Helaman's Stripling Warriors and the Principles of Hypovolemic Shock

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THE STORY OF HELAMAN and his stripling warriors is well known to students of the Book of Mormon. In brief, around 75 B.C. the people of Ammon, who originally were Lamanites, converted to the Lord and went to live among the Nephites. They swore an oath to never again use weapons for the shedding of man's blood (Alma 24:17-19). When the Lamanites later engaged in a recurring war with the Nephites, the Ammonites wanted to help defend their adopted country, but were persuaded by Helaman not to break their pacifist covenant. Instead, they sent their male offspring, who had not entered into the non-aggression pact, to battle. These two thousand sons of Helaman are described as "all young men, and they were exceedingly valiant for courage, and also for strength and activity" (Alma 53:20). Later they are described as "stripling warriors" (Alma 53:22) and "stripling Ammonites" (Alma 56:57).

Helaman's army eventually engaged a Lamanite force, and after a bitter struggle prevailed. He then took stock of his casualties and discovered unexpected good fortune: "And it came to pass that there were two hundred, out of my two thousand and sixty, who had fainted because of the loss of blood; nevertheless, according to the goodness of God, and to our great astonishment, and also the foes of our whole army, there was not one soul of them who did perish; yea, and neither was there one soul among them who had not received many wounds. And now, their preservation was astonishing to our whole army, yea, that they should be spared while there was [sic] a thousand of our brethren who were slain." (Alma 57:25-26)

In Joseph Smith's time, Webster's (1828) dictionary defined "stripling" as "a youth in the state of adolescence, or just passing from

boyhood to manhood; a lad." The chronology of the Book of Alma suggests a period of fifteen to thirty years between the oath-taking of the senior Ammonites and the military exploits of their sons. These soldiers may have ranged in age from their mid-teens to early twenties, although most societies would consider a male in his twenties as fully grown. Present-day Mormon conceptions of the stripling warriors have been partially influenced by the Arnold Frieberg painting, which shows an apparently endless procession of half-naked, well muscled recruits, much closer physiognomically to men than boys.

Regardless of their exact ages, Helaman noted that his wounded young volunteers "fainted because of the loss of blood" (Alma 57:25). In medical terminology, this phenomenon is known as hypovolemic shock. Shock is defined physiologically as inadequate organ perfusion, which in turn leads to cellular hypoxia, acidosis, and death. Shock usually has one of four etiologies: cardiogenic (the heart not pumping well), septic (infectious causes), neurogenic (loss of muscle and vascular tone), and hypovolemic (a sudden decrease in blood volume). Given Helaman's observation relating loss of consciousness to the loss of blood, his injured troops must have suffered from hypovolemic shock.

According to the American College of Surgeons Committee on Trauma, hypovolemic shock is further divided into Classes 1-4, depending on percent of blood volume loss.[1] As a rule of thumb, the volume of blood in an individual is roughly 7 percent of body weight; therefore a 70 kg male will have approximately five liters of blood. In Class 1 hypovolemic shock, 15 percent of the blood (less than one liter) is lost. Anyone who has donated a unit of blood has experienced a Class 1 loss. At this stage, physical signs and symptoms of any change in hemodynamic status are minimal or absent, as demonstrated by post-phlebotomy blood donors cheerfully enjoying juice and cookies. In Class 2 hypovolemic shock, up to 30 percent of blood volume is lost. Physical changes include a slight increase in heart rate, but blood pressure and mental status usually remain normal. Class 3 shock indicates that 30 to 40 percent of the patient's blood has been lost. These patients will have a marked increase in heart rate and a decrease in urine output. For the first time, a drop in blood pressure is measurable. The mental state may be somewhat clouded as the individual displays anxiety or confusion.

Class 4 hypovolemic shock means that the patient has lost 40 percent or more of his blood volume. Only in Class 4 does loss of consciousness transpire. Death occurs after a deficit of 50 percent of blood volume.

