CLINICAL ANALYSIS OF 22 CASES OF TOXIC PULMONARY EDEMA

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The pulmonary edema, caused by intoxication of irritant gases, is one of indications of severe intoxications. A violent or mild attack is depended on sorts and the concentration of the chemicals in the air. Being treated promptly, the courses would be commonly short and prognoses would be favourable. Three hundred and thirty-four cases of acute intoxication of irritant gases were treated in our institution in 1970–1987. Of these cases, 143 were the irritant reactions; 150 mild, 16 middle and 25 severe intoxication. There were 22 cases of pulmonary edema in the last group, accounting for 6.6% in all cases, 88% in the severe cases. They were 10 cases of nitrogen dioxide, 6 of chlorine, 2 of hydrogen sulfate, 1 of ammonia, 2 of dimethyl sulfate, 1 of phosgene intoxication. Twenty-one patients were recovered except a case of phosgene intoxication that died of ARDS. All patients were poisoned by breathing in high concentrations of irritant gases in a short time due to accidents. In two special cases, continuous localized rales could be found though the shadows on chest X-ray had been absorbed. The severity degrees, incubation periods, indications, X-ray showings and courses of pulmonary edema varied with the differences of sorts of poison, visiting times and treatment. Now we analyze these clinical data of 22 cases of toxic pulmonary edema by some poisons.

Cause of Poisoning

The cause of poisoning were breathing in high concentration of irritant gases in a short time period in accidents. Two pupils breathed in heavy chlorine and was poisoned in resident area in a chlorine leakage.

Clinical Data

The incubation periods were short in chlorine, dimethyl sulfate, hydrogen sulfate, ammonia. It took 30 minutes in a case of chlorine intoxication. While it was longer in nitrogen dioxide and phosgene intoxication, e.g., it took 24 hours in a case of nitrogen dioxide and 72 hours in a case of phosgene intoxication. The incubation periods of the rest 19 cases varied from 1 to 20 hours with a average of 4.3 hours. Most of the cases were between 1–7 hours (Table I).

The onset time and severity of symptoms and signs of pulmonary edema varied with different particularities (kinds) of irritant gases. For example, in pulmonary edema caused by water soluble poisonous gases, the upper respiratory tract symptoms were mild and the clinical expressions were generally the same, i.e., cough, suppressing in chest, breathlessness, white or pink sputum, hemoptysis, cyanosis, dyspnea, rales on chest (Table II).

In 10 cases of toxic pulmonary edema by nitrogen dioxide. Pulmonary signs disappeared earlier than shadows on chest X-rays. It took 13.7 days in average for the clearing of rales and 27.8 days for the shadows of pulmonary edema on chest X-rays to clear. In one special case we got reverse finding (Table III).

Treatment

After proper treatments, 21 cases were cured without any pulmonary sequela except one death with phosgene intoxication, the incubation period of which was 72 hours. In addition to symptomatic treatment, control of infection and pulmonary edema, the courses, to a great extent, were depended on whether administration of corticosteroid was given promptly or not. A short course was got when corticosteroid was given in time, otherwise, long courses were got with delayed or without such treatment (corticosteroid).

There were 3 cases in which the courses were more than 30 days and in which 2 cases were beyond 100 days without the administration of corticosteroid. It was established that pulmonary edema occurred in these 3 cases. The causes of delayed course were late visiting and no corticosteroid administration.

DISCUSSION

1. The clinical data of these 22 cases showed that incubation period of toxic pulmonary edema by irritant gases were related with the kinds, properties and concentration of poisons, e.g. the incubation periods of water-insoluble nitrogen dioxide were 5–11 hours mostly, those of water-soluble chlorine, were between 30 minutes to 1 hour. The incubation period, we should pay attention to this.

2. In 22 cases of toxic pulmonary edema, rale disappeared earlier than shadow on chest X-ray.

   On occasions when roentgenoscopy is not available, disappearance of rales should not be regarded as the criterion for the healing of pulmonary edema. In special cases continuous localized rales could be found though the shadows on chest X-ray had been absorbed. This may be due to the accumulation of secretions in the narrowed and deformed bronchioles damaged by poisons.

