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Dates: Received: 17 April, 2017; **Accepted:** 18 May, 2017; **Published:** 19 May, 2017

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Keywords: Turin Shroud Man; Cross; Humerus dislocation; Crucifixion technique; Causalgia; Cause of death

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Review article

New Light on the Sufferings and the Burial of the Turin Shroud Man

Abstract

This paper presents news concerning the transportation of the whole cross on the shoulders and the falling mode of the Turin Shroud (TS) Man on the ground that explains the detected traumas. These news base themselves on the hypothesis that the TS Man is Jesus of Nazareth.

Based on historical information and on a structural analysis, after a reconstruction of the Roman "Tau" cross, a life-size sample of it has been built in order to study its compatibility with some traumas visible on the TS.

Also discussed are the medical implications caused by a violent blunt trauma from behind, to the neck, chest and right shoulder including the etio-pathogenesis of the head posture of Jesus on the cross represented in traditional iconography. Finally, additional news is included regarding bloodstains like the "blood belt", the "mattress" of spices and the sudarium used as chin bandage.

Introduction

The TS is a peculiar fabric not easy to study. However, after properly detailed analysis shows many interesting data, while still hiding many secrets. For example, up to now science has not been able to explain how the body image formed [1].

The TS (Figure 1) is a linen sheet 4.4 m long and 1.1 m wide that once enveloped the corpse of a scourged, thorn-crowned, and crucified man stabbed in the side by a sharp object compatible with a lance [2-5]. Many other marks are visible on the TS like those caused by blood, fire, water, and creases that partially obscure the double, front and back, body images, causing medical analysis to be difficult.

Many believe the TS is the burial cloth in which Jesus Christ was wrapped. On the other hand, others still think that it is a fake, referencing the 1988 radiocarbon result that debatably declared it Medieval. More recent studies in fact demonstrated that it is compatible with the age in which Jesus lived in Palestine [6,7].

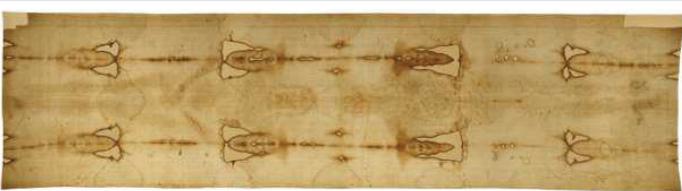


Figure 1: Turin Shroud, 2002 photo by G. Durante (© Arcidiocesi di Torino).

After recent studies [8-10], confirming the many correspondences between the new findings of the TS and what is described in the Holy Bible, the authors base the following discussion on the hypothesis that the TS Man is Jesus of Nazareth. Therefore from this point onwards they will rename Jesus the TS Man.

This paper specifically highlights the correlation between Jesus and the sufferings inflicted to Him, crucifixion included, after looking at His posture blocked by an evident rigor mortis, coherent with a death on a cross [6] and by the wounds both on the wrists and on the feet that are coherent with a nailing.

A first paper [8], addressed to evidence the sufferings imposed on Jesus, found an underglenoidal, right humerus, dislocation produced by a trauma suffered during the carrying the cross to Calvary. It caused injury to the Entire Brachial Plexus, which explains the lowering of the right shoulder, the enophthalmos and the right hand flat posture with stretched fingers II, III, IV and V. The fall and/or the scourging caused pulmonary contusion with hemothorax and, likely, cardiac contusion and then myocardial infarction and heart rupture.

A second paper [9], reports that a hole was made in the wrists by the nail put in the Destot's space with ulnar nerve injury. It also adds that the Jesus suffered probably an ankle dislocation during nailing showing that the two feet were been nailed together, in agreement with the Latin Church.

A third paper [10], indicates that the most likely immediate cause of Jesus' death was myocardial infarction complicated by heart rupture with hemopericardium in a subject crucified with the nailing of hands and feet; severe emotional stress and depression; severe hypovolemic-traumatic shock, acute respiratory failure at a first stage by crucifixion and causalgia; blunt trauma following the fall with paralysis of the entire right brachial plexus, right shoulder dislocation, pulmonary contusion with hemothorax, cardiac contusion; probable left ulnar proximal paralysis and right foot dislocation from stretching during crucifixion.

