2. McNally LM, Jeena PM, Gajee K, Thula SA, Sturm AW, Cassol S, *et al*. Effect of age, polymicrobial disease, and maternal HIV status on treatment response and cause of severe pneumonia in South African children: a prospective descriptive study. Lancet 2007; 369: 1440-1451.
3. Marais BJ, Hesseling AC, Gie RP, Schaaf HS, Beyers N. The burden of childhood tuberculosis and the accuracy of routine surveillance data in a high-burden setting. Int J Tuberc Lung Dis 2006; 10: 259-263.
4. Marais BJ, Gie RP, Schaaf HS, Donald PR, Beyers N, Starke J. Childhood pulmonary tuberculosis – Old wisdom and new challenges. Am J Resp Crit Care Med 2006; 173: 1078-1090.
5. World Health Organization. Guidance for National Tuberculosis Programmes on the Management of Tuberculosis in Children. WHO, Geneva, Switzerland. WHO/HTM/TB/2006.371.
6. Marais BJ, Pai M. New approaches and emerging technologies in the diagnosis of childhood tuberculosis. Paediatr Respir Rev 2007; 8: 124-133.
7. Marais BJ, Gie RP, Schaaf HS, Starke JR, Hesseling AC, Donald PR, *et al*. A proposed radiological classification of childhood intra-thoracic tuberculosis. Ped Radiol 2004; 33: 886-894.
8. Marais BJ, Gie RP, Schaaf HS, Hesseling AC, Obihara CC, Starke JJ, *et al*. The natural history of childhood intra-thoracic tuberculosis: a critical review of the pre-chemotherapy literature. Int J Tuberc Lung Dis 2004; 8: 392-402.
9. Marais BJ, Gie RP, Hesseling AC, Schaaf HS, Lombard C, Enarson DA, *et al*. A refined symptom-based approach to diagnose pulmonary tuberculosis in children. Pediatrics 2006; 118: e1350-1359.
10. Marais BJ, Graham SM, Cotton MF, Beyers N. Diagnostic and management challenges of childhood TB in the era of HIV. J Infect Dis 2007; 196 (Suppl 1): S76-S85.
11. Marais BJ, Gie RP, Schaaf HS, Hesseling AC, Enarson DA, Beyers N. The spectrum of childhood tuberculosis in a highly endemic area. Int J Tuberc Lung Dis 2006; 10: 732-738.
12. Marais BJ, Wright C, Schaaf HS, Gie RP, Hesseling AC, Enarson DA, *et al*. Tuberculous lymphadenitis as a cause of persistent cervical lymphadenopathy in children from a tuberculosis-endemic area. Pediatr Inf Dis J 2006; 25: 142-146.

Long-Term Prognosis of Neonatal Seizures – Where are We?

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Neonatal seizures are a relatively common marker of brain dysfunction in the newborn. Population based studies from Western countries(1) suggest a relatively low incidence of 2.6/1000. The incidence in outborn babies admitted to Indian NICUs is close to 12%, and reflects the actual reality in our country where babies are born in small hospitals and nursing homes(2).

The recurring question uppermost in both parents and pediatrician's mind is what will be the long term neurological outcome in a baby with neonatal seizures. For many decades, it has been clear that the etiology of neonatal seizures is one factor critical in determining outcome. Newborns with transient correctible metabolic abnormalities, focal ischemia and without clear etiology do well, while those with hypoxic-ischemic encephalopathy (HIE), CNS infections and cerebral dysgenesis regularly do poorly(1,3). In India, where perinatal care is uneven, transient metabolic disturbances like hypocalcemia and hypoglycemia still account for about a fifth of the neonatal morbidity(2). Also, the outcome of hypoglycemia is not necessarily

favorable(4,5). It is difficult, if not impossible, to separate out the impact of the etiology from the impact of seizures themselves on the immature developing nervous system, though recent evidence seems to suggest an independent deleterious effect of both status epilepticus(6) and electrographic seizures(7). Other parameters studied to predict outcome include a neonatal neurological examination(3), EEG abnormalities especially abnormal background activity(1,3), USG and MRI, especially diffusion-weighted abnormalities(3). However, interpretation of the newer methods is technically demanding and can be often misleading.

