

## Turin Shroud: Etiology of Jesus Christ's Death for Infarction Followed by Hemopericardium

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### ABSTRACT

The news about the blood of the TS (Shroud of Turin) reported by two very recent papers, which also dealt with the consequent sufferings endured by Jesus Christ during His last hour on the cross before dying, have prompted the authors to study in detail the last twenty hours of the Passion of Christ to highlight what was the most probable cause of the death of Jesus Christ and how was its etiology.

Therefore, these twenty hours of Passion suffered by Jesus Christ, have been divided into seven phases, each of which describing the particular pathological state of this Man harshly tortured in all his limbs.

These aspects, fused together, have highlighted various possible causes of death, such as orthostatic collapse, asphyxia, uremia and hemothorax, accentuated by the insult that produced a heart disease from strong stress. Each of these contributing causes, if considered individually, would probably have led to the death of Jesus and obviously they severely weakened Him, but the results of this analysis indicated tamponade due to hemopericardium as the primary cause of the death of Jesus Christ.

**Keywords:** Shroud of Turin; Hemotorax; Asphyxia; Uremia; Orthostatic collapse; Hemopericardium; Relic.

### INTRODUCTION

Two recent papers<sup>[1,2]</sup>, have reported several news on the blood of the TS (Turin Shroud) and the discussed consequent sufferings endured by Jesus Christ during His last hour on the cross, before dying of a very probable heart attack followed by hemopericardium<sup>[3,4]</sup>.

This paper aims to delve into some etiological aspects regarding the alleged heart attack suffered by Jesus in the light of new details deriving from the analysis of the TS, also supported by information deriving from the Holy Christian Bible.

We know from the Christian Bible that Jesus, in His thirties, was a mature man since life expectancy in Palestine at the time of Christ was around 43-45 years<sup>[5]</sup> and he was muscular enough for his presumed occupation; in fact, in the Gospels, Jesus is defined as a "carpenter" (Mk 6:3) and "the carpenter's son" (Mt 13:55).

Although it is not easy to suppose that a man such as Jesus could have been affected by such a pathology, His particular physical and psychological conditions suffered during the Passion demonstrate that the hypothesis formulated is tenable-as will be discussed in this paper.

The TS is a handmade 3:1 twill linen cloth, 4.4 m long and 1.1 m wide, on which the front and back images of a human body are mysteriously imprinted in a way that has yet to be reproduced with all of its notable characteristics<sup>[6,8]</sup>.

In agreement with the current Catholic Christian tradition, the TS is the burial cloth in which Jesus Christ was wrapped before being placed in a tomb in Palestine almost 2000 years ago<sup>[1]</sup>.

The face of Christ on Byzantine coins demonstrate that the TS was seen during the Byzantine empire from the seventh century<sup>[9]</sup>. Furthermore, there is evidence that the TS proceeded from Constantinople (after its sacking in 1204) to Lirey, France in 1353. In 1988, it was radiocarbon-dated to 1260-1390 A.D. <sup>[10]</sup>, however the result is questionable and very controversial<sup>[11-14]</sup>.

As the process that could form the body image on the TS with all of its particular features is still unknown, it might, quite possibly, be related to a neutron flux<sup>[15]</sup>, which potentially varied the percentage of the TS's carbon isotopes which altered what should have been the normal radiocarbon dating result for the linen cloth. A partial confirmation of the neutron flux comes from blood results of the TS that is poor in nitrogen<sup>[16]</sup>.

In agreement with J. Heller and A. Adler of STuRP (Shroud of Turin Research Project)<sup>[17,18]</sup> and P.L. Baima Bollone<sup>[19]</sup>, the numerous red stains present on the HS, is genuine blood and Refs.<sup>[1,2]</sup> confirm this.

While is not simple to precisely reconstruct from the TS's body image and bloodstains what the various physical conditions were of the Man that was subjected to various tortures and that the TS wrapped, there is still a lot of important scientific information which can be gleaned from it by experts. This two-dimensional sheet, which bears a very particular double body image, contains different types of blood. They provide evidence as to what some of the particular physical conditions the Man who was wrapped in it as a corpse suffered from.

But from this information to describe the etiology of death by heart attack followed by hemopericardium, is not an easy task. However, given the stunning congruence between what has been scientifically observed on TS and what is reported in the Holy Christian Bible, the authors try in this work to put together the various information from the two sources to make a sufficiently detailed description of the etiology of the hypothesized heart attack that the authors think that, based on the evidence, Jesus Christ suffered.