Only a man sustained by a faith in his mission, conscious of his martyrdom, though young and strong, could bear such a massacre with a deep and absolute peace of mind!

Results of the Investigation

Starting from the most probable model of the cross detected by the authors, from experimental tests performed on a man carrying this model of cross, and experiments made on parts of cadavers, this paper sheds light on ten points about the medical effects of the violent trauma suffered by Jesus and other topics related His sufferings and burial.

Model of the "tau-shaped" cross

Different from the hypothesis of some scholars who supposed that the Jesus only carried the horizontal beam of the cross, the *patibulum* [11,12], for various reasons the authors agree with [13], who demonstrated, also with experimental results, that Jesus carried the whole cross on his shoulders, along the way to the Calvary. This conclusion is also in agreement with the Christian iconography that shows Jesus Christ carrying a whole cross likened to the letter "T", the Greek letter tau (as reported in the Epistle of Barnabas, 70-132 A.D.).

The main structure of the cross consists in the *stipes* (vertical beam) and in the *patibulum* (horizontal beam) joined together by nails. The *crux sublimis* that was taller than the *crux humilis* is preferred. The "Tau-shaped" cross (*crux commissa* instead of the *crux immissa* or Latin cross in which the vertical beam sticks above the crossbeam) proposed by [14] and painted by Giotto at Scrovegni's Chapel in Padua (Figure 2) are therefore taken as reference. The following reasons justify the conclusion.

1. The crucifixion for Jesus Christ was required by the Jews and the high priests of the Sanhedrin could not allow Jesus to hang on a *stipes* already fixed on the Golgotha used for previous crucifixions because it was stained with impure blood and thus untouchable.
2. Jesus, therefore, would have had to carry the whole cross already assembled which would have required a simpler procedure on the Calvary.
3. As it will be shown on the next Section, the abrasions on the shoulders of Jesus are consistent with injuries from falls while carrying the whole cross, not with the *patibulum* alone.

The *stipes* could have about the following minimum sizes: 15 cm x 10 cm, 3.0 m long (man's height 1.7 m, plus 0.8 m that is his height from the ground, plus 0.5 m for the hollow in the soil); the *patibulum* could have the following sizes: 15 cm x 5 cm, 1.8 m long.

The structural stability of the cross, that had to bear various shocks like those due to a sudden falling, was probably obtained, after connection of the *stipes* (vertical beam) with the *patibulum* (horizontal beam), by nailing the two crossbeams inclined of about 45° of figure 2.

Sometimes a *suppedaneum* was used in correspondence of the feet to relieve the torture, but this seems not to be the case of Jesus because his feet are much too rotated forward, over the limits of ankle dislocation.

The hypothetical horizontal rod at the basis of the *crux* is an instrument foreseen to extract the cross from the soil. It can be removed and replaced when necessary. It is also reported that the *titulus crucis* was hanged to the convict neck during the cross transportation. Over the *patibulum*, the *titulus crucis* was hanged using a thin supporting rod; the total mass of such a cross made of wood (probably walnut or olive wood) was 65 ± 15 kg also considering the iron used to finish it.

Two iron rings are finally supposed at the *patibulum* extremities in order to make more simple the hoisting procedure of the cross over the soil using cords.

Bearing the cross

A life-size model of a cross has been built in accordance with the sizes reported in Section 2. It was built using cardboard, reinforced at the corners by plastic L-profiles; the

