Shaken baby science questioned

Crucial set of symptoms isn't a sure sign of child abuse, finds **Andy Coghlan**

PEOPLE who have been convicted of shaking infants to death may have new support for appealing their convictions. An extensive review has concluded that there is no solid scientific evidence that a specific pattern of head injuries is incontrovertible evidence on its own of child abuse.

Formerly known as shaken baby syndrome, abusive head trauma is a combination of symptoms believed to result from violently shaking an infant – an action that usually has long-term health consequences and can be

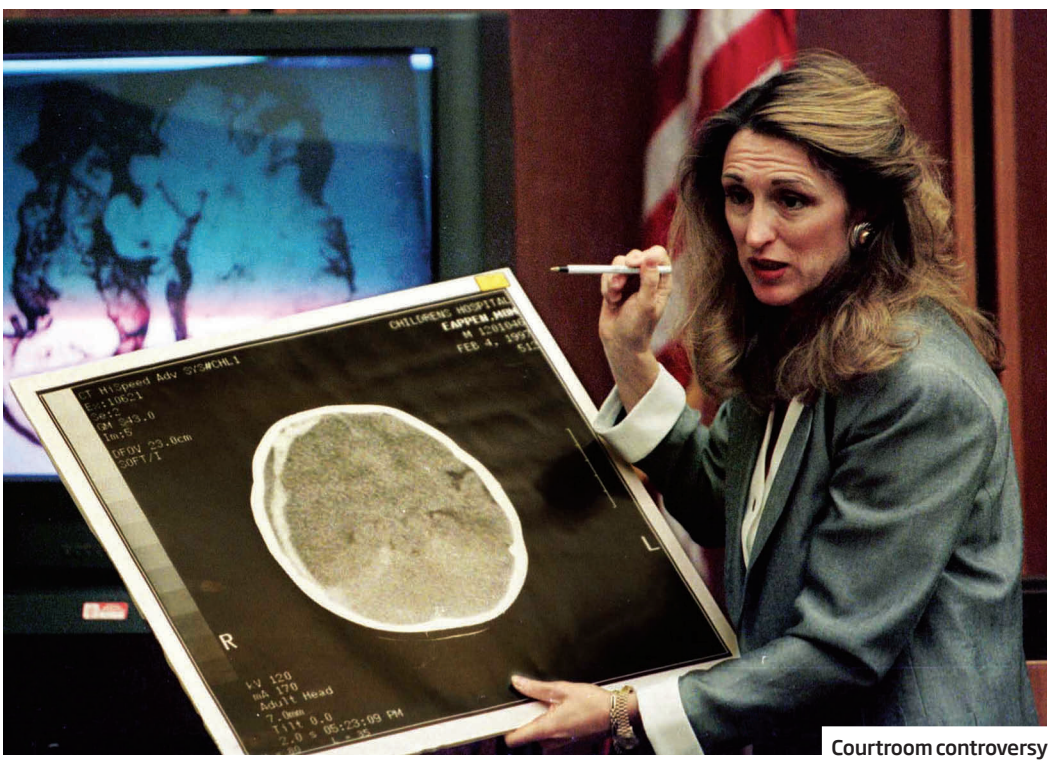
"Critics are afraid people who've abused infants might go free, or parents will cover up abuse"

fatal. Three symptoms in particular – swelling of the brain, bleeding on the brain's surface and bleeding behind the retinas – have together been used as crucial evidence in court. In many countries, including the UK and US, this triad of symptoms, sometimes in the absence of other physical signs of harm, has played a key role in convictions for abuse.

But there is growing debate over whether these symptoms can have other causes, and the latest study could throw some existing convictions into doubt. The study's findings imply that "we've been breaking up families and imprisoning caretakers – with at least three in the US still on death row – based on flawed forensic science", says Heather Kirkwood, a lawyer in Seattle.

