HAUTE AUTORITÉ DE SANTÉ

SOFMER Société Française de Médecine Physique et de Réadaptation
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CLINICAL PRACTICE GUIDELINE

Shaken baby syndrome

or non-accidental head injury caused by shaking

Update of the guidelines issued by the 2011 hearing commission

GUIDELINES TEXT

July 2017

The good practice guidelines (GPG) are defined in the health field as methodically developed proposals to assist the practitioner and the patient to find the most appropriate care in given clinical circumstances.

The GPGs are rigorous summaries of the state of the art and scientific data at a given time, described in the evidence report. They do not exempt the health professional from exercising discretion in the patient's treatment; this must be the treatment considered to be most appropriate depending on their own findings and the patient's preferences.

This good practice guideline has been developed according to the method summarised in the evidence report and in the HAS methodology guide available online:
Development of good practice guidelines – Clinical practice guidelines method.
The objectives of this guideline, the population and the professionals involved in its implementation are summarised on the last page (information sheet) and described in detail in the evidence report.
This sheet and the guideline summary can be downloaded from www.has-sante.fr.

Grades of guidelines

A	**Established scientific evidence** Based on studies with a high level of evidence (level of evidence 1): randomised controlled trial with high power and without major bias or meta-analysis of randomised controlled trials, decision analysis based on well conducted studies.
B	**Scientific presumption** Based on scientific presumption provided by studies with an intermediate level of evidence (level of evidence 2) such as low power randomised controlled trials, well conducted non-randomised controlled studies, cohort studies.
C	**Low level of evidence** Based on studies with low level of evidence such as case-control studies (level of evidence 3), retrospective studies, case-series study, comparative studies with significant bias (level of evidence 4).
EC	**Expert consensus** In the absence of studies, the guidelines are based on agreement between experts in the working group after consultation with the reading group. The absence of grading does not mean that the guidelines are not relevant and useful. However, it should prompt additional studies.

The evidence report of this guideline can be downloaded from
www.has-sante.fr

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Summary

Abbreviations and acronyms

ADC .....Apparent Diffusion Coefficient

AEMO .....*Action éducative en milieu ouvert* [Child protection procedure in an open environment]

AHI.....Accidental head injury

ASE.....*Aide sociale à l'enfance* [Child Welfare Services]

AT .....Accidental trauma

CIVI.....*Commission d'indemnisation des victimes d'infraction* [Crime Victims Compensation Commission]

CML.....Classic metaphyseal lesion (metaphyseal corner fracture)

CRIP .....*Cellule de recueil, de traitement et d'évaluation des informations préoccupantes* [Child abuse prevention office]

CSF.....Cerebrospinal fluid

EDH .....Extradural haematoma

EEG .....Electroencephalogram

ESAS .....Enlargement of the subarachnoid spaces

FO.....Fundoscopy

GOS.....Glasgow Outcome Scale (Glasgow score)

GSTF .....Global Strategy Task Force

HAS .....Haute Autorité de santé

HC.....Head circumference

HC.....Head injury

IH .....Intracranial hypertension

IHI .....Inflicted head injury

IOE.....*Investigation et orientation éducative* [Investigation and care review procedure]

ITT.....Total disability

MJIE.....*Mesure judiciaire d'investigation éducative* [Court-ordered child protection investigation]

MRI .....Magnetic resonance imaging

MVA.....Motor vehicle accident

NAHI .....Non-accidental head injury

NAT.....Non-accidental trauma

NIHI.....Non-intentional head injury

OPP .....*Ordonnance de placement provisoire* [Temporary care order]

PJJ.....*Protection judiciaire de la jeunesse* [Youth legal protection]

PMI.....*Protection maternelle et infantile* [Maternal and child welfare]

RBV .....Rupture of bridging veins

RH.....Retinal haemorrhage

SBS.....Shaken baby syndrome

SDH .....Subdural haematoma

SOFMER .....Société française de médecine physique et de réadaptation [French Society of Physical Medicine and Rehabilitation]

TFU.....Transfontanellar ultrasound

UMJ….....*Unité Médico-Judicaire* [Abuse consultation team]

Introduction

Development context

HAS and SOFMER wanted to jointly prepare an update of the guidelines issued by the 2011 hearing commission on the topic of shaken baby syndrome (SBS)[1].

Objective of the guideline

The objectives are to:

- improve the recognition of SBS by healthcare professionals and to specify the approach and diagnostic criteria;
- specify the possible mechanisms of injury;
- specify the actions to take to protect the infant.

This guideline dedicated to the diagnosis and legal treatment of SBS aims to answer the following questions:

- What are the risk factors of SBS?
- What are the clinical signs?
- What are the injuries?
- What assessments should be carried out?
- What mechanisms should be ruled out?
- What are the diagnostic criteria?
- What is the dating evidence?
- What is the legal treatment?

Patients concerned

Children under 2 years of age. Children over 2 years of age can much more rarely be victims of shaking, but have not been considered in this document.

Professionals concerned

- Health and medico-social field: general practitioners, paediatricians, child psychiatrists, emergency medicine specialists, radiologists, ophthalmologists, neurosurgeons, anaesthetists/intensive care specialists, doctors of physical medicine and rehabilitation, forensic doctors, midwives, psychologists, paediatric nurses, childcare assistants, healthcare assistants.
- Legal and judicial field: legal officials (prosecutors, assistant prosecutors, investigating judges, children's judges, family court judges, guardianship judges), lawyers, ad hoc administrators
- Individuals responsible for the training of various professionals (doctors, early childhood professionals including childminders, legal officials, lawyers, etc.).
- Others: early childhood professionals, police officers, members of the gendarmerie, firefighters, guarantee funds for crime victims, insurers.

[1] Shaken baby syndrome. Public hearing. Guidelines issued by the hearing commission. SOFMER. May 2011.

Guidelines

1. Shaking: diagnostic approach

Shaken baby syndrome (SBS) is a subsection of inflicted head injuries or non-accidental head injury (NAHI), in which shaking, alone or in combination with impact, causes head and brain injury. The subject of this guideline is NAHI caused by shaking.

The shaking in question is always violent, and usually done by grasping the baby's chest under the armpits. The violent back-and-forth movements of the head cause the brain to bounce around inside the cranial cavity and the tearing of the bridging veins located at the convexity.

It usually occurs in children under 1 year of age and in 2/3 of cases under 6 months of age. From an epidemiological viewpoint, the risk factors identified and related to the child are as follows:

- male sex;
- prematurity or perinatal medical complications;
- mother-child separation in the neonatal period;
- multiple pregnancy or pregnancies close together;
- unwanted pregnancy;
- inconsolable crying;
- difficulties achieving a regular sleep pattern, sleep disorders;
- feeding difficulties;
- prior interventions from social services.

The main potential perpetrators identified in the literature are: adult male (or possibly an adolescent the size of an adult) living with the mother (who may be the child's father or the mother's partner), caretaker (male or female) of the child (childminder, non-certified nanny). The perpetrators often have a very poor knowledge of the child's normal needs, abilities and behaviour.

As with domestic violence, all socio-economic, cultural and education backgrounds may be affected; however, insecurity (low education and income level, young age of the mother) and social and familial isolation are additional risk factors.

Each year, several hundred children are victims in France of this type of abuse (incidence of 14 to 56 cases per 100,000 children under 1 year of age according to foreign studies; the stronger the methodology of the studies, the greater the reported incidence). The incidence of SBS is certainly underestimated because it does not include children who were not seriously enough injured to lead to hospitalisation and for whom the diagnosis will never be made, or hospitalised children for whom the diagnosis is not made (missed diagnoses are very common).

A recent concept is the recurrence of episodes of shaking in the majority of cases. Lack of knowledge of the condition is common and exposes the risk of recurrence and therefore persistent severe sequelae or death. The human and economic cost of this syndrome is considerable.

These are the difficulties faced by professionals in making the diagnosis, which have led to focusing guidelines on this diagnosis. This is a vital first step in deepening reflection on other aspects such as prevention, treatment, etc.

1.1 Importance of identifying NAHI

In an infant, dead or alive, what clinical signs may or should be suggestive of the diagnosis, or may lead to misdiagnosis?

► Initial symptoms

- **A severe neurological impairment may be suggested from the outset by a combination of the following to varying degrees:**
  - apparent life-threatening event : impaired vigilance and consciousness, extending to coma;
  - severe apnoea or even cardio respiratory arrest;
  - repeated convulsions, or even status epilepticus;
  - signs suggesting acute intracranial hypertension (fixed upward gaze, vomiting);
  - axial hypotonia, sudden motor deficit;
  - paleness.

- **Other signs suggestive of neurological damage:**
  - poor contact (including eye contact with wandering gaze);
  - signs of chronic intracranial hypertension: progressive macrocrania, bulging fontanelle, vomiting, ophthalmological disorders: strabismus, nystagmus, psychomotor stagnation and/or regression.

- **Some non-specific signs of neurologic damage, which can lead to misdiagnosis are :**
  - paleness;
  - feeding difficulties, poor food intake (stagnant weight curve), vomiting without fever or diarrhoea;
  - sleep disorders;
  - behavioural changes: apparent pain, irritability and crying.

These elements, which may lead to misdiagnosis, reflect either intracranial hypertension (vomiting without fever or diarrhoea, crying accentuated by supine position) or severe anaemia.

- **Discovery of injuries of a traumatic appearance**

Sentinel lesions:

- finding of skin lesions, especially bruises or haematoma;
- finding of ear, nose and throat lesions, especially inside the mouth;
- discover of fractures in a child who cannot walk.

Under these circumstances, it is essential to have a rigorous diagnostic approach in the search for an NAHI.