For example, the Christian Bible reports that Jesus Christ, God Incarnate, was severely tortured and we find on the TS the signs of severe beating and scourging along with bloodstains on the head which are consistent with a crown of thorns. The Bible reports that Jesus had a heavy cross carried to Mount Calvary where He died crucified to the cross, as confirmed by the bloodstains and body image on the TS which indicate both a man that was crucified (as indicated by the nail wounds visible on the hand and feet) and that was in rigor mortis at the time of body image formation<sup>[20]</sup>. The Bible adds that, after death, the body was removed from the cross, wrapped in a shroud and placed in a rock hewn sepulcher.

The Bible reports that the body of Jesus was in the sepulcher from Friday evening to Sunday morning and the TS confirms that the corpse remained wrapped in the TS for the same time for no more than 30-40 hours, because no putrefaction signs appear on it. The Resurrection of Jesus is mentioned in the Bible and, in coherence with it, an intense source of energy, probably also of neutron type<sup>[21]</sup> can at least partially explain the double body image visible on it.

After many years of studies, the authors found compelling scientific correspondences between the narration of the Bible and the TS, are convinced that the TS is the authentic burial shroud of Jesus Christ<sup>[22]</sup> described in the Bible.

A description of the above-mentioned etiology for the heart attack that Jesus Christ is hypothesized to have had, follows.

## **ETIOLOGY OF DEATH BY HEART ATTACK FOLLOWED BY HEMOPERICARDIUM**

The pathology that led to the death of Jesus was not sudden but most likely developed slowly during the last twenty hours of His life prior to His heart attack that was followed by hemopericardium. This pathology is divided into seven phases that are discussed below.

### **Last Supper**

We begin this analysis from the Last Supper (John 13:1-3) when it was extremely humiliating for Jesus to sit at the table with Judas, and share His cup with him-knowing that Judas would soon betray Him. This could have produced intense psychological stress that resulted in the beginning of the onset of His heart disease.

Clinical analysis has scientifically demonstrated that, following intense emotional stimuli, sudden death is possible.

This syndrome is also found at the autopsy table which via hematomas of the ventricular surface of the heart with crumbling of the cardiac muscle tissue with visible micro or macro tears in full thickness.

It is called stress heart disease (“*crepacuore*” in Italian)<sup>[23]</sup>, or Takotsubo<sup>[24]</sup>, The authors, however, highlight that, while in literature these syndromes are not considered to be well distinct from each other, the Takotsubo pathology causes sudden death, while stress heart disease (or broken heart syndrome) could lead to a much slower death. In the case of Jesus, therefore, the latter should be chosen as a non-triggering factor.

### Gethsemane

After the Last Supper Jesus went to pray in the Garden of Gethsemane where an intense agony caused Him to experience hematohidrosis: “*And being in anguish, he prayed more earnestly, and his sweat was like drops of blood falling to the ground* (Luke 22:44).”

Hematohidrosis is a spontaneous emission of blood from the sweat glands whose cause is not yet fully understood, but it is thought that there is a narrowing and then a rupture of the capillaries surrounding the sweat glands, which produces a mixing of blood with sweat. It occurs in conditions of intense emotional stress and anxiety and can also be accompanied by depression and possible panic attacks<sup>[25,26]</sup>.

According to Pierluigi Baima Bollone<sup>[27]</sup> it is a phenomenon caused by an intense neurovegetative stimulation of the cutaneous vessels with marked vasodilation that determines the escape of red blood cells from the capillaries of the skin dermis. He explains that Jesus, in the grip of panic suffered shortness of breath, intense sweating, burning, cardiac pain and palpitations, strong dizziness and typical symptoms of a “somatization” that was precisely the cause of this spiritual agony.

While the TS does not exhibit any bloodstains that can reliably be attributed to hematohidrosis, the description given in the Gospel (Luke 22:44) us strong evidence that Jesus experienced this, probably copious, loss of blood. As such, this may be taken into consideration into the discussed hypothesis predisposing Jesus to infarction.

