

# Investigating subdural haemorrhage in infants

A M Kemp

*Arch Dis Child* 2002;**86**:98–102

When an infant or young child presents with subdural haemorrhage, the diagnostic priority is to exclude physical child abuse. A team approach should be adopted for the clinical child protection investigation. The diagnostic process is inevitably one of detective work; appropriate radiological, ophthalmological, haematological, biochemical, and postmortem investigations are discussed.

have their own specific physical signs or diagnostic markers.

## TEAM APPROACH

The clinical child protection investigation should be led by a paediatrician with expertise in the field. Optimal care of the sick child depends on a partnership between the clinical team and the carers, and there is often an anxiety that this will be jeopardised by invoking child protection procedures. A clinical specialist in the field can address the situation with the required level of objectivity and work with local authority child protection teams. When the child is admitted to a tertiary centre or adult centred neurosurgery unit, child protection procedures are often not initiated at a local level.

Infants suffering from SDH are commonly seen in paediatric neurology units; however, the general paediatrician will be involved with a case less frequently. The clinical expertise of the paediatric neurologist or paediatric neurosurgeon will therefore be invaluable in the discussion and management of all cases.

The Local Authority Child Protection Team must be involved early to undertake preliminary investigations<sup>11</sup> and exclude any previous concerns of child abuse within the family unit. Early involvement of the police will identify relevant criminal records of the child's carers and ensure that any forensic investigation can be initiated as soon as possible.

## HISTORY AND EXAMINATION

An SDH is usually diagnosed in an infant who presents as an acute hospital admission where child abuse is not the primary presenting complaint. The clinical presentation is variable in terms of severity, symptoms, and signs.<sup>1</sup> There is rarely a straightforward history of events preceding the diagnosis. Frequently the carers do not identify trauma as the most likely cause of the child's symptoms and when asked for a possible cause, may propose various explanations from the days prior to admission that have little relevance.

Paediatricians are unused to conducting "forensic style" inquiries and are reminded that they can contaminate evidence by close cross examination. Open ended questions will uncover the dynamics of any traumatic events described; such as the height and forces of any alleged fall or impact, the part of the body involved, how hard the surface was, and what was the child's response after the injury. The clinician needs this

Subdural haemorrhage (SDH) arising from intentional injury is relatively common in infants, with an annual incidence figure of 21/100 000.<sup>1</sup> The morbidity from shaken baby syndrome is serious: 12–30% of victims die,<sup>1,2</sup> and 60–70% of the survivors suffer from significant neurological handicap.<sup>1–3</sup>

When an infant or young child has an SDH, the diagnostic priority is to exclude physical child abuse which is the commonest cause following shaking or shaking impact injury.<sup>1</sup> Research suggests that when these children are admitted to hospital, they are often incompletely investigated.<sup>1</sup> Information collected at this stage forms the major component of evidence for key decision making throughout the child protection process, within civil, criminal, and compensation litigation. The consequences of missing a diagnosis of physical abuse may leave children at risk of further injury, while an incorrect diagnosis of shaken baby syndrome will have profound effects on a family unit.

There are a number of features associated with SDH that raise the probability of abuse.<sup>1,4,5</sup> These include retinal haemorrhages,<sup>1,4,6,7</sup> additional physical injuries,<sup>1,4,8,9</sup> and a previous history of child abuse in the family.<sup>1,4</sup>

As with any other clinical discipline, the field of child protection must be subject to the rigours of evidence based practice and national clinical guidelines. There are currently, however few systematic reviews in this field and a paucity of publications concerning the overall investigation of SDH. The literature<sup>1,4,6,10</sup> and child protection legislation<sup>11</sup> support a comprehensive interagency assessment of the child and family. All young children who have a "subdural haemorrhage diagnosed on admission to hospital where there is no clear underlying medical cause or history of witnessed major accidental trauma" must have a series of essential baseline investigations. There must be a systematic interpretation process to decide whether physical child abuse has occurred or not.

