version of the Stgw57 can be identified by a serial number starting with an "A," the demilitarized version shows the military serial number together with the abovementioned additionally imprinted "P" on the gun. The civil version of this weapon exhibits a serial number starting with the letters "PE."

In Switzerland, all versions of the Stgw57 are allowed on the civil shooting range, but single fire only.

The Stgw57 was replaced by the Sturmgewehr 90.

S*turmgewehr 90 (Stgw90) (GP 90/5.56 × 45 mm), SIG, Neuhausen, Switzerland* (Fig. 2, E and F).

The Stgw90 (equivalent to the SG [Sturmgewehr/assault rifle] 550) is from approximately 1990 on up to today the standard rifle of the Swiss Army. It is a magazine-fed (20 rounds, removable magazine), gas-operated, selective-fire weapon. Its operation system is similar to that of the AK-47. The rifle is hammer-fired and has a trigger mechanism with an ambidextrous safety and fire selector switch with 4 settings ("S" = safe, "1"= single fire, "3" = three-round burst and "20" = automatic fire). There is also a winter trigger function which works by flapping the trigger guard to 1 side. It is fitted with a foldable stock and integrated bipod.

After completion of military service, the Stgw90 can be taken home into private possession for 100 Swiss Francs (approximately US $100) and a Waffenerwerbsschein (weapon permit) by the soldier. For this, the Stgw90 will be demilitarized by removing and modifying the automatic fire function and imprinting a "P" on the gun.

The military version of the Stgw90 can be identified by a serial number starting with an "A," the demilitarized version shows the military serial number together with the above mentioned additionally imprinted "P" on the left side of the upper receiver of the gun. The civil version of this weapon exhibits a serial number starting with the letters "PE."

In Switzerland, this gun, too, is very popular at civil shooting ranges (single fire only). In Canada, the semiautomatic variant of the 550, the Swiss Arms PE90, has been reclassified as a prohibited Weapon in spring 2014[17] due to the supposedly easy rebuilding into a fully automatic variant.

The Stgw90 is said to be one of the most precise assault rifles in the world.

DISCUSSION/CONCLUSION

The CT reconstruction of both rifles and handguns was successful. Additionally, a very clear visualization of the different component parts of the guns, including the loaded ammunition, was achieved. Pictorial representations of weapons as shown in this work provide a magnificent insight in technical details aiding in the understanding of their special mechanism of action. This is crucial for the teaching not only of professionals but also lay people interested in guns as a hobby. Understanding the mechanisms of a gun can hopefully contribute to a safer weapon handling.

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