



Sulfur mustard induced bronchiectasis 15-20 years After exposure, review of 34 cases

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Abstract

Introduction: sulfur mustard is a chemical warfare agent that was widely used against Iranian veterans. The most prevalent effect of this agent on the respiratory system was chronic obstructive pulmonary disease. The aim of this study was evaluation of bronchiectasis as a late complication of chemical gas injury.

Materials and Methods: One hundred fifty two patients who had been exposed to chemical weapons were selected. Complete history, physical examination, chest x-ray, HRCT of chest, and spirometry were performed.

Results: Among one hundred fifty two patients with pulmonary complications of chemical gas inhalation thirty four patients with bronchiectasis were diagnosed. Others were mostly asthma, chronic bronchitis and, rarely, large airway stenosis and interstitial fibrosis. Bronchiectatic lesions were mostly identified as bilateral 67.6%, and 33.4% of cases were unilateral. The most common sites were RLL, LLL, RML, Lingual and LUL in order. Abnormality of spirometric parameters were found in all of them. The most common finding was obstructive pattern (58%). No significant difference was seen between Spiro metric values and age in the patients with bronchiectasis and patients with asthma and chronic bronchitis.

Conclusions: Bronchiectasis is a late pulmonary complication of sulfur mustard gas inhalation and should be considered in chemical gas victims with pulmonary problems.

Keywords: Sulfur mustard gas, Bronchiectasis, Inhalation injury

Introduction

Since 1983 several Iranian veterans have been admitted with clinical features of chemical gas poisoning, mostly sulfur mustard, which was used by Iraq in The Iran-Iraq conflict (1).

Most organs which are affected were lung, skin and eye. Both the upper and lower respiratory tracts may be damaged by its inhalation.

These effects are largely confined to airways (2,3). Chronic bronchitis and asthma are the most common problems in victims. The other respiratory complications are bronchiectasis, large airway stenosis and pulmonary fibrosis (3-5).

In this study we evaluate clinical and Para clinical aspects of bronchiectasis as a late complication of sulfur mustard gas inhalation in Iranian veterans, 15-20 years after exposure.

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Methods

One-hundred fifty-two patients with pulmonary symptoms who had been exposed to chemical weapons, sulfur mustard, during the Iran-Iraq war between 1983 to 1988, participated in this study. These patients were visited regularly in the pulmonary clinic for chemical gas victims in Mashhad, northeast of Iran.

Patients were excluded of study if they had history of tuberculosis or other chronic pulmonary diseases. History and physical examination were done by pulmonary physicians. Chest x-ray, high resolution CT scan (HRCT) of chest and spirometry were performed for all subjects. HRCT of chest were performed with 1.5-2mm thick section taken in 1cm interval.

Spirometry was performed using a spirometer (spiroanalyzer ST90 fukuda, Japan) Spirometric parameters, FEV1-FVC-FEV1%, were expressed as a percentage of predicted values. The highest value of three consecutive measurements was chosen for analysis.

Diagnosis of the bronchiectasis was made according to standard criteria, which included: bronchial dilation, bronchial wall thickening, and lack of normal bronchial tapering and airfluid level in distended bronchi(11). The number of lung lobes, including lingula as a individual lobe, affected by bronchiectasis was determined. Based on clinical and HRCT findings the subjects were divided into two groups: thirty-four patients with bronchiectasis and one hundred eighteen patients without bronchiectasis, which mostly were chronic bronchitis and asthma and rarely large airway stenosis and interstitial fibrosis. Large airway stenosis was diagnosed by typical configuration of flow-volume loop and clinical findings. Diagnosis of interstitial fibrosis was performed based on HRCT findings.

Diagnosis of asthma and COPD were performed based on assessment of reversibility and irreversibility of bronchoconstriction after inhalation of salbutamol.

Clinical and spirometric features of patients with bronchiectasis were assessed and then comparison was done with asthmatic and chronic bronchitis patients about age and spirometric parameters.

Statistical analysis: All data are reported as mean \pm SD.

Data were compared using student T test (upaired), and P values less than 0.05 were considered statistically significant.

Results

Among one hundred fifty two patients with pulmonary complications of sulfur mustard gas inhalation, thirty four patients with bronchiectasis were diagnosed and others were mostly asthma, chronic bronchitis and rarely large airway stenosis and interstitial fibrosis.

All of the patients were male. Duration of lung injury after gas exposure was between 15 to 20 years. The mean age of patients with bronchiectasis was 40.3 ± 9.8 years old and mean age of patients with asthma and chronic bronchitis was 43.6 ± 10.5 . There was no significant difference between two groups in the age values. Table 1 shows symptoms and signs of patients with bronchiectasis.

Table 1: Symptoms and signs of patients with bronchiectasis

Findings	Percent
Cough	100%
Purulent sputum	78%
Hemoptysis	73%
Crackle	65%
Wheezing	86%
Clubbing	28%

Considering the site of bronchiectasis, 23 cases (67.6%) were identified as bilateral and 11 cases (33.4%) were unilateral respectively. The most common sites were right lower lobe, left lower lobe, and right middle lobe, lingula and left upper lobe in order (Table 2).