1. American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors, Student Course Manual* (Chicago, American College of Surgeons, 1997), 89-105.

Thus, the window between loss of consciousness (40 percent blood loss) and death (50 percent blood loss) is small indeed. Treatment for Class 4 hypovolemic shock involves immediate intravenous fluid replacement, preferably with whole blood or packed red cells. With such severe blood loss, unless a patient is transfused in a timely manner, he will die. If a bleeding patient is transfused after too long a delay, he may still die, as shock soon reaches a point where the process of cellular physiologic decay becomes irreversible, despite aggressive fluid resuscitation.

With regard to the medical history of the stripling warriors, several questions are worth asking. First, what was their intravascular volume status prior to battle? Were they already dehydrated from marching and possibly fasting? Or did they have a recent meal and ready access to water during the course of the day? If they were well hydrated before receiving their wounds, they would have been better able to tolerate blood loss. History, however, suggests that men in combat are frequently hungry and thirsty. Simple logistics often make it difficult to transport food and water into an active battle zone. On the other hand, soldiers might have access to nourishment, but neither the time nor inclination to take it. For example, it was a common practice in World War I to avoid eating before going "over the top" in the belief that a soldier had a greater chance of surviving an abdominal wound if the bowels were empty. More likely, though, Helaman's troops suffered the more common lot of soldiers in battle, and went through the day with empty stomachs and dry throats. As Rudyard Kipling noted in his poem, *Gunga Din*:

> But if it comes to slaughter
> You will do your work on water,
> An' you'll lick the bloomin' boots of 'im that's got it.[2]

Next we may wonder what types of wounds the stripling warriors sustained. Military forces in the Book of Mormon armed themselves with a variety of weapons, "with swords, and with cimeters, and with bows, and with arrows, and with stones, and with slings, and with all manner of weapons of war, of every kind" (Alma 2:12). Presumably "all manner of weapons" included more primitive instruments, such as clubs, hatchets, knives, and spears. In medieval times, peasant armies used farming tools as weapons; much later, in World War One, a shovel was still a handy accessory during the crowded melees of trench warfare. Thus "all manner of weapons" may have included some non-traditional armaments. The Nephites must have been skilled metal smiths; at least some

2. Rudyard Kipling, *Gunga Din and Other Favorite Poems* (New York, Dover Publishers, 1991), 7.

of their swords were forged of steel of a caliber high enough to demonstrate the remarkable ability to repeatedly cut off human arms without becoming dull (Alma 17: 37-39).

Such a broad assortment of weapons could inflict wounds that were superficial or deep, blunt or penetrating. Helaman's troops likely suffered from a variety of anatomical injuries, including cuts, stab wounds, missile tracts (from arrows), and crushing blows. Any of these mechanisms can result in significant blood loss. Helaman further specified that each soldier had received "many wounds" (Alma 57:25), i.e., they were victims of multiple traumas, which greatly complicates triage and treatment. The resultant hemorrhage may have been external, where it was readily visible and amenable to intervention, or it may have occurred internally, where it would have been much more difficult to recognize and treat.

Unfortunately, very little is recorded in the Book of Mormon concerning the state of Nephite or Lamanite medical capabilities. The reader is left to wonder how potentially fatal wounds were doctored. Simple bandaging will not always stop arterial bleeding and is, of course, useless for internal hemorrhage. Tourniquets can buy time and save a life, but often at the expense of a limb. No mention is made in the Book of Mormon of cauterization, the time-honored practice of achieving hemostasis by pouring boiling oil on a bleeding wound. In any case, with loss of consciousness as in Class 4 hypovolemic shock, the treatment consists not only of control of ongoing bleeding, but also of immediate fluid resuscitation. Without a timely blood transfusion, the victim will die.