Table 1 outlines the causes of SDH in infancy and early childhood. Findings must be interpreted in the context of the different causes; all

See end of article for authors' affiliations

Correspondence to:  
Dr A M Kemp, University of  
Wales College of  
Medicine, Academic  
Centre, Llandough  
Hospital, Cardiff  
CF64 2XX, UK;  
Kempam@cardiff.ac.uk

Accepted for publication  
19 October 2001

**Abbreviations:** CT, computed tomography; MRI, magnetic resonance imaging; SDH, subdural haemorrhage

**Table 1** Recognised causes of subdural haemorrhage in infants and young children

Cause of SDH	Comment
Intentional injury Shaken baby syndrome	The commonest cause of SDH <sup>1</sup> SDH is commonly associated with other injuries and retinal haemorrhages. However shaken baby syndrome can cause isolated SDH or isolated retinal haemorrhages
Non-intentional injury <sup>27</sup> Major trauma, e.g road traffic accident, serious falls	Minor household falls rarely cause SDH. SDH has been described in more serious falls and in whiplash injury <sup>27</sup> Retinal haemorrhages are only associated with severe accidental injury <sup>7</sup>
Neurosurgical complications	SDH commonly reported as a postoperative complication of neurosurgery
Perinatal Fetal <sup>28</sup>	SDH infrequently reported on fetal ultrasound scans
Traumatic labour <sup>29</sup>	SDH can follow traumatic delivery and be associated with retinal haemorrhage
Cranial malformations Aneurysms <sup>30</sup>	Spontaneous bleeding from vascular malformations
Arachnoid cysts <sup>31</sup>	Less serious trauma can result in SDH when arachnoid cyst is present Both are unlikely to be associated with retinal haemorrhages unless intracranial pressure is raised
Cerebral infections Meningitis <sup>32,33</sup>	Postinfective subdural effusions are seen. These can be associated with retinal haemorrhage <sup>7</sup>
Coagulation and haematological disorders Leukaemia <sup>34</sup> Sickle cell anaemia <sup>35</sup> Disseminated intravascular coagulation Haemophilia <sup>36</sup> von Willibrand's disease Haemorrhagic disease of the newborn <sup>37</sup> Idiopathic thrombocytopenia purpura <sup>38</sup>	Diagnosis will be excluded on coagulation and haematological investigations. All may be associated with retinal haemorrhages <sup>7</sup>
Metabolic disorders Glutaric aciduria <sup>16</sup>	Associated with widening of subdural space that can result in SDH due to stretching and rupture of subdural vessels
Galactosaemia <sup>39</sup>	Case reports describe associated retinal haemorrhages in both conditions <sup>16,40</sup>
Biochemical disorder Hypernatraemia <sup>1,41</sup>	SDH described in association with salt poisoning, hypernatraemic dehydration Hypernatraemia may also be a complication of the intracranial trauma

level of information to determine whether the proposed explanation is plausible.<sup>6</sup> The number of different explanations and variation in detail from one raconteur to another must be recorded. This detail must complement a full paediatric clinical history and examination that can be overlooked during the intensive management of the sick child. Any additional signs of physical abuse should be recorded in detail, injuries measured, and clinical photographs obtained.

## RADIOLOGY

Acute haemorrhage is more easily seen on cranial computed tomography (CT) than on magnetic resonance imaging (MRI). A CT scan is more readily obtained for the acutely unwell child and is more widely available.<sup>12</sup> However, small

quantities of subdural blood may be invisible on CT and it can be difficult to differentiate from fluid in the subarachnoid space. Chronic SDH may therefore look very similar to benign enlargement of the subarachnoid space which can be seen in CT scans of infants.

MRI will identify small areas of SDH and can visualise blood in positions that are not well seen on CT scan, such as the floor of the middle and posterior cranial fossae. It is also more sensitive than CT in identifying underlying parenchymal brain injury from shearing forces sustained during shaking.<sup>13</sup> MRI can detect SDH of different ages; chronic (low attenuation) subdural collections on CT often have different signal intensities on MRI which allow differentiation in time. This is of great importance when assessing the likelihood of

repeated abuse<sup>13</sup>; however, it does not follow that MRI enables accurate estimates of the ages of these bleeds.

All investigations requested should be accompanied by clear clinical details and relevant questions to the radiologist. The sequence of investigations that best identifies the effects of the injury and its sequelae, as well as detecting signs of any previous episode of abuse is therefore: a CT scan as the first line investigation, followed by an MRI within the first 7–10 days, repeated some 14 days later. Some tertiary centres, where there is a wider availability of MRI and expertise, are relying purely on sequential MRI as the imaging of choice. In expert hands cranial ultrasound may be incorporated as an additional diagnostic tool to monitor findings; however, paediatricians and general radiologists should not rely on cranial ultrasound as an exclusive investigation to identify or exclude an SDH.