The clinical examination, and in particular the neurological portion, must be thorough and performed after undressing the child. It should include palpation of the fontanelle to check for bulging, measurement of the HC (which should be checked against the previously established growth chart to see whether there has been a change in the upward curve) and examination of the whole body for bruises (including the scalp, the face, on or behind the ears, on the neck, the torso, under the armpits and inside the mouth). These lesions may be tenuous.

Given the lack of specificity of certain signs on their own, a combination of them is of considerable importance: a combination of various degrees of vigilance disorders, hypotonia, vomiting, convulsions, abnormal change in the HC curve, skin lesions or even fractures.

► Absence of lucid interval

In all cases, shaking produces immediate symptoms. However, the first symptoms are not always well described by the family or well interpreted by doctors. They should therefore be searched for and recorded accurately in the medical record.

This is separate from the fact that there may be a delay in care, with the consultation occurring some time after the shaking.

► Other elements that can be suggestive of NAHI caused by shaking

- Data from the medical history:
  - a delay in seeking care;
  - lack of explanation for the symptoms, or explanations that are incompatible with the clinical signs or the child's developmental stage, and/or explanations that change over time and/or depending on the person asked;
  - spontaneous report of a minor head injury incompatible with the severity of the clinical manifestations and/or injuries observed;
  - adult's attitude minimising the child's symptoms;
  - incessant crying that is difficult to calm, which may or may not have been the reason for prior consultations;
  - trauma of any kind;
  - history of unexplained sibling death(s);
  - "doctor shopping".

- Laboratory data
  - haematocrit below 30% and/or platelets above 400 G/L with no explanation.

- **The child was found dead**: it is then an unexpected infant death. In this case, it is essential to follow the guidelines of the Haute Autorité de santé[2]. Post-mortem examinations are essential (especially fundoscopy and post-mortem CT scan) and will lead to an autopsy.

1.2 Lesions and hospital-clinical and paraclinical assessment necessary and sufficient to detect them

► Injuries observed in case of shaking

In case of shaking, intracranial lesions (meninges and cerebral parenchyma) and/or spinal lesions (spinal cord and meninges) and/or ocular lesions are likely to occur. Other injuries may also be associated: lesions of the soft parts of the neck; fractures of the limbs or spine, rib cage (especially the ribs) or skull; skin or mucosal lesions with bruising or haematoma.

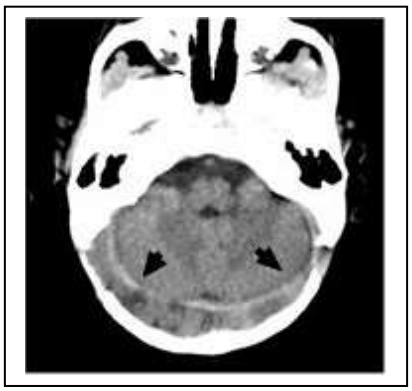
Intracranial lesions:

- Subdural haematoma (SDH):
  - Multifocal (see figures below), they are bilateral or unilateral, in the falx cerebri and/or the tentorium cerebelli. They may be associated with subarachnoid haemorrhages.
  - The predominance of subdural haematoma and the presence of blood clots at the vertex due to the rupture of bridging veins are, in the acute phase, essential elements of the diagnosis.
  - A haemorrhage of the falx cerebri or the tentorium cerebelli is very suggestive of the diagnosis.
  - SDH are not always initially visible because they may be masked be cerebral oedema.
- Brain lesions : they may be anoxic, oedematous or contusion-type lesions, localised or diffuse, or else cerebral lacerations.
- Late lesions: multicystic encephalomalacia, porencephaly, cerebral atrophy.

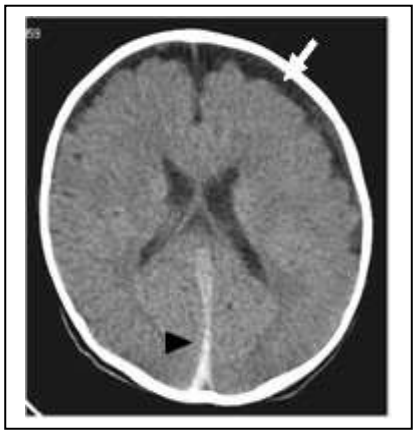
[2] Management of unexpected infant death (under 2 years of age). Good practice guidelines. HAS. February 2007.

Illustrations. Examples of subdural haematomas

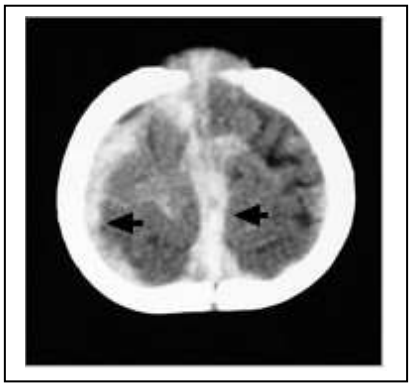
French-speaking Society for Paediatric and Prenatal Imaging (SFIPP)



SDH of the tentorium cerebelli (arrows)



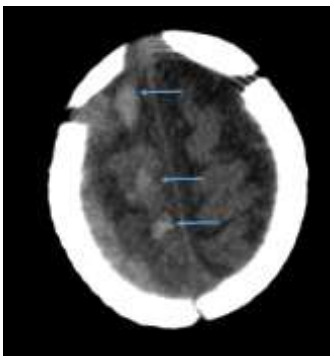
Interhemispheric multifocal SDH (hyperdense, arrowhead) and left pericerebral SDH (hypodense, arrow)



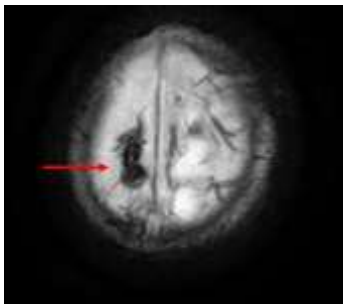
Multifocal SDH of the vertex (arrows)
The predominance of haematoma or blood clots at the vertex is an essential element of the diagnosis of shaking (rupture of bridging veins) in acute phase

Rupture of bridging veins

To the right (arrows) in a 5-month-old shaken baby.

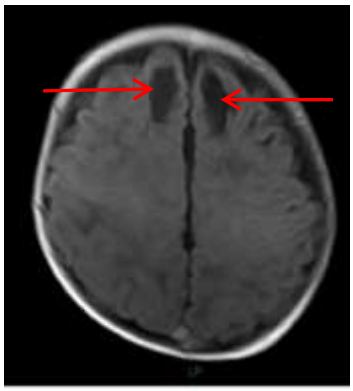


CT scan without injection of contrast medium showing oval-shaped millimetric hyperdensities at the convexity (arrows)



The MRI (susceptibility weighted imaging) confirms the rupture of the bridging veins, showing a so-called “tadpole” or “lollipop” sign (arrow) at the convexity.

Cerebral lacerations in T1-weighted images



Spinal cord and intraspinal lesions: spinal cord lesions (contusion, haematoma, severing, etc.) and intraspinal subdural haematomas are not always associated with vertebral fracture. Intraspinal SDH are very highly correlated with NAHI (as opposed to accidental trauma).

Ocular and periocular lesions

- **Retinal haemorrhages:**
  RH are very rare in young children after 1 month of age and do not occur in young children in good health.
  - RH are highly correlated with NAHI (versus accidental trauma).
  - RH may be unilateral or bilateral.

  - RH are quasi-pathognomonic for SBS when they affect the periphery of the retina and/or several layers of the retina, whether bilateral or unilateral, sometimes with haemorrhagic retinoschisis or perimacular retinal fold. This type of lesion can also be seen after cephalic crushing or high-speed MVA or fall from a significant height (several floors).
  - But other types of RH may be seen.
  - They are absent in about 20% of cases. Therefore, they are not essential for diagnosis, but, when present, are strongly suggestive of shaking.
  - Their severity is correlated to that of the NAHI.
- Vitreous haemorrhage.
- Haemorrhages of the orbital cavity (muscles, fat, optic nerve sheath).
- Late lesions: hypoperfusion of the retina (ischaemia).

The following classification is recommended for characterising lesions (see Annex 1)

Surface area size of RH = according to 2 regions:

- region 1 = posterior pole (centred by the fovea)
- region 2 = periphery

Quantity of RH:

- A mild = <10 RH
- B moderate = >10 RH but <50% of the retina (or region 1 if no involvement of region 2)
- C severe = involvement of >50% of the retina

Depth = depends on the layer of the retina reached:

- i = intraretinal haemorrhages (excluding the region under the internal limiting membrane)
- ii = extraretinal involvement = pre-retinal under the internal limiting membrane, sub-retinal or in the vitreous body

Classification:

- grade 3 = involvement of region 1 or region 2 or both, with retinal folds or retinoschisis
- grade 2 = involvement of region 2 but without retinal folds or retinoschisis
- grade 1 = RH limited to region 1

After the grade, the abundance of RH is noted:

- A = mild
- B = moderate
- C = severe

Then, the depth of the retinal involvement is stated:

- i
- ii

so that the nomenclature is given as grade (1, 2 or 3; A, B or C; i or ii) and then the associated involvements are listed.

- **Mucocutaneous lesions**: bruises are very suggestive of abuse regardless of their location in a child who does not move on his or her own. They are usually on the scalp, the face, on or behind the ears, on the neck, the torso, under the armpits and inside the mouth. A coagulation panel is required.

- **Lesions of the neck**: neck muscle lesions are an additional sign suggestive of shaking, but are not always present. They are significantly associated with the presence of diffuse cerebral hypoxic-ischaemic lesions.

