Medical Aspects of the Mass-scale Civilian Casualties at Sarajevo Markale Market on August 28, 1995: Triage, Resuscitation, and Treatment

Ismet Suljević, Ismana Šurković
Department of Anesthesiology, Resuscitation and Intensive Care, University Hospital Center Koševo, Sarajevo, Bosnia and Herzegovina

The siege of Sarajevo, which holds an important but tragic position in the history of war, lasted for more than 45 months, from April 6, 1992 to March 19, 1996. Shelling of the Markale city market on August 28, 1995, was the attack with the largest number of civilian casualties. There were 23 persons killed on the spot. Another 104 were injured, of whom 15 died immediately after the explosion or during surgery, and 4 died a week later. Transport to the hospital was provided mostly by other civilians and resuscitation on the spot was not attempted. The triage of the wounded was conducted at the Koševo University Hospital Center and State Hospital by teams of surgeons and anesthesiologists. Out of 104 wounded, 94 were treated at several different Surgery Departments and the Emergency Department. There were 85 survivors among the wounded. This incident once again illustrates the importance of timely adequate triage and resuscitation after mass-scale injuring, which can increase the chances of survival.

Key words: Bosnia and Herzegovina; first aid; injured; resuscitation; shock; transportation of patients; triage; war; wounds and injuries

Throughout the 1,450 day siege, the city of Sarajevo and its 527,048 inhabitants were exposed to constant shelling by the Yugoslav Federal Army and local Serb paramilitaries. More than 61,136 citizens were wounded, among them 14,946 children, and 10,615 were killed, including 1,601 children.

Caring for patients with massive injuries caused by the explosions of heavy artillery projectiles and mortars shells used in modern wars is a major problem for health service. The organization of activities and urgent first aid are the primary requirements for minimizing the loss of life and later complications.

The critical period when the impact of injury can be minimized is the first hour. Evidence from World War I show that mortality of patients who were treated within one hour of injury was 10%, whereas mortality of those treated within eight hours of injury was 75% (1-3). The time taken for evacuation, combined with hypotension and reduced perfusion of vital organs, has a major effect on mortality and morbidity of patients with visceral and vascular injuries (4-6). Other factors are hypovolemic shock, combined extraabdominal injuries, delayed transport and surgery, number of injuries, and organs injured (7,8). The most important factor for successful management of such patients is reserve of blood and blood derivatives.

We report on the surgical management of 104 Sarajevo citizens wounded by the explosion of a single 120mm shell, which caused a massacre on Sarajevo market place – Markale, on August 28, 1995 (Fig 1). The aim of our report is to show the importance of individual factors affecting the outcome of the management of massive injuries.

Triage

The explosion caused instant death of 23 civilians and massive injuries to a large number of people. Many were lightly or seriously wounded (Table 1). After the explosion, the civilians provided assistance to their wounded fellow citizens, and unprofessional and nonmedical triage was carried out. The wounded were evacuated without being given first aid and transported to the hospital mostly in private cars and vans. A small number of casualties were brought in by ambulances. The dead were the last to be driven to the hospital mortuary.

The first casualties arrived half an hour after the explosion at the reception-triage premises of Koševo University Hospital Center (Fig. 2). At first, the wounded were received by the hospital staff on duty. After it had become clear that there was a large number of casualties, physicians from other hospital departments were summoned for help. Also, an emergency call was broadcast over radio and TV, requesting all medical workers in Sarajevo to come urgently and help their colleagues at the Koševo hospital.
With such a large inflow of injured patients, the lightly wounded had to be transferred to other rooms because of the space shortage (Fig. 2). Some patients were able to indicate the site of their injury. Those with serious injuries had to be undressed and fully examined. Nurse aids cut the clothes and undressed the patients, while nurses were inserting IV lines.

After examination, the wounds were protected with bandages and immobilized. Diagnostic X-rays were performed. Injured patients were sent to the operating theaters, other clinics or intensive care units to await surgery. Surgeons performed thorough examinations, whereas nurses registered all the patients’ data and the extent of injuries. Each patient had his own record sheet. The sheets also showed the patient’s destination. Wherever the patients were referred to from the reception-triage room, they were accompanied by all their data and diagnosis. Requests for X-rays were made on a separate sheet.

Medical triage of the wounded, following the principles of war doctrine (9-12), was carried out at the reception triage center. The aim of the triage was to provide each casualty with optimal medical aid within the shortest time possible.

The triage was performed mostly by surgeons and anesthesiologists. The injured were classified into groups according to the injury severity (13). Group A consisted of patients with minor injuries, who were sent home after being examined and adequately treated. Group B also had light injuries, but needed to stay in hospital after the treatment. Group C1 comprised casualties needing immediate surgery, and Group C2 those who required urgent resuscitation before surgery. Group C3 consisted of casualties whose surgery could be deferred. Group D included casualties who had no hope of survival. Casualties with non-serious injuries from the A and B groups were put in the corridors and nearby wards, where they waited to receive first aid and surgical assistance.