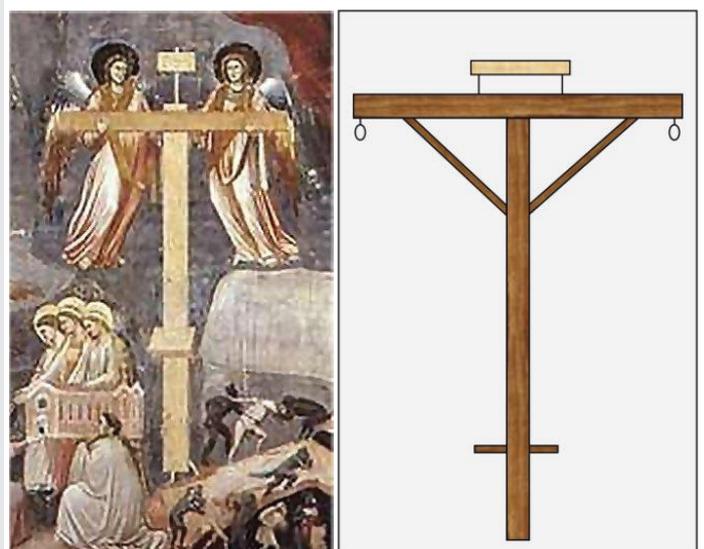


Figure 2: Probable scheme of the cross used for the TS Man. On the left a "T-shaped" cross (*crux commissa*) painted by Giotto at Cappella degli Scrovegni in Padua, Italy. On the right the most probable model of cross proposed by the authors: the horizontal beam (*patibulum*) is nailed to the vertical one (*stipes*) and the structure is reinforced by means of two transversal crossbeams to prevent breaking during a possible fall with the convict. The lower horizontal rod is foreseen to extract the cross from the soil; the two iron rings posed at the extremities of the *patibulum* were used to hoist the *crux*.

result is shown in figure 3. As the first author is 169 cm tall and Jesus resulted [5], 175 ± 2 cm tall, he offered himself for the experiments.

The high-contrast TS dorsal body image seems to show four darker reddish areas in correspondence of the shoulders that could have been a heavy and harsh object rubbing on the Jesus skin. Figure 3 shows these areas that also present the scourge marks as more enlarged and less defined than in other zones of the body image; this is coherent with the chafe with relative high pressure on a previous wound.

In reference to the experiments regarding a convict carrying a cross, many positions have been studied; the most probable seems to be that reported in figure 3 where the insertion of one convict's arm in one of the two triangles made by *patibulum*, *stipes* and crossbeam is visible. The cross therefore loaded one convict shoulder in two typical areas that can also be detected on the TS dorsal: image area n. 1 with n. 2 and n. 3 with n. 4. Probable dynamics regarding the facts of the cross's transportation and falling can be reported as follows, see figure 4.

It can be supposed that Jesus had first used his right shoulder to bring the cross. The abrasions in question are consistent with injuries caused by carrying the cross on the shoulders. The contact areas of the cross on the shoulder have been experimentally verified in the same figure 3.

The authors suppose that during a falling a shock could have been produced on the right end of the *patibulum* against the ground, perhaps a stone; the right shoulder and arm fast slipped from the conjunction of the *patibulum* with the *stipes* to the angle formed by the *patibulum* and the crossbeam of the cross and it was therefore blocked in the corner, inert. During the Jesus's falling, his right arm remained entangled in the triangle of the cross and after a rebound of it the right arm was therefore raised over its limit. The relatively high mass of the cross therefore dragged the humerus forward and downward and produced the right shoulder dislocation.

In the authors' hypothesis, the *patibulum* with all his mass swooped to the left of the body, violently beating on the base of the neck, posteriorly, thus strongly traumatizing muscles and nerves of shoulder and neck, and tearing the cervical nerve