Ideally a neuroradiologist with expertise in the field should report these investigations promptly. Many will be performed in a centre without such onsite support, when it may be necessary to ask for an opinion from the local neuroradiology centre. Some hospitals have image links to regional centres to facilitate this process.

### **SKELETAL RADIOLOGY**

Skeletal fractures are common in these children.<sup>1 4 8 9</sup> Rib fractures are consistent with a squeezing injury, where the infant is grasped around the chest and shaken.<sup>9</sup> Coexisting skull fractures support a shaking impact injury.<sup>6 9</sup> Long bone and metaphyseal fractures<sup>9</sup> need to be excluded. The latter are seen in association with shaking from the indirect acceleration deceleration forces to the fragile growing plate of the long bones or from forceful pulling or twisting of the limbs.

An early skeletal survey should be undertaken when the child is clinically stable and repeated at 10–14 days.<sup>14</sup> In practice the repeat skeletal survey is often omitted; however, follow up radiology may reveal previously unidentified fractures and enable more accurate dating of those already identified. Some centres perform an isotope bone scan in conjunction with the initial skeletal survey,<sup>15</sup> which can identify hot spots from the early fracture healing process or subperiosteal haemorrhage. Fractures at the growing points of long bones are, however, difficult to identify on isotope bone scan.

### **OPHTHALMOLOGY EXAMINATION**

Ophthalmological examination of the infant's eye is difficult and paediatricians often have a poor success rate. Retinal haemorrhages are characteristically at the periphery of the retina<sup>7</sup> and are difficult to see with direct ophthalmoscopy. All children should have a retinal examination of both eyes, performed by an ophthalmologist with paediatric experience. Examination should use the indirect method after dilatation of the pupils as recommended by the working party of the Royal College of Ophthalmologists.<sup>7</sup>

### **HAEMATOLOGY AND BIOCHEMISTRY**

These children often have a low haemoglobin on admission<sup>1</sup> or within the first 24 hours, which may reflect the timing and extent of bleeding. A full blood count and coagulation studies will indicate blood loss, coagulation, and haematological abnormalities. Blood cultures, urea and electrolytes, and liver function tests are important to screen for infection, associated biochemical disorders, and possible intra-abdominal injury.

Screening for rarer metabolic conditions is not routinely recommended. SDH in association with glutaric aciduria is seen in cases with frontotemporal atrophy.<sup>16</sup> If the radiological findings support this possibility, glutaric aciduria should be excluded in consultation with a paediatrician who specialises in metabolic conditions.

### **STRATEGY MEETING**

There must be an early strategy meeting with all agencies to discuss the findings and come to a joint decision about the probability of child abuse. Social services will invoke section 47 of the Children Act<sup>11</sup> and initiate a child protection investigation in the majority of cases, while making provision for the immediate safety of the child and siblings.

In the cases where the cause of the SDH has not become evident and physical abuse is unlikely, consultation with tertiary specialists is recommended to exclude rarer causes.

### **AT POSTMORTEM EXAMINATION**

Physical child abuse should be considered in any infant who dies unexpectedly. In an ideal world all such postmortem investigations should be undertaken by a paediatric pathologist in consultation with a forensic pathologist,<sup>17</sup> and according to nationally recommended protocols.<sup>18</sup> When SDH is diagnosed at postmortem investigation, the diagnosis needs to be approached with the same rigour and multiagency involvement. Investigations must include a full dissection of the eyes and a complete radiological skeletal survey.<sup>19</sup> Detailed histopathology techniques can be enrolled to identify diffuse axonal injury<sup>20</sup> and identify the degree of brain repair in order to give an idea of the timing of injury.<sup>10</sup>

### **WHEN TO PERFORM CT**

We know that some children with SDH present with relatively mild symptoms.<sup>1</sup> It is therefore important that paediatricians maintain a low threshold for considering this diagnosis. Many children will have a lumbar puncture as the first investigation to exclude meningitis; if this shows evidence of uniform bleeding or xanthochromia, it must be followed up with a CT scan to exclude intracerebral bleeding.

In the investigation of any child under the age of 2 years who is referred under the Child Protection Procedures, consideration should be given to performing a CT scan. This should be mandatory if the child has retinal haemorrhages, unexplained neurological findings, or an increasing head circumference, and strongly recommended in any infant with bone fractures or non-accidental bruising, or under 6 months old.

