

## A Brief Review on Kernicterus

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### ABSTRACT

Kernicterus is a rare neurological condition which occurs when the unconjugated bilirubin levels rises above 25 mg/dL in the blood leading to decreased elimination and increased production of bilirubin. Most commonly, it affects newborns and infants of age three to four years, in that the premature infants are more prone to this condition. Accumulation of toxic levels of bilirubin in blood as well as in brain leads to life threatening complications. However, early diagnosis and management of this condition helps in preventing brain damage and also developmental abnormalities in an infant. In this article, we mainly reviewed about the epidemiology, etiology, pathophysiology, clinical manifestations, diagnosis and the treatment of kernicterus. It is necessary for the health care team and professionals to detect the early signs of kernicterus by close monitoring of infant at the time of birth to prevent it from getting worsen. However, there are various effective and advanced techniques available to treat the condition as soon as it is diagnosed and thus it is a preventable condition if managed with utmost care.

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## Introduction

Kernicterus is a rare neurological condition which occurs when the unconjugated bilirubin levels rises above 25 mg/dL in the blood leading to decreased elimination and increased production of bilirubin. Most commonly, it affects newborns and infants of age three to four years, in that the premature infants are more prone to this condition. Accumulation of toxic levels of bilirubin in blood as well as in brain leads to life threatening complications. However, early diagnosis and management of this condition helps in preventing brain damage and also developmental abnormalities in an infant [1,2].

## Epidemiology

The incidence of jaundice in a newborn is about 60-90% during their first days of life. Increased incidence is observed in Southeast Asian infants and lower rates were seen in African infants unless there is G6PD deficiency in newborns [3]. As per reports in 2011, the current incidence of kernicterus in Japan was estimated to be at 1.8 per 1000 live births of newborns [4].

In India, about 15.3% of neonatal admissions among which 4.4% of deaths were caused due to severe jaundice in infants and it was also reported that the mortality rate is about 7.3 per 1000 live births in the rural villages of India [5,6].

## Etiology

Normally, newborns and infants have higher bilirubin levels compared to adults but when these levels rise abnormally it reaches the brain causing various complications [7]. Some of the main causes are polycythaemia, haemolysis in case of G6PD deficiency, birth injuries, viral or bacterial infections, internal haemorrhage and biliary atresia. Hence all these conditions leads to increased lysis of red blood cells and decreased functioning of liver in removal of bilirubin from the blood which leads to excess production of unconjugated bilirubin causing hyperbilirubinemia leading to kernicterus [8-11].

## Pathophysiology

The unconjugated bilirubin which is lipid soluble accumulated due to some conditions like Rh incompatibility, crigler najjar syndrome, hemolysis etc., travels through the blood circulation and crosses the blood brain barrier where it binds to globus pallidus, subthalamic nucleus, hippocampus and many other crucial regions of brain there it attaches to cell membranes causing mitochondrial damage, inhibits oxidative phosphorylation also causes calcium release promoting apoptosis finally affects axonal and dendritic growth resulting in irreversible nerve damage. In this condition there will be a marked decrease in albumin binding capacity, increased serum bilirubin concentration and low serum pH. Sometimes,

use of drugs which tends to competitively displace bilirubin from albumin also increases the chances of developing kernicterus [12-14].

## Clinical Manifestations

Usually, in preterm infants this condition causes symptoms which are unrecognizable whereas in full term infants the typical signs and symptoms associated with hyperbilirubinemia condition which are commonly observed includes decreased feeding, hypotonia, lethargy, high pitched cry, opisthotonos and as the baby gets older other complications like cerebral palsy, intellectual abnormalities, lack of upward gaze, auditory dysfunction, ataxia, seizures and difficulty in speaking can be developed. Mostly this syndrome develops at the age of 3-4 years and it makes hard for the infant to cross the developmental mile stones [15-18].

## Diagnosis

It can be identified in the initial weeks of birth. It is mainly based on clinical evaluation and physical findings like abnormal cry, persistent yellowish coloration of skin, whites of eye and it can also be identified through hematological findings like total & direct bilirubin and complete blood count.

However, diagnosis cannot be made solely depending on serum bilirubin levels hence imaging studies like brain stem evoked auditory response (BEAR) which is used to detect the hearing impairment caused due to bilirubin toxicity and MRI is helpful in detecting bilateral lesions in subthalamic regions [19-22].

## Treatment

Kernicterus in newborns is generally managed by considering various factors among which the two main things considered were the age of infant measured in hours from the time of birth, and the levels of bilirubin present in excess in the blood. The treatment includes phototherapy, blood transfusion, increased feeding and immunoglobulin transfusion [23].

**Phototherapy:** It is also known as light therapy in which the newborn is placed under an incubator with a protective eye shield from ultraviolet radiation and maximum body surface area should be made to expose to the light. The wavelength of light ranges from 460-

490nm which is effective in converting unconjugated bilirubin to conjugated bilirubin and further it is eliminated in the form of stools and urine. However there are some complications which may develop in infants under went phototherapy such as childhood asthma, type 1 diabetes mellitus which is very rare [24-27].

**Blood transfusion:** This is mostly preferable in extreme conditions. It is done only when there is a need to immediately reduce the high bilirubin levels in the body. Expected mortality rate is 3-4 per 1000 infants within 6 hours of transfusion and complications like cardio respiratory and metabolic derangements were observed in rare cases [28].

**Increased breast feeding:** This technique involves the increased feeding of baby with plenty of fluids, milk for every 2hrs. In some conditions, hydrating fluids can be given through vein. By this process, there will be generation of excess waste in the body along with that the free bilirubin in the blood is also gets eliminated thereby the levels of high bilirubin can be reduced greatly [23].

**Immunoglobulin therapy:** This therapy is preferred in cases where there is Rh incompatibility between the mother and newborn blood groups which is one of the causes for developing kernicterus. Hence immunoglobulin boosts the immune system were administered to prevent further complications in early stages of the kernicterus [29].

## Conclusion

Kernicterus is a rare condition observed in infants which if left untreated causes serious complications that affect the infants' developmental and functional abilities by causing auditory and visual disturbances. It also challenges the behavioral and intellectual capabilities of a newborn. Hence, it is crucial to manage this condition by keeping a check to the raised bilirubin levels and the risk factors associated with this condition. It is necessary for the health care team and professionals to detect the early signs of kernicterus by close monitoring of infant at the time of birth to prevent it from getting worsen. However, there are various effective and advanced techniques available to treat the condition as soon as it is diagnosed and thus it is a preventable condition if managed with utmost care.

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