Thus, Helaman recounts the saga of two hundred young men who suffered significant physical trauma and then bled to the point where they lost consciousness—a sure harbinger of death. All two hundred then spontaneously recovered, with no fatalities recorded. According to our current understanding of human pathophysiology, such an event is so extremely unlikely as to border on the impossible.

Is there a rational scientific explanation for this singular account? One possibility is that the Nephites may have developed more advanced medical knowledge and technology than had their contemporaries. Lehi left Jerusalem around 600 B.C., just before the zenith of Greek civilization. The Greeks produced superb physicians, such as Hippocrates and Galen, who were held in such high esteem by the Romans and other Western societies that the Hellenistic teachings on anatomy, physiology, and pathology went virtually unchallenged for nearly two millennia.

During the Greek period of medicine, the function of blood was unknown. Galen of Pergamon (131-199 A.D.) taught that the body contained four fluids which influenced temperament—blood, phlegm, black bile, and yellow bile—whence come the English expressions sanguine, phlegmatic, melancholy, and bilious. In Pergamon's day, dissection of

human cadavers was proscribed and the understanding of anatomy and physiology was therefore quite limited. Blood vessels were often confused with nerves. It was thought that the heart was a furnace to heat blood, and the lungs in turn cooled the heart. Blood originated in the liver from the conversion of food and was somehow used up in the periphery. Such was the general thinking until English physician William Harvey (1578-1657) published in 1628 his book, *An Anatomical Disquisition on the Movement of the Heart and Blood.*[3] Harvey described the double circulation of the four-chambered human heart, the purpose of valves, and differences between the venous and arterial systems.

It is possible that the Nephites had an understanding of hematology superior to that of their Mediterranean contemporaries. Perhaps they even practiced a primitive form of blood transfusion and thus were able to resuscitate their brethren with donated blood. If so, they would have faced the same challenges eventually overcome two thousand years later by European physicians, such as the problem of blood clotting as soon as it was withdrawn from the donor. In due course, it was discovered that clotting could be avoided by using polished glass pipettes, or whipping the blood to remove fibrin (a clotting factor) prior to transfusion. Even when these precautions were taken, transfusion recipients would still often die of a mysterious sudden febrile illness. Consistently safe blood transfusions were not possible until the discovery of the four blood cell types (A, B, AB, and O) by Austrian physician Karl Landsteiner (1868-1943), who won a Nobel prize in 1930 for his work. Could the Nephites and Lamanites have used blood transfusions to revive their wounded troops? Even if the descendants of Lehi were genetically homogeneous and able to avoid the problem of incompatible blood types, safe transfusion still requires a degree of technical sophistication unlikely to be present in pre-Common Era societies.

Another possibility to explain the resuscitation of the two hundred moribund stripling warriors is that occasionally someone unconscious and even presumed dead is in fact not so. An American military physician recorded one such incident during the Vietnam conflict:

> About 3 P.M. there was a call on the wall phone set. It was from Graves Registration.
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> "Dr. Parrish, we were washing down the bodies when one of them moaned. I don't know how long he's been back here. He's got two legs and an arm missing, and he's full of holes, but he really moaned. I heard him. The guys are bringing him up to triage now."

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3. William Harvey, *An Anatomical Disquisition on the Motion of the Heart and Blood in Animals* (in Latin), transl. Robert Willis (London: J. M. Dent and Co., Ltd., 1908).

> Four excited marines rounded the corner each carrying a handle of the litter, and its light burden. . .after two or three seconds I felt a heartbeat. . . then another. . .then two coupled beats. The pupils were large, but they reacted sluggishly to light.
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> "Don't just stand there staring. Put some tourniquets on his legs and arm, and get me an IV set."[4]

After the transfusion of sixteen units of blood, the American soldier was conscious and talking. He survived long enough to be transferred to Saigon, but later died of renal failure. This case demonstrates that although most Class 4 hypovolemic shock victims will perish, a few may survive their ordeal, at least temporarily. However, the chance of two hundred consecutive victims undergoing spontaneous revival would be exceedingly small.

