Review Article

A review on neonatal neural tubal disorders

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ABSTRACT
The neurological examination is an important in the evaluation of fetal abnormalities and helping to diagnose and provide the prognostic information regarding neonates. Neurological disorders like Spina bifida and Intra ventricular hemorrhage are may be apparent before birth or appear during course of gestational period or after birth. Most of the neurological disorders are due to the preterm birth (before 37 weeks of pregnancy). This article reviews about epidemiology, pathophysiology , diagnosis, treatment, management and prevention of neurological disorders like Spina bifida and Intra ventricular hemorrhage.

Keywords: Spina bifida, neonatal disorders, intra ventricular hemorrhage, neural tubal disorders

INTRODUCTION

SPINA BIFIDA: Spina bifida is the term used to describe a group of neural tube conditions where the fetal spinal cord does not close properly during the first month of pregnancy. With the open Spina bifida some of the vertebrae are not completely formed but are split or divided and the spinal cord and it's covering (the meninges) protrude through the opening.

Intra Ventricular Hemorrhage: IVH in neonatal period ranges from a silent bleeding to an extended bleeding into the ventricles or parenchyma of brain. This events commonly occur in preterm infants, especially less than 32 weeks of gestation and in infants with very low birth weight. In both preterm and term neonates almost 90% of IVH occurred within 72 hours of birth. That half of them might occur in the first 24 hours. The thalamus was as the main origin site for IVH in 63% of neonates. Apparently the main source of bleeding directly depends on the main etiology as well as cerebro vascular structure.

Epidemiology

SPINA BIFIDA: Spina bifida prevalence rate is ranged from 1 in 1000 live births depending upon their age and weight. The highest number of diagnoses reported as myelomeningocele type of spina bifida is most commonly spreaded throughout the world. The prevalence of different types of spina bifida are reported as myelomameningocele spina bifida , spina bifida occulta , hydrocephalus spina bifida, encephalocele are 45.35%, 26.74%, 37.21%, 1.16% respectively. Mostly Spina bifida is more prone to males than females.

Intra Ventricular Hemorrhage: The IVH is the most common subtype of stroke usually leading to severe disability or death. IVH is common in Asians, advanced age people, male sex , low and middle income countries. Overall mortality of babies with IVH seen mostly in low birth weights less than 1500 grams. Babies with severe IVH (grade III and IV) were about 23 times more likely to die than those without IVH. Among the risk factors babies with EOS were more likely to have IVH. Prevalence of intraventricular hemorrhage is conformed by TFU result. 90% of IVH cases are seen in babies delivered before 35 weeks. Severity of IVH correlates with age. The incidence of grade III IVH is 32% for infants born at 24-26 weeks and 11% for those born at 31-32 weeks. The incidence of grade IV IVH is 19% for infants born at 24-26 weeks and 5% for those born at 31-32 weeks.

