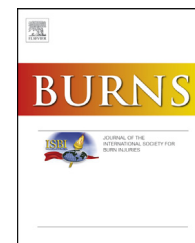


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## Immediate and long-term psychological problems for survivors of severe pediatric electrical injury<sup>☆</sup>

Marta Rosenberg<sup>a,b,c,\*</sup>, Neha Mehta<sup>a,b,c</sup>, Laura Rosenberg<sup>a,b,c</sup>,  
 Maribel Ramirez<sup>a,b,c</sup>, Walter J. Meyer III<sup>a,b,c</sup>, David N. Herndon<sup>a,b,c</sup>,  
 Clark R. Andersen<sup>a,b,c</sup>, Christopher Thomas<sup>a,b,c</sup>

<sup>a</sup> Shriners Hospitals for Children, Shriners Burns Hospital, Galveston, TX 77550, USA

<sup>b</sup> Department of Surgery, School of Medicine, University of Texas Medical Branch, Galveston, TX 77555, USA

<sup>c</sup> Department of Psychiatry and Behavioral Science, School of Medicine, University of Texas Medical Branch, Galveston, TX 77555, USA

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### ABSTRACT

**Objective:** To compare psychological difficulties experienced during the initial acute hospitalization and the last follow up visit for children with electrical injuries (EI) and children without electrical injuries (non-EI). We hypothesized that children with electrical burns would have different psychological outcomes.

**Methods:** This retrospective study compared emotional and cognitive functioning of EI patients and a matched group of survivors of other burns.

**Results:** Medical records of 67 patients with and without EI were reviewed. For the EI group, the mean age at injury was  $12.6 \pm 3.9$  years, the mean age at follow up was  $15.5 \pm 4.6$  years, and mean TBSA  $32 \pm 21\%$ . For the Non-EI group, the mean age at injury was  $12.4 \pm 3.9$  years, the mean age at follow up was  $14.5 \pm 4.7$  years, and mean TBSA  $32 \pm 21.5\%$ . During the acute hospitalization, a significant difference was found between the groups in the area of neuropathic pain (Chi-square tests  $p < 0.011$ ). Individuals with EI were more likely to have acute stress disorder/post-traumatic stress disorder as well as amnesia of the accident than the controls; however, this did not reach statistical significance. No differences were found between the groups in other psychological areas. Follow up information from the last documented psychology/psychiatric visit revealed an equal number of patients experienced anxiety disorders, depression, grief, behavioral problems, and cognitive difficulties.

**Conclusions:** Some differences were evident between the groups immediately after injury; however, long term outcomes were similar.

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 \* Corresponding author at: Shriners Hospitals for Children, 815 Market Street, Galveston, TX 77550, USA. Tel.: +1 409 770 6718; fax: +1 409 770 6555.

E-mail address: [marosenb@utmb.edu](mailto:marosenb@utmb.edu) (M. Rosenberg).

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## 1. Introduction

Experts have reported that the severity of electrical burns is classified by the voltage, type of current, and the path and duration of the current [1–3]. Two types of injuries are reported in the literature low voltage injuries (<1000 V) and high voltage injuries ( $\geq 1000$  V) [1–3]. Typically in the US many of the electrical burns that occur indoors are low voltage and those that occur outdoors are high voltage [2,3].

Survival from electrical burns is more prominent given advances in burn care, which has highlighted the focus on long-term adjustment and quality of life.

