



## HISTORY OF MEDICINE

## The history and pathology of crucifixion

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In antiquity crucifixion was considered one of the most brutal and shameful modes of death. Probably originating with the Assyrians and Babylonians, it was used systematically by the Persians in the 6th century BC. Alexander the Great brought it from there to the eastern Mediterranean countries in the 4th century BC, and the Phoenicians introduced it to Rome in the 3rd century BC. It was virtually never used in pre-Hellenic Greece. The Romans perfected crucifixion for 500 years until it was abolished by Constantine I in the 4th century AD. Crucifixion in Roman times was applied mostly to slaves, disgraced soldiers, Christians and foreigners — only very rarely to Roman citizens. Death, usually after 6 hours — 4 days, was due to multifactorial pathology: after-effects of compulsory scourging and maiming, haemorrhage and

dehydration causing hypovolaemic shock and pain, but the most important factor was progressive asphyxia caused by impairment of respiratory movement. Resultant anoxaemia exaggerated hypovolaemic shock. Death was probably commonly precipitated by cardiac arrest, caused by vasovagal reflexes, initiated *inter alia* by severe anoxaemia, severe pain, body blows and breaking of the large bones. The attending Roman guards could only leave the site after the victim had died, and were known to precipitate death by means of deliberate fracturing of the tibia and/or fibula, spear stab wounds into the heart, sharp blows to the front of the chest, or a smoking fire built at the foot of the cross to asphyxiate the victim.

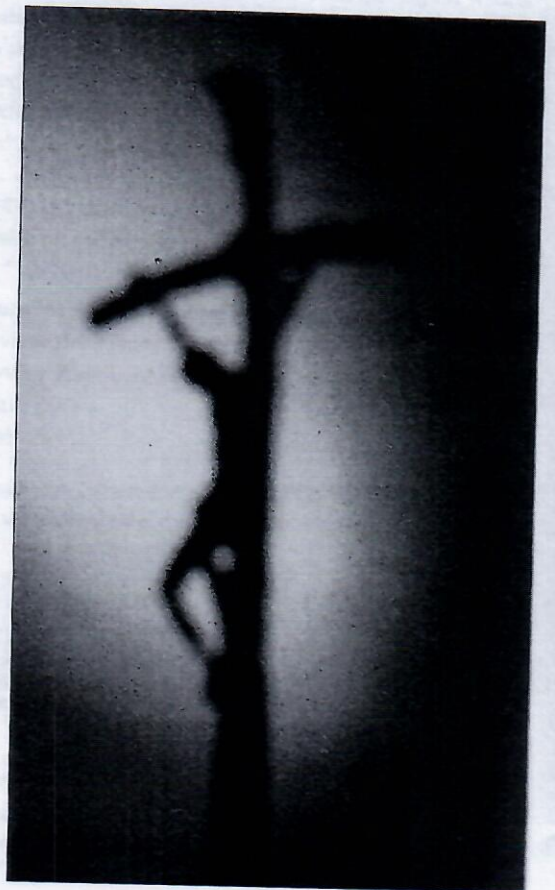
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The three most brutal forms of execution known to antiquity were judged to be *crux* (crucifixion), *crematio* (burning), and *decollatio* (decapitation), in that order.<sup>1</sup> Originating in Mesopotamia and Persia, crucifixion was perfected by the Romans, who saw it as a most shameful mode of death,<sup>2</sup> with Cicero once exclaiming that it was inappropriate for a Roman even to be confronted with the word 'cross'.<sup>3</sup> The history of this procedure over almost a thousand years until it was abolished in the 4th century AD is reviewed, with emphasis on medical aspects of death by crucifixion.

### History

Crucifixion may be defined as a method of execution by which a person is hanged, usually by his arms, from a cross or similar structure until he dies. This must be differentiated from an ancient Jewish custom whereby a condemned person was first executed, e.g. by stoning, and then hung from a post, tree or other structure.<sup>1,2</sup>

Probably originating with the Assyrians and Babylonians, crucifixion was first used systematically by the Persians. In its earliest form in Persia the victim was tied to a tree or post, or even impaled on an upright post, with feet clear of the ground. Only later was a cross used.<sup>1,2</sup> In the 4th century BC Alexander the Great adopted crucifixion and brought it to the Mediterranean shores where his successors introduced it *inter alia* to Egypt, Syria, Phoenicia





and Carthage. During the Punic Wars the Romans learnt the technique and proceeded to become the principal utilisers of crucifixion for more than five centuries.<sup>1</sup>