The highest level of attention was given to the C1 group of casualties, who needed immediate surgical intervention, and to C2 group, who needed rapid resuscitation (Table 2). Twenty-eight casualties were transported from the scene of the tragedy to Sarajevo State Hospital in other part of the town. When attempts were made to help five patients from group D, it was clear that there was no hope for them. The whole triage process took about 90 minutes.

The ABC (Airway, Breathing, Circulation) system of resuscitation was used (1,13). Ventilation was often supported by Ambu-bag or anesthetic machines, which were placed in the triage room. Venous cannulation, bandaging and immobilization, and endotracheal intubation were performed in parallel with the triage. After establishing an IV line, patients’ blood was taken for cross matching, and the infusion of crystalloids (2-3 L of Ringer’s lactate) and colloids (1-1.5 L Hemacel) started, followed by transfusion of the appropriate blood type. The period between the drawing of the blood sample and receiving the results of blood typing never exceeded 10 min. In the meantime, many patients were given blood group 0-negative, which was available in sufficient quantity, unlike other specific blood groups. Seventy-five liters of whole blood were used for 38 injured patients (1.9 L/patient) were used.

### Table 1. Casualties of the shelling of the Markale market place in Sarajevo, August 28, 1995

<table>
<thead>
<tr>
<th>Casualties</th>
<th>Kotevo hospital</th>
<th>State hospital</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wounded</td>
<td>76</td>
<td>28</td>
<td>104</td>
</tr>
<tr>
<td>Instantly killed</td>
<td>0</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>Dead on arrival</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Died during surgery</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Died a week later</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Survived</td>
<td>59</td>
<td>26</td>
<td>85</td>
</tr>
</tbody>
</table>

### Table 2. Severity of injuries in casualties on the Markale market shelling, August 28, 1995

<table>
<thead>
<tr>
<th>Degree of urgency</th>
<th>Injury severity</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (highest)</td>
<td>C1, C2</td>
<td>24</td>
</tr>
<tr>
<td>II</td>
<td>C3</td>
<td>12</td>
</tr>
<tr>
<td>III</td>
<td>A, B</td>
<td>56</td>
</tr>
<tr>
<td>IV (lowest)</td>
<td>D</td>
<td>5</td>
</tr>
</tbody>
</table>

*The injured were classified into groups according to the severity of their injuries. Group A consisted of those with minor injuries, who were sent home after appropriate treatment. Group B also consisted of those with lesser injuries, but who needed to stay in hospital after the treatment. Group C1 comprised casualties needing immediate surgery, and group C2 was composed of those who required urgent resuscitation before receiving surgery. Group C3 consisted of casualties whose surgery could be deferred. Group D included casualties who had no hope of survival.

### Resuscitation

After the wounded had been received in the reception triage room, they were provided first aid by the first aid team. Physicians of different specialties and technicians took care of the lightly wounded, whereas anesthesiologists and anesthetic technicians performed the resuscitation of the severely wounded.

The ABC (Airway, Breathing, Circulation) system of resuscitation was used (1,13). Ventilation was often supported by Ambu-bag or anesthetic machines, which were placed in the triage room. Venous cannulation, bandaging and immobilization, and endotracheal intubation were performed in parallel with the triage. After establishing an IV line, patients’ blood was taken for cross matching, and the infusion of crystalloids (2-3 L of Ringer’s lactate) and colloids (1-1.5 L Hemacel) started, followed by transfusion of the appropriate blood type. The period between the drawing of the blood sample and receiving the results of blood typing never exceeded 10 min. In the meantime, many patients were given blood group 0-negative, which was available in sufficient quantity, unlike other specific blood groups. Seventy-five liters of blood for 38 injured patients (1.9 L/patient) were used.
in one day. We had a sufficient amount of blood at disposal during the resuscitation. Our requirements for blood were successfully met due to the International Red Cross and the solidarity of the people of Sarajevo who were coming to donate blood regardless of the constant shelling of the city. After the triage had been completed, patients were transferred to either operating rooms or departments, where treatment was continued. The cases of hemotorax were managed in the reception area, whereas those with abdominal bleeding underwent immediate surgery.

During surgery, intravenous fluid and blood transfusions were continued until satisfactory hemostasis was achieved. Antibiotics were administered intraoperatively and postoperatively at the Intensive Care Unit. The most commonly used antibiotics were penicillin, gentamicin, and metronidazole, which were given in 90% of the cases. Central venous lines were established after the surgery, in the Intensive Care Unit (14,15).

Casualties

There were 127 civilian casualties. Twenty-three died on the spot and 104 were injured, of whom 76 were transported to the Košev University Hospital (Table 1). Eight more patients died in the hospital reception area immediately upon arrival. Twenty-eight casualties were taken to the State hospital; two of them died following reception. Another five wounded died at the Košev Hospital after the surgery, and four died of complications a week later. Eighty-five casualties survived. The anatomical localization of the injuries is shown in Table 3.

