INVITED ARTICLE

MANAGEMENT OF NEONATAL JAUNDICE

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ABSTRACT

Neonatal jaundice is the commonest complication among newborn infants in Singapore. Treatment is only required when the jaundice becomes severe. The trans-cutaneous bilirubinometer is useful in screening for neonatal jaundice; it is fairly reliable at levels ≤200 μmol/l in fullterm babies.

Phototherapy is the commonest form of treatment and is effective in almost all cases if high intensity phototherapy is also used. Exchange transfusion is now only rarely used in view of its known complications and relatively high mortality rate.

Key Words: Neonatal Jaundice, Phototherapy, Exchange Transfusion

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INTRODUCTION

Neonatal jaundice is a very common complication of neonates in Singapore, especially in Chinese infants (1); about 9% of all fullterm Chinese infants present with non-haemolytic hyperbilirubinaemia with about 29% of "healthy" prematures of less than 1500gm being similarly affected (2). It is therefore not surprising that this is the commonest problem facing the neonatal paediatrician.

Mild jaundice needs no treatment, this being only required when significantly raised levels are reached. However, general measures aimed at maintenance of good health, adequate oxygenation, and avoidance of birth asphyxia and hypothermia help in the prevention of severe jaundice. Early feeding helps to prevent hypoglycaemia and encourages early evacuation of meconium, thus reducing enterohepatic circulation of bilirubin. Adequate nursing care and hygiene helps in the prevention of sepsis.

IDENTIFICATION OF HIGH RISK INFANTS

High risk infants should be identified so that they can be kept under close surveillance, and any treatable condition promptly managed. The following risk factors place infants at high risk:

- Asphyxia
- Trauma
- Metabolic disorders, eg acidosis, hypoglycaemia
- Sepsis
- Prematurity
- Intestinal obstruction
- Intrauterine infections
- Enzyme deficiency, eg G6PD deficiency
- Hypothyroidism

Close surveillance of these infants will ensure early detection of severe jaundice and effective treatment. Prompt management of any treatable condition is also mandatory.

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SPECIFIC PREVENTIVE MEASURES

Phenobarbitone

Phenobarbitone has been demonstrated to be effective in preventing or reducing the severity of neonatal jaundice, by rapid induction of glucuronyl transferase together with increased levels of ligandin, thus improving the efficiency of conjugation. Unfortunately, it has to be given prophylactically to be effective. In view of its known side effects, its use in infants does not seem to be justified.

Agar Agar

Agar agar forms an irreversible compound with meconium thereby interfering with the entero-hepatic circulation. This prevention of the recycling of bilirubin has not been demostrated to be very effective.

Tin-protoporphyrin

This new drug interferes with the formation of bilirubin by competitive inhibition. Only one study demostrating its efficacy in preventing severe jaundice has been documented (3). Further studies have to be done before its efficacy and safety can be accepted.

CLINICAL ASSESSMENT OF SEVERITY OF NEONATAL JAUNDICE

Neonatal jaundice is only clinically evident when its level is equal to or exceeds 5mg/dl (85 μmol/l). Clinical jaundice usually starts on the face, spreading to the upper trunk, lower trunk proximal and finally distal extremities. The rate and rapidity of spread is only approximate and therefore too unreliable for use in assessing the severity of jaundice.

Clinical assessment of the depth of yellowness of the skin, and thus the degree of jaundice needs constant exposure and practice for such expertise to be acquired. A more objective method is the use of the transcutaneous bilirubinometer based on this principle (4); the depth of yellowness of the skin is objectively assessed and given a value (index). By correlating this index with the actual bilirubin values, a regression curve can be drawn, and used for future measurement of bilirubin levels. Studies in Singapore have demonstrated its reliability especially with levels less than or equal to 200 μmol/l (5), but it has severe limitations in very low birth weight premature

infants (6). However, it is a convenient screening procedure for fullterm infants, and can be performed even by paramedical personnel. Accurate determination of bilirubin values will, however, need capillary blood sampling.

INDICATIONS FOR TREATMENT

The need for treatment will depend mainly on four factors:

- The general condition of the infant
- The age of the infant
- The underlying cause
- The bilirubin level

The general condition (including prematurity) of the infant is a major factor in determining his susceptibility to bilirubin encephalopathy. The type of illness as well as its degree and the use of antibiotics need to be weighed before any decision on treatment can be made. Similarly, the age of the infant has a role since CNS susceptibility is related to the postnatal age of the infant; also the rate of bilirubin increment can be assessed, thereby allowing an approximate projection of future bilirubin increase. The underlying cause enables a prediction of the bilirubin behaviour to be made, thus allowing anticipatory treatment to be done as deemed necessary, eg in severe haemolysis. All these three factors are important and should be related to the fourth factor of bilirubin level. The severity of the jaundice is then related to all three factors, thus allowing a decision to be made regarding the necessity for treatment, its timing as well as form. Using all these four factors all forms of jaundice can be adequately assessed and managed.

Presently only two forms of treatment are commonly use, namely phototherapy and exchange transfusion.

PHOTOTHERAPY

Phototherapy involves the use of lamps to treat neonatal jaundice. The usual lamps used are the daylight lamps and special blue lamps. Though green lamps (7) have been claimed to be equal to blue lamps in effectiveness, our study has demonstrated that green lamps are in fact less effective than daylight lamps (8). The effectiveness of phototherapy is mainly dependent on the light intensity, with a dose-response relationship being demonstrated; however, with increasing intensity, the rate of increase in response begins to decline until a "saturation point" is reached, beyond which no further response will occur (9). At bilirubin levels equal to or greater than 15 mg/dl (256 μmol/l) the rate of decline in 24 hours is about 50%. Bilirubin decrement is also proportionate to the initial bilirubin level, the decline being greater at higher levels and lesser at lower levels; at about 5 mg/dl (85 μmol/l) no further decline will occur.

