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A Study of Death by Crucifixion With Attempted Explanation of the Death of Jesus Christ

by

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“And they crucified him.” How many, many times have we heard or read these words? Have we really understood what they mean? This is an attempt to describe the medical aspects of death by crucifixion and to explain, as best we can, the suffering of our Lord Jesus Christ on Calvary.

Historical

The modern study of medical aspects of crucifixion was begun by Barbet¹ when, in 1931, he was asked to study some photographs of and later the actual Shroud of Turin when it was on public exhibition. He observed locations of the wounds in the hands and chest that were not consistent with the general interpretation of artists and sculptors at that time. This prompted his studies and these led to many more.²⁻⁹ There were rare medical studies before this.¹⁰⁻¹¹

The Shroud of Turin

The Shroud of Turin is a piece of linen forty inches wide by thirteen and one-half feet long that was the property of the House of Savoy for decades, but has been given to the Vatican and is under the protection of the Archbishop of Turin. There, it is kept in a special chapel. It is probably the most studied artifact in the world. In a 1978 study, forty American scientists of various disciplines spent almost three hundred and fifty thousand man hours in study of it.¹³ They were members of the Shroud of Turin Research Project working voluntarily at

their own expense. The results have been published in various scientific journals and books.¹²⁻²² In fact, this research project has spurred hundreds of articles in scientific, religious, and other journals and newspapers. The recent carbon dating, which approximated the date of a small portion of the linen on one edge to the thirteenth or fourteenth century²³, has also caused great controversy.^{24,25,26} New studies are being planned.

There are two types of impressions on the Shroud; one of a body image, and the other, stains which have been proven to be blood.¹² "The body images are produced by a dehydrative oxidative process of the cellulose structure of the linen to yield a conjugated carbonyl group as chromophore. However, the detailed mechanism for the production of the image, accounting for all of its properties, remains undetermined."¹² Suffice it to say that we will use the Shroud as an image of a man who was scourged, his scalp pierced many times with profuse bleeding; and was crucified with nails; died without his legs being broken; and was buried without his body having been washed.

Archeology and Crucifixion

The practice of crucifixion came to us from the Assyrians, Phoenicians, and Persians from whom Alexander the Great borrowed it. The Carthaginians and Romans popularized it and used it as a form of capital punishment.¹ It was reserved for captured enemies in war, slaves, thieves, and deserters.²⁷

Josephus²⁸, a Jewish historian, reports that Jews captured during the siege of Jerusalem under Titus were first whipped, tormented, tortured, and then crucified before the wall of the city. He described so many victims that there was no room for the crosses. Often five hundred were crucified each day.^{1,28} Crucifixion was outlawed by Constantine between 315-330 A.D.¹

Scourging

It was customary¹ under Roman law to subject the victim to scourging or flogging before the actual crucifixion. The victim was stripped of clothing and bound to a column. The scourging was usually carried out by two soldiers who used a "flagrum." This was a short wooden handle to which were tied two or three leather thongs, to the ends of which were attached lead balls or small bones of sheep.

The Jewish law forbade over forty lashes, so with their meticulousness, only thirty-nine were given. Thus the "Five times have I received thirty-nine lashes from the Jews" was suffered by Paul.²⁹ The Romans had no such rules. However, they could not kill the victim with lashing. He had to die on the cross.¹

This scourging could be severe, causing great tears in the flesh, bleeding and pain. Schaff reports the scourging of a victim until the bones could be seen.³⁰ The amount of blood lost would vary, but it could be substantial if a superficial vein was severed.

Instruments of Crucifixion

The usual cross used was in the form of a T.¹ The cross-beam, a rough piece of wood, was called the *patibulum*. This was about the size and shape of a railroad tie. This beam served as handcuffs. It was placed upon the victim's shoulders and his arms were tied to it. In this way, he was usually led to the site of crucifixion.

The vertical part of the cross, the *stipes*, was always in place at the execution field outside of the city walls. Usually several were in place permanently. The height varied but it was usually just high enough for the soldiers to reach without climbing on anything. Since hundreds were often done in one day, the convenience and speed necessitated a low, easily accessible *stipes*.¹

It was much easier to have a T-shaped cross. The carpenter could mortice out the center of the patibulum and fit it onto the top of the *stipes*, allowing ease of insertion and good fixation.