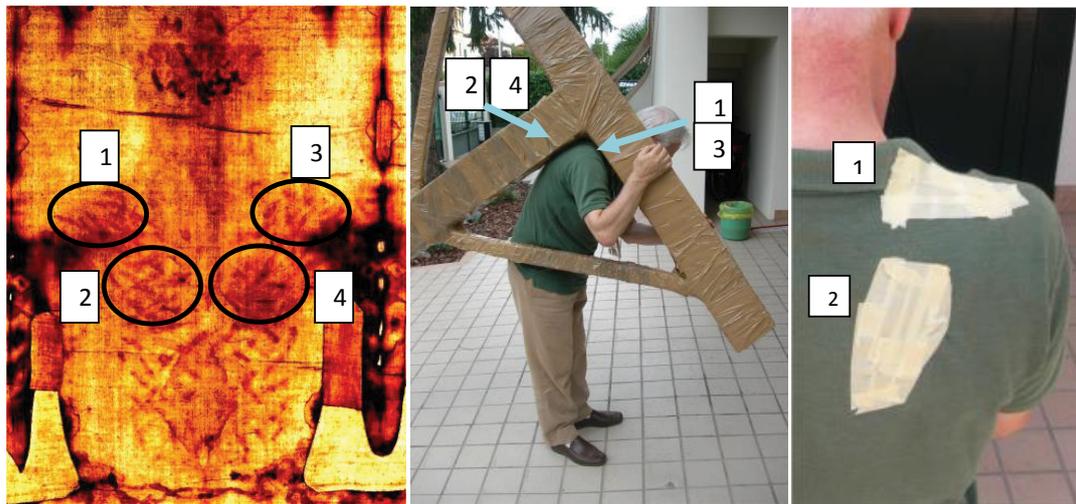


Figure 3: On the left, high-contrast upper dorsal image of the TS. Areas n.1+2 and 3+4 respectively corresponds to the bruises caused by the cross brought on the right and left shoulder. On the center experiments while carrying a cardboard model of the cross in which it is shown that the *patibulum* touches areas n.1 and n.3 while *stipes* touches areas n.2 and n.4. On the right, experimental contact areas of the cross that correspond to the TS image.



Figure 4: Simulated falling during cross transportation. From the left to the right, the convict carries his cross producing a pressure in areas n. 1 to 4 of Figure 3; during a fall the *patibulum* strikes the ground making the convict shoulder to slide forward to the connection between *patibulum* and transversal rod; the right arm entangled in the cross is dislocated by it.

roots. The pain was extreme and Jesus completely lost the function of his right limb. When the soldiers raised the cross to compel Him to proceed to the crucifixion place, they also wildly pulled down his arm causing a complete underglenoidal dislocation, as it is reported in [8].

As the right humerus was dislocated, Jesus was not able to carry the cross using this arm and probably the Roman soldiers forced him to use the left arm. This would explain the presence of areas n. 3 and n. 4 on TS.

To sustain this thesis we seem to see that area n.1 and area n. 4 are better defined in TS images, making to think to a higher pressure acting on them. Area n.1 being better defined than area n.2 implies a more straight posture while area n.4 better defined than area n. 3 implies a more curved posture due to the increasing difficulty to proceed for the TS Man. For the right humerus dislocation, at a certain time the Roman soldiers were forced to command another man (Simon from Cyrene, (Luke: 23,26, Marc: 15,21) to carry his cross.

Wrist nailing

In agreement with the Old [Es 12,46] and New Testament, [John 19,36], the nail did not cause any bone fracture; this is confirmed from a study of the posture of the TS Man.

The authors [9] report that the radio-carpic nailing, between radio, scaphoid and lunate produces a deviation of the flexor pollicis longus tendon with retraction of the thumb last phalanx and a marginal lesion of the median nerve that would cause contraction of the thumb flexor brevis and opponent muscles and then thumb retraction.

But supposedly the entry hole of the nail on the TS is from the ulnar side, between the first and second row of the carpal bones, between lunate/pyramidal and capitate/uncinate, the so-called Destot space, not far from the median nerve and away from the flexor pollicis longus tendon. Instead, perhaps due to the elevated tension applied to the hand, during the suspension on the cross, the exit hole of the nail appears on the TS in correspondence of carpal-metacarpal joint.

The thumb retraction was obtained by P. Barbet [15], by nailing in the center of the main skin fold (the middle) causing a partial laceration of the median nerve in the ulnar side, likely saving the fibers that innervate the thumb muscles. B. Lussiez [16], by nailing the same site, found a median nerve deviation to the radial side. According to the Authors, a partial injury of the ulnar nerve with sparing of the most lateral fibers that innervate the flexor hallucis brevis and adductor thumb muscles could explain the thumb retraction.

So, there are various possibilities of nailing without bone fractures, that equally cause thumb retraction. According to [9], the more likely nailing in the TS Man case was in the Destot space: the lesion of the ulnar artery could explain also the post mortem bleeding on the left wrist and forearms, due to unnauling, while the procedures performed by Barbet and Lussiez do not explain the bleeding because in these sites there are few vessels.

Coupled with the preferred hypothesis of a single nailing there is a second, more remote, possibility that Jesus suffered a double nailing in the wrist with a single nail: first on the radial side and then, abandoned this nailing (perhaps due to the inability to do penetrate the nail into the hole preformed on the *patibulum*), a second nailing in the Destot space.

