

UPNVJ Faculty of Medicine students again won an achievement. They won 1st place in the PCC AMSC 2020 AMSC PCC Competition

Monday, 20 April 2020 09:31 WIB

HumasUPNVJ - UPN Veteran Jakarta Faculty of Medicine students again won an achievement. They won 1st place in the PCC AMSC 2020 competition (*Pre-Conference Competition Asian Medical Students Conference*) *scientific* poster category with the theme *Trauma care: Same Problems with Different Solutions*.

This competition is an annual competition held by *the Asian Medical Student's Conference Association Indonesia* (AMSA-Indonesia) which is held *online* to recruit members who will become AMSA-Indonesia delegates at the conference.

This competition was attended by students (AMSA members) from dozens of medical faculties in Indonesia. This year, AMSC 2020 should have been held in London on June 29 - July 5, but due to the Covid-19 pandemic, the event has been postponed until an uncertain time limit.

The teams that joined this competition included Annisa Nur Insani, Bunga Vidya Prajnanta, Goldy Natanael, Nitya Fithra Salsabila Alhaque.

Annisa Nur Insani representing her team explained to UPNVJ Public Relations about the competition they participated in, "In this competition we made a *systematic review* which was presented with poster media, the title of our work is: *CSF Biomarkers to Predict Injury Severity and Predicting Neurological Recovery in Human Traumatic Spinal Cord Injury : A Systematic Review* ". Obviously



CSF Biomarkers To Predict Injury Severity and Predicting Neurological Recovery in Human Traumatic Spinal Cord Injury : a Systematic Review

Annisa Nur Insani, Bunga Vidya Prajnanta, Goldy Natanael, Nitya Salsabila Alhaque
Undergraduate Program, Faculty of Medicine, Universitas Pembangunan Nasional "Veteran" Jakarta

1 INTRODUCTION

Spinal cord injury (SCI) is a devastating condition that can lead to significant neurological impairment and reduced quality of life (Hachem, Ahuja, & Fehlings, 2017). Estimated global SCI incidence is 40 to 60 new cases per million population per year, based on quality country-level incidence studies of spinal cord injury from all causes. This means that every year, between 200,000 and 500,000 people become spinal cord injured (Bickenbach & Society, 2013). This number of yearly SCI patients have their own severity which differs in the treatment approach and possible future recovery in the current settings. Assessment of spinal cord injury includes American Spinal Injury Association Impairment Scale (AIS) and Frankel score classification. However, there is a recognized challenge in conducting this examination in the early phase of injury.

In its current format, the International Standards for Neurological Classification of SCI (ISNCSCI) examination requires acute SCI patients to be conscious and cooperative enough to participate in a fairly detailed assessment of motor and sensory function. However, many such patients cannot be examined initially upon arrival in the emergency room because of concomitant injuries or pharmacological sedation/intoxication (Burns, Lee, Ditunno, & Tessler, 2003; Lee, et al., 2012). This makes many SCI patients in the acute phase unable to be measured. Because of this limitation, we identified an alternative to the mentioned assessment tool to avoid any problems measuring patients with SCI. Recent biomolecular studies of cerebrospinal fluid (CSF) components have led us to the findings of substances that are seen as a potential indicator of patients' prognosis.

Preclinical and translational studies have highlighted the molecular pathology that follows trauma, divided into three phases: acute (a few seconds or minute after the injury), secondary (from a few minutes to a few weeks after the injury), and chronic (some months to years after the injury) (Tran, Warren, & Silver, 2018). In the acute phase, mechanical and vascular events are prevalent such as edema and alterations of the clinical microenvironment, where excitotoxicity and infiltration by circulating macrophages prevails. Many of these events are also present in the secondary phase, in particular oxidative stress, inflammation, and immunological reaction also mediated by microglial cells, that lead to the infiltration of astroglial scarring, extensive demyelination and the electrophysiological collapse. In the chronic phase, demyelination, astroglial reaction and the central cavitation continues and are prevalent (James, et al., 2011). Therefore, the biochemical analysis of the cerebrospinal fluid (CSF) composition at specific times after the trauma has been pursued for lesion severity and prognostic biomarkers discovery (Fernandez, et al., 2020).

This systematic review aims to study the usage of CSF biomarkers as a potential tool in predicting injury severity and future neurological recovery of SCI patients.