Daylight lamps are usually used because they (10) are easy on the eyes, improve visual monitoring of the infant and cause no disruption in nursing care. Special blue lights though more effective cause giddiness and nausea, and prevent cyanosis being detected.

PRECAUTIONS

Infants exposed to phototherapy should be completely unclothed to maximise surface area. The eyes should be padded to prevent possible damage. The infant's temperature should be maintained within the normal range; for very small infants, a radiant heater may be required to maintain normal temperature but in large infants increased ventilation may be neccessary to prevent pyrexia. Since the skin will be bleached, jaundice can no longer be assessed clinically. Regular sampling for bilirubin determination should be done at six-, eight- or twelve-hourly intervals; the lights should be switched off to avoid bleaching of the plasma. Assessment of the 24 hour decline should be made to avoid diurnal variation. Phototherapy can be stopped when the bilirubin levels decline to <180 μmol/l, the minimum period of exposure being 24 hours. After cessation of treatment, bilirubin levels should be monitored for at least two consecutive days or until a stable level is observed. Should a rebound exceeding the pre-phototherapy level occur, re-exposure is necessary following the same.

In general, phototherapy is indicated under the following conditions:

(a) In babies less than 72 hours of age, it should be started when serum bilirubin level is equal to or exceeds 13 mg/dl (222 μmol/l).
(b) In infants of an older age group, it should only be started when serum bilirubin level is equal to or exceeds 15 mg/dl (256 μmol/l).

In this manner, it is possible to treat rapidly increasing jaundice at an earlier stage, thereby ensuring a greater safety margin. For those with slower rising values, treatment can be started at a high level without danger to the baby. This will avoid unnecessary treatment of those with only moderate levels of bilirubin.

Using the above guidelines, it has been possible to treat infants with neonatal jaundice very effectively, the failure rate being only 2 per 1000 (10). High intensity phototherapy is effective even for those with severe haemolysis, the anaemia being corrected by (a) simple packed cell transfusion (s) (11).

EXCHANGE TRANSFUSION

This used to be the only treatment for severe jaundice before the advent of phototherapy. It involves the dilution and removal of infant's blood with donor blood via the umbilical vein. The standard of 20 mg/dl (342 μmol/l) has been the main criterion for exchange transfusion though it has long been realised that many babies with higher levels do not suffer brain damage and some, especially those who are feeble and sick, suffer brain damage with lower levels. Exchange transfusion is not without risk and carries a mortality rate of about 1%; hence the inclination to avoid it whenever possible. In exchange transfusion, twice the infant's blood volume is exchanged over a period of one hour. Many physical and metabolic complications can occur (12). The need for careful preparation for exchange transfusion is therefore obvious and include the following:

(a) Meticulous collection and storage of donor blood. Blood stored beyond 5 days should not be used.
(b) Careful grouping and cross-matching of blood to be used for the procedure.
(c) Adequate preparation of the baby; the baby's stomach should be empty. It should therefore be emptied if recently fed. The umbilical cord area should also be thoroughly cleansed to prevent infection.
(d) The infant should be securely strapped and temperature maintained by a radiant heater.
(e) The clinical, cardio-respiratory status as well as the temperature should be carefully monitored throughout the procedure.
(f) A side hole catheter should be inserted not beyond 7cm from the surface to prevent entry into the portal vein. Correspondingly, shorter insertion should be

made in a premature baby.

(g) The blood used should be warmed to body temperature before usage.

(h) The amount withdrawn and infused should exactly match.

(i) 1ml calcium gluconate (10%) should be infused after every 100ml exchanged. No sodium bicarbonate should be used since the citric acid is converted to sodium bicarbonate in the liver.

Meticulous asepsis and haemostasis should be practised at the end of exchange transfusion. The bilirubin level should be monitored at least at six hours after exchange since 20% of the infants would have achieved levels exceeding the pre-exchange level (13); a repeat exchange would then be required. The infant should be monitored clinically as well as with regard to his blood glucose. Early feeds should be given and observation of the stools and abdomen should be made to exclude necrotizing enterocolitis.

In view of the invasive nature of the exchange transfusion and its severe complications, it should be the treatment of last resort. Phototherapy with its good safety record and efficacy should be attempted initially. In infants with very high bilirubin levels, high intensity phototherapy using blue light will in the vast majority of cases control the hyperbilirubinaemia effectively. In my experience, it has been almost 100% successful even in severely haemolytic cases (11). It has the advantage of convenience, very little expense with no need for extra medical and nursing staff. Besides, it is extremely safe if used with adequate guidelines. Exchange transfusion with its massive rebound is not really necessary for the treatment of severe jaundice. If indeed it is used, it should be followed by high intensity phototherapy to eliminate the need for a second exchange.

CONCLUSION

Neonatal Jaundice is a highly treatable condition. It therefore should not be allowed to cause morbidity and mortality. Education of parents and nurses as well as doctors to detect neonatal jaundice at an early stage and initiate treatment before any damage occurs can effectively eliminate its ill effects. However, constant vigilance is required. A casual attitude towards such a common condition must be avoided.

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