DISPATCHES FROM THE SBS/AHT/IHT BATTLEFIELD: IS THE SBS/AHT/IHT DIAGNOSIS "SAFE" TO USE IN A CRIMINAL TRIAL?^

Richard Edney*

In criminal trials involving the death of, or serious injury to, an infant, expert evidence is often adduced by the prosecution. Those experts include forensic pathologists, forensic paediatricians, and other medical experts such as radiologists and ophthalmologists. Evidence is adduced from those experts to prove the cause of death or explain how it was that the infant suffered those injuries. On occasion there may be no obvious manifestation of the infliction of trauma, or other features, which would enable the identification of the cause of that death or serious injury, let alone a way of providing an explanation as to the precise circumstances that led to that death or serious injury. For some time, the concept of Abusive Head Trauma ("AHT") or Inflicted Head Trauma ("IHT")– which was formally known as Shaken Baby Syndrome ("SBS") has been used as a means of proof in criminal trials, both in Australia and overseas. The key diagnostic theory that underpins SBS/AHT/IHT is 'the triad'. In short, the 'triad' has at its essence the idea that if an infant presents with certain symptoms – (i) subdural haemorrhages; (ii) retinal haemorrhages and (iii) encephalopathy – then, in the absence of an explanation, it is more than likely that the infant has been subject to application of unlawful physical force. The legitimacy of the SBS/AHT/IHT diagnosis has, however, become the subject of sustained criticism in recent years. It has been criticised for lacking scientific rigour and possessing a 'circularity' in its underlying premises that is said to be contrary to scientific method. But against that, supporters of the SBS/AHT/IHT diagnosis, especially forensic paediatricians, have attempted to counter such criticisms as unfounded 'theories' that do not possess any legitimacy. The result of all of this is a profound epistemological 'battlefield' for, and against, the SBS/AHT/IHT diagnosis and how much it can truly 'prove' in a criminal trial. The most recent illustration in that ongoing 'battle' was the decision of the Victorian Court of Appeal in R v Vinaccia (2022) 70 VR 36; [2022] VSCA 107. What follows is an analysis of that decision and an attempt will be made to trace not only the likely future trends of this forensic 'science' but also whether it is 'safe' to use the triad in criminal trials.

Introduction

Epistemology, Forensic Science, and the Triad: The Broader Context of R v Vinaccia

In philosophy, epistemology is concerned with how we come to 'know' what we do 'know' about the world. It is, in short, a theory of knowledge. Forensic science, too, is a claim about knowledge. So, too, is the law when it claims certain things about the world and the people within it. And when it applies other disciplines – such as

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* Barrister at the Victorian Bar.

medicine, psychology, economics, and others – the law circumscribes how those other theories of knowledge are to apply and the law deems what the law will, and will not, accept[1]. In that sense, the law is a powerful legitimator of what is acceptable and unacceptable knowledge for its purposes.

There are also different ways to know the world. But those different ways of knowing can also lead to irreconcilable differences about the features of the world and what is true and what may be false. This is certainly the case with the SBS/AHT/IHT diagnosis and the claim to 'truth' that emanates from proponents of SBS/AHT/IHT to the validity, and reliability, of that diagnosis.

That 'truth' is partly divined by forensic paediatricians in the context of emergency rooms when a seriously unwell infant is taken for treatment, and the forensic investigation begins. The knowledge that emerges from the practice of day-to-day treatment of those cases and extrapolation of those individual cases to an aggregate level, where they are said to be explanatory of the cause of such presentations, is at the core of the SBS/AHT/ IHT diagnosis.

In contrast, critics of the SBS/AHT/IHT diagnosis suggest that it is, in truth, a diagnosis bereft of a scientific basis. It is contended that the knowledge base of the SBS/AHT /IHT diagnosis is necessarily incomplete and remains a work in progress because it lacks proper scientific credentials. In short, the certitude that is expressed by advocates of the SBS/AHT/IHT is, when closely examined in accordance with the tenets of the scientific method, found wanting by critics of the SBS/AHT/IHT diagnosis.

Broadly then, the 'clash' of epistemologies is between practice – and all that that reveals – and the purity of scientific method which seeks by application of a methodology grounded in science to produce reliable 'scientific' knowledge.

[1] As Stanley Fish explained in his essay, 'The Law Wishes to Have a Formal Existence' in S Fish, *There's No Such Thing as Free Speech: And it's a Good Thing, too* (1994) the law is a dominant discourse because it decides what knowledge it will accept, and what it will not, and it – and it alone – possesses the power to do so. Or another way: the law has the final say.

Arguably, too, is this 'clash' of epistemologies revealed in the majority and dissenting judgments in *R v Vinaccia* in that the former accepted the 'claim to knowledge' about the SBS/AHT/IHT diagnosis while the latter questioned just how much could be known. But more of that later.

A Short Primer on Shaken Baby Syndrome (SBS), Abusive Head Trauma (ABT) and Inflicted Head Trauma (IHT)

Before commencing the analysis of *R v Vinaccia*, it is appropriate to set out a short 'primer' or 'history' of the SBS, AHT/IHT diagnosis so there is a proper context to consider the judgment. It is generally accepted that the modern 'origin' of the Shaken Baby Syndrome ("SBS") – with the later iterations of AHT and IHT – was an influential article by Dr AN Guthkelch that was published in the 1971 in the *British Medical Journal*[2] (though an earlier paper in 1946 by John Caffey is also part of the intellectual linage in this area[3]).

Dr Guthkelch's paper was titled "Infantile Subdural Haematoma and its Relationship to Whiplash Injuries". The paper arose from the author's experience working in an emergency department. He had observed certain commonalties, or patterns, in infants who had presented at emergency departments where he had worked. A key insight in what he observed was that infants were presenting in emergency departments with injuries to the brain, including subdural haemorrhages, but there were no obvious signs of abuse or application of force such as bruising, skeletal injuries or abrasions that would account for those injuries.