To examine the quality of evidence supporting the triad alone as a hallmark of child abuse, a team in Sweden narrowed 3700 abusive head trauma studies down to 1000 that were relevant to the triad of symptoms. Of these, 30 met their strict criteria, such as having a large enough sample size, and not including cases that involved extra injuries in addition to the triad. Of these, they deemed only two studies, both conducted in France and published in 2010, to contain plausible evidence that the triad of symptoms, in the absence of other injuries, point to child abuse. However, the team decided that these didn't show sufficient support for the triad alone as definitive evidence of abuse, in part due to a lack of detail about the adults' confessions of shaking.

"Our main finding is that there's very low-quality scientific evidence for the claim," says Niels Lynöe, a specialist in general medicine at the Karolinska Institute in Stockholm, and leader of the team, whose report was published last month. "You can't use these studies to say that whenever you see these changes in the infant brain, the infant has been shaken – it's not possible according to current knowledge."



BILL GREENE/THE BOSTON GLOBE VIA GETTY

Courtroom controversy

CAN'T GET A WITNESS

Despite questions over evidence for "shaken baby syndrome", there is a lack of expert witnesses willing to speak on behalf of UK defendants.

Pathologist Waney Squier, at John Radcliffe Hospital in Oxford, has previously argued that, on their own, the triad of symptoms taken as a sign of child abuse may have other causes. But her court appearances led to her being struck off the medical register in March. A High Court judge ordered her reinstatement last week, but she is banned from giving court evidence for three years.

Her experience could deter others. "I still feel that it's not safe to give an opinion, so I can't risk my job by giving evidence in court," says Irene Scheimberg at the London Hospital, one of the few other experts in the UK who could speak on behalf of the defence.

"Expect to see a lot more false convictions in the UK," says Heather Kirkwood, a lawyer in Seattle.

Alarmed response

While the team didn't seek to determine alternative causes of the triad, some studies suggested small falls or bleeding in the head during vaginal births may also be

associated with these symptoms.

The conclusions have prompted alarm among some doctors. *New Scientist* has seen letters sent prior to publication expressing concern over the report's content.

The American Academy of Pediatrics (AAP), the Society for Pediatric Radiology in the US, and the European Society of Paediatric Radiology (ESPR) all urged the SBU – the Swedish agency that commissioned the report – to let them see a draft and have a say on the contents of the report before publication.

"Quite a few courts have recognised there's a legitimate controversy," says Kirkwood. "If the courts take the next step and recognise that there is no reliable evidence base for abusive head trauma, the next logical step would be to eliminate prosecution testimony on this. For obvious reasons, opponents of the report don't want this to happen – hence the last minute effort to stop the Swedes from publishing."

"What we wanted was a chance to review it before it was published," says Robert Block, chairman of the US charity National Center on Shaken Baby Syndrome, and a former president of the AAP. The SBU declined to let the societies comment on the report before publication, with director general Susanna Axelsson telling them it had already been extensively reviewed by external experts, as well as carefully looked over by the SBU board of directors and scientific advisory board.

But this hasn't stopped criticism of the report. Three of the six-member study team has no knowledge of abusive head trauma, says Block, who also criticises recent court cases. "There has been a groundswell of biased, incorrect and sometimes outright lying in courts, and gullible media that misrepresent the facts about the diagnosis of abusive head trauma," says Block.

The report is currently being translated into English. "We are reserving our opinion until we have seen an official transcript, but fear their conclusions will cause diagnostic difficulties," says Amaka Offiah, chair of the ESPR's child abuse task force.

Legal impact

Lynöe says opposition to the report is understandable. "They're afraid people who have abused infants might go free, or that parents will use the report as a cover-up for abuse," he says.

But the report has been backed by Iain Chalmers at the Cochrane Collaboration, which conducts evaluations of scientific evidence in health that are often considered the gold-standard in systematic reviews. The team seems to have done a thorough job, he says.

Critics argue that the so-called triad isn't solely relied upon for diagnosing abusive head trauma. "The diagnosis is made when thorough physical, radiological, laboratory and other examinations point towards trauma, and confessions by adults who have injured children help our understanding," says Block. Courts seldom look at the triad on its own, says Offiah.

