



Injuries Caused by Recurrent White Phosphorus Bombing as a Crisis in Gaza Strip

Mostafa Khafaei¹, Yunes Panahi², Hassan Abolghasemi³, Ali Miri¹, Forouzan Karimi⁴, Gholamreza Farnoosh^{5*}

¹ Human Genetics Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran.

² Pharmacotherapy Department, Faculty of Pharmacy, Baqiyatallah University of Medical Sciences, Tehran, Iran.

³ Department of Pediatrics, Faculty of Medicine, Baqiyatallah University of Medical Sciences, Tehran, Iran.

⁴ Department of Immunology, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

⁵ Applied Biotechnology Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran.

***Corresponding Author:** Gholamreza Farnoosh; Applied Biotechnology Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran; **Email:** rzfarnoosh@bmsu.ac.ir

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Abstract

White phosphorus, a chemical compound with highly flammable and smoke-generating properties, is extensively used in military weaponry. Consequently, this substance is regarded as very dangerous. The risk of harm or fatality resulting from contact with WP is heightened when it is inhaled, ingested, or absorbed by the skin. There is a correlation between this risk and the probability of mortality. This research thoroughly investigates the possible ramifications of being exposed to WP, including systemic toxicity and deep tissue burns. The text covers the process of igniting, the generation of dense smoke with a characteristic garlicky aroma, and associated subjects. Performing laboratory tests, including measuring creatinine, potassium, calcium, serum phosphorus levels, and liver enzymes and conducting blood gas analysis, is essential for accurately diagnosing phosphorus poisoning based on the patient's symptoms. Promptly extracting the individual exposed from the origin of contamination, cleansing the impacted skin or injuries with frigid water or a saline solution, and cautiously managing phosphorus particles to avert more igniting are all crucial elements of immediate post-exposure treatment. It is essential to see an ophthalmologist promptly upon detecting any indications of an eye injury and to wash the area thoroughly with water or a saline solution. Immediate medical intervention is necessary to carry out a thorough assessment and treatment. The Israel Defense Forces' use of white phosphorus in densely populated areas of Gaza throughout the war raises significant moral and humanitarian concerns. Exposure to WP poses a considerable danger to workers because of its pyrotechnic and smoke-generating properties, which may lead to systemic poisoning and significant tissue damage. This article examines the use of White Phosphorus by the Israel Defense Forces, elucidating the challenges in preventing injury and the possible consequences for innocent bystanders. The use of WP serves as evidence of the very intricate ethical dilemmas associated with the deployment of chemical weapons in modern warfare. Enhanced understanding and accountability in executing military operations are necessitated as a consequence.

Keywords: White phosphorus, Systemic toxicity, Phosphorus poisoning, Immediate post-exposure treatment, Ethical dilemmas.

Introduction

White phosphorus (P₄) is a chemical substance that ignites upon oxidation, produces a massive smoke with a smell similar to garlic, and burns for approximately 7 minutes.

White phosphorus ignites with oxidation, up to more than 816°C (1500°F), until the oxygen supply ends.

Deep burns occur when white phosphorus comes into contact with the skin, sometimes reaching the bone marrow. Infection and absorption of chemicals in the

skin leads to severe damage, and in most cases, is associated with death.

White phosphorus is mainly used in military weapons, bombs, rockets, and mortars, and it is used to fog the scene of military operations. After such weapons collide with the ground or with aerial shrapnel, the white phosphorus in the weapons emits dense white smoke, which the military forces can quickly move by using to camouflage themselves. In addition, the resulting smoke disrupts the infrared vision and tracking systems by

creating an obstacle; so, protects the military forces against tracking and guided missiles¹⁻³.

Numerous international conventions and agreements have been established to address the use of phosphorus weapons in conflict zones, particularly in residential areas and against civilians. These include the Lahe Court Conference in 1899, the Third Geneva Convention protocol, the ENMOD Convention, and the International Criminal Court. These agreements explicitly prohibit the use of phosphorus weapons in civilian settings, such as schools, hospitals, and religious buildings, aiming to protect innocent lives and reduce the devastating impact of warfare on civilian populations²⁻⁴. Governments may breach human rights and employ weapons that inflict significant damage to civilian populations during geopolitical wars in order to attain their objectives and commitments.

