When the Golden Hour Goes Away

Prolonged Casualty Care in LSCO—Considerations for Commanders and Decision-Makers

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Evacuating the large number of casualties expected to occur across the depth and breadth of the battlefield in the [future operational environment] will heavily challenge [Army Health System] evacuation assets [and logistical support] … Medical and non-medical leaders will face challenging triage decisions with unknown timelines [for] resolution … [we must] envision the use of prolonged care to sustain life until evacuation is possible.

—Army Futures Command Pamphlet 71-20-12, *Army Futures Command Concept for Medical 2028*

Evacuating casualties to operating rooms within the Golden Hour of injury will be a foregone luxury in large-scale combat operations (LSCO) and other austere operational environments (OE). The OE will be both too contested and too congested; it will not be unreasonable to expect the killed-in-action rate to be near 30 percent in some conflicts.[1] Prolonged casualty care (PCC) will become the collective effort by close combat forces at the brigade-and-below levels to hold back death a little longer for their severely wounded casualties. And, while the Golden Hour may be going away, clinically it is here to stay, as casualties with potentially lethal injuries require timely life saving interventions such as blood transfusion and hemorrhage control. Lifesaving interventions delivered too late are no longer lifesaving.

The current expectation for combat medics is to stabilize casualties for up to seventy-two hours on the battlefield. This is a lofty standard that combat medics and corpsmen are not trained, equipped, or experienced to support. This article presents attainable time standards for *how long commanders should strive to*

Spc. Trevor Milbury, a crew chief with the Medevac Platoon Dustoff, Charlie Company, 3rd Battalion, 238th Aviation Regiment, Task Force Dragon, pulls a litter on a hoist back into a UH-60 Black Hawk helicopter during a training exercise near Forward Operating Base Fenty, Nangarhar Province, Afghanistan, on 16 September 2013. MEDEVAC teams provided emergency care to U.S. and coalition forces, and transport patients by air to medical treatment facilities. Using a hoist allows MEDEVAC crews to raise and lower supplies and personnel into remote or treacherous areas where landing the aircraft is impossible. (Photo by Sgt. Margaret Taylor, U.S. Army National Guard)

prolong care at each tactical echelon on the battlefield. Codified time standards will help structure training, equipping, and organizing unit medical teams from the company to the brigade level.[2]

The Joint Trauma System describes PCC as "the need to provide patient care for extended periods of time when evacuation or mission requirements surpass available capabilities and/or capacity to provide that care."[3] Close combat forces will perform PCC to buy time—just a couple of hours—while operational commanders align the conditions to evacuate casualties to higher levels of care.[4]

Military medicine leaders have analyzed and debated the issue for several years and have championed initiatives to help address systemic shortfalls across military medical practices. But *the conversation of prolonged casualty care really belongs in the operational community,* among commanders, civilian leaders, and policymakers. Preparing for restricted casualty care in LSCO requires more than altering medical training at the unit level. Preparing for this inevitable problem requires military transformation at multiple levels within the Department of Defense. PCC is a medical concept that becomes an operational commander's responsibility in a major conflict.

The Evolution of Casualty Care

The medical practices that evolved around the evacuation paradigm of the Golden Hour expectation over the last twenty years will not be feasible in LSCO.[5] Implementing tactical combat casualty care (TCCC) saves lives on the battlefield and will be

(Image from Canadian War Museum, https://www.warmuseum.ca/firstworldwar/objects-and-photos/archival-documents/documents-created-by-organizations/the-tourniquet/)

Figure 1. "The Tourniquet" Poster from the American Red Cross, 1918

necessary on any future battlefield. While the Golden Hour policy significantly decreased mortality on the battlefield, it unintentionally eroded the U.S. military's prehospital battlefield care by rapidly moving casualties to Role 2 surgical teams where both hemorrhage control and blood transfusion could occur. Nonsurgical facilities were prudently bypassed in recent conflicts in Iraq and Afghanistan since commanders could reliably evacuate patients directly to surgical teams who were readily available throughout the combat zones. The policy also resulted in propagation of multiple nondoctrinal surgical teams without standardized manning, training, or equipping.[6]

Medical evacuations in contested environments will become combined arms maneuver operations, relying on both lethal and nonlethal effects to create windows where air or ground assets can backhaul casualties to higher levels of care. In the indeterminate time it takes to carve out these windows, combat forces will likely rely on buddy aid and medics (or corpsmen) performing TCCC and prolonged care devoid of organized medical units and advanced medical/surgical capabilities.

