

Concepts of Early Intervention for High Risk Babies

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Abstract

The advances in technology and quality of care have significantly improved the survival rates of high risk newborns. The neuro-developmental impairment has been on the rise. Prevention, early detection and early intervention have been the options which hold potential for improving neuro-developmental outcomes of babies with such impairments. The evidence of impact of early intervention on neurodevelopmental outcome is well documented. However, the awareness regarding concepts of early intervention among primary health care providers and therapist is limited.

Early intervention (EI) is a purposefully planned, timely program, offered to prevent and limit the occurrence, complications and deterioration of disability. Early Intervention is provided during pre-conception, prenatal and postnatal periods up to the age of three years. The services are offered to the babies who are 'at-risk' to develop disabilities and the babies who have established disabilities/developmental delays from birth to three years of age. In this context, "early" refers to the most critical period of a child's development and "intervention" means giving a child variety of opportunities to experience, explore and play with things around. Critical period and plasticity or networking of the neuronal synapses is maximum up to three years of age, hence intervention may have maximum effect in the development during this time. Plasticity to the damaged nerves increases through the appropriate environmental stimulation. Individualized early intervention program is the intensive intervention plan designed for an individual baby considering the family resources, support and

culture. Families are involved as major collaborators in therapeutic intervention.

This article briefly overviews conceptual framework, the rationale, benefits, and disciplinary approaches of early intervention in the early age group.

Keywords: *Early Intervention, plasticity, critical period, individualized early intervention program (IEIP).*

1. Introduction

According to WHO, around 15 million babies are born prematurely every year. India has the highest babies born prematurely about 3.5 million per year. Advances in technology and better quality of care in recent decades have improved the survival rates (1). It is believed that damage to the central nervous system (CNS) may occur due to the immaturity and fragility of their nervous system and present with neuro-psychomotor developmental delay (2). Consequently neuro-developmental impairments such as learning disability, cerebral palsy, hearing and visual impairment are on the rise (1). The other common risk factors associated with adverse neuro-developmental outcomes are low birth weight, meningitis, perinatal asphyxia, bilirubin encephalopathy (3-5).

Development of a child takes place parallel in all the five domains namely sensory (hearing and vision), motor (gross and fine), speech & language, cognition and socio-emotional. The domains of development are interdependent on each other (Fig-1). When the child does not attain age appropriate developmental milestones, developmental delay is said to exist. Delay in one domain invariably affects the development in other areas. Early intervention holds the potential for improving neuro-developmental

outcomes of babies with such impairments or delays(6).

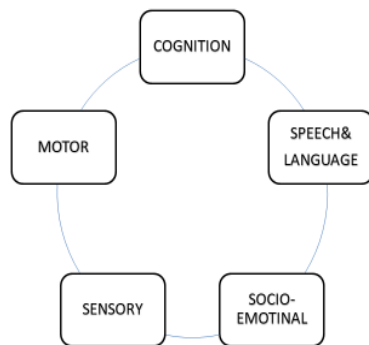


Figure 1: Developmental domains

2. What is Early Intervention?

Siegel (1972) defined 'Early Intervention' as "the introduction of planned program deliberately timed and arranged in order to alter the anticipated or projected course of development". 'Early' in the field of disability implies not only to intervene at the early stage of disease/disorder/disability but also to identify the early risk factors for the same and prevent their occurrence (Primary Prevention). It also helps in preventing the complication, minimizing the effect or further deterioration of disability (Secondary Prevention) (7).

Prevention is more beneficial than habilitation services. The term *Habilitation* refers to the services which facilitate development and acquisition of skills in a high risk babies who have failed to develop such skills or age appropriate milestones. Early intervention emphasizes the utilization of most critical periods of a child's development which spans from birth to three years.

'Intervention' means giving a child a variety of opportunity to experience, explore and play with things around to alter the anticipated development. Dunst (1996) defined "early intervention" as a term which broadly refers to a wide range of experiences and supports provided to children, parents and families during pregnancy, infancy and early childhood period of development.