The Middle East has been the epicenter of war and conflict for the majority of the twenty-first century because of its unique geography. West Asia was hit by a number of local conflicts at the start of 21st century, including the US-led war in Iraq, the 2008 Israeli-Palestinian War, the 33-day Lebanon War in 2006, and the 2009 Saudi Arabian army invasion of northern Yemen. These geopolitical conflicts have frequently caused damage to civilian areas. Urban civilians were the target of phosphorus weaponry in all of these wars, resulting in significant casualties. More than two million populations in the Gaza Strip are situated on the eastern coast of the Mediterranean Sea. Gaza has challenged many Israel attacks⁵⁻⁶. Nevertheless, the Israel army has repeatedly used these types of weapons in urban areas against civilian areas. It has caused high casualties to the oppressed people of the Gaza Strip and Southern Lebanon. In the recent Israel attack on the Gaza Strip in 2023, according to the reports and pictures published by the news agencies, this army has again used this prohibited weapon against the people of the Gaza Strip. Therefore, international organizations, including the Human Rights Organization, the World Health Organization (WHO), and other related world organizations, should seriously pursue this case and save the Gaza Strip people from these cruel attacks⁷⁻⁹.

This review aims to outline the devastating impact on civilians in Gaza resulting from the use of phosphorus weapons by Israel. It also explains into the mechanism

of action and potential side effects of this substance, shedding light on the urgent need for effective measures to mitigate the harm inflicted on urban populations. By exploring the effects of phosphorus weapons and proposing strategies for minimizing civilian casualties, this review underscores the importance of addressing the humanitarian implications of such weaponry in conflict zones.

Historical Context

The Israel-Palestinian conflict originated from historical events and transformations that started in the late nineteenth century. In 1947, the United Nations adopted Resolution 181, often known as the Partition Plan, to separate Palestine into separate Arab and Jewish states. This settlement significantly impacted the dynamics and progression of the conflict¹⁰⁻¹².

However, the Gaza Strip has historically been a source of violence. This area has seen several battles throughout the years. The Gaza Strip has always been a dangerous combat zone, with a history of occupations and conquests. This turbulent history has kept the area in continual upheaval and instability¹³.

In the 1967 war, the Israel occupied both the Gaza Strip and the West Bank, including East Jerusalem, which was subsequently annexed. This occupation added another layer of complexity to the ongoing conflicts in the region¹⁴.

An important aspect of military history and examining global conflicts revolves around the past use of white phosphorous in several wars. Executing this requires diverse participants and has extensive ramifications in many war zones. Prominent instances of its use include the Iraq War, the utilization by Israel troops in the fights in Lebanon and Gaza, as well as its deployment in Syria, Afghanistan, and the Second Nagorno-Karabakh War, among several other circumstances.

An analysis of the deployment patterns of white phosphorus in various historical contexts provides insight into the operational aspects of modern warfare, the moral quandaries associated with incendiary weapons, and the enduring humanitarian impacts of these battles. Furthermore, by exploring this subject matter, we may better understand the regulations governing warfare and how both state and non-state actors in contemporary geopolitical arenas use evolving military tactics (Table 1).

Table 1: Military history of using white phosphorous in several wars.

Date	Event	Reference
Nov-2004	The United States military used white phosphorus munitions during the Second Battle of Fallujah in Iraq.	15
Nov-2005	The use of white phosphorous in Fallujah has been officially acknowledged by the US Department of Defense.	16
2006	During the War in Lebanon in 2006, Israel forces used phosphorous munitions.	17
16-Oct-2003	Israel faced allegations of using white phosphorus artillery munitions in Lebanon during border skirmishes.	18
2008-2009	Israel soldiers allegedly used white phosphorous munitions in densely populated areas during the Gaza War.	19
Jul-2009	The Israel has officially acknowledged the use of white phosphorous during the Gaza War.	20
2009	American military personnel employed white phosphorus in Afghanistan during confrontations with the Taliban.	21
31-Oct-20	Allegations were made that Azerbaijani troops using phosphorus munitions during the Second Nagorno-Karabakh War.	22

Mechanism of toxicity of white phosphorus

Exposure to white phosphorus, a hazardous substance, can lead to severe injury or fatality by several means. Adverse effects can occur by inhalation, ingestion, or cutaneous absorption.

Due to its high lipid solubility, this substance can readily enter the body and have systemic effects, making it hazardous. When reacted with oxygen and water, white phosphorus produces potent acids that can harm tissues and induce heat and chemical burns. Moreover, it possesses the capacity to inflict damage on the cardiovascular system, kidneys, liver, and central nervous system, potentially resulting in coma and fatality. Ingesting even a small quantity of this substance can be deadly; the established lethal dosage is 1 milligram per kilogram of body weight.

Inhaling smoke that contains white phosphorus has the potential to irritate the respiratory system and eyes. The inherent property of white phosphorus to spontaneously combust upon exposure to air and produce irritating white smoke renders it a valuable component in military ordnance, serving as both an incendiary and smoke agent.

The diagnosis of phosphorus poisoning cannot be determined based on the exact measurements of serum phosphorus values. Additional beneficial laboratory tests include creatinine, potassium, calcium, liver enzymes, and blood gas analysis²³⁻²⁷.