RESULTS & DISCUSSION

Author Year	Design	Sample Size	Primary Outcome	Secondary Outcome	Quality Score	Conclusion	Reference
1. Dalkic et al. 2018	RET	10 SCI patients	CSF	AD	CSF	CSF inflammatory proteins concentrations in the acute phase of injury. We also found the concentrations variability in AIS or Frankel grade. This finding could make it possible for CSF biomarkers to classify baseline AIS or Frankel grade objectively without having to conduct full sensory and motor examination. Six of seven studies also assessed the use of each biomarker in predicting improvement in six months post injury using conversion of AIS scores and total motor score (TMS). Results show that higher concentrations of analyzed biomarkers are associated with more severe injury and lesser chance of neurological improvement. Dalkic et al. (2018) explained that this may be due to the association of more-severe injuries with a greater release of the analyzed proteins into the CSF. Furthermore, Each study reviewed addressed particular proteins with the most significant results which can be used and evaluated more comprehensively in future studies.	28
2. Dalkic et al. 2018	RET	10 SCI patients	CSF	AD	CSF	CSF inflammatory proteins concentrations in the acute phase of injury. We also found the concentrations variability in AIS or Frankel grade. This finding could make it possible for CSF biomarkers to classify baseline AIS or Frankel grade objectively without having to conduct full sensory and motor examination. Six of seven studies also assessed the use of each biomarker in predicting improvement in six months post injury using conversion of AIS scores and total motor score (TMS). Results show that higher concentrations of analyzed biomarkers are associated with more severe injury and lesser chance of neurological improvement. Dalkic et al. (2018) explained that this may be due to the association of more-severe injuries with a greater release of the analyzed proteins into the CSF. Furthermore, Each study reviewed addressed particular proteins with the most significant results which can be used and evaluated more comprehensively in future studies.	28
3. Dalkic et al. 2018	RET	10 SCI patients	CSF	AD	CSF	CSF inflammatory proteins concentrations in the acute phase of injury. We also found the concentrations variability in AIS or Frankel grade. This finding could make it possible for CSF biomarkers to classify baseline AIS or Frankel grade objectively without having to conduct full sensory and motor examination. Six of seven studies also assessed the use of each biomarker in predicting improvement in six months post injury using conversion of AIS scores and total motor score (TMS). Results show that higher concentrations of analyzed biomarkers are associated with more severe injury and lesser chance of neurological improvement. Dalkic et al. (2018) explained that this may be due to the association of more-severe injuries with a greater release of the analyzed proteins into the CSF. Furthermore, Each study reviewed addressed particular proteins with the most significant results which can be used and evaluated more comprehensively in future studies.	28
4. Dalkic et al. 2018	RET	10 SCI patients	CSF	AD	CSF	CSF inflammatory proteins concentrations in the acute phase of injury. We also found the concentrations variability in AIS or Frankel grade. This finding could make it possible for CSF biomarkers to classify baseline AIS or Frankel grade objectively without having to conduct full sensory and motor examination. Six of seven studies also assessed the use of each biomarker in predicting improvement in six months post injury using conversion of AIS scores and total motor score (TMS). Results show that higher concentrations of analyzed biomarkers are associated with more severe injury and lesser chance of neurological improvement. Dalkic et al. (2018) explained that this may be due to the association of more-severe injuries with a greater release of the analyzed proteins into the CSF. Furthermore, Each study reviewed addressed particular proteins with the most significant results which can be used and evaluated more comprehensively in future studies.	28
5. Dalkic et al. 2018	RET	10 SCI patients	CSF	AD	CSF	CSF inflammatory proteins concentrations in the acute phase of injury. We also found the concentrations variability in AIS or Frankel grade. This finding could make it possible for CSF biomarkers to classify baseline AIS or Frankel grade objectively without having to conduct full sensory and motor examination. Six of seven studies also assessed the use of each biomarker in predicting improvement in six months post injury using conversion of AIS scores and total motor score (TMS). Results show that higher concentrations of analyzed biomarkers are associated with more severe injury and lesser chance of neurological improvement. Dalkic et al. (2018) explained that this may be due to the association of more-severe injuries with a greater release of the analyzed proteins into the CSF. Furthermore, Each study reviewed addressed particular proteins with the most significant results which can be used and evaluated more comprehensively in future studies.	28
6. Dalkic et al. 2018	RET	10 SCI patients	CSF	AD	CSF	CSF inflammatory proteins concentrations in the acute phase of injury. We also found the concentrations variability in AIS or Frankel grade. This finding could make it possible for CSF biomarkers to classify baseline AIS or Frankel grade objectively without having to conduct full sensory and motor examination. Six of seven studies also assessed the use of each biomarker in predicting improvement in six months post injury using conversion of AIS scores and total motor score (TMS). Results show that higher concentrations of analyzed biomarkers are associated with more severe injury and lesser chance of neurological improvement. Dalkic et al. (2018) explained that this may be due to the association of more-severe injuries with a greater release of the analyzed proteins into the CSF. Furthermore, Each study reviewed addressed particular proteins with the most significant results which can be used and evaluated more comprehensively in future studies.	28
7. Dalkic et al. 2018	RET	10 SCI patients	CSF	AD	CSF	CSF inflammatory proteins concentrations in the acute phase of injury. We also found the concentrations variability in AIS or Frankel grade. This finding could make it possible for CSF biomarkers to classify baseline AIS or Frankel grade objectively without having to conduct full sensory and motor examination. Six of seven studies also assessed the use of each biomarker in predicting improvement in six months post injury using conversion of AIS scores and total motor score (TMS). Results show that higher concentrations of analyzed biomarkers are associated with more severe injury and lesser chance of neurological improvement. Dalkic et al. (2018) explained that this may be due to the association of more-severe injuries with a greater release of the analyzed proteins into the CSF. Furthermore, Each study reviewed addressed particular proteins with the most significant results which can be used and evaluated more comprehensively in future studies.	28