In this issue of *Indian Pediatrics*, Iype and colleagues(8) have followed up a large cohort of newborns with neonatal seizures over 2-8 months to assess what happens to them in terms of mortality, neurological outcome and the developmental of post-neonatal epilepsy (PNE). HIE, hypoglycemia and meningitis accounted for the bulk of cases and often multiple risk factors were present. Clinical rather than electrographic recognition of seizures, as the authors have done may lead to overestimates as was shown in a landmark study of video-EEG in neonatal seizures in the 1980s(9). Clonic and focal tonic seizures had EEG correlates confirming their epileptic nature, while generalized tonic, some myoclonic and most subtle seizures had no EEG correlate suggesting that these were non-epileptic phenomena related to an injured neonatal brain. In the Indian setting, availability, affordability and interpretation issues make video EEG an unviable option in more than 90% of nurseries; hence clinical recognition of seizures is perfectly acceptable with the caveat that some non-epileptic phenomena will be misdiagnosed as seizures. Neurological outcome was overall good in the Iype study, with about 2/3 of patients having a normal outcome and only a minority having post-neonatal epilepsy (PNE). Birth weight and gestational age did not correlate with outcome. In a Canadian population-based outcome study of neonatal seizures followed up for >10 years(1), the prognosis was a lot more discouraging with only 35% having a normal outcome and 34% having PNE. The outlook was even worse in preterms, with only 12% considered normal at the end of a decade and 48% having PNE. Full term babies seem to do uniformly better(1,3). As the authors of this study(8) admit, the short follow-up of only a few months may explain this cohort's better outcome. Milder motor/cognitive deficits may be not recognized in infants and PNE may have its onset later(1). The authors report a normal EEG in the majority of newborns and showed that interictal epileptic discharges (IEDs) correlated with a poor outcome. The prevalence of EEG abnormalities is much higher in Western literature and abnormal background activity rather than IEDs are more correlative of poor outcome(1,3). Unfortunately, the authors have not reported on the EEG background activity. One study, however, did find that temporal IEDs correlated with outcome and PNE(10). Another novel observation in this study was the association of hypocalcemia and neonatal mortality. However, numbers were small (only 6 newborns had hypocalcemia of which 2 died) and confidence intervals wide, making this finding difficult to interpret. In general, hypocalcemia of later-onset has a good long-term prognosis(3).

The major strength of this study is that it is the first prospective study looking at outcome in a cohort with neonatal seizures in the Indian setting. It reiterates the need to reduce correctible etiologies like hypoglycemia and kernicterus which have long disappeared from developed nations. Though the follow-up is short, it does suggest that many survivors of neonatal seizures do well and aggressive treatment is warranted. This study has not studied the newborn neurological examination in predicting outcome. It has been shown that a normal examination is highly predictive of outcome in at least term babies though the converse is not true(3). This tool does not need sophisticated technology and is ideally suited for outcome prediction in the Indian setting.

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REFERENCES

1. Ronen GM, Buckley D, Penney S, Steiner DL. Long-term prognosis in neonatal seizures. A population based study. Neurology 2007; 69: 1816-1822.

2. Morbidity and mortality among outborn neonates at 10 tertiary care institutions in India during the year 2000. J Trop Pediatr 2004; 50:170-174.

3. Tekgul H, Gauvreau K, Soul J, Murphy L, Robertson R, Stewart J, *et al*. The current etiologic profile and neurodevelopmental outcome of seizures in term newborn infants. Pediatrics 2006; 117: 1270-1280.

4. Singh M, Singhal PK, Paul VK, Deorari AK, Sundaram KR, Ghorpade MD, *et al*. Neurodevelopmental outcome of asymptomatic and symptomatic babies with neonatal hypoglycemia. Indian J Med Res 1991; 94: 6-10.

5. Udani V. Pediatric epilepsy-an Indian perspective. Indian J Pediatr 2005; 72: 309-313.

6. Pisani F, Cerminara C, Fusco C, Sisti L. Neonatal status epilepticus vs recurrent neonatal seizures. Clinical findings and outcome. Neurology 2007; 69: 2177-2185

7. McBride M, Laroia N, Guillet R. Electrographic seizures in neonates correlates with poor neurodevelopmental outcome. Neurology 2000; 55: 506-513.

8. Iype M, Prasad M, Nair PMC, Geetha S, Kailas L. The newborn with seizures – A follow-up study. Indian Pediatr 2008; 45: 749-752.

9. Mizrahi E, Kellaway P. Characterization and classification of neonatal seizures. Neurology 1987; 37: 1837-1844.

10. Ortibus EL, Sum JM, Hahn JS. Predictive value of EEG for outcome and epilepsy following neonatal seizures. Electroencephalogr Clin Neurophysiol 1996; 98: 175-185.

Intestinal Failure – An Indian Perspective

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This issue of *Indian Pediatrics* carries an interesting review by Goulet, *et al.*(1) on the management of permanent intestinal failure. The definition, various etiologies and management options ranging from home based parenteral nutrition to intestinal transplantation are discussed.

With improvements in clinical nutrition techniques, life expectancy of children with intestinal failure (IF) has progressively increased. The management however is made difficult by the less number of cases, heterogeneity of clinical presentation and need for advanced clinical, nutritional and surgical expertise(2). Parenteral nutrition (PN) constitutes a very important cornerstone in the management of children with IF(2). The development of effective home-based PN program is essential for the successful management of children with IF. Home PN allows children to grow in the best psychological environment. As highlighted by Professor Goulet, children on home PN also have better results than those in hospital, should they require an intestinal transplant. The North American Home Parenteral and Enteral Nutrition patient Registry indicates a four-year survival on home PN of 80% for short bowel syndrome (SBS) patients. Children who develop complications due to long term PN or those who are unable to achieve intestinal autonomy are the candidates for intestinal transplantation (ITx). One of the first successful attempts at intestinal transplantation with long term survival is credited to Goulet and colleagues in Paris in 1988. Advances made in the field of immunosuppression and surgical techniques have vastly improved the clinical outcomes. In the United States, where nearly 75% of all pediatric intestinal transplants are performed, the overall 5-year graft survival of