The addition of a *sedile*²⁷ or a peg for the victim to sit on would only prolong the period of torture.

When the victim reached the location of the *stipes*, he was given a drink of bitter wine mixed with myrrh to help decrease the pain.^{1,7} Then the victim was forced to lie down with arms outstretched, and the upper extremities were fixed to the patibulum. Nails were most commonly used to affix the victim to the cross,¹ although in certain areas ropes were used because nails were scarce.

Josephus¹ reports that during the siege of Jerusalem in seventy A.D., three of his friends were crucified, two with nails and one with ropes. When he was able to obtain their release, the two who were nailed were dead while the one who was secured with ropes was able to live.¹

The Shroud shows the location of the nails in what we call the wrists. Barbet¹ placed a nail through the palm of a severed arm and found that it could not support the weight of one-hundred pounds, much less the struggle of a crucified victim. He found that if the nail was placed through the wrist between the metacarpal bones, it would secure the extremity firmly. Since the Romans were proficient, they would place the nails in areas where they would hold; either in the wrists or in between the distal ends of the radius and ulna in the upper arm near the wrist. Edwards⁷ agrees with the wrist location of the nails. The Greek word for hand is CHEIR. This can include the wrist as well as the hand.^{8,33} Tzaferis³¹ excavated the bones of a young Jew who was crucified in the 1st century A.D. Scratches were found at the wrist end of the radius which could be from a nail in the forearm. Zias and Sekeles³² believe that these scratches could have occurred after death.

However, Zugibe³⁴ disagrees with this theory. He feels that the nail was driven through the "Z" space, called the thenar furrow, at the base of the thenar eminence and exited at the back of the wrist where it joins the hand.

After the upper extremities were adequately nailed to the patibulum, the victim was forced to sit up, to rise to a standing position and backed up to the *stipes*. Then the soldiers (executioners) would raise the patibulum, slip it over the top of the *stipes* and set it in place.^{1,27}

The feet were then nailed to the *stipes*. Barbet¹ feels that the nail was first passed between the second and third metatarsal spaces of the left foot, then this foot was placed over the right foot and the nail passed through the same area on the right foot. Thus, both feet were secured by one nail. However, the shroud shows blood from the heel area and the metatarsal area of the right foot. This would suggest that the right heel was fixed to the *stipes* first with one nail and then the left foot secured over the right with another nail. Gambescia,³⁵ in his studies, is convinced that this is what occurred to the man on the Shroud. The findings of the nail in the os calcis of a man

who died of crucifixion seem to confirm this.^{31,36}

Buchlin⁴ observed that the suspension of a man by the wrists with no support causes severe pain in the wrists, spasm of the pectoral and deltoid muscles and inability to use the thoracic muscles for breathing. LeBec³⁷ in 1925 showed that the hanging by the arms extended upward and outward over the head caused dyspnea, eventually tetanic spasm of the muscles, and unless relief was obtained, asphyxia.¹ This was confirmed by Hynek³⁸ of Prague, who described the torture inflicted in the Austro-German army prison camps of 1914-1918 called "Aufbinden." A vivid description of a similar type of torture and execution carried out at Dachau is described by Barbet.¹ In this procedure as death approached, the skin became violet in color and a profuse sweat covered the body. On the cross, however, a support is given to the feet which allows the victim to raise his body up high enough to breathe. This position is held until the pain in the feet becomes so intense that the victim can no longer maintain this position. Then the victim returns to the sagging position for a few minutes and the process is repeated.

During this time, there is an increase in lung volume, respiratory acidosis develops, hypoxia, an excess lactic acid production, and metabolic acidosis develops. A tachycardia develops secondary to hypoxemia. Profuse sweating causes dehydration. With the respiratory and metabolic acidosis, the muscular cramps worsen and the victim has difficulty raising himself up on the nail in the feet. The periods of elevation become shorter, the periods of sagging become longer, until the victim dies with the voluntary muscles in spastic contraction.⁸

In order to hasten the death, it was customary to break the legs of the victim with a heavy beam, the *crurifragium*.¹ This obviously prevents the victim from straightening the legs, and breathing and death comes within a few minutes.

