



Clinical Epidemiological Analysis of 573 Rhabdomyolysis Inpatients

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Abstract: *Background:* In the past fifteen years, more and more rhabdomyolysis patients were diagnosed. The cause of this disease was different. As a doctor, he/she should find out what happened to rhabdomyolysis patients. *Objective:* To analyze the clinical epidemiological data of inpatients with rhabdomyolysis, to grasp the occurrence pattern of rhabdomyolysis, and furnish the basis for formulating targeted preventive measures. *Methods:* The clinical data were collected from inpatients with rhabdomyolysis in Taizhou Hospital of Zhejiang Province in recent 15 years. The above indicators were statistically processed using health statistics and the trend of changes in the disease over the past 15 years was evaluated. *Results:* There were 573 inpatients with rhabdomyolysis with a male-to-female ratio of 2.27:1, an age of onset of 1 to 91 years and the median age of 47 years. There were 105 patients with acute renal insufficiency, 158 with abnormal liver function and 35 with hyperkalemia. Common causes comprise infection (223 patients), trauma (171 patients), poisoning (82 patients), hypokalemia (59 patients), etc. The number of inpatient cases was significantly higher between 2011 and 2015 compared to the period between 2006 and 2010. The mortality rate in the underage group was 0, which was lower than other age groups. *Conclusion:* Rhabdomyolysis is more common in male than in female. Common causes encompass infection, trauma and so on. Prognosis is correlated with age, gender, etiology, timeliness of diagnosis and treatment. We should emphasize early diagnosis and early treatment, bearing the idea of "prevention first" in mind.

Keywords: Rhabdomyolysis, Clinical Epidemiology, Analysis

1. Introduction

Rhabdomyolysis is caused by the breakdown and necrosis of muscle tissue and the release of intracellular content into the blood stream, which can lead to muscle weakness, myalgia, and occasionally brownish or dark urine. There are multiple and diverse causes of rhabdomyolysis. Rhabdomyolysis is becoming more and more common not only in adults, but also in adolescents. It is necessary to carry out clinical epidemiological analysis to find out the characteristic of its distribution, as the basis for strengthening public health education in the prevention and treatment of the disease.

2. Information and Methodology

2.1. Clinical Data

All cases were inpatients of Taizhou Hospital, Zhejiang

Province, from June 2005 to June 2020. There were 573 cases of rhabdomyolysis, consisting of 175 females and 398 males, aged 1 to 91 years, with a mean age of (46.17 ± 18.99) years and a median age of 47 years. Grouped by age, i.e. over 66 years old, 45 to 65 years old, 18 to 44 years old, 0 to 17 years old. Died and not cured patients were classified as poor prognosis group; cured or improved patients were classified as good prognosis group.

2.2. Methods

The data were collected, including sex, age, clinical diagnosis, length of stay, date of discharge, outcome of discharge, etc., and analyzed by SPSS26.0 software. The counting data were described by frequency (n) and percentage (%); the χ^2 test was applied for comparison between groups; the measurement data were t test; the test standard was $\alpha=0.05$, and if $P<0.05$, the difference was statistically significant.

3. Results

3.1. Population Characteristic

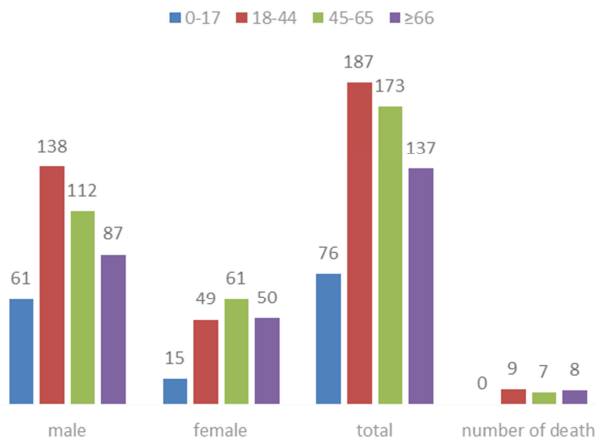


Figure 1. Distribution of cases and deaths by age group There were 398 males among the 573 patients. There were 76 cases in the underage group with no deaths. The youth group had 187 cases, the largest number, with 9 deaths. There were 15 deaths in the middle-aged and elderly group. Compared to the youth group, there was no difference in mortality rate. Subgroup analysis indicated that the mortality was higher in the elderly group than in the middle-aged group.

There were 398 males among the 573 patients. The underage group had 76 cases and no deaths. The youth group

had the largest number of 187 cases, with 9 deaths and a mortality rate of 4.81%. A total of 15 cases died in the middle and old age group, with a mortality rate of 4.84%. There was no difference in mortality rate compared with the youth group, $P > 0.05$, and the difference was not statistically significant. Subgroup analysis indicated that the mortality rate of 8 cases in the elderly group was 5.84%, which was higher than that of 4.05% in the middle-aged group, with a statistically significant difference of $P < 0.05$. The distribution of cases and deaths in each age group is shown in Figure 1.

