

Frontal view of the Shroud

THE SHROUD OF TURIN:
VIEWPOINT OF A FORENSIC PATHOLOGIST*

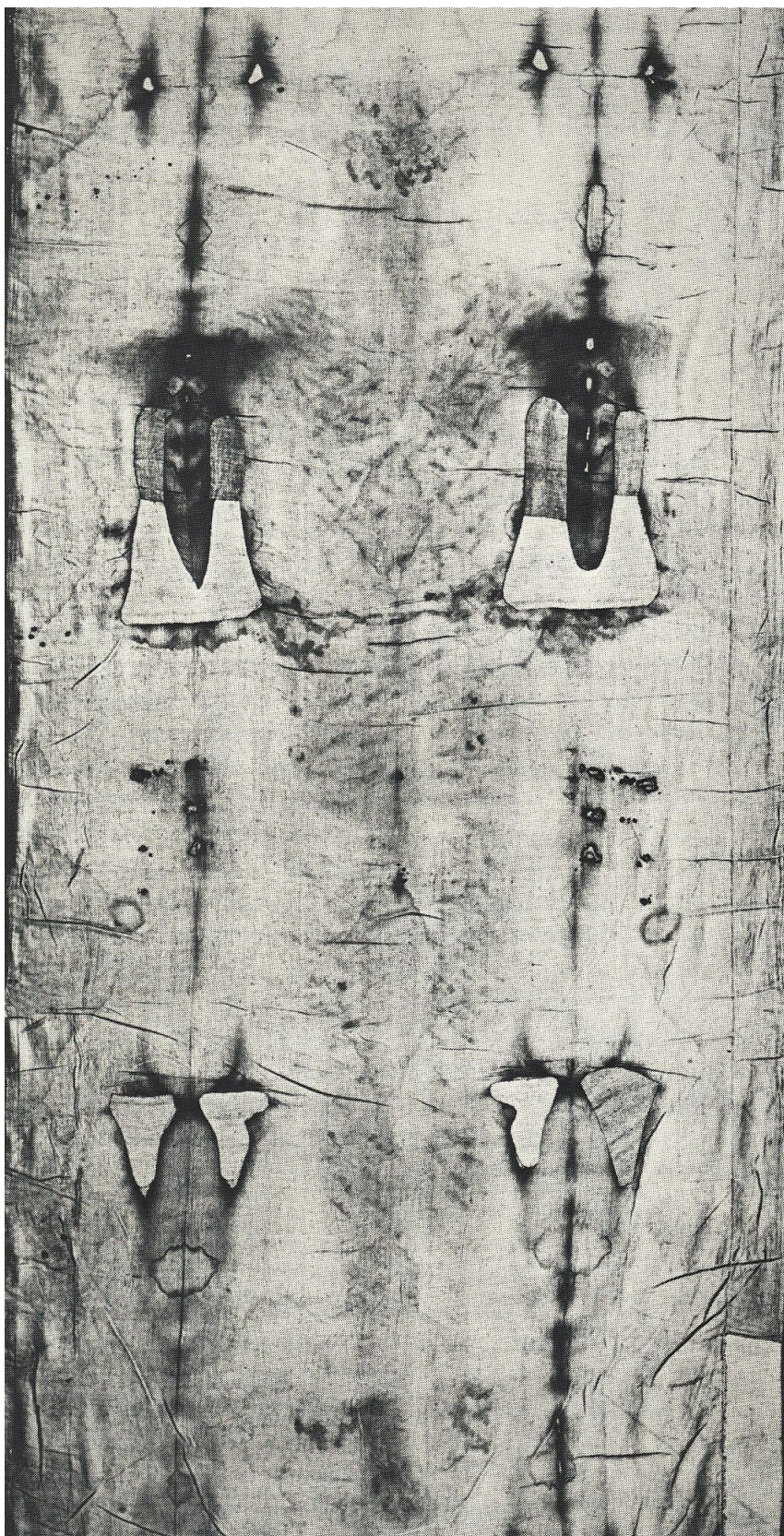
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For four centuries, a piece of linen cloth, 4.3 x 1.1 meters in size and bearing the frontal and dorsal images of a human body, has been kept in Turin, Italy. Individual and group scientific studies have been performed on this cloth, known as the Shroud of Turin. The most exhausting study was done in 1978¹.

