PO Box 745 Indooroopilly QLD 4068 AUSTRALIA Ph 1300 662 173 or +61 7 3378 26
Email info@pacificsolutions.com.au Web www.pacifictranscription.com.au

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MEDICO-LEGAL SOCIETY OF NSW INC.

SCIENTIFIC MEETING

WEDNESDAY, 9 SEPTEMBER 2015 AT 6.15 P.M.

THE TOPIC: CONTACT SPORT: WATCH YOUR HEAD

SPEAKERS: DR ARTHUR SHORES
MR ALAN SULLIVAN, QC

Transcript prepared by Karen Russell

DR MICHAEL DIAMOND: Good evening everybody, welcome.

Tonight we have a topic that came up in one of our committee meetings and certainly generated a lot of interest. We were looking at the question of head injuries and how they are dealt with in a professional sense, the legal connotations of head injury particularly in terms of liability and in terms of prevention and how they end up before the courts. Following that discussion about the topic, the snappy title we came up with for this meeting was “Contact Sport - Watch your Head”. Further we have arranged for two very interesting and very expert speakers to address the Society this evening. We have from the clinical/medical/psychological perspective, Dr Arthur Shores, who will be our first speaker and then we will have Mr Alan Sullivan QC, who will address the subject from the legal perspective as is our traditional format.

Arthur Shores, a PhD in Medicine from the University of Sydney, is a very well known and respected clinical neuropsychologist. He is an adjunct professor in the Psychology Department at Macquarie University and has previously been the director of postgraduate neuropsychology programs at that university from 1996 till 2011. He has held positions nationally and internationally. He is a past national chair of the Australian Psychological Society, College of Clinical Neuropsychologists being made a Fellow of that Society in 2006. He received an award of distinction from the College of Neuropsychologists in 2007 and has been recognised internationally by the British Psychological Society and the National Academy of Neuropsychology in the United States.

I could go on and on. Arthur has published extensively. He has also been quoted many, many times in the literature. Consequently you will be hearing from somebody who knows his stuff and can tell you what you need to know in this field. I will not go on any further. It is my pleasure to welcome Dr Arthur Shores to address the Society.

DR ARTHUR SHORES: Thank you very much for that introduction. I was very pleased to receive the invitation from the Medico Legal Society of New South Wales and I am honoured to be here tonight to present on the topic of sport-related concussion from a neuropsychological perspective. I have had an interest in concussion and traumatic brain injury for a long time and

involvement in a number of research projects over the years to try and improve diagnostic measures. One of these measures is the abbreviated Westmead PTA Scale, which is used for assessing patients with mild traumatic brain injury and whose use is now mandatory in New South Wales Hospital Emergency Departments.(1)

My aims in this presentation are as follows:

i) To define sport related concussion

ii) To provide an overview of the sideline (or pitch-side as they say in the United States) assessment of sport-related concussion

iii) To provide an overview of Australian hospitalisation for sport-related concussion.

The take-away or take-home messages are two:

i) An uncomplicated single sport-related concussion is a relatively benign event that is typically characterised by a full recovery. If you read the newspapers, you would not believe that.

ii) In cases of prolonged recovery with persistent symptoms, a more serious brain injury is likely and the term “Concussion” should be replaced with the grade of brain injury severity (Mild/Moderate/ Severe) as determined traditionally by the Glasgow Coma Scale score at six hours after injury.

Most experts would agree that the Consensus statement on concussion in sport from the Fourth International Conference on concussion in sport held in Zurich in November 2012 represents a reasonable summary of our current knowledge in relation to sport-related concussion. (2) In the Zurich statement, concussion is considered to be a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by mechanical forces. The features of a concussive head injury include:

(1) It may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an “impulsive” force transmitted to the head.

(2) It typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases

symptoms and signs may evolve over a number of minutes to hours.

(3) It may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury and therefore no abnormality is seen on standard structural neuroimaging studies. That is CT scans and MRI will not reveal anything.