Table 1. Characteristics of Included Studies

Seven studies were reviewed with the total sample of 280 patients. We identified a variety of potential proteins obtained from CSF which was reflected in the overall increase of CSF inflammatory proteins concentrations in the acute phase of injury. We also found the concentrations variability in AIS or Frankel grade. This finding could make it possible for CSF biomarkers to classify baseline AIS or Frankel grade objectively without having to conduct full sensory and motor examination. Six of seven studies also assessed the use of each biomarker in predicting improvement in six months post injury using conversion of AIS scores and total motor score (TMS). Results show that higher concentrations of analyzed biomarkers are associated with more severe injury and lesser chance of neurological improvement. Dalkic et al. (2018) explained that this may be due to the association of more-severe injuries with a greater release of the analyzed proteins into the CSF. Furthermore, Each study reviewed addressed particular proteins with the most significant results which can be used and evaluated more comprehensively in future studies.

Despite the promising result, the size of each study is still limited, therefore, further studies with larger samples are required. Furthermore, factors and variability of subjects in their response to injury should be thoroughly assessed as the result might be confounded by a variety of factors.

2 MATERIALS & METHODS

INCLUSION CRITERIA

1. Samples using CSF
2. Study published in 2015-2020

EXCLUSION CRITERIA

1. Non-human trials
2. Using non-english
3. Full text irretrievable

QUALITY ASSESSMENT

CEBM Level of Evidence

KEYWORDS

("Cerebrospinal fluid" OR ("CSF")) AND ("Traumatic spinal cord injury") AND ("Prognosis")

Records identified through database searching (n = 432)
 PubMed = 40
 Scopus = 46
 Science direct = 3
 PLOS ONE = 40
 Proquest = 265

Additional records identified through other sources (n = 6)

Records after duplicates removed (n = 408)

Records excluded (n = 384)
 - 7 full text irretrievable (n = 17)
 - 1 full text irrelevant (n = 242)
 - 2 non human trials
 - 1 non CSF samples

Records included in qualitative synthesis (n = 7)

Figure 1. Diagram Flow of Literature Search Strategy

CONCLUSION

CSF biomarkers are potentially useful in classifying patients severity and predicting SCI outcome. The discovery of CSF biomarkers in SCI may bring benefits and lead to a more comprehensive approach in the evaluation and treatment of SCI cases, ultimately resulting in the improvement of the quality of life of SCI patients.

REFERENCES

Bickenbach, J. & Society, I. S. C. (2013). International Perspectives on Spinal Cord Injury. *World Health Organization*.