That 'missing link' led Dr Guthkelch to postulate a theory that what was likely to have caused those internal injuries was the 'shaking' of infant by the person who had care of that infant. Part of the 'shaken baby' theory assumed, that because infants neck muscles were not particularly strong, and the brain of the infant was not totally fixed

[2] (1971) 2 *British Medical Journal* 430.
[3] See J Caffey, 'Multiple Fractures in the Long Bones of Infants Suffering from Chronic Subdural Hematoma' (1946) 56 *American Journal of Roentgenology* 163.

in the cranial cavity then the shaking of the infant and rotational movement of forces inside that cavity caused by that rapid acceleration and deceleration was put forward as a possible explanatory variable that would account for those internal injuries.

It is important to observe at this point, that Dr Guthkelch was not putting forward his findings as establishing an immutable scientific principle; but rather, he was suggesting a possible, and tentative, hypothesis for what he had seen in emergency departments. And thus, this hypothesis would form the basis for further studies to establish whether the hypothesis was scientifically valid (I will return later to some observations made by Dr Guthkelch in 2013 as to what had become of his 1971 thesis).

But that is not exactly what happened.

Instead, Dr Guthkelch's article rapidly became an influential 'article of faith' and transformed from what, at best, was essentially a small scale, observational 'experiment' from an emergency department to something much greater. The article, and its fundamental thesis that shaking of a baby can lead to catastrophic injuries, became the basis for expectant parent's maternal health advice as well as becoming the subject of public health campaigns in the 1970's and 1980's.

Concurrently, in the 1970's and 1980's in the United States saw the rise of forensic paediatricians as a distinct professional group independent of forensic pathologists. Those practitioners were based in, or sometimes associated with, public hospitals and teaching universities. Those practitioners emerged in an environment where they had to access to infants who presented with injuries. Armed and informed with the findings of Dr Guthkelch's article it emerged as almost a truism that an infant who presented – in the absence of explanation – with the presence of 'the triad' symptoms led to a conclusion that that infant had been subject to an unlawful application of force. As an extension of that idea, the person who had last had contact with the infant, or was present when the infant became unwell, was often treated as the person who was more than likely to have caused those injuries.

The 'findings' of forensic paediatricians – and their expert opinions – became an important part of the prosecutions in these types of cases to explain an important anomaly that existed in cases of this type: the absence of external indicia that would suggest the application of force or mistreatment by those caring for the infant (which was exactly the case in *R v Vinaccia*). Significant research was undertaken to establish a 'scientific' basis for the 'triad' and thus burnish the credentials of 'experts', especially in the context of a criminal trial, to explain how these injuries occurred. But the attempt to find a scientific basis for the SBS/AHT/IHT diagnosis has always been problematic and elusive. A proper scientific experiment – that involved infants – would be ethically abhorrent. Other avenues included biomechanical studies. But even then, the biofidelic modelling was less than satisfactory. Confessional studies – involving the perpetrators of abuse towards infants – were then used and treated as the 'gold standard' (despite the obvious limitations of those confessions to establish reliable proof of the causative steps of the SBS/ABT/IHT diagnosis).

What was also occurring during this period were other studies that started to raise doubts as to the scientific validity, and reliability, of the SBS/AHT/IHT diagnosis. It perhaps did not assist the development of the 'science' that the type of scenarios put forward to explain the level of force – and resultant injuries – was made analogous with a fall from a great height[4] or that the injuries were consistent with a high-speed motor vehicle collision.

By the mid 2010's then the state of the 'evidence' for the SBS/AHT/IHT diagnosis could broadly be described in the following way. First, forensic paediatricians had for many years been giving evidence that led to convictions based on an opinion that was substantially based or entirely based upon the theory of 'triad' where the 'gold standard' was confessional studies. Second, the scientific basis of the 'triad' was not yet established. Finally, there was a growing body of criticism of the use of that diagnosis in criminal trials and child protection hearings[5].

[4] Small falls were claimed not to have been sufficient to cause the triad of injuries – until it was observed to be so.

[5] See D Tuerkheimer, *Flawed Convictions: "Shaken Baby Syndrome" and the Inertia of Injustice* (2014); R Papetti, *The Forensic Unreliability of the Shaken Baby Syndrome* (2018).

A particularly important development was what I will term the Swedish Study of Traumatic Head Shaking which became known, in a shorthand manner, as the 'SBU Report''. The SBU Report was discussed at length in *R v Vinaccia* because one of the experts called on behalf of JV was an expert author on the SBU Report and that report directly challenged the scientific credentials of the SBS/AHT/IHT diagnosis. Following an extensive review of the literature, the SBU Report found that the 'scientific literature' was consistently of a low grade and an overwhelming number of the studies were infected by 'circular reasoning'.

That then is the full 'context' in which *R v Vinaccia* was decided: a growing challenge to the SBS/AHT/IHT diagnosis and attempts by proponents of that diagnosis to maintain its legitimacy.

The Decision in R v Vinnaccia: Some Background Facts & The Prosecution & Defence Case at Trial

Jesse Vinnacia ("JV") was charged, and convicted, of the offence of child homicide[6]. The prosecution case at trial was that JV, while caring for Kaleb Baylis-Clarke ("KBC"), who was 3 ½ months of age when he died, had assaulted him, and had caused his death. JV gave accounts of what he had said had occurred to a range of people, including Forensic Paediatrician Dr Tully, and a ROI with the police where he said he had picked up KBC 'a bit hard' and had placed him in the bed 'like pretty rough'[7]. But he had always denied that he had applied a high – and criminal – level of force towards KBC. The defence at trial embraced what the applicant had said in the ROI but contended that those acts did not – and could not – have caused the death of the deceased because, in effect, they were at such a low level of force[8].

[6] *Crimes Act 1958* (Vic) s 5A.
[7] *Vinaccia* at [33]-[34].
[8] On appeal, the majority – at [35] made it clear that the answers given in the ROI 'did not constitute admissions to any more than was previously admitted by the applicant, and is not capable of constituting an admission to applying violent shaking with accelerative and decelerative force'.

