Epidemiological analysis of single center of acute poisoning cases based on poisoning treatment platform

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Abstract
To studied epidemiological characteristics of 493 cases of acute poisoning in Nantong city, Jiangsu province. Based on the analysis platform of poisoning treatment, adopted single center and prospective investigation method, analyzed data of acute poisoning patients from May 2015 to December 2018 in the second affiliated hospital of Nantong University.

Among 493 patients with acute poisoning, men 227 (46.04%), women 266 (53.96%). Age ranged from 12 to 89 years old, average age 41.6 years. In the occupational distribution, farmers were 30.02%; 351 cases (71.20%) visited the hospital within 6 hours after exposure. Oral exposure poisoning 415 cases (84.18%). Pesticide poisoning accounted for 45.45% of deaths.

Using the poisoning treatment platform to analyze the clinical characteristic had accurately and reliably in Nantong. The fatality rate of pesticide poisoning in cases of acute poisoning is high. Management of highly toxic pesticides should be continued and effective health education on pesticide use should be carried out.

Abbreviation: ED = Emergency department.

Keywords: acute poisoning, epidemiology, poisoning treatment platform, prospective

1. Introduction
Acute poisoning accounted for 5.6% of the patients in Emergency department (ED), and the trend of increasing gradually. According to National Health Commission of the People’s Republic of China, poisoning and injury have become the top 5 causes of death in China, accounting for 10.7% of the total mortality rate.[1,2] Acute poisoning was also one of the most common critical cases in emergency, with the development of social economy, the progress of industry, the change of human life style. The spectrum, population, treatment of acute poisoning have changed obviously.[3,4] Based on the poisoning treatment platform, this study adopted the prospective research method, then investigate and analyzed the epidemiological characteristics of poisoning in Nantong city, Jiangsu province.

2. Methods
2.1. General data
Clinical data onto acute poisoning patients in the ED of the second affiliated hospital of Nantong university from May 2015 to December 2018 were selected, and excluded poisoning cases of children under 12 years old.

2.2. Ethics and informed consent
This study was approved by the Ethics Committee of The Second Affiliated Hospital of Nantong University (IRB number: 2015ky013).

2.3. Statistical analysis
Adopt prospective investigation method, application “hospital acute poisoning case information management system” (Sue ICP for 16042896), based on a Chinese slow disease network platform, design the questionnaire of acute poisoning, including sex, age, occupation, vital signs, types of poison, poison contact time, cause of poisoning, poisoning and dosage, and accept the gastric lavage, antidote, glucocorticoid treatment, after treatment outcome, etc. To describe the continuous and qualitative variables, mean standard deviation and frequency (%) were reported.
average age 41.6 years. Thirty to 39 years group most poisoning cases (18.05%). (Table 1).

3.2. Occupational distribution
Among the 493 patients with acute poisoning, farmers were 30.02%, followed by individual industrial and commercial was 15.01% (Table 2).

3.3. Visit time after exposure to poisoning
Three hundred fifty one cases (71.20%) visited the hospital within 6 hours after exposure, 89 cases (18.05%) visited the hospital within 6 to 24 hours after exposure, 53 cases (10.75%) visited the hospital longer than 24 hours after exposure.

3.4. Poisoning pathways
Among the 493 patients with acute poisoning, oral exposure poisoning 415 cases (84.18%), respiratory exposure 68 cases (13.79%) (Table 3).

3.5. Poison species
Among the 493 patients with acute poisoning, pesticide poisoning 178 cases (36.11%), drug poisoning 158 cases (32.05%) (Table 4).

3.6. Food-borne poisons classification
Among the 35 patients with food-borne poisoning, alcohol poisoning 21 cases (60.0%), animal and plant poisoning 8 cases (22.86%) (Table 5).

3.7. Drug poisons classification
Among the 158 cases of drug poisoning, sedative-hypnotic drugs 93 cases (58.86%), antipsychotic drugs 16 cases (10.13%) (Table 6).

3.8. Pesticide poisons classification
Among the 178 cases of pesticide poisoning, organophosphorus 88 cases (49.44%), pyrethroids 26 cases (14.61%) (Table 7).