Prior to 1978, nearly all studies of the Shroud of Turin were based on examination of photographs, the best of which were those made by G. Enrie in 1931. As a result of those studies, there has been general agreement among medical investigators that there is a human image and blood deposits on the cloth. These opinions were based on the physical appearance of the image and the stains considered to be blood. The body image is that of an adult human male. The proportions of the body are generally realistic and support the anatomic opinion that the image represents a human form. There are no elements of the image which do not conform to this conclusion and there are many features of the figure which are typical of a human. Details of facial features, including eyes, nose and hair are examples. The conformations of the upper and lower extremities, as well as the chest, abdomen and back are clearly those of a human. The umbilicus can be identified and is in its proper anatomic location. The genital area is covered by the image of the crossed hands so that no details are seen. It is not within the scope of this paper to discuss the theories of origin of the body image on the cloth, but there is no doubt that contact between the body and the cloth was a most important factor in the development of the image and the transfer of blood from body to cloth².

The characteristics of bloodstains are quite clear and these blood deposits are in sharp contrast to the imprint of the body. In many instances, the bloodstains overlie the body imprint, while in other places on the cloth, they appear outside the body image. The origin of these spatially removed stains cannot be fully explained at this time. Positioning of the body during its placement in the burial cloth may account for some of them. There is evidence to suggest that some of the blood deposits on image areas antedate the development of the

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Dorsal view of the Shroud

image. A study is now underway to try to explain the pathophysiology of blood-shedding in light of fibrinolytic actions and liquefaction of clots, and the possible role of intravascular coagulation in these events.

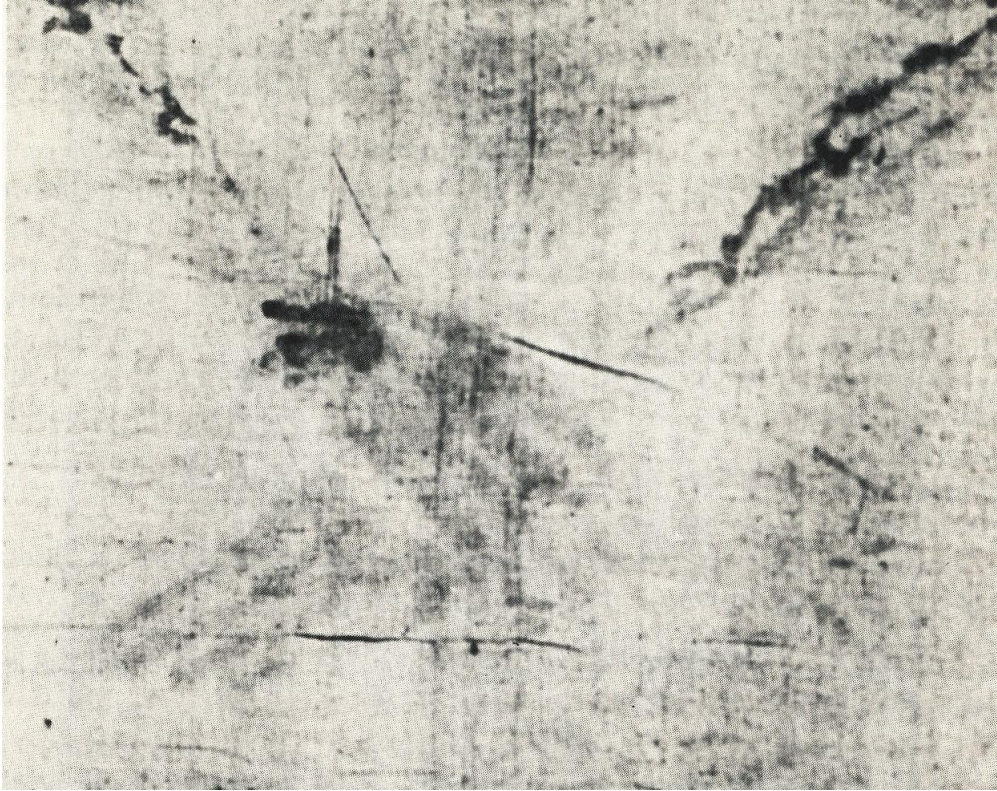
With color photos prepared by the Shroud of Turin Research Project in 1978, the evaluation of the bloodstains becomes more precise. The photographic material, particularly those pictures which accentuate the red color of the bloodstains, bring out details of the stains very clearly. There is a distinct difference in the color of the body image and the stains representing blood deposits, with a definite carmine-red color in the latter. Enhancement photos made with the Digital Image Analysis and Display System show considerable internal structures of the blood prints, with physical separation of red blood cells from serum and localization of the cells toward the periphery of the blood deposits.

