Evaluation of High-dose Ascorbic Acid in Thermal Injury

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Background

- Burns >20% total body surface area (TBSA) are associated with hypovolemic shock, local tissue edema, and release of inflammatory mediators.
- Inflammatory mediators lead to production of reactive oxygen species, which can worsen burn shock by causing lipid peroxidation and increased vascular permeability.
- Ascorbic acid is a free radical scavenger that may reduce lipid peroxidation and vascular permeability by inactivating reactive oxygen species.
- Ascorbic acid has been shown in animal models and one human clinical trial to reduce fluid requirements in thermal injury.
- Concerns for osmotic diuresis and risk for renal injury have limited widespread use in burn centers.

Methods

Inclusion Criteria:
- Patients >18 years of age
- Admission to the University of Utah Burn Trauma ICU (BTICU) from June 1, 2014 to July 1, 2016
- Patients with >15% TBSA thermal injury requiring fluid resuscitation according to BTICU protocol
- High-dose ascorbic acid administration (defined as 66 mg/kg/hr) initiated during first 24 hours of fluid resuscitation

Exclusion Criteria:
- Patients who survived fewer than 48 hours
- Patients not resuscitated based on compassionate withdrawal of care
- Patients presenting > 10 hours from time of thermal injury
- Patients with documented renal insufficiency or renal failure (defined as admission creatinine >1.5 mg/dL or ESRD requiring hemodialysis)
- Pregnant or incarcerated patients

Statistical Analysis:
- Fisher’s exact test and Student’s T-test will be used for analysis of categorical and continuous data

Objectives

- Analyse the impact of high-dose ascorbic acid in reducing fluid requirement and the risk for renal injury during the first 24 hours of fluid resuscitation

Outcomes of Interest

Primary Outcomes:
- Determine the impact of high-dose ascorbic acid on total fluid requirements during the first 24 hours of fluid resuscitation
- Assess the risk for renal injury following high-dose ascorbic acid administration

Secondary Outcome:
- Evaluate the impact of high-dose ascorbic acid administration on all-cause mortality

Results

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>AA (31)</th>
<th>Control (31)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>24-hr fluid resuscitation</td>
<td>5.9 ± 2.9</td>
<td>5.1 ± 2.7</td>
<td>0.16</td>
</tr>
<tr>
<td>Renal injury</td>
<td>10</td>
<td>5</td>
<td>0.24</td>
</tr>
<tr>
<td>Mortality</td>
<td>8</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

Conclusions

- The addition of AA to fluid resuscitation with LR + albumin did not reduce 24-hour fluid requirements.
- Ascorbic acid did not statistically increase the risk for renal injury.
- Patients receiving AA may survive longer, but no difference in mortality versus LR + albumin alone.

References


All authors have no relevant conflicts of interest to report.

Figure 1

- University of Utah Burn Center Adult Fluid Resuscitation Protocol
- Initiate fluid resuscitation with LR at calculated starting rate
- Target UOP 30-50 mL/hr
- UOP >30 mL/hr for two hours
- Consider adding albumin at 1/3 of hourly LR rate
- UOP <15 mL/hr
- Failing resuscitation
- Consider adding ascorbic acid
- UOP >30 mL/hr
- UOP at goal for 2 hours and patient is >24 hours post-burn, change fluids to D5W NaCl 0.45% with KCl 20 mEq/L
- Fluid resuscitation complete
- Continue fluids at calculated maintenance rate

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