Feet nailing

Experimental tests showed that the right foot, with the knee slightly flexed as the TS shows, does not rest entirely on the support plane, but there is a room of about 5 cm, at fingers' level, from the sole of the feet and the table. The right sole of the foot on the TS is clearly imprinted but blurred towards the fingers thus leading to suppose that there was a distance of some centimeters between fingers and sheet. Of the left foot, only the heel is visible because the foot is rotated and superimposed to the right one.

We can thus deduce an important fact: the nailing of the right foot caused or accentuated a previous ankle dislocation [9]. Therefore the right foot of Jesus was probably dislocated. This fact is easy to be supposed because Jesus was enveloped into the TS without a tight wrapping [17]. If the right foot had not been dislocated, it would not be tilted forward of more than 30° with respect to a plane perpendicular to the leg, but in this case the part of TS resting on the tombstone would have been too distant from the fingers of the right foot and would not be impressed by them.

The authors confirm the preferred hypothesis reported in [9], that is, a single nail used to fix both the feet together, driven among tarsal bones (probably between the scaphoid and cuboid, proximally, and the third cuneiform, distally), not in the metatarsal bones because the blood stain on the heel of the right foot is likely coming from the hole, identifiable in the center of the foot that is at the about 42% of the length of the foot starting from the heel. This hypothesis would be in agreement with the Latin Church, but not in agreement with the Orthodox Church that refers to two nails used for the feet of Jesus.

In the experiments on human body from the pelvis to the feet [9], to fix the right foot on the table, we first used a 10 cm-long nail passing at the bases between the 1st and 2nd metatarsal bones in order to make a hole easy to find in the second phase. After removing this nail a 25 cm-long nail was used to pierce the tarsal bones of the left foot. After this the two feet were nailed together.

In this way in agreement with the Catholic Church only three nails were used to crucify Jesus Christ (two in the wrists and one in the feet), but also in agreement with the Orthodox Church and with the double nailing practiced in the experiment of [9], two different nailing phases were performed for the feet. In this view the TS both confirms what is reported by the Churches and, more importantly, joins and explains their different convincement.

This experiment provide two information useful for the TS understanding: a) the right foot, with the knee slightly flexed

as we see on the TS, must have been probably dislocated by the crucifiers with violent jerks; b) the TS had been gently put down on the Jesus Body but it was not tied around as Egyptians made with mummies.

Head position

Jesus was in a state of rigor mortis soon after death; the rigor was particularly evident also because of his violent death. This has already been demonstrated in various papers as in [18]. It must be remembered here that the rigor was not coherent with a supine body, but with a man crucified in a vertical position with his head bent forward [5], caught between the shoulders remained in raised position even after the rigor in his arms was broken to bring them down [19].

Although not easy to detect, on the TS one can spot a slight rotation of the head to the right. The iconographic tradition depicts Jesus Christ on the cross with his head bent forward, but turned to the right and this likely originated from direct testimony. This posture of the head can be explained by the consequences of the fall of Jesus, which has led to a paralysis of the posterior muscles of the neck saving the sternocleidomastoideus and so with a posture similar to a person with wryneck.

The difference between artistic representations of Jesus and the imprint on the TS can be explained by considering that the head has been straightened during the positioning of the body before being placed under the TS. This operation was quite easy, despite the rigor mortis, since the right of the neck muscles were largely paralyzed.

Tortures of the crown of thorns

Many bloodstains visible on the TS can be easily related to a crown of thorns (as supposed by the authors or, according others [20], to a helmet of thorns). While these thorns are commonly related to the *Euphorbia milii* (*Spina Christi*), prof. Avinoam Danin of Hebrew University of Jerusalem stated [21], that this plant is not present in the Jerusalem surroundings. He instead proposed the *Rhamnus Lycioides* as the most probable plant used to build the crown of thorns for Jesus.

In addition to the causalgia produced by these thorns piercing the many nerves present around the head, it's interesting to observe that the red tips of these thorns is made by urticant substances that increase the pain produced in the skin.

Experimental results of a man carrying the cross evidenced another fact: if there is a thorn crown (or helmet) around the head, it is very easy that the *patibulum* bumped against the crown thus producing additional pain to the cross bearer.