In 1980, Heller and Adler reported the finding of blood on fibers taken from the Shroud, based on spectroscopic and chemical tests which identify a porphyrin³. Later testing by the same authors has confirmed the presence of hemochromogen, protein and serum albumin.

The imprint on the burial cloth represents the body of an adult male, 71 inches in height and weighing an estimated 160 to 170 pounds. The general appearance of the body indicates stiffness suggesting that rigor mortis is present. There is much physical evidence to show that the individual whose image appears on the shroud has been crucified and that his wrists, feet, chest, head, and large parts of his skin have been injured by a variety of objects. To a pathologist, the blood deposits and stains which reflect injuries to the body are of great interest^{4,5}. A number of these are characteristic enough to permit an interpretation of their probable cause. There are some markings which reflect abrasions and contusions and others which indicate punctures and outflow of blood from cavities. Some markings on the image are good examples of patterned injuries.

The injuries on the body can best be divided into five groups: the marks on the skin, piercing lesions in the wrists, similar injuries in the feet, wounds on the head, and the wound in the chest. Each of these groups will be analyzed in some detail.

The marks on the skin appear on the anterior chest as well as the back of the body where they extend from the shoulders to the calves. On the back, the imprints appear in a sheaf-like fashion directed toward and medially from the shoulders. Each of the marks consists of two portions indicating that the instrument used was bifid. There are indented bleeding points at each of these sites and, by ultraviolet fluorescence contrast, the marks resolve into scratch-like linear lesions, each with three or four parallel elements. Some of the other blood deposits on the Shroud show a pale aura around the area, suggesting



Detail of the hands



Detail of the feet, dorsal view

a separation of serum from other blood components. While the lower extremities are involved by these injuries, none are present on the arms or forearms. The appearance of these wounds is consistent with the application of a whip-like device having sharp or rounded ends which tore the skin in a characteristic fashion. The marks are difficult to count but they number at least 100.

Two large discolored areas over the shoulder blades are consistent with bleeding from surface abrasions as if a heavy, rough object had been in contact with the skin at these points. From what is known about crucifixions, it was the custom for the crossbar of the cross to have been carried by the victim, supported across the upper back and shoulders. It is quite likely that it was this sort of structure which produced the abrasions over the scapulae.

The imprints of the hands show that they are crossed with the left hand covering the right wrist. The outlines of four fingers are clear but there are no imprints left by the thumbs. In the left wrist area, there is a bloodstain which is composed of two projecting rivulets from a central source and separated by an angle of about 10 degrees. That this bloodstain is not in the palm of the hand can be determined by simple measurement taken from a site of the mark to the tips of the fingers. It is too far from the fingertips to be in the palm. A nail can be easily driven through the bones of the wrist, separating these bones but not producing fractures. This was done experimentally by Barbet⁶ and has been repeated by others. Since the right wrist is covered by the left hand, no puncture mark is visible on the right wrist. The fact that on the imprint of the hands no thumbs are clearly visible is explained by the penetrating pointed objects passing through the wrists having damaged the median nerve. The motor function of the median nerve is to produce flexion of the thumb. The thumb may either be adjacent to the hand or flexed over the palm.

From the angulation of the stain on the wrist as well as the direction of flows of blood on the forearms, it is possible to approximate the position of the victim at the time of the injury and subsequent blood flow. Blood follows the laws of gravity, and if one were to extend the arms laterally until the bloodstains appear vertical, it would show that the arm position was approximately 65 degrees above the horizontal at the time of the blood flow. The divergence of the streams suggests that two positions were maintained by the victim during the period of the blood flow. The difference in angulation is about 10 degrees and can be explained by the victim elevating his body by directing his weight toward the feet and then changing position to permit the full body weight to be supported by the wrists.

A study of the imprints of the feet is somewhat less complicated. On the Shroud, there are two prints representing the marks left by blood-covered feet. The imprint of the right foot is nearly complete: the outline of the heel and toes can be seen. In the area corresponding to

the metatarsal zone is a square image surrounded by a pale halo, and this represents the place where the foot has been pierced. The imprint of the left foot is less clear. Examination of the calves of the legs on the dorsal view shows that the right calf has left a well-defined print in which the marks of the whip can be seen. The imprint of the left calf is much less distinct. This, coupled with the fact that the left heel is elevated above the right heel, leads to the conclusion that there is some degree of flexion of the left leg at the knee.