### Beatings

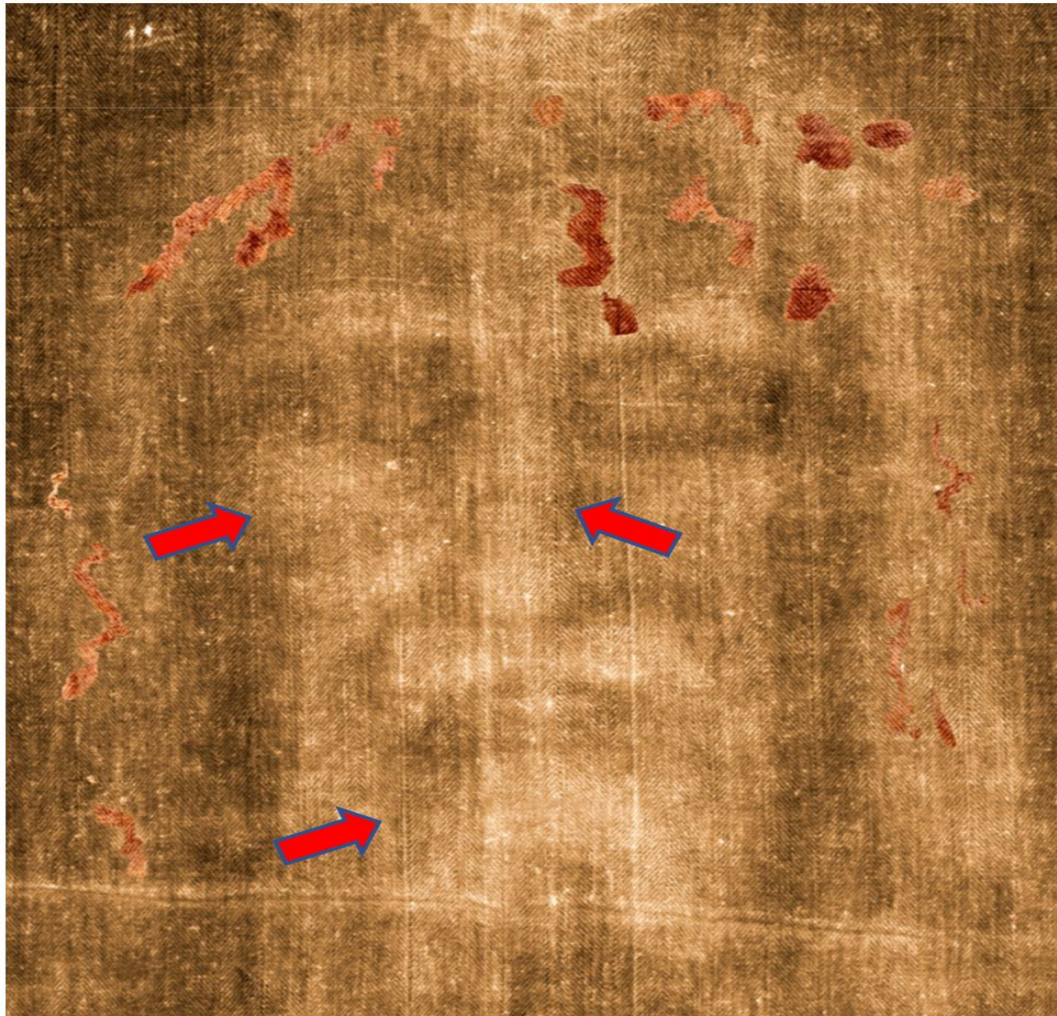
According to the Bible, several hours passed after the Judas’ traitorous kiss, before Jesus was arrested and taken on foot for kilometers to be judged before the Sanhedrin which was presided over by Caiaphas high priest of the Temple of Jerusalem. Jesus was then taken to Pilate, to Herod and then again to Pilate.

The Bible report that Jesus was severely beaten during these hours; we find a precise reference to these beatings when we read on the Gospels that “*Again and again they struck him on the head with a staff ...*”(Mark 15:19) and in the Old Testament, prophecy about the Messiah, that “*I offered my back to those who beat me, my cheeks to those who pulled out my beard; I did not hide my face from mocking and spitting* apitting (Isaiah 50:6). On the TS we observe the corresponding swollen right cheekbone, the nose broken and the right beard torn of Jesus, (Figure 1).



## Scourging

When, after these events, Jesus was brought to Pilate he was severely scourged. On the TS we can count more than 370 scourge wounds<sup>[28]</sup>, but in reality, there were likely many more, perhaps even upwards 600 because on the Relic we only see the parts where the sheet was in contact with the body and therefore we do not see the lateral areas of the legs, arms and chest that were undoubtedly hit by the flagrum, but which (because of their position) could not transfer the scourge signs on the TS by contact.