3.2. Incidence of Acute Liver and Kidney Dysfunction and Hyperkalemia in Rhabdomyolysis

There were 158 cases of abnormal liver function (2 cases of acute liver failure), with the incidence rate of 27.57%. The incidence of acute renal dysfunction was 18.32% with 105 cases. The incidence of hyperkalemia was 6.10% with 35 cases.

3.3. Distribution and Incidence of Trauma

Of all the patients with rhabdomyolysis (both primary and secondary), 171 had injuries, 57 had fractures, 55 had contusions and soft tissue injuries, 18 had snake bites, 16 had burns, 7 had crush injuries, 7 had bee stings, 5 had electric shocks, 4 had liver or spleen ruptures, and 2 had other injuries. The composition of trauma cases is detailed in Table 1.

Table 1. Trauma Cases and Composition Of all the patients with rhabdomyolysis (both primary and secondary), 171 had injuries, 57 had fractures, 55 had contusions and soft tissue injuries, 18 had snake bites, 16 had burns, 7 had crush injuries, 7 had bee stings, 5 had electric shocks, 4 had liver or spleen ruptures and 2 had other injuries.

Etiology	Number of cases	Composition ratio (%)
fracture	57	33.33
contusion or soft tissue damage	55	32.16
snake bite	18	10.53
burns	16	9.36
crush injury	7	4.09
bee sting	7	4.09
electric injuries	5	2.92
liver or spleen rupture	4	2.34
other injuries	2	1.17
Total	171	100

3.4. Distribution and Incidence of Infection

There were 223 infections in all cases, comprising 120 pulmonary infections (26 aspiration pneumonia and 1 ventilator-associated pneumonia), 13 acute upper respiratory tract infections, 8 acute tonsillitis and 18 urinary tract

infections. There were 28 cases of sepsis and 5 cases of septic shock. Rare cases consist of 8 toxic myocarditis, 4 gastroenteritis or enteritis, 3 infectious fever, 2 abdominal infection. The infection diseases and composition are shown in Table 2.

Table 2. Infection diseases and composition There were 223 cases of infection in all cases, including 120 pulmonary infection, which were most common. There were 28 cases of sepsis. There were Rare cases comprising 8 cases of toxic myocarditis, 4 cases of gastroenteritis or enteritis, 3 cases of infectious fever, 2 cases of abdominal infection.

Kinds of infection	Number	Composition ratio (%)
pulmonary infection	120	53.81
sepsis	28	12.56
acute upper respiratory tract infection	18	8.07
urethral infection	13	5.83

Kinds of infection	Number	Composition ratio (%)
toxic myocarditis	8	3.59
septic shock	5	2.24
gastritis or enteritis and other infections	9	4.03
Total	223	100

3.5. Causes and Incidence of Poisoning

There were 82 cases related to poisoning, 28 cases of carbon monoxide poisoning, 15 cases of acute and chronic alcoholism, 22 cases of pesticide poisoning (10 cases of organophosphorus pesticide poisoning). There were 15 cases

of drug poisoning, containing 9 cases of antipsychotic and antidepressant poisoning, 4 cases of clozapine. Other rare causes were rodenticide poisoning, meth poisoning, food poisoning and so on. Poisoning diseases and composition are shown in Table 3.

Table 3. Poisoning diseases and composition There were 82 cases related to poisoning, including 28 cases of carbon monoxide poisoning, 15 cases of acute and chronic alcoholism, There were 15 cases of drug poisoning, including 9 cases of anti-psychotic or antidepressant, 10 cases of anti-psychotic or antidepressant.

Kinds of poisoning	Number	Composition ratio (%)
carbon monoxide poisoning	28	34.15
acute and chronic alcoholism	15	18.30
organophosphorus pesticide poisoning	10	12.20
pesticide poisoning	11	13.4
anti-psychotic or antidepressant poisoning	9	10.98
other drug poisoning	6	7.31
poisoning of rodenticide	1	1.22
methamphetamine poisoning	1	1.22
food poisoning	1	1.22
total	82	100

3.6. Other Causes and Composition

There were 33 cases of exercise-induced rhabdomyolysis, 32 cases of epilepsy, 25 cases of heat stroke. There were 9 cases of thyroid dysfunction, 6 of which were hypothyroidism. There were 67 cases with diabetes, 4 of which were ketoacidosis. There were 7 cases with hypertonic coma or hypertonic syndrome. There were 165 cases of hypertension, 74 of which were essential hypertension, which had no necessary causal relationship with rhabdomyolysis.