<table>
<thead>
<tr>
<th>Anatomical location of injury</th>
<th>No. (% of patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head, face, and neck</td>
<td>14 (13.0)</td>
</tr>
<tr>
<td>Thorax</td>
<td>14 (13.0)</td>
</tr>
<tr>
<td>Abdomen</td>
<td>12 (12.0)</td>
</tr>
<tr>
<td>Upper extremity</td>
<td>10 (10.0)</td>
</tr>
<tr>
<td>Lower extremity</td>
<td>54 (52.0)</td>
</tr>
<tr>
<td>Total</td>
<td>104 (100.0)</td>
</tr>
</tbody>
</table>

Table 3. Anatomical location of injuries in casualties of the Markale market shelling, August 28, 1995

Forty-eight casualties were hospitalized in the two hospitals. Thirty-three major and 67 minor surgeries were carried out, with some of the casualties requiring two or more operations (Table 4).

Table 4. Major and minor surgeries performed in the casualties of the Markale market shelling, August 28, 1995

<table>
<thead>
<tr>
<th>Hospitals</th>
<th>No. of hospitalized patients</th>
<th>Major surgery</th>
<th>Minor surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Košev hospital</td>
<td>33</td>
<td>24</td>
<td>50</td>
</tr>
<tr>
<td>State hospital</td>
<td>15</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>33</td>
<td>67</td>
</tr>
</tbody>
</table>

*Some casualties required more than one surgical intervention.

The evacuation of the injured from the Markale market was spontaneous, disorganized, and carried out by civilians who happened to be there in their cars at that moment. This is not the best mode of transport because all of the wounded were in a sitting or half-lying position. For the lightly wounded this was not a problem, but for those who were unconscious or seriously wounded, it was obviously a dangerous method of transport. The injured were not given first aid on the spot, what could have significantly reduced the mortality.

Markale market is around 2 km away from the Košev or State hospital, so the transport of the injured to the hospitals did not take long. However, the time was lost in the spontaneous organization of the transport during which the injured were losing blood. The principle "there is no urgent evacuation, but resuscitation is urgent" (13) could not be applied there. The activation of a large number of surgical teams and medical staff in general is indispensable for the successful management of such disasters. It is necessary to organize in a short time a large number of surgical teams who will start operating in as many theaters as possible to give an equal chance to the largest possible number of the injured. It is indispensable to reduce the number of surgical team members to one surgeon with certain subspecialty, one assistant, and a surgical nurse. In the triage of a large number of casualties, it is necessary to have as many staff as possible to provide first aid, and to have several triage

The main characteristics of these injuries were major destruction of tissue, massive hemorrhage, and hemorrhagic shock. Twenty-three citizens died on the spot in that massacre and ten during the admission. Head and brain injuries were the most common injuries in patients who died immediately after admission or on the operating table immediately after triage. The first casualties arrived at the triage center half an hour after the explosion. According to Bellamy (1), this is regarded as rapid evacuation. In Vietnam, 31% of all admitted patients arrived at the hospital within one hour of being wounded. During the war in Croatia, 40% of the wounded arrived at Ošijek Hospital within the first hour after injury (11).

According to the doctrine of war surgery, surgical help should be administered as soon as possible to save life and limb. The surgical control of massive hemorrhage is the key to reducing mortality. In abdominal injuries, speedy surgical intervention is often the most vital part of successful resuscitation and life saving. This experience was gained in earlier wars in Vietnam, Korea, the Falklands, and Israel. Analyses have shown that the effect of treatment depends on speedy and adequate evacuation (2,11,12).

The evacuation of the injured from the Markale market was spontaneous, disorganized, and carried out by civilians who happened to be there in their cars at that moment. This is not the best mode of transport because all of the wounded were in a sitting or half-lying position. For the lightly wounded this was not a problem, but for those who were unconscious or seriously wounded, it was obviously a dangerous method of transport. The injured were not given first aid on the spot, what could have significantly reduced the mortality.

The evacuation of the injured from the Markale market was spontaneous, disorganized, and carried out by civilians who happened to be there in their cars at that moment. This is not the best mode of transport because all of the wounded were in a sitting or half-lying position. For the lightly wounded this was not a problem, but for those who were unconscious or seriously wounded, it was obviously a dangerous method of transport. The injured were not given first aid on the spot, what could have significantly reduced the mortality.

The evacuation of the injured from the Markale market was spontaneous, disorganized, and carried out by civilians who happened to be there in their cars at that moment. This is not the best mode of transport because all of the wounded were in a sitting or half-lying position. For the lightly wounded this was not a problem, but for those who were unconscious or seriously wounded, it was obviously a dangerous method of transport. The injured were not given first aid on the spot, what could have significantly reduced the mortality.
teams, so that the triage can be carried out as soon as possible (14-17). In this case, each triage team consisted of a surgeon and an anesthesiologist.

Physicians, nurses, medico-legal teams, and volunteers should be well educated (simulating exercises) in management and taking care of massive injuries, to be most prepared to face this or similar type of catastrophe, which is always possible.

References


Received: January 12, 2002
Accepted: February 12, 2002

Correspondence to:
Ismet Suljević
Department of Anesthesiology
Košev University Hospital Center
Bošnička 25
71000 Sarajevo, Bosnia and Herzegovina
ismetsul@bih.net.ba