**Figure 1:** Negative face of Jesus of the TS on which the bloodstains have been superimposed in positive by the first author. The arrows indicate the broken nose, the swelling on the right cheek and the torn right beard.

So, it is an astounding number of wounds that not only resulted in a significant blood loss, but also physically weakened the body already debilitated by the previous events. For the authors, a most important feature, about these scourge wounds, is that at least four can be distinguished directly on the “cardiac aia” (surface projection of the heart onto the chest wall) of Jesus, which undoubtedly caused contusions (Figure 2).

We emphasize here that it is inconceivable that a blow from a flagrum can lacerate the cardiac muscle, but however, it could, instead, have seriously damaged it as a traumatic insult.

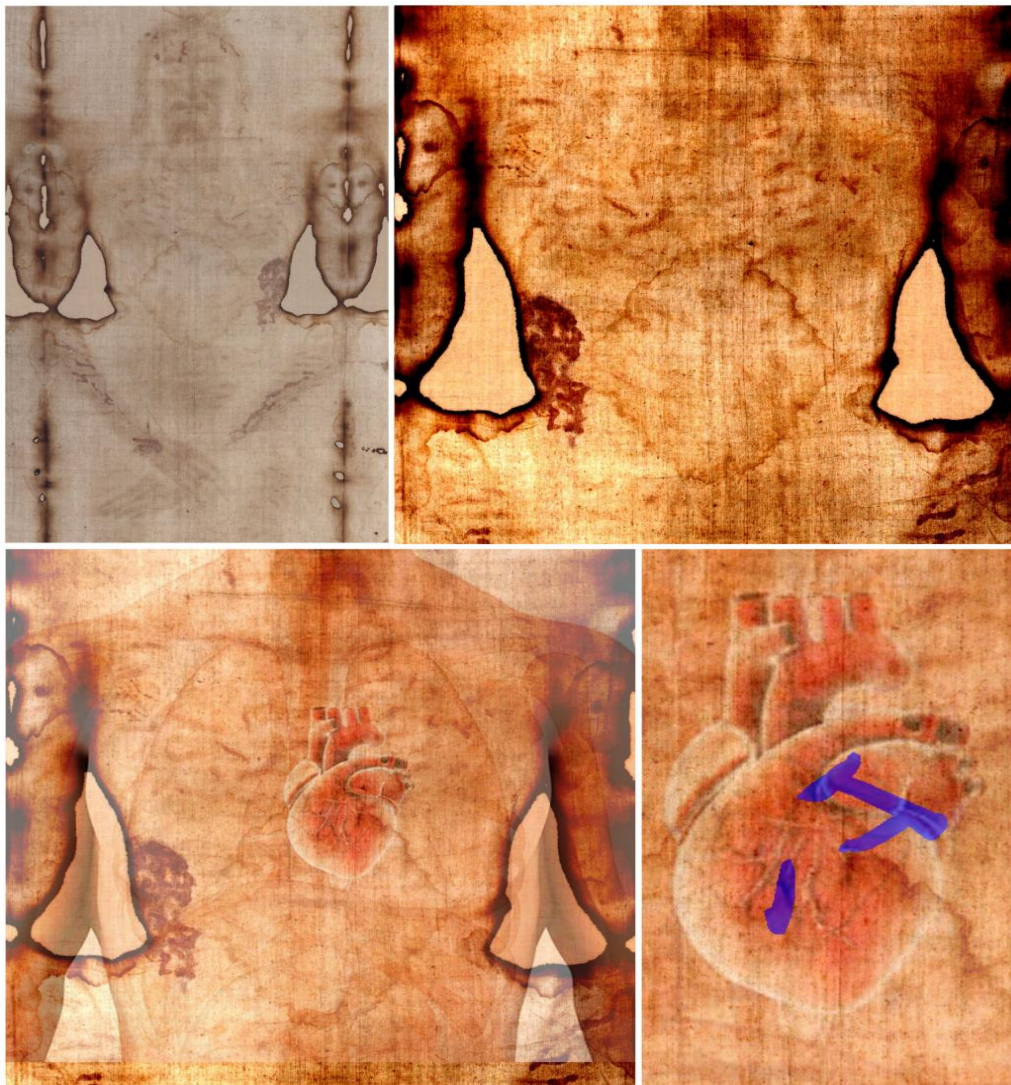


These were almost certainly the first physical cause of the onset of the heart attack. This should not surprise us because the TS shows that Jesus, during the ferocious torture, was also struck by scourge on the head<sup>[1]</sup>.

