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Innovations and technology transforming 'Neonatal baby care'

06 February 2022 | Views | By Dr Karthik Nagesh, Manipal Hospitals

Major advances in neonatal care have helped the sickest and smallest of babies survive

Neonatal babies have always required that extra care when they come into this world. The first 28 days of the baby's life is the most vital and crucial stage for a child's survival. During this period, the risk of death is the highest than any other stage of the child's life. The first month of life is the foundation for your health and development for your entire life ahead.

Innovations and transformations in technology have tremendously helped in providing advanced treatment and care to neonates improving their intact survival especially, these last three Decades.

The major advances in neonatal care that have helped the sickest and smallest of babies survive are are as delineated below-

Infant Ventilators with Volume-Targeted Ventilation

With the advent of volume-targeted ventilators, it has been observed that babies have survived better and free of lung damage. These babies require ventilator assistance for shorter durations and have reduced risks of developing pneumothorax. Volume-targeted ventilators help in maintaining more stable carbon dioxide levels in the blood and reduce the brain ultrasound abnormalities. However, research is still on to understand whether volume-targeted ventilators improve the development of movement and intellect in these babies.

Non-invasive Ventilators with Synchronisation

These ventilators combine *Continuous Positive Airway Pressure (*CPAP) with positive pressure during inspiration to improve the ventilation and lung health. Breaths caused by the non-invasive ventilators are triggered by the patient and hence they appear synchronised. The non-invasive ventilators give respiratory assistance that is better than CPAP and prevents intubation in most neonatal cases who would have required CPAP and got invasive ventilation.

Non-invasive Administration of Surfactant

Surfactant spreads easily when administered in large airways. In non-invasive administration of surfactant, a thin catheter is inserted into the trachea to push the surfactant at the exact site. The surfactant is infused at slower rates and the child continues to breathe with supported continuous positive airway pressure. This helps reduce the occurrence of pneumothorax and the possible need for mechanical ventilation.

High Frequency Oscillatory Ventilation

This ventilator is a promising system that provides lung protective mode in the treatment of respiratory ailments in newborns. The ventilator measures the baby's tidal volume for each ventilator breath and then adjusts the peak inspiratory pressure as required to deliver the set tidal volume.

Inhaled Nitric Oxide Therapy for PPHN

Persistent Pulmonary Hypertension (PPHN) in neonates can lead to life-threatening circulatory failure. Inhaled nitric oxide helps in relaxing the smooth muscles and dilates the blood vessels in the lungs. It has proved to improve the oxygenation and reduce the need for Extracorporeal Membrane Oxygenation (ECMO) in the patients.

Oxygen Saturation by 'Signal Extraction Technology'

Continuous monitoring of the neonate is essential in case of any lung disease. And without constantly having to prick the baby, you can monitor their oxygen saturation accurately. It is a non-invasive tool for monitoring the oxygen saturation index accurately in neonates. Even when in small babies, the pulse volume is low and signals obtained are poor using a modern pulse oximeter with Signal Extraction Technology which has revolutionized critical care for neonates.

Newer Diagnostic Techniques

The recent advances in technology have made it easier to diagnose host- and pathogen-centered diseases. This helps improve neonatal care in acute infections and ensures quick effective treatment. These techniques use Polymerase Chain Reaction and molecular genetics to identify microbial resistance thereby reducing the use of unnecessary antibiotics.

Newer Diagnostic Genetics

Advances in genetic sequencing have made it easier to screen newborns for treatable metabolic disorders. Earlier, the biochemical screening tests would sometimes miss the milder forms of treatable inborn metabolic errors in neonates. But with advanced genetic testing, it is possible to confirm the diagnosis and start treatment.

New Micro Diagnostic Techniques and Point of Care diagnostic devices

Neonates are too tiny and have soft, thin skin. The blood tests using the older techniques cause a lot of pain and harm to the little one. With new micro blood sampling techniques, the blood loss is reduced along with a decrease in the risk of infection. With these micro-volume blood sampling techniques, the risk of sample cross-contamination also reduces. There is no fluid leakage in the system and no possibility of air embolism. Also bedside diagnostic devices can provide valuable information critical for the care of the sick baby instantly using a few drops of blood only.

Minimally Invasive Surgeries

Laparoscopy has been in use since quite a few years now. And this type of surgical therapy has enabled surgeons to achieve better post-surgical outcomes. With the advances in less invasive surgeries, neonatal surgical care has become easy. You can treat the baby without causing much pain or harm to the neonate. The recovery period reduces, and the newborn baby can push through a smaller surgery at such a tender age. The 3-mm incisions for these surgeries are relatively painless and will mostly disappear after a few weeks of surgery.

New Portable Diagnostics

There are many portable diagnostic techniques available like bedside ultrasounds for lungs, functional 2D Echo, portable ultrasounds, etc. With the help of these techniques, the load on the baby is reduced. You do not have to constantly shift the baby from the NICU to the testing machine and back.

New Scanning Techniques

Technology has brought in new infant MRI machines for easy diagnosis and improving treatment plans. PET scans and radio nucleate scanners like HIDA, DMSA, and DTPA help in tracking the overall health of the neonate without causing any physical pain. You can check the status of the baby's kidneys with the help of the DMSA and DTPA scans.

Tele-ROP for Eye Screening

ROP screening helps diagnose early retinopathy in premature babies. With the help of this technique, you can check for retinoblastoma and other eye complaints in the neonate without inserting a needle or a tube into the baby.

The current healthcare system is well equipped to handle the challenges that we face in managing the health of infants. The ever-growing, rapid development in the field of neonatal care ensures optimal healthcare for infants. Technology and medicine need to work together to provide the best possible care to babies and to save millions of young lives.

Remote monitoring

Remote monitoring involves keeping tabs on your patients from a remote place. With the help of this type of monitoring, irrespective of the doctor's place of consulting, the baby can get the best care possible. The patient can save up on travel costs and travel time. Some patients who are unable to travel can benefit from remote monitoring as well.

Artificial Intelligence (AI)

Medicine is incomplete without being able to diagnose the disease. With the help of artificial intelligence, you can identify the different causes of a condition as well as diagnose the exact condition. AI solutions for managing the patient data in the medical field enables keeping electronic medical records (EMRs), smart health management systems, and medical big data, for improving the accuracy and standardization of clinical decision making. AI also helps in optimising treatment plans and collecting medical information for knowledge-based systems.

Telemedicine in NICU Remote Monitoring With Internet of Things (IoT)

Telehealth allows for telephonic consults between the patient and the doctor. The parents of the baby can openly communicate with the doctor and the other caregivers. This helps in patient compliance after follow-up as well. Many parents are not able to follow-up due to various reasons related to their baby. With tele consults, you can relax with your baby at the comfort of your home and discuss your queries about your child's health. More importantly, Internet of Things has enabled us to connect our daily objects to the internet and track our everyday routine. Whether you wish to use a camera to see the baby or wish to monitor the neonate for their vitals, you can use IoT and make the most of it. You are connected from any part of the world, and you can easily alter treatment protocol and control the vitals remotely.

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