CRUCIFIXION

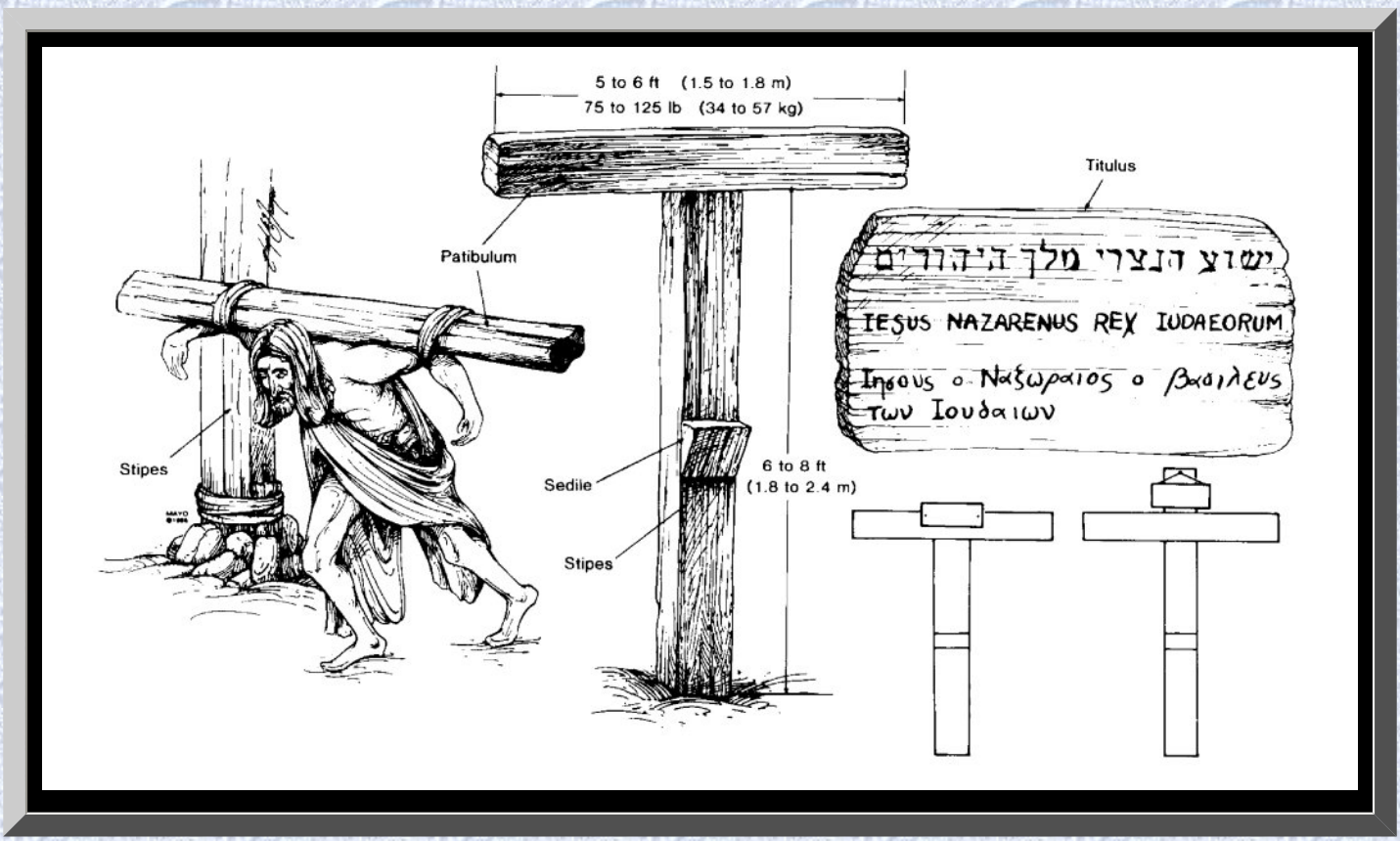

Fig 3.Cross and titulus. **Left, victim carrying crossbar (patibulum) to site of upright post (stipes). center Low Tau cross (crux commissa), commonly used by Romans at time of Christ. upper right, Rendition of Jesus' titulus with name and crime Jesus of Nazareth, King of the Jews written in Hebrew, Latin, and Greek. Lower right Possible methods for attaching tittles to Tau cross (left) and Latin cross (right).**