- **Bone lesions**: all traumatic injuries may be and should alert (fractures, periosteal appositions and calluses reflecting an old fracture, etc.) to the possibility of non-accidental trauma; some lesions are particularly common in case of abuse, such as rib fractures and metaphyseal corner fractures. These fractures may be latent clinically, more specifically in these situations of inflicted trauma that may alter the clinical expression of pain.

► Clinical and paraclinical hospital assessment in a living child

Clinical examination: thorough examination, especially neurological, HC, weight and height curves, screening for traumatic injuries (which must be photographed), the state of the fontanel.

- **Careful examination of the health record book**.

- **Brain CT scan without injection**: first-line, urgent examination. It must include slices on the entire skull, including the vertex, with three-dimensional reconstructions of the cranial vault. Transfontanellar ultrasound is not indicated for the diagnosis of subdural or meningeal haemorrhages.

- **Ophthalmological examination after dilatation and use of an indirect ophthalmoscope if possible**: this must be done, if possible, within 24 hours and no later than 48 to 72 hours after admission to the hospital by an experienced ophthalmologist. The results should be accompanied by at least one diagram. Photographs of lesions using a portable device are recommended. They allow for telemedicine (interpretation by a paediatric ophthalmologist), assessment of progress of the lesions and archiving.

- **Cerebral MRI**: this is done as soon as the child is stable, ideally in the first week. It has a prognostic value as well as a diagnostic value, in case of uncertainty on the initial CT scan. At minimum, it must be done with T1-weighted axial and sagittal images, T2-weighted axial images, diffusion-weighted images, and T2-weighted images*. It allows for a complete assessment of parenchymal and extra-parenchymal lesions, whether haemorrhagic or not; it makes it possible to highlight ruptures in bridging veins (T2* sequences) in the form of rounded or linear images called “lollipop” or “tadpole” signs.

- **In case of diagnostic uncertainty**, a **complete cervical examination** must be carried out with sagittal STIR sequence for ligament injuries and an axial T1 sequence.

- If the diagnosis remains uncertain and in case of spinal fracture, **a complete spinal examination** (sagittal and axial T1 and T2 sequences) must also be carried out

- **Other examinations required:**
  - full blood count, haematocrit, blood electrolytes, lactate assay, haemostasis assessment (FBC, platelets, PT [prothombin time], aPTT [activated partial thromboplastin time], fibrinogen, Von Willebrand factor [RCo and Ag] FVIII, FIX, FXI), transaminase and lipase assay.
  - X-rays of the entire skeleton which should be done in accordance with current guidelines and interpreted by a paediatric radiologist. In case of uncertainty about a bone lesion, targeted images will be repeated after two weeks. In addition, a radionucleide bone scan may indicate bone lesions that are not apparent on X-rays.
  - Abdominal ultrasound is advised in France, based on the clinical examination.
  - EEG: essential given the frequency of seizures; it may reveal subclinical seizures.

- Transcranial Doppler: it makes it possible to non-invasively indicate IH, and to guide a possible decision for emergency surgery.
- When a neurosurgical procedure is necessary, a macroscopic description (appearance/pressure) and a cytological analysis of the samples from the cerebrospinal fluid and haematoma must be carried out.

1.3 Differential diagnoses for NAHI caused by shaking

The main differential diagnosis is accidental head injury, but in this case the clinical history must be completely constant and concordant. Only accidental injuries with high deceleration (motor vehicle accident type) can cause multifocal SDH and a rupture of the bridging veins. These SDH are then most often associated with other brain injuries.

A fall from less than 1.5 m cannot cause a multifocal SDH or diffuse and/or bilateral retinal haemorrhage. It never leads to the combination of SDH and RH.

Incorrect diagnoses are often made:

- in case of vomiting, diagnosis of acute gastroenteritis even when there is no fever or diarrhoea. The diagnosis of acute intestinal intussusception is eliminated by an abdominal ultrasound;
- in case of fainting spell;
  - spasm sob,
  - discomfort due to gastro-oesophageal reflux disease.

Rarer medical diagnoses may also be suggested, which do not rule out the possibility of abuse in addition to those diagnoses:

- congenital (haemophilia, Willebrand) or acquired (thrombocytopaenias) haemostasis disorders;
- cerebrovascular deformities and cerebral aneurysms, rare before 1 year of age (easily diagnosed on MRI: haemorrhage around the vascular malformation); this malformation must be confirmed by an MRI angiography.
- certain metabolic disease (very rare), such as glutaric acidaemia type 1 or Menkes disease, may be suggested and therefore confirmed by specific additional examinations only when there are previously clinical abnormalities (abnormality of HC growth, psychomotor delay, etc.).
- osteogenesis imperfecta is a differential diagnosis only for certain fractures and not for SDH. It causes diaphyseal and/or costal fractures and not metaphyseal corner fractures.

1.4 Action to be taken, depending on the clinical situation

Regardless of the clinical signs:

- early, acute neurological distress;
- signs of neurological damage (vomiting without fever or diarrhoea, trouble breathing, paleness, apparent pain);
- non-specific signs suggestive of abuse: bruising, fracture, etc.

→It is essential to:

- consider NAHI caused by shaking,
- complete the clinical examination (including palpation of the fontanel, measurement of HC with reconstruction of weight, height and HC curves),
- hospitalise the child for an injury assessment (brain imaging and a fundoscopy right away) and look for other signs of abuse.

➔ Hospitalisation is required

In case of suspected NAHI, the parents must be made aware of the concerns about the child's condition and informed that emergency hospitalisation is required in the interest of the child's health. Care should be taken to ensure that the child is actually taken to the hospital for a comprehensive assessment and care.

If a pair of twins is involved: emergency hospitalisation of both children is required.

High diagnostic value is given to:

- A history that changes, is absent or is incompatible with the observed lesions or the child's age;
- Bilateral RH and/or RH affecting the periphery of the retina and/or several layers of the retina, or a retinoschisis, or a retinal fold;
- Multifocal SDH, pericerebral SDH, SDH of the falx cerebri and/or the tentorium cerebelli;
- Blood clots at the vertex evidencing ruptures of the bridging veins;
- Cerebral lacerations

2. Causal mechanism of the lesions

To determine the diagnostic criteria for shaking, the 2011 public hearing relied on data that could not be questioned:

- on the one hand, the type of lesions observed in the context of SBS: the occurrence of SDH (almost always present) and RH (very frequently observed);
- on the other hand, the mechanisms put forth to explain the child's condition and the injuries by the perpetrators or some doctors: fall from a low height, resuscitation manoeuvres, play, intervention of another child, childbirth, hypoxia or anoxia, large pericerebral spaces, osteogenesis imperfecta, etc.

The methodology used to determine the 2011 guidelines was as follows: define, with the help of data from the literature and the opinion of experts, the lesions induced by these various mechanisms and then compare them to the lesions of SBS.

Either the lesions were similar and the alleged mechanism could be retained, or they were absent or very different and the mechanism was rejected.

From the results obtained, it was possible to establish diagnostic criteria for shaking, in a new way, only on identified lesions and reported history, and not on risk factors.

An update of the literature was carried out for the mechanisms already mentioned in 2011.

The following mechanisms and circumstances were examined:

- shaking without impact;
- mild head injury caused by a fall from a low height;
- play;
- childbirth;
- hypoxia or anoxia;
- resuscitation manoeuvres.

The update looked at other mechanisms mentioned: vaccinations, dehydration, thrombosis of the intracranial venous sinuses and haemostasis disorders.

2.1 Shaking without impact

Shaking is a highly violent action during which the cervical spine suffers brutal whiplash. Subdural bleeding and RH are correlated to the angular acceleration experienced by the head. This also explains the lower frequency of these two lesions in case of fall, in which the angular component of the acceleration is almost non-existent and linear acceleration is predominant. Therefore, it is easy to understand that the movement imposed on the head must be violent in order to cause sufficient angular acceleration. The greater this angular acceleration, the greater the lesions will be. Everyday movements (stroller ride even on rough terrain, car ride, play, consoling movements, etc.) as well as spontaneous movements of the child’s head if one forgets to support the head are of course insufficient to cause subdural or retinal bleeding. Similarly, this cannot be caused by everyday clumsy movements.

- **SDH**: an SDH can occur during shaking without impact. The occurrence of an SDH is more related to the shaking mechanism than to the existence of an impact.
- **RH**: RH, of all types, can occur during a shaking without impact and seems to be more related to the shaking mechanism than to the existence of an impact. Grade 2 or 3 RH, rare in other circumstances (high-speed MVA), are quasi-pathognomonic for shaking.

2.2 Shaking by a child

Concerning this mechanism, the only evidence found in the literature relates to biomechanical elements. Children under the age of 9 are unable to shake masses of 7 kg (average weight of a 6-month-old baby). Furthermore, the acceleration of the shaking, when possible for older children, is practically less than half of that generated by an adult, or an adolescent the size of an adult.

2.3 Mild head injury caused by a fall from a low height (< 1.5 m)

The mechanism of fall from a low height is especially important to examine, because it is one of the first mechanisms alleged by adults to explain the symptoms noted in an infant (data established in 2011 from literature review taking into account cases of fall with impartial or multiple witnesses).

- **Clinical signs**
  - A fall from a low height does not cause any consequent clinical symptoms in most cases.
  - Fewer than half of children may have bruising at the impact point.
  - A simple fracture, usually linear, of the cranial vault may be found. When it does occur, it is not accompanied by any neurological signs.
- **SDH**
  - Clinically, a fall from a low height exceptionaly gives rise to an isolated SDH. If present, the SDH is localised and near signs of impact: contusion of the scalp and possible fracture line.
  - In biomechanical terms, even though studies are needed to determine damage thresholds in children (which are not yet known), convergent results (with values measured well below the damage thresholds for adults) show that it is very unlikely that, in the cases of falls examined, severe brain damage could occur.
  - Intraspinal SDH are rare after accidental injury and are evidence of very high kinetic energy.
- **RH**

A fall from a low height is rarely the cause of RH. When they do occur, they are:

  - never extensive in terms of surface area (they are localised in the posterior pole of the eye) or depth (they are intraretinal);
  - always unilateral;
  - usually associated with an extradural haematoma but not an SDH.

