

A bird's eye view of early intervention: Past, present, future

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Neonatal Mortality in India

Neonatal mortality is the key indicator of national new-born care, and it directly reflects prenatal, perinatal, and postnatal care. The Neonatal Mortality Rate (NMR), defined as infant death before 29 days postnatally, in India is amongst the highest in the world, especially in rural India. This is basically due to unavailability of quality neonatal care and trained manpower at the grass root level. Despite a decline in the overall infant mortality rate (IMR) across the world, neonatal mortality in India has been more or less static over the last few years, indicating that the proportion of infant deaths that occur during the neonatal period has typically increased. The last reported NMR in 2012 by the United Nations inter-agency group for child mortality was 32 per 1000 live births. IMR in India, last measured in January 2013, was 43.8.1 (World Bank report published in 2012, developed by UNICEF, WHO, World Bank, UN DESA Population Division www.childmortality.org).

Neonatal Morbidity in India

Advances in perinatal and neonatal medicine have resulted in an increase in the number of preterm and extreme preterm babies and of high risk babies who survive the neonatal period. This survival in turn, is a major cause for increased neonatal and infant morbidity. Preterm births are the leading cause of perinatal mortality and morbidity across the world. According to global estimates, preterm births (28%), severe infections (36%), complications of asphyxia (23%), tetanus (7%), and diarrhea (3%) account for most neonatal deaths and morbidity. India has a huge burden of preterm deliveries and HIE.

The past - Early Intervention – Conventional Role

The diagnosis was done by the pediatrician. It could be late diagnosis or late identification of associated comorbidities. Intervention included conventional and varied quality of therapy for the child. The team for intervention comprised of pediatrician, physiotherapist, occupational therapist and speech therapist.

The present - Evolutionary phase of Early Intervention

We start from the NICU. The term 'early' got a new definition. High risk new born is the target. We work on a damaged brain, focusing on maximizing the

neuroplasticity process. It is a multi-disciplinary approach and we have many tools for early identification.

How is early intervention defined?

Early intervention is a system of coordinated services that promotes the child's age-appropriate growth and development and supports the family during the critical early stages of the newborn's life.

What are the goals of early intervention?

The primary purpose of early intervention is to lessen the effects of the disability or delay. Services are designed to identify and meet a child's needs in five developmental areas, including: physical development, cognitive development, communication, social or emotional development, and adaptive development. Goals change from NICU to the first 3 years of life.

What are the aims of early intervention?

Physiological stability, attachment and bonding, increased oral feeding, improved motor function and improved weight gain.

Guidelines of NICU Care

Chest physiotherapy has evolved as an integral part of management of ventilated neonates. Endotracheal intubation (prolonged or repeated) and mechanical ventilation cause trauma and inflammation of airways and thus contributes to respiratory complications.

The NICU is a high-risk environment, exposing the infant to inappropriate and intense sound and light. Environmental adaptations like dimming the light, placing the crib in a quiet place, or placing stuffed toys to modify the environment is critical. The therapist should gradually introduce sensory stimuli, allowing the baby sufficient time to react.

Babies in the NICU often have limitations in their positioning due to attachments to life support systems, monitoring equipment, or low tone. The child must be positioned to promote visual and motoric interaction with the environment. Positioning of the baby is important to provide postural and self-regulatory support that normalizes sensory-motor experience while accommodating the constraints of medical environment. The therapist has to assess the positioning to avoid contractures, flattening of the skull, and to promote flexion, midline orientation, and body symmetry to prevent the formation of iatrogenic musculoskeletal

abnormalities. Different bolsters, cushions, and soft splints are used to achieve a position of physiological flexion.

In India, swaddling, the most common way of handling newborns, is very useful to facilitate self-quietening and behavioral organization. A baby that is medically stable or nearing term can be handled more appropriately and at more regular intervals so that transition from NICU to home becomes easy. Therapists need to grade touch and handling according to each infant's response. It should provide support and containment. Goals of handling are to reduce hyperextension of the neck and trunk, elevation of shoulders, retraction of the scapulae, and extension of the lower extremities, and to facilitate flexion. Handling also promotes typical patterns of movement like hand to mouth and reciprocal kicking. Techniques of gentle massage and myofascial release can also be soothing to babies and help regulate arousal.

The important task of empowering the parents about their baby is the role of the physical therapists, just as it is of the other team members. The immediate period after birth is the most sensitive time for bonding with babies. Bonding is essential for a baby's emotional and educational development. Mothers are educated about the importance of eye contact, smiling, talking, singing, touching, and cuddling. We also teach them skin to skin bonding with techniques such as kangaroo care. The correct positions for feeding are explained to the mother. Techniques of swaddling and nesting are taught to be followed after discharge from the hospital. New mothers are also guided about how to soothe their babies when there are difficulties with self-regulation. We also educate the parents about motor development and red flags to detect any developmental delays. This is done by showing them pictures and giving them check lists.

