Severe Cardiovascular Dysfunction and Pulmonary Edema in Children with Scorpion Envenomation

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ABSTRACT

Scorpion envenomation is a life-threatening emergency and a common public health problem in children, especially during summer time in all regions of Turkey. Severe scorpion envenoming is characterized by cardiocirculatory failure which may lead to pulmonary edema. We aimed to evaluate clinical, laboratory, treatment and outcome characteristics for children with scorpion envenomation who required treatment in intensive care unit. Cardiovascular toxic effects and acute pulmonary edema are the most important complications and mortality factors for scorpion envenomation. We studied five patients (4-7 years), three girls and two boys. Four of the children were stung on foot, one on head. Three of them had respiratory distress, four had tachycardia and hypotension and three had lethargy. Three had pulmonary edema on chest X-ray. Four had high troponin values. Four had important echocardiographic evidence of moderate to severe systolic dysfunction. Two had serious cardiomyopathy. Intensive inotropic treatments were given to children with serious cardiomyopathy. Prazosin, diuretics and oxygen treatment were given to children suffering pulmonary edema. The clinical course for all patients was satisfactory and laboratory, electrocardiographic and echocardiographic changes returned to normal. Severe scorpion envenomation is characterized by myocardial damage, cardiovascular disturbances, lung edema and dysfunction of the autonomic nervous system. We decided that to analyse scorpion envenomation, systemic findings must be observed in intensive care unit to watch for the development of serious cardiomyopathy and pulmonary edema. Investigations may bring out the severity of a patient's condition. A treatment plan should be determined according to the test results.

Keywords: Scorpion, envenomation, antivenom, prazosin, pulmonary edema

INTRODUCTION

Scorpion envenomation is an important public health problem in many tropical and subtropical countries (Goncalves et al. 2012). Scorpion stings are common in Turkey due to its geographic location, climate and socioeconomic characteristics. Scorpion envenomation cases are an important public health problem, especially in the summer time in all regions of the country. Scorpions that commonly threaten health in Turkey are Androctonus crassicauda, Leirurus quinquestriatus, Mesobuthus gibbosus and M. euepus, all of which belong to the Buthidae family (Ozkan et al. 2006). We believe our cases were stung by Androctonus crassicauda because they were seen in the emergency room during the hottest months, especially August.

Children with low weight are at greater risk for developing severe cardiac, respiratory and neurological complications. Symptoms vary and can change rapidly in a negative way. It is common for children to have pallor, tachycardia with
hypotension, costal retractions and throbbing of the nostrils. Severe scorpion envenomation is characterized by cardiocirculatory failure which may lead to pulmonary edema. Causing a life threatening acute medical emergency. Envenomation of children can cause multiple organ failure and death (Ozkan et al. 2006, Goncalves et al. 2012). Scorpion antivenom is the accepted treatment for scorpion envenomation. But, prazosin has increased in importance as a treatment of scorpion envenomation in recent years. Prazosin is a competitive postsynaptic-alpha-1 adreno-receptor antagonist. It decreases the preload, after load and blood pressure without increasing the heart rate (Bosnak et al. 2009). Because prazosin turns over both inotropic (hypertension) and hypokinetic (hypotension, pulmonary edema and tachycardia) issues induced by scorpion envenoming, prazosin therapy has been recommended for severe scorpion envenomation. In many cases, early administration of antivenom in addition to prazosin hastened the recovery and shortened the hospital stay. Administration of prazosin prevented development of pulmonary edema and led to rapid recovery (Bawaskar et al. 2000).

We aimed to evaluate clinical, laboratory, treatment, and outcome characteristics for children with scorpion envenomation who required treatment in the intensive care unit. Cardiovascular toxic effects and acute pulmonary edema are the most important complications and mortality factors for scorpion envenomation (Bahloul et al. 2004).