- **SDH + RH**: no cases were found in the literature of a child under 1 year of age with a combination of SDH and RH after a fall from a low height.
- **Mortality**: the immediate or deferred mortality rate after a fall from a low height (< 1.5 m) is very low, estimated at less than 0.48/million children under 5 years of age per year. This low risk is corroborated by the fact that, even for falls from a high height, mortality is very low.

2.4 Activities considered to be play by the family

One mechanism sometimes evoked by adults is shaking of the baby due to play in a baby bouncer, swing or pushchair.

- **Biomechanics**: the accelerations generated by rocking an infant in a baby bouncer cannot be considered lesion-inducing.
- **Clinical data**: no cases of head and brain injury with RH and SDH resulting from play of this type or other activities (tossing the child in the air, making the baby fly like a plane) were found in the literature or in the experience of the experts.

There are no data in the literature on other activities considered to be play.

2.5 Childbirth

Childbirth is sometimes suggested as being responsible for SDH or RH. The health record book must indicate the lesions observed after childbirth and their progress in an asymptomatic child.

Subdural lesions occurring after childbirth are not related to impacts, but rather to “static” compression phenomena.

- **SDH**
  - An asymptomatic SDH may be seen soon (< 72 hours) after childbirth. The frequency varies from 9% to 46%, depending on the imaging technique, the date of the examinations, and the type of delivery.
  - The incidence of intracranial haemorrhages is higher after vacuum-assisted delivery, forceps delivery and Caesarean section performed after induction of labour than for children born without instrument assistance or born by Caesarean section performed before induction of labour.
  - In published studies of asymptomatic newborns (who had not undergone fundoscopy), SDH may be exist on brain imaging. They are supratentorial, always posteriorly located, and/or in the posterior fossa. These SDH are often multifocal. When specified, the lesions are homogeneous and have the same appearance (density, intensity). They resolve spontaneously in less than 1 month.
- **RH**: up to 50% of normal full-term newborns examined in the first 24 hours have RH. These are more common after use of vacuum and forceps. RH can affect all layers of the retina and extend to the periphery, but never include vitreous haemorrhage, retinoschisis or retinal fold. They disappear in less than 1 month, most often in a few days.
- **RH + SDH**: there are no studies available.

2.6 Hypoxia, anoxia

- **SDH**: in imaging tests, three retrospective studies have demonstrated the absence of SDH in children with severe hypoxia, including children with prolonged cardiac arrest.
  Post-mortem studies: while the death of children under the age of 1 is frequently related to severe hypoxia, SDH is rarely found in the autopsy and if it is, a cause is identified. In a particular population (comprised of foetuses and children who died during their first month and usually during their first week), hypoxia is likely to be the cause, contribute to or be associated with histologically detectable intradural haemorrhage and with very thin supratentorial, posterior and infratentorial subdural effusion at most. Hypoxia does not lead to macroscopic SDH in children older than 1 month of age. Hypoxia does not lead to rupture of the bridging veins.
- **RH**: although acute hypoxia, as can occur during suffocation, frequently produces petechiae on the surface of the lungs, heart or other internal organs, it does not induce RH.

2.7 Resuscitation manoeuvres

Cardiopulmonary resuscitation manoeuvres are sometimes alleged to have caused an SDH.

- **SDH**: no study has been identified in the literature reporting an association between SDH and cardiopulmonary resuscitation. The intracranial lesions observed following resuscitation are above all related to whatever justified the resuscitation.
- **RH**: the few available studies concerning pre-hospital or hospital-based resuscitation by healthcare professionals: these manoeuvres do not lead to RH.

2.8 Other circumstances invoked for the occurrence of a subdural haematoma

- A SDH does not occur spontaneously.

- There is no scientific evidence that establishes a connection between vaccines and SDH.
- No connections between SDH and dehydration have been reported in the scientific literature.
- No connections between SDH and intracranial venous sinus thrombosis have been reported in the scientific literature.
- A haemostasis abnormality may be accompanied by a subdural haematoma with or without intraparenchymal haemorrhage during childbirth (but without rupture of the bridging veins) or may increase bleeding during an injury. Intraparenchymal haemorrhages remain the most common locations.
- Convulsions do not cause SDH.

2.9 Other circumstances invoked for the occurrence of retinal haemorrhages

- **Convulsions**: RH are rare. In the only reported case, they were unilateral, around the papilla and flame-shaped.
- **An apparent life-threatening event** (unexpected and brutal accident leading to changes in muscle tone and/or colour of the skin and/or breathing pattern, with or without loss of consciousness) does not on its own cause RH in an infant.
- **Intracranial hypertension**: RH, when they occur, are peripapillary and always accompanied by papillary oedema.
- **Rupture of aneurysm**: Exceptional RH with pre-retinal haemorrhage, subarachnoid haemorrhage and Terson syndrome.
- **Coughing**: no RH was reported in a series of 100 children with persistent cough.
- **Vomiting**: no RH was reported in a series of 100 children with vomiting due to pyloric stenosis.
- **Vaccines**: data from the literature do not show any connections between vaccines and RH.

3. Medical criteria that allow the diagnosis of head injury caused by shaking to be made in an infant, differential diagnoses having been ruled out

These diagnostic criteria are based solely on the lesions identified by the assessment and the reported history, and not on risk factors.

In an infant, if there is no medical history or a medical history that changes or is incompatible with the clinical lesions or the child's age, and after ruling out differential diagnoses:

- **the diagnosis of non-accidental head injury caused by shaking is certain** in case of:
  - multifocal SDH with blood clots at the convexity (vertex) evidencing ruptures of the bridging veins,
  - or multifocal SDH and RH whatever they are,
  - or unifocal SDH with cervical and/or spinal cord lesions.

- **the diagnosis of non-accidental head injury caused by to shaking is likely** in case of:
  - multifocal SDH even without any other lesion,
  - or unifocal SDH with intraretinal RH limited to the posterior pole,
  - or RH affecting the periphery and/or several layers of the retina, whether unilateral or bilateral.

In any case, the likelihood of abuse is increased in case of recent or old associated lesions:

- diffuse hypoxic cerebral lesions or laceration;
- cervical and/or spinal cord lesions;
- skeletal fractures;
- bruising, especially on the face, neck or torso;
- traumatic, thoracic or abdominal visceral lesions (liver, pancreas, digestive tract, etc.).

When the diagnosis is made or highly suspected, the child must be considered to have a severe head injury, be at especially high risk of convulsions, and must be hospitalised in a paediatric intensive care unit, with neurosurgical opinion.

In case of a constant medical history, compatible with the lesions and with the child's age, and describing an accidental violent head injury:

- the diagnosis of head injury caused by shaking can be ruled out if a unifocal SDH is noted, with traces of impact, uni- or contralateral, compatible with the alleged mechanism: contusion of the scalp and possible linear fracture nearby.

4. To what extent can the shaking be dated?

Dating is based on a set of clinical, radiological (examinations can be repeated, if necessary) and possibly pathology data and data from the medical history.

Dating must not be carried out by the medical staff that cares for the child.

Dating will be handled by the forensic medical expert, who will consider all of the clinical and paraclinical lesions associated (bruising, fracture, pulmonary oedema, etc.) and will have all of the medical documents as well as procedural documents.

4.1 Dating based on clinical symptoms

Several publications have examined complete accounts given by the perpetrators or by third parties in contact with the child following a shaking, indicating that the symptoms, when presented occur immediately: the child displays unusual behaviour immediately.

In some cases, retrospective analysis of these clinical data reported may specify the moment of this change and thus allow clinical dating.

4.2 Dating based on additional tests

► Retinal haemorrhages

- It is difficult to date RH.
- Intraretinal haemorrhages usually disappear within a few days, sometimes in less than 24 hours. The absence of RH in a fundoscopy performed more than 24 hours after hospitalisation does not mean that there was no RH.
- The finding of preretinal haemorrhage without intraretinal haemorrhage indicates an injury dating from a few days to a few weeks earlier.
- RH too abundant to be counted date from less than 1 week ago.
- Only the association of intraretinal haemorrhages with scars, sequelae of preretinal or subretinal haemorrhages (circular white scars of retinal folds, macular retraction syndrome, areas of pigmentation and retinal atrophy, especially in macular areas or at the extreme periphery of the retina, fibroglial scarring), can be considered to demonstrate the coexistence of older and recent lesions.

► Subdural haematoma

The range for dating an acute SDH is wide, up to about 10 days, whether by CT scan or MRI. It is therefore impossible to obtain an accurate date using imaging only.

Furthermore, it should be noted that:

- a heterogeneous SDH does not necessarily indicate repeated shaking;
- heterogeneous SDH can reflect new bleeding from the capillaries of a neoformed post-haemorrhagic inflammatory membrane in the absence of new shaking.

Parenchymal abnormalities

Abnormalities in diffusion-weighted MRI develop in a few hours or days. They may be secondary to a post-shaking anoxia and/or status epilepticus that itself takes several hours or days to develop. Therefore, the dating is not precise.

Lesions of different ages

Brain imaging may make it possible to determine the presence of lesions of a different age, indicating repeated shaking inflicted on at least two occasions: for example, haematomas of a clearly different density in different areas, or association of a haematoma of old appearance (hypodense in CT scan) with recent parenchymal lesions (anoxia-ischaemia with diffusion abnormalities in MRI, etc.).