Table 2: Frequency of sites of bronchiectasis

Site	Percent
RLL	61.7%
LLL	53%
RML	35.2%
Lingual	29.5%
LUL	11.7%

According to spirometric results, the most common abnormality was obstructive 58%, restrictive 17% and mixed pattern 25%. The mean values for FEV₁, FVC and FEV₁% were 58.03% ± 12.5%, 63.5 ± 14.7% and 60.57% ± 11.2%.

The mean values for FEV₁, FVC and FEV₁% in patients with asthma and chronic bronchitis were 54.1 ± 15.6, 61.6% ± 13.94% and 57.7 ± 12.3% respectively. There was no significant difference between two groups about spirometric values Table 3, (Fig 1).



Fig 1: Computed tomographic scans showing Bronchiectatic lesions in the both Lungs

Table 3: The mean age and spirometric values in two groups

Parameters	Bronchiectasis	Asthma and chronic bronchitis	P Value
Age (years)	40.3±9.8	43.6±10.5	NS
FEV ₁	58.03±12.5%	54.1±15.6%	NS
FVC	63.5±14.7%	61.6±13.94	NS
FEV ₁ %	60.57±11.2%	57.7±12.3	NS

Discussion

Sulfur mustard is one of a class of chemical warfare agents known as vesicants because of their ability to form vesicle or blister on exposure to skin (6). Probably the largest use of sulfur mustard was by Iraq been in the Iran-Iraq conflict (7). Sulfur mustard is an alkylating agent which after passing through the cellular membrane it rapidly cyclises and the cyclic compound

reacts with enzyme proteins and DNA. This leads to cellular damage, inflammation and ultimately cellular death (2,8). Pulmonary injury is the principle cause of mortality in the first few days to weeks after exposure with sufficiently high concentration of sulfur mustard (9). Damage to the respiratory tract induces acute edema, inflammation, and destruction of airway epithelium.

Severe damage includes destruction of the epithelium with subsequent formation of pseudomembrane which may slough and obstruct the airway resulting in death (3,6).

In some cases damage extends into the deeper alveolar region resulting in generalized edema of the lung (10).

Pulmonary injury following gas inhalation occurs in two phases. The initial cellular and exudative phase is characterized by an influx of neutrophils, elaboration of oxygen free radicals and production of inflammatory mediators. Repair and proliferative phase is characterized by cellular hyperplasia and fibrosis (11).

In faction of the respiratory tract resulting in bronchopneumonia is a common complication of respiratory tract injury from inhaled sulfur mustard (9). Immunosuppression from systemic absorption of sulfur mustard plays a major role in the pathogenesis of these infections and ultimately results in bronchiectasis (4,6).

Asthma and chronic bronchitis are the most common late complications of sulfur mustard inhalation in the respiratory system, as was seen in our patients (3-5).

Incidence of bronchiectasis as a late complication of sulfur mustard gas exposure was 22% in this study. Emad et al also demonstrated bronchiectasis as a complication of sulfur mustard, 10 years after exposure, in 8.6% of cases (4).

Bronchiectasis has been reported in patients with ammonia burns and other toxic inhalation. Bronchiectasis that develops after the inhalation of various fumes or gases is likely related to the airway damage and recurrent pulmonary infections (12). Most patients with bronchiectasis demonstrate some degree of airflow obstruction. Mild restriction may also present (13,14).

In this study obstructive pattern was the most common abnormality. Lower lobes were most frequently involved in patients with bronchiectasis, presumably because of lack of gravitational drainage.

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خلاصه

برونشکتازی در اثر گاز خردل ۱۵-۲۰ سال بعد از تماس، مروری بر ۳۴ بیمار

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مقدمه: گاز خردل به عنوان عامل شیمیایی به طور وسیعی بر علیه رزمندگان ایرانی استفاده شد. شایعترین عارضه این گاز بر روی سیستم تنفسی، بیماری مزمن انسدادی ریه است. هدف این مطالعه بررسی برونشکتازی به عنوان عارضه تاخیری آسیب گاز شیمیایی است.

روش کار: ۱۵۲ بیمار که در تماس با گازهای شیمیایی جنگی بودند انتخاب شدند. شرح حال، معاینه فیزیکی رادیوگرافی قفسه سینه، سی تی اسکن ریه و اسپیرومتری انجام شد.

یافته ها: از میان ۱۵۲ بیمار با عوارض ریوی گازهای شیمیایی ۳۴ بیمار برونشکتازی تشخیص داده شدند. سایر موارد عمدتاً آسم و بیماری مزمن انسدادی و ندرتاً تنگی مجاری بزرگ هوایی و فیروز نسج بینابینی ریه بود. ضایعات برونشکتازی در ۶۷/۶٪ موارد دوطرفه، ۳۳/۴٪ موارد یکطرفه بود. شایعترین محل های برونشکتازی به ترتیب لوب تحتانی راست، لوب تحتانی چپ، لوب میانی راست، لینگولا و لوب فوقانی چپ بود. اختلال اسپیرومتری در همه بیماران وجود داشت و شایعترین یافته طرح انسدادی (۵۸٪) بود.

اختلاف معنی دار بین اختلالات اسپیرومتری و سن در بیماران برونشکتازی با سایر بیماران مثل آسم و بیماری مزمن انسدادی وجود نداشت.

نتیجه: برونشکتازی در بیماران با آسیب گازهای شیمیایی جنگی و مشکلات ریوی، بایستی مد نظر قرار گیرد.

واژه های کلیدی: گاز خردل، برونشکتازی، آسیب ناشی از استنشاق