



Original Article

Role of Anaesthesiologist in Hybrid Warfare

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ABSTRACT

Hybrid warfare - a blend of conventional, irregular and asymmetric tactics in civilian-dense settings has evolved into a multimodal threat over recent decades. This review article examines its impact on anaesthesiology, particularly in operation theatres (OTs), Intensive Care Units (ICUs) and casualty evacuation (Cas-evac) systems within the “Grey zone” between peace and war. Key modalities like cyber-attacks, biohazard warfare, criminality, and terrorism disrupt healthcare delivery, as evidenced in the Ukraine conflict. These are some situations where anaesthesiologists can assume a substantial role. We face challenges such as targeted violence, supply chain disruptions, Cas-evac turmoil and cyber vulnerabilities of sophisticated medical devices. Strategies for preparedness include all-hazards approach, disaster planning with military and police, cyber security collaboration with IT and use of portable, non-networked equipment. Mitigation involves mobile hospital facilities, secure logistics and enhanced training via simulation and CME. Anaesthesiologists as “Grey zone warriors,” require resilience and adaptability to safeguard patients and staff.

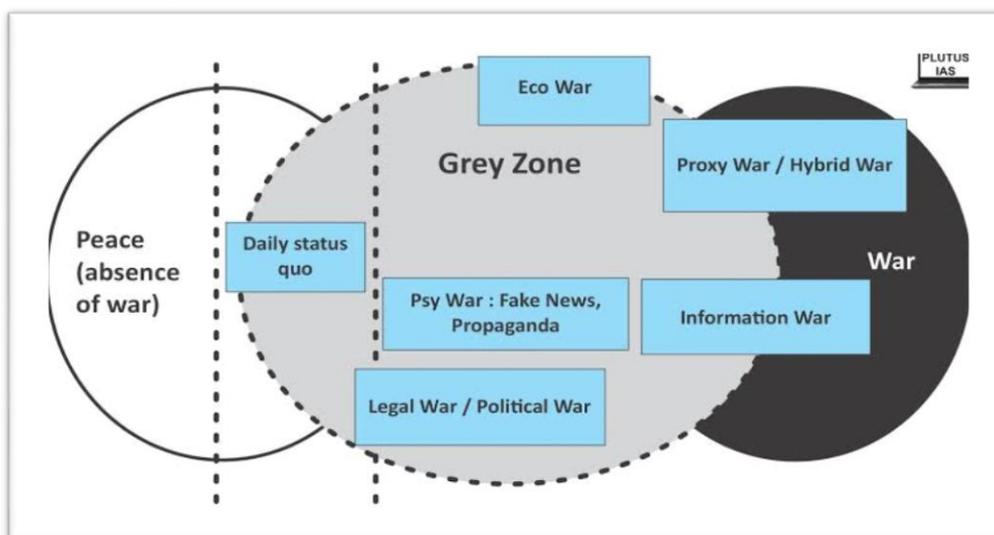
Keywords: Hybrid warfare, Anaesthesiology, Cyber-attacks, Disaster preparedness, grey zone conflict, Ukraine war.

INTRODUCTION

Hybrid warfare is a combination of conventional, irregular, and asymmetric conflicts with advanced weapons systems: chemical, biological, radiological, nuclear, high-yield explosives, drones and cyber terrorism creating a ‘Grey Zone’ between peace and war. (1,2) Over the last few decades, tactics such as cyber-attacks, biohazards, criminality and terrorism have intensified, directly affecting Anaesthesia practices in OTs, ICUs and Cas-evac. The Ukraine-Russia war (3) highlights these threats to Anaesthesiologists facing violence, supply chain disruptions and improvised care demands. This review article outlines - Principal effects of hybrid warfare on Anaesthesia and strategies for preparedness to mitigate risk for patients and health care workers.

Grey Zone of Conflict:

Zone between peace and war without crossing the line of open war (Picture no. 1). It forms the essential zone of Hybrid warfare. The focus of review is Anesthesiologists working in this Grey Zone of Conflict.



