SKIN-TO-SKIN CARE FOR MANAGING
CONGESTIVE HEART FAILURE IN INFANTS WITH
CONGENITAL HEART DISEASE

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Abstract

Background: The growing evidence of the benefits of skin to skin (STS) care shown by
different studies has encouraged us to study the possibility of introducing this technique as
part of the management in babies with CHD.

Aim: The aim of this study was to examine the effect of STS care during breastfeeding and
artificial feeding on the vital signs of babies with congenital heart disease admitted to
hospital with heart failure.

Methods: Fifty five infants under one year with congenital heart disease were divided
according their mode of feeding into 19 exclusively breastfed, 21 formula fed and 15
mixed fed for comparison. Their oxygen saturations (P0\textsubscript{2}), heart rate (HR) and respiratory
rates (RR) were monitored before and during a session of feeding, then measured again
after a period of STS care by the mother. The anxiety state of the mother was measured
also before and after feeding with STS care using the STAI test fo anxiety state.

Results: Babies who were breastfeeding exhibited significantly higher levels of P0\textsubscript{2} at start
of the feed than the formula fed ones and it continued to rise decreasing at about 8 minutes
then rising again at the end of the feed. The P0\textsubscript{2} of formula fed did not rise during a feed
and fell at 6 minutes. The P0\textsubscript{2} patterns improved with STS and remained stable and high in
both breastfed and formula fed, but remained statistically significantly higher in the
breastfed. HR initially rose than decreased to physiological levels in both breastfed and
formula fed but decreased with STS. The anxiety state of mothers who were formula
feeding was moderately high among the breastfed but moderately and severely high among
formula fed.
**Conclusion:** Contrary to the faulty misperception that formula feeding is safe, it appears that it is more stressful for babies with congenital heart diseases and heart failure. Breastfeeding is far superior and should be encouraged as the ideal mode of feeding that assists in recovery. STS care helps to decrease anxiety state of mother and probably has the same effect on babies irrespective of the mode of feeding and is recommended to be used as an adjunct in the treatment of these cases to hasten recovery and reduce refractory heart failure.

**Introduction**

The benefits of skin to skin (STS) care for babies is attracting much attention since the discovery of its beneficial effects on the growth and development of preterm babies by the workers in Colombo in the early 1980s \(^{(13,14)}\). STS care has been shown to stabilize the heart rates and respiration of preterm infants as well as to improve their oxygen saturation \(^{(1,2,3,4,6,10,27)}\). Infants with congenital heart disease (CHD) are particularly prone to oxygen desaturation, rapid heart rate and respiratory distress with repeated heart failure (HF) that is sometimes refractory to treatment. Bottle-feeding was previously recommended for these babies because it was assumed that it needed less effort unlike breastfeeding \(^{(4)}\). However many other workers have shown that oxygen saturations improve with breastfeeding \(^{(27)}\). Moreover many workers have shown that breastfed babies gain weight faster and have shorter hospital stays and are protected from severe disease \(^{(9, 11, 12, 16, 28, 29)}\). STS care has many benefits and can even reduce mortality \(^{(13)}\). Hence combining breastfeeding with STS care during the care of a child with congestive heart failure due to CHD can be very beneficial for these babies. This practice may also be prophylactic by reducing exposure to infective episodes that may precipitate heart failure and thus decrease their exposure to repeated stressful unnecessary costly and painful hospitalizations.

The mechanism whereby breastfeeding improves oxygenation and weight gain is not understood. Moreover since babies with CHD and heart failure are under great stress, STS as method for allaying pain and anxiety and grief may be useful for both mothers and babies \(^{(17,19,20,21)}\).
Hence it was the aim of this study to identify the patterns of feeding of these infants on breast versus on bottle by examining the effect of skin-to-skin care on the baby's vital signs during breastfeeding and during bottle feeding. Since many of these mothers who have sick babies have high levels of anxiety that can affect their coping and their ability to care for these babies, we also examined how STS care would affect mother's anxiety state and whether the mode of feeding also influenced her anxiety and in turn the health and well being of her baby.

