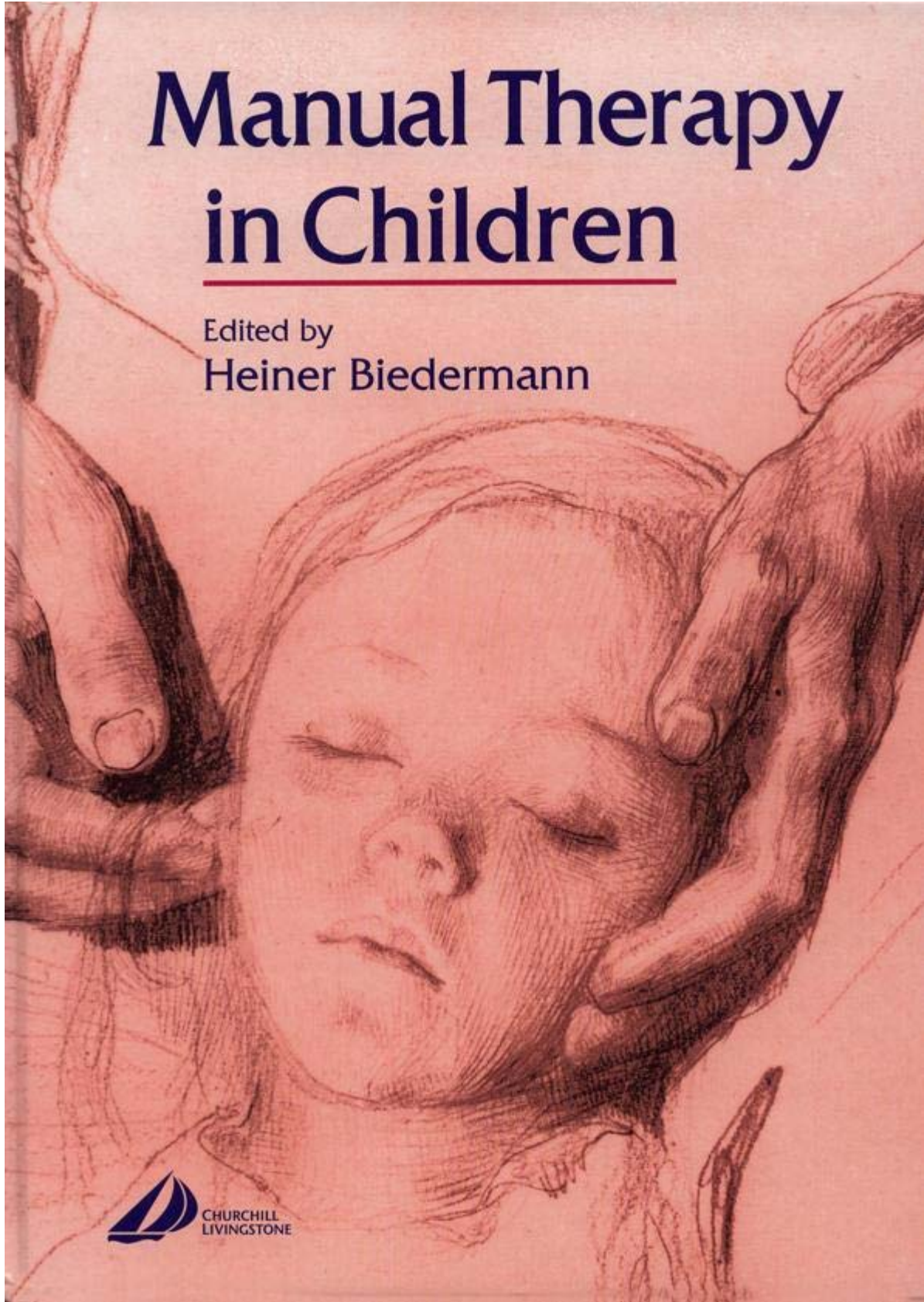


Manual Therapy in Children

Edited by
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Differential diagnosis of central and peripheral neurological disorders in infants

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Small children, before undergoing manual therapy, have to be thoroughly examined as their symptoms are so diverse at the time of the first encounter. One of the biggest problems for those active in this field is to achieve a valid differential diagnosis in order to distinguish between a functional and/or truly central (i.e. cerebrospinal) origin of the clinically observed situation. Neuropediatric and neuro-orthopedic procedures can help to improve the level of this still difficult distinction. We have to accept the fact that most of the small children we examine and treat suffer from a combination of those two types of problems. Combined with the injuries and irritations acquired during delivery or in utero are genetically determined ailments and other morphologically fixed disorders.

A sharp separation between the three groups (genetic, central and functional) is by no means as simple as one would like it to be, but up to a point we are able to define probabilities which help to sort out those children with a mainly central (i.e. neuromorphological) problem and those where the predominant part of the pathology can be attributed to a functional disorder in the arthrovertebral region. This differentiation does not imply that children with a primarily neuromorphological disorder cannot be treated with manual therapy and profit from such a treatment. As we point out in Chapter 25, patients with cerebral palsy improve markedly after manual therapy.