(4) It results in a graded set of clinical symptoms that may or may not involve loss of consciousness. That is you do not have to be “knocked out” to have a concussion. Resolution of the clinical and cognitive symptoms typically follows a sequential course. However, it is important to note that in some cases symptoms may be prolonged.

To understand the features of concussion, it is of value to know how the severity of traumatic brain injury is typically graded and the Glasgow Coma Scale (GCS) is the measure used to grade severity. The scores on the GCS range from 3 to 15. After a “Severe” injury the score is equal to or less than 8 and one is generally considered then to be in a coma. A “Moderate” injury is represented by a score of 9 to 12 and a “Mild” injury by a score of 13 to 15.(3)

The GCS consists of three components: Eye opening, Verbal response and Motor response. One is considered fully conscious if they are able to open their eyes spontaneously, are fully orientated and can obey commands. Such a person would get a score of 15.

At the other end of the scale, one is considered deeply unconscious if they do not open their eyes to pain (even to a painful stimulus), can make no sounds and make no movements. Such a person would score 3. A prolonged low score on the GCS is of significant prognostic value. The longer and lower the score, the greater the odds of death. (4) There is a strong linear relationship between the depth of unconsciousness and the likelihood of dying.

Sports concussion experts consider “concussive” injuries to fall at the lower end of the category of a traditional “Mild” traumatic injury as defined by the Glasgow Coma Scale score. When one considers the neuropsychological outcome from the traditional “Mild” injury is generally favourable, then one would expect outcome from an injury of even less severity to also be favourable or even more

favourable. (5) It is my view that after a head blow and a player has an abnormal Glasgow Coma Scale score at six hours, they should then be classified by the GCS severity categories (Mild/Moderate/Severe/traumatic brain injury), and not be described as having had a concussion, which implies only a very minor injury with rapid recovery. Consequently sports concussions are at the very minimal end of what is traditionally known as a "Mild" traumatic brain injury.

When considering injuries that fall in the "Minimal" severity range, it is sage advice the British Neurologist JMS Pearce provides when he says:

> "The millions of minor bumps to the head in children and adults in which the victim is only momentarily dazed and is completely back to normal within a few seconds or minutes without later sequelae should remind us of the dangers of the over-enthusiastic use of medical labels and their indiscriminate dissemination to the public." (6)

To demonstrate the favourable outcome from concussion, to which I have been referring, I wish now to turn to the classic study that has been replicated by others on numerous occasions, and that is the study by Michael McCrea et al (2003). His group studied 1,631 football players who were all tested pre-season and then at regular intervals after sustaining a concussion. Of their original group, 94 sustained a concussion and they then compared these with a group of 56 of the players who had not sustained a concussion.

There is no difference in the two groups with the pre-season cognitive or neuropsychological testing. At the time of concussion there is a severe drop with a very low score on cognitive testing or neuropsychological testing. After the game, on the same day, there is already improvement. By day 1 there is a significant improvement and by day 2 there is almost no difference between the controls and the concussed players. By day 7 they are back to being equal to each other. It should be noted the controls' scores gradually go up, probably due to the repeated practice at doing the testing. This outcome is very, very typical of all the studies done on concussed players when they are tested neuro-psychometrically.

In addition to the neuro-psychometric testing, which is memory, concentration, processing speed, et cetera, we also look at their symptoms. The pre-season, pre-

concussion baseline in both groups looks the same on a concussion checklist. At the time of concussion the concussed players have a massive number of problems that gradually reduces over a seven day period to where they are back to the low baseline they had before they had the injury. So again, over a seven day period there is a reduction in symptoms back to the baseline. The symptoms the players get rated on are their level of headache, “pressure in the head”, neck pain, nausea or vomiting, dizziness, amongst many others. Over a seven day period these symptoms return to their baseline level.

These findings by McCrea have been replicated on numerous occasions and it is generally found the outcome from a single uncomplicated concussion is full recovery by about seven days.

