

## **Supplementary Methods:**

The Seattle International Severe Traumatic Brain Injury Consensus Conference (SIBICC) originated from the perception of the American Association of Neurological Surgeons/Congress of Neurological Surgeons Joint Section on Neurotrauma and Critical Care that there was a need to provide practitioners with modern and expert guidance for managing patients with severe TBI. The goal was to bridge the gap between the evidence report provided by the 4<sup>th</sup> edition Brain Trauma Foundation Guidelines for the Management of Severe TBI and the practicalities of patient care. At the outset of its work, the SIBICC governance was established to help ensure the successful completion of the work and to ensure there was an effective dispute resolution process in place. Two Co-Chairs (RC and GH) led the project. A five-member executive committee (EC) comprised of an international group of senior and respected leaders in the TBI field (JG, PH, DM, FS, JU) provided the ultimate oversight of the project. During the planning stages of SIBICC the Co-Chairs frequently communicated with the EC. The EC provided recommendations for the scope of the work, participants who were suitable to serve on the consensus working group (CWG), and for interfacing with the various medical societies. Ultimately the EC held final authority on matters relating to the development of this algorithm; a majority vote of the EC (greater than or equal to 3 votes) superceded decisions of the Co-Chairs.

The Co-Chairs and EC worked together to establish a consensus working group, sharing the responsibility for nominating and approving participants. We based panel selection on a) > 10 years clinical experience in sTBI; b) current, active involvement in acute care management of sTBI patients; c) representation of involved disciplines; and d) geographic diversity; and e) ability to commit time to the algorithm development process. We calculated panel size based on logistic considerations. An effort was made to ensure diversity of the CWG in terms of representing all aspects of those managing sTBI patients. In a number of cases, participating medical societies nominated specific individuals to participate in this project and these nominations were honored when the nominees met the CWG

criteria. Ultimately the panel consisted of 42 experienced, clinically-active physicians who currently manage sTBI, (10 neurointensivists, 23 neurosurgeons, 5 neurologist/neurointensivists, 2 trauma surgeons, 2 emergency medicine specialists) from six continents. Panelists completed conflict of interest forms relevant to sTBI management. There were no conflicts mandating recusal of any participant.

The expressed focus of the effort was to design a consensus-based management algorithm that would be acceptable to the panel and amenable to application in both neurological and general ICUs by physicians not specialized in neurointensive care. At the outset of the project we chose Delphi methodology as currently the best available approach to be employed as the tool for developing consensus opinion of the CWG. We endeavored to minimize bias by rigorously employing Delphi principles, by hiring a pair of independent non-expert moderators, and by defining our Delphi parameters *a priori*. “Acceptable” represented 80% agreement (voting threshold) by at least 80% of the voting panelists (a quorum). This level of agreement meets or exceeds that used in other neurotrauma consensus efforts (Chesnut, et al. J Neurotrauma 32:1722-4, 2015, Hendrickson, et al. World neurosurgery 110:e952-e7, 2018) (Stocchetti, et al. Acta Neurochir (Wien) 156:1615-22, 2014) (Hutchinson, et al. Acta Neurochir (Wien);161:1261-74, 2019). Each member of the CWG had a single vote; the Co-Chairs served as voting members of the CWG. It was decided that once an item was subject to a consensus vote, the wording or placement of an item could not be altered except by an additional, specific vote of the CWG.

Beginning 6 months prior to the meeting, the CWG completed eight web-based surveys (SurveyMonkey Inc., San Mateo, California, USA, [www.surveymonkey.com](http://www.surveymonkey.com)) to determine the algorithm design and focus, explore definitions and thresholds, operationally define treatment modalities, evaluate acceptability and tier assignments of treatment modalities, etc. The Co-Chairs developed the surveys with input from the EC. They were loaded into SurveyMonkey by an independent non-clinician

academic (PH), who also managed the database of voting results. We combined voting results with panelists' comments to iterate these surveys to maximize consensus and define areas requiring focus at the in-person meeting.

We developed two special surveys when early voting using discrete-elements did not progress toward resolution. One of these surveys addressed the timing of ICP monitor removal. The second examined the use of sedation holidays for neurological examinations. We arranged multiple variables relevant to these topics into 384 cell matrices, each cell of which represented a concatenation of multiple individual clinical indicators. By combining individual panelists' responses and color-coding the results using a traffic-light model (red-yellow-green), we constructed heatmaps to guide decision-making. We modified the Marshall CT Classification[7] of post-operative imaging for this exercise. The post-surgical CT scans of patients having an evacuated mass lesion (EML) were classified as if they had not had surgery (i.e. DI I – IV) and this ranking was appended to the EML label (e.g. EML/DI IV). We did this to increase the sensitivity of post-operative images to indicators of intracranial hypertension.

