Iraq-Iran chemical war: Calendar, mortality and morbidity

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Iraq-Iran chemical war: calendar, mortality and morbidity

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【**Abstract**】**Objectives:** To review the calendar, mortality and morbidity of Iraq-Iran chemical war among Iranians based on researchers' reports.

Methods: We used national and international databanks such as PubMed, ISI, Scopus, Irandoc and Iranmedex and studied 350 articles related to chemical agents and their effects on different organs. The main criteria for qualification of articles were relevancy orientation and being published in approved medical journals.

Results: The Iraqi army invaded to west and southwest Iran using chemical weapons such as nerve agents (NAs) and sulfur mustard (SM). Most victims were civilians including women and children. These attacks had imposed more than 150 types of diseases and complications on Iranians and the frequency of death was 2%-3%. Most reports were about respiratory problems and a few were in the domain of socio-economic damages.

Conclusion: At present, 25 years after the end of war, the victims are faced with different complications induced by chemical agents and it is estimated that they will be continuously troubled by these problems in future.

Key words: ***Chemical warfare; Wounds and injuries; Iran; Iraq***

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During the Iraq-Iran war (1980-1988), Iranian people suffered more than 200 000 deaths and about 400 000 injuries that require prolonged care.[1,2] At present, about 30 000 Iranian chemically injured veterans are under follow-up treatment, most of whom were exposed to sulfur mustard (SM) agent.[3] Approximately 100 000 military and civilian people have been injured by this agent.[4]

Iraq firstly used chemical weapons in an area between Halaleh and Ney Khazar located in southern Iran in January 1978, in accordance with Iranian month of Dey (23/10/1359).[5] At the beginning of the war, the use of chemical weapons was limited, but in March 1985, Iraq used large amounts of chemical agents against Iranian military and civilian people.[2,6]

Such chemical agents caused extensive physical, mental, emotional and financial losses on Iranian people. SM has less lethal effects but mostly produces long term disabilities.[7] On the contrary, nerve agents (NAs) have more acute effects and less long term complications.[8] Therefore, the main purpose of this study was to review the calendar, mortality and morbidity of Iraq-Iran chemical war among Iranians based on researchers' reports.

METHODS

In a systematic search, we studied 350 articles including 10 reports related to NAs, 29 to dermatological studies, 21 to hematological diseases, 10 to cancer; 50 articles about SM, 31 about ocular system; 44 in the field of psychology, 10 in the field of endocrinology; and 90, 15, 30, and 10 articles in respiratory system, prevention, immunology, and mortality domain respectively. In this study, we used more than 40 key words to obtain the best articles. We used national and international valid medical databanks such as PubMed, Scopus, ISI, Irandoc and Iranmedex.

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Chinese Journal of Traumatology 2014;17(3):165-169

Titles and abstracts were assessed by two experts separately and unrelated papers were excluded from the study. Then subjects were classified and used. The main criteria for qualification of articles were relevancy orientation and being published in approved medical journals.

RESULTS

Calendar of chemical warfare in Iran

For a period of about 5 years from August 1983 to July 1988, Iran was attacked several times with chemical weapons by the Iraqi army. During the year 1983, due to the presence of some problems in building Iraqi bombs, most attacks were not successful. Therefore, in this year the lesions and damages were not as devastating or severe, but from 1984 onwards, after solving the technical problems of the bombs, damages became more severe.[9]

Sardasht (one of the Kurdish cities in the North West of Iran) was attacked by several bombs in July 1987 and June 1988. These bombs contained 250 kg of SM that was released in the city center. At the time of the attacks, 8 025 people of 12 000 residents in this town were chemically injured and 130 civilians were killed.[10,11] The last Iraq chemical attack was in Feb 1988 in the town of Oshnaviyeh (in the North West of Iran) which left 2 680 injured civilians.[12,13] The use of chemical weapons against civilian population in 8 locations at Sheikh Othman District in Oshnaviyeh has been confirmed by United Nation's experts.[2]

Frequency of deaths and injuries

Most deaths among chemically injured Iranian victims were in the battle fields[14] and the main lethal types of chemical weapons were NAs. Khateri and colleagues[2] reported that during chemical war, about 100 000 Iranians received medical treatment and they estimated that there were 25 000 civilians and thousands of veterans who were injured by chemical agents not registered.