Variations in Cross's Used for Crucifixion	
Latin Designation	**Characteristics**
lnfelix lignum	Tree
Crux simplex,	Upright post
crux acuta	
Crux composita	Stipes and patibulum
Crux humilis	Low cross
Crux sublimis	Tall cross
Crux commissa	T-shaped (Tau) cross
Crux immissa	V-shaped (Latin) cross
Crux capitata	V-shaped (Latin) cross
Crux decussata	X-shaped cross

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Crucifixion Practices

Crucifixion probably first began among the Persians.[34] Alexander the Great introduced the practice to Egypt and Carthage, and the Romans appear to have learned of it from the Carthaginians.[11] Although the Romans did not invent crucifixions they perfected it as a form of torture and capital punishment that was designed to produce a slow death with maximum pain and suffering.[10,17] It was one of the most disgraceful and cruel methods of execution and usually was reserved only for slaves, foreigners, revolutionaries, and the vilest of criminals.[3,25, 28] Roman law usually protected Roman citizens from crucifixion, [5] except perhaps in the ease of desertion by soldiers.

In its earliest form in Persia, the victim was either tied to a tree or was tied to or impaled on an upright post, usually to keep the guilty victim's feet from touching holy ground.[8,11,30,34,38] Only later was a true cross used; it was characterized by an upright post (stipes) and a horizontal crossbar (patibulum), and it had several variations (Table).[11] Although archaeological and historical evidence strongly indicates that the low Tau cross was preferred by the Romans in Palestine at the time of Christ (Fig 3),[2,7,11] crucifixion practices often varied in a given geographic region and in accordance with the imagination of the executioners, and the Latin cross and other forms also may have been used.[28]

