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Hammersmith Infant Neurological Examination (HINE)

Guidance notes for completion of proforma

Main references (others at end)

- Haataja L et al. Optimality score for the neurologic examination of the infant at 12 and 18 months of age. J Pediatr 1999;135:153-61
- Neurological Assessment in the first 2 years of life. Ed Cioni G & Mercuri E. 2008 Clinics in Developmental Medicine 176; ISBN: 978-1-898683-54-4; Mac Keith Press (now Wiley)

This neurological examination is aimed at being easy and quick to do. It is divided into 5 sections, which are scorable (cranial nerves, posture, movements, tone, reflexes). There are then two sections, which we do not score, documenting motor developmental milestones and age at which they were achieved and a record of the child's responsiveness and interaction.

The examination is validated for term and preterm children from 6 months to 18 months in terms of optimal scores and prediction of gross motor outcome. We have also used it in 2 year old infants though some of the reflex items and those involving lifting may be difficult for the examiner and the children may deliberately flop or dislike being handled making those items difficult to assess.

The examination should be easy to complete in 5-10 minutes. It is ideally performed on a bed but can be done on a parental / carers lap provided it is possible to lie the child down for some items.

Recording the examination

In order to record and score the examination indicate the response to any item by circling the appropriate picture (stick drawing) on the form

- If a response does not fall clearly into one of the options offered but falls between two options then mark across the vertical line dividing the two.
- If the response is asymmetrical mark the observation twice, once for left and once for right. You will see that in many boxes L and R are written.
- If there are two drawings in any box mark the one closest to what you see.
- If the response or observation that you find is not offered on the proforma then write it down descriptively.
- You do not have to do the items in any particular order
- If you are not sure about the response redo it or wait a little and retry if the child is fractious

- If you are not sure about the response say so rather than marking a definite response

Scoring

- Within the scored section of the exam there are 26 items (cranial nerves 5, posture 6, movements 2, tone 8, reflexes 5).
- The maximum and optimal score for any item is 3 and appears in column 1 giving a total optimal score of 78
- As you move across the page from left to right for any one item the scores reduce to 0.
- If you do not think the response is optimal for an item but not poor enough to score 0 or 1 then give a score of 2.
- If the response to an item is asymmetrical and in two different boxes take the score for 1 side e.g. 2 and the score for the other side, e.g. 1 - add them and divide by 2 - in this example we get (2 + 1)/2 = 3/2 = 1.5 and also make a note in the margin to the right of the form. If the response is asymmetrical but within the same box do not do this but again make a note of the asymmetry in the box and in the margin to the right of the form - in both cases count up the number of asymmetries in the summary. See the paper by Nathalie Maitre´s group (Hay K et al Pediatric Neurology 2018) on hemiplegia where more than 5 asymmetries were predictive of that type of CP. Note however these infants were quite old when examined.
- At age 12 months scores >72 are optimal and at 18 months scores >73 is optimal. Scores above 66 (term) and 64 (preterm) are associated with independent walking and scores above 40 (term) and 52 (preterm) are with independent sitting. The scoring in the preterm is independent of gestational age at birth and of the age at assessment within the age range of our study.

Section 1 Cranial nerves

Most of this section will be readily observable whilst talking to parent/carers prior to the formal examination.

- Observe eye movements and also get the child to follow a clear target fully vertically, horizontally and in a circular manner.
- Ideally have someone out of the child´s line of vision to help you test the auditory response. (If this is difficult and parents report that the child has had a formal hearing test and you have no concerns you can assume a score of 3).
- Observe the child´s face for a range of movements – if there are no specific problems but you think there is some paucity of movement give a score of 2
- Likewise If a child does not have definite difficulties with sucking, chewing or swallowing but does not feed well give a score of 2.

Section 2-5

Ideally the following items should be assessed with the child undressed down to vest and diapers. However if undressing the child causes upset at least remove shoes and socks, trousers and thick jumpers.

Section 2 Posture items

- Head posture in sitting – for younger children you will have to support them in sitting
- Trunk posture in sitting – in order to obtain a score of 3 the back needs to be really straight most of the time.
- Observe arm postures during the exam
- Observe hand postures during the exam
- Long sitting, i.e. sitting on a flat surface with legs out straight in front (this cannot be done sitting on a chair). For children that are not yet sitting lie them down and observe leg posture from the hips
- Observe the foot posture in relation to the lower leg - many children will have some external angling of the foot but generally this comes from the hip and is not genuinely present at the ankle.

Section 3 Movements

These items will probably have been observed earlier in the visit but it is necessary to watch the child and decide whether the quantity and quality of movements are within normal limits. Some children will have slightly jerky movements, i.e. column 3 but rarely do they fall into column 4. If you judge that the movements are not optimal but do not fall into column 3 then place them into column 2.