### **QUESTIONS IN COURT**

As well as endorsing the value of good quality evidence, it is important to recognise the limitations of the evidence at various points in the process. This is never more relevant than in court, where clinicians give their opinion as expert witnesses. Questions that commonly arise concern the timing of the injury and the mechanism and forces needed to cause an SDH. The evidence to contribute to this debate is limited.

Opinion about the age of SDH is based on MRI imaging that can only suggest whether bleeds have occurred within the previous week or are older, resolving haemorrhages.<sup>13</sup> Precise dating of associated long bone fractures is not possible, but an approximate time band can often be given according to the degree of healing evident on x ray examination.<sup>21</sup> The colour changes in retinal haemorrhages and bruises depend on the amount of bleeding into the retina or subcutaneous and surrounding tissue respectively, and a variable rate of resolution. Both have a red appearance when acute and a range of colour change when older.<sup>7 22</sup> Severe retinal haemorrhages may take months to clear, milder ones resolving within weeks.<sup>7</sup>

Spectrophotometry appearance of cerebrospinal fluid after an intracranial bleed, the degree of cerebral oedema, and details of autopsy findings can contribute to the timing of injury.<sup>10</sup> Discussion of the clinical features and the chronology of events, identified in the police and social assessment, often builds a more accurate forensic picture; however, accurate timing of the injury is rarely possible.

**Table 2** Essential baseline assessment of an infant or young child with SDH

Multiagency team members	Paediatrician with expertise in child protection Paediatric neurologist and/or neurosurgeon Neuroradiologist Ophthalmologist Area child protection team social worker and police
Clinical history	Full paediatric case history Full documentation of all possible explanations for injury
Social and police history	Identify any previous child protection concerns, relevant criminal record of carers
Examination	Thorough general examination Documentation and clinical photographs of coexisting injury Monitor head circumference
Ophthalmology	Ophthalmologist to examine both eyes using indirect ophthalmology through dilated pupils
Radiology	Initial cranial CT scan Repeat neuroimaging at 7 and 14 days (MRI scan preferable) Discuss neuroimaging with neuroradiologist Full skeletal survey: repeat imaging at 10–14 days
Serology	Full blood count repeated over first 24–48 hours Coagulation screen Urea and electrolytes, liver function tests, blood cultures
Early strategy meeting of all agencies involved to come to a joint decision about the likely cause of SDH and appropriate line of management.	
Possible outcome	Action
Likely physical child abuse	Social services will invoke section 47 of Children Act, initiate a child protection investigation and make provision for the immediate safety of the child and siblings
Medical cause of SDH identified	No further child protection concerns: continue medical management
Physical child abuse unlikely, cause of SDH unknown	Further clinical investigation in consultation with tertiary specialists to fully exclude all different causes of SDH

Knowledge of the mechanism and the forces required to elicit SDH are based on evidence from small case studies, where perpetrators have admitted shaking the baby,<sup>23</sup> studies of the clinical features of domestic and serious head injuries in children,<sup>24, 25</sup> old animal based studies where monkeys have been shaken,<sup>26</sup> and biomechanical modelling experiments.<sup>6</sup> These studies convince us that SDH occurs after violent whip-lash (acceleration–deceleration injury), but none as yet can identify the least force required for such an injury.

The clinical spectrum of these cases varies from children with multiple injuries as a result of a severe degree of violence to a child with an isolated SDH. There are accounts of babies shaken by carers with postnatal depression who cannot cope with the crying, and carers who have shaken to resuscitate an apnoeic baby. It is clear that even when the full clinical picture is evident, difficult decisions need to be made as to the intent of the assailant to harm the child.

## CONCLUSIONS

The diagnostic process is one of detective work from the outset of an infant who presents with a variety of symptoms and rarely any clear history of cause. A consistent approach to the investigation, terminology, and interpretation of findings will improve the quality and accuracy of the diagnosis and management of an infant with SDH (see table 2). This must be complimented by seamless interagency cooperation with clear lines of communication.

There is evidence that clinicians are reluctant to consider a diagnosis of child abuse and often delay or fail to make an early referral to the child protection agencies.<sup>1, 13</sup> This can put

the child and siblings at risk of further abuse, can obviate the collection of police evidence, and hinder the diagnostic process. In accordance with the Children Act 1989,<sup>11</sup> any one who has concern that a child is suffering from significant harm should refer the matter to social services.