PCC is the continuation of TCCC; it requires additional training in resuscitation, triage, pain control, airway management, and wound care. Prolonged care was rare for prehospital and frontline providers in U.S. Central Command (USCENTCOM) and is a new component of the battlefield trauma care continuum when compared to combat operations with rapid evacuation.

The future OE will necessitate a revitalization of our medical evacuation systems. Tactical units will fight isolated from one another and intermittently out of reach from field hospitals. Artillery and rocket strikes will occur in volumes and frequencies that the U.S. military rarely faced in recent conflicts like Iraq and Afghanistan. Shrapnel wounds to the torso—bleeding that tourniquets cannot stop—will become a prevalent and distinct challenge in LSCO. Wounded may have to wait hours, perhaps days, in prehospital settings waiting for surgeries they urgently need. If they wait too long, they will suffer slow, demoralizing deaths caused by internal bleeding and sepsis.

Bleeding Out on the Battlefield

Research performed in the 1980s and 1990s concluded that bleeding from the extremity was the leading cause of preventable death in Vietnam. The United States has a long history of tourniquet use on the battlefield. During World War I, it was required that every soldier "know how to fix a garrot" (figure 1). During World War II, tourniquets fell out of favor due to inappropriate use and the risk of limb loss. During Vietnam tourniquets were not used, resulting in deaths from extremity hemorrhage.[7] Despite this knowledge, the United States entered the conflicts in Iraq and Afghanistan without tourniquets.[8] Data-driven processes and the Joint Trauma System helped resurrect the widespread employment of tourniquets, and the death from extremity hemorrhage decreased substantially. Several battlefield medical advancements included the development of the combat application tourniquet—a modest device made of nylon, plastic, and Velcro. The

simple but effective tourniquets went on to save thousands of lives over the last twenty years in Iraq and Afghanistan. Bleeding from extremities is no longer a major cause of death from survivable injuries thanks to the accessibility and familiarity with these tourniquets among individual soldiers and marines.

The challenge for the next war won't be gunshot wounds to the arm or severed limbs from improvised explosive devices. It will be treating *hemorrhage that is not amenable to a tourniquet or direct compression*, particularly the chest and abdomen (called "noncompressible torso hemorrhage" [NCTH] by medical professionals). Future conflicts against major adversaries are likely to include high volumes of artillery and mortar fire—the sorts of massive barrages that are regrettably good at finding the gaps and seams of a soldier's body armor (figure 2).

It is also worthwhile to recognize the limitations of tourniquet use and when to replace it with a hemostatic pressure bandage (known as *tourniquet conversion*). Tourniquets save lives, but misusing them threatens both limbs and lives. The importance of tourniquet conversion has been moved into the spotlight from "lessons observed" in Ukraine.[9] Given the short transport times in recent conflicts, liberal use of tourniquets was standard practice. If not needed, the tourniquet was removed at the Role 2, usually in less than an hour. However, studies reveal that up to 49 percent of tourniquets applied in Iraq and Afghanistan were not necessary.[10] Prolonged or unnecessary tourniquet use threatens the limb and the life. Medics and combat lifesavers must train and get comfortable with tourniquet conversion for extremities without a vessel injury. Recent experiences in Ukraine have underscored the severe consequences of prolonged tourniquet use, with a notable increase in avoidable amputations and cases of kidney failure due to delayed removal. These outcomes highlight the critical need for U.S. military training to adapt—emphasizing proper tourniquet application, timely conversion techniques, and a deeper understanding of PCC to prevent similar complications on future battlefields.

The only way to reliably stop internal bleeding is on the operating table. In Iraq and Afghanistan, combat medics relied on hasty measures like stuffing torso wounds with gauze and transfusing blood, and they relied on the efficiency of the "operational" Golden Hour to save the life of a casualty suffering from NCTH. The

(Figure by Lt. Col. D. Max Ferguson)

