Reviewer's report

Title: Midline shift in relation to thickness of traumatic acute subdural hematoma predicts mortality. A retrospective cohort study.

Version: 2
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Reviewer: Ashwin Kamath

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General comments
1) The authors report their analysis of a series of 59 patients with subdural hematomas (SDH) in which they used a novel measurement of the difference of the midline shift (MLS) and the thickness of the SDH to determine if this could be used a predictor of mortality. This is a relatively straightforward, easily measurable value to make a prediction about mortality.

The study identified an interesting finding that a midline shift exceeding the thickness of the SDH by 3mm or more was highly predictive of a fatal outcome. The measurements of MLS and thickness of the SDH were made at the level of the frontal horns of the lateral ventricles. This is an interesting finding, but there are some limitations of the study.

The proposed criterion - midline shift >3mm larger than hematoma thickness - is highly specific (100% in this series) but not highly sensitive (10-23%). In other words, all 8 patients who met this criterion died, but a large number of patients who died (22) did not meet the criterion. All patients but one also underwent surgery in this series. So, in situations where the utility of surgical evacuation is equivocal, the finding of MLS exceeding hematoma thickness by >3mm may be a predictor of poor prognosis or mortality, favoring no surgery due to futility. However, this is based on only 8 patients - it would be interesting to see results of a larger study consisting of a larger population of patients meeting the criterion.

The finding that 8 patients with midline shift greater than 3 mm or more greater than the thickness of the SDH all went on to death is an interesting and curious finding, but in the absence of multivariate analysis or other more robust data we would be very cautious about drawing any conclusion from this small number of patients. Furthermore, the fact that 30 of the 59 patients in this series went on to die at a median of 2 days indicates the other factors also might exist that have greater predictive power than the measurements used by the authors.

Major Compulsory Revisions
1) The overall size of the SDH's are not reported by the authors. Was this measure (MLS minus SDH thickness at the level of the frontal horns) any more predictive of outcome than merely the measure of the maximum thickness of SDH itself (whether it is at the level of the frontal horns of the lateral ventricle or
otherwise)? The authors suggest that the MLS is a marker of cerebral edema and that perhaps this is an indicator of brain injury beyond the severity of the SDH. Alternatively, MLS may be a surrogate of the size of the SDH, but the relationship of the size of the SDH to the degree of MLS is not provided. There were only 8 patients who fit the criteria (MLS >3mm thicker than hematoma) and all but one were GCS 3 to begin with; as discussed, it would seem that intuitively, in addition to mass effect from hematoma itself, patients meeting the criterion have severe underlying parenchymal injury as well, causing midline shift to exceed hematoma thickness, and portending poor outcome or mortality consistent with the GCS score.

2) The manuscript describes that a decompressive surgery was performed for all of the patients except 1. The nature of that decompression is not specified. Was a craniotomy for evacuation of the hematoma performed with replacement of the bone flap? Were decompressive craniectomies performed leaving the bone out to accommodate cerebral swelling? Was it a combination of these techniques? If these patients had significant MLS, a decompressive craniectomy might seem more appropriate. Clarification of the surgical technique is needed.

3) The authors primarily focus only on mortality in patients meeting the "MLS > hematoma+3mm" criterion? What about hematoma+2mm, +1mm, and MLS = hematoma patients? They seem to rate inter-observer reliability in these groups but not actually present the mortality data. Only 8 of 30 mortalities met the +3mm criterion. Relaxing it to +2mm or +1mm might increase sensitivity of the test and capture more mortalities but there doesn't seem to be any data presented on those.

We would like to see the quantitative data on more than just the (MLS-SDH)>3mm group - such as the (MLS-SDH)>1mm and >2mm group, or stratified by hematoma thickness alone, or even treating the value (MLS-SDH) as a continuous variable and reporting the correlation with mortality. I think this would greatly strengthen the paper and perhaps yield some additional interesting conclusions. It should also be relatively easy to do given the data already available.

Minor Essential Revisions

1) The following sentence from the Discussion was somewhat unclear: “We did neither correct for severity of eventual multiple injuries, since in first instance we were interested in the investigated relationship." (Discussion, 6th paragraph, line 17). This point needs clarification.

2) What does the abbreviation NCV stand for? (Methods, 6th paragraph, line 16)

Discretionary Revisions

1) The measurement of the MLS & thickness of the SDH were all performed at the level of the anterior horn – would a measure of the maximal thickness of the SDH have any greater utility than the measurement of the thickness of the SDH at the level of the anterior horns? The authors discuss the possibility of assessing the volume of SDH, but dismiss this strategy, as they report no way to measure
the volume of MLS. It is possible that SDH volume independently might be more predictive of outcome than the measure of MLS minus the thickness of SDH.

Level of interest: An article of importance in its field

Quality of written English: Needs some language corrections before being published

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests:

I declare that I have no competing interests.