Adverse effects and intricacies of white phosphorus

White phosphorus may result in severe injury or fatality upon exposure, regardless of the entry route. Due to its high lipid solubility, this substance may quickly penetrate the body and potentially harm the system.

White phosphorus reacts with oxygen and water, producing potent acids that can erode tissues and cause chemical and thermal burns. Ingesting even a small quantity of this medicine might result in several detrimental consequences, such as gastrointestinal issues, cardiovascular complications, renal and hepatic injury, as well as impairment of the central nervous system, perhaps leading to a state of unconsciousness or fatality.

Inhalation of white phosphorus smoke may result in severe skin burns, eye irritation, and respiratory complications. White phosphorus combustion yields phosphorus pentoxide, a toxic smoke that may cause eye and respiratory irritation. White phosphorus can induce lethal consequences, such as shock, liver or renal failure, harm to the central nervous system or myocardial, and several other severe health complications (Figure 1)^{23-26,28}.

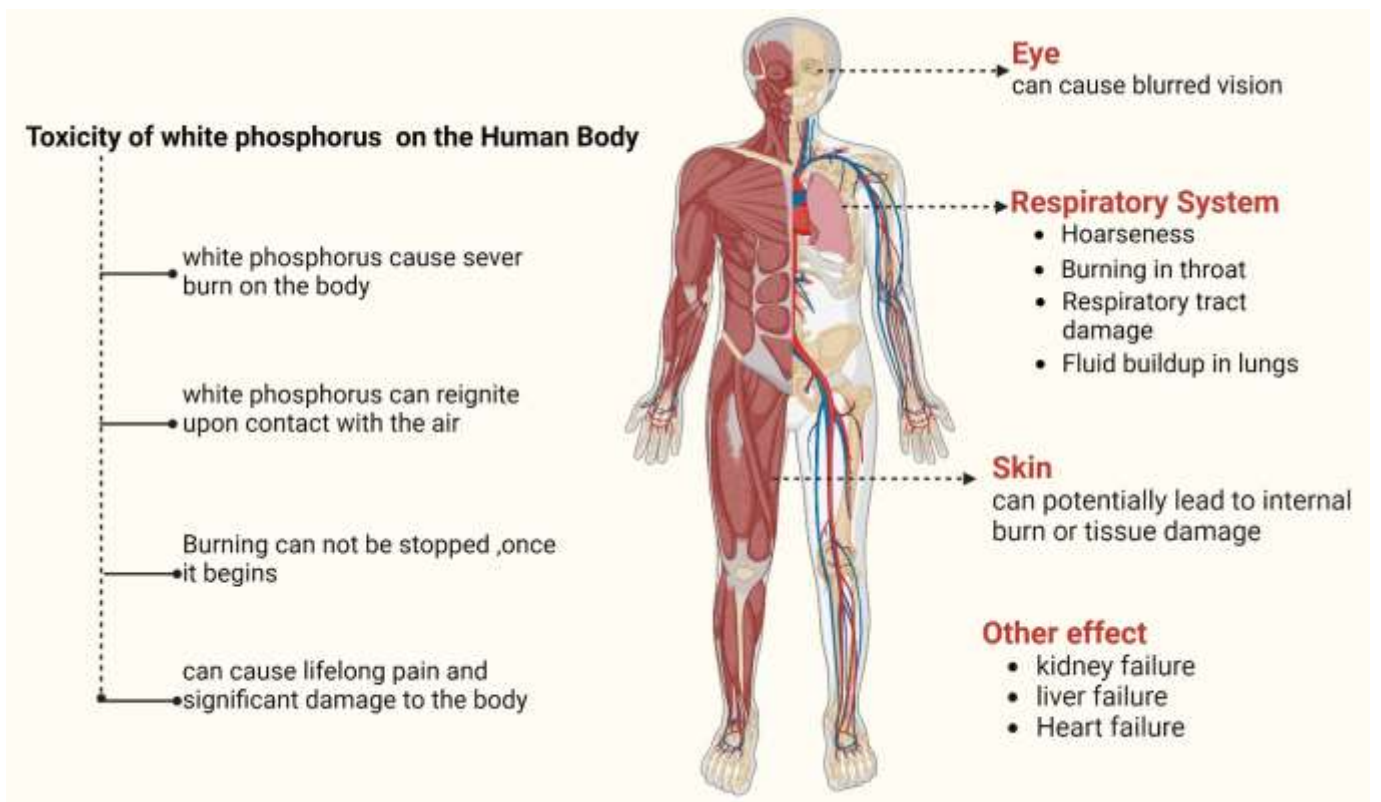


Figure 1: A combination of white phosphorus, oxygen, and water can form an acid that can inflict thermal and chemical burns. Serious and potentially fatal diseases affecting the gastrointestinal tract, cardiovascular system, kidneys, liver, and central nervous system can result from inhaling or ingesting this chemical.

