

# 3D Autopsy Documentation Using LiDAR Sensor in Smartphones

## Highlights

- The LiDAR (light detection and ranging) sensor in smartphones can be used to produce a realistic 3D reconstruction of corpses and injured organs.
- The measurement of lesions is accurate in 3D reconstructed models of corpses and the injured organs.

## Need for the study

- Traditional 2D images can lead to misinterpretation and distortion of autopsy findings.
- The latest 3D scanners and 3D computed tomography scans are expensive, time-consuming, and require photographic skills to produce 3D reconstructed images.
- An affordable, portable and reliable 3D image-producing device is needed for recording autopsies.

## What is a LiDAR Sensor?

- A remote sensing device that measures the distance between two points using an infrared light pulsed laser.
- The combination of LiDAR sensor and photographic data is used to produce 3D models of objects.
- It is available in some latest smartphones and tablets, including iPhones and iPads.

## Study design

**Subjects:** Ten corpses (Age: 22-74)

**Cause of death:** Gunshot, cardiovascular disease, traffic accident, and fire burn

**Device:** iPhone 12 Pro with LiDAR sensor and a conventional camera

**Software:** TRNIO (a mobile application to construct 3D models); MeshLab (a computer application to process 3D models and measure any length between two points)

## Expected outcomes

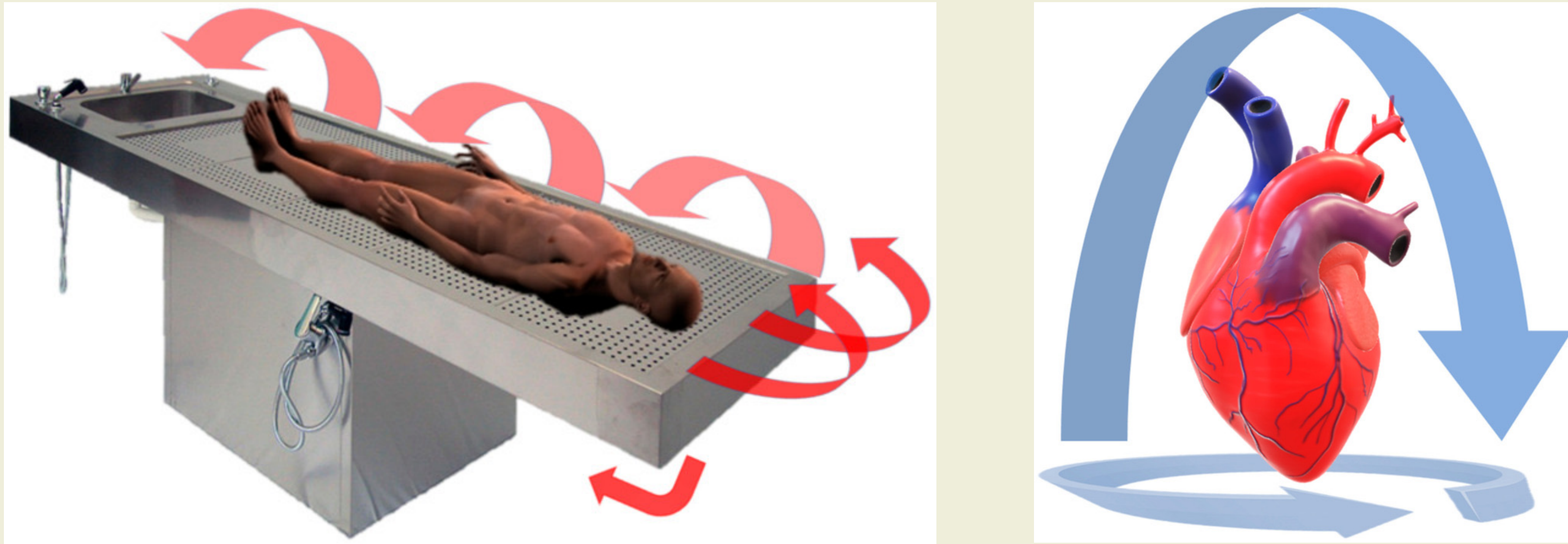
- Reliable recording of the corpse and wounds
- Better measurement of injuries

## What did the autopsy process include?

- Production of 2D images using a conventional camera and 3D models using an iPhone with a LiDAR sensor
- Comparison of 2D images and 3D reconstructed models by two forensic pathologists
- Comparison of lesion description and measurement between 2D images and 3D reconstructed models