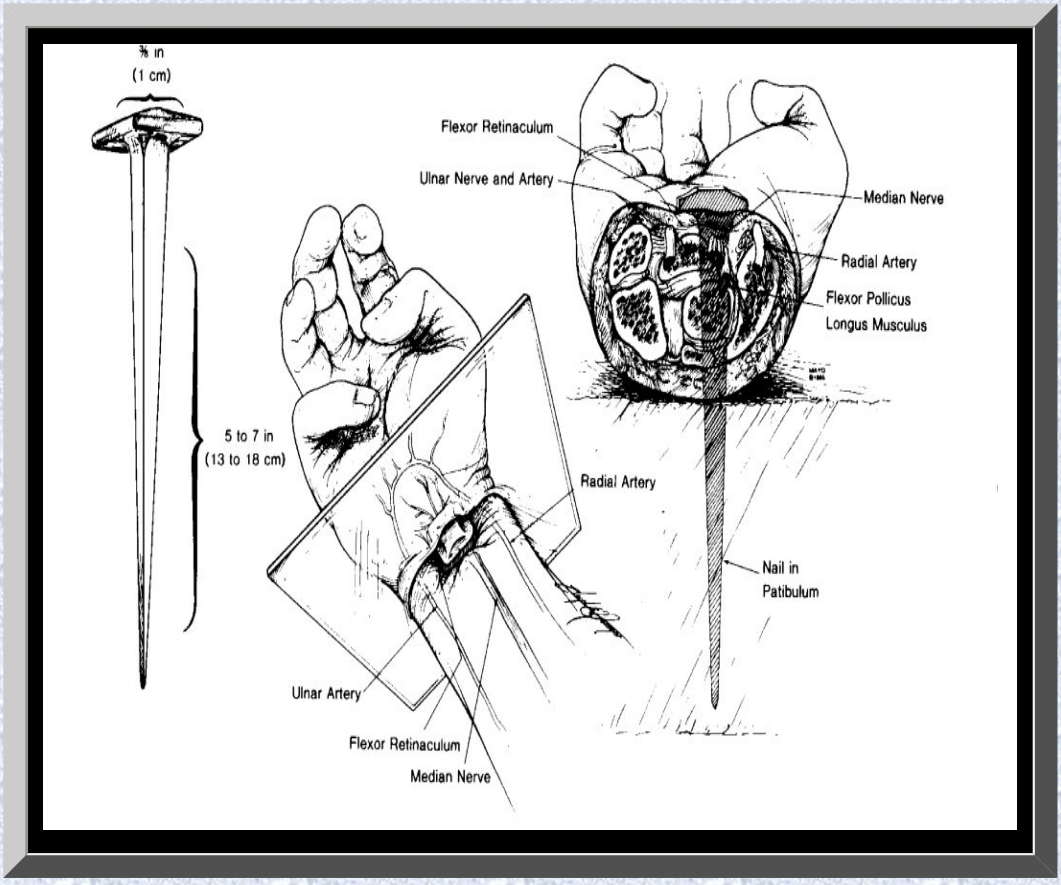


Fig 4.Nailing of wrists. Left, Size of iron nail. Center, Location of nail in wrist, between carpals and radius. Right, Cross section of wrist, at level of plane indicated at left, showing path of nail, with probable transection of median nerve and impalement of flexor pollicis longus, but without injury to major arterial trunks and without fractures of bones.

It was customary for the condemned man to carry his own cross from the flogging post to the site of crucifixion outside the city walls.[8,11,30] He was usually naked, unless this was prohibited by local customs.[11] Since the weight of the entire cross was probably well over 300 lb. (136 kg), only the crossbar was carried (Fig 3).[11] The patibulum, weighing 75 to 125 lb. (34 to 57 kg),[11,30] was placed across the nape of the victim's neck and balanced along both shoulders. Usually, the outstretched arms.then were tied to the crossbar.[7, 11] The processional to the site of crucifixion was led by a complete Roman military guard, headed by a centurion.[3,11] One of the soldiers carried a sign (titulus) on which the condemned man's name and crime were displayed (Fig 3).[3,11] Later, the titulus would be attached to the top of the cross.[11]The Roman guard would not leave the victim until they were sure of his death. [9,11]

Outside the city walls was permanently located the heavy upright wooden stipes, on which the patibulum would be secured. In the case of the Tau cross, this was accomplished by means of a mortise and tenon joint, with or without reinforcement by ropes. [10,11,30] To prolong the crucifixion process, a horizontal wooden block or plank, serving as a crude seat (sedile or sedulum), often was attached midway down the stipes.[3,11,16] Only very rarely, and probably later than the time of Christ, was an additional block (suppedaneum) employed for transfixion of the feet.[9,11]

At the site of execution, by law, the victim was given a bitter drink of wine mixed with myrrh (gall) as a mild analgesic .[7,17] The criminal was then thrown to the ground on his back, with his arms outstretched along the patibulum.[11] The hands could be nailed or tied to the crossbar, but nailing apparently was preferred by the Romans..[8,11] The archaeological remains of a crucified body, found in an ossuary near Jerusalem and dating from the time of Christ, indicate that the nails were tapered iron spikes approximately 5 to 7 in (13 to 18 cm) long with a square shaft 3/8 in (1 cm) across. [23, 24, 30] Furthermore, ossuary findings and the Shroud of Turin have documented that the nails commonly were driven through the wrists rather than the palms (Fig 4). [22-24, 30]