The finding of a change in the upward curve of the head circumference chart or the presence of suggestive signs, in the preceding weeks (see 1.1) are strong additional clinical evidence suggestive of one or multiple prior episodes.

4.3 Dating based on pathology data

Pathology-based dating is relatively accurate, but can only be performed comprehensively through autopsy. The accumulation and cross-checking of all clinical, imaging and pathology data considerably narrows the time interval during which the trauma occurred. This can thus be narrowed down to a day or sometimes a half-day.

The examination of the SDH must be macroscopic and histological. Dating is based on the appearance of the blood clot, the dura mater and the meningeal surface of the brain. The study of any brain contusions, in particular immunohistochemical analysis of macrophages, can help with dating. Another non-specific element that helps to date the stress is the presence or absence of acute thymic involution; however, it is only discriminant for durations of stress less than 4 days.

5. Are some babies predisposed to the occurrence of subdural haematoma?

5.1 Enlargement of the subarachnoid spaces[3]

The finding of an enlargement of the pericerebral spaces coexisting with an SDH is the origin of two hypotheses.

First hypothesis: the observed widening of the pericerebral spaces is part of an enlargement of the subarachnoid space (ESAS), a condition which may predispose the occurrence of SDH

No evidence was found in the literature to support the hypothesis that ESAS is a factor predisposing infants to SDH.

Second hypothesis: the observed widening of the pericerebral spaces is the consequence of a previously undiagnosed head injury.

Two prospective studies suggest that widening of the pericerebral spaces identified during the initial phase of head injury corresponds not to an ESAS but rather to residual lesions from a previously undiagnosed head injury.

5.2 Can an SDH occur during a CSF circulation disorder?

An SDH can occur in a case of excessive CSF drainage and also as a postsurgical complication of an arachnoid cyst. There is a very specific diagnostic context in all of these cases. There is no RH or other associated signs.

5.3 New bleeding after subdural haematoma

A new bleeding can occur, outside of any traumatic context.

It is asymptomatic. It has the following characteristics:

- It is located at the site of an old SDH with a fronto-parietal location;
- It is observed in the pericerebral subdural space;
- It is not observed in the tentorium cerebelli or in the interhemispheric space;
- This new bleeding, identified by imaging tests as part of routine monitoring, is not accompanied by RH or new clinical symptoms;
- A fundoscopy is necessary to verify the absence of RH.

[3]ESAS, which is a transient cerebrospinal fluid resorption disorder, has sometimes been called infant benign external hydrocephalus. ESAS is an accepted condition by the paediatric and neurosurgical community that is characterised by an enlargement of the arachnoid spaces in an infant, usually a male, with no neurological clinical signs. The primary clinical sign is a macrocrania with a smoothly increasing head circumference and a wide and depressible fontanelle.

In this condition, the head circumference is usually (but not always) large at birth, increases regularly, exceeds + 2 standard deviations (SD) between 3 and 6 months, generally stabilises between age 1 and 2 years, then seamlessly moves closer to + 2 SD afterwards. The subarachnoid spaces become normal after 2 years.

There may be family history.

The diagnosis of ESAS is based on the clinical analysis including head circumference curve and cerebral imaging tests showing a fluid-filled enlargement of the pericerebral spaces and cerebral sulci (which evidences the subarachnoid participation), predominant in the frontal region, usually bilateral, and in the interhemispheric fissure. The effusion is isodense with CSF, the arachnoid is not distinct and the parenchyma is normal. The enlargement then reduces. A moderate craniocerebral detachement may persist.

6. What are the legal consequences of a diagnosis of shaking?

6.1 When the diagnosis of NAHI caused by shaking is suggested or made

The child must be protected and hospitalised and the child's rights as a victim of a crime must be acknowledged.

For this purpose, it is recommended that a protocol on how to report a child in danger or likely to be in danger be established between the prosecutor's office, the hospital and the chair of the regional council.

6.1.1 Should it be reported? For what reasons?

The term "report" refers to any communication with the public prosecutor concerning the situation of a child in danger or likely to be in danger.

> Since this is a certain or possible criminal offence, reporting to the public prosecutor is required, with a copy to the chair of the regional council (*cellule de recueil, de traitement et d'évaluation des informations préoccupantes* [CRIP - child abuse prevention office]).

A dual procedure is then triggered: civil, to protect the child immediately, and criminal.

Reporting is protecting the child.

In case of doubt about the relevance of a report, the doctor can ask for telephone advice from the public prosecutor's office and/or ask the referring physician for the management of violence against children at his/her institution (see plan to combat violence against children, proposal 11).

6.1.2 Discuss before reporting

When SBS is suspected, an initial meeting of at least two physicians must take place right away, and must be the subject of a medical report to be included in the medical record. A report must be made without delay. A more comprehensive medical, psychological and social evaluation will be performed later.

6.1.3 What procedures follow the report?

► The civil procedure

The public prosecutor may deliver an *ordonnance de placement provisoire* (OPP) [temporary care order], which allows the immediate protection of the child and prevents the parents from being able to take the child back (endangerment of the child in case of immediate return home). This decision cannot be appealed and is valid for 8 days, during which the case can be referred to a juvenile court judge. The judge will give a ruling within 15 days of taking up the matter, after having summoned the parties with parental authority; the judge may extend the temporary care order (which can be appealed by the parents), issue a permanent care order or implement other child protection measures.

When the child was under the care of a childminder, the chair of the regional council must immediately decide on a possible suspension of his/her authorisation.

► The criminal procedure

Referring the matter to the public prosecutor triggers an immediate criminal investigation, to identify the perpetrator(s) and potentially prosecute them. If the criminal investigation makes it possible to quickly rule out the parents, it will not be necessary to issue an OPP, and the child will then be able to return to the parental home at the end of his/her hospitalisation. In case of death and a forensic autopsy is required, an autopsy is ordered by the public prosecutor.

6.1.4 Who can make a report?

Any person aware of child abuse, any person working in a public or private establishment who becomes aware of the situation of a child in danger or likely to be in danger, or any public authority or any public servant who becomes aware of a crime or offence in the exercise of his/her official duties must immediately notify the competent authority.

By dispensation from the principle of medical confidentiality, Article 226-14 of the French Penal Code allows healthcare professionals who become aware of child abuse to make a report to legal authorities.

Other important articles of the French Penal Code, the French Social Action and Family Code, the French Criminal Procedure Code and the French Code of Medical Ethics (Article 44), are detailed in the 2011 public hearing guidance report[4].

6.1.5 To whom is the report made?

Any suspected shaking is a serious situation that must be referred directly to the public prosecutor (corresponding to the usual place of residence of the child) for the protection of the child. A report is also justified by the fact that shaking is a criminal offence.

A copy of the report must also be sent to the chair of the regional council (CRIP).

The public prosecutor can issue an OPP, refer the matter to the juvenile court judge, initiate the criminal investigation and name an administrator ad hoc. The public prosecutor can also refer the matter to the CRIP.

6.1.6 What does a report contain?

The report is not legally defined. There are no legal or regulatory texts specifying the content of the report or the procedures for transmission to the public prosecutor.

However, a certain number of rules must be followed to create a factual document:

- in no case should the person who reports the shaking accuse or name a person as the perpetrator of facts likely to be qualified as a criminal offence;
- it is important to clearly separate the observed facts from reported remarks, to always specify the source of information (remarks from the parents, social worker, etc.) in order to avoid any ambiguity for the recipient, to use the conditional tense, an indirect style or to put reported remarks between quotes;
- determining the perpetrator of the shaking is not the responsibility of the hospital staff. No investigation aiming to determine the perpetrator of the shaking should be carried out by the hospital staff. This is the responsibility of the police force or gendarmerie under the direction of the public prosecutor;
- any element of dating of the lesions must be excluded from the report.

[4] http://www.has-sante.fr/portail/upload/docs/application/pdf/2016-01/syndrome_du_bebe_secoue_-_rapport_dorientation_de_la_commission_daudition.pdf

The report must contain the following information

Essential information:

- Name and address of the recipient
- First and last name, job title and professional address of the writer(s)
- First and last name, address, telephone number of each parent
- First and last name, date of birth of the child
- Sex and address of the child
- List of siblings
- First name, last name and address of the childminder, if applicable
- Person accompanying the child
- Chronological description of the facts concerning the child
- Medical findings (medical history, clinical examination, results of additional tests and progress note) and hypotheses concerning the cause of the lesions; Explanations provided by the family about the lesions identified and incompatibility between the explanations and the medical findings
- Note about the danger for the child and/or the medical severity of the situation justifying the direct submission to the prosecutor's office
- Details on the immediate actions envisaged by the physician or medical staff
- Date, first name(s), last name(s) and signature(s)

Later add when possible:

- detailed administrative information about the family: composition, ages, professions, etc.;
- childcare: parents, childminder, nanny, other people.

The report must not:

- accuse or name a person as the perpetrator of facts likely to be qualified as a criminal offence;
- include any element of dating of the lesions.

Following the initial report, hospital staffs can send, as a supplement to the report, the results of aetiological examinations, any items reported by the family and any additional data from the initial injury assessment.

It is recommended that each hospital establishment define the procedure to be followed by its staff in case of reporting to the public prosecutor concerning children who are victims of shaking (proposal 11 of the plan to combat violence against children). The following instructions can be used:

- contact the public prosecutor by phone, and confirm the report in writing (fax or email);
- send the report using a pre-established template and keep a copy in the hospital record in the non-transferable part of the patient’s record;
- send a copy to the chair of the regional council (CRIP) in accordance with Article L. 226-4-3 of the French Social Action and Family Code.
- if there is no reporting protocol, it is recommended that the writer(s) request in the report that information about the public prosecutor’s actions be provided to the writer(s).