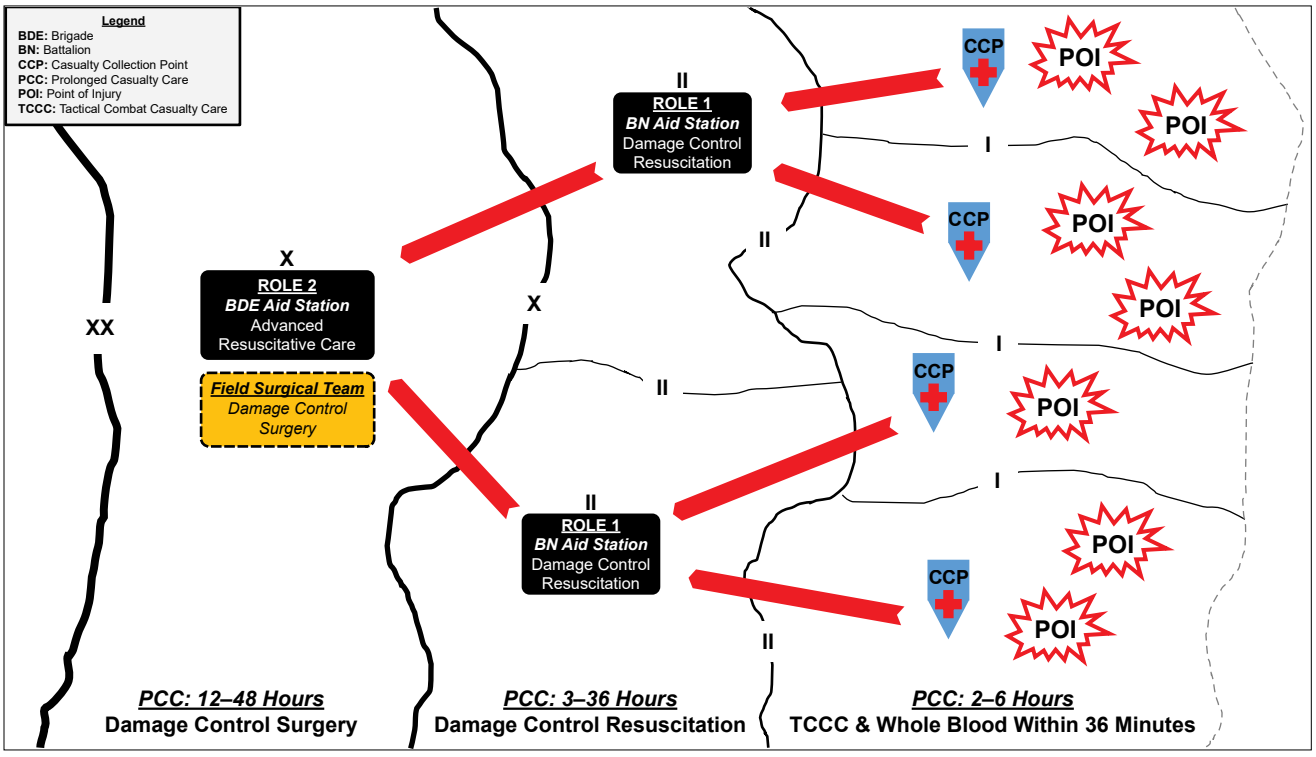
Figure 2. Zone of Noncompressible Torso Hemorrhage

Golden Hour of evacuation mitigated the risk of the clinical Golden Hour (or less) of bleeding out on the battlefield. Stuffing a wound with hemostatic gauze and prehospital transfusion buys precious minutes, but only minutes. In LSCO, *combat units will need to buy hours, not minutes, to save the lives* of their wounded given that during LSCO the Golden Hour of evacuation will go away; however the Golden Hour of bleeding out is still here to stay without quick interventions to control bleeding and transfuse blood.

Extending the time before casualties expire will require multiple efforts. Frontline commanders must orchestrate the transfer of casualties from the point of injury to nearby presurgical resuscitative care nodes before gaining access to established surgical facilities. Evacuations in LSCO will require time, resources, and measured risk.

The Three Echelons of Tactical Care

The process of buying time for casualties on the battlefield starts with self-aid and buddy aid by trained nonmedical soldiers and those trained as combat lifesavers. Combat lifesaver training is currently



(Figure by Lt. Col. D. Max Ferguson)

Figure 3. Three Echelons of Tactical Care on the Battlefield and Medical Capabilities

considered Tier 2 TCCC training; given the threats of the future battlefield, these "medically enabled" nonmedical service members will support medical care on a LSCO battlefield. Commanders cannot prolong the lives of their casualties if those wounded bleed out at the point of injury. *Therefore, the whole process of PCC depends on soldiers mastering the fundamentals of tactical combat casualty care and training nonmedical personnel in combat lifesaver skills.*[11] The importance of this basic capability cannot be overstated. TCCC relies on leaders at the platoon and company levels to train and implement sufficiently.[12] In future scenarios, when the Golden Hour of evacuation goes away, a severely injured soldier may have to wait hours before there is a safe route to bring that casualty to higher levels of care. This highlights the importance of the entire team or crew being well versed in TCCC as battle injuries are battle injuries regardless of circumstance.