3.7. Multiple (Systemic) Organ Damage and Its Incidence

Multi-system/organ dysfunction/failure occurred in 39 cases, comprising 23 cases of multiorgan failure, 16 cases of multisystem failure. A total of 11 cases died, with the mortality rate of 28.21%. There were 7 deaths in cases of multiple system failure. There were 3 deaths in 12 cases of non-infectious multiple organ failure and 1 death in 11 cases of infectious multiple organ failure. Subgroup analysis indicated that the mortality rate of multisystem failure was higher than the other 2 groups (non-infectious multiple organ failure, infectious multiple organ failure.), with a statistically significant difference of $P < 0.05$.

3.8. Electrolyte Disorder and Acid-Base Imbalance

There were 59 cases of hypokalemia, the most common type of electrolyte disturbance. There were 14 cases of hypocalcemia, 13 cases of hypernatremia and 11 cases of

hypothermia. There were 47 cases with metabolic acidosis, the most common type of acid-base imbalance. There were 2 cases of respiratory alkalosis, which is rare.

3.9. Pathogenesis (Occurrence Regularity), Hospital Day and Outcome

The pattern of morbidity, length of stay and outcome were reviewed for the past 15 years. There were 62 cases of rhabdomyolysis in the first 5 years, 258 cases in the second 5 years and 253 cases in the third 5 years. The overall mortality rate was 4.19%, involving 17 male patients and 7 female patients. The mortality rate was slightly higher in males than in females, $P < 0.05$. The difference was statistically significant. In the first quinquennium, the mortality rate was 16.13%. In the second quinquennium, there were 12 deaths and the mortality rate was 4.65%, a significant decrease from the previous period. In the third quinquennium, the mortality rate was 0.79%, and the mortality rate for the last three-year was 0, a significant decrease from three years earlier. Median length of stay was eight days. Eleven deaths occurred between days 1 and 3 of hospitalization, with a mortality rate of 16.18%. Nine deaths occurred between days 4 and 7 of hospitalization, with a mortality rate of 4.74%. Four cases died after day 7 of hospitalization, with the mortality rate of 1.27%, a significant decrease from the first 7 days in hospital, $P < 0.05$. Subgroup analysis indicated that the mortality rate was significantly higher in the first 3 hospital days than in the last 4 hospital days. Details are shown in Figure 2.