We must highlight that with an acute hemorrhage, an adult man can lose up to a third of his blood volume (approximately 1.8-2 liters of blood) before dying, and much more if the bleeding is slower due to the numerous compensatory mechanisms that counteract asphyxia for as long as possible.

### Carrying the cross

The immense effort undergone by Jesus when He had to carry the heavy cross to Calvary was certainly not of help to the heart partially torn by the congestive heart failure also induced by the violent flagellation of the “cardiac aia”, which in conditions of rest for a man like the one in question would probably have healed. Instead we must assume that this stress accentuated the cardiovascular dysfunction.



**Figure 2:** On the top, images of Jesus Christ on the TS; on the left bottom, position of heart on the TS image and, on the right, evidenced in blue, four scourge marks that struck the heart.

We can also assume that there was an exacerbation of the heart problems when Jesus fell to the ground repeatedly and perhaps the cross He was carrying bounced off a stone in the ground, causing a dislocation of his right arm. We find confirmation of this in the TS when we observe the marks on Jesus' shoulders caused by carrying the cross and the 2-3 cm dislocation of the right arm in the body image<sup>[29]</sup>.

But the stress for Jesus did not end there, with obvious consequences for the incipient heart attack, because, having reached Calvary, He was nailed to the cross by His hands and feet after immense suffering. In fact, the holes made on the patibulum, the horizontal beam of the cross, were placed at a greater distance from the limbs which consequently had to be pulled with ropes, with consequent dislocation, in order to make their nailing point coincide with the hole in the pre-formed wood<sup>[30]</sup>.

We must not forget the continuous spiritual agony suffered by Jesus accentuated by the innumerable insults received, for example: "*Scorn has broken my heart and has left me helpless* (Pslm 69:20), that increased the above-mentioned stress heart disease.

The TS confirms this when we see that Ref.<sup>[1]</sup> reports the presence of erythrocytes and creatinine in the blood samples - which is typical of a tortured person. In addition to this, the post-mortem blood of Jesus results composed of microcytes (which are erythrocytes having a diameter of about 0.7 micrometers and which are about ten times smaller than normal human erythrocytes) typical of human blood diluted with urea. The fact that Jesus of the TS suffered from acute uremia agrees with the above-mentioned flagellation, which would have likely resulted in sudden renal failure.

The renal and probably liver malfunction or blockage (the possibility of liver failure is likely as a consequence of renal dysfunction and acute congestive heart failure) caused microcytic anemia which also would have been exacerbated by a prolonged lack of hydration and food deprivation (which further supports the extreme hypovolemia), imply the extreme difficulties for Jesus to exchange oxygen. Therefore, this pathology resulted in a labored breathing which further fatigued the heart and accentuated the initial heart injury.

### Effects of tortures

We must not forget here the probable coagulopathy, also caused by the excessive loss of blood that occurred during hematomatosis and scourging, caused hypovolemic shock. In addition to this, hypovolemia and severe dehydration (in parallel with (John 19:28) "*Jesus said, 'I thirst.'*") would have caused reduced blood flow which further burdened the heart.

The microcytes found in Ref.<sup>[1]</sup> would have been significantly reduced in their ability to exchange oxygen, which would have increased a lot the tachycardia that therefore accentuated the heart injury.

The lactic acid produced by the limbs stretched out in the cross would have been produced intense tonic and clonic contractions. Jesus' heart would therefore have been beating very rapidly due to congestive heart failure while, also, causing a pericardial effusion.

To compensate for these physical problems in exchanging oxygen, Jesus had to heavily increase His breathing and, consequently, increase the frequency of His heartbeats.

Obviously, all the physical tortures suffered by Jesus produced several very serious pathologies, each of them potentially fatal, among which the hypovolemic shock hypothesized by Zugibe, see Ref<sup>[31]</sup>, and others such as the hemothorax also caused by the blows of scourging, which can be supposed to have acted as contributory causes of death. However, the primary cause, also accentuated by the insults of those present addressed to the Redeemer, according to the authors, is that reported in the following Section.