But the primary cause of a given problem has to be evaluated as well as possible in order to define our treatment goals realistically.

This diagnostic canon does not yet exist. One of the main reasons is the fact that most neurologists and pediatricians do not recognize that functional disorders of the vertebral spine may make an important contribution to their patients' problems. Until now it was the cerebrum where one looked in order to find the cause of neurological problems. As the role of the spinal system has been neglected there is no incentive to pay much attention to this differential diagnosis. This is the situation in the West, at least until very recently. In Russia, on the other hand, a long-established tradition exists of examining this area situated between neurology and orthopedics.

To establish a diagnostic base we use observation of the spontaneous movements, examination of the primitive reflexes and Vojta's screening tests (Fig. 9.1) (Vojta and Peters 1992). These tests show abnormal movement patterns with a multitude of causes:

- disharmonious maturation of an otherwise intact cerebrum
- cerebral trauma
- perinatal injury of the spinal cord

- perinatal injury of the vertebral spine
- lesion of a peripheral nerve
- neuromuscular disorder
- endocrine disorder.

Differentiation between these possibilities is not easy with the standard tests, let alone an assessment of where the problem originates. Here the work of Ratner comes into play. Until his premature death in 1992 he was head of the neuropediatric clinic in Kazan (Ratner and Bondarchuk 1990, Ratner and Michailov 1992) and published prolifically on pediatric neurology and perinatal injuries of the spinal column. Based on this work a more precise procedure is possible.

Assigning a neurological finding to a neuropediatric category or a neurological syndrome and/or a functional vertebrogenic disorder offers some important possibilities to a manual therapist, as it is the base from which to decide about further diagnostic tests and the ensuing therapy. To compile this information, neurologists, pediatricians and manual therapists have to work together. This is easier said than done, as these different specialties use a different vocabulary. Here we have tried to bridge this gap and offer an initial version. We do hope to improve on this using the comments of our readers.

Figure 9.1

A: Peiper-Isbert-reaction.

B: Vojta test. The correct interpretation of these tests has to take into account the developmental age of the child. The two pictures show a normal reaction pattern for a 3-month-old.

A





MEDICAL HISTORY

The history starts with the family history and the health situation of the mother. One main focus is on the risk factors before and during pregnancy:

- Which (if any) medications and/or drugs were taken ?
- Infectious diseases, e.g. cytomegalic inclusion disease and rubella, or endocrine disorders, e.g. hyperthyroidism, dysfunction of the suprarenal gland. The third group are cardiovascular problems, e.g. valvular defects. Problems in these fields increase the probability of a more 'central' neurological problem.

Problems immediately before or during birth:

- premature labor
- transverse presentation
- placental anomalies
- delayed delivery
- twin pregnancies

- lengthy labor
- oversized child
- vacuum extraction, forceps or other extraction aids.

All these items make functional problems more probable.

Our questionnaire covers these items and the completion of this form helps the parents to remember these details. It is astonishing (and has to be taken into account in the evaluation of the questionnaire) the extent to which the details of the delivery are forgotten by the parents - and how sketchy the documentation of the delivery often is. We saw several callused clavicular fractures in children whose birth was described by parents and documentation as 'quite normal'.

Sensorimotor development of the child: children with retarded motor development due to a central problem often have retarded psychic development, too. In KISS children there is often a marked difference between the apparently normal mental and the slower sensorimotor side of development. Parents often talk about the unhappiness

of their (KISS) children who want to do things they cannot achieve, thus becoming discontented, unhappy and angry.

There are many variants in the motor development which are interpreted differently depending on the viewpoint of the examiner.

Most neuropediatric specialists tend to consider a child's preference to shove on the buttocks (Fig. 9.2) instead of crawling a normal variant of motor development. Seen from the viewpoint of manual therapy, this preference indicates problems with the sacroiliac (SI) joints and/or the occipitocervical (OC) region.

For most parents the moment when their child starts walking is much more important than the period during which the child crawled. Almost all professionals, on the other hand, put the emphasis on this detail of motor development, as it is a very good indicator of a child's motor competence.



Figure 9.2

Shoving on the buttocks. This movement pattern is often used by babies who cannot master the difficulties of crawling. Its pathological significance is often underestimated. These children are able to develop normally, but having left out the crawling phase makes them susceptible to other coordinative disturbances.

Crawling is by far the most important step in the acquisition of bipedal gait and - skipped over - the lack of this coordination level tends to render the further coordinative successes more fragile (Birrer and Levine 1987, Loovis and Butterfield 1993, Patel et al 2002). So it is important to get information about other 'milestones' (Ayres 1979) in the child's development as well.

All these observations should be complemented by reports of others, especially those who are already in professional contact with the child, e.g. physiotherapists or creche staff. Another aid to verify the statements of the parents are photographs. To that end we ask the parents to bring pictures of the first years of their child. The quality of these photographs varies widely, but more often than not they offer at least a base for further questions to the parents. Quite a few parents are themselves surprised to what an extent one can see a stereotype posture in these albums.