### Table 1
Age distribution of acute poisoning cases.

| Age, yr | n   | (%)  |
|---------|-----|------|
| 12–19  | 25  | 5.07 |
| 20–29  | 87  | 17.65|
| 30–39  | 89  | 18.05|
| 40–49  | 81  | 16.43|
| 50–59  | 87  | 17.65|
| 60–69  | 54  | 10.95|
| 70–79  | 41  | 8.32 |
| 80–89  | 29  | 5.88 |
| Total  | 493 | 100  |

### Table 2
Occupational distribution of acute poisoning.

| Occupational                   | n   | (%)  |
|--------------------------------|-----|------|
| Farmers                       | 148 | 30.02|
| Individual industrial and commercial | 74  | 15.01|
| Business services              | 62  | 12.58|
| Chemical enterprises workers   | 40  | 8.11 |
| Building materials processing workers | 35  | 7.10 |
| Retired personnel              | 32  | 6.49 |
| Administrative personnel       | 24  | 4.87 |
| Students                       | 18  | 3.65 |
| Driver                         | 14  | 2.84 |
| Construction worker            | 10  | 2.03 |
| Medical                        | 6   | 1.22 |
| Fishermen                      | 6   | 1.22 |
| Teacher                        | 4   | 0.81 |
| Homemaker                      | 4   | 0.81 |
| Agricultural technology personnel | 3   | 0.61 |
| Other                          | 12  | 2.43 |
| Total                          | 493 | 100  |

### Table 3
Distribution of poisoning pathways.

| Poisoning pathways    | n   | (%)  |
|-----------------------|-----|------|
| Respiratory exposure  | 68  | 13.79|
| Skin absorb           | 8   | 1.62 |
| Intravenous           | 2   | 0.41 |
| Oral exposure         | 415 | 84.18|
| Total                 | 493 | 100  |

### Table 4
Species distribution of acute poisons.

| Poison species         | n   | (%)  |
|------------------------|-----|------|
| Pesticide              | 178 | 36.11|
| Drug                   | 158 | 32.05|
| Food-borne             | 35  | 7.10 |
| Chemical poisons       | 60  | 12.02|
| Other classes          | 42  | 8.52 |
| Unknown reasons        | 20  | 4.06 |
| Total                  | 493 | 100  |

### Table 5
Classification of food-borne poisons.

| Classification          | n   | (%)  |
|-------------------------|-----|------|
| Alcohol poisoning       | 21  | 60.00|
| Nitrite poisoning       | 2   | 5.71 |
| Animal and plant poisoning | 8  | 22.86|
| Other                   | 4   | 11.43|
| Total                   | 35  | 100  |

### Table 6
Classification of drug poisons.

| Drug                   | n   | (%)  |
|------------------------|-----|------|
| Sedative hypnosis      | 93  | 58.86|
| Antipsychotic          | 16  | 10.13|
| Cardiovascular drugs   | 10  | 6.33 |
| Nonsteroidal anti-inflammatory drugs | 6  | 3.80 |
| Digestive system drug  | 2   | 1.27 |
| Traditional Chinese medicine | 1  | 0.63 |
| Other                  | 25  | 15.82|
| Did not fill           | 5   | 3.16 |
| Total                  | 158 | 100  |
3.9. Chemical poisons classification
Among the 60 cases of chemical toxicosis, nitrite poisoning 6 cases (10%), organic solvents poisoning 4 cases (6.67%) (Table 8).

3.10. Gastric lavage analysis of oral poisoning
Among the 415 cases of oral exposure poisoning, gastric lavage 155 cases (37.35%), time to start gastric lavage <30 minutes 99 cases (63.87%), gastric lavage juice volume 10 to 20L 122 cases (78.71%) (Table 9).

3.11. Treatment of acute poisoning
Among the key rescue treatments for patients with acute poisoning, 105 cases (21.29%) of specific antidote, including atropine, naloxone, melanin, flumazenil, vitamin K1, cholinesterase reactivator, etc. Fifty seven patients (11.56%), including methylprednisolone, dexamethasone, and hydrocortisone. Thirty eight cases (7.7%) of blood purification treatment, including hemoperfusion, hemodialysis, etc. Thirty seven cases (7.51%) of hyperbaric oxygen treatment. All patients with poisoning received symptomatic supportive treatment (Table 10).

3.12. Outcomes and follow-up
We followed up to the end of December 2019 after all patients were actively treated. Three hundred ninety three patients (79.72%) were cured of acute poisoning, including 279 patients (56.59%) hospitalized, 114 patients (23.12%) in ED, and 89 patients (18.05) with residual organ dysfunction, including nervous system and respiratory system. There were 11 deaths (2.23%), including 5 cases of pesticide poisoning (3 cases of organophosphorus, 2 cases of Paraquat), 2 cases of sedative sleep aids, 2 cases of alcoholism, 1 case of carbon monoxide poisoning, and 1 case of unknown poison (Table 11).

4. Discuss
This research hospital is a designated acute poisoning treatment center in Nantong city. The included subjects are from Nantong city and surrounding counties, which can reflect the epidemiological characteristics of poisoning in Nantong city. Based on “hospital acute poisoning case information management system,” the data are true and reliable.

