

REVIEW ARTICLE

Benefits of skin-to-skin contact during the neonatal period: Governed by epigenetic mechanisms?

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Abstract The perinatal period experiences are important for later life physiology. Prematurely born babies have been shown to benefit from close contact with their mothers, and evidence suggests that epigenetic mechanisms are involved in these early imprints. This mini review is summarizing current praxis and discusses the need for more and larger studies. Copyright © 2018, Chongqing Medical University. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Benefits of skin-to-skin contact during the neonatal period: Governed by epigenetic mechanisms?

Immediately at birth, the preterm infant needs support through the transition from the *intrauterine* environment to the very different *extrauterine* life. During the first 24 h after delivery the neonate experiences the most vulnerable period, since major physiological adjustments are required for survival.¹ During this initial phase, the infant may need support in establishing regular breathing,

and maintaining normal body temperature and blood glucose levels to avoid potentially life-threatening situations.² Methods for initial stabilization of the preterm infant include ventilation, provision of oxygen and intravenous nutrition and temperature regulation through radiant warmers, warm beds or incubators.² Kangaroo mother care (KMC) or skin-to-skin contact (SSC) is a successful way of caring for stable low-birth-weight infants, by placing the naked baby on the mother's chest. Despite its well documented benefits and recommendations by WHO it is not always implemented for stable newborns. Currently there is no large well documented study supporting immediate kangaroo mother care (iKMC) for unstable infants. A Cochrane review concludes, however, that the use of immediate SSC promotes breastfeeding, although larger studies are necessary to confirm physiological benefits.³

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Background of skin-to-skin contact

In 1988 Bergman et al performed a study in a Zimbabwe hospital, where there was no equipment for caring for neonates, and no referral facilities.⁴ Survival of infants between 1000 and 1500 g had been as low as 10% in the previous 4-year period. Based on literature available on Kangaroo Mother Care (KMC) from Colombia, a modification of this intervention was started as care for low birth weight infants. Continuous skin-to-skin contact was initiated from birth or from admission in all low birth weight infants. The infants were breastfed or fed by a nasogastric tube and given prophylactic antibiotics. The overall survival of babies 1000 g–1500 g improved dramatically from the above 10%–50%, and survival of infants 1500 g–2000 g improved from 70% to 90%, see Fig. 1. In another study, a randomized control study, stable neonates with birth weight 1200–2199 g were either assigned SSC or conventional care.⁵ Temperature and cardio-respiratory scores were monitored during 6 h after birth. At 6 h, 100% of the SSC group showed perfect stability scores, compared to 46% of the conventional care group.

Current SSC practice

In addition to increased survival, SSC of low birth weight infants is reported to have important effects including increased breastfeeding and better mother-infant bonding in comparison to conventional care (incubators) with parent-infant separation.⁶ The immediate SSC has also a positive effect on children delivered with cesarean section. A recent study investigated if immediate SSC after cesarean birth had an effect of the transfer rate of newborns to the neonatal intensive care unit (NICU) for observation.⁷ A significant reduction was found, reducing the number from 5.6%–1.75%. These new care routines are not only important for the patient's wellbeing but also for improving health economics.

To date SSC is hardly ever implemented for newborns who are clinically *unstable* due to prematurity or other illness. Such infants are routinely separated from the parents in incubators, warm beds or "hot rooms", often for

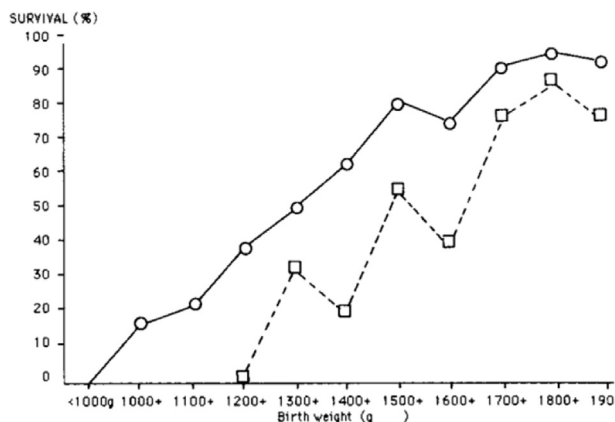


Figure 1 Survival according to birth weight, figure from Bergman et al. *Trop Doct* 1994. Circle (○) represents survival rate of babies in KMC and squares (□) represents survival of babies without/before KMC intervention.

long periods of time. One small randomized control study, by Worku et al, has implemented immediate/early KMC before stabilization of low birthweight infants. This trial showed a lower mortality of the KMC children and the survival for the preterm low birthweight infants was significantly better for the early KMC group than the babies in the conventional method.⁸ Modern neuroscience recognizes that early development of the brain is dependent on sensory experience of positive maternal stimulations, even at early fetal stages,⁹ and this adaptation is likely mediated through epigenetic changes. Preterm birth and low birth weight are known to be associated with an increased risk of psychiatric disorders, most commonly mood and anxiety disturbances.^{10,11} Swedish reports, using national registers, verified that individuals being born with a very low birth weight or prematurely are more likely to be hospitalized with a diagnosis of psychiatric disorders, i.e. psychosis, bipolar affective disorder, depression and eating disorder.^{12,13} In other words, this particular risk group may be in extra need of SSC to avoid the stress exposure of separation. However, there are only a few small studies showing SSC suitability for unstable infants,^{14,15} and more data are needed to make SSC praxis. A large randomized control trial, organized by WHO, has just launched to investigate SSC vs. conventional care in separation of unstable premature/low birth weight infants, with mortality as primary outcome, to establish guidelines.

There are no mechanistic data of the positive effects of SSC, but it may improve stabilization by supporting intrinsic maternal-neonate regulation that promotes neonatal physiological functions and attenuating potentially harmful autonomic-neuroendocrine stress responses. Lowered and harmonized cortisol levels have been measured at mildly stressful situations-e.g. at bath or still-face test-in SSC treated babies compared to conventional care.¹⁶ Further, a long term study conducted by Feldman et al showed remarkably results; SSC increased autonomic functioning of the infant in addition to maternal attachment behavior in the postpartum period. Additionally, a reduced maternal anxiety and an enhanced child cognitive development and executive functions were detected in measures from 6 months to 10 years. By age 10, children who received SSC showed an improved stress-resilience and better cognitive control.¹⁷ Recently Moors et al reported that children receiving low amount of contact with their mothers, displayed an altered methylation profile than those of high contact, 4–5 years later. This indicates that early postnatal contact can have long lasting impact.¹⁸

The benefits of SSC is well documented, but there is a need for a large well-controlled trial to test the effect of immediate SSC of unstable preterm/SGA (small for gestational age) neonates on neonatal physiological function, and further to investigate the mechanisms, likely epigenetic gene regulation, mediating its effects on developmental disability and long-term neurodevelopmental outcome. Such studies can identify early risk factors that are modifiable, laying the grounds for preventive strategies for improved public health.

Conflicts of interest

None.

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