Once ready for a discharge, these babies are given what we call as a passport status and they are called for follow-up to an Early Intervention OPD, once a week. This is a multidisciplinary consultation where the babies are examined by a neonatologist, a pediatrician, a pediatric neurologist, a physical therapist, an occupational therapist, and a speech therapist. During this consultation, the therapists further screen the babies using the Test of Infant Motor Performance and the Alberta Infant Motor Scale. Upon discussion, further plans of action for each baby are designed. If required, necessary referrals are also done, ie. ophthalmological or auditory evaluations.

What type of interventions will best show improvements? What is the evidence?

Active Movements - Lee. J of Phys Ther Sci, 2017

Passive movements - Valizadeh et al. J Caring Sci, 2017

Multimodal Parent – Medoff-Cooper et al. Adv Neonatal Care. 2015

Infant Task specific enriched Environment - Campbell et al. J Pediatr Rehab Med 2012
Massage

Neuroplasticity

From birth to 3 years, the brain size and the brain grows rapidly. Newborn has 100 billion neurones, 2,500 synapses per neuron and 15,000 synapses per neuron by 2 - 3 years. At 3 months, in the baby's 'plastic brain' synapse development peaks for motor skills, vision and hearing. (Chapparo, 2013; Doidge, 2007)

What's new as far as neo-natal care?

Prevention or limiting brain damage

We identify at antenatal level and the delivery level. We identify the high risk mother and intervene antenatally and prevent primary brain damage 'Natal' means intervene within hours of delivery to prevent secondary brain damage. The main aim is to utilize maximum neuroplasticity of the newborn brain in early infancy.

Parent-child interaction

Parent of preterm infants' experience: Positive emotions like, love, amazement, happiness, closeness and relief. Attachment and Bonding -immature expressions, poor self-regulation, reduced capacity for social interaction. This also has psychological effects on the parent in the form of stress, anxiety, guilt, and mental health issues like depression.

The Future – where are we going?

Technology – what's on the horizon -range from low to high cost options, low cost assistive technology, clothing (Lobo MA.), social media and family empowerment, video games and virtual reality (www.atinnh.org) -A software system (x-box, Kinect, Nintendo, Wi) that produces simulations of real or imagined settings; in which participants interact using a remote control device (passive) and/or their own movements (active). Client motivation, therapist knowledge and management support were positive facilitators as per Levac et al (2017), Robotics-Go Baby Go, Self Initiated Prone Progressive Crawler, WREX: Wilmington Robotic Exoskeleton Arm, Arms for Angels

Physiological Interventions • NICU Interventions to promote stability

Neuroprotection Intervention: are a few names telling us about the advances in the field of resources available for the high- risk neonates and their parents

Systemic Hypothermia: a well established protocol which is based on on long term safety and efficacy, identifying the right candidate; (Shankaran et al, 2016). hypothermia for neonatal HIE: NICHD Neonatal research: seminal of perinatology: 2016) hypothermia in low resource settings-equipment/cost: instead of cooling blanket (Rs 5 lacs) or cool cap (Rs 35 lacs) re-

usable 3-5 cloth-covered ice-packs; Re-usable rectal probes Total cost ~ Rs 900 / patient

Medical Interventions/Therapies: Magnesium ($MgSO_4$) has been seen to block preterm labor. Recent studies show $MgSO_4$ given in pregnancies with fetuses <30 wks gestation, LD 4g over 20-30mins, followed by 1g/hr for 24 hrs after 12 hrs reduced death and disability rate by 50%. (Constantine et al, 2007) (NEJM 2008, GynecobstFertil 2008, BJOG 2007, Cochrane database 2007); Late Umbilical cord clamping (Als et al, 2004. *Pediatr*, 2004)

Parent Training: Interventions to support-infant interactions

Take Home Messages

Early Intervention for infants is not a new concept! Despite difficulty in demonstrating long- lasting benefits of early intervention, early interventions for high risk infants are important.

Greater care must be taken to identify the infants who will derive the greatest benefit from intervention.

Empower parent-child relationship.

Explore today's technology and products for inspiration.

Conclusion

1. We in India are the largest contributor to the burden of prematurity
2. We still lack adequate facilities in large parts of our country
3. Early intervention is slowly shifting to earlier times
4. From infancy to the NICU. And now to the antenatal and natal period.
5. Prevention is always better than cure. Prevention starts before conception
6. Maximize the benefits of neuroplasticity.
7. Little extra care in the newborn period can change the life of the patient and their family!!

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