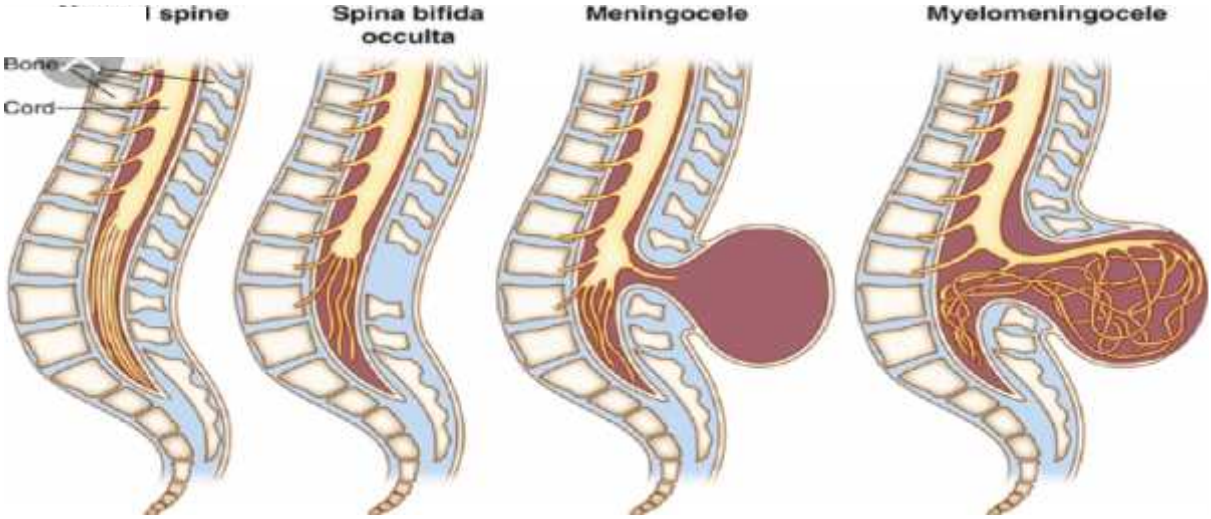
Pathophyioslogy

SPINA BIFIDA

Classification : Spina bifida also referred as myelodysplasia and myeloneningocele

1) Spina bifida occulta: Spina bifida occulta is a closed type and, hidden spina bifida as spinalcord and nerves are usually normal and there is no opening on the back. In this form of spina bifida, there is only a small gap in the vertebrae that make up the spine (as shown in figure 1). In many cases spina bifida occulta is so mild that there is no disturbance of Spinal function at all. Most people are not aware that they have spina bifida occulta unless discovered on X-ray. Mostly seen in 1 in 1000 or may seen in disabilities as bowel or bladder dysfunction, back pain, leg weakness etc. 2)

Meningocele spina bifida : Meningocele spinabifida occurs when the bones do not close around the spinalcord and the meninges are pushed out through opening, causing a fluid filled sacrifice to form.the meninges are three layers of membranes covering the spinalcord, consisting of duramater, arachnoid mater and pia mater (as shown in figure 1). In most cases, the spinalcord and the nerves themselves are normal or not severely affected, the sacrifice is often covered by skin and may require surgery. This is the rarest type of spinabifida. 3) Myelomeningocele spina bifida : Myelomeningocele spina bifida is seen about 75%cases, all are with this type. This is the most severe form of condition in which a portion of spinalcord itself protrudes through the back. In some cases, sacs are covered with skin, but in other cases sacs are covered with tissues and nerves may be exposed(as shown in figure 1).The extent of neurological disabilities is directly related to the location and severity of spinalcord defect. If the bottom of spinalcord is involved, there may be only bowel and bladder dysfunction, while in most cases can result in total paralysis of the legs with accompanying bowel and bladder dysfunction.



