3-1999

Nebulized Nitroglycerin in Children with Pulmonary Hypertension Secondary to Congenital Heart Disease

Hatim Omar
University of Kentucky, hatim.omar@uky.edu

Fangqi Gong
Zhejiang Medical University, China

Mei Y. Sun
Zhejiang Medical University, China

Stanley Einzig
West Virginia University

Click here to let us know how access to this document benefits you.

Follow this and additional works at: https://uknowledge.uky.edu/pediatrics_facpub

Part of the Pediatrics Commons

Repository Citation
Omar, Hatim; Gong, Fangqi; Sun, Mei Y.; and Einzig, Stanley, "Nebulized Nitroglycerin in Children with Pulmonary Hypertension Secondary to Congenital Heart Disease" (1999). Pediatrics Faculty Publications. 152.
https://uknowledge.uky.edu/pediatrics_facpub/152

This Article is brought to you for free and open access by the Pediatrics at UKnowledge. It has been accepted for inclusion in Pediatrics Faculty Publications by an authorized administrator of UKnowledge. For more information, please contact UKnowledge@lsv.uky.edu.
Nebulized Nitroglycerin in Children with Pulmonary Hypertension Secondary to Congenital Heart Disease

Notes/Citation Information
Published in *The West Virginia Medical Journal*, v. 95, p. 74-75.

The copyright holder has granted permission for posting the article here.

This article is available at UKnowledge: https://uknowledge.uky.edu/pediatrics_facpub/152
Nebulized nitroglycerin in children with pulmonary hypertension secondary to congenital heart disease

HATIM A. OMAR, M.D.
Associate Professor and Director of Adolescent Medicine, University of Kentucky, Lexington; Former Assistant Professor of Adolescent Medicine, Department of Pediatrics, West Virginia University School of Medicine, Morgantown

FANGQI GONG, M.D.
Associate Professor, Zhejiang Medical University Children’s Hospital, Hangzhou, People’s Republic of China

MEI Y. SUN, M.D.
Professor, Zhejiang Medical University Children’s Hospital, Hangzhou, People’s Republic of China

STANLEY EINZIG, M.D., PH.D.
Professor, Pediatric Cardiology, West Virginia University, Department of Pediatrics, Morgantown

Abstract

Pulmonary hypertension continues to be a major cause of morbidity and mortality in the pediatric age group. One common cause of pulmonary hypertension is congenital heart disease, unless the congenital heart lesions are surgically corrected early in life (1).

Conventional therapy with mechanical ventilation is not always effective and use of intravenously administered vasodilators is limited because of the systemic effects, such as hypotension. Extracorporeal membrane oxygenation (ECMO) can be effective, but it is invasive and not feasible in small hospitals and rural areas. The discovery of the endothelium-derived relaxing factor (EDRF, 2) and its identification as nitric oxide (NO, 3) made it potentially possible to use inhaled NO for treatment of persistent pulmonary hypertension.

Reports of beneficial effects of inhaled NO in infants with persistent PHT (4), as well as in children with congenital heart disease (CHD, 5), are promising. Delivery of inhaled NO, however, requires special equipment (5,6) and may also be toxic.

Many rural areas in the U.S. and the world have no access to either ECMO or inhaled NO. Nitrovasodilators are believed to release NO during their metabolism (7) and thus their vasodilatory mechanism is similar to that of NO.

In this study, we sought to determine if nebulized nitroglycerine (NTG) can be effective in reducing pulmonary artery pressure without significant change in systemic BP in children with pulmonary hypertension secondary to CHD.

Methods

This study was approved by the Research Administration at Zhejiang Medical University Children’s Hospital and consent was obtained for each of the four children, ages 6 months to six years. These children were spontaneously breathing with uncorrected ventricular septal defect and severe PHT undergoing diagnostic cardiac catheterization.

Severe pulmonary hypertension was defined as pulmonary artery pressure at least half of systemic blood pressure (Table 1). Baseline pulmonary artery pressure, systemic blood pressure, oxygen saturation, and heart rate were measured. Each patient received 3 cc of nebulized normal saline (NS) as placebo control and these vital signs were recorded at 5 min intervals.
Next, each patient received a dose of 20 g per kilogram body weight of NTG in total volume of 3 cc NS nebulized and their vital signs were recorded at 5 min intervals.

**Results**

Nebulized NS failed to produce any changes in any of the patients. Nebulized NTG, on the other hand, significantly reduced pulmonary artery pressure without changing the systemic BP or heart rate (Table 2).

This study was terminated at the end of the catheterization procedure with no long-term follow-up.

**Discussion**

Treatment for severe PHT continues to be difficult and often is not successful, despite the promising role of nebulized NO and ECMO as well as other treatment modalities. The fact that the mechanism of action of nitrovasodilators involves metabolism to NO led us to investigate of their potential.

To study the potential benefits of nebulized NTG on PHT, we selected four stable patients undergoing a diagnostic procedure. The lack of effect of NS eliminated the possibility of a placebo effect when using NTG. The significant reduction of both systolic and mean pulmonary artery pressures is encouraging, knowing that patients with uncorrected VSD tend to have sustained high diastolic pressure which would not respond well to any treatment.

Administering nebulized NTG had no effect on systemic BP or heart rate, presumably because of the fast local metabolism and short half-life. This finding is also promising because of the limitations of any treatments associated with systemic effects.

**Conclusion**

Nebulized NTG appears to be an effective, easy to administer, inexpensive and safe alternative for treatment of severe PHT in children with CHD, especially in areas where other treatment modalities such as ECMO or inhaled NO are inaccessible.

Larger studies on similar patients and also on patients with different etiologies are needed to confirm our preliminary findings.

**Acknowledgement**

We thank Bertha Romine for her secretarial assistance.

**References**


**Table 1. Characteristics of the Four Pediatric Patients.**

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Diagnosis</th>
<th>Baseline PAP</th>
<th>Baseline BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>VSD</td>
<td>80/32</td>
<td>84/51</td>
</tr>
<tr>
<td>36</td>
<td>VSD</td>
<td>85/33</td>
<td>93/39</td>
</tr>
<tr>
<td>18</td>
<td>VSD</td>
<td>56/35</td>
<td>99/62</td>
</tr>
<tr>
<td>6</td>
<td>VSD</td>
<td>45/20</td>
<td>64/34</td>
</tr>
</tbody>
</table>

VSD = ventricular septal defect
PAP = pulmonary artery pressure
BP = blood pressure

**Table 2. Effects of Administration of Nebulized Nitroglycerine.**

<table>
<thead>
<tr>
<th>Before NTG</th>
<th>At 10 minutes</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPAP</td>
<td>68 ± 8</td>
<td>53 ± 6</td>
</tr>
<tr>
<td>MPAp</td>
<td>47 ± 4</td>
<td>38 ± 4</td>
</tr>
<tr>
<td>SBP</td>
<td>85 ± 8</td>
<td>88 ± 3</td>
</tr>
<tr>
<td>MBP</td>
<td>59 ± 6</td>
<td>63 ± 4</td>
</tr>
<tr>
<td>HR</td>
<td>131 ± 8</td>
<td>127 ± 7</td>
</tr>
</tbody>
</table>

SPAP = systolic pulmonary artery pressure
MPAP = mean pulmonary artery pressure
SBP = systolic blood pressure
MBP = mean blood pressure
HR = heart rate