**Subjects and Methods**

This is a non randomized controlled trial for assessing the effect of STS care on the vital signs on infant with heart failure according to the mode of feeding.

**Sample** The study was conducted on 55 babies with congenital heart disease; 33 male and 22 female aged from a few weeks up to 2 years .They were grouped as 15 control (mixed fed), 19 exclusively breastfed and 21 artificially fed babies.

**Dropouts:** From the study 2 patients were under I.V. line medication and 3 patient's mother refuses to do STS care.

**Duration of study** The clinical work was conducted over a period of about two years from 2008 to 2010 and from 10/2010 to present time data compilation, statistical analysis, drafting and revision

**Site** The study was done in Cardiac Ward, of Abu El Reesh Pediatric University hospital, of Cairo University Hospitals.

**Selection criteria:** infants included were under 12 months of age hospitalized for heart failure, almost fully breastfeeding in the first six months and received foods after 7 months with continued breastfeeding or received infant milk formula before six months and were then only on formula or other milks feeding. They received medication for heart failure. They were neither exposed to operative procedure nor operative procedure with residual cardiac dysfunction necessitating treatment.

**In the intervention groups we excluded** infants with heart failure due to any other cause, other than congenital anomalies apart from heart defect, neurological disease, mother sickness or severely malnourished. Also infants with CHD that was totally corrected and heart failure is secondary to chest infection or other cause than heart.

**Predesigned questionnaires** including a full history, including mother's antenatal history, perinatal history, postnatal history for both mothers and babies, feeding history, vaccination history and morbidity and allergic history.
Psychometry was done for the mother using the STAI test: This is a test which was designed to assess two different parameters; state of anxiety and trait anxiety by self assessment. The study used the parameter of state anxiety which assesses the mother’s feeling at a particular moment in the time of examination. It was done before doing STS care and after doing it. The test is composed of 20 questions which are answered by the mother and the results were scored according to the scoring system of the test.

Pulse oximeter: was used to measure the oxygen saturation of the babies. It measures the oxygen saturation of the blood hemoglobin in the tissue capillary by transmitting a beam of light through tissue to a receiver. As the amount of saturated hemoglobin alters the wave length of the transmitted light, analysis of the received light is transmitted into percentage of oxygen saturation of the blood. Normal range is 95-100 nanometer.

Assessment of the baby: All infants were admitted for one day and assessed as follow:- weight to nearest gram, supine height to nearest mm and body mass index, head circumference on cms. The vital signs including temperature.PaO₂ saturation, heart rate (H.R), respiratory rate (RR) were recorded just before the feeding, every min. during feeding and in the last 5 minutes. after feeding (without STS). This was followed by a session of Skin to skin care with baby wearing only a diaper and a head cap and placed in prone and bent in an upright position onto mother’s bare chest secured by a strip of cloth in a manner that extends the baby’s head and neck to prevent apnea. The mother wears a shirt or hospital gown with opening to the front. The cloth wraps around and under the baby’s bottom to support the baby in a flexed position.

Statistics: Data was statistically analyzed using SPSS (statistical package for social science) program version 13 for windows and for all the analysis a p value < 0.05 was considered statistically significant: Data are shown as mean, range or value and 95 confidence interval (95 CI) and frequency and percent. Chi square test was done for qualitative variable analysis and p-value < 0.05 was considered significant. Student t-test was done for normally distributed quantitative variables to measure mean and standard deviation and p-value < 0.05 was considered significant. Mann-Whitney test was done for quantitative variables which are not normally distributed and p-value < 0.05 was considered significant. ANOVA test was done to compare three variables; one qualitative variable and the
other two are quantitative variables of normally distributed variables and p-value < 0.05 was considered significant to detect mean and standard deviation where post hoc tests done to detect the relationship between variables within groups. **Kruskal-Wallis test** was done to compare three or more variables. **LSD test** is a post hoc test it was done to variables of significant difference of more than two groups of normally distributed data after ANOVA test to detect the significant difference between either groups. **Repeated measures ANOVA test** was performed to differentiate changes in different follow up results of normally distributed studied variables and p-value < 0.05 was considered significant. All data are tested with Kolmogorov-Smirnov Z test and most of them were found normally distributed and presented with mean ± SD.