Crucifixion was virtually never used in pre-Hellenic Greece, although it was mentioned in non-historical literature.<sup>1</sup> However, wherever the Roman legions went crucifixion was practised, and according to historians local tribes retaliated in kind. In AD 9 the victorious Germanic leader, Arminius, crucified many of the Roman general Varus's defeated soldiers,<sup>4</sup> and in AD 28 Germanic tribesmen crucified Roman tax collectors.<sup>5</sup> During Boadicea's revolt in Britain (AD 59 - 61) many legionnaires were crucified.<sup>6</sup> Little information exists about the extent of crucifixion practised in Spain, Gaul, North Africa, the Danube valley and Asia Minor.<sup>1</sup>

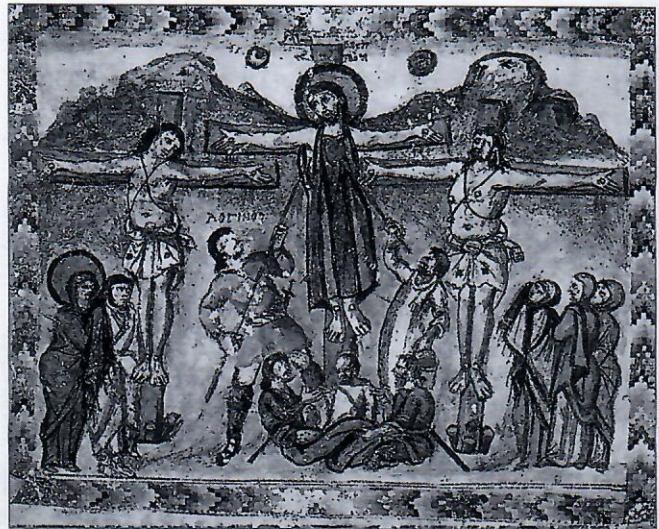
Although it is commonly accepted that crucifixion did not play a role in early Judaic Law, Fitzmyer<sup>7</sup> makes a case for possible pentateuchal origins. The Qumran parchments certainly approved of it and we do have evidence of Jewish crucifixions after the 2nd century BC.<sup>8</sup> At the time of Christ, Jewish Law therefore accepted crucifixion in addition to older methods of execution like stoning and strangling, considering it a particularly shameful way of dying and a curse from God (Deuteronomy 21: 23).<sup>2</sup> Under Roman occupation crucifixion became commonplace in Palestine, Varus crucifying 2 000 Jews in 4 BC and Josephus reporting on mass crucifixions during the Jewish War.<sup>1,9</sup>

Crucifixion was finally abolished by Constantine I after AD 320.<sup>1</sup>

## Roman indications for crucifixion

Although Roman citizenship brought a measure of protection against execution by crucifixion, this protection was not absolute.<sup>1</sup> The Republican axiom of equality of all in terms of Roman law became eroded during the early Empire. The new concept of *honestiores* (upper classes) and *humiliores* (lower classes) developed, with the former very rarely crucified.<sup>1</sup> Crucifixion was generally seen as slave punishment. But other groups, such as Christians, foreigners and liberated slaves (*liberti*) were also numerous, whether or not they had acquired Roman citizenship and had been promoted to equestrian rank. Kuhn<sup>1</sup> showed that although a rare event, Roman citizens were crucified from time to time.

During the 1st century Palestine saw the crucifixion of large numbers of rebels against Rome (mostly Jews).<sup>1,10,11</sup> Christ was crucified on the pretext that he instigated rebellion against Rome, on a par with Zealots and other political activists.<sup>9</sup> Kuhn<sup>1</sup> makes the point that although many victims condemned to crucifixion were called robbers, the majority were probably politically motivated individuals rather than true criminals. He furthermore states that in Palestine the Romans were primarily interested in subjugating political dissent, not ordinary criminality.<sup>1</sup>



Crucifixion scene, from illustration in *Codex Rabula* (Zagbar, East Syria, AD 586).

## Crucifixion procedure

### The cross

In Persian times crucifixion was originally performed on trees or simple pole structures rather than a formal cross.<sup>12</sup> The Romans still crucified on trees (*infelix lignum*) or post (*crux simplex*) from time to time, but now a variety of crosses came into regular use, viz. an X-shaped cross (*crux decussata*), but in the majority of cases the well-known Latin cross (†) (*crux immissa*) or Tau cross (T) (*crux commissa*) were used. These crosses could be tall (*crux sublimis*), but were more commonly low (*crux humilis*), and consisted of an upright post (*stipes*) and crossbar (*patibulum*). The commonly used low cross was 1.8 - 2.4 m tall and the *patibulum* 1.5 - 1.8 m long and it weighed well over 130 kg, with the *patibulum* alone weighing up to 57 kg. The *stipes* was usually implanted ahead of the crucifixion event, and the *patibulum* attached after the victim had been nailed or tied to it. The inscription (*titulus*) was nailed to the *stipes* above the victim. Sometimes a wooden support for the buttocks (*sedile, sedicula*) was attached to the *stipes*, and rather rarely a footrest (*suppedaneum*).