The Use of the Triad at JV's Trial

The prosecution case at trial was that JV had 'underplayed' the level of force he had applied to KBC. This prosecution case theory was supported by the opinions of forensic pathologist, Dr Linda Iles and forensic paediatrician, Dr Joanne Tully who both gave evidence at JV's trial *and* appeal. In short, they both gave evidence that despite there being no obvious physical manifestation of injuries to the body of KBC he had been the subject of unlawful, violent force by JV[9].

Both experts used the 'triad' as a means of explaining, or accounting, for the death of KBC. Part of the exercise in coming to that conclusion was the utilization of a 'differential diagnosis' that was said to have excluded all other reasonable possibilities that would account for the presentation of KBC at MMC. That involved the completion a battery of tests that would, in effect, exclude all 'natural' or organic, endogenous causes of death.

KBC's Complicated Medical History

What complicated this case was that KBC had, in his short life, several complex medical problems. First, he was born via an emergency caesarean section and was 'undersized for a normal term baby' and the 'circumference of his head in the third percentile for newly born infants'[10]. Second, over the course of the first three months of his life KB's mother had 'become concerned about the apparently disproportionately increasing size of Kaleb's head'[11]. Third, by 11 January 2016, his head circumference was in the 85th percentile. Fourth, there had been an earlier hospital admission – between 14 and 17 January 2015 – where KBC had presented with a raised fontanelle and an increase in vomiting[12]. Treating doctors found the following:

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[9] This is the 'ultimate' step to be taken and it is a conclusion by exclusion. And is the basis of the criticism that any SBS/ABT/IHT diagnosis is inherently circular in nature. Even the majority in *Vinaccia* acknowledged the 'circularity' that underpins the SBS/ABT/IHT diagnosis.
[10] *Vinaccia* at [19].
[11] *Vinaccia* at [24].
[12] That is consistent with raised intracranial pressure.

'…Kaleb's head was observed to be abnormally large, and that it had grown at a concerning rate. An MRI was conducted on 15 January and mild ventricular dilation was observed together with small bilateral frontal subdural hygromas. No intra-axial haemorrhage was observed and this fact was noted. The neurosurgical team reviewed Kaleb and considering performing a diagnostic tap of his fontanelle[13], but Kaleb's improving condition led the team to decide against such a course. He was discharged on 17 January for outpatient follow up'[14].

Following his release, KBC's mother noticed that he was more settled and active – although he seemed to be sleeping a lot – and on 20 and 21 January she 'texted the applicant on a number of occasions expressing concerns that that Kaleb was still unwell and vomiting regularly'[15].

Immediate Foreground of the Allegations

On 23 January 2015, KBC was left in the care of JV from about 4.30pm when his mother went to work. JC and KBC's father had exchanged acrimonious Facebook messages at around 6pm. At around 6.45pm mother received a text message from JV stating that 'Kaleb was not breathing' and was 'acting funny'. At 6.46pm, JV called 000 and requested an ambulance. JV performed CPR on KBC until paramedics arrived. KBC was found by paramedics to be in cardiac and respiratory arrest. He was transported to the Monash Medical Centre (MMC) in a critical condition[16].

Examinations at Monash Medical Centre (MMC) and findings as to Cause by Drs Tully and Iles

[13] That diagnostic procedure – in the form of a spinal tap – had two possible benefits: (i) a therapeutic one that would relieve pressure on the brain and (ii) would be able to diagnose whether there was any blood in the spinal cord. At trial Dr Tully conceded that such a procedure performed a therapeutic and diagnostic purpose. See *Vinaccia* at [66]-[67].

[14] *Vinaccia* at [27]-[28].

[15] *Vinaccia* at [29]. KBC's grandmother also noted that he had 'sunsetting' eyes which is a symptom of raised intracranial pressure.

[16] By 27 January 2015, Kaleb was showing no signs of brain activity. His life support was turned off on 30 January 2015: see *Vinaccia* at [40]-[41].

Upon examination at MMC, KBC was found to have 'no bruising, skin discolouration or redness on any part of him'. Subsequent investigations noted that there was 'evidence of recent bleeding in the subdural space'[17]. But there were no observable skull fractures. An ophthalmological consultant found multiple retinal haemorrhages[18]. Forensic Paediatrician Dr Tully provided an opinion 'that Kaleb had died as a result of a traumatic head injury, most likely caused by acceleration and deceleration and rotational forces'[19].

During the post-mortem examination, Dr Iles found KBC had suffered a severe brain injury with extensive bilateral retinal haemorrhages. Dr Iles found 'no evidence of bruising to the under-surface of the scalp such as to indicate impact'[20]. Her opinion as to the cause of death – and likely mechanism – was 'shaking and/or impact trauma'[21]. So both Dr Tully and Dr Iles were unified in their opinion that the 'triad' provided an explanation for KBC's presentation as well as his cause of death[22].

As to the earlier hospital admission Dr Tully conceded, at trial, that because of the 'failure to perform a tap of Kaleb's fontanelle between 14 and 17 January, there remained a reasonable possibility that raised intracranial pressure may have persisted beyond that time. And due to the failure to conduct an eye examination, 'we don't know whether he had retinal haemorrhages at that stage or not'[23]. And she did not find any 'grasping injuries' to the trunk of KBC and found no evidence of skeletal injuries[24].

In addition, KBC's head circumference was around 44-45 centimetres 'which placed him in the 95th percentile for his age and gender'[25]. Examinations were conducted to

[17] *Vinaccia* at [38].
[18] *Vinaccia* at [39].
[19] *Vinaccia* at [45].
[20] *Vinaccia* at [46].
[21] *Vinaccia* at [46]-[47].
[22] This was the case at trial and on appeal. But at the appeal there was a new expression used to describe that conclusion: a reasonable degree of medical certainty.
[23] *Vinaccia* at [68].
[24] *Vinaccia* at [70].
[25] *Vinaccia* at [71]

ascertain whether there were underlying causes of KBC presenting conditions that could excluded by means of differential diagnosis[26].