Sometimes when you look at the siblings and remark on their individual postural pattern the ensuing discussion leads to the discovery of related problems in these children.

JACK BE NIMBLE, JACK BE QUICK: OBSERVATION AND APPRAISAL OF MOVEMENT AND POSTURE

Almost all books on pediatric neurology offer a fairly comprehensive overview of the tests and observations appropriate for a specific age, and this is not the place to list them (Dubowitz et al 1999, Fenichel 2001, Swaiman 1994). It should be emphasized that the neurological examination of all children, and especially newborn and toddlers, has to be smooth and as quick as possible in order to succeed. Before one even touches the baby, a calm and trustful atmosphere has to be established. Enough space, no external noise and a well-lit and warm environment may sound like a matter of course, but in practice these basic preconditions are not always met. It is important that the child is well rested and neither hungry nor ill. An experienced therapist starts grasping vital diagnostic information the moment the family comes into the room - which is one of the reasons we strongly advise being present when the baby is brought into the examination room. This enables the therapist to evaluate the reaction of the child to the room's setting and to use this background information to gauge the reaction to the tests performed on and with the child.

The first aim in dealing with a new young patient should be to open up to the *Gestalt* of the disorder, i.e. use one's professional prejudices. This is an intentionally provocative remark, but - especially for the beginner - the over-supply of available tests tends to hide the basic truth that a clinical diagnosis was and will be an act of intuition. If this was not the case we could indeed program computers to take care of diagnostics - and treatment, too, for good measure. But this first impression needs to be verified, questioned and fine-tuned to the individual situation in order to give us a meaningful base to proceed from.

Our examination of the small child has to be quicker than the evaporation of patience of the little patient - which takes place quite rapidly. It is not realistic to ask all relevant tests to be applied in order to get a valid diagnosis. Having gained a first hunch by observing the child on the arm of its parent, we apply the most important tests first and continue from there as far as the patient allows us to go, keeping in mind that we need a minimum of compliance for the treatment, too.

The observation of the child's spontaneous movements is the principal source of information for the examiner; all tests serve to standardize the hunches one gets from the examination of the baby before one even touches it. And the more the child is in distress, the more the watching parents will get nervous - which feeds back onto the child's behavior immediately. The amount of distress is of diagnostic interest, too, and one should keep in mind at what time of day the child is presented. The younger the child, the more the diurnal rhythm plays a part, and at noon almost every child is much more irritable than between 9 and 11 a.m. So it does make sense to note the time of the examination routinely.

It is useful to make the transition of the baby from the parent's lap into our hands as smooth as possible. At the end of the initial conversation we sit next to the parents and help them to undress the child while it is still on their lap. How far we go with this undressing is open to discussion: in the beginning of our work with small children we routinely undressed them completely, the way we were taught at university. Later on we realized that there is a trade-off between the area of skin visible and the mood of the little patient. So we use a bit of reafpolitik and mostly leave the underwear on, at least in the beginning. It is easier to examine a moderately cooperative baby in its underwear than a naked baby stiff with anger.

Examination in the dorsal position

Adduction and pronation of the arms and/or extension and inside rotation of the legs are symptoms of central nervous problems. KISS children, on the other hand, often show unilateral fisting, mostly on the concave side of the body, together with fewer (or less differentiated) movements of the extremities on that side. After manipulation, this often changes rather quickly and the ability to grasp things improves.

Children in whom there is a risk of cerebral palsy do not show such an improvement.

We also look to see if there is a 'cervical' pattern to the child's symptoms. Facial asymmetry, unilateral enophthalmos, marked folding of the neck skin (often clammy) and a laterally fixed posture of the head are signs which direct our attention towards a functional problem of the (cervical) spine. In children with a fixed retroflexion (KISS II) a marked persistence of the Moro test is typical. These children react with a marked and Moro-like movement to noise and change of position well beyond the age of 5 months.



Figure 9.3 Moro reaction. This reaction is physiological till the third month. Later on its persistence is pathological. The differential diagnosis between a functional or central origin is not easy. Persistence till adolescence may be one reason for coordination disorders (Goddard Blythe and Hyland 1998). In this case the lack of head support and the asymmetry of the hands are pathological.

Examination of the form of the thorax and the abdomen is important, too. Children with a parietic diaphragm have a retracted lower rib case which is fixed in an exhalation position. A reduced muscle tone of the abdominal muscles can have a multitude of different origins which have to be checked.

Examination in the ventral position

Next is the examination in the ventral position (Fig. 9.4). First and foremost we are interested in the posture and movement of the head and the coordination of the arm muscles. From the age of 4 months the child can support head and shoulders, albeit still a bit wobbly, in a neutral and symmetrical position and is able to direct head and eyes towards a stimulus.

KISS I (fixed lateroflexion) children often have delayed head control and an asymmetrical posture. If the stimulus comes from the 'right' - i.e. convex - side they are able to fixate the stimulus and they will follow it with their eyes till the point when the limited movement range of their cervical joints prevents further following. If the baby is in a mood to be sufficiently cooperative this allows for a repetitive test of the range of movement. It is evident that this restriction of movement is frustrating (and painful) for the child and one reason for the fits of rage these children sometimes display.