The equal interaction between nature and nurture helps in acquiring intelligence or adaptive behavior. Environment is required for genetic expression. The genetic constitution is predetermined and fixed, so only a stimulating environment may be manipulated to bring the best for learning or development of the child.

The main objective of early intervention is to enhance the normal development, increase the

independent functioning of the child and to minimize the disability.

3. Rationale of early intervention:

3.1. Plasticity: Neuroplasticity is the ability of the brain to modify its connections or re-wire itself to recover from brain injury. Brain has many neural pathways that can replicate another's function so that small error in the development or temporary loss of function through damage can be easily corrected by rerouting signals along the different pathways. Reinforcement or repetitive activities through stimulating environment (sensory) the connections will be strengthened and which are not stimulated and practiced will be pruned away (reduction in number of synaptic connections)(8) Fig-2. Strengthening of connections when offered to the damaged brain will eventually lead to recovery. Massive pruning has been seen to take place during childhood (9).

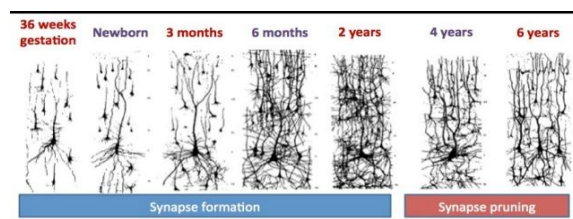


Figure 2 Synapses and pruning

3.2. Rapid growth of development: The brain development goes through a most rapid phase of growth during first 2 years of age group, where 75% brain development happens by two years. The head circumference increases in infants by 12 cms in the first year. Second year it increases by 2.5 cms and 2.5 cms up to adult. All the milestones in each domain are achieved by two years of age, which are the foundations for movement, communication, social and emotional capabilities and intellectual functioning.

3.3. Critical periods of brain development: Critical period is the maturational stage of a child during which the nervous system is especially sensitive to learning development, for environmental stimuli. They are present in prenatal and postnatal periods of development. In the first trimester where the organ is being formed, if harmful substances, called teratogens, invade the womb, they may insult the brain and hinder brain development. During post-natal period from birth to three years of age is the critical period when myelination is happening. External stimuli helps in formation of the myelin sheath. During this period if the baby is under-stimulated the milestones may be delayed. For example, in an experiment, a baby rabbit in early

development was blindfolded in one eye for six months without external stimuli of light. After six months when the eye was opened the eye was permanently impaired, as the sensitive period for the light input to retina was lost. The characteristics of brain development that are peculiar to early childhood make them amenable to early intervention which tends to mitigate consequences of developmental problem in this vulnerable population.

4. Who requires early intervention?

Early intervention is effective from birth to three years of age in all vulnerable at risk babies with high risk factors such as: Biological risk factors like preterm, low birth weight and asphyxiated babies.

Rationale of early intervention

- Plasticity,
- Rapid growth of
- Critical periods

Environmental risk factors like babies who are understimulated, with single parent, from poor socio-economic environment and babies who have already established disability of any type (Fig.3).

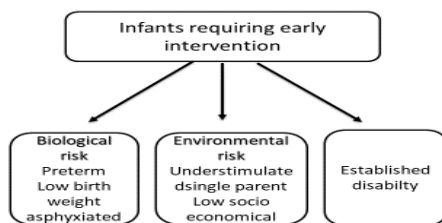


Figure 3

5. Collaborative Learning Approach:

In this, families are involved as collaborators in the intervention which is known as collaborative learning approach. Collaborative learning approach involves a professional in a joint venture with a child and her parent or parents and even other family members (10).