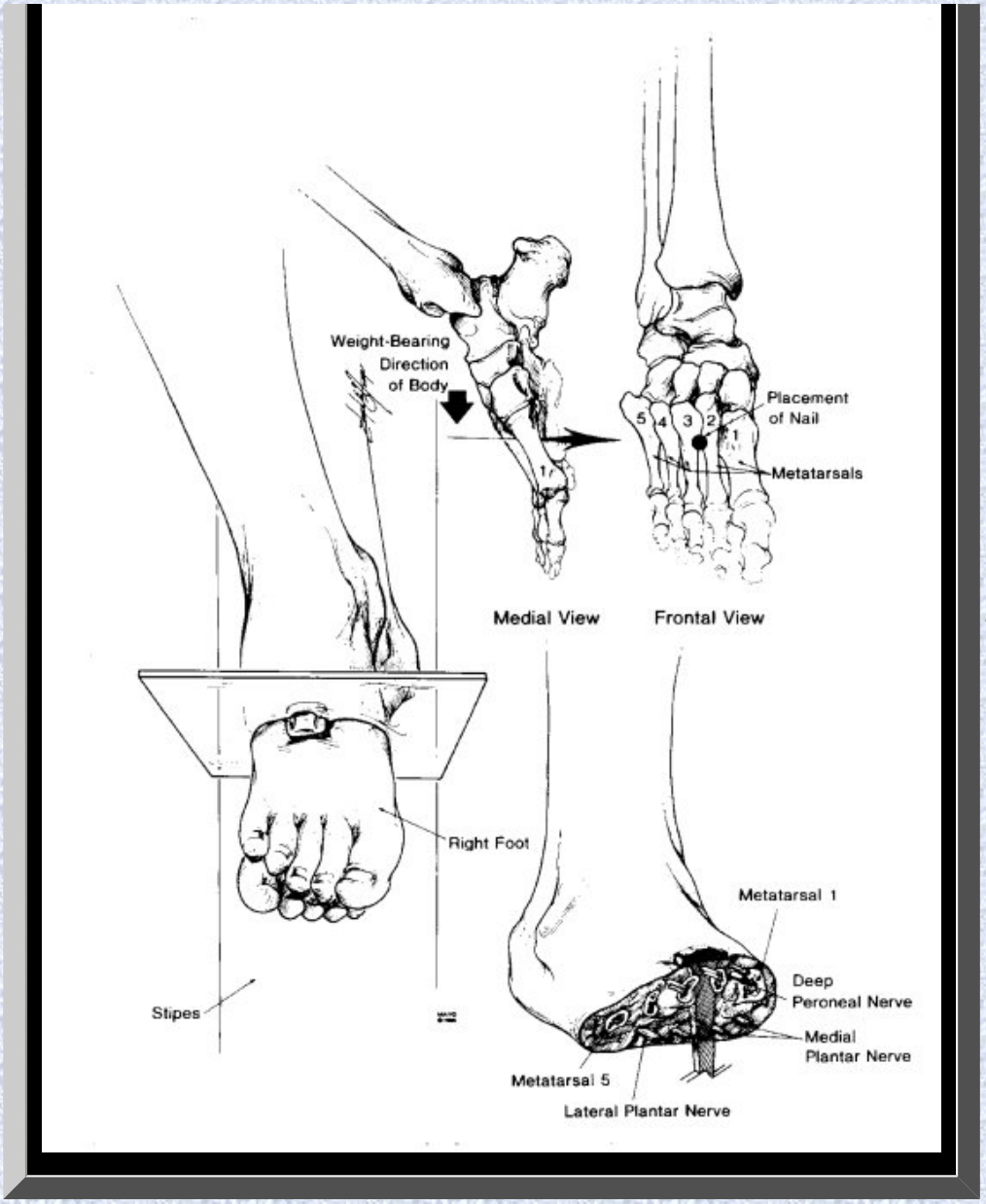
After both arms were fixed to the crossbar, the patibulum and the victim, together, were lifted onto the stipes.[11] On the low cross, four soldiers could accomplish this relatively easily. However, on the tall cross, the soldiers used either wooden forks or ladders.[11]

Next, the feet were fixed to the cross, either by nails or ropes. Ossuary findings and the Shroud of Turin suggest that nailing was the preferred Roman practice.[23, 24, 30] Although the feet could be fixed to the sides of the stipes or to a wooden footrest (suppedaneum), they usually were nailed directly to the front of the stipes (Fig 5).[11] To accomplish this, flexion of the knees may have been quite prominent, and the bent legs may have been rotated laterally (Fig 6) [23 -25,30]

Fig 5.Nailing of feet.

Left, Position of feet atop one another and against stipes. Upper right, Location of nail in second inter metatarsal space. Lower right, Cross section of foot, at plane indicated at left, showing path of nail.

