PAIN IN NEONATES

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Understanding of pain in another starts with each person's isolated internal reference to his or her own experience (Bakan 1968)

Pain has a number of personal/perceptual aspects based upon physiological, emotional, behavioral and developmental variables. Developmental variables are probably the most important with regard to the problems of defining, assessing and treating pain in the preverbal human being. In this respect a premature baby differs only gradually from a term newborn, as does a sick neonate from a healthy one, regardless gestational age. Although the concept of a neonate as a non-hearing, non-perceiving and non-feeling being (which in the past has led to newborns undergoing surgery without proper analgesia) has largely been abandoned, the evaluation of pain in neonates still lacks appropriate, easily applicable criteria; it depends largely on clinical experience and current analgetic therapy in neonates is mainly empirical. To a certain degree this also applies to treatment of pain in older children and adults: these, however, can verbally express their experiences which has led to the development of a number of pain inventories, scales and other assessment tools (as for instance the pain-thermometer). Reports on pain in neonates are extremely rare; as such the subject is indexed in only one out of the 119 books on neonatology or pediatric surgery in our library. However, it is likely to get more attention because investigators are increasingly focusing on the influence of so-called "environmental factors" on neonatal development, especially in neonates admitted to intensive care units. Because of the lack of psychometric methods for pain assessment in the newborn, the study of pain is restricted to the observation of behavioral and physiological responses at different postconceptual (p.c.) ages. Some endocrine-system responses may be useful as well.

BEHAVIORAL RESPONSES

The nervous systems of an immature baby and a term neonate differ more from each other than the nervous systems of a term born and an adult. Peripheral, spinal and central pathways for pain transmission and perception may be immature at birth. This probably applies for pain modulation as well and certainly applies for neonatal motor response.
to painful stimuli, because myelinization of motor neurons is known to be incomplete at birth. Already in 1945 McGraw\(^3\) demonstrated the evolution in motor responses to a pin-prick. Immediately after birth newborns react with gross body movement and occasionally reflex responses; the reaction increases in intensity during the first month and subsides during the second month. Subsequently their reactions change to 'purposeful withdrawal' of stimulated limbs around the age of one year. Anticipatory responses to avoid the pin-prick stimulus do not occur until the age of one year. The phenomenon of inhibition of motor activity or "motor shut down", regularly seen in adults, is uncommon in neonates.

It is astonishing to note that, even in the seventies, suggestions were made about a possible lack of pain perception in human neonates, using the incomplete myelinization of neuronal pathways as an argument, because a substantial part of the afferent pathways involved in pain transmission are composed of unmyelinated (c) fibers. Although it may be assumed that differences exist in the processing of painful stimuli between the developing and the mature nervous system, it seems beyond doubt that neonates, regardless gestational age at birth, do experience pain. The sociocultural and psychological factors known to modify pain perception in later life probably exert little or no influence in the neonatal period.

Evolution is also apparent in behavioral responses to pain such as facial distortion and grimacing: newborns react with eye-closure, brows-down and nasal root bulging whereas adults open their eyes widely, knot their brows and perspire. Although these responses can be measured objectively, results from studies fail to show any consistency with regard to the quantification of pain.

The most extensively studied behavioral response is without doubt the pain-cry. Auditory analysis of crying has already been described by Hippocrates and the topic of infant crying and screaming was reviewed in 1855 by Darwin. Sound spectrographic cry analysis is developed into a useful diagnostic tool in a variety of diseases\(^8\) and has shown differences between healthy full-term and low birthweight infants. Sound spectrographic properties of pain cries in prematures of 31-36 wks gestational age have recently been published by Thoden e.a.\(^5\). The impression, already described in the middle ages, that experienced "caregivers" are able to distinguish birth, pain, pleasure and hunger cries from each other has been substantiated by spectrographic analysis. Behavioral responses probably are reliable indices of emotional states only in neonates with adequate behavioral-state organization and control. Behavioral states already exist in utero but their final organization as well as circadian periodicity is developed only after birth. This development may be hampered by premature birth or perinatal illness. Because differential use of behavioral states determines a baby's possibility to communicate with his caregivers or to modulate incoming stimuli, a lacunar behavioral-state organization must inevitably lead to abnormal and/or inconsistent behavioral responses.

**Physiologic responses**

A number of physiologic responses may be used for the evaluation of pain (Table I).\(^6\)