One critical addition currently missing from unit-level training is learning how to *transfuse whole blood on the battlefield*. When the Golden Hour of evacuation is not attainable, the alternative time standard becomes "thirty-six minutes," which is based on evidence. Studies from the military clearly demonstrate that transfusion in less than thirty-six minutes is the optimal benchmark to provide stored or fresh whole blood to casualties at risk of dying from severe hemorrhage; this is the Golden Hour that is here to stay.[13] Walking blood banks offer a field-expedient option to provide fresh whole blood to injured soldiers far forward on the battlefield. It simply requires awareness, prescreening, and training. If soldiers can stick an IV, they can learn to transfuse blood. Tactical unit commanders just need to incorporate the practice of whole blood transfusions within their formation. It starts with learning who can be donors, how to store blood, or how to draw fresh whole blood from prescreened volunteer donors within the ranks. Having access to whole blood far forward on the battlefield will save lives.

If units perform diligent TCCC training and adopt whole blood transfusion programs at the tactical level, commanders can expect to extend a casualty's life *by*

two to six hours (depending on the severity of the injury and the amount of blood available) before they expire.[14] Without whole blood, *within thirty-six minutes*, that planning factor drops to an hour or less for those with severe injuries. The two-to-six hours gained with whole blood transfusions, reliable TCCC practices, and the implementation of PCC buys commanders just enough time to evacuate to the next level of care: the battalion's Role 1, depicted in figure 3.

Battalion aid stations, referred to as "Role 1 medical facilities," provide presurgical lifesaving measures. This entails maintaining the airway, immobilizing fractures, and protecting wounds. Most importantly, Role 1s can store whole blood and have better capability for a walking blood bank; therefore, Role 1s can provide damage control resuscitation. "Damage control" is a bundle of clinical interventions that will hold off death from traumatic injury. The most important aspects of damage control resuscitation are hemorrhage control and early blood transfusion; some of the other interventions include preventing hypothermia, tourniquets/external hemorrhage control, advanced airway and breathing management, basic procedures, and wound care. All these can mitigate the otherwise lethal shock state from blood loss and injury.[15]

Role 1 medical facilities currently lack the capacity to "hold" patients for extended periods after initial stabilization. Training and equipping can mitigate that. Role 1 medical teams stabilize casualties and allow for medical evacuation to resuscitative care at Role 2.[16]

Role 2s are the last level of medical care in a tactical environment. Role 2 care is exemplified by damage control surgery; this is rapid surgery care to restore physiology and prevent death—delaying fixing the anatomic aberrations at a later operation. Role 3 field hospitals are theater-level assets (formerly called combat support hospitals) with multiple operating rooms, advanced medical specialty care, and neurosurgical care. Role 4 hospitals are long-term facilities outside the combat zone (e.g., Landstuhl and Walter Reed medical facilities).

During World War II, the 7th Army Field Hospital maintained one thousand beds in France. Casualties were held in France for thirty days and either returned to the fight or returned to the United States.[17] Modern-day combat support hospitals shrank from two hundred beds in USCENTCOM to a thirty-six-bed field hospital. These combat support hospitals maintain an impressive surgical capability, but the capacity is woefully insufficient in the future OE. Major combat operations in the next major war could lead to thousands of casualties in concentrated periods that may overwhelm contemporary field hospitals.

Surgical care should be the standard for Role 2 facilities, but the level of care is not consistent across the services. In particular, the Army does not have enough surgical teams to support all their Role 2 units. All services should adopt the same expectation for levels of medical care, and Role 2 care needs to be synonymous with access to damage control surgery.

Damage control surgery stops hemorrhage, restores blood flow, and controls wound contamination. These emergency surgeries prioritize quickly controlling hemorrhage and wound contamination to keep casualties alive prior to definitive surgical treatment at Role 3 and Role 4 facilities. Role 2 surgical teams exist to ward off death for casualties who will not survive long transports to Role 3. Surgical care, done by board certified and credentialed surgeons, should be the Role 2 standard. Everything prior to an actual surgical capability, no matter how many people a facility can treat, should be considered the "Role 1 space."

The U.S. Navy, Marine Corps, Air Force, and NATO all currently have surgical teams permanently assigned to their home station Role 2 units. The U.S. Army, however, still relies on pairing deploying units with surgical teams because it does not have enough teams available to assign all brigade Role 2s with permanent teams. That will become a troubling issue in LSCO.