6.1.7 When to report?

The report should be made as soon as possible, to immediately protect the child and to not jeopardise the criminal investigation. The sooner the report is made after the event, the more effective the criminal investigation will be.

However, this does not dispense with the discussion with colleagues, which allows for subsequent completion of the report.

6.1.8 What are the consequences for the child in case of non-reporting?

In the absence of reporting, a child may be exposed to violence again. The child can only receive legal protection if the public prosecutor is aware of the facts; the criminal investigation, subsequent compensation and appointment of a special legal guardian also depend on this report.

6.1.9 What are the risks for professionals who make reports?

Since the Law of 5 November 2015, there is no longer any risk when the reporting is done within the rules. The last paragraph of Article 226-14 of the French Penal Code now states that *"reports made to competent authorities carried out in the conditions established in this article cannot incur the civil, criminal or disciplinary liability of the reporter, unless it is determined that he or she has not acted in good faith".*

No prosecution or sanction is therefore possible if the report is carried out according to the rules: finding and description of lesions without interpretation as to their origin, statements of the various parties involved reported in quotation marks, possible use of the conditional tense, no accusation of any person, no name mentioned.

The professional only incurs a risk if the report is considered to be a false accusation, i.e. if it can be proved that the writer of the report acted in bad faith, with the intention to harm.

6.1.10 What are the risks for professionals who do not make reports?

For healthcare professionals, the secret entrusted to them because of their position or profession or because of a temporary office or mission does not dispense them from notifying the legal authorities.

When a diagnosis of shaking is suggested or made, lack of reporting by the healthcare professional may in particular subject him/her to sanctions under Article 223-6 of the French Penal Code.

These provisions do not contravene Article 44 of the French Code of Medical Ethics.

6.1.11 What information should be given to the parents? What are their rights?

The hospital staff must reconcile the need for dialogue and the obligation to inform the parents with the effectiveness of the investigation.

The parents must be informed of the report, unless this is not in the child's interest, as well as the possibility of filing a complaint if they do not deny the shaking, but attribute it to another person.

The report is part of the legal record and not the medical record, and can only be transmitted to the parents by the legal authorities.

6.1.12 What information should be given to other professionals from the hospital staff and to outside professionals?

As an exception to the principle of professional secrecy, persons involved in the protection of the minor including healthcare and medical-social professionals may share secret information amongst

each other in order to evaluate an individual situation, to determine and implement protection and assistance actions benefiting the children and their family (Article L. 226-2-2 of the French Social Action and Family Code).

The information communicated within the care team must be limited to the information that is strictly necessary for each professional to establish the diagnosis, evaluate the situation, ensure care and protect the child.

Regarding professionals outside of the hospital establishment, including medico-social professionals, it is important to communicate to them the information that they need as part of their mission, for purposes of protection, whether to evaluate the situation, decide on whether a protection order is necessary, take charge or ensure the follow-up of the child.

Also, especially in the case of social workers, it should be noted that Article L. 226-2-2 of the French Social Action and Family Code states that “persons subject to professional secrecy who implement the child protection policy set out in Article L. 112-3 or who provide their assistance are authorised to share secret information between each other”.

6.1.13 What feedback is given to professionals following the report?

The public prosecutor must inform the professional who made the report of the actions taken: ongoing criminal investigation, referral to a juvenile court judge, etc. It is recommended that a form be created for the exchange of information between the public prosecutor and the person who made the report.

6.1.14 What actions may be taken by the public prosecutor after a report?

A report sent to the public prosecutor can lead to the opening of a child protection procedure by the juvenile court judge and/or the opening of a criminal investigation. Two parallel, complementary procedures may thus be ordered. At the same time, a special legal guardian may be appointed.

If applicable, the report may lead to protection extended to all siblings.

The special legal guardian can be appointed by the public prosecutor (especially when one of the parents is suspected or when the perpetrator is not known), the examining judge, the juvenile court judge, the jurisdiction to which the criminal offence has been referred or the guardianship judge.

The administrator ad hoc has a legal duty dependent on the judge who appointed him/her and a role as a contact person and a support provider. He/she is independent with respect to the judge and the parents, but must keep the judge informed about the major steps of the procedure and the performance of his/her duties. For the proper defence of the child’s rights, he/she must appoint a lawyer specialised in personal injury assessment and familiar with SBS through training or experience.

► Criminal investigation

It is entrusted to the police force or the gendarmerie, usually specialised (specialised children’s protection unit), under the supervision of the public prosecutor.

The members of the hospital staff and the professionals in contact with the family may be interviewed (telephone interviews are prohibited). They must state and communicate, for the purposes of the investigation, only facts that they know, limiting themselves to their own area of expertise, taking care to reread, and possibly correct, before signing the minutes of the meeting; this will be produced, if necessary, several years later during the judgement phase.

These same healthcare professionals can then be heard as witnesses.

The hospital staff and social workers cannot invoke professional secrecy to a police officer who is investigating the subject of the report under the direction and supervision of a legal authority.

During the course of the investigation or order, the patient's full medical record may be requisitioned. This procedure must comply with a necessary formality to preserve medical confidentiality.

It is important that the necessary legal experts are competent, regardless of their speciality, in the field concerned, in this case SBS. Otherwise, they should recuse themselves.

► Outcome of the criminal investigation

The case may:

- be dismissed in the absence of an offence or if it is not sufficiently characterised;
- lead to an opening of an investigation, at the end of which the file may be dismissed if the offence could not be established due to lack of evidence or because it could not be attributed to anyone, or the file may be referred to the *tribunal correctionnel* (if the incident is considered to be a minor offence) or to the *cour d'assises* (if considered to be a serious criminal offence).

► Opening a child protection file

If the case is referred to a juvenile court judge, he or she generally orders a *mesure judiciaire d'investigation éducative* (MJIE) [court-ordered child protection investigation] with a deadline of 6 months (with possible maintenance or immediate placement of the child), and can then decide on either an *action éducative en milieu ouvert* (AEMO) [child protection procedure in an open environment], or a placement of the child in a host family or organisation.

If the presumption of innocence leads, in case of doubt as to the identification of the perpetrator of the violence, to the dismissal of legal proceedings, this of course should be no obstacle to the protection of the child.

► What are the potential criminal charges and sentences for perpetrators?

There is no specific criminal charge for shaking, but it always constitutes a criminal offence. Criminal classifications related to voluntary assault with aggravating circumstances are used. It is important to differentiate between the intent to shake and the intent for the consequences of act: shaking cannot be qualified as an involuntary act. It is always a voluntary act.

Lawmakers have made it very clear, given the severity of the sentences incurred, the penalty associated with any violence inflicted on a child under 15 years of age by an ascendant (legal, natural, or adoptive parents or the grandparents if the child has been entrusted to them) or a person with authority over the child (any person charged with looking after the child or his/her entourage). Sentences incurred range from 5 to 30 years of imprisonment.

In addition to the main perpetrator, other people in the child's environment may be prosecuted for not having prevented a crime or offence against the child, or for failure to assist a person in danger or, for an ascendant or person with authority, having deprived the child of care to the point of compromising his/her health.

Additional sentences may be handed down: for example, temporary or permanent professional ban against the person charged with looking after the child.

► What are the conditions necessary for the victim to receive compensation?

Compensation is possible once the diagnosis of shaking is established. It is therefore important that this be done, even if the perpetrator is not identified. Reporting to the legal authorities is essential for enabling the possibility of long-term compensation for the child who was the victim of shaking.

The appointment of a special legal guardian compensates for the fact that the child has no legal competence and that his/her parents are delinquent. This legal guardian must appoint a lawyer

specialised in personal injury assessment and familiar with SBS through training or experience for proper defence of the child's rights.

The victim or his/her representative may refer the matter to the *Commission d'indemnisation des victimes d'infraction* (CIVI) [Crime Victims Compensation Commission] (in case of total disability exceeding 30 days or permanent partial disability) to obtain compensation for his/her bodily injury since it is the consequence of events with the material nature of a crime. The CIVI is an autonomous jurisdiction whose decision is separate from the criminal proceedings. In theory, a victim can therefore be compensated, even if the criminal proceedings are still in progress, if they lead to dismissal or acquittal, or even in the absence of criminal proceedings. In practice, in order to avoid being exposed to an unjustified rejection of the victim's claim for damages, the existence of criminal proceedings to establish the reality of the offence is often vital. Also, if no legal report is made by doctors, the risk of not obtaining any compensation is significant.

The *Fonds de garantie des victimes d'infractions* [Crime Victims Guarantee Fund] pays the victim, through intermediary (the parents or special legal guardian, as applicable), the sums allocated temporarily or permanently by decision of the CIVI. The fund may then take action against the perpetrator, who may be held liable by a criminal court.

The existence of the CIVI is therefore essential, regardless of whether the perpetrator is economically disadvantaged or has not been identified. In general, the matter can be referred to the CIVI immediately, within 3 years of the date of the offence, or within the year following the final decision of the court issued in public or civil action before the criminal courts. In this case, because the victim is a minor, these periods are suspended until the child reaches legal age; the child can refer the matter to the CIVI until his/her 21st birthday.

6.2 Additional role of the regional council (CRIP) when the matter is referred to it by the public prosecutor

6.2.1 Parental support

Parental support actions can be considered at the request of the CRIP after evaluation of the situation by the social and medico-social professionals of the regional council.

Support from maternal and child welfare professionals, in particular through home visits, can be considered.

Specialised parent-child mediations and child psychiatry-perinatal care, to improve or help build the child-parent relationship, are preferable options.

Families can be informed about the possibility of contacting approved associations dedicated to supporting patients and families.