In this case, the majority summarised Dr Tully's diagnosis this way:

> 'She [Dr Tully] sated "I think the combination of these findings, when an infant has been fully investigated for any other medical reason and there's no history of significant trauma, then we don't have another diagnosis other than inflicted head trauma. She further stated that the 'current understanding is that … that combination of findings is most likely to be caused by forceful shaking with or without associated impact against a firm surface'.[27]

As to the issue of causation, Dr Tully said this about the connection between shaking and the triad injuries in infants:

'So, what happens when you shake a baby: a baby has a relatively big head compared to its body which is relatively heavy. And as you probably know, babies also have relatively weak necks, and babies, it takes a while for them to be able to lift their head, they need to strengthen their neck. What happens when you shake a baby is that generally the baby is grasped around the chest and forcefully shaken backwards and forwards. What that does is, it means that the baby's head goes back and forwards and round and round, poorly supported by a relatively weak neck and shoulder musculature; they can't splint their head, so their head is moving in multiple directions back and forward, and we call that acceleration and deceleration and rotational movement which causes/applies forces to the baby's head. That means that the brain, which is very, very soft in an infant, much softer than it is in an older child or adult, what happens to the brain is, it moves back and forwards within the skull which is fixed. What that causes is for the brain itself so sustain some damage, by banging effectively back and forward and side to side against the skull, and that those bridging veins that we talked about earlier that go from the surface of the brain up to the inner table of the skull are stretched and sometimes torn; that results in subdural bleeding. In addition, a similar process happens within the eyes. So those layers of the retina actually sheer against one another to cause retinal bleeding within the layers, and the jelly like substance inside your eyeballs moves back and forward against the retina itself, causing [bleeding[in other parts of the retina, so you get this pattern of multilayered retinal haemorrhages. The third part of this is that there is damage, we think, to the upper part of the spinal cord as it comes up through that hole and to the brainstem that sits down there at the base of the brain, so there is disruption to some of the … nerve centres…in there, that results in the infant stopping

[26] *Vinaccia* at [72].
[27] *Vinaccia* at [78]. The following 'conditions' are set out in *Vinaccia* at [77].

breathing, problems to their heart rate et cetera. That therefore results in a reduction or loss of oxygen supply to the brain. That, in combination with probably some direct damage to the tissue of the brain from the movement, means that you get injury – hypoxic ischaemic injury to the brain, because it's basically squashing the blood vessels, so what you get is a secondary cascade of events that makes the actual damage to the brain sometimes unsurvivable [sic].[28]

I have set out that part of the opinion of Dr Tully in some detail because it sets out not only how the 'triad' is said to apply but, in addition, it exposes the basic premises and assumptions that underly the SBS/AHT/IHT diagnosis. What it also makes clear is that there remains a heavy intellectual nexus, or linkage, to the foundational article by Dr Guthkelch in the *British Medical Journal* in 1971 and how his provisional idea had become a 'scientific' ready reckoner that has been made to be descriptive, predictive, and explanatory of the SBS/AHT/IHT diagnosis.

But, of course, as will be become apparent later Dr Guthkelch – writing in 2013 – was concerned that his original – and foundational – hypothesis had been used to explain issues of causation, when it was a tentative hypothesis[29].

As to other features of KBC's presentation which would perhaps explain his presentation because of organic, alternative causes Dr Tully was of the view that there were no other matters, alone or in combination, altered her view that the cause of Kaleb's was a product of SBS/AHT/IHT[30].

[28] *Vinaccia* at [82].
[29] See K Findlay, AN Guthkelch, PD Barnes & W Squier, 'Admissibility of Shaken Baby Syndrome/Abusive Head Trauma Evidence' (2013) 43 (7) *Paediatric Radiology 890.*
[30] *Vinaccia* at [85]-[99].Dr Iles came to a similar conclusion based also upon 'triad' considerations. See *Vinaccia* at [100]-[116]. Dr Iles did acknowledge – at [114] – that '…she had not detected any injuries in Kaleb outside if the central nervous systems and the eyes. There were no external marks to the trunk, fractures to the ribs or paravertebral region, no skeletal injuries from chips in the bones or from flailing limbs, nor injury to the neck (which might indicate shaking)'. What stood out as critical to the opinions of both Dr Tully and Dr Iles was the evidence of the extent and nature of Kaleb's retinal haemorrhages. It is observed that that was also critical to the majority – at [141] in dismissing the unsafe and unsatisfactory ground of appeal – where it was possible to put to one side the 'subdural haemorrhages' and 'encephalopathy' as being related to an underlying medical conditions of Kaleb – that 'The retinal haemorrhages are however, in the circumstances of this case, *only* consistent with inflicted head trauma'(italics in judgment).

In addition, Dr Tully's evidence at trial was that there was no 'medical controversy'[31] in the ability 'to diagnose inflicted head trauma when the triad injuries are present with 'very specific features' and a 'rigorous and accurate medical diagnostic pathway is followed'[32]. Of course, at the end of that 'diagnostic pathway' a 'leap' of faith has to be made by the forensic pathologist or forensic paediatrician that they have, in fact, excluded all other causes. And that is the problem with a diagnosis by exclusion: in fact, all other causes may not have been excluded by differential diagnosis. Again, more of this later.

The New/Fresh Evidence on Appeal – The Approach of the Majority: T Forrest & Emerton JA

At his trial, JV did not get evidence nor was evidence given on his behalf. No expert evidence was called to challenge the opinions of the central prosecution expert witnesses, Dr Tully, and Dr Iles[33].

On appeal the situation was very different.

By that stage the applicant's instructing solicitors – Doogue + George – had been able to secure three international experts to provide expert evidence on a *pro bono* basis: Professor Anders Eriksson, Professor Ulf Hogberg and Professor Knut Wester.

They were described by the majority as the 'Scandinavian witnesses'[34].

This 'new' expert evidence went directly to the issue of KBC's cause of death. It was contended that the new evidence demonstrated (i) that the JV was innocent or (ii) at the very least created a reasonable doubt as to the JV's guilt.