In Section 5.5 of Ref<sup>[1]</sup> a photo-micrograph shows nanometric spheres that have been recognized as creatinine. The result was reported in a perhaps too synthetic form there and it could be roughly confused with some nanometric pigment. It therefore must be added that the author of the paper in question made also additional tests with SEM-FEG EDX technique and these spherical particles were determined to be of an organic type. He does not know of the existence of pigments of this size, which have a spherical shape and are of organic type which are different from creatinine.

### **Heart attack with hemopericardium**

After all this physical and spiritual torture, it is not difficult to think that a heart attack could have occurred in a robust person such as Jesus Christ must have been.

Thrombi due to cardiac insufficiency could therefore have originated in the so-called "auricle" or atrium, annexed as an offshoot of the left atrium which is a small sac-shaped formation, embryonic residue, as highlighted in Ref<sup>[32]</sup>.

The very high frequency of heartbeats produced a heart attack which caused a significant effusion of blood into the pericardial layer producing hemopericardium with consequent cardiac congestive tamponade and immediate death after a sharp (Mark 15:37) in the chest. This is also in agreement with the Gospel of Mark, "*With a loud cry, Jesus breathed his last* (Mark 15:37).

Before finishing this section, it seems interesting to report a description of the hemopericardium made by Stroud<sup>[33]</sup> already in 1847 in reference to Christ death: "*The immediate cause is a sudden and violent contraction of one of the ventricles, usually the left, on the column of blood thrown into it by a similar contraction of the corresponding auricle. Prevented from returning backwards by the intervening valve, and not finding a sufficient outlet forwards in the connected artery, the blood reacts against the ventricle itself, which is consequently torn open at the point of greatest distension, or least resistance, by the influence of its own reflected force. A quantity of blood is hereby discharged into the pericardium, and having no means of escape from that capsule, stops the circulation by compressing the heart from without, and induces almost instantaneous death. Soon divides into its constituent parts, namely, a pale watery liquid called serum, and a soft clotted substance of a deep red colour termed crassamentum.*"



We can finally observe that serum and crassamentum could just be the “*blood and water*” which came out of the wound in Jesus’ side when the Roman centurion struck it to confirm His death, (John 19:34).

In Section 4.1 of Ref<sup>[1]</sup> a fluid different in color from blood was identified in the bloodstains relative to the chest wound. According to some Spanish scholar, see Ref<sup>[34]</sup>, it could be a fluid connected to pulmonary edema, but the discover is only addressed to the distinction of this fluid from blood and therefore nothing is able to say in addition to this. As such, the possibility that the fluid in question can be also either pleural fluid or serum consequent to hemopericardium must not be discharged.

## CLARIFICATIONS

Before finishing, it seems appropriate to clarify two points of interest reported in Ref<sup>[1]</sup>.

In Section 4.2 of Ref<sup>[1]</sup> three different main directions of the blood pattern, evidenced on the TS in correspondence with the side wound, are highlighted and are interpreted as caused by the many different positions of Jesus during the process of depositing His body from the Cross and preparing Him for burial.

It can be observed that these directions could also correspond to the bloodstains produced by a man placed in a vertical position but with a dilated rib cage which cause the ribs to protrude.

According to the authors, this could be an interesting observation if only two of the three highlighted directions were considered, but the third direction that is perpendicular to the vertical one, as highlighted in the photo, is a challenging one to explain.

In Section 5.1 of Ref<sup>[1]</sup> and following the characteristics of Type A hematic fluid (with no references to blood groups A-B-AB-O) are discussed and two hypotheses are formulated for their interpretation: “*Either they derived from uncoagulated blood that underwent strong shrinkage (preferred by the author) or, alternatively, these particles could be apoptotic bodies that resulted from echinocytes .... that have fragmented and scattered in the plasma.*”

With reference to the first hypothesis, the authors add that the blood in question could also derive from coagulated blood; in fact, Dr. F. Zugibe in n Ref<sup>[31]</sup>, reports: “*A body can continue to bleed post-mortem, and this blood can be found, depending upon the circumstances, in either clotted or unclotted form. ... However, in scenarios where the deceased experienced a sudden and/or violent death-such as in cases of severe trauma-the blood’s clotting might begin, however in a matter of 15-30 minutes, the blood becomes fluid again.*”

Finally, Zugibe points out that these are not firm rules. The fluidity in postmortem blood is connected to the presence of fibrinolysins (enzymes in the blood that promote the dissolution of blood clots, see Ref<sup>[35]</sup>), and its presence in the blood of a corpse is associated with rapid death due to violence.

