G86 Extent and Distribution of Retinal Hemorrhages in Abusive and Non-Abusive Head Injury

M.G.F. Gilliland, MD, Brody School of Medicine East Carolina University Department of Pathology and Laboratory Medicine, Brody 7510, Greenville, NC*

The goals of this presentation are to present the differences between the extent and the distribution of retinal hemorrhages found in abusive compared with non-abusive head injury.

Outcome: Attendees may know differences in retinal findings which can be used to help distinguish between abusive and non-abusive head injuries.

Observations from ocular examination of 80 head-injured infants and children identified a statistically significant greater extent and different distribution of retinal hemorrhages in those with abusive head injury compared with those with non-abusive head injury.

A prospective ocular and systemic study of infants and children was undertaken at the Southwestern Institute of Forensic Sciences between 1981 and 1989. The study group included 169 infants and children. Death was attributed to head injury in 80 of the children. Review of investigations, medical records, and follow-up investigations was used with gross and microscopic findings from autopsy examinations which included ocular examinations. Most of the deaths were attributed to abusive head injury, 62 cases, while 18 of the deaths were attributed to non-abusive injury. The latter included five children involved in motor vehicle collisions. Five more were run over by motor vehicles. One was thrown from a motorcycle. Four children fell: one went out a second story window to a concrete patio, one fell from stairs to a conglomerate patio, the third was standing on a washing machine and fell onto his head, the fourth was standing on tall bed above a concrete floor and fell onto his head. One child was riding on a bicycle with an adult who fell on top of her when the bike hit an obstacle. A child's stroller rolled downhill and collided with a wall; a respiratory tract infection contributed to that death. The eighteenth child suffered a gunshot wound of the head and the ipsilateral eye was examined; no hemorrhages were seen in that eye.

Retinal hemorrhages were found in nine of the eighteen children with non-abusive injuries (50%) compared with 53 of the 62 children with abusive head injuries (85%). The Yates-corrected p value was 0.004 with Greenland, Robbins 95% confidence limits 1.07 < Relative Risk <2.74. Looking at the presence of retinal hemorrhages at the retinal periphery, hemorrhages were found in three of the 18 with non-abusive injuries (17%) compared with 47 of the 62 with abusive injuries (76%). The p value was <0.001 with confidence limits of 1.60 < RR < 12.90. Hemorrhages at the macula were found in six of the eighteen children with non-abusive injuries (33%) while 48 of 62 with children abusive injuries (77%) had such hemorrhages. The p value was 0.001 with confidence limits of 1.19 < RR < 4.53. Posterior hemorrhages near the optic disk were found in nine of eighteen children with non-abusive injuries (50%) and 50 of 62 with abusive injuries (77%). The p value was 0.02 with confidence limits of 1.00 < RR < 2.60. Looking at the presence of hemorrhages in the superficial retina, hemorrhages were found in four of the 18 children with non-abusive head injuries (29%) while 47 of the 62 children with abusive head injuries (76%) had such hemorrhages. The p value was <0.001 with confidence limits of 1.42 < RR < 47.85.

Microscopic grading of the extent of retinal hemorrhages allowed further differentiation between the two groups. Hemorrhages of 4+ markedly distorted the retinal architecture, 3+ slightly distorted the retinal architecture, 2+ were visible at low power (20x), and 1+ were only visible at high power (100x). The distribution of the hemorrhages was described with reference to the ora serrata, the equator, the macula, and the posterior retina including the disk at the nasal and temporal sides of pupil-optic nerve sections of the eye. The hemorrhages were also described with respect to the superficial and deep retina as well as subretinal hemorrhages.

Only one child among non-abusive head injury group had as much as a 3+ hemorrhage and that in one eye only. It was found at the subinternal limiting membrane (superficial retina) at the temporal equator. The child was unrestrained sitting on the lap of a back-seat passenger in a car broad-sided in a motor vehicle collision. The child also had 2+ hemorrhages at the macula, the posterior, and both sides of the ora serrata. Two had more extensive 2+ hemorrhages. One of these children had 2+ hemorrhages extending from the posterior retina to the equator in one eye, the other eye was uninjured. A car rolled over this child's head at low speed. The other child with slightly more extensive hemorrhages had them present posteriorly and extending to the equators bilaterally; hemorrhages were also seen at the ora serrata in one eye. This child had an unwitnessed fall while playing on concrete stairs over a conglomerate patio. The patterned injuries from the conglomerate were helpful in reconstructing the event. All six of the other children with hemorrhages had 2+ hemorrhages in at least one area, usually the posterior or equatorial retina. The superficial retina was involved infrequently.

In contrast, children with abusive head injuries had more extensive retinal hemorrhages which more often were found in the superficial retina and the retinal periphery. Hemorrhages graded as 3+ and 4+ were found in 38 of the 62 children with abusive injuries (61%) as opposed to 1 of 18 of those with non-abusive

 ** Presenting Author*

injuries (6%). The children with at least 2+ hemorrhages tended to have them more widely distributed and to involve the superficial retina more than the children with non-abusive injuries. There was only one child with but a single microscopic 1+ posterior hemorrhage; nine had no hemorrhages.

The presence and extent of superficial and peripheral hemorrhages were good discriminators of abusive head injuries when present. No 4+ hemorrhages were seen in non-abusive head injuries in this population. Only one 3+ hemorrhage was seen in an uncontroverted non-abusive injury death. Only three children with non-abusive injuries had hemorrhages at the retinal periphery. Two were unrestrained back-seat passengers in motor vehicle collisions; the third fell from concrete stairs.

Extensive superficial and peripheral hemorrhages are part of the constellation of abusive head injuries. The absence of such hemorrhages increases the need to identify the other parts of the constellation before making a diagnosis of abusive head injuries.

Retinal Hemorrhages, Abusive Head Injury, Retinal Periphery

 ** Presenting Author*