### Preliminary procedures

In Roman law a person condemned to death (including crucifixion) had to be scourged beforehand, with the exception of women, Roman senators or soldiers (but not in cases of desertion).

Scourging was a particularly brutal procedure, performed with wooden staves or a short whip (*flagellum, flagrum*) with several leather thongs into which small balls or sharp sheep bone fragments were tied. The person was stripped naked, tied to an upright post and then flogged across the back, buttocks and legs by one or two soldiers (*lictores*). Primrose suggests



that scourging was applied to the front of the body as well.<sup>9</sup> In Roman law there was no limit to the extent of flogging, but in Jewish law it was limited to 40 blows. The extent of the scourging therefore depended largely on the inclination of the *lictores*, was intended to weaken the victim significantly, and invariably resulted in deep wounding, severe pain and bleeding. Frequently the victim fainted during the procedure and sudden death was not uncommon.<sup>12</sup>

The victim was then usually taunted, then forced to carry the *patibulum* tied across his shoulders to the place of execution.<sup>12</sup>

In addition to scourging the condemned could also be maimed, e.g. by excision of the tongue or other bodily parts or blinding of the eyes.<sup>1</sup> Josephus<sup>13</sup> reports a particularly cruel procedure used by Antiochus IV whereby the victim's strangled child was hung around his neck.

A set of Roman guards commanded by a centurion accompanied the condemned to the place of execution and stayed on duty until the victim had died. A herald walked ahead with the *titulus*, and on the way bystanders derided and taunted the condemned.<sup>12</sup>

### The crucifixion process

In Jerusalem, according to custom, women offered the victim an analgesic drink consisting of wine and myrrh or incense.<sup>12</sup> If not already naked he was then stripped and made to lie on his back with his arms extended along the *patibulum*. The arms were tied to the beam, or fixed by means of iron nails driven through the wrists, rather than the hands which sometimes could not carry the body weight without tearing loose. There is also evidence that these square nails (13 - 18 cm long; 1 cm thick) were occasionally driven through the upper forearms.<sup>12</sup> On occasion the victim was crucified upside down.<sup>1</sup>

The *patibulum* and victim were now lifted and fixed onto the *stipes* and the feet tied or nailed to the upright post. This could happen in a variety of ways — either the feet were nailed to the sides of the *stipes*, or atop each other to the front of the *stipes*. In the latter case a single nail was usually driven through the metatarsal bones of both feet, with the soles nearly horizontal to the *stipes*'s surface, and the knees flexed. Archaeological evidence shows that the feet were sometimes encased in a small wooden box-like structure before being nailed to the post. In that case the flexed knees and feet were swung laterally and a nail driven through the superimposed *calcanei* (heelbones).<sup>1,12</sup> The *titulus* was then affixed.

The soldiers divided the victim's clothes among themselves, and awaited death, which on average would take from 3 - 4 hours to 3 - 4 days. If there was reason to expedite death or to ensure that death had set in, the legs (one or both) were broken beneath the knees (*crurifragium*) with a blunt implement, although axes and even toothed metal implements were

sometimes used.<sup>14</sup> Death could also be ensured by way of a club blow to the sternal region or a spear stab to the heart through the upper abdomen or chest. Occasionally a smoking fire was lit at the foot of the cross to smother the victim.<sup>2,12</sup>

After death Roman law allowed the family of the deceased to remove the body for burial, after obtaining permission from a judge. Otherwise it was customary to leave the corpse on the cross to be devoured by predatory animals and birds.<sup>12</sup>

### Causes of death

Victims died of multifactorial pathology.<sup>2,12</sup>

#### Preliminaries to crucifixion

Preliminaries to crucifixion like scourging and maiming caused the condemned to arrive at the cross severely traumatised. In addition to psychological shock and severe pain, blood and serum oozing from deep wounds caused by the *flagellum* caused a degree of hypovolaemic shock.<sup>2,12</sup> Sudden death during scourging probably resulted from reflex vasovagal cardiac arrest. Conditions known to precipitate vasovagal cardiac arrest include any very acute pain; pressure on the neck; a blunt blow to the chest, abdomen, groin or neck; puncture of the pleura; sudden dilatation of a hollow organ like the gut or cervix; sudden inflow of cold water into the nasopharynx or down the trachea; and acute anoxaemia.<sup>15</sup>