Cases

We studied five patients ranging in age from 4-7 years, three girls and two boys. Four of children were stung on the foot and one on the head. Upon arrival at the emergency department, antivenom, steroid and antihistaminic were given immediately. Antivenom mixed with 5 ml of 50 ml saline was intravenously administered for 30 minutes to all patients. They were referred to the intensive care unit because of lethargy, dyspnea and tachycardia. One of them arrived 270 minutes after sting envenomation to the hospital, two of them 180 minutes and two of them 120 minutes. Four children had local symptoms such as pain, coldness and paleness. Three children had respiratory distress that includes dyspnea and pulmonary edema on chest X-ray. Prazosin was given at a dose of 250 mg who had pulmonary edema. The same dose was repeated at intervals of 6 hours. Three had somnolence upon arrival at the hospital. Four children had sinus tachycardia and hypotension, and they all had sinus tachycardia and ST-T changes on ECG. Four had important echocardiographic evidence of moderate to severe systolic dysfunction and reduced ejection fraction (Figure 1, 2). Two
Figure 2. The sinus tachycardia (Heart Rate: 136 beat/min)

Table 1. Clinical, laboratory, treatment, and outcome characteristics

<table>
<thead>
<tr>
<th>Patients</th>
<th>Age (Years)</th>
<th>Arrival Time (min)</th>
<th>Heart Rate (min)</th>
<th>BloodPressure (mmHg)</th>
<th>Troponin (ng/ml)</th>
<th>Prazosin</th>
<th>Anti-venom</th>
<th>Inotropic</th>
<th>ICU-Days</th>
<th>Total-Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>270</td>
<td>180</td>
<td>90/50</td>
<td>11</td>
<td>yes</td>
<td>1</td>
<td>+</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>120</td>
<td>126</td>
<td>130/80</td>
<td>-</td>
<td>no</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>180</td>
<td>150</td>
<td>69/58</td>
<td>5.48</td>
<td>yes</td>
<td>2</td>
<td>+</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>120</td>
<td>181</td>
<td>65/47</td>
<td>10.42</td>
<td>yes</td>
<td>2</td>
<td>+</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>180</td>
<td>175</td>
<td>71/52</td>
<td>3.1</td>
<td>yes</td>
<td>1</td>
<td>+</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

of them had serious cardiomyopathy [Ejection fraction (EF): 30%] and were given a second dose of antivenom. Case 2# was hospitalized in the intensive care for her young age and tachycardia. But control echocardiography was normal, and she was discharged to general pediatric service when her tachycardia disappeared.

Laboratory one had acidosis (pH: 7.23, PaCO₂: 29, HCO₃⁻:15.6, base excess:-10.1). Four children had high troponin values [5-11 (normal range 0.02-0.06 ng/ml)]. Urine outputs were normal for all patients. Vital signs of patients are written in Table 1. Intensive inotropic treatments (dobutamine) were given to children with serious cardiomyopathy. Inotropic treatment was arranged as needed for each patient's blood pressure, starting at 5 mcg/kg/min and increasing to 20 mcg/kg/min if necessary. Dobutamine was combined with dopamine for resistant hypotension in two patients whose EFs were approximately 30%. Prazosin, diuretics and oxygen treatment were given to children who had pulmonary edema. The clinical course for all the patients was satisfactory, and the laboratory, electrocardiographic and echocardiographic changes returned to normal within 6 days (median: 2 days). All patients were followed in the intensive care unit.
DISCUSSION