When the nailing was completed, the titulus was attached to the cross, by nails or cords, just above the victim's head.[11] The soldiers and the civilian crowd often taunted and jeered the condemned man, and the soldiers customarily divided up his clothes among themselves [11,25] The length of survival generally ranged from three or four hours to three or four days and appears to have been inversely related to the severity of the scourging.[8, 11] However, even if the scourging had been relatively mild, the Roman soldiers could hasten death by



breaking the legs below the knees (erurifragium or skelokopia).[8], [11]

Not uncommonly, insects would light upon or burrow into the open wounds or the eyes, ears, and nose of the dying and helpless victim, and birds of prey would tear at these sites.[16] Moreover, it was customary to leave the corpse on the cross to be devoured by predatory animals..[8], [11], [12], [28] However, by Roman law, the family of the condemned could take the body for burial, after obtaining permission from the Roman judge.[11]

Since no one was intended to survive crucifixions the body was not released to the family until the soldiers were sure that the victim was dead. By custom, one of the Roman guards would pierce the body with a sword or lance.[8], [11] Traditionally, this had been considered a spear wound to the heart through the right side of the chest -- a fatal wound probably taught to most Roman soldiers.[11] The Shroud of Turin documents this form of injury.[5],[11],[22] Moreover, the standard infantry spear, which was 5 to 6 ft (1.5 to 1.8 m) long,lø could easily have reached the chest of a man crucified on the customary low cross."

Medical Aspects of Crucifixion

With a knowledge of both anatomy and ancient crucifixion practices, one may reconstruct the probable medical aspects of this form of slow execution. Each wound apparently was intended to produce intense agony, and the contributing causes of death were numerous.

The scourging prior to crucifixion served to weaken the condemned man and, if blood loss was considerable, to produce orthostatie hypotension and even hypovolemie shock.[8], [12] When the victim was thrown to the ground on his back, in preparation for transfixion of the hands, his scourging wounds most likely would become torn open again and contaminated with dirt.[2], [16] Furthermore, with each respiration, the painful scourging wounds would be scraped against the rough wood of the stipes. [7] As a result, blood loss from the back probably would continue throughout the crucifixion ordeal.

With arms outstretched but not taut, the wrists were nailed to the patibulum.[7],[11] It has been shown that the ligaments and bones of the wrist can support the weight of a body hanging from them, but the palms

cannot.[11] Accordingly, the iron spikes probably were driven between the radius and the carpals or between the two rows of carpal bones, [2],[10], [11],[30] either proximal to or through the strong band like flexor retinaeulum and the various interearpal ligaments (Fig 4). Although a nail in either location in the wrist might pass between the bony elements and thereby produce no fractures, the likelihood of painful periosteal injury would seem great. Furthermore, the driven nail would crush or sever the rather large sensorimotor median nerve (Fig 4).[2], [7], [11] The stimulated nerve would produce excruciating bolts of fiery pain in both arms.[7], [9] Although the severed median nerve would result in paralysis of a portion of the hand, isehemie eontraetures and impalement of various ligaments by the iron spike might produce a claw like grasp.

