Wagner: I’ve called this session Evaluation and Management of Nonaccidental Head Trauma, but I want to start with a question on terminology. What should we really be calling this condition when we identify a child with eye findings who fits into the category of what was formerly called Shaken Baby Syndrome?

Levin: Several years ago the American Academy of Pediatrics recommended a change in terminology from Shaken Baby Syndrome to abusive head trauma. They clearly indicated that one form of abusive head trauma is Shaken Baby Syndrome, in which children are submitted to repeated acceleration and deceleration with or without blunt head trauma. They clearly indicated that one form of abusive head trauma is Shaken Baby Syndrome, in which children are submitted to repeated acceleration and deceleration with or without blunt head trauma. So, whether you call it abusive head trauma or Shaken Baby Syndrome is a matter of choice, but according to the Academy you should be using the term abusive head trauma.

Wagner: You are asked to see a 4-month-old infant in the pediatric intensive care unit. According to the history, he fell out of the father’s bed, struck his head on the floor, and stopped breathing. He was resuscitated by the father with cardiopulmonary resuscitation and was poorly responsive, so the father then called 911. The infant was admitted to the emergency department and found to have a subarachnoid hemorrhage. You find extensive bilateral intraretinal and preretal hemorrhages involving the entire posterior pole in both eyes, including the papillo-macular bundle between the optic nerves and the fovea. How much credence do you put in the history in this situation?

Forbes: I like to believe the history until proven otherwise, but the scenario really isn’t consistent with the findings you’ve described. It is very unlikely that that degree of retinal bleeding occurred as a result of the scenario described, although doing a complete work-up is of paramount importance.

Levin: History is very important. We listen very carefully to families and we try to take that history into account when we look at the retina. Much research has been done to understand what types of forces it takes to cause what type of retinal picture. When there’s a disparity, three possibilities exist: the history is incorrect; there is something unique that we’re missing about the history, the event, or the child, such as bleeding diathesis or something else that would allow the confluence of these events to occur, whereas otherwise you wouldn’t expect those two to occur; or this is abusive head trauma.

Chan: The history is very important. We rely on what the primary team tells us and what they find. You may also have bone fractures or perhaps a history of other hospitalizations that could contribute to the picture. But we have to reconcile the history with the findings.

Wagner: In the absence of low platelet count or abnormal coagulation studies, can retinal hemorrhages be caused by cardiopulmonary resuscitation?

Levin: There have been seven studies, all of which have shown the exact same thing. Even in a pig model, retinal hemorrhages are generally not caused by cardiopulmonary resuscitation. Certainly not extensive hemorrhages. Perhaps a rare single hemorrhage, a few intraretinal hemorrhages,
or preretinal hemorrhages in the posterior pole is possible, but that would not explain the kind of retinopathy you’re describing.

**Forbes:** I agree, with the additional caveat as Dr. Levin said earlier, “unless there’s something that we are unaware of that would allow the confluence of these events to occur.”

**Wagner:** Are retinal hemorrhages caused by seizures?

**Levin:** Multiple studies have been done and they all conclude that seizures do not cause retinal hemorrhages.

**Chan:** I do not think that seizures cause intraretinal hemorrhaging. In the case of abusive head trauma, the hemorrhage we see is likely caused by the acceleration and deceleration. However, if you encounter a child with both seizures and unilateral intraretinal hemorrhages, especially a girl, I would also consider incontinentia pigmenti in my differential diagnosis.

**Wagner:** What is the significance of unilateral retinal hemorrhages in the child described here?

**Forbes:** I’ve published on that and I don’t think that unilateral retinal hemorrhages are of major significance; unilateral hemorrhages occur in 15% to 20% of cases so it certainly doesn’t rule out abusive head trauma.

**Levin:** I agree, but we should always be asking “Is there some other possible cause in this child?” For example, if the child had a capillary hemangioma in one eye, he may have unilateral hemorrhages. But this would be obvious. We’re always looking for the possible alternate explanation.

**Wagner:** In a normal newborn, how long would you expect the retinal hemorrhages from birth trauma to be present after birth?

**Levin:** Tens of thousands of infants have been studied around the world, and we know that flame hemorrhages are almost always gone by 72 hours and virtually 100% are gone by 1 week. Intraretinal hemorrhages are almost always gone by 4 weeks and can rarely last 6 weeks or beyond. Pre-retinal hemorrhages can last for weeks and vitreous hemorrhages can last for months.

**Forbes:** I agree with Dr. Levin. However, if you look in the eye and you’re just seeing preretinal hemorrhages, that’s not the picture that you usually get. If you are seeing only preretinal retinal hemorrhages, this implies to me that there were likely intraretinal hemorrhages that have cleared because preretinal hemorrhages persist longer.

**Wagner:** I’ve seen a few infants who have undergone cooling therapy and had some retinal hemorrhaging of the posterior pole, a little more extensive than you’d expect from birth trauma. Have you seen this?