Section 4 Tone items

Ideally this section should be done with the child lying on a bed. However, if the child is very reluctant to lie on the bed you can do this by laying the child on both your own and the parent's/carers lap. It is best to do this by sitting in a chair opposite the carer so that your knees are almost touching and then sit the child on the carer's lap and then pull the legs slowly towards you so that the child is lying across your two laps. It is not ideal but you can do the examination that way.

- **Scarf sign:** Pull the arm across gently but firmly. Keep the child's head in the midline and see whether the elbow comes as far only as the outer border of the cheek (column 3), to the middle of the ipsilateral cheek, to the chin or crosses the midline to the middle of the contralateral cheek (mark all in column 1, either the left drawing, between the two, or the right drawing as appropriate). Most infants will be to the right of column one but many are in column 3 because the elbow come across as far as the outer border or beyond the contralateral cheek.

- **Shoulder elevation:** Hold the arm at the wrist and lift it up and take it straight up along the side of the head to lie on the bed. Sometimes you meet some resistance, which can easily be overcome (column 1), but often in ex-preterm children little resistance is met to this manoeuvre (column 3). Repeat the shoulder elevation manoeuvre on each side to feel for mild asymmetries.

- **Supination and pronation:** extend the elbow and hold the wrist and rotate it to fully supinate and pronate through 180°.

- **Hip adduction:** you need the child lying horizontal ideally with a loosened nappy. Have the legs straight at hips and knees and first keep together in the midline and then gently abduct them as far as you can, keeping knees extended.

- **Popliteal angle:** Have the child horizontal. Flex the hips so that the anterior aspect of the thighs are touching the abdomen making sure to keep the child's bottom on the bed - if you let the bottom lift the measured popliteal angle will be bigger. Then extend the lower legs at the knees as far as you can and estimate the angle behind the knee. It is sometimes easier to do one leg at a time especially if the child is wriggling and you are trying to keep the bottom on the bed but doing both together allows a better assessment of any asymmetry.

- **Ankle dorsiflexion:** It is important to do this with the leg straight at the knee and hip. Hold the knee down on the bed and at the same time place your other hand flat on the sole of the foot and dorsiflex the ankle maximally. Estimate the angle between the foot and the shin. Some children will voluntarily resist this manoeuvre but actually be quite flexible, but others will have an involuntary resistance and then a sudden give - if this is the case make a note of it.

- **Pull to sit:** Hold the child by the wrists, and pull them up from lying, watching the position of the head as they come up. It you feel they under-perform repeat. This can be difficult to score if they are crying and hold their head back.

- **Ventral suspension:** Hold the child around the abdomen and tip into ventral suspension. Some of the children may be too heavy to comfortable hold around the abdomen in this position. They may also mess around or not like being held up in the air and deliberately flop down. If this happens write this down rather than score the item.

Section 5 Reflexes and reactions

- **Tendon jerks:** It is best I do the tendon jerks while children are lying but they can of course be done in other positions. It can be difficult to use a hammer with many children and often it is better to sharply tap with your fingers when the child relaxes.

- **Arm protection:** Any child who can sit must have this response and in some older children they won't respond in the manner drawn as they are so competent. Say so if you think this the case rather than score them wrongly. If they obviously have lateral saving mark them in column 1. To do the test lie them down, place your hand on the hip contralateral to the arm you will pull them up with. Then with

pull them up by the wrist and see whether they put their free arm down on the bed to support themselves. Repeat the other way around to test the other side.

- **Kicking in vertical suspension:** Hold the child vertically just under the armpits, with their back to you so they can see their parent or carer, and see whether they kick their legs equally and well. Sometimes it is necessary to get someone to tickle the feet a bit to encourage a response. One is mainly looking for subtle differences in whether they kick one leg more than the other. If they are too heavy to lift or deliberately flop or stiffen say so and don't score.

- **Lateral tilt:** Hold the child just above the hips, (not high under the armpits) with their back towards you so they are facing their parent/carer. Then tilt sideways, not too dramatically as to scare them and see/feel the response of the trunk muscle under your upper hand. Some older children may be too heavy to lift and some may deliberately flop down. To score in column 1 (see drawing) they must have a brisk response not only with the trunk but with leg and shoulder elevation

- **Parachute reflex:** Hold the child just above the waist and tilt briskly forwards towards a bed or table. Look for a brisk forward symmetrical arm response.

Motor milestones and Behaviour

We do not score these items but they act as a record of motor development and state during the examination. The pictures and descriptions for the motor milestones are obvious. Ask whether the child played with their toes when they were younger. Ask if the child rolls both ways and through both sides. Make a comment if they only commando crawled and if they bottom shuffle. Note the age of independent walking.

References

- Neurological Assessment in the first 2 years of life. Ed Cioni G & Mercuri E. 2008 Clinics in Developmental Medicine 176; ISBN: 978-1-898683-54-4; Mac Keith Press (now Wiley)
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