[31] This was the subject of Ground 2 of the appeal.
[32] *Vinaccia* at [98]. But this does not avoid the basic problem of the lack of a scientific basis with the SBS/AHT/IHT diagnosis.
[33] JV's previous solicitors had engaged experts in preparation for his trial.
[34] *Vinaccia* at [155].

It did so because those experts – after examining the same medical material as Drs Tully and Iles – had advanced an alternative contention that the death of KBC was due to BESS (Benign Enlargement of the Subarachnoid Space) *or* a rebleed of subdural hygromas rather than due to inflicted head trauma.

The New Evidence on the Appeal

As part of the appeal evidence was led from those three experts. In addition to their different opinions as to the cause of death of KBC, the evidence of these experts also challenged the 'science' that was said to attach to the 'triad' – a concept that, of course, was critical to the conviction of JV[35]. The prosecution, although permitted to do so, did not introduce 'new evidence' in the same terms as JV. Rather, they used the same witnesses at trial and on appeal. So the prosecution did not have the original opinions of their key expert witnesses re-assessed but, instead, had their original experts provide 'rebuttal reports' to the reports filed on behalf of JV.

The Scandinavian Witnesses

In the initial part of the discussion dealing with this ground the majority made these observations:

'The Scandinavian witnesses are known to each other, have worked together over the past few years and identify as a group seeking to effect a paradigm shift in the acceptable of AHT. They challenge what they say is the presumption that the presence in an infant of the 'the triad' (subdural haemorrhages, retinal haemorrhages and encephalopathy) indicates that the infant has been subjected to traumatic shaking. In fact, they seek to sever any connection between the elements of the triad and AHT, asserting that there is no scientific basis for the proposition that any one of these elements, or all three in combination, is the product of AHT'

And further:

[35] The respondent sought to, and did lead, evidence in rebuttal from Dr Tully, Dr Iles and Professor Michael Ditchfield.

'At its base, the Scandinavian evidence challenges the proposition that the presence of 'the triad' of clinical features found in Kaleb upon his admission to MMC on 23 January and/or on autopsy – subdural haemorrhages, retinal haemorrhages, and encephalopathy – can be used as evidence that he suffered AHT'. According to the Scandinavian witnesses, there is no scientific foundation for any such association. Professors Wester and Hogberg advanced alternative hypotheses for the cause of Kaleb's death, both of which were disease processes unrelated to head trauma: intracranial pressure caused by BESS and intracranial pressure caused by the rebleeding of existing subdural hygromas. This intracranial pressure was said to be sufficient to cause the extensive cerebral and retinal haemorrhages found in Kaleb, and ultimately his death'[36].

The majority anchored, and evaluated, the opinion of the Scandinavian witnesses in the context of the 2016 study by the Swedish Agency for Health Technology that produced the SBU Report. They noted that the group did not carry out its own investigations, but instead 'conducted a systematic review of the scientific literature about the diagnosis of traumatic shaking in children under the age of 12 months. In other words, the project team evaluated the reliability of existing empirical studies that had been used to establish an association between traumatic shaking and the clinical features that make up the triad'[37].

The scope of what the SBU report considered is set out in the majority judgment:

'The SBU project team's search of the relevant scientific literature yielded 3,373 abstracts, of which were 1,065 were retrieved in full text. Of these, 1,035 were excluded because they did not meet the inclusion criteria. Of the remaining 30 studies, two were assessed to be of moderate quality and none to be of high quality'[38].

In the result, the SBU came to the following two conclusions: (i) there was insufficient scientific evidence on which to assess the diagnostic accuracy of the triad in identifying traumatic shaking (very low-quality evidence) and (iii) limited scientific evidence that the triad and its components (low-quality evidence)[39].

[36] *Vinaccia* at [157].
[37] *Vinaccia* at [185]. The majority relied on the 'Consensus Statement' of Choudary et al for this information.
[38] *Vinaccia* at [186].
[39] *Vinaccia* at [188].

The majority described the SBU's conclusions in these terms:

'The significance of the SBU report lies in its epistemological analysis. According to the SBU project group, its review of the scientific evidence disclosed a number of methodological issues in the published studies. The critical methodological shortcoming was described as 'circular reasoning', which was said to arise, in particular, from the role the child protection team plays in the investigation of cases of suspected traumatic shaking. Over the years, these teams have developed criteria based on certain symptoms ad signs, some of which are associated with the carer's credibility. This clinical rather than scientific approach means that the criteria used are not tested in systematic studies of the association between the triad and traumatic shaking. The untested criteria applied by the child protection team infect the scientific investigation and hypothesis testing, which, in turn, reinforces rather than tests the conventional approach to diagnosing SBS/AHT'.[40]

The majority then described the implications of the SBU study in these strong terms:

'The SBU is radical in report in its approach and conclusions. It seeks to set aside decades of study on the consequences of the AHT and the wide-spread acceptance that AHT may cause the constellation of clinical features known as 'the triad'. It does so by excluding nearly all of the available learning. In lieu, it signposts at the task for future research the identification of organic causes for the thousands of cases of infant death and disability hitherto attributed to AHT and for future incidents that would otherwise be 'misdiagnosed' as involving head trauma'[41].

Criticisms of the SBU Report

The majority then set out in some detail the 'Criticisms of the SBU Report'.

It did so by citing extensively from two papers that were produced following the publication of the SBU Report and growing criticism of the use of the triad in the legal setting, especially prosecutions in criminal trials and other child protection investigations[42].

[40] *Vinnacia* at [193].
[41] *Vinaccia* at [196].
[42] *Vinaccia* at [198]-[210].