4)spina bifida cystica: Spina bifida cystica can occur anywhere along Spinal axis but mostly found in lumbar region. Here the spine is bifida and a cyst forms. A meningocele, a cystic swelling of dura and arachnoid , protrudes through spinabifida defect in the vertebral archive. Spina bifida cystica causes a problem when cord tissue extends into the meningocele, in which the cyst is called myelomeningocele. Neuraltube defects are the result of a teratogenic process that causes failed closure and abnormal differentiation of embryonic neuraltube. Neuraltube defects occurs between 17th and 30th day of gestation at time when the mother may not be aware that she is pregnant and the fetus is estimated to be about the size of a grain of rice. 1) Spina bifida aperta: Spina bifida apart a open type spina bifida , sometimes referred as spina bifida cystica in which exposed neural tissue with or without a protruding sacrifice at the site of lesion. Spina bifida may be referred to as either myeloschisis , myeloneningocele, meningocele.a) Myeloschisis: Myeloschisis is an incomplete closure of primary neuralplate result in a cleft spinalcord with edges flushed with the defect (As shown in figure 2(a)). spina bifida myeloschisis is the most severe form of spina bifida. b) Myeloneningocele :Myeloneningocele is a type of open spina bifida cystica in which spinalcord lying outside the spinalcanal. Here the spinalcord protrudes from spinalcanal into a fluid filled sacred. Due to resultant of incomplete closing of primary neuraltube(as shown in figure 2(b)). Usually associated with a type II chiari hindbrain malformation(downward displacement of cerebellarvermis into cervical vertebralcanal) , venrticulomegaly, hydrocephalus. c) Meningocele : In meningocele the spinalcord is not found in the sac and is described by embryologistic to be absent of neuralmater herniating at the site of open lesion. It is may be open type or closed type, means the skin may or may not be present but spinalcord does not lies outside the spinalcanal (as shown in figure 2(c)).These malformation causes elongation of brain stem and obliterating of 4th ventricle, leading to obstruction of cerebrospinal fluid circulation and development of hydrocephalus in 90% patients. Treatment of such accompanying hydrocephalus is needed in about 82% of cases and involves draining of cerebrospinal fluid into either the peritoneal or other body cavity via a subcutaneous shut. 2)Spina bifida occulta : Spina bifida occulta is the second most neuraltube defect disease, here the site of lesion is not left exposed. It includes following types-a) Lipo myelomeningocele Lipo myelomeningocele represents the closed spina bifida (covered with skin) but Spinal cord is interested with lipid global estate(as shown in figure 2(d)).b) Lipomeningocele: A closed type spina bifida but spinalcord does not lie outside Spinal canal even

though lipid globules are present(as shown in figure 2 (e)).c)Spinal dorsaldermal sinus tract: It is a spina bifida occulta with vertebral arches missing often asymptomatic and is though to be a mesodermal defect and a defect of secondary neurulation (as shown in figure 2(f)).

It includes some phenotype changes in patient like tuft of hair at that site, vestige also arches missing, akin appears as dysplastic skin.

