Earthquakes and crush syndrome casualties: Lessons learned from the Kashmir disaster

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Major earthquakes may provoke a substantial number of crush casualties complicated by acute kidney injury (AKI). After the 1988 Armenian earthquake, the International Society of Nephrology (ISN) established the Renal Disaster Relief Task Force (RDRTF) to organize renal care in large disasters; this approach proved to be useful in several recent disasters. This paper depicts the organizational aspects of the rescue intervention during the Kashmir earthquake, in 2005. Specific problems were fierce geographic circumstances, lack of pre-registered local keymen, transportation problems, and inexperience of local teams to cope with problems related to mass disasters. Once treatment was installed, global outcomes were favorable. It is concluded that well-organized international help in renal disasters can be effective in saving many lives, but still necessitates conceptual adaptations owing to specific local circumstances.

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Disasters are sudden calamities causing extensive material damage and distress; inhabitants of the affected area may become homeless, be wounded or die. Although some disasters are man-made, most of them are natural geological, or meteorological phenomena. Recently, the South-East Asian tsunami, hurricane Katrina, and the Kashmir earthquake affected densely populated and/or geographically extended areas causing hundreds of thousands of deaths.

Mass disasters not only result in instant mortality, but also bring along a cluster of heavily wounded victims who are mostly extricated from the rubble after heroic efforts.[1]

CRUSH SYNDROME AND ACUTE KIDNEY INJURY IN DISASTERS

Acute renal failure has been well defined in crush casualties of mass disasters,[2] but the absence of a generally accepted definition has been a major drawback for estimating the incidence and prognosis. The term 'acute kidney injury' (AKI) has recently been proposed as a patho-physiologically more correct alternative to the previous term acute renal failure.[3,4] We suggest to use AKI for disaster crush casualties as well. AKI with impact on clinical outcome is accepted to be present in case of an abrupt (within 48 h) reduction in kidney function defined either as an absolute 1.5-fold increase in serum creatinine or by 0.5 mg/dl or a decrease in glomerular filtration rate by 50%, and/or a reduction in urine output to below 0.5 ml/kg/h for >6 h. This concept implies that even small alterations in kidney function may deeply affect the final outcome.

The AKI component of crush syndrome is often fatal if untreated, but one of the few preventable or reversible life-threatening disaster complications if appropriate medical treatment, fluid resuscitation, and/or dialysis are applied. Unfortunately, the condition is insufficiently known to rescue workers, medics, paramedics, and even nephrologists.

Recently, the general lines of crush-related rescue and its AKI component have been drawn,[5] but the consideration of problems and experiences, related to each specific disaster, might be helpful for future organization of renal rescue and

also of any rescue in general. In this publication, we review the experience gained with the renal relief intervention after one of the most recent mass disasters in Pakistani Kashmir.

RELIEF EFFORTS FOR CRUSH-RELATED AKI AND OTHER NEPHROLOGIC CONDITIONS

Large disasters may be linked to hundreds of AKI cases,[6–9] occur frequently in regions with insufficient dialytic infrastructure to cope with mass casualties,[10] and imply the deployment of expensive strategies in areas that do not always have sufficient financial resources.

Only during the last two decades, extrication, transport, dialytic possibilities, and logistics became sufficiently adequate to handle problems of the epidemic extent of mass disasters, if enough infrastructure is available on the spot.

The first disaster with known massive AKI casualties occurred in Spitak, Armenia, 1988.[6] Local dialysis infrastructure was inadequate, with no pre-conceived regional or international organizations for renal rescue available.[10] This resulted in a sudden influx of unprepared international dialysis personnel and of hardware, reaching their optimal capacity only when mild to moderate AKI cases had recovered and the severe ones had died.

This experience underscored the need for preplanned logistic organization to cope adequately with renal disaster rescue in the future. To address such problems, the International Society of Nephrology (ISN) created the 'Renal Disaster Relief Task Force' (RDRTF) in 1989,[11] organizing rescue structures for three areas: Northern, Central, and South America; South-East Asia; and Europe, Asia Minor, the Middle-East, and Africa.[12] This organization offers personnel, material, advice, and psychological support to medics and paramedics[11] (Table 1), for any disaster that involves renal disease. Lists of volunteers are registered in the headquarters of the organization.[12] In line with the World Health Organization's guidelines for health care equipment donations,[13] the quality of donated material is of standard European level.

Table 1 | Types of support offered by the RDRTF in this specific action

Personnel help
Doctors (nephrologists/intensivists)
Dialysis nurses
Dialysis technicians
Material help
Dialysis machines
Reverse osmosis machines
Dialyzers
Blood lines
Central vein catheters
Drugs (kayexalate/heparin)
Logistic advice
Medical education and training
Technical education and training
Psychologic support

RDRTF, Renal Disaster Relief Task Force.

The RDRTF (European Branch) offered substantial support in the Marmara earthquake in Turkey in 1999[1] and the Bam earthquake in Iran in 2003.[9] Other interventions included assessment missions and/or an advisory role like with hurricane Katrina, Louisiana (2005), the collapse of an exhibition hall in Katowice, Poland (2006), and the Yogyakarta earthquake in Indonesia (2006). Furthermore, material support was offered during the Israelo-Lebanese war (2006).

THE KASHMIR EXPERIENCE

The earthquake in Pakistani Kashmir

On 8 October, at 08:50:38 hours Pakistan Standard Time, the Kashmir area was struck by a severe earthquake with an intensity of 7.6 on the Richter scale. The disaster essentially affected Pakistan, together with neighboring parts of India and Afghanistan (Figure 1a).

Dimensions were extraordinary.[14] Mortality numbers increased quickly; confirmed mortality according to the United Nations was 73 000 with 100 000 wounded and an estimated 3.2–3.5 million people affected by the disaster and in need of assistance.[15] The number of affected people and transportation problems made this disaster a logistic challenge. Specific to this earthquake was its confinement to a remote mountainous area, with only few roads. Relief was rendered difficult because of transport problems hampering the evacuation of affected victims and the delivery of material for extrication and for primary treatment (Figure 1b).[16] During the initial phase, climatologic circumstances endangered the use of helicopters, which were already scarce. Two of them crashed in the first weeks further affecting the transport. It took more than 4 weeks for rescue teams to reach remote disaster areas, and up till early December 2005, some parts in the damaged area still had not been reached. Conceivably, in those remote areas, numerous AKI patients have died before renal help could be offered.

The intervention of the Renal Disaster Relief Task Force

Preparations for a renal intervention started a few hours after the earthquake (09:00 hours Western European time; 12:00 hours Pakistan time). A timeline providing more specific information on the sequential evolution of the rescue effort is given in Table 2. An assessment team from MSF, with two members from the RDRTF (one nephrologist/intensivist and one renal nurse) arrived at Islamabad at 05:30 hours on 11 October. Crush patients are often severely wounded with needs for ventilation and intensive support; dialysis necessitates the availability of purified tap water, electricity, and dialysis infrastructure. Unaffected cities close to the damaged area are considered the most appropriate for this type of mission.[5] Hence, for logistic reasons, the operation was centralized at the Pakistan Institute of Medical Science (PIMS) Hospital in Islamabad, one of the largest public facilities in the area, in collaboration with Pakistani colleagues and nurses (Figure 1c). Global evacuation of casualties had already been directed towards this hospital,