Many victims probably had little to eat or drink in the period preceding crucifixion, and abstinence on the cross must have caused progressive dehydration, aggravating hypovolaemia from other causes.<sup>12</sup> During crucifixion severe continuous pain would have arisen *inter alia* from the nailing procedure, the scourged back rubbing against the rough cross (also aggravating bleeding) and cramps in the arms, shoulders and to a lesser extent, the legs. A large nail driven through the wrists would probably have parted rather than fractured the carpal bones, but could certainly have injured the median nerve, with resultant pain. Similar nerve pain could have arisen from damage to the peroneal and plantar nerves in the feet. Death by crucifixion was indeed excruciating (*excruciates*, 'out of the cross') in every sense of the word.<sup>1,12</sup>

#### Main cause of death

The main cause of death in the majority of victims would have been asphyxiation from severely hampered respiration with secondary cardiovascular collapse.<sup>2,12</sup> Hanging from the arms made expiration very difficult, and when muscle cramps set in, spasmodic contraction of the arms probably became impossible. Respiratory assistance from leg extension would also have been progressively more difficult, and eventually respiration was purely diaphragmatic, and asphyxiation inevitable.<sup>2,12</sup>



Severe lack of tissue oxygen in turn causes so-called Moon's vicious cycle characterised by dilatation and increased permeability of capillaries, congestion of dependent body parts, loss of blood and serum from the vascular system, drop in blood pressure and further tissue anoxaemia due to hypovolaemia. Hypovolaemic shock inevitably causes failure of vital organs like the kidneys, brain and heart.<sup>15,16</sup> Abolished muscular activity in the legs slows the venous return to the heart and potentiates venous leg thrombosis. As mentioned above, anoxaemia may also precipitate vasovagal cardiac arrest.<sup>2,15</sup>

Schulte<sup>2</sup> reports on experiments by Mödder in which healthy medical student volunteers agreed to being hung by the wrists, with continuous respiratory and cardiovascular monitoring. After only 6 minutes the tidal respiratory volumes of volunteers had decreased by approximately 70%, blood pressure had dropped by almost 50% and pulse rates had doubled. Evidence of serious cardiorespiratory decomposition set in and at 12 minutes respiration was purely diaphragmatic, and there was evidence of disturbed consciousness. When the volunteers were allowed to support their weight intermittently on their feet for 20 seconds at a time, the cardiovascular collapse improved significantly. The experiment could only be continued for 30 - 40 minutes, when pain in the wrists necessitated discontinuation.

The potentially beneficial effect of footrests, or by implication seat rests (*sediles*), in maintaining cardiovascular viability, was therefore demonstrated. It has indeed been suggested that these aids were introduced with the specific aim of prolonging suffering on the cross.<sup>2</sup>

Breaking of the tibia(s), (and possibly fibula(s)) of the lower leg(s) (*crurifragium*) was known to cause rapid death. Breaking of bones was indeed also used in antiquity as a primary mode of execution, outside crucifixion.<sup>17</sup> Death probably resulted from pain-induced vasocardiac arrest in a person with a severely compromised cardiovascular system. Fat embolisation from the tibial fractures could have been a contributory cause of death.<sup>2</sup> Significant haemorrhage is unlikely to have ensued. A fracture of the tibia would also have abolished leg extension as an aid to respiration,<sup>2</sup> but one wonders whether this would still have been relevant at the very late stages of crucifixion when *crurifragium* was normally performed.

A sharp club blow to the chest almost certainly caused death by reflex cardiac arrest, and most writers assume that the spear thrust to the upper abdomen or chest was aimed at perforation of the heart — probably the right atrium or ventricle, immediately behind the sternum.<sup>2,12</sup>

## Conclusion

The condemned on the cross dying a slow death (a day or longer) would therefore have died predominantly of multi-organ failure, caused by circulatory collapse due to hypovolaemic shock. Decreased blood volume (hypovolaemia) would have resulted from traumatic blood loss and dehydration, but perhaps mainly from asphyxial anoxaemia (respiratory failure) causing severe capillary dilatation and damage, with orthostatic congestion and exudation of serum and blood into the tissues.<sup>2,15</sup>

Sudden death, whether superimposed on hypovolaemic shock or not, would most probably have resulted from reflex vasovagal heart arrest,<sup>15</sup> caused mainly by severe pain, but perhaps on occasion from puncturing of the pleura by a fractured rib (caused by scourging). Other causes of acute death could have included a pulmonary embolus from venous thrombi in the immobilised legs, or very rarely coronary artery embolisation and myocardial death from aseptic thrombi formed on the heart valves (known to occur in severely traumatised persons)<sup>12</sup> and even haemothorax or acute pneumothorax from a lung punctured by the sharp edge of a fractured rib. Severe and prolonged anoxaemia may also have caused pericardial effusions and theoretically have precipitated cardiac failure.<sup>2,16</sup>

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