One report – from the Royal College of Paediatrics and Child Health in the United Kingdom[43] – and the other, a 'Consensus Statement' from the United States[44] – set out criticisms of the methods and conclusions of the SBU and attempt to justify the utility of the triad as part of the diagnostic framework. The latter report perhaps demonstrates the heightened and passionate nature that appears to be endemic in this area as described by the majority in *Vinaccia*:

'As to the status of any controversy about the use of the triad injuries as a diagnostic tool, the Consensus Statement reports that 'denialism of child abuse has become a a significant medical, legal and public health problem'. It refers specifically to 'courtrooms in the United States, where it says 'defence attorneys and the medical witnesses who testify for them have disseminating inaccurate and dangerous messages that are often repeated by the news media'. According to the Consensus Statement, efforts to create doubt AHT include the deliberate mischaracterization and replacement of the complex and multifaceted diagnostic process by a near mechanical determination based on the 'triad'. This (bogus) critique has been sensationalised in the mass media an attempt to create the appearance of a 'medical controversy' when there is none. The Consensus Statement describes the triad argument as a 'straw man' that ignores the fact that AHT diagnosis typically is made only after careful consideration by a multidisciplinary team of all historical, clinical and laboratory findings, as well radiologic investigations'.[45]

The majority ultimately found that the challenge to the 'science' of the SBS/AHT/IHT found in the SBU report was unpersuasive.

Conclusions as to the New Evidence: The Majority Perspective

It was in the context of this framework that the majority considered the 'new evidence' presented on behalf of JV. There were two alternative causation possibilities put forward by the experts called on behalf of JV. The primary alternative was that related to BESS. The second was that KBC's death was caused by a rebleed of the subdural

[43] *Vinaccia* at [198]-[204]. the Royal College Statement represents an attempt to diminish any criticisms of the triad.
[44] *Vinaccia* at [205]-[210]. The consensus statement is an effort of advocacy masquerading as objective science. It is an attempt to resist the challenge to the scientific basis of the triad. One of the authors is a professor of law. Indeed, it goes as far as suggesting how experts should respond to criticisms of the SBS/AHT/IHT diagnosis.
[45] *Vinaccia* at [208].

hygromas. The majority rejected both alternatives[46] and affirmed the correctness of the expert opinions of Drs Tully and Iles at JV's trial.

The majority accepted the evidence of Drs Tully and Iles and the claim that they made on appeal that there is something more or something beyond the triad: that is, it is too simplistic to consider that 'the triad' only involved the identification of its three components. It was contended to be much more than that. Because according to Drs Tully and Iles there is more to be seen: the diagnostic process is complex involving all these various exclusionary steps before a conclusion or opinion that it is SBS/AHT/IHT is to be reached.

Such an intellectual shift is necessary because the triad, absent scientific validation, remains at the level of hypothesis. So the reply is to contend that the critics of the triad are doing nothing more than creating a 'straw person argument': they are treating the 'triad' in a 'mechanical' and 'deterministic manner'.

But, with respect, that is simply the application of a differential diagnosis which seeks to 'exclude' all other possibilities and alternatives. The problem, of course, is that all differentials are not known, and all possibilities are not susceptible to elimination because they are not all known.

In that sense, a 'leap of faith' is to be made. That 'leap' is ultimately a judgment call. But it is a judgment call made in the absence of a science that is replicable and verifiable and is likely to remain so for the foreseeable future. That is also why claims of 'circularity' properly abound in this area and why the criticism of the SBS/AHT/IHT diagnosis will no doubt continue.

The 'Scandinavian Witnesses' in R v Vinaccia

[46] *Vinaccia* at [413] & [428].

As noted above, the majority were critical of the 'Scandinavian witnesses' and made criticisms that went well beyond a rejected of the alternative possibilities of how KBC's death was caused. It perhaps reached its apogee – when dismissing the new evidence as establishing that an innocent person may have been convicted or that there was a reasonable doubt as to the applicant's guilt – in this observation by the majority:

> 'Even if the evidence of the Scandinavian witnesses represents a respectable body of scientific opinion, *which we doubt*, it would do no more than stand against another respectable body of scientific opinion in the form of the evidence of Drs Tully and Iles and Professor Ditchfield. It would be open to a hypothetical future jury to accept the latter, which would involve rejecting the Scandinavian evidence'[47]. (emphasis and italics added)

It is difficult to know what to make of those words 'which we doubt'.

One way is to read the words exactly as they are written: the Scandinavian witnesses' opinions do not amount to a body of respectable scientific opinion. But what does that mean? The expertise and experience of each the 'Scandinavian' witnesses were immense[48]. So why was it not respectable? Because it was a different view of the SBS/AHT/IHT debate'? Or because they had a different view as to the cause of death? Was it because their evidence challenged the orthodoxy and dominant voice in this area? It is never made entirely clear.

But what must be borne steadily in mind is that the orthodox approach is not, yet, based on 'science' if science is meant to be 'verifiable' and can be the subject of replication and further experimentation. Because the SBS/AHT/IHT diagnosis awaits just such validation. Yet, it would be unusual to say that the proponents of the SBS/AHT/IHT diagnosis are not a 'respectful body of opinion' just because it is different, or critics claim it has the science wrong?

[47] *Vinaccia* at [410].
[48] The background and expertise of each of the witnesses is set out in the judgment.

The Dissenting Judgment of Walker JA

Walker JA would have allowed JV's appeal on two grounds.

First, based on the 'new' evidence she would have acquitted JV[49] and, second, her Honour found there had been a substantial miscarriage of justice[50] because of a failure by the prosecution to disclose 'slides' of a presentation by Dr Tully on the issue of SBS/AHT/IHT[51].