6. Approaches in early intervention:

In early intervention services, team work would be beneficiary as it requires assessment in all developmental domains. Team members usually include neonatologist/pediatrician, psychiatrist, early interventionist, physiotherapist, occupational therapist, speech pathologist, and social worker. Recently, the approach of early intervention services has shifted from multidisciplinary to interdisciplinary and trans-disciplinary approach (11). In a multidisciplinary approach the professionals assess

the child separately and give the specific intervention to the child. The intervention may not be comprehensive. Much time and money is spent in seeking the services. In the interdisciplinary approach professionals from different disciplines take part in assessments but discuss their findings and reach the decisions collaboratively. However, they implement the intervention separately. Whereas in transdisciplinary model, one professional among the team members acquires the knowledge in the different disciplines and comprehensively gives individualized early intervention plan (IEIP) which is holistic approach, cost effective, time saving and there is no overlapping and no confusion to parents. This reduces the professional crunch.

7. Individualized early intervention plan (IEIP):

IEIP is the intensive intervention plan designed document consisting of comprehensive intervention to the individualized child. The structure consists of assessment, setting priority goals on need based, intervention and quarterly evaluation. While formulating the IEIP, therapist must evaluate the child as a whole. Detailed history of prenatal and perinatal for the etiological diagnosis, detailed neurological examination by standardized tool, detailed developmental assessment in all domains such as motor area, sensory, cognition, speech and language must be done. Through IEIP intervention plan should be planned as shown in the Table-I. In the IEIP, the highest abilities of the child and the problems must be identified and short term goals should be set. Principles of the intervention activities should be identified. These activities should be integrated into a twenty-four-hour schedule into the activities of daily living (ADL) such as bathing, feeding, and dressing, sleeping and playing on the basis of culture, family support and resources. Every quarter, the evaluation must be repeated or even on a need basis depending upon the improvements in the development of the child. Conceptual frame work is shown in the (Fig.4).

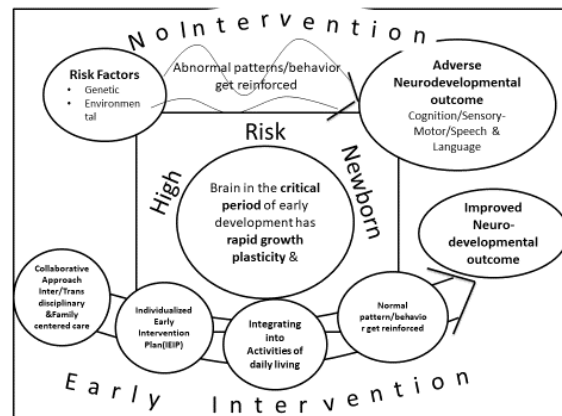


Figure 4 Conceptual frame work of early intervention

7.1. Illustration of IEIP with an example:

A child aged 3 months 15 days is brought with a complaint of stiffness of body. A detailed prenatal and perinatal history reveals a single, term baby home delivered who did not cry immediately after birth. She was admitted into the NICU, and placed on a ventilator for five days. She had neonatal seizures. The etiological diagnosis was Hypoxic Ischemic Encephalopathy-III. On Examination: positive findings found Ophisthotonus posture, Overriding of sutures, small opening of anterior fontanelle, head circumference: less than the 3rd percentile. Neurological examination: Tone increased or hypertonia, head lag was present.

A detailed developmental assessment in all domains done (positive findings) as follows:

Motor area:

Gross: Increased tone or hypertonia, extensor pattern/scissoring in lower limb, upper limb flexor pattern. Atonic neck reflex persistent/prominent, not able to lift head momentarily in prone position, not able to maintain head in the midline.

Fine: Fisting of hand is present, not able to open the hand voluntarily.

Vision: having fixation to black and white pattern, but no tracking and unable to see bright color objects.

Cognition: not keeping the hand in the mouth

Hearing: normal

Speech and language: able to make pleasurable and cooing sounds.

A structured comprehensive IEIP designed for this child based on the NIMH's manual on Early Intervention is shown in Table no 1&2 (12-14).

8. Conclusion:

The current research reveals that infants are at significant risk of developmental delay in motor, sensory, communication domains due to their extreme vulnerability. Early Intervention is a structured, comprehensive, holistic and cost effective approach proved to be beneficial method in preventing, identifying and intervening the babies with high risk or developmental delays.

