Modeling the Effects of Trauma on Epidermal Wound Healing

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Objective: To simulate the effect of trauma on epidermal wound healing using a 2-D Agent Based Model (ABM). **Background:** Oftentimes during a serious systemic trauma, such as a high speed motor vehicle collision or a gunshot wound, an acute soft tissue wound is a complicating factor. Currently, the mechanism behind the impairment in wound healing associated with systemic trauma is poorly characterized. Although difficult to study *in vivo,* the myriad of interactions among the wound healing cells are ideally suited to examination using computational techniques. Agent Based Modeling ABM is the computational tool utilized by the authors to model the effects of trauma on epidermal wound healing. **Methods:** Using a 2-D ABM model, keratinocytes were represented by "agents" that interact with other keratinocytes. These agents were arranged in a 40 by 80 grid to simulate a partial thickness wound. The neighborhood of each cell was composed of the 4 directly adjoining cells. During each iteration, every keratinocytes was subjected to mathematical rules to determine their behavior. The NetLogo software platform was used to implement the ABM. Each tick of the simulation clock is equivalent to 1 hour. 1,000 simulations were run until the wound was healed in the absence and presence of trauma. R**esults:**

Sample	**N**	**Mean (hours)**	**Std Dev**	**P value**
Control	**1,000**	**31**	**2.93**	**N/A**
Trauma (ISS = 5)	**1,000**	**64**	**2.99**	**<.0001**
Trauma (ISS = 40)	**1,000**	**122**	**2.89**	**<.0001**

Conclusions: The initial results of this model indicate that the effects of trauma on epidermal wound healing can be readily simulated using ABM. The impairment in wound healing can be seen even in mild systemic trauma. A patient with a high ISS is at a much higher risk of complications from a soft tissue wound given the extended course of wound healing. ABM modeling of wound healing affords the novel possibility of simulating the effect of therapeutic interventions at the cell and tissue level. The goal of creating such a model is to design a therapy to be given in the ED that will decrease the morbidity associated with wounds inflicted during a traumatic injury.

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