The adult literature identifies various physical, cognitive, and emotional consequences of electrical burns. Neuropsychological studies have shown cognitive changes in attention, memory, speed of processing, motor skills, executive functioning skills, and personality [4–8]. The head doesn't have to come in contact with the electrical power source for patients to experience these difficulties [5]. Pliskin and colleagues have extensively examined the neuropsychological outcome of electricians who sustained injuries and compared them to electricians without injury [5–7]. In an initial study, Pliskin and colleagues found that the electrical injury group endorsed more difficulties with physical, cognitive and emotional functioning. The most common physical complaints were headaches and parasthesia, the most common cognitive complaints were difficulties with concentration, word finding, slower thinking, memory problems and distraction, and the most common emotional difficulties were stress, anxiety and depression [6]. Interestingly, they found that depression symptoms were associated with increased symptoms complaints among survivors [6]. In a subsequent study, Pliskin and colleagues examined the neuropsychological effects of electrical injury and found that survivors reported similar difficulties with cognitive and emotional functioning and with some survivors the difficulties persisted several years after injury [5]. More recently, Pliskin and colleagues compared the neuropsychological functioning of electrical injury survivors with a matched group of healthily electricians. They found that electrical injury survivors performed worse on measures of attention, mental speed, and motor skills [7].

Kelly and colleagues examined the relationship between subjective experiences of survivors of electrical injury and subsequent psychiatric sequelae. They found that patients who reported a sensation of being held by the electrical current had increased incidence of post-traumatic stress disorder and major depression. Altered states of consciousness and amnesia were associated with major depression and post-traumatic stress disorder [9]. Ramati and colleagues found that psychiatric difficulties were common following electrical injury and that burn survivors with two psychiatric diagnoses such as depression and posttraumatic stress disorder typically experienced more difficulty with cognitive functioning [10]. Hahn-Ketter and colleagues found that depression was indicative of difficulty with psychosocial adjustment twelve years after electrical-injury [11]. Cochran and colleagues compared differences in quality of life of adult burn survivors with electrical and thermal injuries and found that they did not significantly differ in their responses [12]. A

subsequent study by Noble and colleagues found that survivors of electrical injury had limited ability to return to work and poor quality of life due to emotional distress [13].

We could not find any studies that examined the psychological outcome for children with electrical burns. We have seen prior differences from the adult burn data in the pediatric population, which then merits description and duplication in the pediatric group for electrical injury. Also, if electrical injury leads to different risks in outcome then it would be important to know and alter treatment accordingly. The purpose of this study was to compare the nature of psychological and psychiatric difficulties experienced during the initial acute hospitalization and at the last follow up visit for children who sustained electrical burns with those who did not. Our hypothesis was driven by the adult literature on electrical burns. We hypothesized that children who sustained electrical burns would have different psychological outcomes from children with other types of burns.

## 2. Methods

### 2.1. Design

The University of Texas Medical Branch Institution Review Board approved this study (IRB #01-305). A retrospective review of the medical records of acutely burned pediatric patients who were admitted to this burn care facility due to electrical injuries between the years 1997 to 2002 was done to identify the psychological outcomes of the children during their initial acute hospitalization and at their last follow up visit with the mental health provider (psychologist and/or psychiatrist). This study had two groups, the electrical injury group and the control group. The inclusion criterion for the electrical injury group was medical documentation by a physician of electrical injury. The source for this injury varied from contact with high voltage sources, low voltage sources, electrical wires, or electrical outlets. Exclusion criteria for this group included: 1) a pre-burn history of cognitive difficulties, learning disorders, and/or developmental disorders as reported by the parents or guardians during the initial clinical interviews and/or available school records, 2) a history of pre-injury traumatic brain injury or organic dysfunction, 3) a history of hypoxic episodes related to the burn, and 4) a history of burns to the calvarium in order to control for the possible causes of affective and cognitive difficulties. The psychological outcomes of pediatric burn patients who sustained hypoxic episodes or burns to the calvarium have been reported in previous publications [14,15]. Control subjects for this study were individuals who sustained burns from other sources such as flame, scald, contact burns and were treated acutely at this burn care facility. The exclusion criteria mentioned above applied to the controls. Controls were matched on size of burn and age of burn. We initially looked at the year of injury to identify possible controls. Controls were randomly selected among those closest in size of burn ( $\pm 5\%$  to  $10\%$ ) and age of burn ( $\pm 1$  to 2 years).

The medical records of children who fit the inclusion criteria were reviewed. We reviewed the physician's records, neurology consults, psychology records, and psychiatric

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