Foetal therapy is an emerging, rapidly growing trend in the field of perinatology. Pregnant uterus remained a source of mystery until 1960s when technological advancement in imaging came up. The first successful therapeutic foetal procedure was reported by Sir AW Liley, who transfused a hydropic foetus with Rh disease in 1965. Later on Dr Michael Harrison and his team at the University of California did the first open foetal surgical procedure in 1982 for obstructive uropathy. The PubMed search shows nearly 122158 entries in response to foetal therapy while applying AND OR NOT strategy.

Global estimates suggest that congenital anomalies affect 2-3 percent of births among which most common anomalies are of cardiovascular system on central nervous system. According to the recent SRS 2018 data of Registrar General of India 4.6 percent of total infant deaths in India were due to birth defects. Congenital anomalies constitute the fifth largest cause of neonatal mortality in India, but national estimates on the prevalence of these conditions are lacking. Currently there are various foetal therapeutic modalities that can help a foetus to grow inside the womb and survive later while minimising the effect of congenital problems.

In India, few private hospitals are equipped in providing foetal therapy e.g. Apollo Centre for Foetal Medicine, New Delhi, CIMAR Cochin, Amrita Institute of Medical Sciences and Research Centre, Kochi etc. Nursing care of a pregnant mother with complications are itself unique challenge to nurses. Nurses working in the field of maternity or neonatal care take special care of the pregnant woman and the unborn along with specialised neonatal care later.

What is Foetal Therapy?

It is a therapeutic intervention undertaken for the purpose of correcting or treating a foetal anomaly or condition. Criteria for Foetal Surgery (adapted from Harrison 1982):

1. Accurate diagnosis and staging possible, with exclusion of associated anomalies
2. Natural history of the disease is documented, and prognosis established
3. Currently no effective postnatal therapy
4. In utero surgery proven, feasible in animal models, reversing deleterious effects of the condition
5. Interventions performed in specialised multidisciplinary foetal treatment centres within strict protocols and approval of the local Ethics Committee with informed consent of the mother or parents.

Rationale for in utero therapy for foetal surgery in outlined in Table 1.

Types of Foetal Therapy Based on Invasion

1. **Non-invasive foetal treatment: foetal pharmacotherapy**; 'Non-invasive' here means administering drugs to the mother which reach the foetus via the placenta. This is the mean for administration of corticosteroids, anti-arrhythmics, antiviral and anti-parasitic drugs, propylthiouracil, intravenous administration of immunoglobulin to pregnant women and substitution or restriction diet in inherited foetal metabolic diseases.

2. **Minimally invasive foetal treatment via needle insertion**: Minimally invasive foetal treatment via needle insertion is a phrase used to describe a category of interventions that involve inserting a thin needle (0.7 to 1.1 mm in diameter) into the uterus. These procedures are carried out in an out-patient clinic under local anaesthesia applied to the skin, and usually take 15 to 30 minutes and the whole procedure is done under ultrasonic guidance. These include:

   - **Intra-uterine blood transfusion** indicated in red cell alloimmunisation, Parvovirus B19 infection, fetomaternal haemorrhage, twin to twin transfusion syndrome, chorioangioma, foetal sacro-coccygeal tumour, Kaposi like hemangioendothelioma, homozygous alpha thalassemia, beta thalassemia, xerocytosis, eliptocytosis, congenital syphilis, CMV infection, blackfan-diamond anaemia etc.

   - **Intra-uterine thrombocyte transfusion** indicated in alloimmune thrombocytopenia (FNAIT), Parvovirus B19 infection

   - **Direct intravascular foetal anti-arrhythmic administration** (via umbilical cord puncture)

   **Minimally invasive foetal therapy via endoscopy** (fetoscopy):
(a) Fetendo procedures - Fetendo was developed in the 1990s. This method uses seeing the foetus in real time to use both endoscopic, and sonographic techniques on separate screens. Fetendo intervention can be done either through the mother's skin (percutaneous) or, in some circumstances, requires a small opening in the mother's abdomen (minilaparotomy). Aberrant placental vessels providing imbalance of blood flow to twins can be identified and ligated in this way to prevent foetal death due to twin-twin transfusion syndrome. Other surgeries possible with this technique are radiofrequency ablation or coagulation of non-viable twin’s umbilical cord in twin reversed arterial perfusion and division of amniotic bands in amniotic band syndrome. Procedures, such as foetal cystoscopy with laser ablation of posterior urethral valves, thoraco-amniotic shunt and vesico-amniotic shunts are also done using this method.

(b) FIGS-IT - This is a term used for foetal image guided surgery for intervention or therapy, and describes the method of manipulating the foetus without either an incision in the uterus or an endoscopic view inside the uterus. The manipulation is done entirely under real time cross-sectional view provided by the sonogram. Like Fetendo, it can be done either through the mother’s skin or, in some cases, with a small opening in the mother’s abdomen. It can often be done under a regional anaesthesia like an epidural or a spinal, or even under local anaesthesia and causes the least problem for mother in terms of hospitalisation and discomfort.