Burns, A. S., Lee, B. S., Ditunno, J. F., & Tessler, A. (2003). Patient Selection for Clinical Trials: The Reliability of the Early Spinal Cord Injury Examination from 18 Hospitals. *Journal of Neurotrauma*, 20(11), 1179-1182. doi: 10.1089/neu.2010.20.1179

Carlini, S., Rivie, T., Sillings, D., Silva, C., Chennappaiah, S., & Giovannoni, G. et al. (2018). Cerebrospinal Fluid Biomarkers in Human Spinal Cord Injury. *Journal of Neurotrauma*, 35(1), 151-158. doi: 10.1089/neu.2017.35.151

Dalkic, T., Falah, N., Noonan, V., Salim, Ezzat, S., Dong, K., & Belanger, L. et al. (2018). Predicting Injury Severity and Neurological Recovery after Acute Traumatic Spinal Cord Injury: A Systematic Review of Cerebrospinal Fluid and Microglial Neuron Specific Biomarkers. *Journal of Neurotrauma*, 35(1), 455-465. doi: 10.1089/neu.2017.35.455

Fernandez, M., Salazar, S., Caporaso, R., Romanovich, S., Baranika, J., Casanovi, M., Giovannoni, T., Giovannoni, G., Ubedillo, M., Giovannoni, G., Giordano, L., and Caba, L. (2020). Possible Strategies to Optimize a Biomarker Discovery Approach to Correlate with Neurological Outcomes in Patients with Spinal Cord Injury: A Pilot Study. *Journal of Neurotrauma*, 37(1), 20-33. doi: 10.1089/neu.2019.37.20

Hachem, L. D., Ahuja, C. S., and Fehlings, M. G. (2017). Assessment and management of acute spinal cord injury: From point of injury to rehabilitation. *The Journal of Spinal Cord Injury*, 43(5), 665-676.

James, N. D., Bhatia, K., Giral, J., Barnett, D. L., Hershman, S. B., & Bradbury, E. J. (2011). Conduction Failure Following Spinal Cord Injury: Kinetics and Anatomical Changes from Acute to Chronic Stages. *Journal of Neuroscience*, 31(35), 12643-12650. doi: 10.1523/JNEUROSCI.4306-11.2011

Kumar, B., Srinivasan, R., Fathallah, M., Noonan, V., Belanger, L., & Rivie, L. et al. (2017). Cerebrospinal Fluid Biomarkers to Identify Injury Severity and Predict Outcomes in Human Traumatic Spinal Cord Injury. *Journal of Neurotrauma*, 34(3), 567-580. doi: 10.1089/neu.2016.44.567

Lee, B. S., Noonan, V., K. Rivie, L., Fathallah, M., A. Purohit, S. J., Boyd, M. C., & Kumar, B. K. (2012). Feasibility of patient neurophysiological trials of experimental treatments for acute spinal cord injury. *Journal of Clinical Neurophysiology*, 19(1), 1338-1343. doi: 10.1159/000320102.015