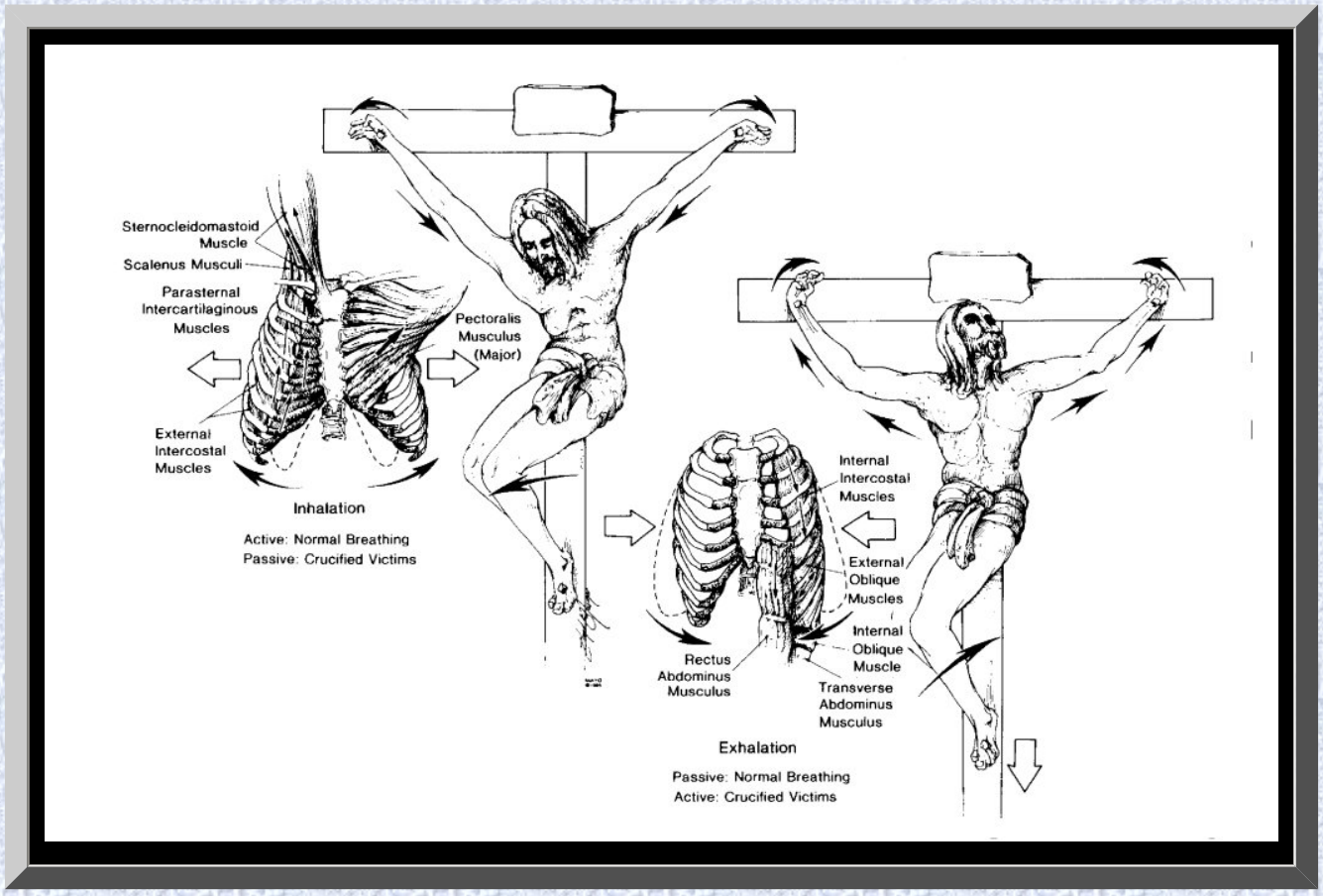


Fig 6. Respirations during crucifixion. Left, Inhalation. With elbows extended and shoulders abducted, respiratory muscles of inhalation are passively stretched and thorax is expanded. Right, Exhalation. With elbows flexed and shoulders adducted and with weight of body on nailed feet, exhalation is accomplished as active, rather than passive, process. Breaking legs below knees would place burden of exhalation on shoulder and arm muscles alone and soon would result in exhaustion asphyxia.

Most commonly, the feet were fixed to the front of the stipes by means of an iron spike driven through the first or second inter metatarsal space, just distal to the tarsometatarsal joint.[2], [5], [8], [11], [30] It is likely that the deep peroneal nerve and branches of the medial and lateral plantar nerves would have been injured by the nails (Fig 5). Although scourging may have resulted in considerable blood loss, crucifixion per se was a relatively bloodless procedure, since no major arteries, other than perhaps the deep plantar arch, pass through the favored anatomic sites of transfixion. [2],[10], [11]