After death cleansing

The Jesus face became a mask of blood, also because of the bleedings produced by the crown (or helmet) of thorns and the various injuries inflicted, mixed with dirty of sweat, saliva and soil after the falls. In addition, a lot dirty material was probably thrown by the crowd during his way to the Calvary. It is

therefore easy to think that such a human body could not have been buried with all its dirty without a minimum cleansing.

In agreement with [9,20], it was supposed the body was cleansed at least partially. Indeed, according to Jewish tradition, the blood came out from a living body could have been touched and cleaned, but not the blood that came out after death that was impure by the Jews, but it cannot be excluded that Jesus, when hanged to the cross was also partially washed by the rain of a storm.

So the rivulets in correspondence of the arms and feet produced by the unnauling procedure are of post mortem type as well as the escape of blood and serum from the side that can be correlated to hemothorax and a spear blow.

The "blood belt"

The rivulets of blood around the waist, named "blood belt", see figure 5, have been probably misinterpreted in the past [11], as being due to the blood flows coming out from the chest wound collected on the right side of the TS Man. In fact, they are coherent with a symmetrical position of the rivulets that indicates two different sources of blood, coming also from the left side.

It is not clear up to now which was the source of these rivulets, but the preferred hypothesis of the authors is related to the wrist wounds because it is also supported by experimental tests. Both the arms of Jesus show various rivulets coming from the wrist wound that flowed to the elbow. If it experimentally produces such a flow of fluids, it has been experimentally demonstrated that many drops fall from the elbow just in the position of the "blood belt" thus supporting this hypothesis.

These rivulets, of post-mortal blood, show that Jesus was in a horizontal position with the arms partially raised when this blood was poured from the wrist wound. Being the residual blood in the veins of the order of few cubic centimeters, this blood flow lead to think that Jesus was unnailed in proximity of the Sepulcher. Therefore, according to this hypothesis, the "blood belt" was produced by the drainage from the elbows leaned on the abdomen just after unnauling of the wrists and repositioning of the upper limbs.

Other hypotheses can be considered to explain the "blood belt"; one of them supposes a drainage of blood due to lateral wounds (as such not visible on the TS) perhaps in correspondence of the kidneys caused during the scourging or in correspondence of armpits produced by the soldiers if they used spears for the cross positioning in the ground on Calvary.



Figure 5: "Blood belt" visible on the back image of the TS.

A “mattress” of spices

The authors [9] report that, Jesus was “lying on the “mattress” of myrrh and aloe resin powders” and this hypothesis is in agreement with [5], that reports, after an anthropometrical analysis what follows: “As the back image of the TS also shows distortion due to partial wrapping of the sheet, the body of the TS Man was probably not laid on a flat surface ... but on a curved one, like a trough or stretcher. This hypothesis fits the possibility that the TS Man was laid on a flat surface covered with a layer of soft material like dust of spices.”

The Gospel of John refers to a quantity of 30–40 kg of spices (“...bringing a mixture of myrrh and aloes, about a hundred pounds”, John 19,39) corresponding the Roman *libra* to about 0.33 kg.

The authors made a rough experiment to verify the congruence of the hypothesis of a “mattress” of powders with what it is reported in the Gospel of John. Supposing that 30 kg of spices were minced in a powder and spread over a stone 2 m long and 1 m wide, we the corresponding “mattress” height results of about 2 cm.

Using the half scale manikin of [9], the authors detected that just a height of about 1 cm was necessary to produce the shoulder distortion detected in the TS dorsal image. This result therefore confirms the hypothesis of a “mattress” of spices used to lean the body of Jesus.

This result is also in agreement with the Bible (II Chronicles 16, 14) “And they buried him [king Asa] in his own sepulchres, and laid him in the bed which was filled with sweet odors and divers kinds of spices ...” and supports the hypothesis that also Jesus was buried as a King.

Chin bandage

It is interesting to comment a piece of John’s Gospel (20, 6–8): “He saw the strips of linen lying there, as well as the cloth that had been wrapped around Jesus head. The cloth was still lying in its place, separate from the linen. ... He saw and believed.”

A part from the unhappy translation of “strips of linen” from the Greek “*othonia*” that simply indicates “linens” at plural, probably in reference to the set of TS, chin bandage, sudarium, and, perhaps, also rolled linens put at the corpse’s sides, the best explanation for the authors is the following: probably both a sudarium wrapping the face to better protect it and a chin bandage to close the mouth of Jesus (placed, around the chin and the top of the head) were used, see figure 6.

