



How was the Turin Shroud Man crucified?



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ARTICLE INFO

Keywords:

Turin Shroud Man
Crucifixion technique
Nailing
Causalgia
Cause of death

ABSTRACT

As the literature is not exhaustive with reference to the way the Turin Shroud (TS) Man was crucified, and it is not easy to draw significant information from only a “photograph” of a man on a linen sheet, this study tries to add some detail on this issue based on both image processing of high resolution photos of the TS and on experimental tests on arms and legs of human cadavers.

With regard to the TS Man hands, a first hypothesis states that the left hand of the TS Man was nailed twice at two different anatomical sites: the midcarpal joint medially to the pisiform between the lunate/pyramidal and capitate/uncinate bones (Destot's space) and the radiocarpal joint between the radio, lunate and scaphoid; also the right hand would have been nailed twice. A second hypothesis, preferred by the authors, states that the hands were nailed only once in the Destot's space with partial lesion of the ulnar nerve and flexion of the metacarpophalangeal joint of the thumbs.

With regard to the TS Man feet, the imprint of the sole of the right foot leads to the conclusion that TS Man suffered a dislocation at the ankle just before the nailing. The entrance hole of the nail on the right foot is a few inches from the ankle, and excludes a double nailing. The nail has been driven between the tarsal bones.

The TS Man suffered the following tortures during crucifixion: a very serious and widespread causalgia due to total paralysis of the upper right limb (paradoxical causalgia); a nailing of the left wrist with damage to the ulnar nerve; a similar nailing of the right wrist; and a nailing to both feet using one only nail that injured the plantaris medialis nerves.

The respiratory limitation was probably not sufficient to cause death by asphyxiation. Also considering the hypovolemia produced by scourging and the many other tortures detectable on the TS, the principal cause of death can be attributed to a myocardial infarction.

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Introduction

For more than a century the mode of crucifixion of the Turin Shroud (TS) Man has been studied [1], but no reliable conclusions have yet been reached because it is not easy to draw significant information from only one “photograph” of a man on a linen sheet, with many peculiar bloodstains coherent with a human body. Little historical information is available about the means of crucifixion in

the Roman period and limited studies involved direct experiments on cadavers [2,3]. Barbet made studies on crucified cadavers more than half a century ago [2]. More recently, many researchers have investigated aspects of the TS; for example, the forensic pathologist, Zugibe [3] studied many cadavers. Nevertheless, none of the researchers has conducted direct experiments on cadavers or parts of them to study nailing procedures.

The Archbishop of Bologna, Paleotto, who accompanied St. Charles Borromeo over the Alps to Turin in 1598, was the first to note that wounds appeared to be in the wrists and not in the middle of the hand [4]. The iron nails were then mainly considered to have been driven between the radius and the carpus or between the two rows of carpal bones [5,6] either proximal to or through the strong band-like flexor retinaculum and the various intercarpal ligaments [7]. Barbet performed some experiments on amputated limbs and

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argued that nailing took place through the so-called Destot's space, between the lunate/pyramidal and capitate/uncinate bones on the ulnar side of the wrist. He also reported movement in opposition and slight flexion of the thumb, after nailing, and ascribed this phenomenon to injury of the median nerve [5].

However, it was contested that a lesion of the median nerve at the wrist is not compatible with the nailing in the Destot's space, because its course is away from the radial side [3]. So, in the authors' opinion, the absence of fingerprint of the thumb needs another explanation.

According to the preferred nailing practice by the Romans [8], the TS Man had his feet touching each other, the left on the right, fastened with a single nail on the cross, without suppedaneum, passing between the metatarsal bones [2,9].

Caselli [10] identified two nail wounds on the right foot, "one in its true place on the metatarsal bones, the other on the heel", and attributed the second wound to displacement of the TS Man caused by arrangement of the body on the anointing stone, which is the bench for burial preparation. In the authors' opinion, the bloodstain on the heel is due to a blood leakage from the nail imprint "on the metatarsal bones". The heel is not completely visible on the TS because the TS was not in contact with the entire foot.

Specific analyses have been conducted on the trickles of blood on the upper limbs. Fasola [11] attributed the divergence of the blood flow from the wrist wound to a slight rotation of the arm. Ricci [12] suggested that the divergence of the blood flow was due to the variable position of the arms on the cross that allowed the TS Man to breathe. Massey [13] determined the position of the arms on the cross deriving it from the corner of the trickles of blood on his forearms with the axis of the respective arms. In the authors' opinion, these trickles formed when the arms were moved after unnailling.