Picture no. 1 – Zones of War (<https://plutusias.com/grey-zone-warfare/>)

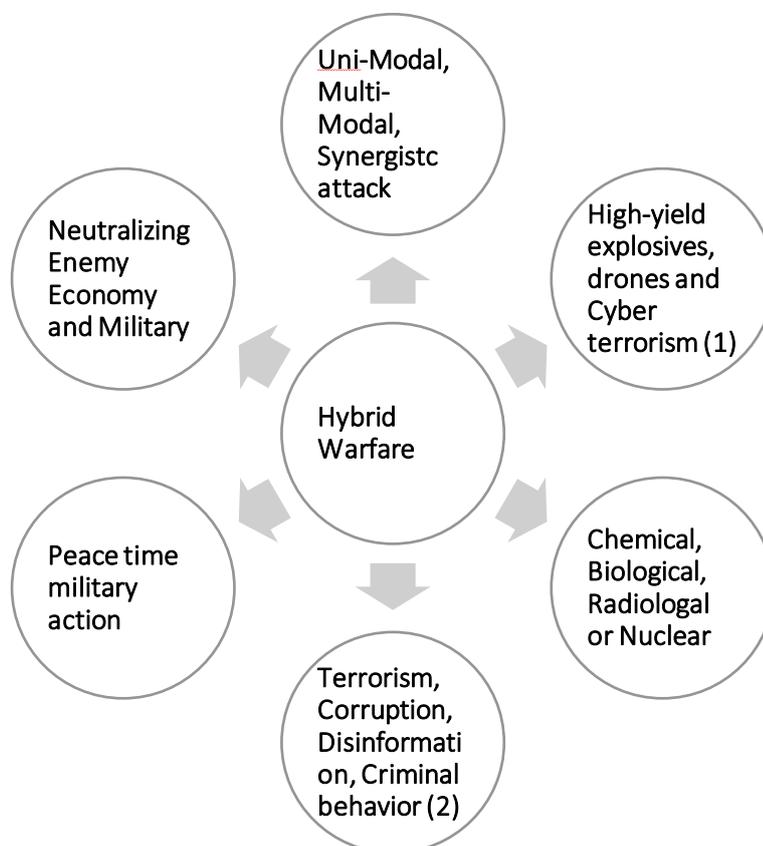


Chart no. 1 – Modalities of Hybrid Warfare (1,2)

Table no. 1 – Modalities of Hybrid Warfare directly effecting Health Sector (1,2)

Modalities directly affecting Hospitals	Example
Cyber-attacks	On Anesthesia work-stations, ventilators, infusion pumps, imaging devices, IT & communication
Biohazard warfare	Chemical, biologic, radiological, nuclear, and high-yield explosives.
Criminality	Counterfeit pharmaceuticals & PPE. Urban gang networks activation, Society disruptive behavior.
Terrorism	Multi-modal attacks & Direct attacks on health-care facilities

Table no. 2 – Characteristics of Hybrid Warfare (<https://visionias.in/current-affairs/monthly-magazine/2025-03-24/security/hybrid-warfare>)

<p>Obscurity and Ambiguity: Hybrid warfare makes it difficult to identify the threshold of war and complicates attribution and response to attacks.</p>
<p>Multi-domain Operations: It involves engaging multiple domains like land, air, sea, cyber, and space, making defence challenging.</p>
<p>Non-state Actors: It utilizes proxy organizations and non-state entities.</p>
<p>Psychological operations: It manipulates morale and public opinion through propaganda and media influence.</p>

Anaesthesiology at the Epicenter of Hybrid Warfare:

War in Ukraine has questioned the Geneva convention. Medical providers are no longer immune to violence and aggression (3). Hence, there is a shift towards utilization of smaller, mobile hospitals and surgical facilities rather than large conventional hospitals with Red-cross. There has also been threat to healthcare logistics, making regular ambulances and air ambulances vulnerable to attack. Ukrainian medical teams adapted by utilizing unconventional transport modalities such as unmarked ambulances (4) (Picture no 2,3). The war also demonstrated destruction of supply chains of medicines and equipment. Anaesthesiologists in Ukraine have shown resilience by using non-standard medications and improvising equipment (5).

Anaesthesiologists are special group of trained physicians who are assets in complex and critical situations such as mass casualty incidents, terrorist attacks, pandemics and the new threat of hybrid warfare. We are the core strategic resource in inaccessible areas which puts us in crosshairs of an aggressor (Picture no. 4). Anaesthesiologist’s job spans the entire healthcare trajectory, starting from prehospital stabilization, Cas-Evac to resuscitation in Accident and Emergency dept to Damage Control Surgeries (DCS) in OT to ICU for critical care of the patients. (Chart no. 2).

In additional to our principal role, we also participate in critical vital based resource decision making such as patient flow, logistic support, patient triage and advanced care as demonstrated in past terrorist attacks in Oslo- Norway, Paris- France and London- United Kingdom (6,7).