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Area	Ability	Problem	Short term goal	Activity/suggestions
Motor area	Child is able to turn the head to side for breathing in prone position	Ophisthotonus posture Not able to lift the head in between 45 to 90 deg Persistence of ATNR Scissoring of LL Elbow in flexion LLs- increased Extensor tone & adductor spasticity	To inhibit ATNR To decrease the spasticity in lower limb and upper limb To achieve head control	<p>Normalization of tone Slow rocking movements in hammock, jhula, mother's lap, bolster, therapy ball Slowly stroke the body with smooth textured cloth Slow melody music Talk before touching and firm and gentle touch. No feathery touch No massage</p> <p>Lifting & carrying Correct way of lifting should be taught to mother Carrying: head supported, hand extended, legs abducted, knee flexed</p> <p>Positioning Encourage side lying positioning Supine: head in the midline, legs abducted, flexion at knee, extension of upper limbs</p> <p>To achieve the neck holding, Ophisthotonus posture: Make the child to lie on the bolster in a inverted u shape. Or Hammock position in the jhula / scooty tube Make the child to lie on mother's chest and talk to the child so that child can lift head to see mother's face</p>
Fine motor		Not able to open the hand voluntarily (fisting)	Voluntary opening	Stroke the dorsum of the hand, when the fingers opened keep small cotton or soft ball where the fingers extension maintained.
Vision	Able to perceive the light, able to fix to contrast colour black and white	Not able to track vertically, horizontal	Tracking	Series of light where bulb glitter one after the other. Moving toys like train ,jumping toy
Speech and language	Able to produce cooing sounds			Mother child interaction, talk to the child regarding the activities done to child in a baby talk.
Cognition		Not able keep the hand in the mouth, Not able to grasp object and bang	Keep the finger in the mouth Grasp the object and voluntary release	Modify the environment and positioning and giving the opportunity to actively try to keep the finger in the mouth like side lying position

Table 1. Individualized Early Intervention Plan (IEIP)

ADL	Motor	Sensory(vision and hearing)	Cognition	Speech, language & Communication
Bathing	Put the child on extended leg where head in midline alignment of body legs apart, and abducted where elbow extended and fingers open and it inhibits ATNR decreases the Ophisthotonus posture Next again put the child in prone on the leg ,so child try to lift head	Put black and white pattern puppet to the big toe and move the toe so that child try watch and helps for tracking. Keep floating toys in the water where child can try to see objects and try tracking	Stroke the dorsum of the hand so that the child try to open and try to grasp and bang	Talk to baby about the happening of surrounding like running commentary
Sleeping	Make the child to lie down side lying with good alignment of body for inhibiting ATNR, decreases the tone	Just in front of wall paste a black and white chart so that child can look at that and sleep or hang some balloon in front and move it, so that child tracks when it is moving	This side lying position helps the child to keep the hand in the mouth and facilitates sometimes	Sings lullaby (gentle song) where child will be able hear all the words
Playing	Lifting and carrying : Carry the child where the child can sit on the left hand of mother facing outward, good alignment of trunk support from chest ,keeping hand between to separate the legs apart ,head in the midline to inhibit the ATNR and decreases the tone and adductor spasticity	Keep the moving toy train so that child attains the tracking	Play peek a boo game putting a cloth on the mothers face and move it slowly and do repeatedly	Keep talking about the happening of surrounding
Feeding	When the child is breast fed, a pillow or towel should be kept in between the thighs. Head and body should be aligned symmetry and hand should be together to inhibit ATNR. Stroke on the dorsum of child for opening of the hand and make the child to hold mothers saree like a ball. The child presses and release the saree.	Mother should wear black and white or contrast colour saree, so that child will be able to see the colour in between the feeds.	In between the feeds or just after feed mother can play peek a -boo by putting saree on child's face.	Just after song sing a rhyme contains rhythm

Table 2.Integrating Activities of Daily Living (ADL)