**Ethical considerations**: Consent was taken from the authority of the Hospital of Cairo University to practice the study work. An oral consent was taken from the mother undergone the study. A full explanation was said to each mother of the study about the procedures done, how to do it, why to do, benefits, hazards and their outcome.

**Results**

Analysis of the cases by groups showed that a mean age of 9.57±5.04 for the control group, 4.55±2.81 and 4.32±1.5 for the exclusively breastfed (group I) and artificially fed (group II) cases respectively. Males constituted (13, 8 and 13) of the three consecutive study groups, compared to 3, 11 and 8 females. Mothers' age fell between 20 to 39 years in 86.6% of control cases, 89.5% in group I and 81% in group III. Most of the mothers under 19 years of age were formula feeding (14.3) (P>0.05). Most of the breastfeeding mothers came from rural areas (63.2%), while most of the formula feeding mothers came from urban areas (7.4%), the difference was statistically significant at P<0.5. There was some degree of consanguinity in all cases but mostly third degree.

Age of diagnosis ranged from 7.67±6, 10.7±8.2 NS 9.28±5.5 weeks in each of the control, groups I and II respectively.

Table (1) shows the distribution of health problems encountered in the babies by study group. Respiratory infections were higher among formula fed but the difference was not significant. Other problems were similar in all groups.

Figure (1) shows the distribution of cases according to the diagnosis.
Figure (2) shows a statistically significant increase followed by a decrease in heart rate within normal value, and increase in oxygen saturation in both breastfed and formula fed groups exposed to STS care in comparison to the group that was not exposed to STS care. We found that heart rate decrease was within the normal physiological range in both groups. However the breastfed group showed a lower decrement than that of the formula fed group.

Table (3) shows that mothers who practiced STS care whether breastfeeding or formula feeding had a significant decrease in their anxiety score when compared to mothers who did not practice. Moreover when STAI was measured before and after a STS care session, there was considerable reduction in the anxiety state in both breastfed and artificially fed babies. Severe and very severe states of anxiety were much higher among the formula feeding mothers compared to the exclusively breastfed mothers.

Table (3) and Figure (1 and 2) shows a statistically significant difference in oxygen saturation during feeding session and at 10 minutes after feeding in both groups. In the breastfeeding group oxygen saturation did not decrease below 90 while formula fed babies scored lower results.

Table (4) and Figure (3) shows a significant difference in heart rate between breastfed group and formula fed group with the mean heart rate of the breast fed babies lower than that of formula fed babies.

**Discussion**

Skin to skin (STS) care introduced as an intervention to measure its efficacy in improving the response of the infants with heart failure to medical treatment showed interesting findings in our study. We found that oxygen saturation was characteristically higher among the breastfed compared to the artificially fed. This is was in agreement with the findings of other workers (5, 6, 10, 27).

When these infants were exposed to breastfeeding we found a statistically significant initial increase followed by a decrease in heart rate (HR), especially with STS care, although the decrease was within physiological ranges. These changes corresponded to an increase in oxygen saturation in both breastfed and formula fed groups augmented by exposure to STS in comparison to the group that was not exposed to STS care. However the breastfed group showed a lower decrement in HR than that of the formula fed group. This indicates that
because breastfeeding is an active and physiological process, it enables the baby to self regulate and to stop feeding to stabilize the HR or RR then go back to breastfeeding. On the contrary we found that the HR continued to rise in the bottle fed babies probably predisposing them to refractory heart failure and exposure to more medications to control the failure.

These results agree with who mentioned that heart rate increased initially breastfeeding then decreased during the STS care session. However the increase in the heart rate was within the normal physiological range

\(^{(2, 6, 7, 8)}\).