In any case, "the child's interest and consideration for his/her fundamental, physical, intellectual, social and affective needs and respect of his/her rights must guide all decisions concerning the child" in accordance with the first article of Law 2007-293 of 5 March 2007, reforming child protection, codified as Article L. 112-4 of the French Social Action and Family Code.

7. Guidelines

7.1 Guidelines for hospital staff

► Dialogue with parents and family

From the start of care, and especially during the diagnostic phase, it is important to respect a climate of neutrality and goodwill with the family while implementing the diagnostic approach (see item 6.1).

Dialogue with the parents is essential, especially to initially collect their explanations as to the child's injuries. This is to establish the traumatic origin of the lesions, and not to determine the perpetrator. This is the sole responsibility of the public prosecutor.

The parents (and the parents alone) should be informed that given the severity of their child's condition, the public prosecutor will be notified, specifying that only the public prosecutor will decide on legal actions to be taken. This approach, which requires availability and listening skills, is best led by one of the attending physicians, in the presence of another staff member. The severity of the situation and the obligation to report to protect their child must be explained to the parents.

The parents must be informed of the reporting and possibly of its content (unless this is contrary to the child's interest), as well as the possibility of an OPP.

However, the necessary dialogue and the obligation to inform the parents must not hinder or jeopardise the criminal investigation.

► Exchanging information with the public prosecutor

It is recommended that a form be created for the exchange of information between the public prosecutor and the reporting person. To establish this practice, the form should be part of the reporting protocol.

► Requisition of medical records

The requisition includes the original copy of all documents. In the case of a healthcare establishment, this is done in the presence of a physician of the department, a representative of the council of physicians, and a representative of the hospital administration. In requisition of the file, it is recommended to ensure the presence of all additional tests performed, including imaging CDs.

It is necessary to photocopy the requested documents prior to their requisition, in order to comply with the obligation to store medical data collected by healthcare establishments and given the risk of not having the requisitioned items returned.

It is advisable to request the return of the requisitioned items. This request must be sent to the examining judge when it occurs during the judicial investigation (French Criminal Procedure Code, Article 99, paragraph 1) or to the ruling jurisdiction if the investigation is closed (French Criminal Procedure Code, Article 373 and 484, paragraph 2).

7.2 Guidelines for non-hospital-based medical staff

Private practice healthcare and PMI professionals (physicians, midwives, etc.) must know how to detect at-risk situations (incessant crying, exhausted parents, domestic violence, etc.) and promptly make referrals to locally identified resource sites (PMI, networks, entourage, family, etc.).

Private practice healthcare and PMI professionals must know how to bring up abuse and refer the child to the hospital, after contacting the hospital staff, when the clinical signs are present (see 1.1).

Collaboration should be established between private practice and PMI professionals and hospital professionals.

Joint multidisciplinary continuing education sessions should be organised on the issue of shaking.

7.3 Guidelines for prevention

Prevention of SBS is the 10th measure of the plan for prevention of violence against children.

Awareness and information campaigns organised by public authorities—in different forms and in all locations and aimed at everyone in contact with babies—on crying, the dangers of shaking for the child and the precautions to be taken are an essential element of prevention.

► Training of early childhood professionals

Initial and continuing training of professionals in this field should be strengthened due to the very high frequency of missed diagnoses and recurrences.

Early childhood professionals must be trained on SBS. They must know how to discuss the dangers of shaking and the risk of recurrence with families and guardians of children, especially in situations of risk.

In general, any professional likely to learn, in one way or another, about situations of shaking must be trained on this issue: this includes medical professionals, paramedical professionals, psychologists, medico-social professionals, child welfare professionals, etc.

In general, difficulties related to the caregivers' living situation must attract the attention of the professional who learns of them.

It is recommended to look for all resources available in the family environment to best help the parents.

► Awareness for parents and guardians

Everyone in contact with babies should be informed about the dangers of shaking and about measures to avoid it with a simple message: "If the child cries and you cannot take it anymore, the best thing to do is to put the child on his/her back in his/her bed, leave the room and ask for help". It is not dangerous for a child to cry in his/her bed, but it can be dangerous to be in the arms of an exasperated adult.

Making parents aware of the danger of shaking should be done routinely in prenatal care, in the maternity ward and in the days after coming home from the hospital, addressing in particular the issue of a crying infant and the possibility of being exasperated[5].

► Fostering support for parents and caregivers

It is important to provide appropriate support to parents who request it or to make it available to them. Support from maternal and child welfare professionals (midwives, childcare workers, etc.), through home visits and/or at a PMI centre, can be considered. The same is true for various forms of in-home help (provided by social workers and family, for example).

In a goal of prevention, "child-parent activity centres" to improve or help build the child-parent relationship are preferable options.

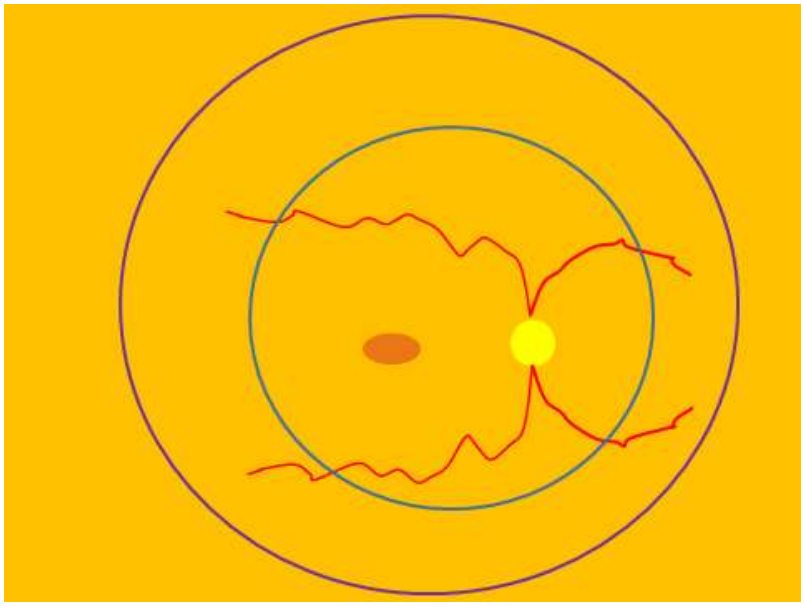
The regional councils should support the childminders who they grant authorisation to by offering them initial and continuing training on this topic, as well as attentive listening in case of problems with a difficult or crying infant.

[5] Simonnet H, Laurent-VannierA, Yuan W. *et al Parents' behavior in response to infant crying: abusive head trauma education. Child abuse and neglect* 2014 ;38(12) :1914-1922.

Annexe 1. Classification of retinal haemorrhages and areas of the fundus of the eye

From the study by Bhardwaj JAAPOS 2014	*Bhardwaj et al. Grading system for retinal hemorrhages in abusive head trauma: clinical description and reliability study*. J AAPOS 2014;18(6):523-8	**Note according to fundoscopy and/or retinography**
Location	1 posterior pole	
	2 periphery	
Extension	A mild: few haemorrhages	
	B moderate: numerous haemorrhages but less than 50% of the retinal surface	
	C severe: numerous haemorrhages greater than 50% of the retinal surface	
Morphology	i: intraretinal haemorrhages only	
	ii: extraretinal and pre-retinal extension, under the internal limiting membrane, sub-retinal or in the vitreous body	
Severe lesions	R: haemorrhagic retinoschisis	
	P: retinal fold	

Areas of the fundus of the eye – posterior pole (inside the blue circle) – periphery of the retina (betwee the blue circle and the purple circle)



Annexe 2. Full skeletal X-rays in any child under 2 years of age suspected of child abuse - SFIPP Forensic Expertise Group (French-speaking Society for Paediatric and Prenatal Imaging). Guidelines for examination in case of suspected abuse. Suspected abuse imaging protocol

- Prohibit “whole” images (“babygram”).
- Give preference to **images centred on each segment**, with an exposure adapted to the complete visibility of the cortical bone, cancellous bone and soft tissues. The quality of images must be extremely thorough.
- X-ray examination must be performed at the radiology department during business hours in the presence of a **senior radiologist** (quality control and indication of any additional images). Two exceptions: 1. child in intensive care (limited to the chest and areas of the appendicular skeleton suspected of unstable trauma); 2. clinically evident fracture (e.g. femur) requiring urgent examination.
- **Double reading by experienced radiologists** in case of suspected non-accidental trauma, as soon as possible, notifying the requesting paediatrician of the results if necessary.
- **The following are routine**:
  - frontal X-rays of each segment of the limb;
  - frontal and lateral X-rays of the entire spine, lateral view of the thoracic spine including the sternum;
  - frontal view of the pelvis;
  - a frontal image of the rib cage including the shoulder girdle and two oblique images of the chest;
  - images of the skull will only be done if a good quality brain CT scanner with 3D reconstruction is not available.
- The following are highly advised as supplemental images:
  - lateral views of the knees and ankles.
- If the skeletal images are uncertain or normal with high clinical suspicion (bruising before 6 months):
  - either bone scintigraphy as soon as possible, if it is not certain that the child will be placed under protection (noting that the major benefit of scintigraphy is in the diagnosis of poorly visible rib fractures and non-displaced diaphyseal fractures and that the analysis of the metaphyseal regions is not sensitive because of the physiological hypermetabolism of the tracer);
  - or new X-rays of the skeleton in the conditions mentioned above (except skull and spine), after about ten days, with the child placed under protection.
- As a reminder, it is rare to find fractures in children with a vitamin D deficit or in osteopathy due to prematurity; if these fractures occur, they are diaphyseal fractures. The presence of metaphyseal corner fractures is, as extensively described in the literature, very highly suggestive of abuse. Finally, the approach of bone mineralisation is extremely delicate on X-rays.
- The approach of bone mineral content by bone densitometry is also extremely delicate and there is currently no reliable standard of densitometry in children, regardless of the technique used.