Gilasi and colleagues[7] studied the causes of mortalities among martyred veterans in Isfahan province (a central province in Iran) in 2006. The frequencies of deaths were related as follows: neoplasms (30%), accidents (30%), myocardial infarction (20%), renal failure (10%) and respiratory disorders (10%). SM has low lethal effects.[14] The frequency of acute lethal rates of SM is about 2% to 3% but the frequencies of chronic lethal effects are not well documented.[15] A lethal dose of SM in human beings is 200 mg (oral) and 3-5 g via long standing exposure to bare skin.[16] The deaths probably occurred due to pulmonary edema.[14] Mortality caused by SM during the first weeks was due to heavy exposure and severe respiratory problems.[17] Low dose exposure to SM associated with redness and mild dermatologic vesicles would not increase the probability of deaths.[18]

Chemically induced diseases and complications on Iranian people considering the type of agents

NAs After the first attacks by Iraq, international authorities for several years refused Iran's claim of the use of chemical agents by Iraqi armies. But finally, a 28-page report about chemical attacks by a team from the UN who traveled to Iran was published. In this report, it was mentioned that "for the first time in the world, NAs were used in chemical warfare." The UN team announced the composition of the applied agents in a bomb as: Tabon 75%, chloronenzene 12% and three acetyl phosphate 3%-10%. In the analysis of components of another bomb, the compound consisted of 50% Tabon, 20% chlorobenzene and some impurities.[6] The applied poisons included organophosphorous agents such as Tabon, Sarin and in limited cases, cyanide, arsenic and the phosphorus compounds.[19] In the tests performed on several samples of peripheral blood, skin, urine and stomach contents of the martyred victims, the use of Tabon and SM has been proven.[20,21]

NAs have various toxic effects on human beings via over stimulation of muscarinic and nicotinic receptors as well as direct effects on central nervous system.[22] Clinical findings of muscarinic effects are sweating, lacrimation, salivation, dryness of eyes, myosis, visual impairment, respiratory problems, nausea, vomiting, diarrhea, colicky abdominal pains, bradycardia and hypotension. Nicotinic effects are shown as mydriasis, weakness, chills, muscular convulsions and paralysis. Patients are at risk of sudden respiratory arrest during awareness due

to respiratory muscle weakness and paralysis. Heavily toxic patients would be comatose in less than 30 seconds and after seizure they would have respiratory arrest. Direct effects on central nervous system are chills, insomnia, headache, seizure, confusion, impaired concentration, cyanosis, respiratory problems, coma and death.[22]

SM The most common chemical agents used in Iraq-Iran war was SM.[3] The use of mustard agent by Iraqi forces against Iranian people was confirmed by Dr Dominguez, the head of the UN team that was traveling in Iran in 1986.[23] In another study on Iranian victims, exposure of Iranian people to SM was also confirmed by Benschop and colleagues[21].

SM causes DNA damage, cell membrane damage, decreased glutathione, nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB) activation, and caspase activation. Consequently, DNA damage causes polymerase activation and nicotinic adenine nucleotide depletion. Decreased glutathione produces reactive oxygen and both these phenomenon can lead to necrosis and cell death. SM has several other adverse effects on cells, such as alkylation effects, mitosis inhibition, mutagenesis, carcinogenesis, and colinomimethic effects. Furthermore, mustard gas (MG) causes release of proinflammatory cytokines and prostaglandins.[24]

A wide variety of biopsychological complications induced by SM among Iranian injured people have been reported by researchers, most were about respiratory problems and a few about direct socioeconomic effects. Since the range and duration of usage of SM was much larger than NAs during the war, there are more related reports published and consequently, we mostly explained the effects of SM in this paper. Problems induced by SM were as follows:

(1) Respiratory problems: According to Khateri and his colleagues' research[8] conducted on 34 000 patients, respiratory problems are the main biological problems and account for 42.5%. We previously reported respiratory complications induced by SM among Iranian victims in two other review articles.[24,25]

(2) Ocular complications: According to Khateri's findings, chronic ocular problems were found in 39% of the biological problems.[8] The detailed ocular complications induced by SM among Iranian victims have been reported in References 26 and 27.