In our study, we found that all mothers had moderately elevated anxiety scores but breastfeeding mothers had overall better levels of anxiety than bottle fed. The practice of STS in both the breastfeeding or formula feeding mothers resulted in a significant decrease in their anxiety score when compared to mothers who did not practice. Moreover when STAI was measured before and after STS care, there was considerable reduction in the anxiety state in both breastfed and artificially fed babies. This indicates that STS care had an effect on mother's psychological state that was independent of the mode of feeding and that was empowering her to cope with the stress of watching her baby suffer. Many workers have introduced different methods for assisting the parents to cope with the stress of having a sick baby \(^{(32,33,34)}\). However this study demonstrates that STS care can be useful in allying the suffering of parents and thereby improving their coping abilities.

Our study showed an even better psychological state (less anxiety score) among mothers who practiced STS care with breastfeeding in comparison with mothers who practiced STS care with formula feeding, which indicate that breastfeeding has an additive or augmentative and synergistic effect on the emotional state of mothers. This could be due to the effect of STS care on reducing maternal stress hormones especially cortisol and ACTH and increasing oxytocin and endorphins that relax and stabilize mothers mood \(^{(7,17,19)}\).

The study demonstrated a statistically significant rise in oxygen saturation during feeding session and at 10 minutes after feeding in the breastfed that decreased then increased while it
tended to decrease in the bottle fed. In the breastfeeding group oxygen saturation did not decrease below 90 while formula fed babies it did. Such a finding indicates that a breastfed baby has the ability to self regulate its vital signs during a breastfeeding session, unlike the formula fed \(^{(8,25,26)}\).

This could be explained by the high content of endorphin identified in breastmilk that can have a role in sedating the baby and normalizing the vital signs hence hastening recovery. Suckling itself is sedating to the infant. This is not the case for formula fed\(^{(20,21)}\).

STS care on the other and tends to increase the baby's ability to self regulate in both breastfed and non breastfed, probably by decreasing the stressful effects bottle feeding has on the baby, in the same way it was able to decrease the anxiety state of the mothers .\(^{(21,23,31,32)}\).

We conclude that STS care is shown to be an effective, efficient, acceptable, safe, affordable cost effective method for caring for infants with CHD with HF and can be used as adjunctive to ordinary medical treatment and can be very costly in our health care system.

References


negative consequences of "the stress of being born": a study on temperature in newborn infants, subjected to different ward routines in St. Petersburg. Acta Paediatr; 92(3):272-3.


Table (1): Comparing anxiety state of mothers of infants according to mode of feeding of the group under study by frequency distribution and chi-square

<table>
<thead>
<tr>
<th>p-value between groups compared with (X^2) test</th>
<th>p-Value</th>
<th>(X^2) test</th>
<th>Artificial feeding and STS care ((N=21))</th>
<th>Exclusive breastfeeding and STS care ((N=19))</th>
<th>Control group ((N=15))</th>
</tr>
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<tbody>
<tr>
<td>P1= &lt;0.05*</td>
<td>&lt;0.05*</td>
<td>18.8</td>
<td>1 4.8</td>
<td>0 0.0</td>
<td>3 20.0</td>
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<tr>
<td>P2= &gt; 0.05</td>
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<td>1 5.3</td>
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<td>P3= &gt; 0.05</td>
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<td>11 52.4</td>
<td>13 68.4</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>8 38.1</td>
<td>3 15.8</td>
<td>5 33.4</td>
</tr>
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<td></td>
<td></td>
<td>1 4.8</td>
<td>2 10.5</td>
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<td></td>
<td></td>
<td></td>
<td><strong>21 100.0</strong></td>
<td><strong>19 100.0</strong></td>
<td><strong>15 100</strong></td>
</tr>
</tbody>
</table>

P1= between control and exclusive breastfeeding with STS care group
P2= between control and artificial feeding with STS care group

Figure (1): Distribution of the type of diagnosed congenital heart defect in the studied groups.
Table (2): Comparison of mean and standard deviation SD of vital signs in the study groups

