Fatigue during cardiac compression (CC) exercise using neonatal patient simulators

Diego Enriquez MD; Javier Meritano MD; Edgardo Szyld MD, MSc

SIMMER: Simulación Médica Roemmers. Olivos, Buenos Aires, Argentina; Maternidad Ramón Sarda. CABA, Argentina; OUHSC; Oklahoma City, Oklahoma, USA

BACKGROUND

- Adult, pediatric, and neonatal patient simulator studies have shown that CC performance quality decreases over time.
- The physical effort required to successfully perform CC in adolescents and adults is comparable to performing a demanding physical activity, such as running or high impact aerobics.
- Regular exercise can improve clinicians’ ability to deliver effective thoracic compressions.
- Both adult and pediatric resuscitation guidelines recommend that persons administering CC rotate every two minutes.
- This recommendation has not yet been incorporated into neonatal resuscitation guidelines.

OBJECTIVES

- Primary: To assess the impact of physical fatigue on the quality of cardiac compressions performed by pediatric healthcare providers, when applied in combination with ventilation on a neonatal simulator.
- Secondary: To evaluate the contribution of gender, body mass index (BMI), and regular physical exercise on caregiver fatigue during the simulation exercise.

METHODS

- Neonatal providers were instructed to administer CC as if they were performing an actual resuscitation on a live newborn patient.
- Participants were told to discontinue CC in the event of extreme fatigue, otherwise the procedure continued for 10 minutes.
- Oxygen Saturation and HR of the participants were measured.

RESULTS

- CC depth of one third of chest diameter was defined as adequate quality.
- 4 consecutive CC below target depth was considered as fatigue equivalent.
- A student-T test was used to evaluate continuous measures. Comparisons were made using a square Chi test, for all categorical data. A p < 0.05 significance value was used for all statistical tests.

METHODS cont.

- CC performance quality decreases frequently before 10 minutes on a neonatal simulator.
- Providers’ heart rate increased significantly after 10 minutes of CC administration.
- Fatigue was associated with both the lack of provider aerobic activity and provider obesity.
- These findings support the need for guidelines requiring frequent rotation of CC providers during prolonged neonatal resuscitation.

RESULTS cont.

40 subjects were enrolled: 25 females (62%) No exercise in the last 3 months: 17 (42%)

- Chest compression performance during 10 minutes

- Mean time for fatigue: 7.7 minutes (range 3.5-9)

- 52% Low Quality
- 48% Good Quality

- HR and saturation

<table>
<thead>
<tr>
<th>n total: 40</th>
<th>before</th>
<th>after</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR Mean (SD)</td>
<td>77.9 (14.2)</td>
<td>101.4 (17.3)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Saturation Mean (SD)</td>
<td>97.7 (2)</td>
<td>98 (0.9)</td>
<td>0.5444</td>
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</table>

- Gender, routine exercise and BMI association with fatigue

<table>
<thead>
<tr>
<th>N=40</th>
<th>NO FATIGUE 19 (48%)</th>
<th>FATIGUE 21 (52%)</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Female</td>
<td>11 (44.0)</td>
<td>14 (56.0)</td>
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<tr>
<td>Male</td>
<td>8 (53.3)</td>
<td>7 (46.7)</td>
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<tr>
<td>Routine Aerobic Activity (yes) N=23</td>
<td>14 (74)</td>
<td>9 (43)</td>
<td>0.0489</td>
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<tr>
<td>BMI normal</td>
<td>14 (60.9)</td>
<td>9 (39.1)</td>
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<tr>
<td>Overweight</td>
<td>5 (35.7)</td>
<td>9 (64.3)</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>0</td>
<td>3 (100)</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSIONS

- CC performance quality decreases frequently before 10 minutes on a neonatal simulator.
- Providers’ heart rate increased significantly after 10 minutes of CC administration.
- Fatigue was associated with both the lack of provider aerobic activity and provider obesity.
- These findings support the need for guidelines requiring frequent rotation of CC providers during prolonged neonatal resuscitation.