Figure 9.4 Ventral examination: inadequate prop of the shoulders. This baby cannot bring the right arm into a supportive position.

Sometimes the child compensates for the restricted range of movement by lifting the shoulder. By pulling up the shoulder the distance between origin and insertion of the sternocleidomastoid muscle is minimized. In those cases where - through treatment or by its own means - the child is unable to overcome this condition, there is a chance that the muscle reacts to this long-term shortening by fibrotic transformation. This transformation of the muscle results in a thin, piano-wire like remnant of the sternocleidomastoid. These cases cannot be effectively treated by means of a functional therapy, be it manual therapy or other physiotherapeutic means. In most cases a myotomy offers the best chances of improvement.

Children with a basically functional problem display a mild form of absence of head control; a basic muscular tonus is present and this tonus can be reinforced by repeatedly testing it. If the muscular tonus is severely reduced or completely absent, a central origin of this condition is probable.

KISS II children display hyperextension of the head in the ventral position and a fixated thoracic hyperkyphosis. Because of the hyperactivity of the neck extensors, the shoulders are often protracted and the child cannot bring the elbows into a ventral position (see p. 287). We call this posture 'the dying swan' (Vasilyeva et al 2001). An additional test is to check for hypersensitivity of the neck area, especially the insertions at the occiput.

It is essential to distinguish between the hyperextension due to functional and arthrogenic problems and the classic opisthotonos caused by central nervous problems, e.g. meningitis.

Examination of cranial nerves and eye muscles

We also examine the quality of the cranial nerves and the functioning of the eye muscles. Eye movement can be tested by establishing eye contact and moving one's head in front of the child. Alternatively a toy or a colored object might be moved in front of the child's eyes. A strabismus convergens (nervus abducens) or divergens (nervus oculomotorius) has be excluded. The optico-facial reflex gives a rough idea about the strength of vision (nervus opticus), as the auro-palpebral reflex allows testing of the infant's hearing.

The evaluation of the functioning of the facial nerve distinguishes between a central paresis affecting the muscles of the lower half of the face and a distal paresis which affects the entire face. The caudal group can only be examined and evaluated indirectly (nervus vagus, nervus glossopharyngeus, nervus hypoglossus.). In a newborn baby with swallowing difficulties, injury to these nerves has to be considered after other possibilities have been excluded.

Testing the muscular tonus

The neonatal automatisms and the muscular tonus are the next steps in the test battery.

First and foremost we are interested in whether the different muscle groups display a regular muscular tonus, comparing the upper and lower extremities and the left and right side as well as the tonus of the ventral and dorsal muscle groups. The tonus can be normo-, hyper- or hypotonic and regionally different. KISS children without additional neurological problems have a normal muscular pattern.

If an elevated muscular tonus is found we have to look for articular disorders. A hip dysplasia with reduced abduction results in a heightened muscular tonus of the adductor

and the psoas muscles, but a blockage of the iliosacral (IS) joint can cause the same phenomena. Additional differential diagnosis is always necessary in these cases.

A hip dysplasia can be verified by sonography and/or radiography, an IS blockage is associated with local trigger points and a palpable dysfunction of the joint; it should subside shortly after successful treatment, either locally or at the OC junction.

If these two causes can be excluded, a central coordination disorder becomes the most probable reason. In this case we expect to find additional signs, e.g. fixed extension and inversion of the foot/feet and spasticity of the biceps surae muscle.

In the quite frequent case of a combination of IS blockage and a dysfunction of the central nervous system, the normalization of the joint function leaves the reduced abduction as the persisting 'central' sign.

Muscle reflexes

The routine control starts with ASR (L5/S1), PSR(L₃/L₄), BSR(C₅/C₆) and TSR(C7/C8). We register the amount of response, and possible enlargement of the zone, and compare the reactions on both sides.

Positive Babinski and Rossolimo reactions are pathological from the fourth month on. KISS children without neurological problems display normal and symmetrical reflexes without these signs.

Primitive reflexes

For the examination of the primitive reflexes we use Ratner's methodology (Ratner and Bondarchuk 1990).

Search reflex

Slight touch of a cheek induces a search movement of the mouth and slight rotation of the head to the side of the stimulus. The neuronal chain includes the nervus trigeminus as its afferent and the nervus facialis (mouth movement) and the nerves of the upper cervical segments (head rotation) as the efferent part. If the child does not sense the touch we suspect a cerebral problem; if the head rotation is reduced a cervical disorder is most probable.

Sucking reflex

If a nipple or a finger is found with the mouth, a sucking movement begins. This neuronal chain goes via nervus trigeminus, nervus facialis, nervus vagus and nervus hypoglossus. This reflex is purely cerebral.

In a few cases the sucking response improved very quickly after cervical manipulation. A possible explanation might be found in an increased perfusion of the vertebral artery with a consequent improvement of brainstem function.