Annexe 3. Articles 226-13 and 226-14 of the French Penal Code

Article 226-13
“The disclosure of secret information by a person entrusted with such a secret, either because of his or her position or profession or because of a temporary office or mission, is punished by one year of imprisonment and a fine of EUR 15,000.”

Pursuant to Article 226-14 of the French Penal Code, the civil, criminal or disciplinary liability of the person making the report cannot be incurred, based on the disclosure of information covered by professional secrecy, if the report was made under the conditions established by this article.
Article 226-14
“Article 226-13 is not applicable to cases where the law imposes or authorises the disclosure of the secret. In addition, it is not applicable to:

1. A person who informs judicial, medical or administrative authorities of deprivation or abuse, including genital mutilation, of which he/she has knowledge and which has been inflicted on a minor or a person unable to protect himself/herself because of his/her age or physical or psychological disability;

2. A doctor or any other healthcare professional who, with the consent of the victim, brings to the knowledge of the public prosecutor or the child abuse prevention office, as mentioned in the second paragraph of Article L. 226-3 of the French Social Action and Family Code, abuse or deprivation that he has observed, whether physical or psychological, in the exercise of his profession and that lead him to believe that physical, sexual or psychological violence of any sort, has been committed. When the victim is a minor or a person who is unable to protect himself/herself because of his/her age or physical or psychological disability, the victim’s consent is not necessary;

3. Healthcare or social work professionals who notify the prefect and, in Paris, the chief of police, that someone who consults them presents a danger to him/herself or to other people when they know that this person has a weapon or has manifested the intention to acquire one.

Reports made to competent authorities carried out in the conditions established in this article cannot incur the civil, criminal or disciplinary liability of the reporter, unless it is determined that he or she has not acted in good faith.”

Annexe 4. Article 44 of the French Code of Medical Ethics

When a physician observes that a person he/she has been called upon to treat has suffered abuse or deprivation, he/she must take the appropriate action to protect this person while observing the necessary care and prudence.

If the person is a minor or a person who is unable to protect himself/herself because of his/her age or physical or psychological state, the physician must alert the legal, medical or administrative authorities, unless special circumstances prevail, which he must weigh up according to his conscience.

Annexe 5. Prevention message for new parents and caretakers of infants

→ Here is some information on baby crying and shaken baby syndrome.

1) BABIES CRY!
IT IS NORMAL FOR A BABY TO CRY FOR UP TO 2 HOURS A DAY. This does not mean that you are not caring for your child well or that your child is ill.

2) SHAKEN BABY SYNDROME IS REAL!
A baby's crying can lead some adults who cannot take it anymore to shake the baby. This is the shaken baby syndrome.

3) SHAKING A BABY CAN KILL HIM OR MAKE HIM HANDICAPPED FOR LIFE.
- Shaking is much more serious than a fall.
- Shaking has nothing to do with play. Playing with a baby is not a shaking it! Playing with a baby is essential for the baby's development.

4) ONCE IS ENOUGH! AND IT'S FOR LIFE.

5) If your child is crying, you can check:
- if he is hungry;
- if his nappy is dirty;
- if he has a fever, if he is too covered up.

If, despite everything, the baby continues to cry AND YOU CANNOT TAKE IT ANYMORE
- PUT THE BABY ON HIS BACK IN HIS BED AND LEAVE THE ROOM
- call someone close to you
- ABOVE ALL, DO NOT SHAKE THE BABY!

Participants

The following professional bodies and associations of patients and users were asked to offer experts individually invited to the work and reading groups:

- Conseil national professionnel de pédiatrie [National Professional Council of Paediatrics]*
- Association française de pédiatrie ambulatoire [French Association of Ambulatory Paediatrics]*
- Conseil national professionnel de médecine d'urgence [National Council of Emergency Medicine]
- Conseil national professionnel de radiologie [National Professional Council of Radiology]*
- Conseil national professionnel d'anesthésie-réanimation [National Professional Council of Anaesthesia and Intensive Care]*
- Conseil national professionnel de neurochirurgie [National Professional Council of Neurosurgery]*
- Conseil national professionnel de médecine légale et d'expertise médicale [National Professional Council of Forensic Medicine and Medical Expertise]
- Collège infirmier français [French Nurse College]*
- Conseil national professionnel d'ophtalmologie (Académie française de l'ophtalmologie) [National Professional Council of Ophthalmology (French Academy of Ophthalmology)]*
- Syndicat national des médecins de PMI [National Union of Physicians of Maternal and Child Welfare]
- Collège national des sages-femmes [National College of Midwives]
- Union nationale des associations de familles de traumatisés crâniens (UNAFTC) [National Union of Associations of Families of Sufferers of Head Injuries]*
- Association Tatiana, défense des droits de l'enfant [Tatiana Association for the defence of children's rights]*
- Collège national pour la qualité des soins en psychiatrie (CNPP-CNQSP) [National Association for the Quality of Psychiatric Care]*
- Collège de la médecine générale [College of General Medicine]
- Association nationale des puéricultrices (teurs) et des étudiants (ANDPE) [National Association of Childcare Workers and Students]*

(*) This body offered one or several experts for this project.

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► Stakeholders

The following stakeholders were consulted for opinion:

- Conseil national professionnel de pédiatrie [National Professional Council of Paediatrics]*
- Conseil national professionnel de médecine d'urgence [National Council of Emergency Medicine]*
- Conseil national professionnel de radiologie [National Professional Council of Radiology]*
- Conseil national professionnel d'anesthésie-réanimation [National Professional Council of Anaesthesia and Intensive Care]*
- Conseil national professionnel de neurochirurgie [National Professional Council of Neurosurgery]
- Conseil national professionnel de médecine légale et d'expertise médicale [National Professional Council of Forensic Medicine and Medical Expertise]*
- Collège infirmier français [French Nurse College]*
- Conseil national professionnel d'ophtalmologie (Académie française de l'ophtalmologie) [National Professional Council of Ophthalmology (French Academy of Ophthalmology)]
- Syndicat national des médecins de PMI [National Union of Physicians of Maternal and Child Welfare]
- Collège national des sages-femmes [National College of Midwives]*
- Union nationale des associations de familles de traumatisés crâniens (UNAFTC) [National Union of Associations of Families of Sufferers of Head Injuries]
- Collège national pour la qualité des soins en psychiatrie (CNPP-CNQSP) [National Association for the Quality of Psychiatric Care]
- Collège de la médecine générale [College of General Medicine]*
- Collectif Communic'Actif des psychomotriciens [Associaiton of Psychomotor specialists]*
- Association nationale des puéricultrices (teurs) et des étudiants (ANDPE) [National Association of Childcare Workers and Students]*

* This stakeholder provided an official opinion on the guidelines.

► The following institutional bodies were asked to give an opinion on the guidelines

- National Salaried Workers' Health Insurance Fund (CNAMTS)*
- Health and retirement scheme for independent workers (RSI)
- Agricultural Social Mutual Fund (MSA)
- Ministry of Health

- General Directorate of Health Care Supply
- Ministry of Justice
- Ministry of National Education
- Ministry of the Interior

* This body provided an official opinion on the guidelines.

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Information sheet

Title	Shaken baby syndrome or non-accidental head injury caused by shaking
Work method	Clinical practice guidelines (CPG)
Objective(s)	Practice improvement objectives
Patients or users concerned	Children under 2 years of age.
Professional(s) involved	• Health and medico-social field: general practitioners, paediatricians, emergency medicine specialists, radiologists, ophthalmologists, neurosurgeons, anaesthetists/intensive care specialists, doctors of physical medicine and rehabilitation, forensic doctors, nurses, childcare assistants. • Legal and judicial field: legal officials (prosecutors/assistant prosecutors/examining judges/children's judges/family affairs judges/guardianship judges), lawyers, special legal guardians. • Individuals responsible for training (doctors, early childhood professionals including childminders, legal officials, lawyers, etc.) • Others: early childhood professionals, police officers, members of the gendarmerie, guarantee funds for crime victims, insurers.
Requested by	HAS and SOFMER wanted to jointly prepare an update of the guidelines issued by the May 2011 hearing commission.
Sponsors	Haute Autorité de santé (HAS), Department for Good Professional Practice. Société française de médecine physique et de réadaptation (SOFMER)
Financing	Public funds
Project steering	Coordination: Mr Alexandre Pitard, project manager, HAS Department for Good Professional Practices (head of department: Dr Michel Laurence) Secretary: Ms Laetitia Cavalière
Literature search	From January 2009 to June 2015. Performed by Ms Virginie Henry, with assistance from Yasmine Lombry (Head of Documentation Department – Watch: Ms Frédérique Pagès)
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Participants	Professional bodies and associations of patients and users, working group (chair: Dr Anne Laurent-Vannier, physical and rehabilitation medicine, Paris), reading group and other people consulted: see list of participants.
Conflicts of interest	Members of the working group have sent their public interest declarations to the HAS; these can be seen on www.has-sante.fr. They were analysed according to the analysis grid in the HAS guide on the declaration of interests and management of conflicts of interest. The interests declared by the working group members were considered as being compatible with their participation in this work.
Validation	Adoption by HAS College in July 2017

Title	Shaken baby syndrome or non-accidental head injury caused by shaking
Updating	Updating of the guideline will be considered depending on the data published in the scientific literature or significant practice modifications occurring since publication.
Other formats	The evidence report and summary of the good practice guideline can be downloaded from www.has-sante.fr
Accompanying documents	Evidence report “Shaken baby syndrome or non-accidental head injury caused by shaking” (HAS 2017)

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