A Note About Surgeons

An outside glance at the task organization for an Army brigade combat team will show that each unit has a brigade surgeon assigned, so it would seem that every Role 2 can establish some sort of surgical capability. But these are just antiquated (and misleading) titles for unit *physicians*, not surgeons, and sometimes not even physicians.

Commanders understand that words have meaning in combat, and they do not designate tasks like destroy, suppress, seize, or neutralize casually. Nor should we indiscriminately designate key positions like unit surgeons. Yet the military still uses a carryover practice to call unit physicians *field surgeons* or *force surgeons* even

though they are not surgeons at all and therefore cannot perform damage control surgery. The title dates back to the Civil War era when titles of "doctor" and "surgeon" were used interchangeably.[18] It has been decades since the military staffed battalions and brigades with surgeons who perform surgery. The physicians in a Role 1 (or Army Role 2) medical facility are still highly trained medical doctors, they just cannot perform damage control or definitive surgical care to treat hemorrhage. Nor can these physicians perform surgeries to prevent infection from extremity and abdominal injuries (the types of surgeries that LSCO will increasingly demand).

Most often, battalion and brigade physicians are residency trained in primary care or other nontrauma focused specialties, predominantly internal or family medicine. In rare occasions, they may be emergency medicine and trauma specialists. It is important to ask the question about what type of experience a physician has prior to joining a combat unit. The experience will vary widely from one PROFIS [Professional Filler System] doctor to another. But these unit "surgeons" will rarely be trained in surgery. The military needs to retire this legacy title to clarify the distinction between surgical versus resuscitative care on the battlefield; command medical officers would be more appropriate for these positions.

Forward Surgical Teams

Gaining access to actual forward surgical teams or, as they are currently designated in the Army, forward resuscitative surgical detachments on the battlefield is not only necessary to prevent death from hemorrhage but also to manage wounds of the extremities and abdomen that will cause sepsis (and death) if not addressed surgically. In the Army, forward surgical care became regular additions to Role 2 facilities at the brigade level in recent conflicts throughout USCENTCOM. Various Role 2 surgical teams emerged, including Golden Hour offset surgical teams, special operations surgical teams, austere resuscitative surgical teams, expeditionary resuscitative surgical teams, and ground surgical teams. Their manning spans from five to twenty personnel and includes anywhere from 350 to 7,000 pounds of equipment.[19]

Forward surgical teams provided lifesaving capabilities, so services fielded them in whatever construct they could develop. Yet inadequate doctrine guided the training, manning, and equipping of these bespoke teams. Services often assembled teams together piecemeal without letting them train or certify as a crew. "An ad hoc approach across the services for two decades has resulted in undertrained and underprepared austere surgical teams, which poorly reduces risk and may cause it to increase both for the teams themselves and the combat forces they support."[20] There remains no joint training standard across the services for forward surgical care. This is a risk because it should not be assumed that individuals who have never trained for this mission set should be able to accomplish it based only on their baseline medical training.[21]

A surgical team can be compared to a tank crew. Armor units take great pride in their crew gunnery tables. Tank crews can only deploy once they train together. Breaking the crew decertifies their team. Similarly, surgery only happens as a team. Surgeons are analogous to the tank commander; they cannot perform surgery without their team. Commanders would not accept a tank crew to deploy unless they trained together. They should hold the same expectations for their surgical teams.

Another challenge with battlefield surgery is the dilemma of getting close to the point of injury but not *too* close. This dilemma was voiced by Dr. William Ogilvie (1887–1971): "Good surgery must be done as far forward as possible. If it is too good, in the sense of too elaborately equipped, it will not be far enough forward, and if it is too far forward it will not be good enough."[22] This dilemma is real. The future OE will necessitate forward surgical teams to remain capable and nimble. Mobility, dispersion, and small signatures will be key to survival on a LSCO battlefield. If they grow too large, they risk being too cumbersome to deploy across the battlefield. Conversely, if forward surgical teams become too lean, they will not keep up with the number of casualties needing damage control surgery held up in austere environments.

Higher Echelons of Care: Understanding Capability versus Capacity

The patient capacity of any echelon of care will drastically depend on the acuity of the casualties being treated. Each higher role of care has increased capability but not always increased capacity.

Staff Sgt. Azgad Cardona and Sgt. Kimberly Williams, assigned to William Beaumont Army Medical Center, perform cardiopulmonary resuscitation on a medical training mannequin as part of the prolonged casualty care portion of the Medical Readiness Command, West Best Medic Competition at Fort Cavazos, Texas, on 19 November 2024. (Photo by Spc. Josefina Garcia, U.S. Army)

High-acuity casualties require immense resources. It only takes one high-acuity casualty to consume all available blood at a medical facility, and one casualty can take up all the resources of an entire surgical team.[23] Commanders and medics will face unsettling choices in LSCO about how to provide the best for the greatest number of casualties. Surgeons will have to make judgment calls about whom to treat based on the availability of time and supplies.