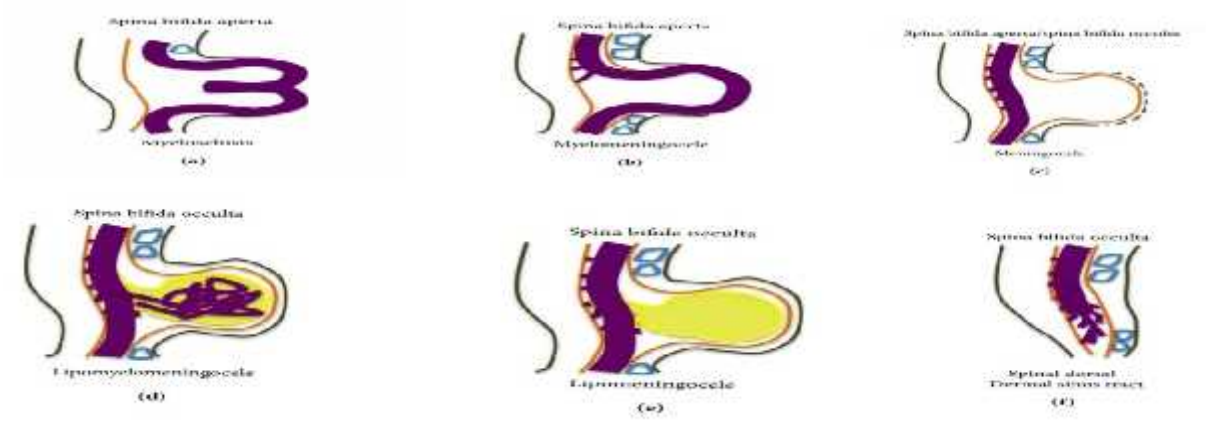


Figure 2

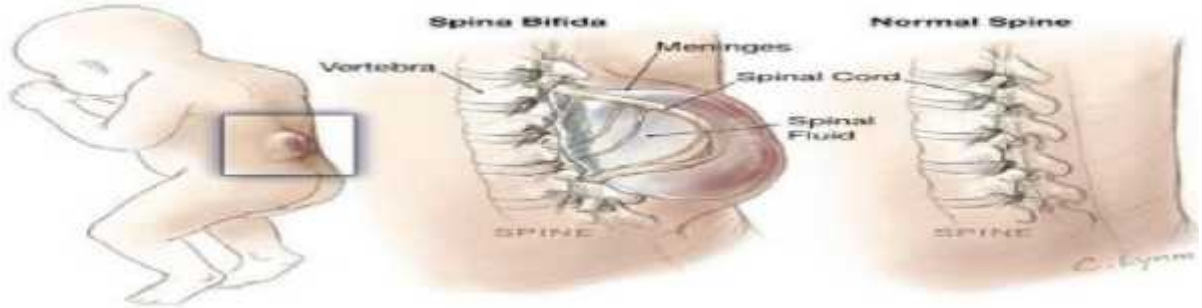
Pathophysiology For Intra Ventricular Hemorrhage

Role Of Cerebral Blood Flow And The Germinal Matrix Microvasculature

IVH has generally been attributed to alterations in cerebral blood flow to the immature germinal matrix microvasculature . During the risk period of IVH , this region is richly supplied with micro vessels lacking basement membrane deposition, tight junctions, and glial end foot investiture , all components of a competent blood brain barrier. In response to hypotension, hypoxemia, hypercapnia or acidosis, cerebral blood flow rises, hemorrhage begins within the germinal matrix and blood may rupture into the ventricular system.

Genetic Factors

The relativity recent description of the thrombophilians associated with the factor V Leiden and prothrombin G20210A mutations and the implications of both in prenatal stroke suggest these might also be candidatege



genes for IVH.

Polymorphisms in the pro inflammatory cytokine IL-6 have been proposed as possible genetic modifiers of the risk for IVH, although the results have been some what contradictory. Position 174 can be either a G or a C, and IL-6 production is thought to be greater in neonates with a CC genotype.

Independent Of Gestional Age

If one is to prevent injury, knowledge of the risk period is critical for success. IVH is most commonly encountered with in the first 24 hours after birth and hemorrhage can progress over 48 hours or more. By the end of the first postnatal week, 90% of the hemorrhages can be detected at their full extent, and this risk period for IVH is independent of gestational age.

Treatmentand Management

SPINA BIFIDA:

Patients with spina bifida require extensive, active, interdisciplinary treatment by a trained and coordinated team. In babies with spina bifida nerves and membranes can push out of an opening in the spine and form a sac. This damage the nerves and can lead to serious infections. So babies should have surgery to repair the spine with in 48hrs after birth.

The figure.3 shows the surgery of spina bifida in neonates.The neonatal neurosurgery is followed by monitoring evaluation of sphincters and progression towards an appropriate bowel and bladder regimen. Early monitoring of motor function in the lower extremities like serial orthopaedic examination, muscle strength and joint range of motion assessment to detect any early changes that may require intervention. During management of spina bifida considerable attention may be needed to prevent the "outhouse syndrome" in which the patients physical problems give rise to social consequence because of failure to comply with an appropriate bowel reginum. The babies with hydrocephalus can be treated by" shunting " to drain away the excess fluid to another part of the body.

Intraventricular hemorrhage

The treatment of new borns with IVH should be done by multidisciplinary team consisting of pediatricians, neurologists, pediatric neurologists and neurosurgeons. Treatment should be focused on adequate ventilation, feeding, prevention of metabolic acidosis and normalization of coagulation disorders. Anticonvulsant therapy should be used to control seizure activity. Transfusion with fresh frozen plasma and platelets may be beneficial in newborns with IVH. Neurosurgical intervention in patients with IVH should be considered in post hemorrhagic hydrocephalus to relieve increasing intracranial pressure or to drain hemorrhagic ventricular cerebrospinal fluid.In conclusion, several factors influence the predisposition for severe IVH in term neonates. A perinatal period complicated by fetal distress, birth trauma, and severe asphyxia should be taken into account. However, it is possible that etiopathogenesis can not be defined clearly as in our cases. Cranial ultrasounds in a specific group of term newborns (taking into account risk factors for IVH) should be widely recommended.