The period of time that a crucified victim could endure the alternate sagging with asphyxia and straightening up to breathe would depend upon his state of nutrition, hydration, age, muscular development, and general health. It was not rare for a victim to live twenty-four to thirty-six hours on a cross. LeBec³⁷ quoted an Arab text which stated that in 1247 at Damascus a crucified man lived into the second day. Origen reported that it was not unusual for a crucified man to survive a day and a night. Cooper¹⁰ quotes Origen as stating that a married couple, TIMOTHEUS and MAURA, were crucified under Diocletian in 286 and lived nine days and nights on the cross. They died on the tenth day.

Barbet¹ feels that asphyxia is the cause of death of a crucified victim. Zugibe disagrees.³⁴ He suspended volunteers 20 to 35 years of age on a cross-secured them at their wrists and used a seat belt to secure their feet. None of them complained of difficulty in breathing after a period of suspension from five to forty-five minutes. They did have leg cramps after ten to twenty minutes. The heart rate increased to 120 a minute. He also reported that the angle of the wrists did not change when the volunteers were asked to push themselves up on the secured feet. He insists that this completely disproves Barbet's theory of death by asphyxiation.

One must remember that the victims of crucifixion usually were not well nourished, after having been in prison for variable periods of time. They were usually dehydrated, due to the scourging and the carrying of the patibulum. Also, the hot sun beat on them during the day, and the nights were cold. In addition, the

crucifixion lasted for hours and days, not a few minutes. In contrast, Zugibe's volunteers were in good physical health, the environment was an indoor laboratory, and the suspension lasted from five to forty-five minutes.

Coupe De Grace

The final determination of death was the thrust of a short lance or javelin into the chest. This would enter the right side of the chest between the fourth and fifth intercostal space, and penetrate the right auricle of the heart. This would be the *Coupe de Grace*.

The Death of Jesus Christ

There have been several theories about the cause of the death of Jesus Christ. Clark in 1890¹¹ stated that the spear penetrated the urinary bladder which accounted for the water mentioned in the scripture.²⁹ He felt that Jesus Christ swooned on the cross and died several weeks later from the results of the abdominal wound. This theory is untenable. For a trained Roman soldier to mistake the lower abdomen for the chest is unimaginable. Furthermore, the testimony of John and the other apostles²⁹ of the appearances of Christ on the shore of the Sea of Tiberias and eating with them would eliminate a man dying from an abdominal wound. Edwards⁷, *et al*, state "interpretations based on the assumption that Jesus did not die on the cross appear at odds with modern medical knowledge."

Cooper¹⁰ felt that Jesus had a sudden rupture of the heart as he uttered his last cry. Davis² stated that the hematidrosis in the garden, the scourging, the long walk to Calvary, repeated partial asphyxiation, and fluid loss, all caused shock, pericardial effusion and heart failure. DePasquale and Burch⁶ felt the death was due to suffocation on the cross. Tenny³ describes shock from severe scourging and physical exhaustion as factors in the death of Jesus. Bucklin⁴ stated that the suffocation and pleural effusion caused congestive heart failure. Edwards, Gabel and Hosmes⁷ state that it remains unsettled whether the death of Jesus was due to respiratory failure or cardiac rupture. They mention the possibility of cardiac rupture occurring secondary to the hypoxemia, hypovolemia, and even an altered coagulable state producing friable vegetations on the valves. Then emboli to the coronary vessels could produce myocardial infarction with rupture of the left ventricle in a few hours.

Ball⁸ states that the scourging and the cruel treatment weakened Jesus. Then the falls under the heavy patibulum caused blunt trauma to the chest with cardiac contusion and rupture. Zugibe^{9,34} feels that the mental anguish in the garden, profuse perspiration and hematidrosis, then the scourging, and the exertion on the walk to Calvary all caused hypovolemia and pleural effusion, shock and death. Barbet¹ feels the weakness secondary to the hematidrosis in the garden contributed to the early exhaustion of Jesus on the cross. This prevented him from raising himself up in order to breath and he died from asphyxia.