Damage caused by white phosphorus used in the Gaza war

The use of white phosphorous during periods of hostility may result in widespread destruction and profound bodily harm. Allegedly, the Israel Defense Forces (IDF) deployed white phosphorous in densely populated areas during the Gaza conflict, resulting in bone injuries and other serious, long-lasting burns upon contact with the skin. The consequences were fatalities, profound psychological suffering, and the onset of diseases. In highly populated areas, the use of white phosphorus resulted in civilian deaths, mostly due to burns and inhalation of flames²⁹⁻³³.

Treatment

After contact with white phosphorus, the most essential act is ending the burning process. WHO recommended the following guidance after providing immediate care (Figure 2).

Conclusion

White phosphorus weapons, which have chemical reactivity, provide a significant danger to both military troops and civilians in areas affected by armed conflict. Its inherent flammability and ability to release substantial amounts of pollutants when subjected to high temperatures and oxygen make it suitable for use as a strategic weapon in military operations. The use of white phosphorous in warfare inside heavily inhabited areas has resulted in gruesome fatalities, extensive burns, and terrible injuries.

The use of white phosphorus in conflict zones such as the Gaza Strip, Lebanon, and Iraq has raised serious concerns over human rights violations and has sparked international condemnation. The deployment of white phosphorus in densely populated areas not only violates numerous international agreements and norms but also inflicts significant harm and damage on civilian populations.

The collaboration and coordination among international agencies, including the World Health Organization (WHO), United Nations (UN), and various human rights

groups, are essential in addressing and mitigating the devastating impact of white phosphorus on civilian populations in conflict-affected countries. By working together, these organizations can provide crucial support, medical assistance, and advocacy to those affected by the use of white phosphorus, as well as raise awareness and advocate for the enforcement of international laws and regulations governing the use of such weapons. This collaborative effort is instrumental in ensuring the protection and well-being of civilians caught in the midst of armed conflicts where white

phosphorus is being used.

Immediate medical care is necessary in cases of white phosphorus exposure. It is essential to consistently implement international norms and laws to ensure the responsibility of those who break the rules and avoid more harm.

The use of white phosphorus as a weapon raises humanitarian issues. International collaboration is necessary to avoid further loss of innocent lives and uphold human rights and humanitarian law.

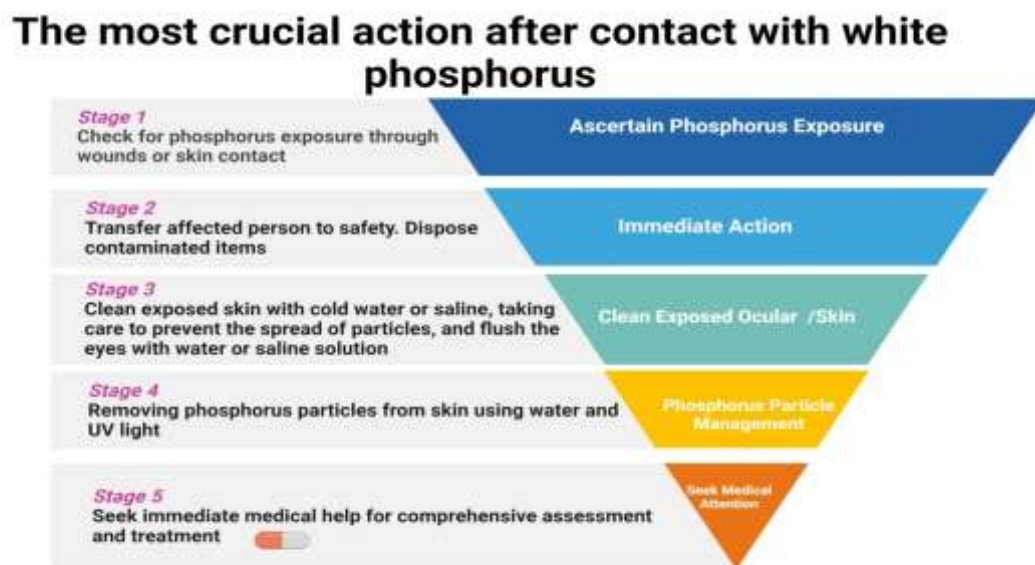


Figure 2: Five critical care stages in case of exposure to white phosphorus, defined by the World Health Organization (WHO).

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Conflict of Interest Disclosures

The authors declare that they have no Conflict of Interest.

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Ethical Statement

None.

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