Zugibe [3] proposed that the body of the TS Man was washed before it was buried to remove the "mask of blood", which he would have had after the cruel scourging (more than 370 wounds by the scourge [14]). Conversely, the postmortem blood on the TS Man (spilled from the chest after the spear, from the head after removal of the crown of thorns, and from the wrist and feet after unnailling) was not supposed to be removed because according to Jewish custom it was forbidden to touch postmortem blood as it would make the person "impure" [3]. The authors share this opinion.

In a recent publication [15] the authors proposed that the TS Man could have suffered a violent trauma to the right side of the neck, chest and shoulder, causing an underglenoidal dislocation of the humerus, with injury of the entire brachial plexus, right flattened hand and enophthalmos. The blunt chest trauma, which resulted in the body falling forward, was also a direct cause of a lung contusion and haemothorax. A sign of this chest trauma, which was probably caused by the cross falling on the body, can perhaps be seen on the dorsal TS body image as the two darker areas beneath the shoulders.

The aim of the present study was to provide further hypotheses about the possible anatomical sites of nailing of the TS Man, through a renewed analysis of the TS bloodstains and experimental procedures of nailing on cadavers. The following questions were considered: How many nails were used on the hands and feet, and where? What is the meaning of the trickles of blood on the forearms and feet? What is the most likely posture of the TS Man? What are the possible clinical consequences of such a nailing?

Materials and methods

TS analysis

Various high-resolution images of the TS, taken by G. Enrie, G.B. Judica Cordiglia, G. Durante and Haltadefinizione, were analysed after proper image processing with reference to posture of the four

limbs and their segments, and particular consideration given to feet, hands and fingers. Another evaluation specifically involved the bloodstains, assessing their orientation with respect to the upper limb axis.

Experimental procedures on limbs

Analyses were performed on three right upper limbs resected from cadavers at the shoulder, and on another anatomic specimen consisting of the trunk and both inferior limbs. The donors gave specific consent. Cadavers were managed by the Body Donation Programme of the Section of Human Anatomy of the Department of Molecular Medicine of the University of Padua. In 2011, the Body Donation Programme achieved certification by an accredited third-party registrar (Certiquality Srl[®], Quality Certification Body, Milan, Italy), which audited the quality management system and certified that the Body Donation Programme of the University of Padova met EN ISO 9001:2008 criteria [16]. The use of cadavers for medical training and scientific research is performed according to European, National and Regional normative references [17,18].

The experimental procedures performed were as follows.

The upper limbs were nailed in the following points:

- radiocarpic joint between the radio, lunate and scaphoid;
- midcarpal joint line between the scaphoid/lunate and trapezoid/capitate;
- midcarpal joint medially to the pisiform between the lunate/pyramidal and capitate/uncinate (Destot's space).

With regard to the inferior limbs, the following procedures were performed:

- dislocation of the right ankle joint, through increasing weights applied with a rope to the ankle (this tension technique of the limbs with ropes was usual in the crucifixion [19]);
- nailing of the right foot between the 1st and 2nd metatarsal bone, with a 10 cm-long nail;
- nailing of the left foot between the scaphoid and cuboid, proximally, and third cuneiform, distally, with a 25 cm-long nail;
- further nailing of the right foot, with the long nail passing through the left one, at the level of the right tibiotarsal joint.

The points of entrance were identified under radioscopic control (OEC C-Arms, 9600; GE medical system) with the help of small lead semi-spheres. Nailing of feet was performed on a wooden plank. CT axial scans (Philips Brilliance iCT, Philips Medical Systems; Best, The Netherlands) of the specimens were acquired. Analysis and post-processing of the CT scans were carried out on an Aquarius Workstation (version 3.6.2.3; TeraRecon, San Mateo, California). Source images and 2D-3D reconstructions were reviewed at the workstation. Specific anatomical dissections were then performed to confirm the CT findings and to verify the condition of vessels and nerves.

Results

TS analysis

Right hand

The posture of the right hand is compatible with a flat paralytic hand.

- The hand is slightly flexed towards the ulna, as normal, not contracted (the angle between a line drawn between the 3rd and 4th metacarpus and a line coaxial to the forearm is $15^\circ \pm 3^\circ$) (Fig. 1).

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