Picture no. 2 – Ukrainian medics in unconventional modified ambulance with shielded windows (<https://noticias.r7.com/internacional/como-ucrania-utiliza-imas-para-salvar-soldados-feridos-na-guerra-contra-a-russia-05072025/>)



Picture no. 3 – Ukrainian unconventional modified ambulance without Red-cross logo for safety (<https://www.nytimes.com/2022/07/05/world/europe/ukraine-donbas-medics.htm>)



Picture no. 4 – On ground in action Ukrainian Anaesthesiologist in active war zone (<https://www.nytimes.com/2022/07/05/world/europe/ukraine-donbas-medics.html>)

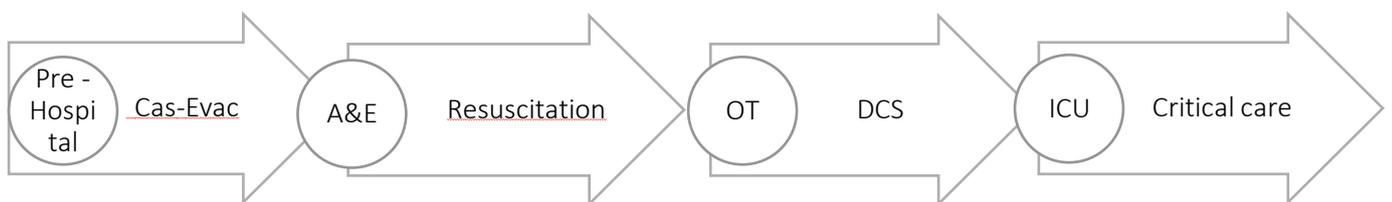


Chart no. 2 – Anaesthesiologist’s role in complete care pathway

Cyber-attacks on Anaesthesia and Intensive Care:

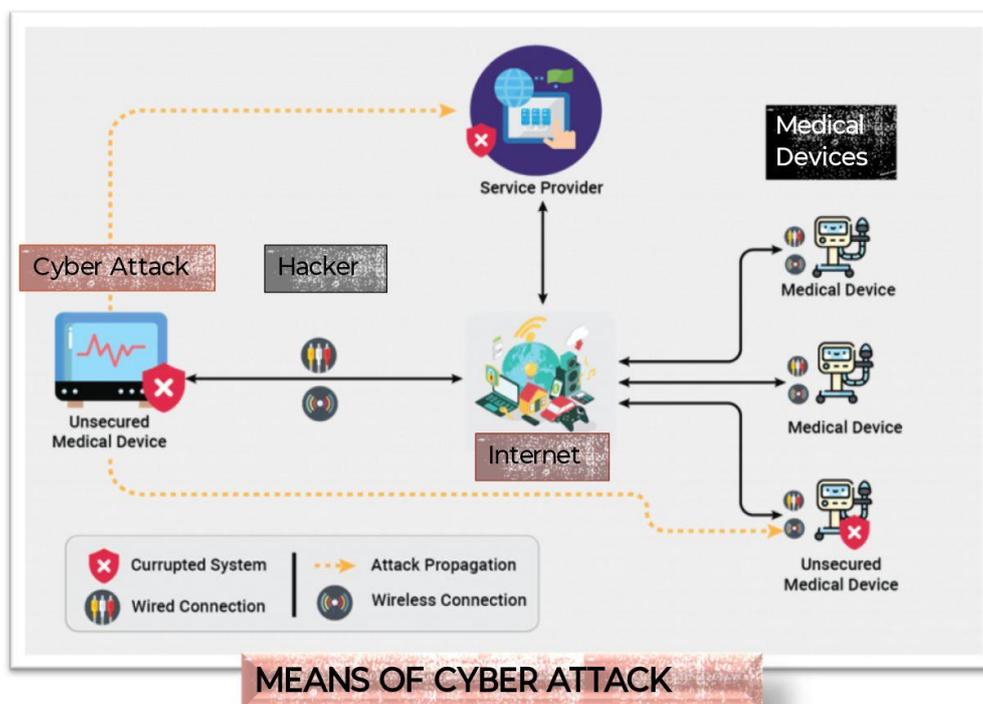
As per data collected by American cyber based company - Cyphre in 2022 (8), over 74,000 (EMR- electro-medical records) breaches occurred in a year and about 51 million data were lost due cyber-attack. Also there has been incidences of cyber-attack causing disruption of sophisticated medical equipment like anaesthesia workstation, imaging devices, intra-cardiac

devices, automated insulin pumps etc. Superior technology in OTRs, ICUs and critical care transport are extremely vulnerable to cyber-attacks.