The reason the U.S. military's trauma system developed such a small footprint in USCENTCOM is because of rapid evacuation and air superiority. Commanders were able to maintain small medical footprints because casualties moved quickly along the continuum of care. Many casualties were back in the United States within seventy-two to ninety-six hours of severe injury. This is unlikely in LSCO.

Buying Time at Echelon in LSCO

Current military standards expect tactical units to stabilize casualties for up to seventy-two hours in prehospital facilities using battlefield resuscitative care.[24] This is a bold benchmark that is more aspirational than medically attainable for any tactical battlefield facility.

Keeping trauma patients alive is incredibly difficult even in the most sophisticated settings. Emergency medicine physicians spend four years in undergraduate education, four years of medical education, and then three years of residency training before they are certified.[25] Emergency medicine physicians who work in intensive care units spend an additional two to four years of critical care training.[26] Afterward, these highly trained civilian emergency medicine practitioners perform their duties in fully equipped hospitals and trauma centers across the country.[27]

Despite all this training, emergency medicine physicians cannot perform surgery. Trauma surgeons have the same baseline education: four years undergraduate, four years of medical school, then five to six years of residency training, followed by one to two years of additional trauma fellowship training. The average

Table. Unit/Command Elements, Medical Capability, and LSCO Planning Factors

Echelon	Medical Level	Attainable Planning Factors for LSCO		Key Functions
Platoon & Company (Nonmedically Regulated)	Medic / Corpsman	**2–6 hours****	Per Medic: • Up to 2 casualties (that require lifesaving interventions) • Up to 5 casualties (that **do not** require lifesaving interventions)	**Tactical Combat Casualty Care** ✓ Whole Blood Transfusion ✓ Wound Care ✓ Airway/Breathing Management
Battalion	Role 1* *(Non-Surgical)*	**6–24 hours****	10–15 Ambulatory and Litter Casualties	**Prolonged Casualty Care** ✓ Whole Blood Transfusion ✓ Damage Control Resuscitation (DCR) ✓ Wound Care Management/Basic Burn Management ✓ Antibiotics/Sepsis Management ✓ Nursing Care (Brigade Only)
Brigade (C-MED *Only*)			15–45 Ambulatory and Litter Casualties	
Brigade *with* **Forward Surgical Team**	Role 2 *(Surgical)*	**12–48 hours****	15–45 Litter Casualties	**Advanced Resuscitative Surgical Care** ✓ Damage Control Resuscitation (DCR) ✓ *Damage Control Surgery* (DCS) with Hold Capacity ✓ Nursing Care

**Surgical care should be the standard Role 2 facilities but the level of care is not consistent across the services.*

***These times and number of casualties reflect **what could be attained** with deliberate efforts to train and equip tactical units for prolonged casualty care and prolonged care (once casualty enters medical regulation). Acuity and quantity of injuries also matters. High acuity casualties require a large number of resources. One high acuity casualty can consume all available blood at a medical facility.*

(Table by authors)

trauma surgeon is "schooled" for fourteen years to practice their trade.

In contrast, combat medics get sixteen weeks of initial entry training and a week of refresher training per year. Frontline medics are lucky if they find an abandoned building for their casualty collection point and get to work on their patients without bullets kicking up the dirt around them. Then they must work with whatever they have on their backs to keep their casualties alive.

We put the most challenging tasks (keeping a dying casualty alive) on those with the least education and training. It is no wonder that the Golden Hour for evacuation became a mandate: it is inherently difficult to stabilize casualties for more than an hour without surgical intervention in combat. In LSCO, commanders will need more than one hour to evacuation casualties. But they are misguided to expect to have seventy-two hours as currently advertised. Commanders can more realistically expect to keep casualties alive between two and thirty-six hours in LSCO, depending on the type and quantity of injuries at different levels of prehospital care, the availability of blood products, and the training of medics.

The benchmarks and timelines for prolonged casualty care need to be delineated by echelon. With revised training and equipping standards, frontline medics can achieve a two-to-six-hour standard for keeping severely injured casualties alive. Role 1 facilities at the battalion and brigade levels should strive to stabilize and hold multiple severely wounded casualties from six to twenty-four hours before they need more advance resuscitative and surgical care. A U.S. Army brigade does not expand the timeline for casualties that need surgical intervention for either hemorrhage control or to manage wounds that would result in infection and death without a surgical team. Forward surgical teams and nursing care at a Role 2 can help hold back death for up to forty-eight hours on the battlefield by performing advanced resuscitative surgical care.