Insofar as the 'new' evidence ground was concerned her Honour said this:

> 'This case concerns the tragic death of Kaleb-Baylis-Clarke, an infant aged three and-a-half months. The Crown case was that the applicant, Jesse Vinaccia, who was caring for Kaleb at the time of his collapse, had shaken Kaleb with sufficient force to cause his death. Cases of this kind are not unknown to the law, both here and in the United Kingdom. In *Henderson v The Queen*[52] the United Kingdom Court of Appeal heard appeals concerning babies alleged to have died as a result of forceful shaking. In allowing one of the appeals, the Court said this:
>
> There are few types of case which arouse greater anxiety and controversy than those in which it is alleged that the baby has died as a result of being shaken…The controversy to which such cases give rise should come as no surprise. A young baby dies whilst under the the sole care of a parent or childminder. That child can give no clue to clinicians as to what has happened. Experts, prosecuting authorities and juries must reconstruct as best they can what has happened. There remains a temptation to believe that it is always possible to identify the cause of injury to a child. Where the prosecution is able, by advancing an array of experts, to identify a non-accidental injury and the defence can identify no alternative cause, it is tempting to conclude that the prosecution has proved its case. Such a temptation must be resisted. **In this, as in so many fields of medicine, the evidence may be insufficient to exclude, beyond reasonable doubt, an unknown cause…[E]ven where on examination of all of the evidence, every possible known cause has been excluded, the cause may still remain unknown' [emphasis in bold in judgment]**[53]

[49] *Vinaccia* at [492]-[499] & [502].
[50] *Vinaccia* at [500]-[501].
[51] Which it was contended on appeal demonstrated the bias and partiality on the contested issue of the SBS/AHT/IHT diagnosis.
[52] [2010] EWCA Crim 1269.
[53] *Vinaccia* at [483].

Walker JA found that this was such a case, primarily on the basis of the new evidence, that 'it would not have been open to the jury to conclude that BESS had been excluded' and 'once that that is accepted, Dr Tully's evidence at trial is necessarily undermined, because she had relied on Professor Ditchfield's evidence as the basis for excluding BESS'[54].

Walker JA also went on – at [494]-[496] – to expand on why, even if BESS was not excluded 'the evidence before this Court concerning the connection of retinal haemorrhages with abusive head trauma was not sufficient to support Dr Tully's definitive position at trial that the retinal haemorrhages must have been caused by the application of significant force'[55].

As this makes clear, the epistemological 'divide' or 'gulf' between the majority and minority centred of what could, and could not, have been known about the death of KBC.

Likely legacy of Vinaccia to Future Research in SBS/AHT/IHT

It is obvious that *Vinaccia* will not be the final word on SBS/AHT/IHT and its use in criminal trials in Australia.

The different epistemological perspectives that underpin SBS/AHT/IHT – on the one hand, from the world of forensic paediatricians and their allied disciplines and, on the other, the world of science and the need for verification so that reliable knowledge is used in criminal trials – do remain in real disputation and that is unlikely to change in the foreseeable future. Both sides, at least from my observation during the evidentiary hearing in *Vinaccia*, were passionate in their beliefs and energetic in the defence of their point of view.

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[54] *Vinaccia* at [494].

[55] *Vinaccia* at [495]. Finally – at [496] – Walker JA found that 'had the jury heard the new evidence, and noting the uncontroverted evidence concerning Kaleb's ill-health prior to 23 January 2016, it would not have been open to the jury to conclude, beyond a reasonable doubt, that the applicant had committed child homicide, either by an unlawful and dangerous act or by criminal negligence'.

But that should not be unsurprising, or a matter of concern, as that is how science 'develops' and progresses. There are ruptures in thought. Ideas do change and paradigm shifts do occur even in things that appear fixed and immutable. So much was made clear by Thomas Khun in his seminal work in the history of the philosophy of science, *The Structures of Scientific Revolutions.*

However, there is a real problem in the use of such challenged evidence in real criminal trials where substantial interests are at stake. Because in this area – and despite protestations to the contrary – the 'science' is not yet settled. There are correlations and associations but that does not equate with causality.

And that is the real test for the criminal law with this type of evidence. Because these are not mere arid, epistemological debates. It cannot be so because the SBS/AHT/IHT diagnosis is used as a potent form of evidentiary power by prosecutors in criminal trials. Yet, the 'safety' of the diagnosis is far from as conclusive as it needs to be. It is also highly susceptible to change and development.

In truth, whatever 'science' is in this area remains at a nascent level. *Vinaccia* is likely to prompt more, rather than less research, as the epistemological fracture, or divide, that was at the core of the dispute in the SBS/AHT/IHT diagnosis has been well and truly exposed.

Other Post-Vinaccia Developments

In the two years post-*Vinaccia*[56] several significant events have occurred.

The following list is not complete, but it does give an idea as to the ongoing uncertainty in this area of forensic science.

[56] *Vinaccia* was handed down on 7 June 2022. Submissions were filed on behalf of the applicant in *Vinaccia* that relied on the ruling of Judge Pedro J Jimenez Jr in *State of New Jersey v Darryl Nieves.*

The uncertainty that surrounds the SBS/AHT/IHT diagnosis – and the amount of work now being completed in this area – is profound and it could not be vouchsafed that the diagnosis will be used in criminal trials in five years, let alone in 10 years.

First, on 13 September 2023 – so 15 months after the decision in *Vinaccia* was published – a decision by the Appellate Division of the Superior Court of the State of New Jersey, *State of New Jersey v Daryl Nieves; State of New Jersey* was published. Apart from representation for each accused, amicus curiae briefs were filed by: New York and California Bar; The Innocence Network and Centre for Integrity in Forensic Sciences and Medical Physicians. The issue in the appeals was framed in this way:

> 'In these appeals, we consider the scientific reliability of expert testimony that shaking alone can cause the injuries associated with shaken baby syndrome (SBS), also known as abusive head trauma. The State sought to admit the testimony to prove aggravated assault and child endangerment charges against defendants Darryl Nieves and Michael Cifelli, father of infant sons who exhibited associated symptoms while in their respective fathers' care. Following a *Frye* hearing, Judge Pedro J Jimenez Jr, concluded that expert testimony of shaking-only SBS/AHT was not scientifically reliable, barred admission of the evidence at Nieve's trial, and dismissed the indictment against Nieves'[57]

This then was a State, or prosecution, appeal against the exclusion of expert opinion as to the SBS/AHT diagnosis. In a detailed judgment – the judgment is some 60 pages in length – the Court made this critical finding:

> 'The evidence supports the finding that there is a real dispute in the larger medical and scientific community about the validity of shaking only SBS/AHT theory, despite its seeming acceptance in the paediatric medical community. Where the underlying theory integrates multiple scientific disciplines, as here, the proponent must establish cross-disciplinary validation to establish reliability. The State failed to do that here. Indeed, all the experts at the hearing agreed that, at the very least, there was controversy surrounding the theory that the biomechanical principles underlying the SBS/AHT actually supported the conclusion that shaking only can cause the injuries associated with SBS/AHT'[58]

[57] *State of New Jersey v Darryl Nieves; State of New Jersey v Michael Cifelli,* 13 September 2023, at 3-4.
[58] *State of New Jersey v Darryl Nieves; State of New Jersey v Michael Cifelli,* 13 September 2023, at 3-4.

