

Propranolol Use in Pediatric Burn Patients

When patients sustain severe burn injuries, there is more damage done physiologically than meets the eye. Burns induce a hypermetabolic response due to stress hormone increases, catecholamine release, and inflammatory mediators circulating in the body. These changes lead to increased muscle wasting, a suppressed immune system, and increased resting energy expenditure which can all cause poor wound healing and affect multiple organ systems. And surprisingly, this chemical response can last up to 2 years while the burn is seemingly healing on the surface. These catecholamines act through the alpha and beta adrenergic receptors to affect the cardiovascular system, and can be mitigated with the beta blocker propranolol. Studies have shown that long-term treatment with propranolol results in improved outcomes in pediatric burn patients by **reducing post-burn hypermetabolism and cardiac stress**.

This study by Herndon, et al, focuses on 443 pediatric patients with more than 30% of their total body surface area burned. Of this group, 179 patients who also required at least one surgical operation were randomly assigned to either the control group (n=89) or the propranolol treatment group (n=90). Both groups received standard-of-care treatment with the Galveston resuscitation formula and the propranolol treatment group received 4 mg/kg/day that was started within the first five days of admission and continued for up to 1 year. The goal was to lower the patients' heart rate by 15% and propranolol administration was titrated as necessary.

Of note, five control group patients and five propranolol treatment patients were either lost to follow up or withdrew from the study. There was no significant difference in demographics or severity of injury between the groups, and one-third of the patients in each group had sustained an inhalation injury on admission.

The propranolol treatment group not only initially decreased the heart rate by 15% but maintained a lower rate than the control group through the duration of the study. At 4 weeks post-injury, the propranolol treatment group maintained an average HR of 150 compared to 162 in the control group. However, both groups still exhibited tachycardia from 1-3 months after the injury at around 120-140% above the age-predicted normal HR. At 6 months, the heart rate in the treatment group decreased to 110% of the age-predicted normal, at an average of 116 bpm compared to the control at 127 bpm. Resting energy expenditure also decreased by 20% at 6 months after the injury in the propranolol group. Central mass was decreased by 15% at 3 months post-injury and remained decreased as long as propranolol was administered. This particular finding is consistent with the idea that propranolol decreases mesenteric blood flow and reduces peripheral lipolysis. Peripheral lean body mass was shown to improve by 10% in the propranolol treatment group compared to the control.

Adverse events were minimal. There were 5 deaths in the control group and 4 deaths in the propranolol treatment group, and all were determined to be caused by sepsis in the autopsies. There were only 2 instances of bradycardia, 1 episode of hypoglycemia, 1 cardiac arrhythmia, and 2 episodes of respiratory compromise in the propranolol treated group. In all cases involving adverse events, propranolol was temporarily held and reinitiated as tolerated.

Future studies are needed that enroll larger numbers of patients and have longer follow-up to determine long-term effects of cardiovascular events and psychological outcomes, including acute stress disorder and posttraumatic stress disorder. It would also be interesting to

study a group of patients with a larger dose of propranolol administered, as it has been proposed that larger doses could potentially decrease HR and cardiac work even more.

References/Further Reading:

- Herndon, et al. Long-Term Propranolol Use in Severely Burned Pediatric Patients. *Annals of Surgery* Volume 256, Number 3, September 2012.

[http://www.ncbi.nlm.nih.gov/pubmed?holding=utswmlib&otool=utswmlib&cmd=Search&term=](http://www.ncbi.nlm.nih.gov/pubmed?holding=utswmlib&otool=utswmlib&cmd=Search&term=Long-)

[Long-Term%20Propranolol%20Use%20in%20Severely%20Burned%20Pediatric%20Patients%3A%20A%20Randomized%20Controlled%20Study](http://www.ncbi.nlm.nih.gov/pubmed?holding=utswmlib&otool=utswmlib&cmd=Search&term=Long-Term%20Propranolol%20Use%20in%20Severely%20Burned%20Pediatric%20Patients%3A%20A%20Randomized%20Controlled%20Study)

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