The Effectiveness of Lactated Ringers Solution Versus Normal Saline

Danis Davis  
*Cedarville University*, danisdavis@cedarville.edu

Sara Kochanowski  
*Cedarville University*, skochanowski@cedarville.edu

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The Effectiveness of Lactated Ringers Solution Verses Normal Saline

Danis Davis & Sara Kochanowski
Cedarville University School of Nursing

PATIENT CARE ISSUE

Background & Significance

In this review of literature we aim to determine which crystalloid solution would be the most beneficial and safe for:
- **Aim 1:** Patients experiencing shock due to hemorrhage
- **Aim 2:** Patients undergoing organ transplant or repair
- The choice of crystalloid solutions, such as Lactated Ringer’s solution or Normal Saline is under debate as to which should be used during specific scenarios to achieve safe fluid administration
- The purpose of this literature review to discover whether or not there was evidence to support fluid administration of either Normal Saline or Lactated Ringer’s in fluid resuscitation or during surgery.
- Table 1 gives a detailed description of the Normal Saline and Lactated Ringer’s solution contents as compared to blood
- Framework of the study: IOWA Model [2]

Table 1: Contents of human serum compared to normal saline and lactated ringers [1]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Human Serum</th>
<th>0.9% NaCl</th>
<th>Lactated Ringer’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na+ mmol/L</td>
<td>135-145</td>
<td>154</td>
<td>131</td>
</tr>
<tr>
<td>K+ mmol/L</td>
<td>3.5-5.3</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Ca2+ mmol/L</td>
<td>2.2-2.6</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Cl- mmol/L</td>
<td>95-105</td>
<td>154</td>
<td>111</td>
</tr>
<tr>
<td>HCO3- mmol/L</td>
<td>24-32</td>
<td>-</td>
<td>29</td>
</tr>
<tr>
<td>Albumin g/L</td>
<td>30-50</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pH</td>
<td>7.35-7.45</td>
<td>5.4</td>
<td>6.0</td>
</tr>
<tr>
<td>Osmolality</td>
<td>275-295</td>
<td>308</td>
<td>276</td>
</tr>
</tbody>
</table>

Question:
- **O:** Provide a better physiologic response to resuscitation or surgery [3]
- **C:** Compared with Normal Saline
- **EVIDENCE-BASED PRACTICE QUESTION**

EVIDENCE-BASED PRACTICE RECOMMENDATIONS

Considering the review of literature that we completed there was consensus to conclude that there is no protocol determined at this time.

RESULTS

The results of our research included:
- One level 1, four level 2, one level 3 and two level 7 research articles
- Five articles written in the past five years or less
- Three articles written over five years ago
- These articles were included because of their relativity to the review and high level of evidence

SYNTHESIS OF EVIDENCE

Aim 1 (Shock)

Outcomes
- **pH**
  - The findings concluded that Lactated Ringers is the better solution to give to avoid acidosis in patients experiencing shock. [4,5]
- **Oxygenation**
  - One study suggests that oxygenation is not affected by either solution during resuscitation in patients experiencing shock. [4]
- **Hemodynamics**
  - A hypercoagulable state can result when Lactated Ringers is given to resuscitate patients experiencing shock; this state may prove to be a positive protective symptom but could result in thrombolytic complication leading to readmission to the ED. [4,6]
- **Extravascular Lung water**
  - Lactated Ringers proves to result in lower levels of extravascular lung water. [4]

Aim 2 (Organ transplant/repair)

Outcomes
- **pH**
  - Normal Saline groups experienced more instances of metabolic acidosis and hyperchloremic acidosis than the Lactated Ringer’s group. [7,8,9]
  - Lactate, found in LR lowers acidosis due to the strong ion difference (SID) and by the conversion process of lactate into bicarbonate. [9]
- **Urine Output**
  - Increased levels of urine output in the LR group compared to the NS group. [7,8]
- **Hemodynamics**
  - NS groups required higher platelet transfusion rates than the LR groups, however, the LR group experienced rare but significant cases of hypercoagulability resulting in thrombosis. [7,8,9]
- **Hyperkalemia**
  - The serum potassium concentration exceeded 6.0 in 19% (5 out of 26) of the NS group members resulting in a hyperkalemic state. [8]

While most of the articles pointed to the solution of choice being Lactated Ringer’s over Normal Saline in the outcomes of pH, oxygenation, urine output, hyperkalemia and extravascular lung water the element of hypercoagulability remains as a potential problem with LR. This leaves the choice of solution up to the physician’s preference. There can be no protocol determined at this time.

METHODS

Eligibility Criteria
- Credible author
- Within 5 years old
- Knowledge of the topic
- Information Sources
  - Website searched: NephrologyNow
  - Interview: Registered Nurse and Pharmacist
  - Databases searched: Medline, PubMed and Cochrane Library
- Search Strategy
  - Key Words: “crystalloid solutions” “Normal Saline” “Lactated Ringers” “resuscitation” “renal transplantation” and “shock”

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REFERENCES