It affirmed the decision of a trial judge to exclude the expert opinion of the SBS/AHT/IHT diagnosis. The decision is an important one in that it approached the SBS/AHT/INT diagnosis at an 'elemental' level and simply considered whether it had a scientific basis in accordance with biomechanical principles. It found that it did not.

To read the decision of the *State of New Jersey v Daryl Nieves; State of Michael Cifelli* alongside *Vinaccia* makes uncomfortable reading.

Many of the same articles that were considered in *Vinaccia* were considered in *State of New Jersey v Daryl Nieves; State of Michael Cifelli.* In particular: confessional studies[59], ophthalmological studies of retinal haemorrhages[60], the 'Consensus Statement' by Choudary et al[61] and the SBU Report[62]. In addition, 'the State failed to submit any biomechanical study that was able to confirm the theories set forth by Caffey and Guthklech, that shaking alone can create acceleration and deceleration forces sufficient to cause intracranial trauma'[63].

In particular, the Court in *State of New Jersey v Darryl Nieves; State of New Jersey v Michael Cifelli* was able to do something that the majority in *Vinaccia* could not do: that although the forensic paediatric community may have a 'view' this does not mean that that 'view' had 'scientific support', let alone was supported by scientific evidence outside the 'echo chamber' that was – and is – the SBS/AHT/IHT community.

Again, this dovetails to that issue of epistemology that is fundamental to the thinking in this area and the choice to be made in how criminal trials are to be run and whether the 'forensic paediatric community', so deeply immersed in practice, is the 'right' vehicle to provide opinions as to the ultimate cause in cases of this type.

[59] *State of New Jersey v Darryl Nieves; State of New Jersey v Michael Cifelli,* 13 September 2023, at 35-37.
[60] *State of New Jersey v Darryl Nieves; State of New Jersey v Michael Cifelli,* 13 September 2023, at 43-44.
[61] *State of New Jersey v Darryl Nieves; State of New Jersey v Michael Cifelli,* 13 September 2023, at 40-42.
[62] *State of New Jersey v Darryl Nieves; State of New Jersey v Michael Cifelli,* 13 September 2023, at 37-39.
[63] *State of New Jersey v Darryl Nieves; State of New Jersey v Michael Cifelli,* 13 September 2023, at 58.

Second – also in 2023 – Cambridge University Press published *Shaken Baby Syndrome: Investigating the Abusive Head Trauma Controversy.* All three 'Scandinavian Witnesses' from JV contributed chapters to that edited volume. There were also authors who were not 'Scandinavian Witnesses' but, in fact, were from many, and varied, places around the world. The work itself is a challenge to the orthodoxy that surrounds the SBS/AHT/IHT and is likely to foster vigorous scientific debate. It represents and demonstrates that the SBS/AHT/IHT debate and scholarship is truly international in scope.

Third, research continues to be published that affects the reliability of some of the SBS/AHT/IHT research. Two significant articles include: M Raissaki et al, 'Benign Enlargement of the Subarachnoid Spaces and Subdural Spaces – When to Evaluate for Abuse' (2023) *Paediatric Radiology* and N Aoki, 'Clinical and Neuroimaging Characteristics in Mild-Type Infantile Acute Subdural Hematoma: Report of Four Cases' (2024) 40 *Child's Nervous System* 189-195.

Fourth, in 2024, in the Australian forensic context, an important article was published in the Australian referred law journal, *Journal of Law and Medicine* by Professor James Tibballs and Neera Bhatia. Titled 'Medical and Legal Uncertainties and Controversies in "Shaken Baby Syndrome" or Infant "Abusive Head Trauma' the article provides a commentary on *Vinnacia*[64]. The lead author is an Associate Professor in the Department of Paediatrics at the University of Melbourne. What is significant about this article is that represents a different view of the SBS/AHT/IHT debate and one that is more circumspect about the deployment of that 'diagnosis' in the criminal trial.

Concluding Observations

Flawed forensic science has long contributed to miscarriages of justice[65]. This is unsurprising. Part of the difficulty, of course, is the seductive nature of this type of

[64] (2024) 31 *Journal of Law and Medicine* 151.
[65] See generally Justice Weinberg, 'Juries, Judges and Junk Science: Expert Evidence on Trial' (2020).

evidence. It trades on the trust that inheres in the word 'science' in circumstances where what is claimed is, in fact, far greater than what is objectively the case.

The headline point that must be made about the SBS/AHT/IHT diagnosis is its unstable scientific basis. It is, in essence, a forensic science searching for its 'scientific' El Dorado. No less than the author Dr Guthkelch – who, of course, all of those years ago, provided the 'hypothesis' for the SBS/AHT/IHT diagnosis made these observations about the 'state' of the SBS/AHT/IHT 'science':

> '…these papers are characterized by unsupported assumptions, lack of controls, misunderstanding of statistics and misplaced reliance of conjecture. In short, the evidentiary basis for the traditional SBS/AHT hypothesis is unreliable'[66]

So much was recognized in *State of New Jersey v Darryl Nieves; State of New Jersey v Michael Cifelli,* too.

It is to be hoped that this could be achieved in the Australian context.

[66] Findlay, K, Guthkelch, AN, Barnes PD & Squier, W, 'Admissibility of Shaken Baby Syndrome/Abusive Head Trauma Evidence' (2013) 43 (7) *Paediatric Radiology* 890.