Let it be understood that the current training, equipping, and experience levels do not meet these time standards (see table). Additionally, doctrine must evolve to reflect the realities of Role 2 care and support

the need for Role 2 care to always include a surgical team to advance the hold times to ninety-six hours with an acceptable preventable death rate. The reality is additional measures at echelon must be incorporated to achieve these marks.

Current Department of Defense protocols set practice guidelines for forward surgical teams to be prepared to be able to operate on two to four surgical patients and hold three to eight patients for sixteen to seventy-two hours without resupply.[28] Casualty figures coming out of the ongoing war in Ukraine and medical planning estimates by the Joint Trauma System suggest that number is too low. Role 2s should be prepared to perform ten damage control surgeries in twenty-four hours.[29] Holding severely wounded casualties for seventy-two hours is also a stretch, where sepsis and infections will consume available equipment, supplies, and staff attention. Commanders should expect Role 2 facilities to hold severely wounded casualties alive for forty-eight hours in LSCO before they will need higher level of care.

Conclusion

There are a couple key takeaways from this article. First, the Golden Hour for evacuation is going away; however, the Golden Hour of hemorrhage physiology is here to stay. Therefore, the joint force needs to be prepared to hold casualties longer at tactical echelons of care and extend the lifesaving interventions of TCCC into this nebulous area of prolonged casualty care. There are not enough surgical teams in the joint force to move them close enough to maintain the Golden Hour, and conventional surgical teams do not have the tactical training for isolated survivability in these environments. Tactical units from platoon to brigade and dispersed warships at sea will struggle with uncertain evacuation timelines. Commanders will rely on their organic medics and providers to treat internal bleeding (with whole blood transfusion), sepsis, and infection for prolonged periods. The future OE will produce casualties in quantities and breadth that no currently serving leaders have encountered over the last two decades of conflict. Logistics will become both contested and congested at various stages in the conflict. Casualties will have to wait hours, likely days at times, as commanders organize deliberate operations to backhaul casualties.

Prolonged casualty care is more than a medical task. It is a commander issue that requires clear parameters and planning factors. Time is the most important consideration. Current doctrine lacks specificity and is more aspirational than attainable for what LSCO will demand. This article establishes time considerations at echelon for commanders to plan against as they sustain casualties in high-intensity and restrictive environments.

The first step is at the platoon and company levels, where units become proficient at TCCC and whole blood transfusions. These efforts can buy two to six hours for frontline commanders to organize medical evacuations to nearby battlefield medical facilities. Battalion and brigade commanders should expect their Role 1 (nonsurgical) facilities to perform damage control resuscitative care for critically wounded casualties. This should keep casualties alive for six to thirty-six hours. Role 2 care must be synonymous with forward surgical care and damage control resuscitation and surgery to keep critically injured casualties alive for forty-eight hours until evacuation to Role 3 care (or augment these teams with holding capability and capacity).

The force needs to transform the training, organization, and processes to meet these time standards, but they are attainable. With the loss of the Golden Hour for evacuation, "blood far forward" (early transfusion) will mitigate some risk of the physiologic Golden Hour (which with some casualties is much shorter than sixty minutes depending on the severity of the injury); and patients arriving at Role 2s will be sicker as delays increase. Subsequent care will be proportionately more complex during transport and all subsequent echelons of care. This will require a different mindset than what combat units experienced in recent conflicts. These changes, implemented now, will save lives and maximize combat power in the next fight. ■

Notes

Epigraph. Army Futures Command (AFC) Pamphlet 71-20-12, *Army Futures Command Concept for Medical 2028* (AFC, 2022), 9, 18, https://api.army.mil/e2/c/downloads/2022/04/25/ac4ef855/medical-concept-2028-final-unclas.pdf.

1. David B. Hoyt, "Blood and War—Lest We Forget," *Journal of the American College of Surgeons* 209, no. 6 (2009): 681–86, https://www.doi.org/10.1016/j.jamcollsurg.2009.09.005.

2. This article focuses primarily on the perspective of ground combat for U.S. Army and U.S. Marine Corps units, but the principles of prolonged casualty care in large-scale combat operations have application for all U.S. Department of Defense services.