Analysis of the Scriptures

All of the Gospel writers describe the last days of Our Lord, and each emphasize certain events. All of these are written from actual observation and from the oral

stories of the early Christian community. Mark was probably written about 50 A.D., followed by Matthew about 80 A.D. Luke wrote around the ninth decade of the first century and John was written somewhere at the end of the first century.³⁷

We must come to the conclusion that Jesus was a healthy adult man of Jewish descent. He had worked most of his adult life as a carpenter, which was manual labor at that time. After he set out on his teaching career, he traveled much of the area of Galilee, Samaria and Judea on foot, and like other travelers at that time, slept outdoors or in caves often. He certainly seemed to be adequately nourished since he attended many banquets. He did have periods of fasting, some long, but there is no evidence that any of these preceded his last few days of life. He had stayed in Bethany and he must have been well fed there. He had just completed the Passover meal on the night before his arrest. There is no mention in the scriptures or by Josephus²⁸ of Jesus being ill or malnourished.

Mark²⁹, Matthew²⁹ and Luke²⁹ describe the agony in the Garden of Gethsemane. However, Luke²⁹, addressed as Doctor³⁷, gives us a medical clue for the rapid death of Jesus. He stated that the agony was so severe that an angel came to comfort him and that his sweat fell like drops of blood. The Greek words³³ mean drops or clots of blood or water from skin, like drops of blood. The Greek term for agony means an active painful struggle, fight, wrestling or to expend self totally in order to win the prize. Thus Christ must have had such severe mental struggle in the garden that he developed a rare medical condition known as hematidrosis.^{1,24,40-53} The capillaries in his skin dilated so much that some of them ruptured causing bleeding into the sweat glands and the perspiration came out mixed with blood. This blood loss in sweat was significant but probably more was lost into the skin. Since the skin is the largest organ in the body, it can hold a large quantity of blood. I have had a patient lose six grams of hemoglobin into the skin and subcutaneous tissue when he was given an injection by a physician who had not been informed of his hypocoagulable state secondary to anticoagulant therapy.

In addition to the blood loss, there was a tremendous loss of fluid in his perspiration. This contributed to his weakness. Furthermore, the subcutaneous hemorrhages caused a severe tenderness of the skin, as we all have learned from the subcutaneous hemorrhages and bruises that we have received in sports or other injuries.

After the agony in the garden, Judas and the soldiers came to arrest Jesus.²⁹ Bishop⁵⁴ reports that it was customary for a Roman soldier, on arresting a man, to grab the right hand and twist the right arm to the back and to the left scapula. Then he would jam his heel down on the prisoner's instep to order to injure his arch and prevent him from running away. This caused severe pain to Jesus when he walked or stood.

Then the prioner and soldiers walked to the house of Caiphias, a distance of about one and a half miles. We must remember that the streets were made of rough stone and were unlighted. The guards were rough. All this caused more fatigue, dehydration and pain in the foot of Jesus. His skin was tender from the hematidrosis.

The trial by the Sanhedrin came next. During the remainder of the night the soldiers tormented Jesus in the garden of the High Priest. He was blindfolded, struck,

and beaten, all the more painful on the tender skin.

The night was cold. Jesus was already dehydrated and hypovolemic. There was no sleep, no food or drink recorded. The Romans had reserved the right to order capital punishment and Pilate had to make the decision. After several hours of torture, he was led to see Pontius Pilate at the Fortress Antonia. This was at about seven a.m.⁵⁴ From there, he was sent to Herod, another half mile. There he was mocked and sent back to Pilate, again a half mile painful walk. Jesus was suffering greatly. With the exhaustion, weakness, hunger, thirst, generalized skin pain.

Then came the shouts of the crowd, "CRUCIFY HIM, CRUCIFY HIM"²⁹ And then, he was sent to be scourged. He was stripped of his clothing and tied to a pole prior to the scourging. We cannot imagine the pain that the many strokes of the flagrum caused on his tender skin!

We do not know how much more bleeding occurred but with the tender skin, it could have been significant. He became the target of the jokes of the soldiers, since he claimed to be king, and then came the crowning with thorns. The soldiers plaited a crown made of branches of the *zizyphus spina*, small trees which were present in Jerusalem.¹ These branches had long thorns, and as the crown was put in place, they punctured the scalp in many places. Since the scalp is very vascular it bleeds profusely, as we physicians have seen many times in scalp wounds. This bleeding caused more weakness and more hypovolemia.

Now the final walk to Calvary. The patibulum was put over Jesus's shoulders and his arms secured to it with ropes. Imagine what pain the one hundred pound rough piece of wood caused to his tender skin.