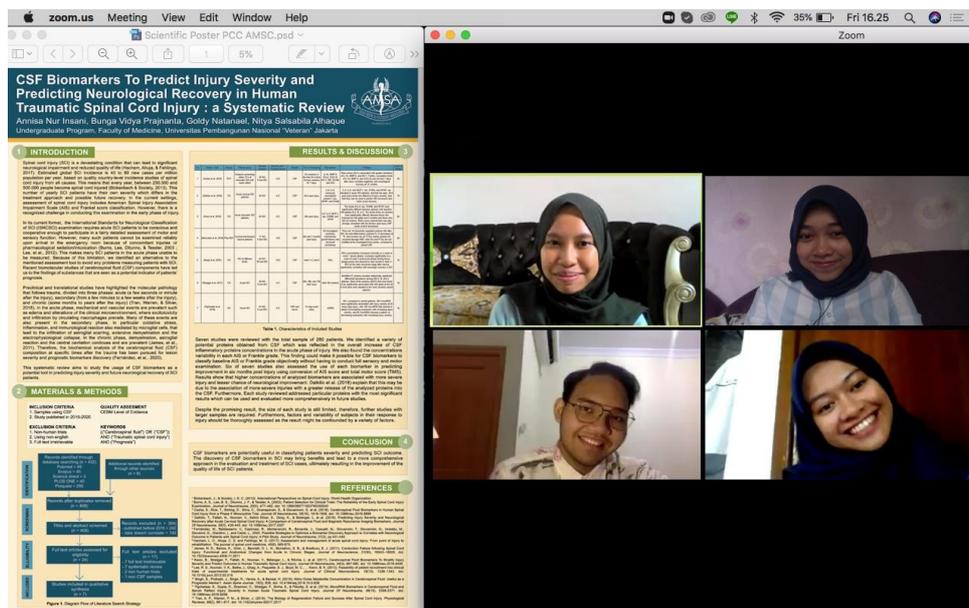
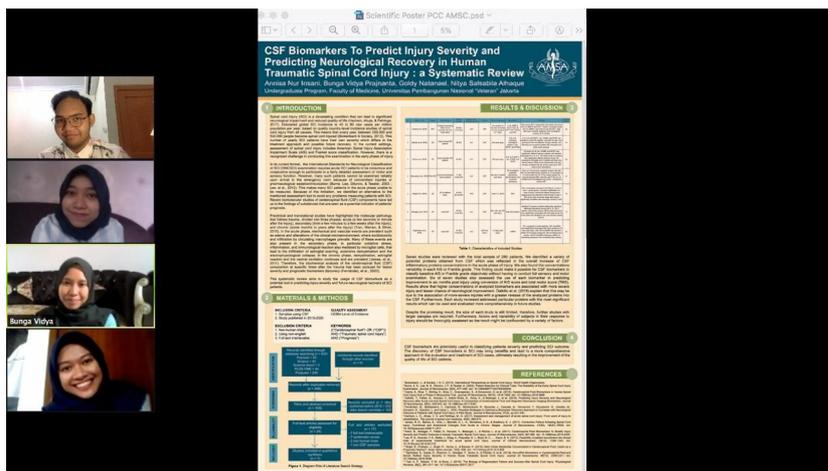
Singh, S., Prasad, J., Singh, R., Verma, A., & Baner, H. (2016). Nitric Oxide Metabolite Concentration in Cerebrospinal Fluid (CSF) as a Prognostic Marker. *Asian Spine Journal*, 25(3), 308-314. doi: 10.1186/s13047-016-0129-2

Togiani, S., Quin, R., Shannon, C., Srinivasan, R., Sinha, S., & Fithra, S. et al. (2019). MicroRNA Biomarkers in Cerebrospinal Fluid and Serum Reflect Injury Severity in Human Acute Traumatic Spinal Cord Injury. *Journal of Neurotrauma*, 36(15), 2555-2571. doi: 10.1089/neu.2018.4236

Tran, A. P., Warren, M. S., & Silver, J. (2018). The Biology of Regeneration Failure and Success After Spinal Cord Injury. *Physiological Reviews*, 98(2), 681-917. doi: 10.1152/physrev.00017.2017

In an *online* interview conducted with UPNVJ Public Relations, Annisa also explained how the process of carrying out this activity from the beginning and shared stories of ups and downs during the poster making process took place, "So the process itself begins with *brainstorming* on the topic of discussion and also consulting with lecturers who are experts." in the field of *traumatology* . The entire process of making a *systematic review* was carried out together via *online discussion* . When finished, the last touch that is no less important is to embellish it with an attractive poster design. As for the joys and sorrows, it was very early experience for us to take part in a *scientific* competition like this. Certainly provides many lessons for us personally. At first it was quite sad because we couldn't do it face-to-face because of the pandemic, but thanks to the support from friends, our enthusiasm didn't give up to continue this work even though Svia was online.â€ Annisa said

"Hopefully this achievement will be a race and motivation for us personally and friends to be able to explore more knowledge and continue to make other interesting and useful works." he continued



Export tanggal : Saturday, 02 May 2026 Pukul 19:46:38 WIB.

Exported dari [<https://www.upnvj.ac.id/en/berita/2020/04/upnvj-faculty-of-medicine-students-achieved-proud-achievements-in-the-2020-amsc-pcc-competition.html> (<https://www.upnvj.ac.id/en/berita/2020/04/upnvj-faculty-of-medicine-students-achieved-proud-achievements-in-the-2020-amsc-pcc-competition.html>)]