Open foetal surgeries:

(a) Ex-utero intrapartum treatment (EXIT) - These are also known as OOPS i.e. operation on placental support which is performed during vaginal delivery or caesarean section. Only a portion of the foetus is delivered and brief procedures such as endotracheal intubation (e.g. in cases of congenital diaphragmatic hernia etc.), ECMO cannulation, tracheostomy in critical cases or examination of neck mass done while the foetus is still connected to the placenta through the umbilical cord. The goal with the EXIT procedure is to provide the baby with a functioning airway so that oxygen can be delivered to the lungs after the baby is separated from the placenta. With advancement of technology placental support can last up to 20 minutes during routine births.

(b) Mid-gestation open procedures - Recognition of foetal defect in early pregnancy allows intervention in midgestation to prevent irreversible damage or development of secondary disease. The foetus is accessed through a hysterotomy following placental location determination by ultrasonography and then returned to the uterus after completion of surgery for the rest of the gestation. Foetal surgery is performed through a low transverse abdominal incision and a wide uterine incision is given by a specially designed absorbable stapler for performing bloodless hysterotomy e.g. repair of meningo-myelocoele at 22 weeks of gestation to prevent damage to central nervous system tissues due to prolonged exposure to amniotic fluid, resection of sacrococcygeal teratoma.

Maternal and Foetal Risks of Foetal Therapy

All foetal intervention is really maternal-foetal intervention. The intervention is designed to benefit the foetus having a problem, but the mother is an innocent bystander who assumes some risk for the sake of her unborn foetus. In weighing the risks versus the benefits of an intervention, the most important consideration is the safety of the mother, her health, her family, and her future reproductive potential.

Recent study findings show that for transplacental medical therapy (corticosteroids, anti-arrhythmics and immunoglobulins), severe maternal adverse
events are rare, when done in expert centres. Studies have demonstrated that in open foetal surgeries the premature delivery rates were 100 percent, 80 percent and significantly reduced when the uterine incision was ≥5 mm, ≥3.3 mm, and <3.0 mm, respectively. Minimally invasive procedures carry a risk of maternal complications of about 5 percent, with 1 percent being severe complications (pulmonary oedema or placental abruption). Open foetal surgery carries important risks to the mother; both in the current pregnancy (pulmonary oedema, placental abruption, chorioamnionitis and scar dehiscence) and in subsequent pregnancies (uterine rupture), yet some of these risks are decreasing with surgical refinement and increasing experience of the surgical team.

Studies show that there is 80.5-93.5 percent survival rate in case of intrauterine blood transfusion when done for red cell alloimmunisation. Neonates treated with IUT require more top-up red blood cell transfusions during the first 6 months of life, which may be explained by the suppression of foetal erythropoiesis. Red blood cell donor transfusions have a minimal but theoretical risk for anaphylactic reactions and transmission of viral diseases. Studies have also demonstrated that EXIT procedure was used successfully to ensure utero-placental gas exchange and foetal haemodynamic stability during a variety of surgical procedures performed to secure the foetal airway or ensure successful transition to post-natal environment. Thus, in case of foetuses the survival and success rate varies based on the type of problem, associated maternal conditions and the timing of the procedure.

Nurses Responsibility

Success of every foetal therapy depends solely on the pre-intra and post-procedure nursing care. In countries other than India where foetal therapies has already been established, ‘Foetal therapy nurse coordinators’ play the role of case manager for individual cases.

Nurses assigned as a team member for foetal therapy must have a sound knowledge of foetal therapy including the procedures (the instruments and gadgets used in the procedures) and the risk and benefit of these procedures is responsible for counselling of the parents. The risk and benefit of surgery for major fetal anomalies must be considered in every case. Even when the surgery is successful the foetus may not survive, may have other serious problems, or may be born pre-term. Despite the risks, foetal surgery may result in birth of an infant who could not otherwise have survived. Parents need help to balance the potential risks to the mother and the best interests of the foetus. They might feel pressured to have surgery or other foetal treatment they don’t understand. Parents should also receive counselling as to the post-treatment period: signs and symptoms of complications, reasons emergency alert symptoms and information regarding mandatory caesarean section at a higher facility centre.

The foetal therapist must have experience as midwife because continuous foetal monitoring is required before and after the procedure and recording of foetal and maternal wellbeing is an important aspect during this phase. Following delivery of the baby the mother requires utmost care to overcome not only the physical wound of caesarean section but also the psychological support for dealing with the stress of complicated birth.

Once the baby is delivered they should be handed over to the experienced neonatal nurses as most of the foetal therapy clients are born pre-term with exposure to multiple factors leading to complications in neonatal life.

Conclusion

The evolving concept of foetal therapy holds promise not only to change the pre-natal history of unborn foetus but also its long term outcome. Mother and the foetus being the client of nurses require competencies from their part for the positive outcome of the therapy.

References

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