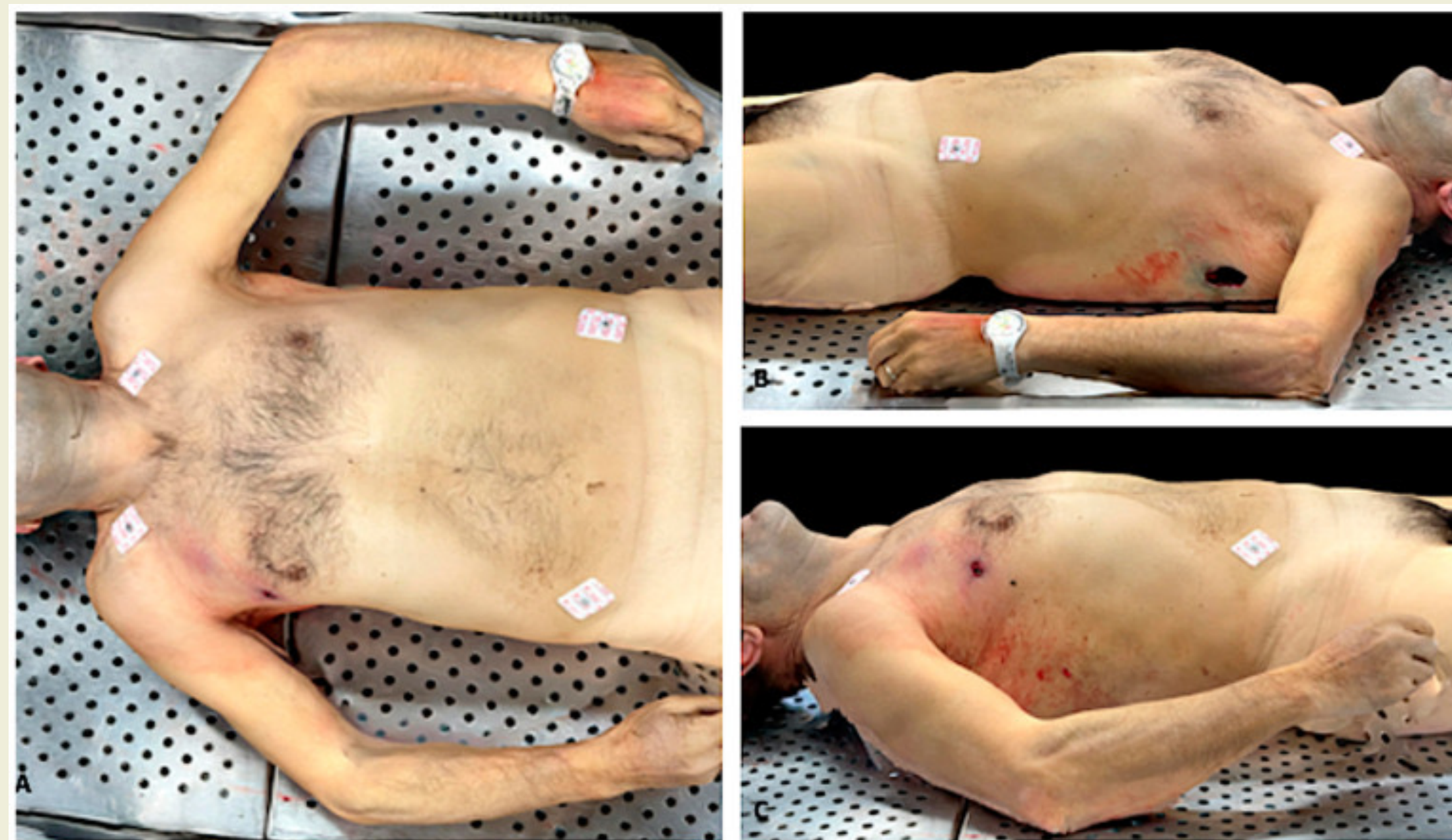
## Key findings

1. 3D models of the entire corpse and heart were reconstructed using a LiDAR sensor (Figure 1). The body was scanned within 60 to 120 seconds, and 3D reconstruction of the body took five to ten minutes.



**Figure 1.** 3D reconstructed models of a corpse and a heart. The arrows indicate the direction of the scan using the smartphone (Maiese A et al.).