However, this is not the case when there are repeated concussions or a more severe brain injury. I will now discuss the concept of chronic traumatic encephalopathy (CTE), which has had considerable attention in the media. Mr Taylor is purported to be the first Australian rugby league player to have had neuropathological confirmation of CTE following autopsy.

The following quote is an extract from an article written by Peter Fitzsimmons, the journalist, on 6 March 2014 talking about Mr Taylor:

> “For, did he care about head knocks? Did he, *hell?* He was Tizza, a man of his generation who knew that concussions were no big deal, that you just shook them off. You didn't go off when you had your bell rung, and nor did you stand down for a few weeks after you had been knocked out cold. You *got on with it*, and he did that until the age of 33.
>
> But did all those concussions have an effect on the health of his brain? The prima facie evidence was strong. He was only 57 years old, back in 1993, when he showed early signs of dementia, including strange outbursts of fury that were totally out of character for the devoted family man, odd behaviour and short-term memory loss. By the time he turned 60, he was, in the words of his son Stephen, “already quite dotty,” and it just got worse from there, to the point he had to be put in a hospice with medical care where he remained until his death at the age of 77 in late April last year, and for the last three years he had no lucidity at all.”

His case was published by the Boston Group led by Dr McKee in 2014. They described grade IV widespread PHF-tau pathology with severe atrophy. (7)

There is evidence of an apparent association between repeated concussions and the later development of CTE. However, whether or not the association is "causal" is controversial. The Australian neurosurgeon, Gavin Davis and his group in Melbourne in a careful recent review of the literature have argued that there is insufficient evidence to establish causation. (8) On the other hand the Boston Group, who published the autopsy results on Mr Taylor, believe strongly that there is a causal relationship. So it really remains a very open question on which, I believe, Alan Sullivan will comment further with respect to the legal implications.

I now turn to how concussion may be identified on the sideline. The task here is to attempt to balance false positive findings against false negative findings. You do not want to identify a player as concussed and remove them from play when in fact they are not concussed. They do not like it. Imagine the captain of Kings first rugby team playing Joeys having had a hard knock to the head, with a complete recovery after a few seconds. He does not believe he is concussed but he is taken off. As this game is the pinnacle of his life, you can imagine how he feels. At the same time, you do not want to identify a player as not concussed when they are in fact concussed and allow them to continue to play. So getting that balance right is key for the doctor on the sideline. In reality most games do not have the privilege of a doctor on the sideline, and it is the coach and the trainers and the parents who end up making those decisions.

Some of the methods and techniques available to identify a concussion on the sideline are the Sports Concussion Assessment Tool 3 (SCAT 3), the Pocket Concussion Recognition Tool (Pocket CRT) and the Abbreviated Westmead PTA Scale (AWPTAS).

The SCAT 3 contains eight separate measures and over 90 individual items and must be administered by a medical professional. It takes approximately 30 minutes to complete (Guskiewicz et al., 2013). (9) It is apparent that if you want to make a decision on whether the person can go back into that game, the SCAT 3 is not very practicable. First of all, there is probably not a doctor in attendance, and if there were, taking the

person out of the game for 30 minutes is almost half the game over. This is clearly a problem.

On the other hand the Pocket CRT, which is a much shorter measure and can be used by non-medical people, such as coaches, teachers, trainers and others, specifies that if one or more of the following visible clues, signs, symptoms or errors in memory questions are present, then the player should be removed from play. These are:

“loss of consciousness or unresponsiveness; lying motionless on the ground/slow to get up; unsteady on feet/balance problems or falling over/incoordination; grabbing/clutching of head; dazed, blank or vacant look; and confused/not aware of the plays or events:”

A second component is the presence of one or more of the signs and symptoms on the concussion signs and symptoms checklists referred to earlier. The presence of any one or more of these signs and symptoms should lead one to suspect a concussion and it is recommended to remove the player from the game.