He further mentioned that it is possible corpses were bleeding or oozing, sometimes even until the following day, from stab wounds, lacerations, bullet wounds and other types of traumatic injuries, especially when such bodies were being moved around in the autopsy room.

He then concludes: *“With Jesus’ having suffered a violent death, this could have caused his postmortem blood to remain fluid long enough to stain His burial shroud when he was placed in it.”*

Therefore, there should not be the presumption that postmortem blood has not clotted, in fact the postmortem clotting of blood is possible, although it is rare.

## CONCLUSIVE REMARKS

Having determined the stunning correspondence between what results from the scientific analysis of the TS and what is reported in the Holy Christian Bible, the authors decided to merge the information to describe a very plausible etiology of the death of Jesus Christ that was produced by various contributing causes, but which resulted in the final cause identified as cardiac infarction followed by hemopericardial tamponade.

The analysis was deepened by referring to two very recent papers regarding new macroscopic and microscopic evidence of samples of different blood coming from the TS after their comparison with appropriate laboratory controls.

The etiological analysis was described through seven critical moments of the torment that Jesus Christ endured during His Passion which occurred in the last twenty hours before His death on the cross.

The various causes such as orthostatic collapse, asphyxia, uremia and hemothorax, accentuated by the insult that produced a high stress heart disease, if they had been considered individually, would have undoubtedly severely weakened Him, but also likely would have led to Jesus’ death. However, several findings highlighted in the aforementioned analysis indicate that tamponade due to hemopericardium was the primary cause of death.

It is interesting to comment here what F. Zugibe<sup>[31]</sup> wrote about the hemopericardium. *“One rare complication of a heart attack is rupture of the heart. ... During the week or so following a heart attack, a process of softening of the heart muscle occurs due to death of the muscle tissue, and the heart attempts to heal itself by forming thick scar tissue. It is during this softening phase that the heart muscle in the area of infarction is particularly susceptible to rupture. If the patient is not at rest in the first several days after the heart attack, the increased pressure may break through the softened tissue, causing blood to be pumped out of the heart into the sac surrounding the heart. This is referred to as cardiac rupture with tamponade. According to Gould’s Pathology of the Heart, rupture of the heart muscle may occur as early as 1 day (very rare) or as late as 4 weeks after the onset of a heart attack but is common during the first week with the average time of occurrence at 7 days.”*

Zugibe adds that Jesus was on the cross for a maximum of 6 hours - and if He suffered a heart attack there would still need to be about at least a day after the heart attack for the heart muscle to deteriorate enough to permit the rupture.

The authors partially agree with Zugibe, because it is true that if Jesus had only been on the cross for 6 hours there would not have been enough time for the heart to deteriorate to allow its rupture, but it must be considered that, in accordance with what was described about the Last Supper and Gethsemane, for at least 20 hours the heart of Jesus was subjected to intense psychological stress that resulted in the beginning of His heart injury.

The beatings and flagellation with at least 4 scourging to the heart obviously increased the broken heart syndrome. The culminating moment of the congestive heart disease with the muscle weakening happened when all the pathologies, listed especially in reference to the effects of the tortures, accentuated the micro-fissures of the muscle already generated and, above all, the microcytic pathology<sup>[1,2]</sup> caused the labored breathing and tachycardia that led to the rupture of the heart with consequent hemopericardium and cardiocirculatory arrest.

We can therefore affirm that Jesus physically gave His heart to humanity and we can see this both from a medical point of view based on the observations made on TS and also from a spiritual point of view. In fact, in accordance with the Catechism of the Catholic Church (CCC 478), Jesus loved us to the end: *“Jesus ... gave himself up for each one of us... He has loved us all with a human heart.”*

We close with a thought written by E.A. Wuenshel of Ref<sup>[36]</sup> more than sixty years ago, which highlights the fact that this hypothesis of death, has been more roughly supposed for some time, and that it can be summarized as follows. The crucifixion of Christ was much more than a judicial execution, it was the voluntary immolation of the God-Man in atonement for the sins of the world. Christ endured all the physical torments of the Passion, but His agony of the soul far surpassed the torments of His Body and this brings us back to the hypothesis of the breaking of the heart.

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