Babkin reflex

The baby is in a dorsal position and the palms of its hands are pushed with the thumb of the examiner. The normal reaction is an opening of the mouth. This is a purely central reflex.

Grasping reflex

The forefinger touches the palm of the hand, coming from the wrist. The ensuing grasp reflex is assessed qualitatively and in comparison with the other side. The neurological chain of this reflex uses the segment levels C.-C.. This reflex is purely spinal and a cerebral or high cervical lesion leads to a marked amplification of the response on the traumatized side. In cases of plexus paresis and lesion of the lower cervical structures, this reflex is attenuated.

KISS I children without signs of neurological impairment often show a diminished reaction to that stimulus on the side where the muscles are shortened, a phenomenon we explain by the reduction in muscular strength on the concave side due to the inhibition of these muscles on the segmental level.

Moro reaction (see Fig. 9.3)

The child is placed in a half-sitting position and fixated at the back and the head. A slight passive retroflexion of the head sets off a generalized movement of the arms. The neuronal chain of this reflex runs through the cervical level C₅/C₇. Attenuation of this reaction can be the result of a central muscular hypertension, a lesion of the lower cervical area or a trauma to the plexus brachialis. KISS I children without additional neurological Problems show, in most cases, an asymmetrical reaction to this test. In KISS II children this reflex persists for a long time, disappearing rapidly after successful treatment (i.e. 1-3 days later).

Galant reaction

During this test the child is held in a ventral - and strictly horizontal - position supported under its belly by the hand of the examiner. Starting from the lower scapular angle the paravertebral skin is stimulated by gently stroking it. This elicits in normal cases a slight contraction of the muscles of this side resulting in a side-bending of the trunk to this side. The head follows this movement.

If the Galant reflex is missing a spinal lesion is probable; central lesions do not seem to influence this test. We often see a asymmetrical reaction in KISS I children.

Foot-grasp reflex

The examiner places his thumb on the sole of the baby's foot close to the toes. More or less rapidly a 'grasping' reflex is elicited. The quality of this reaction can be classified as normal, intensified or reduced. The neural chain of this reflex involves the lumbar segments L₅ S₂.

This reflex is attenuated in cases of cerebral palsy and more frequently due to lesions of the lumbar spinal cord, e.g. in babies born in the breech position.

Walking automatism

The reflex chain of this test runs along the spinal segments; in spasticity and after trauma to the lumbar spinal cord this reflex is diminished. In cases of athetosis, this automatism persists after the third month.

The tonic neck reflex

The elucidation of this reflex peaks between the second and third months, but it can be found earlier. If it persists after the third month, this is considered to be a sign of central lesion, and certainly if present after the sixth month. We see this reflex in children with KISS aged 6 months and older without any other signs of a central lesion and the pathological pattern subsides after manual therapy of the suboccipital structures.

Vojta's reactions

These standardized tests (Vojta 1988) are a handy screening tool when examining the state of the sensorimotor system during the first year. Our impression is that we have to re-evaluate the significance of these tests according to the influence of the suboccipital structures on the smooth functioning of the motor patterns involved. To illustrate these considerations we shall focus on the first four tests.

Traction reaction

This test figures centrally in our examination of small children. The traction reaction yields a lot of information about the degree of coordination in the dorsal position. Especially interesting are the posture of the head and the legs and the relative movements of shoulder and pelvis.

Any analysis of the functioning of the muscles supporting the head can at the most be summary.



Figure 9.5

Traction reaction. This child has a marked weakness in supporting its head in the first phase (A) pulling the chin to the chest. Afterwards the head is thrown back (B) and pulled forward asymmetrically (C). Differential diagnosis with a central tonus disorder: the muscular tonus of the rump is normal, only the short flexors of the neck are weakened. Together with the asymmetry of the head posture in C, this is typical for KISS.

KISS I children often show an asymmetric posture of the head (Fig. 9.5), less frequently a weakness of these muscles. KISS II children show a characteristic reaction pattern. Recognizing this pattern can make it easier to find a functional disorder of the OC junction even when other signs are less clearly discernible.

The anteflexion of the head proceeds in two phases. Initially the nodding movement is initiated by the activation of the short flexors of the neck. This movement takes place

exclusively in the upper cervical spine (i.e. C0/C2) without any involvement of the rest of the cervical spine, which becomes activated in the second phase of the anteflexion. Now the long flexors and the entire cervical column (i.e. to T₃) take part in the movement. These muscles are innervated by the spinal nerves caudal to C₂. The short flexors are innervated via nerves originating in the craniocervical junction, which renders them irritable by disturbances of the functional equilibrium of this level. This irritability is twofold, as it can be caused directly by mechanical irritation of the local nerve fibers and via the spinal/pontal processing of faulty input from this region, a phenomenon we could validate experimentally (Vasilyeva et al 2001). This makes it especially important to examine the two phases of head anteflexion separately.

