# Correspondence

# Management of musculoskeletal trauma & spinal injuries in disasters: stem cells vs. medical rehabilitation

## Sir,

We have read the article on "Stem cell therapy: A novel and futuristic treatment modality for disaster injuries"<sup>1</sup>, with great interest. The authors have provided a scientific update on stem cell therapy and its possible application for a range of injuries caused by natural or man-made disasters. We are especially intrigued by their focus on musculoskeletal injuries and spinal cord injury (SCI), two common, significant disabling injuries sustained in earthquakes and other natural disasters. The authors report that mesenchymal stem cells have been demonstrated in clinical trials to repair large bone defects due to fractures as well as some cell-induced improvements in spinal cord damage. Reflecting on their vision for a future role for stem cell therapy in treating disaster injuries, the successful employment of medical rehabilitation as a treatment modality for disaster injuries in recent earthquakes inspired us to respond with similar enthusiasm.

Severe earthquakes often result in large numbers of significant disabling injuries including musculoskeletal trauma (long bone, pelvic, and spine fractures as well as crush injury), SCI, traumatic brain injury, burns, and peripheral nerve damage<sup>2</sup>. Unfortunately, earthquakes disproportionately occur in developing regions which generally lack the necessary medical resources to effectively manage the sudden overwhelming burden of severe, traumatic injuries; in fact, resources may have been insufficient to meet pre-disaster demands. Consequently, victims with SCI and other complex, disabling injures are often neglected<sup>2,3</sup> and do not receive appropriate care following a disaster<sup>4</sup>, tragically resulting in significant preventable mortality and longterm disability. Timely surgical intervention if indicated and related medical rehabilitation can minimize these human losses.

Medical rehabilitation is concerned with diagnosis, evaluation, and management of persons of all ages with physical and/or cognitive impairment and disability with emphasis on prevention of complications of disability from secondary conditions<sup>5</sup>. Although medical rehabilitation has historically not been emphasized as a disaster response strategy for the management of resulting injuries<sup>6</sup>, its relatively efficient implementation and proven therapeutic efficacy in recent severe earthquakes has resulted in increased global use and acceptance<sup>7,8</sup>. Medical rehabilitation of SCI patients in Pakistan<sup>4</sup>, China<sup>9,10</sup> and Haiti<sup>11,12</sup> earthquakes resulted in reduced hospital length of stay, better functional outcomes, and reduced medical complications. Also, clinical effectiveness of medical rehabilitation intervention has been demonstrated in Chinese fracture victims<sup>13</sup>.

Medical rehabilitation is practiced in a range of post-disaster settings which include emergency, postsurgical rehabilitation of fractures in a humanitarian relief foreign field hospital as well as post-acute functional rehabilitation of SCI in a local tertiary care hospital-with rehabilitation follow up in the community. Specific rehabilitation therapies vary depending on the urgency and resources of the disaster practice setting as well as on the nature and severity of the disabling injury. The rehabilitation intervention indicated determines the required expertise of the provider: rehabilitation aides can perform basic therapies to prevent secondary complications of injuries; a therapist is qualified to administer specific treatment modalities such as ultrasound and pain management techniques, and a rehabilitation physician directs the efforts of a multidisciplinary SCI care team. During the disaster response, rehabilitation task-shifting may occur depending on the skills of the individual medical responders present and local healthcare workers are

typically trained by the responding professionals. The cost of rehabilitation services provided during a disaster response is generally borne by the responding agencies for a period and victims are not charged. Medical rehabilitation emphasizes manual care by providers and use of low technology equipment. As an indirect benefit to post-disaster society, increased acceptance of disability may develop into sustained medical rehabilitation infrastructure (with supporting government funding) which reduces the burden of long-term disability.

Although stem cells therapy holds a promise for the cure and management of diseases like SCI, but it has certain limitations (some of which already have been pointed out by the authors)<sup>1</sup> which preclude its use as a treatment option for SCI and musculoskeletal trauma in disasters at least in the near future. Additional limitations are as follows; (i) Stem cell transplants have resulted in neurological improvement only in a few cases of human SCI stem cell transplants, and so far there have been no reported cases of successful stem cell transplants in a post-disaster scenario. The example quoted by authors is of a single 37 years old chronic paraplegic female who underwent this procedure in a center of excellence in a developed country; a luxury not available to majority of the SCI patients in a disaster. There was no comment on the improvement in the functional outcome after the stem cell transplant in this case. It is not clear if the benefits were maintained over time and if there were procedure related complications. (ii) Stem cell transplant needs expertise, specialized center and trained staff which cannot be possibly arranged for hundreds of SCI patients after a disaster. (iii) Stem cell transplant expenses for a single patient are in excess of thousands of dollars<sup>14</sup> while medical rehabilitation can be provided for much less. (iv) Arranging stem cell transplant for SCI and musculoskeletal trauma patients after disasters will cost billions of dollars and possibly cannot be arranged.

In contrast, medical rehabilitation of SCI and musculoskeletal trauma patients is more effective, economical and has shown good results in the last decade. Medical rehabilitation can be offered not only by trained physical medicine and rehabilitation (PMR) physician, but also by residents and allied rehabilitation professionals (where PMR physicians are not available). While stem cell therapy promises to enhance the therapeutic benefit of conventional treatments for disaster injuries such as medical rehabilitation, the challenges remain to be overcome for this futuristic modality to improve the quality of life of disaster victims. Further elaboration of stem cell science followed by trials demonstrating clinical and functional outcome improvements in disaster injury patients are required; cell delivery protocol must be optimized as indicated by the authors<sup>1</sup>. Specialized facility, equipment, and personnel resources must be considered. And, cost for the current experimental stem cell therapy is prohibitively expensive<sup>14</sup>. Once developed and implemented, application of stem cell therapy in the disaster settings may bring significant changes. Medical rehabilitation will be able to facilitate this process based on its experience as a then well-established disaster injury treatment modality.

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