The major pathophysiologic effect of crucifixion, beyond the excruciating pain, was a marked interference with normal respiration, particularly exhalation (Fig 6). The weight of the body, pulling down on the outstretched arms and shoulders, would tend to fix the intercostal muscles in an inhalation state and thereby hinder passive exhalation. [2], [10], [11] Accordingly, exhalation was primarily diaphragmatic, and breathing was shallow. It is likely that this form of respiration would not suffice and that hypercarbia would soon result. The onset of muscle cramps or tetanic contractions, due to fatigue and hypercarbia, would hinder respiration even further.[11]

Adequate exhalation required lifting the body by pushing up on the feet and by flexing the elbows and adducting the shoulders (Fig 6) [2] However, this maneuver would place the entire weight of the body on the

tarsals and would produce searing pain.[7] Furthermore, flexion of the elbows would cause rotation of the wrists about the iron nails and cause fiery pain along the damaged median nerves.[7] Lifting of the body would also painfully scrape the scourged back against the rough wooden stipes. [2], [7] Muscle cramps and paresthesias of the outstretched and uplifted arms would add to the discomfort. [7] As a result, each respiratory effort would become agonizing and tiring and lead eventually to asphyxia. [2],[3], [7], [10], [11]

The actual cause of death by crucifixion was multifactorial and varied somewhat with each ease, but the two most prominent causes probably were hypovolemie shock and exhaustion asphyxia.[2],[3], [7], [10]Other possible contributing factors included dehydration, [7], [16] stress-induced arrhythmias,[3] and congestive heart failure with the rapid accumulation of pericardial and perhaps pleural effusions. [2], [7], [11] Crucifracture (breaking the legs below the knees), if performed, led to an asphyxic death within minutes.[11>]

Death by crucifixion was, in every sense of the word, excruciating (Latin, *excruciatus*, or "out of the cross").

Crucifixion of Jesus

After the scourging and the mocking, at about 9 AM, the Roman soldiers put Jesus' clothes back on him and then led him and two thieves to be crucified.[1] Jesus apparently was so weakened by the severe flogging that he could not carry the patibulum from the Praetorium to the site of crucifixion one third of a mile (600 to 650 m) away.[1], [3], [5], [7] Simon of Cyrene was summoned to carry Christ's cross, and the processional then made its way to Golgotha (or Calvary), an established crucifixion site.

Here, Jesus' clothes, except for a linen loincloth, again were removed, thereby probably reopening the scourging wounds. He then was offered a drink of wine mixed with myrrh (gall) but, after tasting it, refused the drink.[1] Finally, Jesus and the two thieves were crucified. Although scriptural references are made to nails in the hands,[1] these are not at odds with the archaeological evidence of wrist wounds, since the ancients customarily considered the wrist to be a part of the hand.[7], [11] The titulus (Fig 3) was attached above Jesus' head. It is unclear whether Jesus was crucified on the Tau cross or the Latin cross; archaeological findings favor the former [11] and early tradition the latter.[38] The fact that Jesus later was offered a drink of wine vinegar from a sponge placed on the stalk of the hyssop plant[1] (approximately 20 in, or 50 em, long) strongly supports the belief that Jesus was crucified on the short cross.[6]

The soldiers and the civilian crowd taunted Jesus throughout the crucifixion ordeal, and the soldiers east lots for his clothing. [1] Christ spoke seven times from the cross. Since speech occurs during exhalation, these short, terse utterances must have been particularly difficult and painful. At about 3 PM that Friday, Jesus cried out in a loud voice, bowed his head, and died.[1] The Roman soldiers and onlookers recognized his moment of death.[1]

Since the Jews did not want the bodies to remain on the crosses after sunset, the beginning of the Sabbath, they asked Pontius Pilate to order erueifraeture to hasten the deaths of the three crucified men.[1] The soldiers broke the legs of the two thieves, but when they came to Jesus and saw that he was already dead, they did not break his legs.[1] Rather, one of the soldiers pierced his side, probably with an infantry spear, and produced a sudden flow of blood and water.[1] Later that day, Jesus' body was taken down from the cross and placed in a tomb.[1]