Among the 493 cases of acute poisoning, women poisoning were 266 (53.96%), then higher than that men poisoning. Similar to reports by Qiao et al,[5] which may be related to women’s occupation, education level, economic income, psychological factors.[6] From the analysis of poisoning age, most poisoning cases are concentrated in adults, 30 to 39 years age group has the most poisoning cases, 20 to 29 years old and 40 to 49 years old is similar number. More than 80 years old account for 5.88%, the higher than those reported by Wang et al[9] and Li et al,[4] etc, which are considered to be related to the aging process of Chinese society, Nantong is a famous hometown of longevity.

Among the causes of poisoning exposure, suicide is the most common, oral poisoning is the most common poisoning pathways, the most common poison is pesticides. This study found that organophosphorus pesticides accounted for 49.44%

| Table 7 |
| Classification of pesticide poisons. |
| Pesticide | n | (%) |
| Organo phosphorus | 88 | 49.44 |
| Pyrethroids | 26 | 14.61 |
| Herbicide | 25 | 14.04 |
| Rodenticide | 19 | 10.67 |
| Chlorimi form | 3 | 1.69 |
| Abamec tin | 3 | 1.69 |
| Carbamate | 1 | 0.56 |
| Organochlorine | 1 | 0.56 |
| Other | 7 | 3.93 |
| Did not fill | 5 | 2.81 |
| Total | 178 | 100 |

| Table 8 |
| Classification of chemical poisons. |
| Chemical poisons | n | (%) |
| Nitrite poisoning | 6 | 10.00 |
| Organic solvent poisoning | 4 | 6.67 |
| Acid alkali | 2 | 3.33 |
| Cyanide poisoning | 1 | 1.67 |
| Other chemical poisons | 47 | 78.33 |
| Total | 60 | 100 |

| Table 9 |
| Gastric lavage analysis of oral poisoning. |
| Gastric lavage therapy | n | (%) |
| Time to start gastric lavage <30 min | 99 | 63.87 |
| 30–60 min | 49 | 31.61 |
| 60–120 min | 7 | 4.52 |
| Gastric lavage juice volume <10L | 5 | 3.23 |
| 10–20L | 122 | 78.71 |
| 20–50L | 27 | 17.42 |
| >50L | 1 | 0.65 |
| Total | 415 | 100 |

| Table 10 |
| Main treatment measures for patients with acute poisoning. |
| Treatment | n | (%) |
| Special antidote | 105 | 21.29 |
| Glucocorticoid | 57 | 11.56 |
| Blood purification | 78 | 15.82 |
| High pressure | 37 | 7.51 |
| Total | 277 | 56.18 |

| Table 11 |
| Outcomes of patients with acute poisoning. |
| Outcome | n | (%) |
| Heal | 393 | 79.72 |
| Organ dysfunction | 89 | 18.05 |
| Death | 11 | 2.23 |
| Total | 493 | 100 |
of all pesticide poisons, followed by pyrethroids, herbicides, and rodenticides.

At present, there is still a lack of evidence-based medical evidence about gastric lavage treatment, and there is some controversy. There are some unreasonable phenomena in clinical gastric lavage operation, such as excessive gastric lavage, repeated gastric lavage, and inadequate respiratory protection during gastric lavage. However, at the present stage, gastric lavage is still the most common method for emergency oral poisoning to remove toxic substances. In this study, 37.35% of patients with oral toxic exposure received gastric lavage. The application of blood purification in patients with acute poisoning is significant, effectively improving the clinical treatment of patients, promoting faster recovery of patients, significantly reducing mortality, and has higher clinical application value.

In this study, 79.72% of patients were cured and 2.23% of patients died. Five of the deaths were pesticide poisoning, accounting for 45.45% of the deaths. At present, respiratory failure and myocardial damage caused by Organophosphorus are the main causes of death. At present, the toxicological mechanism of Paraquat is unknown, the lethal dose is low, the mortality rate is extremely high, and there is no effective antidote. In recent years, the application of new pesticides, especially compound pesticides, has lacked detailed instructions and specific ingredients could not be clarified, which has brought challenges to diagnosis and treatment. Pesticide poisoning is still a major problem in Jiangsu province, and the management of highly toxic pesticides should be continued carry out effective health education on pesticide use. Strengthen their awareness of pesticide regulation.

As a single center study, this study has some limitations. There are some differences in the clinical treatment of acute poisoning in economically developed and economically underdeveloped regions in China. In the future, we will carry out multi-center research on the basis of this study, then it will help promote the poisoning treatment in Nantong.

Author contributions

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