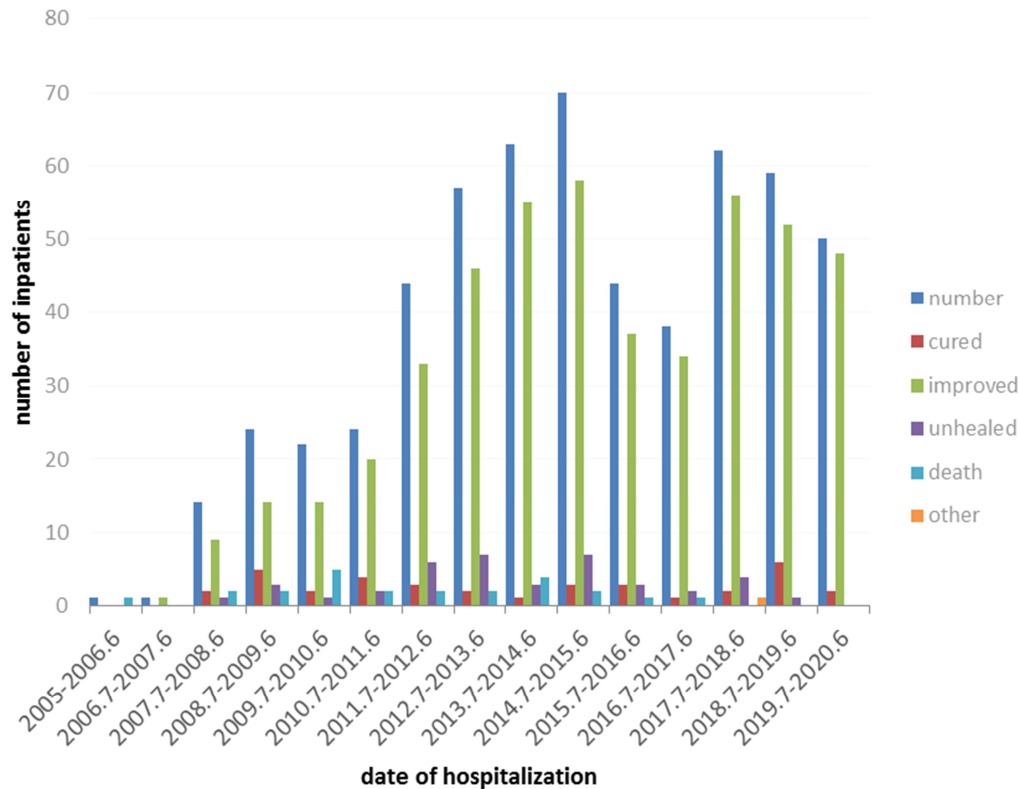


Figure 2. Number of hospitalization and outcome in recent 15 years There were 62 cases of rhabdomyolysis in the first 5 years, 258 cases in the second 5 years, and 253 cases in the third 5 years. In the second five-years period, there were 12 deaths. The mortality rate in the last three-year was 0. Eleven deaths occurred between 1 and 3 days of hospitalization. Nine deaths occurred between 4 and 7 days in hospital. Four deaths occurred after 8 days of hospitalization. This indicated that the mortality rate was higher in the first 7 days of hospitalization.

4. Discussion

Rhabdomyolysis is a kind of clinical syndrome because of severity muscle injury and releasing of myoglobin. Its symptom includes dark reddish urine, muscle weakness, myalgia and so on [1]. It sometimes causes acute renal failure, abnormal liver function and hyperkalemia [2, 3]. Rhabdomyolysis consists of the primary and the secondary. In the study, rhabdomyolysis all points to the secondary.

Rhabdomyolysis has developed into a common disease, which has a high incidence in adults, especially in the young and middle-aged. It's more common in male patients, correlated with male personality traits (aggressive), behavioral habits (adventurous), work environment (hard work) and so on.

This study indicates that the common causes of rhabdomyolysis in patients without underlying disease are trauma, poisoning, strenuous exercise, heatstroke, drowning and other accidents or suicides. Fracture is most common in trauma, carbon monoxide poisoning in poisoning, and organophosphorus pesticide poisoning in pesticide poisoning [4]. Exercise-induced rhabdomyolysis is more prevalent in young and middle-aged people. Heat stroke is frequent in summer and among hot workers. Hypothyroidism and epilepsy are the two primary causes of rhabdomyolysis. Acute and chronic alcoholism are more prevalent in the young and middle-aged [5]. Controlling seizures can control the development of rhabdomyolysis [6]. Infection can induce

rhabdomyolysis. Pulmonary infection with rhabdomyolysis is the highest number of high-risk factors. Common diseases such as diabetes, hypertension, coronary atherosclerosis, hyperlipemia, hyperthyroidism, mental disorders, sleep disorders and other complications, especially after overdose can lead to rhabdomyolysis [7]. Rhabdomyolysis occurs in diabetes with ketoacidosis, hypertonic coma or hypertonic syndrome, suggesting that rhabdomyolysis should be vigilant for severe diabetic complications [8]. Many medications, such as Lipid-lowering drugs, uric acid-lowering drugs, antipsychotic and antidepressants, can cause rhabdomyolysis. Drug poisoning is a common cause of rhabdomyolysis, which may be related to genetic factors [9-11].

This study indicates that the mortality rate is slightly higher in men with rhabdomyolysis than in women. The mortality rate was lowest in the juvenile group and highest in the elderly group, which is associated with the fact that most of the elderly have complications, weak repair ability and so on. Prognosis is correlated with etiology, infection, serious complications and multiple organ failure [12]. Death in some cases within a short period of time after hospitalization may be related to the rapid progress of the disease in the early stage of the critical patients and untimely interventions. In the past five years, the mortality rate has decreased remarkably, especially in the past three years, reflecting the enhancement of the hospital's comprehensive treatment ability and the overall improvement of medical level.

5. Conclusion

To sum up, the etiology of rhabdomyolysis is complex. Typical cases are easily diagnosed clinically, and muscle biopsy sometimes is necessary to assist in the diagnosis [13-15]. The disease is risky, prone to liver dysfunction, acute renal insufficiency, hyperkalemia and so on. It progresses rapidly in the early stage. Doctors should reinforce awareness of screening. Because early diagnosis and early intervention could improve prognosis, we should emphasize the concept of prevention. Minors ought to be actively prevented and treated for infection. Adults avoid trauma, poisoning, heatstroke and so on. The elderly avert drug poisoning, common complications and so on. All these can diminish the occurrence of rhabdomyolysis. If exercise rhabdomyolysis was vigilant, genetic quality should be taken into account for prevention. Exercise is supposed to be gradual, with attention to warming up and cooling down during strenuous exercise. Drinking more water or sports drinks before and after exercise to maintain a normal or even more urine volume. All these are conducive to prevent the occurrence of exercise rhabdomyolysis and reduce its complications. This study indicated that more prevention means less rhabdomyolysis, earlier intervention means less complications.

Authors Contribution Statement

Yang Zheng (Yang Z) conceived and designed the analysis. Tang Zhihong (Tang ZH) collected and contributed the analysis tools. Yang Z performed the analysis and wrote the paper. They both revised the paper.

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