The third component of the Pocket CRT involves what is known as the Maddocks questions. These were published in the 1990s and are widely used around the world. It is of interest that David Maddocks, who developed these questions, began his career as a neuropsychologist after completing a PhD in sport-related concussion. However, he then began studying law and is now a barrister in Melbourne where he keeps a keen interest in sport-related concussion. The Maddocks questions are asked when you want to determine whether or not a person has been likely to have had a concussive injury. The questions are:

“What venue are we at today? Which half is it now? Who scored last in this game? What team did you play last week? Did your team win the last game?”

If the player cannot answer any of those questions, he is thought not to be fully compos mentis and probably concussed.

The Zurich guidelines state that using such methods, any athlete with a suspected concussion should be immediately removed from play and should not be returned until they are assessed medically. Athletes with a suspected concussion should not be left alone and should not drive a motor vehicle.

In Australia we have developed another measure which can be used on the sideline, the Abbreviated Westmead PTA Scale (AWPTAS), which is now used in New South Wales Hospital Emergency Departments and can easily be used on the sideline to aid in the assessment of concussion as well as by ambulance officers.

The AWPTAS is based on the premise that amnesia is the hallmark of concussion and is simply an extension of the Glasgow Coma Scale to include a simple new learning task, namely the ability to remember three simple pictures after a delay of one hour. For sports concussions, when a return to play in the same game is required, we believe a 10 minute recall is sufficient. While the GCS provided for a maximum score of 15, adding the three pictures gives a maximum score on the AWPTAS of 18. After completion of the GCS, the player is then shown three pictures and told they will be asked to remember these for later testing. After a delay, the player is asked to recall the pictures. If unable to recall one or more, they are given a set of nine pictures that includes the three target pictures, to see if they can correctly recognise those pictures. Failure to recall or recognise all three suggests amnesia and the player should not be allowed to return to play. Once the players get to hospital, the emergency department staff, who are familiar with the scale, will ask them what were the pictures shown to them at the field, as a further measure of whether they are now laying down new memories or not and whether they have recovered their amnesia or not.

It might be of interest to know that in a recent research project with players in AFL live matches, we have shown that on the Maddocks questions, around 18 per cent of players without a concussion, but in the heat of play, failed the questions, whereas only around 2 per cent failed the AWPTAS picture cards. (10) Our Westmead Scale had a two per cent failure rate. Hence we have argued that if you use the Maddocks questions, you should also use something else, otherwise you will be mis-identifying players who have not had a concussion.

To conclude my presentation I want to provide a brief overview of hospitalisations for concussion in Australia or more specifically Victoria, because this study is of Victorian hospitals. In 2013 Carolyn Finch and her group published the mean rates over a nine year period per 100,000 sports participants who were hospitalised for concussion. The group with the highest rate was Motor Sports, followed by Equestrian Activities, then

Australian Football, followed by Rugby (all codes) and Roller Sports being the top five. (11) Cricket came in at number 11. We do not typically expect brain injuries from cricket, but as we know, they do happen (Phillip Hughes) but they are rare.

Looking through some of the top problems and why might it be the case that those sports are so prevalent. Motor vehicle racing, motor bikes, and racing cars all involve high speeds with high forces so of course you are going to be at risk of concussions and head injuries. What about horse riding? This is the second highest for hospitalisations, and while I have sympathy for the rider, I am also very concerned for the horse's head. An example of a cricket injury is where two fielders went for the ball and one put his knee into the other's head giving him a fractured skull. Diving is not very safe and a more obvious one is cage fighters from Brisbane. I will end with one more, which is more pleasant - well, more pleasant to view, and this is cheerleaders in the United States. Why cheerleaders? They rank under men's wrestling as the highest rate of concussions. The reason is that they are skilled athletes who go up very high in the air and if they make a mistake, they have a long way to fall and if they fall on their head, they are going to have a concussion.

Thank you very much.

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