When the corpse possibly disappeared (during the non-scientifically-explainable-phenomenon that Christians name Resurrection) the TS wrapping the human body sagged but evidencing the high relief of both the chin bandage covered by the TS and the sudarium still wrapping the disappeared face. This view made John to believe in the Resurrection of Christ.

Supposing a hypothetical electric radiation connected with Corona Discharge to form the body image [22], the sudarium wrapping the face could help in the explanation why this image is more intense than the body image in general. In fact a charge



Figure 6: Detail of a reconstruction representing the TS covering the sudarium after the TS Man became “mechanically transparent” as affirmed John Jackson in [17]. At this sight the apostle John (20, 8) “saw and believed”.

concentration produced by an additional electrical barrier should be supposed [23], if this sudarium was present.

Concluding Remarks

By combining the news reported in this paper with the results previously published in [8–10], the most probable information regarding the sufferings and the burial of Jesus are the following.

1. From the additional correspondences here detected between TS Man and the description of both the Jesus’ Passion in the Gospels and in the Christian Tradition, further clues in favor of the previous formulated hypothesis that TS Man is Jesus of Nazareth results.
2. Jesus carried the whole T-shaped cross.
3. Jesus suffered a violent blunt trauma to the neck, chest and shoulder from behind, produced by the cross during a fall. This trauma had various medical implications including the following.
4. The trauma produced an underglenoidal right humerus dislocation of about 3 cm that caused the right hand to touch the outer edge of the left thigh.
5. The trauma produced a damage of right entire brachial plexus that explains: the lowering of the right shoulder; the right hand flat posture with stretched fingers; the enophthalmos; the head posture on the cross both tilted downwards and to the right that had been straightened during the deposition.
6. The fall and/or the flagellation caused a pulmonary contusion with hemothorax and, likely, a cardiac contusion and then myocardial infarction and heart rupture.
7. A hole was probably made in the wrists by the nail put in the Destot’s space nailing along the middle fold of the skin, close to the pisiform bone with clean break of the ulnar artery and excitation of ulnar nerve fibers that innervate the flexor pollicis brevis and adductor pollicis muscles with thumb retraction. Instead, perhaps due to the elevated tension applied to the hand, during the suspension on the cross, the exit hole of the nail appears on the TS in correspondence of carpal–metacarpal joint.
8. The disappearance of the thumbs is linked to the trauma by nailing.

9. Jesus suffered probably a right ankle dislocation during nailing.
10. Jesus has certainly suffered a very serious and widespread causalgia to the upper and lower limbs (burning pain and shock to the tiniest movements) produced by the nails that forbade every slight movement of Jesus limbs on the cross. The crown (or helmet) of thorns (of *Rhamnus Lycioides*) produced an additional causalgia whose pain was also increased by urticant substances present on the thorns' tips.
11. In agreement with Jews law, Jesus body was probably not cleaned from post-mortem blood, but only from the pre-mortem blood such that due to the scourging; instead the rivulets in correspondence of the arms and feet, due to the unnauling procedure and the escape of blood and serum from the side, related to hemothorax and a spear blow are of post-mortem blood and therefore let as such on the TS.
12. The "blood belt" on the back was probably produced by blood coming from wrist unnauling during the deposition of Jesus in proximity of the Sepulcher; alternatively it was produced by wounds in correspondence of kidneys or armpits.
13. The TS was not tightly wrapped around the Jesus; the body was only enveloped, not wrapped on Friday evening, waiting for the completion of the burial procedure to be performed on the next Sunday.
14. Jesus was treated as a King during the burial procedure because his body was laid down with care over a "mattress" of spices strewed on the gravestone.
15. The peculiar disposition of the chin bandage around the head and perhaps also a sudarium put over the TS made the apostle John to believe in Jesus Christ's Resurrection.

Acknowledgement

The authors thank the sculptor prof. Sergio Rodella who, with the supervision of Prof. Gianmaria Concheri and of Dr. Stefano Concheri, made up a 3D life-size sculpture of the TS Man that was very useful to confirm some findings described in the paper.

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