(3) Dermatologic problems: Skin is among the first line and the most heavily damaged organs upon SM exposure. Skin lesions varied from simple erythema to bullous necrotization.[28] The frequency of dermatologic problems is reported as 24.5%. As well as we described, dermatologic complications induced by SM among Iranian victims can be seen in a review article.[29]

(4) Psychological disorders: Mental disorders are more common among chemically injured veterans rather than normal population. We recently reported psychological complications induced by SM among Iranian victims in another review article.[30]

(5) Immunological changes: SM has short and long term effects on both cellular and humoral immunity.[31] Immunological complications are probably the result of systemic toxicity.[32] We previously reported immunological complications induced by SM among Iranian victims in Reference 33.

(6) Other complications: Zafarghandi et al[34] showed carcinogenesis after acute exposure to SM during the war. Additionally, stomach cancer, basal cell carcinoma, bowen's carcinoma and spinocellular carcinoma have been reported.[3,25,35-36]

DISCUSSION

At present, about 45 000 Iranians are suffering from late respiratory complications of SM.[37,38] Almost all the residents of the invaded areas were forced to leave their homes. Most of them migrated to other cities and due to prolongation of the war, never returned to their original towns and villages. This issue caused many problems for the country.The chemical attacks particularly, imposed high losses on farmers' lives. Contamination of the soil can remain for at least 4 to 5 years[27], thus, a majority of the farmers became unemployed. On the other hand, due to the presence of a lot of mines in the land[39], the farmers could not work on their agricultural lands, and this problem intensified unemployment too. Tragic deaths of the victims imposed dramatic emotional stresses on the surviors, their spouses, children and other family members.

Chinese Journal of Traumatology 2014;17(3):165-169

SM caused less than 2% deaths in First World War among chemically injured soldiers.[26] Since the frequency of death was a little more prevalent (2%-3%) in Iraq-Iran war, it is a challenging issue and we should evaluate the difference in future studies.

Most of the deaths and injuries, especially in western borders, were women and children.[9] The highest and most severe attacks occurred in 1988, in the south of Iran. Each attack occurred using several to 300 bombs per day and the most severe attacks were related to Sardasht, where more than 8 025 out of 12 000 residents of the town were exposed to SM.[40] In Halabcheh, Khormal and Sirvan an unprecedented tragedy occurred: 5 000 people martyred and 7 000 people were injured.[2] These attacks have imposed hundreds of types of adverse physical complications and diseases, psychological disorders and social problems in Iranian people.

Imposed remedial costs

Expected imposed remedial costs due to chemical war injuries were related to repeated hospitalization of the injured people, repeated diagnostic (clinical, laboratory, imaging) testing, continuous medications, numerous surgical procedures, psychotherapies, rehabilitation measures, alternative therapies, specialized counseling and consulting, biopsycho-socio-spiritual care, social insurance and the other social supports, education, research, etc.

One of the most important factors in coping with problems by Iranian people, were the spiritual aspects. Ebadi and colleagues[41] in one study reported that spirituality was a key factor to cope with the chronic complications. Hassankhani and colleagues[42] in their study stated that Iranian veterans' religious beliefs assisted them to accept the impact of the chemical injuries on their lives. Therefore, they adapted their lifestyles accordingly and felt socially supported. Interestingly, they were hopeful about their future and live as fully as possible.

In conclusion, at present, 25 years after the end of war, the victims are faced with different complications induced by chemical agents and it is believed that they will continue to face these problems for the forseeable future. Considering the above mentioned descriptions, the main question is whether it is possible to calculate the costs of such violations. The clear answer is that accurate calculation of the burden is indeed not possible.

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