The Co-Chairs, the two hired moderators, and the audience response system consultant met in-person approximately a month prior to the actual in-person meeting with all panelists. At this meeting, this group conducted a detailed review of all voting to date in order to provide a common understanding of our progress. During a detailed day-long planning meeting, we formulated specific conference goals in the context of progress to date. The group specified areas in which consensus would be sought as well as possible strategies for achieving consensus. Much effort was also put into planning the conference's structure in order to maximize productivity while also managing fatigue. The need to identify and manage bias was paramount to the planning process and specific strategies for achieving this were discussed and integrated into the process. Ultimately the group structured the meeting predominantly to involve whole-group discussions in a large room. To facilitate helpful and rigorous discussion of complex topics, we formulated a series of small group sessions, which ultimately occurred

in adjoining rooms. At this in-person planning meeting we also reviewed and optimised the physical spaces for the meeting. At and subsequent to this planning meeting we drafted a large number of questions for use at the actual in-person meeting of the CWG.

The in-person SIBICC meeting occurred from the 5<sup>th</sup> to 7<sup>th</sup> of April 2019 in Seattle, Washington, USA. In advance of the meeting all participants received electronic copies of all manuscripts taken as evidence for the 4<sup>th</sup> edition Brain Trauma Foundation Guidelines for the Management of Severe TBI, organized by chapter. They also received a handout denoting the goals of the meeting, the agenda, and a summary of consensus achieved to date, as well as links to the raw data from all pre-meeting polling. The conference began with a series of introductory talks to provide historical and evidentiary context, to review progress to date and to formally cover the rules and goals of the meeting and the planned work flow. We discussed the issue of bias along with strategies that would be employed to minimize it. Professional, independent non-physician moderators facilitated group discussions. As work progressed on establishing and refining consensus topics, the professional moderators worked to ensure balanced discussions. The two professional facilitators also helped with collecting and clarifying voting points. They also collected feedback and summarized the voting results following each daily session and after the close of the meeting. The Co-Chairs worked with the moderators to oversee the medical content being discussed.

The moderators and Co-Chairs worked together with the audience response system consultant to formulate and revise questions for voting. We used anonymous electronic voting and vote analysis (Electronic Media Services Inc., Gig Harbor Washington, USA, [www.electronicmeetingservices.com](http://www.electronicmeetingservices.com)). This system also included microphones within the voting device, which could be activated only one at a time, preventing participants from speaking over each other and allowing the facilitators to moderate participation. For iterative voting, the CWG voted on individual issues, either pre-specified or arising during the course of group discussion, using a confirmation threshold of 80% of those voting. These

votes were considered valid if 80% of the CWG were involved (a quorum). If the vote did not achieve the 80% threshold, a facilitated discussion period then allowed clarification of issues surrounding the question, offering pro and con opinions, and, in some cases, rewording or changing the focus of the question. We allowed second and third voting sessions but relegated items failing to reach consensus after three iterations using the same wording to a verdict of “Not Resolved”. These items were then tabled. Unless specifically modified by the CWG, we limited the voting cycle to these three iterations, interspersed with discussions. An element formed part of the final recommendations only if it attained the pre-specified 80% approval level. We incorporated all recommendations verbatim into the final product.

We delegated several complex topics to small group discussions. The co-chairs, in conjunction with the facilitators, established four small groups balanced in terms of panelist expertise, seniority, geographic representation and gender. We constructed distinct small groups for each day of the meeting. Small group topics included ventilator management, transfusion, cerebral perfusion pressure and neuroworsening. The small groups were responsible for defining these topics relevant to the proposed algorithms and for providing actionable recommendations for clinicians. The entire group then discussed the small group recommendations and voted on the resultant modifications, using the same 80% criterion. The professional moderators extensively engaged each group and assisted them in achieving their goals in the allotted time.

Donations solicited from industry and other interested parties funded this meeting. In return, industry representatives were allowed to silently observe the conference, without any interaction with the panelists or the process. Donors signed legal agreements, which recognized their understanding of and compliance with these rules needed to prevent bias. No donors or other outside parties influenced any portion of this work. The professional moderators worked to ensure this agreement was strictly obeyed.

Following the meeting the Co-Chairs compiled the full breadth of the data, with the assistance of the facilitators, and finalized the tables and figures based on the voting results. They drafted the manuscript, which they then circulated to all participants. The Co-Chairs finally collated and incorporated the feedback from all participants into the modified manuscript in order to ensure fidelity of the academic product as well as agreement with the final version of the work.