



## Pathology Biology Section – 2003

### G82 Coins as Intermediate Targets: Reconstructive Analysis With Body Models

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The attendee will learn about intermediate targets and body models in wound ballistics.

**Introduction:** The phenomenon of intermediate targets is well known in wound ballistics. Intermediate targets are materials that receive some kinetic energy from the striking bullet. The result is that the intermediate target may be set into motion and become a secondary projectile. The injury analysis involving intermediate targets is often difficult. Therefore in forensic science, models are used to reconstruct injury patterns to answer questions regarding the dynamic formation of unusual injuries. In ballistic research glycerin soap and ordnance gelatin have been well established as soft-tissue substitutes. Recently, based on previous experiences with artificial bone, a skull-brain model was developed. The goal of this study is to create and analyze a model-supported reconstruction of a real forensic case with a coin as an intermediate target. A man with multiple bullet wounds was admitted to the hospital, where they found, by computed topography of the head, two foreign bodies. The man died several hours after admission to the hospital. At autopsy two foreign bodies in the brain were identified: a .380 caliber Winchester Silvertip bullet and a deformed, 1970, Mexican 50-centavo coin. There was no evidence of close-range firing and a through-and-through gunshot wound at the base of the left index finger suggesting that the bullet passed first through the hand, picking up the coin as secondary projectile before entering the head. Since it wasn't clear exactly how this unusual injury pattern came about, a reconstruction was attempted.

**Materials and Methods:** Gunshot experiments were made at the "Ballistic Missile Trauma Laboratory and Range" of the Armed Forces Medical Examiner at the Armed Forces Institute of Pathology, Washington D.C. For the first experimental set-up 10% gelatin blocks were used (size 36 x 15 x 15 cm) at 4° C. For the reconstruction of the ballistic process, a gelatin block with a thickness of 1.5 cm was used to represent the left index finger of the victim; a gelatin block of 0.5 cm was used to simulate the skin of the head. In some gelatin block experiments "Luan Plywood" with a thickness of 6 mm (Home Depot, USA) was used to simulate the bony skull, which was placed between the finger and skin simulants. For the second experimental the artificial skull-brain-model was used (Thali, et al. *Forensic Science International* 125 (2002) 178-189). The artificial skull is a layered polyurethane sphere 19 cm outside diameter and 6 mm thick) constructed in a specially designed form with a inner table, outer table and a porous diploe sandwiched in between. The brain itself is simulated with ordnance gelatin. Ammunition (Winchester 380 Automatic (85 GR) Silvertip Hollow point – muzzle velocity 1000 fps) similar to the real case was used. The bullets were fired by a Llama .380 pistol. As intermediate target 1970, 50centavo Mexican coins were used. The coin was positioned between the simulated finger and the body simulant.

First the authors fired directly into three gelatin blocks, then fired into two "finger-coin-gelatin-block"-models, then into five "finger-coinwood-gelatinblock"-models and finally into two skull-brain models. The gunshots were documented with a high-speed digital black and white camera PHANTOM V4.0 (Photo-Sonics, Burbank, CA) frame speed of up to 32,000 pictures per second. All gelatin blocks were examined by a digital mobile Carm unit Compat 7600 (OCE, Salt Lake City) at the Office of the Armed Forces Medical Examiner in Rockville, MD. The CT scans of the head models were done at the National Naval Medical Center in Bethesda, MD with a GE Light Speed multi-slice helical scanner (General Electric Medical Systems, Milwaukee, WI). Using this crosssectional modality 3D volumetric data was acquired which gave the possibility to do further post-processing with 3D virtual reconstructions (VoxelView, Vital Images, Inc., USA). After the radiological examination the gelatin blocks and the head models were dissected to analyze the bullets and the coin as an intermediate target.

**Results and Discussion:** With this model of an intermediate target simulation it was possible not only to demonstrate the "bullet-body (finger) interaction", but also to recreate the wound pattern found in the victim. It could be demonstrated that after the primary projectile has struck the simulation materials, that the bullet and the coin traveled through the tissue simulants.

This case demonstrates that using ballistic models and body-part substitutes can reproduce gunshot cases simply and economically, without conflicting with ethical guidelines.

Thus, model set ups with body-part substitutes, in many scenarios, are ideally suitable diagnostic aids for the purpose of solving reconstructive ballistic questions.



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Forensic Science, Ballistic, Intermediate Target