For this differentiated examination we use Janda's method (Janda 1983), which we modified slightly for the examination of small children:

To examine the function of the short flexors of the neck the child is put on its back and a bright toy is held in front in such a way as to attract the child's attention. After the child has fixed the toy with its eyes we move it cranially in order to force the child's neck into a retroflexion. Only then is the toy moved caudally; the child will react to that by activating the short flexors (nodding) and later on by using the entire neck muscles to bend the head forward in order to follow the moving toy with its eyes.

Babies with a fixed retroflexion cannot nod. In the first phase of the anteflexion the head is instead hyperextended or not included in the movement at all. We call this a dove's move (Vasilyeva et al 2001). In the second phase the child catches up and in using the long flexors the head is indeed brought up.

If the baby has a unilateral blockage of an IS joint we observe an asymmetry of the bending phase of the legs or an asymmetry of the rotation of the legs. This movement pattern has to be distinguished from the early signs of a cerebral palsy. The latter shows a fixed extension of the leg in inner rotation of the leg at the affected side. Here the leg is held in an extended posture with predominance of the triceps surae muscle, and scissoring of the legs and toe stance. Sometimes a similar picture can be observed in children with a bilateral blockage of the IS joints. In these cases the fixation of such a posture diminishes soon after the successful manipulation.

Landau reaction

We look at the posture of the spine as a whole together with the positioning of head and extremities. In cases of KISS I the asymmetry of the neck and skull is immediately distinguishable. A hypotonia of the trunk is rather rare in these cases.

KISS II children show a typical position, too. The shoulders are retracted and the edges of the shoulder blades approach each other, the head is hyperextended and the cervical and dorsal spine

are in hyperlordosis. The head founders after a few minutes toward the support. The dystonia between the attenuated flexors and the hyperactive extensors which we found in KISS II children (Vasilyeva et al 2001) helps to explain this pattern.

Axillary suspension response

The child is held in a vertical position with its back to the examiner. To get reliable results one has to take care to hold the trunk without irritation of the trapezius muscle (this would provoke an extension of the lower limbs).

A blockage of the IS joint results in an increased or diminished flexion of the relevant leg, depending on the relative position of the sacrum and ilium. Fixed extension of the legs with scissoring and toe stance are certain signs of a spastic lesion.

Vojta reaction (lateral tilt maneuver) (see Fig. 9.113)

The child is initially held in a vertical position from which it is tilted laterally into a horizontal position. Care should be taken to have the child's hands open when starting the tilt, as closed hands, especially in early infancy, might provoke an artificially abnormal flexed posture of the arm.

In examining the reaction of the child we have to pay attention to the upper half of the body, i.e. the posture of the trunk and head and the upper two extremities. KISS I children have an asymmetrical posture of head and body. The positioning of the head is markedly clumsy on the side of the dysfunction, the hand often in a fistful position on the opposite side. The posture of the legs is mostly asymmetrical, too.

KISS alone does not lead to adduction of the legs or forced extension of the feet. If these signs are present, an at least partially central genesis of the problem is very likely.

Children with a KISS II symptomatology may show a Moro-like reaction after the age of 5 months. Hyperextension of the head, retraction of the shoulders and a (reactive) hypotonia of the trunk are part of this clinical picture, too.

THE DIFFERENTIAL DIAGNOSIS: FUNCTIONAL VERTEBROGENIC VERSUS CENTRAL/SPINAL

Having completed the whole neuropsychiatric examination, we have the necessary means at our disposal to reach a conclusion as to how many Symptoms are caused by a functional vertebrogenic problem (i.e. a KISS sensu stricto), by a more centrally situated disorder or by a traumatic lesion of a region of the spinal cord. It should not be forgotten that this differential diagnosis, necessary as it may be for our assessment of the long-term prognosis of that child, does not alter the actual therapy too much. The combination of rehabilitative measures is more determined by the response of the young patient to the different therapeutic approaches than by the eventual diagnosis.

The one paramount conundrum of neuropsychiatrics lies in the fact that an exquisite arsenal of diagnostic tools - even correctly used - leads more often than not to roughly the same therapeutic protocols. Ultimately the outcome depends more on the initiative and personality of the individual therapist and the supportive environment at home than on the fine print of this diagnosis.

This is by no means a request to drop diagnostics and fall back on a purely pragmatic 'how-to' approach to rehabilitation - far from it. But one should keep in mind that the eventual result of all these therapeutic efforts cannot be predicted with any precision.

This caveat should be kept in mind when one gives a long-term prognosis to the parents, who do naturally enough insist on it. The justified request of 'tell us everything' has to elicit a balanced response which avoids the pitfalls of drawing too dark a picture or

seeking refuge in an all too rosy future. The former extreme is more comfortable for the doctor involved, as it is always possible then to say 'I told you so' - but there is a high probability that this pessimistic picture discourages and demotivates family and caregivers, thus weakening the Support our young patients need so urgently. If we are too optimistic, on the other hand, we are in danger of losing the confidence of the parents and with it any influence and compliance.