**Levin:** Do you mean extracorporeal membrane oxygenation associated with cardiac disease?

**Wagner:** Yes.

**Levin:** Extracorporeal membrane oxygenation can cause retinal hemorrhages probably related to the heparinization and perhaps flow abnormalities. Of course, it would be obvious if a child were receiving such a treatment.

**Wagner:** The reason I ask these questions is that they are the obvious questions people ask when determining the cause of the symptoms. My experience is that when I see hemorrhaging bilaterally or unilaterally extending toward the periphery, it’s difficult for me to find an alternative cause to nonaccidental head trauma in most of the cases.

**Levin:** Hemorrhages can be caused by birth trauma, leukemia, fatal crush injuries to the head, and fatal motor vehicle accidents. After that, the differential diagnosis for such extensive multilayered retinal hemorrhages gets very slim.

**Forbes:** I agree, but I still have to consider other options. If I see six intraretinal hemorrhages in one eye, one hemorrhage in the other eye, and a reasonable history of some minor trauma, I can’t necessarily rule out accidental injury. That said, the cynical part of me thinks Shaken Baby Syndrome is likely, although at the same time, I’m not in a position where I feel like I can say that with certainty.

**Levin:** I think we have an open mind, all things considered. Rare things happen rarely. New diagnoses are discovered. This isn’t a witch hunt. Rather, we want to use what we know scientifically in a tempered way that makes sense, always in the context, as Dr. Chan said, of the multidisciplinary team investigation. We’re not going to make a diagnosis based on eye findings alone, even though the eye findings may be the most striking factor.

**Wagner:** Have any of you had the opportunity to follow some of these children long term? Can you comment about their vision or other abnormalities?

**Forbes:** My experience is that children who have mild hemorrhages can do very well visually and those with moderate hemorrhages do not always have a decrease in vision. Some of the more severe cases with marked optic atrophy have extensive visual impairment, but in general the retinas themselves turn out to
be pretty normal and the children do well visually. That said, central visual impairment is the greatest limitation to vision.

**Levin:** The retina sometimes can evolve to show pigmentary alterations in the macula, but the most common cause of poor vision is cortical visual loss followed by optic atrophy. Certainly, if you go to a chronic care facility you’ll likely see a child who’s blind from this event.

**Chan:** I have a question from the perspective of a retinal specialist. I’ve encountered several children with vitreous hemorrhage secondary to abusive head trauma. As the pediatric ophthalmologist, when would you recommend that the retinal surgeon evacuate the hemorrhage?

**Levin:** That’s a difficult question and we go back and forth with the retinal surgeons. If the hemorrhage is sub-internal limiting membrane, as in traumatic retinoschisis, I would be conservative because we know from surgical experience that it’s sometimes difficult to get that hemorrhage out. It’s also difficult to achieve separation of the vitreous from the internal limiting membrane in young children. It’s a difficult surgery and I think it probably causes more damage than good. For a vitreous hemorrhage, the question is how long do you wait? There’s no right answer to that. I find that we debate it so long that by the time we make the decision the hemorrhage is gone.

**Forbes:** I have seen two children in whom we let the hemorrhages clear on their own and they ended up being markedly myopic at approximately -8, -12. But I agree with Dr. Levin in delaying evacuation because surgery is not a trivial endeavor and could make things worse.

**Levin:** There are some interesting reports in adults with sub-internal limiting membrane hemorrhage being treated by YAG laser, which cuts a hole in the internal limiting membrane. Obviously, I don’t think that’s much of an option in children.

**Chan:** Yes, and now there are drugs such as ocriplasmin that could potentially improve our ability to surgically induce a posterior vitreous detachment.

**Levin:** Do you think they will help in children?

**Chan:** That’s a good question, and there are studies looking at this issue. I struggle with these children because my role as a retinal surgeon is to decide whether to evacuate the blood and whether to intervene early or wait. I am often more conservative and will observe in many cases, but I very much rely on my pediatric ophthalmologist colleagues to help guide that decision.

**Levin:** I think it’s important to stress that having a RetCam or any other form of retinal photography is not a requirement in these cases. Nor is it necessarily the gold standard, because the RetCam in particular has some problems in imaging vitreous hemorrhages in terms of contrast. A great description in the chart with or without a good hand-drawn figure is a very acceptable standard of care. You’re not committing malpractice if you don’t take pictures of the retina.

**Chan:** I am in favor of retinal imaging, but I agree that it’s not absolutely necessary. I do find it useful and I encourage fellows to image so we have baseline documentation. I also will perform fluorescein angiograms on these children, and we have frequently found significant retinal changes. For example, you can see peripheral retinal nonperfusion and retinal neovascularization. Therefore, I believe retinal imaging can help in the management of those cases.

**Wagner:** Thank you all for participating.

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