From the physical appearance of the footprint stains, it appears that the right foot was directly against the surface of the cross and the left leg was flexed at the knee and the foot rotated so that the left foot rested on the instep of the right foot. The sole of the right foot became completely covered with blood while the left did not. A single impaling sharp object like a nail was used to fix both feet in position, passing between the metatarsal bones. One medical investigator has presented evidence that both feet may have been impaled separately rather than together⁷.

The fourth group of injuries are those about the head. On the front portion of the forehead are several blood prints, one of which assumes the appearance of the figure 3. This was formed by the blood flow following the normal skin creases of the forehead. Circling the scalp posteriorly is a row of blood prints and high on the scalp at the vertex are similar prints. Any puncture of the scalp ordinarily produces bleeding excessively because of retraction of torn vessels. To account for all the bloodstains on the head, one must assume that more than a simple circlet of sharp pointed objects was used. A cap-like structure with thorns at the center and periphery would account for the bloodstains on these portions of the head.

On the face over the right cheek, there is a swelling and there is partial closure of the right eye. There is a very slight deviation of the nose and at the tip of the nose is an area of discoloration consistent with a bruise. Detailed photographs and microscopic studies of the cloth in the nose image area show scratches and dirt. These are consistent with the nose having made contact with the ground, most likely as the result of a fall. The deviation of the nose may reflect injury to the nasal cartilage, although this is less clear.

The largest bloodstain on the burial cloth is on the right side of the chest. It covers the area of the 5th and 6th ribs. This stain very clearly shows separation of blood from a clear watery material. Some of the latter may be serum, but there seems to be much more of it than can be explained by a simple process of serum release from a blood clot. Early investigators, including Barbet⁶ and Judica-Cordiglia⁸, believed that the blood came from the right side of the heart and that the water was fluid from the pericardial sac. It is Well-known that the pericardial sac contains a very small quantity of fluid, rarely more than 30 to 50 ml. This would hardly seem to be an adequate source to account for the amount of watery fluid on the Shroud. One of the theories of the origin of blood and water was presented by Sava⁹. He quotes the

experience of physicians who treat severe chest injuries and the frequency of non-penetrating injuries to the chest producing accumulation of bloody fluid in the pleural spaces around the lungs. Since red blood-cells gravitate to the bottom of the cavity, there is accumulation of the lighter serum at the upper part of the chest cavity. Sava's concept was that the piercing of the chest resulted first in an outflow of the settled bloody portion of the effusion followed by release of a clear fluid as the level of fluid in the chest cavity was lowered.

While this is a very plausible explanation of the sequence of events, there is another which is more realistic. With the exception of the whip-like injuries in the area of the upper back and chest, there is little evidence of direct trauma applied to the thoracic area. This would seem to refute one of the requirements put forth by Sava that there be severe chest injury. Accumulation of clear serous fluid in the pleural space is very frequent and occurs under a variety of situations. It may be caused by a simple irritation of the pleura and, much more likely, by congestion related to failure of the cardiovascular system. Because of the posture of the suspended crucifixion victim, it is likely that some degree of congestive heart failure occurred. One of the earliest signs of this is the accumulation of clear fluid in the pleural spaces as well as in other body cavities, including the pericardial sac. In such a situation, if there were perforation by a sharp pointed object to the rib cage into the pleural space, there would be an outflow of clear fluid. If the piercing object were then to be pushed further into the chest, it would penetrate the pericardium and the right side of the heart and release a quantity of blood. This combination of blood and water would account for the stain on the front of the chest as well as the heavy stains which appear over the lower back.

The most logical mechanism for death by crucifixion is development of respiratory asphyxia related to failure of the cardiovascular system from shock and pain. The posture of the victim, the duration of the suspension, and the lack of adequate support for the body weight all serve to promote a condition of diminished respiratory capacity, resulting in cardiac failure and subsequent fluid accumulation in body cavities.

In summary, this has been an analysis of the medically significant imprints on the Shroud of Turin by a forensic pathologist with suggestions as to their probable cause. It is a scientific and objective presentation with no direct attempt at correlation between the Shroud imprints and New Testament accounts of the crucifixion of Christ. However, the author cannot help but comment that a remarkable consistency exists between the gospel accounts and the forensic pathological findings depicted on the Shroud of Turin.

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Acknowledgment

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