A central coordination disturbance in combination with functional vertebro-genic disorders is probable if the following dysfunctions are observed (see also **Table 9.1**):

Table 9.1 Differential diagnosis

Clinical symptomatology	1	2	3
Asymmetry of movements	+	+	+
Dysfunctioning of cranial nerves		+	-
Muscular hypotonia		+	+
Increased muscular tonus or asymmetry		+	+
Asymmetry of myotatic reflexes		+	+
Persistence of Babinski and Rossolimo/Starling sign		+	+
Asymmetry of primitive reflexes	+	+	+
Persistence of primitive reflexes	a	+	±
Vojta tests: asymmetry			
In execution	<i>b</i>	<i>+b</i>	<i>+b</i>

1, KISS without neurological co-symptoms.

2, Combination of KISS and a central coordination disorder.

3, KISS combined with a cervical/spinal irritation.

a Besides Moro sign and ATNR.

a 'Functional' pattern.

a 'Central' (i.e. spastic) or hypotonic pattern.

- dysfunctions of cranial nerves
- missing early childhood reflexes or their persistence (with the exception of the Moro reaction, the asymmetric tonic neck reflex (ATNR) in KISS II children)
- seizures of all types
- central muscular hypotonia
- retardation of psychological development retardation of language acquisition
- central disturbances of movement, e.g. spinal palsy or disorders of the pyramidal tracts

- dyskinesia and extrapyramidal and/or cerebellar motion disorders.

In our daily contact with these children we became aware of the fact that a spastic dystonia is in many cases accompanied by a functional problem of the OC junction on the side of the hemiplegia. In cases of tetraplegia the blockage of the OC junction is mostly found on the side of the more pronounced symptoms. Due to this combination it can be difficult to distinguish between a mostly functional vertebrogenic problem and an athetotic/dyskinetic disorder. Of course, children with a central disorder can have problems of this kind at the same time. From the viewpoint of manual therapy it seems to be practical to check if there is a functional problem with a vertebrogenic origin, as this can be dealt with much more easily.

These vertebrogenic components of the clinical picture are peripheral to the main problem, but in the context of a centrally triggered disorder, these functional problems gain a disproportionate impact on the clinical situation. The role of manual therapy in these cases is not central - physiotherapy and training have a more important role. But manual therapy offers an uncomplicated adjuvant therapy which in some cases is prerequisite to a successful rehabilitation effort using physiotherapeutic techniques.

In many cases we found a combination of functional vertebrogenic disorders with an irritation of the spinal cord. Taking into account the anatomical situation and the close proximity and interdependence of these structures, it seems plausible that a trauma of the spinal cord during delivery results in a rather variable clinical picture.

Ort the cervical level the situation resembles closely that of cerebral palsy. A close examination of the delivery history (forceps, vacuum extractor, breech presentation) and the presence of other signs of cervical irritation may help to clarify the predominant cause of the problems observed.

Signs of an irritation of the cervical part of the sympathetic nerve can be present, too. This group of symptoms comprises unilateral enophthalmia, microsomia and flattening of the occipital part of the skull.

In most cases of KISS I we find an irritation of the cervical autonomous system on the contralateral side of the functional impairment. In cases of KISS II this observation is very rare. To this day we do not have the corresponding scientific investigations at our disposal, but some interesting details are starting to emerge. In papers on sudden infant death syndrome (SIDS), Doppler sonographic research showed that rotation and reclination of the head often leads to a decreased perfusion of the contralateral vertebral artery; this might be a starting point for further research (Saternus 1982).

Traumatic lesions of the lower cervical segments (C5/C7) show another clinical picture. If it is only the motor neurons in the anterior horn that are involved, the child shows a peripheral monoor paraparesis of the arm(s). The differential diagnosis of a plexus lesion, Erb-Duchenne, needs to be excluded in these cases. If further neurological examination reveals signs of spastic symptoms, the diagnosis of a medullar base of the ensuing problems is facilitated. Our experience with these cases indicates that vertebrogenic functional disorders and the mechanical irritation of the spinal cord are etio-pathogenetically intertwined, which is why manual therapy is the most comprehensive approach in these cases.

Most of the symptoms are greatly alleviated 2-3 weeks after treatment. As this therapy does not demand a lot of effort or cooperation from children and parents, we recommend starting with a test manipulation as soon as acute destructive processes or tumors have been excluded. Minimizing the influence of functional vertebrogenic problems clarifies the clinical picture and helps to optimize the rehabilitation, at least in part because of the encouragement the improved situation conveys to the parents and therapists.

Injuries of the thoracic medulla are very rare at birth. The defects are more often situated more caudally, i.e. at the lumbar level and here involving the pyramidal tracts. This leads to a spastic paresis of one or both legs. Other probable causes (spinal stenosis, tumors or an isolated para-sagittal cerebral trauma) are much less frequently found.

The more massive traumas of the lumbar spinal cord are quite as rare as those of the thoracic level. These children display a mono- or diparesis of the legs. In most cases, a typical anamnesis can be found with breech (pelvic) presentation and a difficult and/or forced delivery.