A third possibility is that the writer, editor, or translator of the chronicle may have overstated the severity of the symptoms or the number of individuals involved. Either Helaman writing his epistle, Mormon during his abridgement, or Joseph Smith while translating could have exaggerated the number of victims or the severity of the symptoms. Even ecclesiastical authorities have been known to engage in hyperbole.

Fourth, Helaman might have wrongly attributed a cause-and-effect association with blood loss and fainting. As practitioners of the sacrificial Law of Moses (Mosiah 2:3), the Nephites were familiar with the gradual loss of strength and consciousness suffered by an animal as it slowly exsanguinated. Perhaps this terrifying image haunted Helaman when he viewed his wounded young men. No doubt his troops were bloodied, each one having received many injuries, but the actual blood loss may not have been excessive. Loss of consciousness could have occurred instead from a combination of dehydration, pain, fatigue, and psychological stress. Although Smith defended the Book of Mormon as "the most correct of any book on earth,"[5] the title page itself suggests that there may be errors in the canon when it states, "And now, if there are faults, they are the mistakes of men. . . ."

A fifth possibility to explain events is Helaman's own attribution to divine intervention: "[T]heir preservation was astonishing to our whole army, yea, that they should be spared while there was a thousand of our brethren who were slain. And we do justly ascribe it to the miraculous power of God. . .they (were) preserved by his miraculous power" (Alma 57:26).

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4. John A. Parrish, *12,20 &5: A Doctor's Year in Vietnam* (New York, Bantam Books Inc., 1986), 65.

5. Joseph Smith, *History of the Church of Jesus Christ of Latter-day Saints*, 2d ed. (Salt Lake City: Deseret Book, 1978), 4:461.

In *Mormon Doctrine,* Bruce R. McConkie defined miracles as "all those events which are beyond the power of any presently known physical power to produce. They are occurrences which deviate from the known laws of nature and which transcend our knowledge of those laws. . . .[I]n the gospel sense, miracles are those occurrences wrought by the power of God which are wholly beyond the power of man to perform."[6] Given our current understanding of human physiology and pathology, the spontaneous unassisted recovery of two hundred victims of Class 4 hemorrhagic shock is truly indeed a miraculous incident.

A skeptic may offer another explanation, one that is anathema to faithful church members: Perhaps the described events never occurred at all. In his analysis of the Book of Mormon, B. H. Roberts reviewed the story of the stripling warriors and then remarked somewhat derisively, "Beautiful story of faith! Beautiful story of mother-assurance! Is it history? Or is it a wonder-tale of a pious but immature mind?"[7] After commenting on a host of other incredulities in the Book of Mormon, Roberts pondered, "For these absurdities in expression; these miraculous incidents in warfare; those almost mock—and certainly extravagant—heroics; these lapses of the main characters about conditions obtaining, are certainly just such absurdities and lapses as would be looked for if a person of such limitations as bounded Joseph Smith undertook to put forth a book dealing with the history and civilization of ancient peoples."[8]

In conclusion, the epic tale of the stripling warriors and their miraculous recovery from life-threatening trauma would appear, to the rational mind, highly unlikely or even outright impossible. Hundreds of people, even fit young males, simply do not get up and walk away after experiencing Class 4 hypovolemic shock. Perhaps even Joseph Smith, unschooled as he was, did not appreciate the improbability of Helaman's narrative. Like many other miraculous accounts in the scriptures, the claims of Helaman's epistle can only be accepted on the principles of religious faith rather than scientific reasoning.

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6. Bruce R. McConkie, *Mormon Doctrine,* 2d ed. (Salt Lake City, Bookcraft, 1979), 506.

7. Brigham H. Roberts, *Studies of the Book of Mormon,* 2d ed. (Salt Lake City, Signature Books, 1992), 273.

8. Ibid., 277.