Research in this field is expanding and will inevitably lead to revised recommendations over time as our understanding of the condition improves.

## ACKNOWLEDGEMENT

I gratefully acknowledge the funders of our research programme into SDH in infants: Childrens Research Fund, Patrick Bertoult Trust, Child Safe Wales, Nuffield Foundation, and the Severnside Research Team. Dr Alicia Rawlinson, Dr Jean Price, Jane Schulte, Dr Neil Stoodley, Professor Jo Sibert, Dr Sandeep Jayawant, and Mrs Cathy Cobley are acknowledged. I would like to thank Professor Mike Green, Professor David Taylor, Dr Geoff DeBelle, Dr Jane Ratcliffe, Dr Helen Carty, Dr Jane Wynn, Mr Jonathon Punt, and Dr Phil Anslow for their advice.

## Authors' affiliations

A M Kemp, University of Wales College of Medicine, Academic Centre, Llandough Hospital, Cardiff CF64 2XX, UK

## REFERENCES

- 1 Jayawant S, Rawlinson A, Gibbon F, *et al*. Subdural haemorrhages in infants: population based study. *BMJ* 1998;**317**:1558–61.
- 2 Haviland J, Russell RIR. Outcome after severe non accidental head injury. *Arch Dis Child* 1997;**77**:504–7.
- 3 Billmire ME, Myers PA. Serious head injury in infants: accident or abuse? *Pediatrics* 1985;**75**:340–2.