In both cases, these primarily central neurological lesions are accompanied by blockages of the OC and IS joints. These functional disorders are not at the root of the clinical problem, but aggravate the situation further. Their treatment can facilitate the 'classic' rehabilitation and has to be repeated regularly (i.e. 3-4 times a year). This accompanying therapy is very motivating for the families and for the physiotherapists, as it makes progress possible which otherwise would be beyond the reach of the therapists.

CONCLUSION: STANDING ON TWO LEGS

We hope to have shown here that the manual therapy approach differs somewhat from that of traditional neurology. In examining newborn babies and toddlers the additional information obtained by looking for signs of birth trauma in the spinal structures opens the view to a wider range of possible pathologies than the 'classic' approach which attributes almost everything to disorders of the intracranial structures.

Manual therapy - applied sparingly - can ease rehabilitation and thus motivate everybody involved in this long-term endeavor. It is quite common to find a clearer clinical picture after the functional problems of vertebrogenic origin have been taken care of - at least temporarily.

If the neurological component of the problem at hand is dominant we have to surmise that the treatment has to be repeated. In our experience it suffices to do that 2-3 times a year, at least in the continental European context of a close-knit collaboration between manual therapy, physiotherapy and rehabilitation (e.g. logopedics, remedial education).

Adding this new dimension to the therapeutic arsenal improves the future prospects of our young patients without imposing too much effort on them - and in many cases we can provide the little step forward that was missing.

References

- Ayres A J 1979 Sensory integration and the child. Western Psychological Services, Los Angeles
- Birrer R B, Levine R 1987 Performance parameters in children and adolescent athletes. Sports Medicine 4(3):211-227
- Dubowitz L, Dubowitz V, Mercuri E 1999 The neurological assessment of the preterm and full-term newborn infant. Clinics in Developmental Medicine 148:1-155
- Fenichel G 2001 Clinical pediatric neurology. Saunders, Philadelphia
- Goddard Blythe S, Hyland D 1998 Screening for neurological dysfunction in the specific learning difficulty child. Journal of Occupational Therapy 61(10):459-464
- Janda V 1983 On the concept of postural muscles and posture. Australian Journal of Physiotherapy 29:83
- Loovis E M, Butterfield S A 1993 Influence of age, sex, balance, and sport participation on development of catching by children grades K-8. Perceptual and Motor Skills 77(1+2):1267-1273
- Patel D R, Pratt H D, Greydanus D E 2002 Pediatric neurodevelopment and sports participation. When are children ready to play sports? Pediatric Clinics of North America 49:505-531
- Ratner A, Bondarchuk S V 1990 [Neurologic evaluation of unconditioned reflexes in the newborn]. PEDIATRUA 4:38-41
- Ratner A J, Michailov M K 1992 Klinisch-röntgenologische Befunde bei geburtstraumatischen Verletzungen der Halswirbelsäule. Kinderarzt 23:811-822
- Saternus K-S 1982 Lageabhängige zirkulationsbedingte cerebrale Hypoxämie - eine Erklärungsmöglichkeit des plötzlichen Kindstodes. Zentralblatt Rechtsmedizin 24:635
- Swaiman K 1994 Pediatric neurology. Mosby, St Louis
- Vasilyeva L F, Ilewa S, Biedermann H 2001 EMG - Veränderungen bei der Manualtherapie von Kleinkindern. Manuelle Therapie 5:122-126
- Vojta V 1988 Der zerebralen Bewegungsstörungen im Säuglingsalter. Enke, Stuttgart
- Vojta V, Peters A 1992 Das Vojta-Prinzip. Springer, Berlin

Manual Therapy in Children



Manual Therapy in Children presents a comprehensive conceptual approach to the subject of manual therapy for children of different ages. This approach considers the relationship between the neuromusculoskeletal structure and function at different stages of development and places strong emphasis on the prevention of problems as the child develops as well as on their safe and effective treatment and management. Edited and largely written by a leading European orthopedic physician, the book also includes contributions from over 20 leading practitioners in the field.

The contents are grouped into 5 main sections:

- **The Basics:** summarizes the essential theoretical base (anatomy and physiology, neuromotor development of the first 5 years - crawling to walking, surface anatomy).
- **Clinical Insights:** looks at issues which may affect the neuromotor development of the child and approaches to management, e.g. birthing interventions, birth trauma, differential diagnosis of central and peripheral neurological disorders, asymmetry.
- **Practical Aspects of Manual Therapy in Children:** includes advice on interaction with parents and children; guidance for examination and treatment; considerations to be borne in mind when treating different joints and spinal regions.

- **Radiology in Manual Therapy:** describes the functional radiology of the spine in the young child and how to take, interpret and document radiographs in infants and young children.
- **Making Sense of It All:** outlines the clinical picture including functional disorders (such as KiSS syndrome), neurological and biomechanical disorders, and looks at the long-term consequences of untreated functional disorders in the first year.

Manual Therapy in Children is soundly based on the latest evidence. Written by an established author with contributions from a large team of clinical experts, the text is supplemented with almost 250 high quality illustrations. It presents a fresh and well-considered approach to the management of a wide range of paediatric problems. All practitioners working with children with neuromusculoskeletal conditions will find this a clinically relevant and practical resource.

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