The procession of prisoners, led by soldiers under the command of a centurian, started on the fourteen hundred foot climb up the hill to Calvary from the fortress of Antonia. Jesus must have staggered and fallen several times, until it became obvious to the Centurion that he could not make it to the site of the crucifixion. Therefore, Simon of Cyrene was forced to shoulder the heavy patibulum for the remainder of the journey.²⁹

Each step was painful for Jesus. His skin was tender from the bleeding and in the places where it was torn by the scourging. The foot injury also contributed to unbearable pain. He must have had a marked tachycardia from the dehydration and the blood loss. His respirations become rapid. Finally they reached the top of the hill where the stipes were in place waiting for their next victims.

Before the final fastening to the cross, it was customary to give the victim a drink of wine mixed with myrrh to help relieve the pain of the coming ordeal. Jesus refused this potion.²⁹

Now the soldiers stripped Jesus of His clothing and forced him to lie on His back with His arms outstretched. Then he was nailed to the patibulum with a nail in each wrist, partially severing the median nerve.^{1,7} This caused more pain and resulted in flexion of both thumbs.

When the nailing was completed, two soldiers took each end of the patibulum, lifted it up and placed it in position on the stipes with Jesus hanging by His wrists. He felt excruciating pain as His body sagged as far as it could. Then the soldiers bent the right foot at the knee and forced the sole against the stipes. This was nailed through the os calcis. Then the left foot was positioned over the right foot and a nail driven

through both of them through a metatarsal space of each.

Then the agony of the cross started. Jesus's body would sag as He hung by His wrists. The muscles of the hands, the arm and chest muscles hurt and soon went into spasm, making breathing difficult. He already had tachycardia but, with the hypoxemia that developed from the inadequate respirations, this became worse. He forced Himself to straighten His painful legs on the nails in the feet so that breathing would become easier. He would remain in this position as long as He could endure the pain in His feet, and then He would sag down again. Each period of sagging would be longer and the periods of straightening up would be shorter. During all of this time He was being mocked by the soldiers and the passers-by. Yet, in spite of this, as He rose up to breathe He spoke:

*"Father, forgive them, they know not what they are doing."*²⁹

And then again He sagged. Soon one of the thieves asked Jesus to let Himself down from the cross and free them too. But the other thief only asked that Jesus remember him in His kingdom. And Jesus, again, rising on the nails in His feet, cleared His mind, and said,

*"Indeed, I promise you, today you will be with me in paradise."*²⁹

And seeing His mother and The Beloved Disciple, He said,

*"Woman, this is your son" and to the disciple he said, "This is your mother."*²⁹

The suffering increased. Respiratory and metabolic acidosis developed. Capillary permeability increased and transudates developed in the pleural, pericardial and abdominal cavities, causing inadequate ventilation and thus overloading the heart.

The scriptures record that there was darkness over the land from the sixth to the ninth hour.²⁹ Jesus felt alone in His suffering in the darkness. And at the ninth hour He cried out,

*"My God, My God, why hast thou forsaken me?"*²⁹

The periods of partial asphyxia became longer, acidosis and hypovolemia progresses. And He cried out,

*"I'm thirsty"*²⁹

A soldier dipped a sponge in vinegar and placed it to His mouth for Him to get a little moisture. What little intake for His severe dehydration!

His acidosis and weakness increased, and He cried,

*"Father, into thy hands I commend my spirit"*²⁹

And then,

*"It is accomplished"*²⁹

And He died.

Then as a "coup de grace" a soldier pierced His chest with a spear. As one would expect, water from the pleural and pericardial effusions and blood from the heart came out.²⁹

Medically, we feel that Christ died from a combination of conditions: the weakness from hematomatosis, dehydration from profuse sweating, bleeding from the scourging and the lesions in His scalp, all causing hypovolemia. The severe physical exhaustion from the long walks, the scourging, and the climb to Calvary all contributed to the weakness. Because of this He was not able to hold Himself up to breathe very long at a time and asphyxia developed. Pleural and pericardial effusions aggravated the anoxia. Marked tachycardia, pulmonary edema, heart failure, metabolic acidosis, and shock developed. A cardiac arrhythmia could have been the terminal event due to hyperkalemia.

Crucifixion is described by Cooper¹⁰ as the "greatest example of man's inhumanity to man". As we meditate on this severe suffering that Jesus endured to free us from our sins, we must humbly say, MEA CULPA, MEA CULPA, MEA MAXIMA CULPA.

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