<table>
<thead>
<tr>
<th>LS D post Hoc p-value</th>
<th>p-Value</th>
<th>ANOVA test</th>
<th>Artificial feeding and STS care group (N=21) Mean ± SD</th>
<th>Exclusive breast feeding and STS care group (N=19) Mean ± SD</th>
<th>Control group (N=15) Mean ± SD</th>
<th>Studied variables</th>
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<td>&gt; 0.05</td>
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<td>141.09 ± 12.11</td>
<td>136.7 ± 16.99</td>
<td>141.8 ± 29.6</td>
<td>Heart rate</td>
</tr>
<tr>
<td>&gt; 0.05</td>
<td>0.73</td>
<td></td>
<td>49.7 ± 7.79</td>
<td>51.95 ± 11.32</td>
<td>47.6 ± 12.46</td>
<td>Respiratory rate</td>
</tr>
<tr>
<td>P1= 0.05*</td>
<td>&lt; 0.05*</td>
<td>3.39</td>
<td>90.24 ± 12.07</td>
<td>93.5 ± 8.2</td>
<td>83.07 ± 14.65</td>
<td>Oxygen saturation</td>
</tr>
</tbody>
</table>

Kruskal Wallis test

Figure (2): Comparing heart rate (HR) during 10 minutes of feeding the babies in the groups under study.
Figure (3): Comparing mean and SD of PO$_2$ over 10 minutes of feeding the babies in the groups under study.

Figure (4): Comparing mean and SD of PO$_2$ before, over 5 minutes and after STS in the groups under study.
Figure (5): Comparing mean and SD of heart rate (HR) before, over 5 minutes and after STS in the groups under study.
أهمية وضع الطفل الجلد للجلد عند التعامل مع حالات فشل القلب الاحتفائي

المقدمة: التدخلات الحديثة لإستخدام وضع الإحتضان الجلد للجلد شجعنا على دراسة احتمالية تقديم هذه التقنية كجزء من التعامل مع حالات الربح الكلقي في القلب.

الهدف: الهدف من الدراسة هو طرح تأثير وضع الطفل الجلد للجلد أثناء الرضاعة الطبيعية والتغذية الصناعية والتأثير ذلك على العلامات الحيوية في الأطفال المحتضنين بالمستشفى. ونتيجة تأثير الطفل الجلد للجلد في القلب.

طرق البحث: تم تقسيم 55 طفل تحت عمر سنة مصابين بعيوب خلقية في القلب إلى مجموعات تبعا لطريقة التغذية: 19 طفل رضى الام طبيعيا و 21 طفل رضى الصناعية. وتم قياس النبض ومعدل التنفس قبل وبعد جلسة التغذية، ثم تم قياس قيمة النبض ومعدل التنفس قبل وبعد جلسة التغذية، ثم قياس حالة التوتر الام قبل وبعد الرضاعة.

النتائج: الأطفال الذين تم رضاعتهم طبيعيا أظهروا تشبع إكسجينيا أكثر بكثير في بداية الرضاعة مقارنة بالاطفال الذين رضوا الصناعيا. وانتقل التشبع الإكسجيني يتغير في الزيادة ثم نقص في الحالات التي رضعت طبيعيا، وaminsa يظل في حالات وضع الطفل الجلد للجلد.

الخلاصة: على عكس الاعتقاد الخاطئ أن التغذية بزجاجة الإرضاع الصناعي أمنة، فإنها تسبب ضغوطا على الأطفال في حالات فشل القلب الاحتفائي. ونتيجة تشديدها لتغذية الأطفال، فإن القدرة على تغذية الطفل الطبيعيا يحتاج إلى استخدام تقنية الإحتمالات والمراقبة. وتشجيعها كنموذج مثالي للتغذية لما يساعد على إعادة التغذية الصناعية والانتقادات الطبيعية ويتطلب وضع الطفل الجلد على تقليل حالة التوتر لدى الأم، وقد يكون له نفس الأثر على الأطفال، بالإضافة إلى بعض النظر عن طريقة التعامل والتحفيز باستخدامه كمساعد في علاج هذه الحالات تعجيل الشفاء وتحقيق حدوث هبوط القلب المتغير.