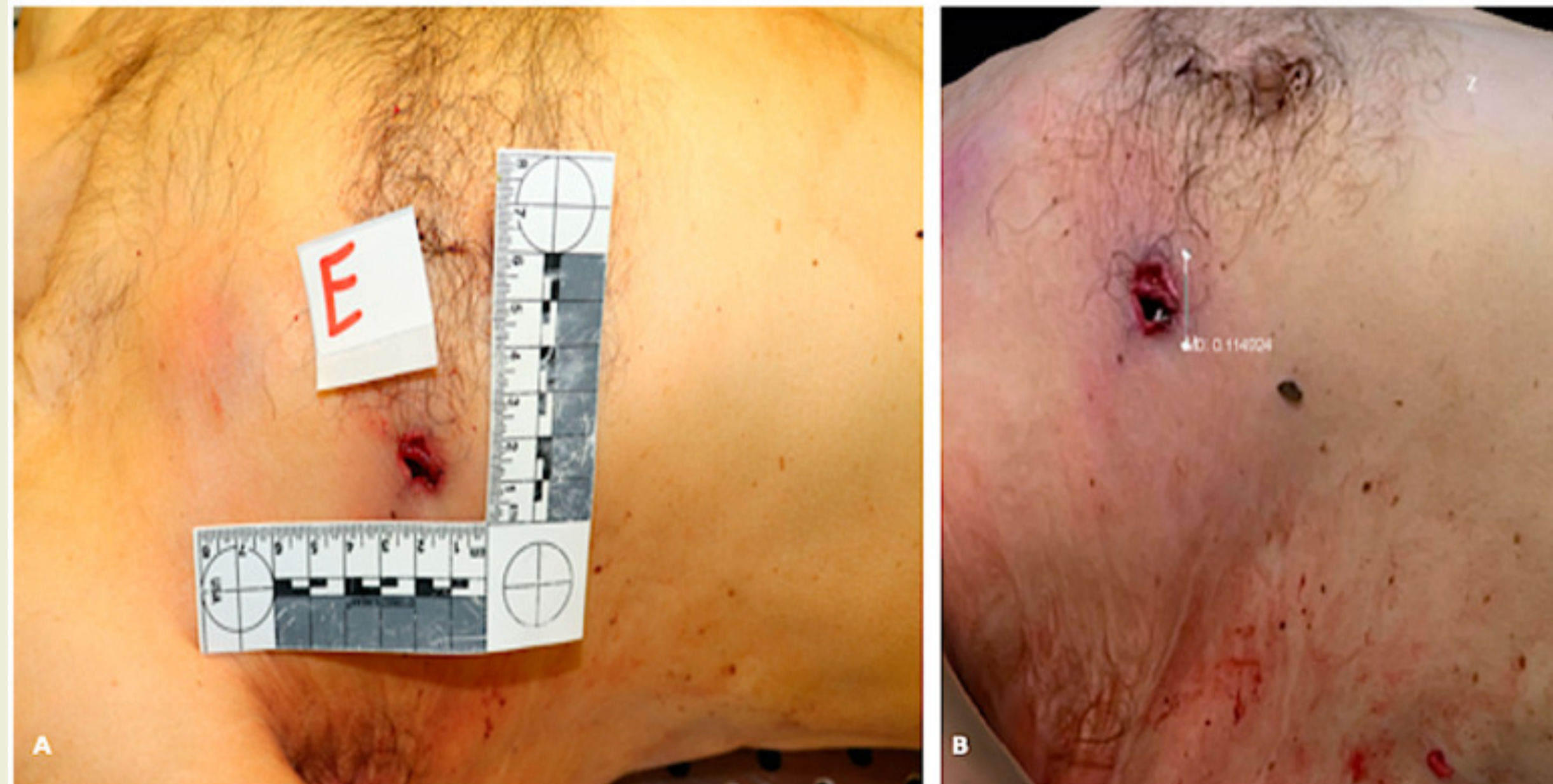
2. 3D models were accurate and realistic with accurate color rendering (Figure 2).



**Figure 2.** A realistic 3D reconstructed model of a corpse with gunshot wounds on both sides of the trunk (Maiese A et al.).