3. The course of pulmonary edema by irritant gases are closely related with administration of corticosteroid besides visiting in time, symptomatic treatment, prevention and control of infection. In cases with prompt

Table I
Incubation Periods of Various Poison Intoxications

Kinds	Cases	Incubation period (hours) 0.5	1	1.5	2	3	4	5	6	7	8	9	10	11	20	24	72
Chlorine	6	1	3		2												
Hydrogen Sulfate	2				2												
Ammonia	1					1											
Dimethyl Sulfate	2			1		1											
Nitrogen Dioxide	10							3		1	1	1		2	1	1	
Phosgene	1																1

Table II
Cases of Toxic Pulmonary Edema by Irritant Gases

Symptoms & Signs	Number of Case
Photophobia	1
Lacrimation	7
Ophthal Malgia	1
Coma	3
Headache	2
Dizziness	9
Nausea	8
Vomiting	4
Cough	18
Suppressing on Chest	16
Breathlessness	20
Chest Pain	3
Fever	8
Conjunctiva Congestion	8
Pharyngeal Congestion	6
Cyanosis	17
Dyspnea	17
Hemoptysis	4
Foamy sputum	11
Dry and Crepitant Rale	22

administration of corticosteroid after poisoning, the time of shadow absorption on chest X-ray were 7.4 days in average, while they were 98 days in cases without administration of corticosteroid and were 30 days in cases with delayed administration. There were 3 cases that their courses were more than 30 days and there were 2 cases their courses were beyond 90 days. These cases were believed that pulmonary edema occurred in initial poisoning.

The chronicity of these cases might be: (1) The chronicity of pulmonary edema, especially interstitial pulmonary edema state due to improper treatment; (2) The rebound phenomenon because the damaged epthelial cells had not completely recovered, even the minor infection would ignite recurrence of the edema state; (3) There might be obstructive bronchiolar alveolitis. There were reports that irreversible bronchiolar fibrosis might occur in the very rare untreated cases. What-

Table III

Comparison of Time for Rale and Chext X-ray Shadows Disappearance

Case	the Time of Rales (days) Clearing	the Time of Chest X-ray Shadow Disappearance (days)
1	5	8
2	6	9
3	7	7
4	3	6
5	10	10
6	7	4
7	6	8
8	15	95
9	19	30
10	19	101
Average	13.7	27.8

Table IV

In Influence of Administration of Corticosteroid on the Courses
(Disappearance of Shadow on Chest X-ray as the Criterion)

Groups	Number of Cases	Courses (days)
Prompt Steroid	7	7.4 (4-10)
Delayed Steroid	1	30
No Steroid	2	98 (95-101)

ever the causes, it can be completely cured without any symptoms left if corticosteroid is administered early.

In summary, the authors hold that in irritant gas intoxication, prompt treatment should be given and in the severe cases, especially if the symptoms of pulmonary edema appear, early and adequate administration of corticosteroid for a short course should be given.

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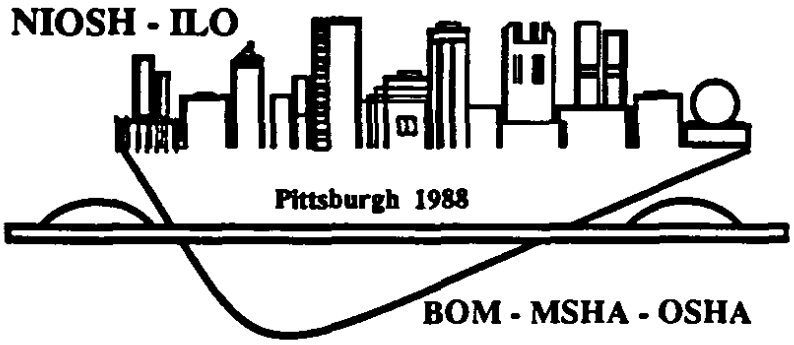

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