ASA Cyber-security Task force (CSTF) was formed in Oct 2019 to counter cyber-attack on EMR, which now provides shield to cyber-attack on entire health care system globally. List of items vulnerable to cyber-attack relevant to dept of anaesthesia are; Anaesthesia workstations, Ventilators, Infusion pumps, Defibrillators and Multi-para monitors. (9)

Cyber-attack Pathway:

Electromedical devices which uses internet connection for installation and upgradation are vulnerable to cyber-attack by hacking as visualized in Picture no. 5. (10,11).



Picture no. 5 – Cyber-attack pathway (<https://www.volansys.com/blog/cybersecurity-for-medical-devices/>)

Anaesthesiologist - An ideal physician of Hybrid Warfare

1. Cas-Evac

During Hybrid threats, Air-Evac by fixed wing aircraft is vulnerable to drones and cyber-attacks. Hence, advanced health care evac by unconventional transport vehicle under guidance of anaesthesiologist becomes safest mode of transport.

2. Biohazard warfare

Familiarity of anaesthesiologist for cholinergic and anti-cholinergic pharmacology makes them critical in managing patients exposed with chemically hazardous substances of war. EMP (Electromagnetic pulse) in a nuclear warfare can result in complete destruction of electromedical equipment. On ground anaesthesiologists' skills become indispensable asset during such warfare. Anaesthesiologists are also the part of decision-making team for optimal care pathways during such threats. (11)

3. Terrorism

Multimodal attacks on hospital causes surge of trauma casualties causing both short and long-term strain on OT and ICU services. Anaesthesiologists as leaders at both these critical areas facilitate rapid transit of patient load by effectively managing care pathway clinically as well as resourcefully, thereby maintaining optimal hospital load. (12,13)

4. Riots:

Public riots may affect transportation and access to healthcare facilities. Hence, on ground anaesthesiologist as a part Cas-evac team (QRMT) becomes very crucial in immediate and delayed management of critical patients during transit. Ukrainian anaesthesiologists during disruption of supply chain, have depicted highest order of resilience by using non-standard medication (such as combination of inducing agents, infusion of secondary choice inotropes, RA instead of GA etc) and improvised on ground equipment by their technical expertise thereby for saving lives of critical cases.

Planning, Mitigating, and Responding:

1. Planning strategies

As a Gatekeepers to OTs and ICUs, we play active role in disaster planning and management. (14). Foundational plan includes All-hazards approach with Maximum Flexibility involving:

Disaster Planning: Collaboration with police, military, and IT for situational awareness.

Resource Adaptation: Use of portable, battery-backed, non-networked devices (e.g., POCUS, ABG analysers, Basic portable Ventilators).

Training: Simulation exercises and CME (Table no. 3) on disaster medicine, biohazards, and counter-terrorism, aligned with NATO. (15)

Table no. 3 – Resource materials for training

Individual training resources
Web sites and reading lists - - ASA Trauma and Emergency Preparedness - Department of Health and Human Services Web site (https://www.phe.gov/preparedness/pages/default.aspx)
Just-in-time training - - PPE charts and quick references (family and CBRN) (https://www.asahq.org/about-asa/governance-and-committees/asa-committees/committee-on-trauma-and-emergency-preparedness-cotep/emergency-preparedness)
Courses - - Basic, core, and advanced disaster life support (https://www.ndlsf.org/) - Stop the Bleed (https://www.stopthebleed.org/)

2. Mitigation Strategies

Mitigation includes shifting to mobile hospitals, securing logistics with unmarked transport, enhancing cybersecurity, fostering interdisciplinary collaboration and situational adaptation to improvised equipment and non-standard medications. These measures protect patients and staff in conflict zones.

CONCLUSION

Hybrid warfare is an increasing multi-modal threat to all segments of health care system, particularly where anaesthesia and intensive care are provided. Anaesthesiologists are potentially well-placed to assume a substantial role in such situations. CME and Simulation training on disaster management, counter-terrorism, cyber-attack and CBRN should be integral part of training for both interns and residents. Ukraine-Russia war has set new war challenges for Anaesthesiologists globally. We are the 'Grey Zone Warriors' of the future.

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