3. Michael Remley, Paul Loos, and Jamie Riesberg, *Prolonged Casualty Care Guidelines*, ed. Michael Remley and Dan Mosely, Joint Trauma System Clinical Practice Guideline 91 (Joint Trauma System, 2021), https://jts.health.mil/assets/docs/cpgs/Prolonged_Casualty_Care_Guidelines_21_Dec_2021_ID91.pdf.

4. Close combat forces refers to tactical elements at the front line of battle. These often include infantry, armor, field artillery, combat engineers, and other combined arms maneuver forces, but the term broadly applies to any unit engaged in direct fighting with the enemy.

5. Russ S. Kotwal et al., "The Effect of a Golden Hour Policy on the Morbidity and Mortality of Combat Casualties," *JAMA Surgery* 151, no. 1 (2016): 15–24, https://www.doi.org/10.1001/jamasurg.2015.3104; Stacy A. Shackelford et al., "The Golden Hour of Casualty Care: Rapid Handoff to Surgical Team Is Associated with Improved Survival in War-Injured US Service Members," *Annals of Surgery* 279, no. 1 (2024): 1–10, https://www.doi.org/10.1097/SLA.0000000000005787. The Golden Hour was originally described during the Vietnam War, when it was observed that wounded casualties are likely to bleed to death within an hour unless they receive advanced interventions. In 2009, the Department of Defense adopted the Golden Hour policy for a reason: saving lives on the battlefield requires arrival to a higher echelon of medical care quickly; prehospital units were unable to consistently stabilize casualties for more than an hour without surgical intervention. In 2012, prehospital units also began using blood as a "Golden Hour extender."

6. Jennifer M. Gurney et al. "Committee on Surgical Combat Casualty Care Position Statement on the Use of Single Surgeon Teams and Invited Commentaries," *Journal of Trauma and Acute Care Surgery* 93, no. 2S (2022): S6–S11, https://doi.org/10.1097/TA.0000000000004058.

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10. Butler, "Tactical Combat Casualty Care," S12–S17.

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12. Tactical combat casualty care training is a leader's priority and should be implemented at the company and platoon levels.

13. D. Max Ferguson, "Blood Types and Titers: Saving Lives on the Battlefield with Blood Far Forward," *Military Review* 105, no. 1 (2024): 92–100, https://www.armyupress.army.mil/Journals/Military-Review/English-Edition-Archives/March-April-2024/Blood-Types/.

14. Casualties who are bleeding to death require transfusion within thirty-six minutes. In situations without surgical capability, a percentage of casualties will die. Transfusion can sustain life in most casualties if they can reach a surgical capability within a few hours. The exact percent of casualties and times are unknown given that in U.S. Central Command surgical care was usually within an hour.

15. Jay B. Baker et al., "Austere Resuscitative and Surgical Care in Support of Forward Military Operations—Joint Trauma System Position Paper," *Military Medicine* 186, no. 1-2 (2021): 12–17, https://doi.org/10.1093/milmed/usaa358.

16. Richard G. Malish, "United States Army Battalion Surgeon: Frontline Requirement or Relic of a Bygone Era?" (master's thesis, U.S. Army Command and General Staff College, 2009), https://apps.dtic.mil/sti/pdfs/ADA512526.pdf. Army Role 2 medical facilities are typically staffed by two physicians or "field surgeons" (who are medical doctors but not actual surgeons, by common understanding), two physician assistants, a dentist, a behavioral health section, a physical therapist, a laboratory/radiology section, and twelve medics. They also include a patient hold section of one nurse and three medics. Like with Role 1, Army field surgeons are usually responsible for continued stabilization and resuscitation of the casualty pre- and postsurgically through interpretation of labs, airway management, and medication administration.

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every Army Role 1 has refrigeration capability to support low titer group O whole blood (LTOWB) storage.

25. "Furthermore, as part of residency, they are required to lead 45 adult medical and 35 adult trauma resuscitations, perform 20 central lines, 10 chest tubes, three cricothyrotomies, 10 dislocation-reductions, 150 clinical ultrasounds with interpretation, 35 intubations, and 15 procedural sedations, along with several other less combat-relevant procedures." Schauer et al., "Risks of Prolonged Casualty Care for Conventional Forces."

26. Schauer et al., "Risks of Prolonged Casualty Care for Conventional Forces."

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29. Aaron Epstein et al., "Putting Medical Boots on the Ground: Lessons from the War in Ukraine and Applications for Future Conflict with Near-Peer Adversaries," *Journal of the American College of Surgeons* 237, no. 2 (2023): 364–73, https://www.doi.org/10.1097/XCS.0000000000000707.

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