Scorpion venom is an apocrine secretion composed of proteins with neurotoxic activity and peptides of low molecular weight which causes interaction in the channel voltage-dependent sodium, calcium, potassium and chlorine, resulting in increased cell excitability and neurotransmitter release. Severe scorpion envenomation characterized by myocardial damage, cardiovascular disturbances, lung edema and dysfunction of the autonomic nervous system (Bawaskar et al. 1992, Sofer et al. 1994, Abroug et al. 1999, Cupo et al. 2002). Administration of antivenom in cases of systemic circumstances prevents complications and decreases the risk of sequel or death. Bawaskar HS et al (Bawaskar et al. 1991) suggested that aggressive medical management directed at the organ system specifically affected by scorpion venom can be effective. Patients were kept under close surveillance in an intensive care unit. Massive life-threatening pulmonary edema was treated with a sodium nitroprusside drip. We immediately implemented antivenom to patients that had systemic findings in the emergency department. A second dose of antivenom was given to two patients in the intensive care unit who were having serious cardiomyopathy. We also gave intensive inotropic treatment to the children who had serious cardiomyopathy. Prazosin, diuretics and oxygen treatment were given to children who had pulmonary edema.

Severe scorpion envenomation is characterized by cardio circulatory failure which may lead to pulmonary edema. Involvement of the heart has been ascribed to the massive release of catecholamines and/or to a direct toxic effect of the venom on cardiac fibers, while pulmonary edema has been considered to be of cardiogenic or non-cardiogenic origin. Most of the published reports suggest that hypertension and myocarditis were frequently observed following scorpion stings, but Santhanakrishnan et al (Santhanakrishnan et al. 1986) demonstrated peripheral failure and hypotension are the complications observed initially. Myocarditis and other serious complications are observed only during follow-up. They showed that the complications and lethal effects of scorpion venom seen in their earlier study indicated that in children cardiovascular complications were seen more frequently than neurological or hematological complications. We observed laryngeal edema in three patients who had cardiovascular involvement too. In four of our patients, tachycardia and hypotension were seen. Especially two patients had a high heart rate (180 beat/min). We observed that our patients responded to effective and rapid treatment. All of our patients were discharged without any morbidity and mortality. However, two of them had serious cardiomyopathy (EF: 30%). These patients were treated with high-dose inotropic therapy, and systolic function improved within days. We emphasised that aggressive inotropic therapy was given for severe systolic dysfunction. If possible, echocardiography should be quickly performed on patients with tachycardia and hypotension. For patients with severe tachycardia at the time of admission, myocarditis should be considered. If echocardiography cannot be done immediately, cardiac enzymes and natriuretic peptide should be measured. High values of these tests should be a warning and existing hypotension is an alert to look for severe cardiomyopathy.

Bawaskar HS et al (Bawaskar et al. 2007) compared the effects of Scorpion antivenom versus Prazosin in the management of severe scorpion sting cases in a rural setting in a non-randomized, open label manner. They found that scorpion antivenom is no more effective to alleviate or reverse the cardiovascular effects of scorpion venom actions in severe case versus prazosin, which prevents and cures cardiovascular manifestations in a severe scorpion envenomation. Therefore, the role of scorpion antivenom in severe scorpion envenomation needs to be reassessed, and prazosin needs to be a standard of care in such cases to overcome the autonomic storm. In another study, they assessed the efficacy of prazosin combined with scorpion antivenom, compared to prazosin alone, in individuals with autonomic storm caused by a scorpion sting and they found that recovery from scorpion sting is hastened by simultaneous administration of scorpion antivenom combined with prazosin compared with prazosin alone (Bawaskar et al. 2011). Due to our small number of cases, we cannot accurately compare between prazosin and antivenom. However, our patients’ pulmonary findings were recovered by prazosin and antivenom therapy within 24 hours.

As a result, we thought that cases of scorpion envenomation with systemic findings (tachycardia, hypotension, dyspnea, and lethargy) must be observed in the intensive care unit for the development of serious cardiomyopathy and pulmonary edema. At admission electrocardiography, chest X-ray, cardiac enzymes, natriuretic peptide, blood gases and if possible echocardiography, must be done as soon as possible. These investigations may bring out the severity of the patient’s condition. A treatment plan should be determined according to the test results. We suggested that intensive inotropic treatment be given to children with serious cardiomyopathy, and prazosin, diuretics and oxygen treatment given to children with pulmonary edema.

REFERENCES


