

Commentary on: Lantz PE, Couture DE. Fatal acute intracranial injury, subdural hematoma, and retinal hemorrhages caused by stairway fall. *J Forensic Sci* 2011;56(6):1648-53.

Sir,

I read with great interest the article by Lantz and Couture (1) describing a 7-month-old infant female with a fatal unwitnessed stairway fall. The authors continue to make meaningful contributions to the literature by providing intriguing case reports. However, there are two issues which I believe require some clarification to avoid misinterpretation and confusion.

The first crucial issue to be clarified is the coagulopathy described in the vignette. The infant reportedly had a prothrombin time of 17.6 sec and a partial thromboplastin time of >200 sec. Unfortunately, a meaningful coagulopathy work-up was not performed or, at least, not reported. There exist other meaningful coagulation tests that help predict neurologic outcome (2,3) which may have been worth reporting. While a mild coagulopathy has been well described with trauma (particularly brain injury) (2-4), this degree of coagulopathy would be unexpected. Children with an underlying blood coagulopathy have been well described as having a greater risk of intracranial hemorrhage in the face of trauma (5-7). Intracranial hemorrhage after head injury is a common presenting event for infants with undiagnosed bleeding disorders, increasing the risk of fatality (8,9). If this infant had an underlying coagulopathy, then the amount of bleeding, both intracranial and retinal, would be markedly accentuated. Without a clearer understanding of the coagulopathy, any conclusions that the fall itself was solely as the cause of the subdural hemorrhage and retinal hemorrhages must be guarded. Additionally, the stairway fall being unwitnessed makes determining the particulars of the fall impossible to ascertain. There may have been something unique about the mechanics of the fall which resulted in the infant's devastating injury.

The authors need to also be applauded for their foray into a Systematic Review of the falls literature. This is a meaningful approach to the literature that can be an effective tool to identify additional relevant published evidence. As the Systematic Review is a powerful tool, it must be precisely utilized. There are three cornerstones of a rigorous Systematic Review: (i) a clearly focused research question, (ii) a meaningful and extensive search strategy, and (iii) a clearly articulated literature appraisal process. My first concern about the author's utilization of the Systematic Review methods is the absence of a true research question. A well-structured question will allow for a more targeted literature search strategy. Asking a broad question ("what is the literature on infant falls?") will cause the resulting search to be quite muddy. Without a clear and broad search strategy, the resulting citation list will likely be incomplete. To highlight the importance of the search terms, when I replicated the search strategy precisely as outlined by the authors, I retrieved 235 citations, not the 906 described. A search of "accidental falls [MeSH] OR fall OR falls OR stair*" (limited to "All Child: 0-18 years") resulted in 16,655 citations, and "accidents / mortality [MeSH] OR child abuse / diagnosis [MeSH] OR craniocerebral trauma / etiology [MeSH] OR retinal hemorrhage [MeSH] OR intracranial hemorrhages [MeSH]" (limited to "All Child: 0-18 years") resulted in 14,228 citations (with a PubMed error indicating "accidents mortality [MeSH], child abuse diagnosis [MeSH], craniocerebral trauma etiology [MeSH]" were not found). When combining these two searches with the Boolean

operator "AND," I get 234 citations. This search strategy will identify papers in which falls in children were accidental, child abuse, had craniocerebral trauma, retinal hemorrhages, or intracranial hemorrhages. Importantly, PubMed does not perform a "full text" search. When a term is searched for (i.e., "fall"), PubMed goes through a hierarchical automatic term mapping (http://www.ncbi.nlm.nih.gov/books/NBK3827/#pubmedhelp.How_PubMed_works_aut [accessed September 11, 2011]) to assign the searched term/phrase to a specific "field." The PubMed search "fields" may include the article title, author name, abstract, MeSH heading, journal title...but not a full text search. Thus, a paper which discusses "injuries" to children and does not have the word "fall" in the title or abstract, but does include "falls" in the reported data or body of the text (i.e., "full text"), would not be identified by simply searching for "fall" (i.e., "fall [All Fields]"). Given the importance of the search terms, it is crucial to note though that the search terms utilized by the authors were not completely consistent with PubMed/Medline vernacular. For example, while "accidental falls," "retinal hemorrhage," and "intracranial hemorrhages" are MeSH (*Medical Subject Heading*) terms, "accidents / mortality," "child abuse / diagnosis," and "craniocerebral trauma / etiology" are not (they are MeSH subheading). Unfortunately, after having run the search as outlined by the authors, I was unable to return 12 (10-21) of the 19 papers the authors discussed (by including "author name [au]" to their search string). This highlights the "operator dependence" of the search strategy of a rigorous Systematic Review.

To again demonstrate the importance of the search terms utilized, I performed the following search (09/11, all limited to "All Child: 0-18 years"):

- #1 accidental falls [MeSH] = 2365 citations
- #2 subdural hematoma [MeSH] = 2239 citations
- #3 retinal hemorrhage [MeSH] = 1156 citations
- #1 AND #2 = 36 citations
- #1 AND #3 = 26 citations
- #2 AND #3 = 94 citations
- #1 AND #2 AND #3 = 9 citations

Each of the combination search strategies will result in any paper which PubMed has assigned both MeSH terms to. Thus, the last strategy (#1 AND #2 AND #3) will return papers in which PubMed categorizes in all three MeSH headings ("accidental falls," "subdural hematoma," and "retinal hemorrhages"). All nine returned in my search were also present in the search strategy outlined by the authors. This emphasizes two points: (i) one can appreciate that a limited search strategy results in a limited result (and perhaps an incomplete search result), and (ii) the importance of clarifying inclusion and exclusion criteria which will be applied to returned papers, as only three of the nine were actually ones discussed by the authors.

Despite the limitations outlined earlier, the authors make a significant contribution to the literature. They remind us that a complete and meaningful evaluation of all of the clinical and nonclinical information needs to occur prior to drawing diagnostic conclusions. While the findings in the vignette would reasonably prompt clinicians to be concerned about an inflicted injury, an exhaustive investigation was able to clarify these findings satisfactorily. The authors also remind us that there is a broad body of

literature available to help inform clinical and diagnostic decisions and that it is beholden upon us, the end users of the medical literature, to become facile in its discovery and analysis.

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