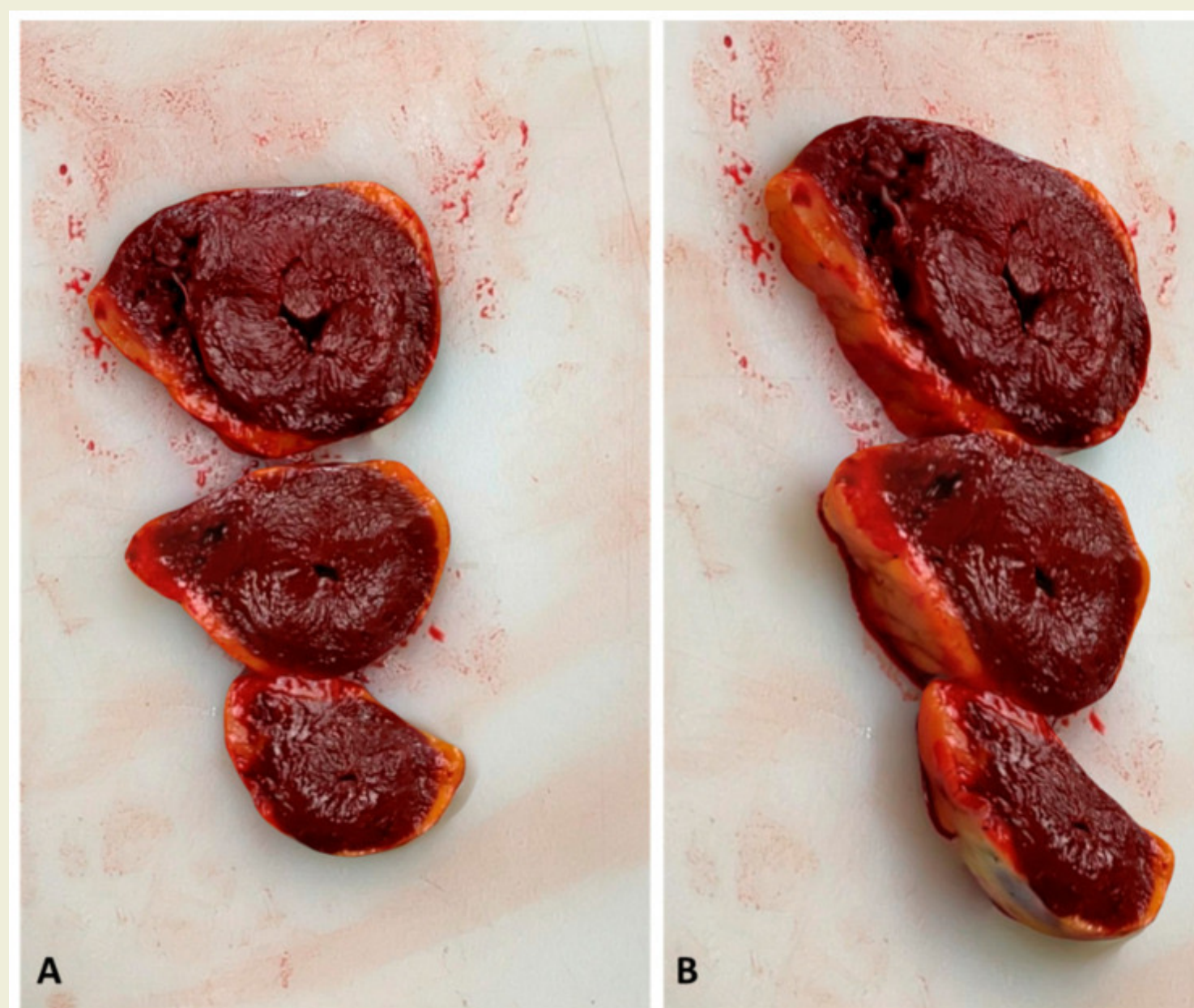
## Key findings

- Measurement of lesions was more trustworthy and accurate in 3D models than in the distorted 2D images (Figure 3).



**Figure 3.** A comparison of wound measurement between a 2D image (left) and a 3D model (right). (Maiese A et al.)

- 3D reconstructions helped the forensic pathologists determine the coronary artery diameter and measure the percentage of lumen obstruction
- 3D reconstructions of heart slides were easy to review the left ventricular hypertrophy (Figure 4).



**Figure 4.** 3D reconstructed model of heart slides. (Maiese A et al.)

## Key findings

- The depth and patterns of lesions were evaluated in a 3D reconstructed burned body (Figure 5). Measuring the depth of the lesions is not possible with the 2D images.



**Figure 5.** A comparison of wound measurement between 2D image (left) and 3D model (right)  
(Maiese A et al.)

## Key takeaways

- The LiDAR sensor helped forensic pathologists reconstruct a 3D model of an entire body within 5-10 minutes.
- 3D reconstructed models were accurate and easier to measure the parameters of the lesions than the conventional 2D images.

## Conclusion

The study demonstrated that the LiDAR sensor in smartphones can produce accurate and reliable 3D models of corpses and wounds. In addition, the measurement of the lesions and injured organs were more accurate in the 3D models than the conventional 2D images.

## Reference

Maiese A, Manetti AC, Ciallella C, et al. The introduction of a new diagnostic tool in forensic pathology: LiDAR sensor for 3D autopsy documentation. Biosensors. 2022 Feb; 12(2):132.