- 4 **Goldstein B**, Kelly MM, Bruton D, Cox C. Inflicted versus accidental head injury in critically injured children. *Crit Care Med* 1993;**21**:1328–32.
- 5 **Duhaime AC**, Christian C, Rorke LB, Zimmerman RA. Current concepts. Nonaccidental head injury in infants—"the shaken baby syndrome". *N Engl J Med* 1998;**338**:1822–9.
- 6 **Duhaime AC**, Alario AJ, Lewander W J, *et al.* Head injury in very young children, mechanisms, injury types, and ophthalmologic findings in 100 hospitalised patients younger than two years of age. *Paediatrics* 1992;**20**:179–85.
- 7 **The ophthalmology working party.** Child abuse and the eye. *Eye* 1999;**13**:3–10.
- 8 **Caffey J.** Multiple fractures of long bones of children suffering from subdural haematoma. *Am J Roentgenol* 1946;**56**:163–7.
- 9 **Kleinman PK.** Diagnostic imaging in infant abuse. *Am J Roentgenol* 1990;**155**:703–12.
- 10 **Brown JK**, Minns RA. Non accidental head injury, with particular reference to whiplash shaking injury and medico-legal aspects. *Dev Med Child Neurol* 1993;**35**:849–69.
- 11 **DOH, Home Office, Department of Education and Employment, National Assembly of Wales.** *Working together to safeguard children.* London: DOH, 2000.
- 12 **Roa P**, Carty H, Pierce A. The acute reversal sign: comparison of medical and non-accidental injury patients. *Clin Radiol* 1999;**54**:495–501.
- 13 **Charbrol B**, Decarie JC, Fortin G. Role of cranial MRI in identifying patients suffering from child abuse and presenting with unexplained neurological findings. *Child Abuse Negl* 1999;**123**:217–28.
- 14 **Kleinman PK**, Nimkin K, Spevak MR, *et al.* Follow up skeletal surveys in suspected child abuse. *Am J Roentgenol* 1996;**167**:893–6.
- 15 **Jaudes PK.** Comparison of radiography and radionuclide bone scanning in the detection of child abuse. *Pediatrics* 1984;**73**:166–8.
- 16 **Morris A**, Hoffman G, Naughten ER, *et al.* Glutaric aciduria and suspected child abuse. *Arch Dis Child* 1999;**80**:404–5.
- 17 **Green MA.** A practical approach to suspicious death in infancy—a personal view. *J Clin Pathol* 1998;**51**:561–3.
- 18 **Royal College of Pathologists.** Minimum guidelines for post mortem investigation of post neonatal infant deaths and sudden deaths in infancy. Appendix 1.7.10. In: *Guidelines for post mortem reports.* London: Royal College of Pathologists, 1993.
- 19 **Kleinman PK**, Marks SC, Richmond JM, Blackbourne BD. Inflicted skeletal injury: a postmortem radiologic study in 31 infants. *Am J Roentgenol* 1995;**165**:647–50.
- 20 **Gleckman AM**, Bell MD, Evans RJ, Smith TW. Diffuse axonal injury in infants with nonaccidental craniocerebral trauma: enhanced detection by beta-amyloid precursor protein immunohistochemical staining. *Arch Pathol Lab Med* 1999;**123**:146–51.
- 21 **O'Connor JF**, Cohen J. Dating fractures. In: Kleinman PK, ed. *Diagnostic imaging of child abuse.* Baltimore: Williams & Wilkins, 1987:103–13.
- 22 **Stephenson T**, Bialas Y. Estimation of the age of bruising. *Arch Dis Child* 1996;**74**:53–5.
- 23 **Kleinman PK**, Blackbourne BD, Marks SC, *et al.* Radiological contributions to the investigation and prosecution of cases of fatal child abuse. *N Engl J Med* 1989;**320**:507–11.
- 24 **Hobbs C.** Skull fracture and the diagnosis of abuse. *Arch Dis Child* 1984;**59**:246–52.
- 25 **Williams RA.** Injuries in small children resulting from witnessed and corroborated free falls. *J Trauma* 1991;**31**:1350–2.
- 26 **Ommaya AK**, Faas F, Yarnell P. Whiplash injury and brain damage: an experimental study. *JAMA* 1968;**204**:285–9.
- 27 **Wilkins B.** Head injury—abuse or accident. *Arch Dis Child* 1997;**76**:393–7.
- 28 **Green PM**, Wilson H, Romaniuk C, *et al.* Idiopathic intracranial haemorrhage in the fetus. *Fetal Diagn Ther* 1999;**14**:275–8.
- 29 **King SJ**, Boothroyd A. Cranial trauma following birth in term infants. *Br J Radiol* 1998;**71**:232–8.
- 30 **Vapalahti J.** A case report—intracranial arterial aneurysm in a 3 month old infant. *J Neurosurg* 1969;**30**:169–71.
- 31 **Donaldson JW**, Edwards-Brown M, Luerssen TG. Arachnoid cyst rupture with concurrent subdural hygroma. *Pediatr Neurosurg* 2000;**32**:137–9.
- 32 **Syrogianopoulos GA**, Nelson JD, McCracken GH Jr. Subdural collections of fluid in acute bacterial meningitis: a review of 136 cases. *Pediatr Infect Dis* 1986;**5**:343–52.
- 33 **Snedeker JD**, Kaplan SL, Dodge PR, *et al.* Subdural effusion and its relationship with neurologic sequelae of bacterial meningitis in infancy: a prospective study. *Pediatrics* 1990;**86**:163–70.
- 34 **Mashiyama S**, Fukawa O, Mitani S, *et al.* Chronic subdural hematoma associated with malignancy: report of three cases [in Japanese]. *Neural Surg* 2000;**28**:173–8.
- 35 **Vernant JC**, Delaporte JM, Buisson G, *et al.* Cerebrovascular complications of sickle-cell anemia [in French]. *Revue Neurologique* 1988;**144**:465–73.
- 36 **Lutschg J**, Vassella F. Neurological complications in hemophilia. *Acta Paediatr Scand* 1981;**70**:235–41.
- 37 **Choo KE**, Tan KK, Chuah SP, *et al.* Haemorrhagic disease in newborn and older infants: a study in hospitalized children in Kelantan, Malaysia. *Ann Trop Paediatr* 1994;**14**:231–7.
- 38 **Gelabert Gonzalez M**, Garcia Allut A, Alvez Gonzalez F, *et al.* Chronic subdural hematoma in a girl with idiopathic thrombopenic purpura [in Spanish]. *Anales Espanoles de Pediatria* 1984;**21**:260–2.
- 39 **Sychlowy A**, Pyda E. Toxic diarrhea in a heterozygote with galactosemia complicated by chronic subdural hematoma [in Polish]. *Polski Tygodnik Lekarski* 1971;**26**:349–51.
- 40 **Levy HL**, Brown AE, Williams SE, de Juan E. Vitreous haemorrhage as an ophthalmic complication of galactosaemia. *J Pediatr* 1996;**129**:922–5.
- 41 **Handy TC**, Hanzlick R, Shields LB, *et al.* Hyponatremia and subdural hematoma in the pediatric age group: is there a causal relationship? *J Forensic Sci* 1999;**44**:1114–18.