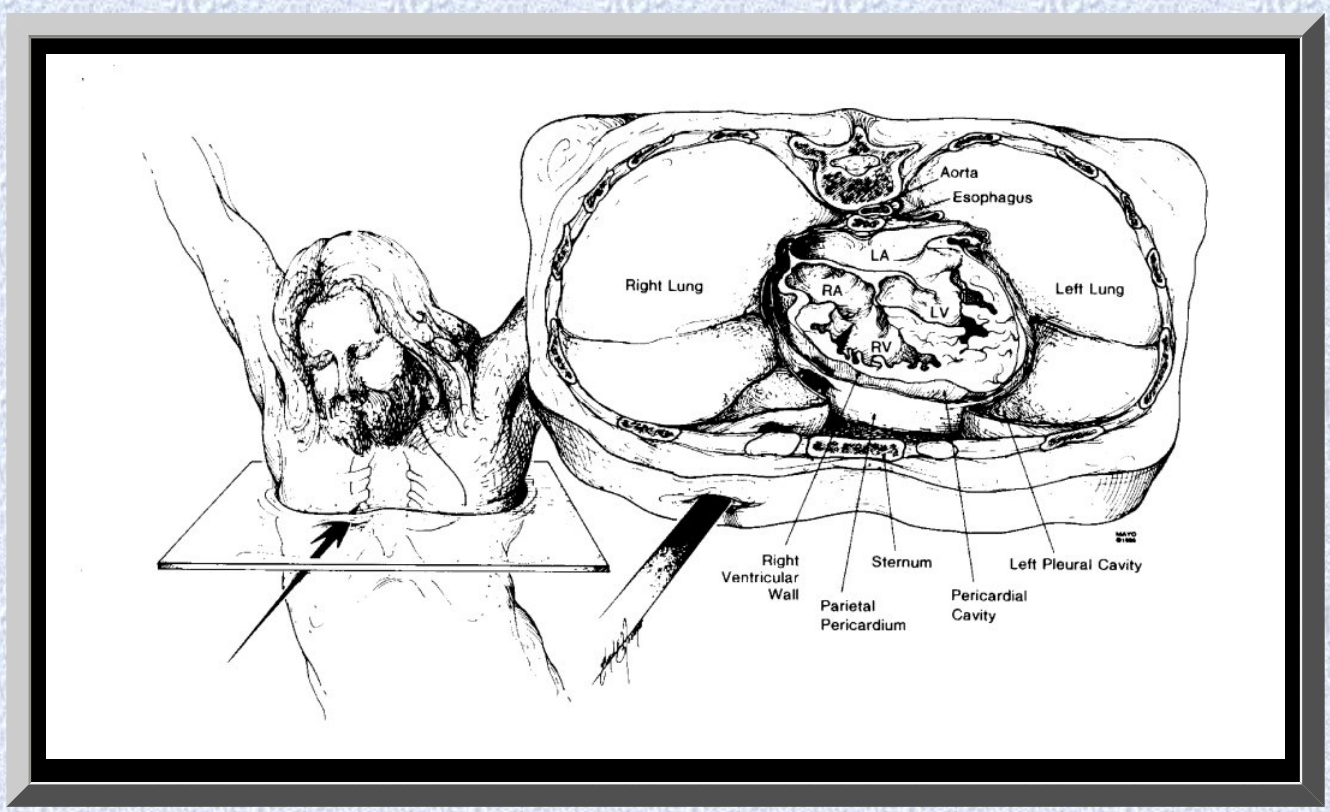


Fig 7.Spear wound to chest. **Left, Probable path of spear. Right, Cross section of thorax, at level of plane indicated at left, showing structures perforated by spear. LA indicates left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle.**

Go To Section 7, DEATH OF JESUS

The Menu:

Easy Navigation Bar

Click here for Additional Articles on the Death of Jesus

A Physician Analyzes The Crucifixion, by Dr. C. Truman Davis
Medical Aspects Of The Crucifixion Of Jesus Christ, Compiled by David Terasaka, M.D.
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Matthew 26:17 - Mark 14:12-15 - Luke 22:7-23 - John 13:1-19

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