Diagnosis

The diagnosis of neural tube disorders can be done before birth during fetal stage and after birth with the help of many techniques . Biochemical diagnosis of spina bifida can be done by measuring the elevated concentration of alpha fetoprotein (AFP) in amniotic fluid samples or in the maternal serum. Sonographic diagnosis : today the fetal spine can be examined by ultrasonograph in the sagittal, axial and coronal planes from last first trimester onwards. provides the most accurate mode of prenatal diagnosis.After birth spina bifida can be detected by MRI, X-ray or CT to get a clear view on the back .Sometime spina bifida is not diagnosed until after the baby is born ,because the mother did not receive prenatal care or an ultrasound did not show clear picture of the affected part of the spine.Nowadays advanced MRI techniques in focus include MR spectroscopy, functional MRI (FMRI) and susceptibility weighed imaging for evaluation of premature infants. It has been suggested to be a useful tool in measurement of the neuro development. Near infra-red spectroscopy (NIRS): NIRS is a spectroscopic technique which can be used to measure changes in the oxygenation of the newborn in a non-invasive way. Being a portable, continous and non invasive bedside monitoring techniques, it has a great potential for use in NICN. It can be used for measurement of regional CBF as well imaging of the brain.Biomarkers: Recently there is a growing interest on the use of biomarkers for early diagnosis of IVH. Activin A, a growth factor belonging to the transforming growth factor beta super family, plays an important role in the physiologic response to any brain injury.S100b is synthesized by astrocytes is reported to be a predictor of IVH and neonatal mortality. IL-6 and erythropoietin have also been shown to be potential biomarkers for IVH.

Prevention

SPINA BIFIDA

There are many ways for pregnant women to reduce the risk of having a baby with spina bifida both before and during her pregnancy. The following tips are useful during pregnancy to avoid spina bifida in the newborn baby.

Take 400mcg of folic acid every day

Avoid over heating of body during pregnancy

Proper care must be taken before using any nutritional suppliments and over the counter drugs.

The medical conditions like diabetes and obesity are should be under control before getting pregnancy

INTRAVENTRICULAR HEMORRHAGE

As support in the neonatal period has improved, more low birth weight infants are surviving, and certain new borns seem to do better than their similarity premature counterparts. By careful evaluation of stress velocity relationship to keep the after load at an acceptable levels by vasodilator therapy may reduce or prevent the serious complications of IVH. By regulating the left ventricular after load can prevent the IVH.

Conclusion

In conclusion, most NTDs are sporadic, and both genetic and non-genetic environmental factors are involved in its etiology. These NTDs continues to involved a multifaceted challenge to epidemiologists, clinicians and developmental biologists alike. The imminent eradication was predicted when prenatal diagnosis was introduced, and again after the discovery of the preventive effects of folic acid. In fact NTDs remain one of the commonest categories of birth defects world wide. Among all the NTDs spina bifida and intra ventricular hemorrhage are most common and frequently occurring. Most of the cases around 60% are seen as inadequate intake of folic acid and low socioeconomic status have been seen as the most common risk factor. Most of the

chromosomal anomalies are found in sub-Saharan Africa, central Asia and south East Asia.

ABBREVIATIONS

IVH: Intra ventricular hemorrhage
CBF: Cerebral blood flow
NTDs: Neural tubal disorders
NIRS: Near infrared spectroscopy
EOS: Early onset scoliosis
NICN: Neonatal intensive care nurseries

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