However, confessions are problematic, and Lynöe says that a reliance on these is at the heart of why scientific support for the triad is so weak. Studies involving confessions often fail to explore whether other events, such as breathlessness, unconsciousness or choking, may have occurred before the confessed shaking.

The study's conclusion may affect several ongoing legal cases in the UK. "We have both appeals and new cases at various stages of development," says Bill Bache, a lawyer in the UK. The Swedish report is welcome, he says, but arguing its findings in court is likely to be difficult due to a lack of expert witnesses to call upon (see "Can't get a witness", left). "There are not many people who can speak authoritatively about this issue," he says. ■

We're missing 75% of worlds with two stars

BINARIES are twice the trouble. The shifty geometry of planets that orbit two stars means we've missed about 75 per cent of these worlds – but we are playing catch-up.

Planets that orbit two stars are truly alien – and they are also trickier to discover and study. Unlike planets around single stars, they shift their orbital paths over just a few years.

The Kepler space telescope has spotted 10 of those worlds by watching them transit – cross in front of their stars from our point of view. Transits around just one star run like clockwork: once you know how long the planet's year is, you can predict exactly when it should next pass in front of the star.

But binaries have more moving parts. The planet could orbit its stars in the same plane, or adopt its own separate plane. The angle of its orbit with respect to the stars' plane shifts with each trip around the binary. Sometimes the planet will transit as it goes around. Sometimes it won't.

Since the easiest way to find the planet is when it transits, we really need to know when to look – a tricky problem only solved by number crunching on high-powered computers.

In 2015, David Martin at the Geneva Observatory in Switzerland started looking for an easier way. First, he and his colleagues devised equations to calculate whether a circumbinary planet would transit at all – an easier technique than running simulations.

"It showed you'd get loads of transits, but it didn't really let you know when," Martin says.

Now, he's calculated when a planet's orbit crosses in front of the orbital path of its stars. That gives astronomers specific windows in which they have a good chance of spotting a transit.

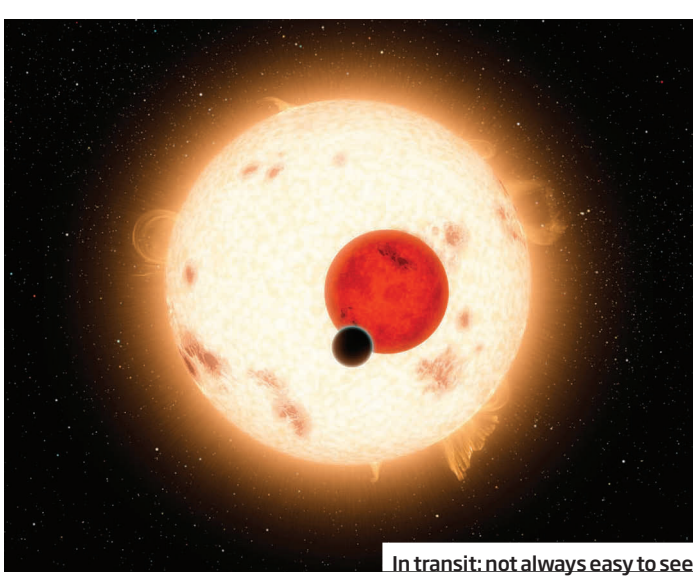
Martin also quantified how lucky Kepler was to see those 10 planets transit during its four-year mission. Extrapolating that chance suggests that 30 more planets may lurk unseen in the same systems, (arxiv.org/abs/1611.00526).

"Using the results here we can estimate how many we miss, making it much easier to understand the whole population," says David Armstrong at the University of Warwick, UK.

Next, Martin hopes to pinpoint future transits precisely.

"Calculating that probability is bloody hard," he says. "I'm trying to do it but I haven't figured it out yet."

Joshua Sokol ■



NASA/JPL-CALTECH/R. HURT

In transit: not always easy to see