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Awareness Regarding Crush Injury and Renal Complications

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The World Kidney Day Joint Steering Committee has declared 2023 to be the year of "Kidney Health for All – Preparing for the unexpected, supporting the vulnerable". It means to say that our point of concern should be preparation for any unexpected events, e.g., natural or man-made disasters, to care for patients with kidney diseases. For example, in the event of emergencies, people with kidney disease are among the most vulnerable in the population due to their ongoing requirements for consistently coordinated care, which is often lifelong and involves complex ongoing treatment. In recent years, the impact of COVID-19 on the health system has placed an added strain on this vulnerable population.

A disaster may be defined as any unfortunate happenings without warning and the consequences are seriously destructive.[1] Disasters can be caused by naturally, such as earthquakes, volcanic eruptions, tsunamis, hurricanes, flooding, or tornadoes, or some man-made events, like accidental (such as an accidental toxic spill or nuclear power plant event), or deliberately caused (such as various terrorist bombings and poisonings).[1] Today nearly around 400 million people live in earthquake-prone areas and almost as many inhabit areas with a high probability of tropical cyclones. With the rapid growth of mega cities such as the Dhaka, Mexico City, Istanbul, Tokyo, and Tehran, and other areas with high seismic risk, a single quake may claim the lives of up to three-million people and injure several millions more.[1,2]

Crush injury is a severe trauma that can occur due to accidents or natural disasters, which can result in extensive tissue damage and dysfunction in various organs, including the kidneys. Renal dysfunction after a crush injury is a common complication in victims trapped in collapsed buildings or by the wreckage of existing dialysis facilities for dialysis-dependent patients or medical care.[3]

One study conducted in China found that the incidence of acute kidney injury (AKI) in earthquake survivors with crush injuries was 62.2%, with a mortality rate of 20.9%. The study concluded that early recognition and treatment of AKI can significantly reduce mortality in these patients.[4] Another study conducted in Iran found that the use of continuous renal replacement therapy (CRRT) in patients with crush-induced renal dysfunction was associated with a higher rate of renal recovery and improved survival.[5]

How does a crush injury cause renal injury? The mechanism of renal dysfunction after a crush injury is complex and multifactorial. The initial insult to the kidneys can occur due to direct mechanical injury, such as compression or ischemia, which can cause damage to the glomeruli, tubules, and interstitial tissues. The release of myoglobin, hemoglobin, and other

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toxic substances from the damaged muscle tissues can cause acute tubular necrosis (ATN) and obstructive nephropathy. The systemic inflammatory response syndrome (SIRS) and oxidative stress can further exacerbate renal injury and dysfunction. Moreover, hypovolemia and hypotension can reduce renal perfusion and aggravate renal ischemia.[6,7]

The diagnosis of renal dysfunction after crush injury is based on clinical and laboratory findings. The clinical presentation may include oliguria, anuria, fluid overload, electrolyte disturbances, and signs of uremia. The laboratory evaluation should include serum creatinine, blood urea nitrogen (BUN), urine output, urine electrolytes, and urine sediment analysis. Imaging studies, such as renal ultrasonography or computed tomography (CT) scan, may be helpful to detect renal obstruction, hydronephrosis, or renal parenchymal injury.[5]

The management of renal dysfunction after crush injury should be multidisciplinary and individualized. The primary goal is to restore renal perfusion and function, prevent further injury, and avoid complications. The initial resuscitation should focus on fluid and electrolyte management, correction of hypotension, and adequate pain control. Renal replacement therapy (RRT), such as hemodialysis or continuous venovenous hemofiltration (CVVH), may be required in patients with severe or refractory renal dysfunction.[8] The use of diuretics, such as furosemide, should be cautious and monitored closely to avoid dehydration and electrolyte imbalances. The administration of antioxidants, such as N-acetylcysteine, may have a renoprotective effect in some cases. The management of crush injury-induced compartment syndrome, rhabdomyolysis, and SIRS should also be addressed promptly to reduce the risk of renal dysfunction.[9,10]

Studies have shown that early recognition and intervention are crucial for preventing and managing crush-induced renal dysfunction. Prompt treatment with fluid resuscitation, diuretics, and renal replacement therapy can improve renal function and reduce morbidity and mortality. In addition, preventive measures can be taken to reduce the risk of renal dysfunction in patients with crush injuries. These include optimizing fluid resuscitation, avoiding nephrotoxic agents, and monitoring renal function closely. Healthcare professionals must be vigilant in monitoring renal function in patients with crush injuries and be prepared to initiate appropriate interventions when necessary.

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