An antialiasing filter was applied and EEG data was down-sampled to 250 Hz before analysis. First, 2 min EEG segments were selected during awake, eyes-closed baseline and then on the basis of behavioural response. For dexmedetomidine, the onset of unconsciousness was defined as first failed behavioral response that was followed by a series of at least five successive failures (10 min). For propofol, two states were identified; one where subjects had a nonzero probability of response to auditory stimuli and another where subjects were unconscious with a zero probability of response, propofol induced unconsciousness trough-max (TM) and propofol induced unconsciousness peak-max (PM) respectively. TM pattern marks the earliest part of propofol induced alterations in consciousness that were identified neurophysiologically to border the state of consciousness and unconsciousness. These neurophysiological pattern were maintained over changing propofol-effect site concentration 1–2 mcg/ml for TM and 3–5 mcg/ml for PM. Spectra and spectrograms were computed using the multitaper method, implemented in the Chronux toolbox.[1] Similarly coherence and coherogram between two frontal EEG electrodes F7 and F8 was estimated.

The spectrogram during dexmedetomidine-induced unconsciousness exhibited increased power across a frequency range of 2–15 Hz. Propofol induced unconsciousness was characterized by broadband (1–25 Hz) increased power during TM and increased power confined to slow, delta, and alpha frequency band during PM. The amplitude of slow oscillations during PM was approximately six-fold larger than during TM. EEG power was larger during dexmedetomidine-induced unconsciousness in a frequency range spanning slow delta, theta and alpha frequencies, while during propofol induced unconsciousness (TM) EEG power was larger in a frequency spanning beta and gamma frequencies ($P < 0.0005$). Spectrum during dexmedetomidine induced unconsciousness showed a clear dex-spindle peak at approximately 13 Hz. EEG power was larger across all frequencies between 0.1 and 40 Hz during propofol induced unconsciousness (TM) and the amplitude of slow oscillations and frontal alpha oscillations during PM were 3.9-fold larger than dex-spindles.

Dexmedetomidine induced unconsciousness was characterized by an increase in coherence across frequency range 1–15 Hz. Propofol induced unconsciousness was characterized by broad increase in coherence (1–25 Hz) and narrow band of alpha oscillations centered at 10 Hz during TM and PM respectively. During dexmedetomidine-induced unconsciousness coherence was larger in the delta, theta and spindle frequency bands with a coherent dex-spindle peak. Coherence was larger within beta/gamma frequency bands during propofol induced unconsciousness (TM); whereas during PM, coherence was significantly larger at frequencies surrounding the alpha oscillation peak and at a narrow gamma band.

The present analysis identifies differences in the power spectrum and coherence that likely relate to the specific underlying mechanisms and clinical properties of these drugs. At the neuronal levels, slow oscillations are associated with an alteration between ON states where neurons are able to fire and OFF states where neurons are silent. The authors speculated that propofol-induced slow oscillation and the duration of the associated OFF states could come from propofol's action at interneurons which would support larger slow waves and deeper levels of hyperpolarization required to sustain OFF states. Propofol's beta oscillations and its highly coherent frontal alpha oscillations appear to be generated by enhanced gamma-amino-butyric acid inhibition at cortical and thalamic interneurons.[2] Dexmedetomidine probably acts through endogenous nonrapid eye movement sleep circuits which may explain why dex-spindles appear similar to sleep-spindle.[3] The data suggest that propofol and dexmedetomidine have specific EEG signatures that can be computed, displayed in real time which would allow them to be readily interpreted by anaesthesiologists.

REFERENCES

1. Peteival DB, Walden AT. Spectral Analysis for Physical Applications. Multitaper and Conventional Univariate Techniques. Cambridge, New York: Cambridge University Press; 1993.
2. Vijayan S, Ching S, Purdon PL, Brown EN, Kopell NJ. Thalamocortical mechanisms for the anteriorization of a rhythms during propofol-induced unconsciousness. J Neurosci 2013;33:11070-5.
3. Mason KP, O'Mahony E, Zurakowski D, Libenson MH. Effects of dexmedetomidine sedation on the EEG in children. Paediatr Anaesth 2009;19:1175-83.

Starke RM, Komotar RJ, Connolly ES. Long-term outcomes of a randomized clinical trial of stenting vs aggressive medical therapy for intracranial arterial stenosis. Neurosurgery 2014;75:N19-21.

Stroke is a leading cause of morbidity and mortality and the most significant source of disability in the United States. Recent trials have demonstrated that although outcomes for stroke patients are improving with aggressive medical therapy, the overall long term prognosis is poor. In the initial stenting and aggressive medical management for preventing recurrent stroke in intracranial stenosis (SAMMPRIS) trial, patients with a recent transient ischemic attack or stroke attributed to stenosis of 70–99% of the diameter of a major intracranial artery were randomized to aggressive

medical management alone or aggressive medical management plus percutaneous transluminal angioplasty and stenting (PTAS) using Wingspan stent system.[1] Aggressive medical management included antiplatelet therapy, intensive management of vascular risk factors and lifestyle modification program. The primary end point was stroke or death within 30 days after enrollment or after a revascularization procedure for the qualifying lesion during the follow-up period or stroke in the territory of the qualifying artery beyond 30 days. Enrollment was stopped after 451 patients underwent randomization because 30 days stroke rate or death was 5.8% in the medical cohort compared with 14.7% in the PTAS cohort.

The final results showed that during a median follow-up of 32.4 months, the primary end point was significantly higher in those receiving PTAS (23%) compared with those receiving aggressive medical therapy alone (15%). Beyond 30 days, 10% of patients in each group had a primary end point. The occurrence of any stroke was higher in the PTAS group (26%) compared with medical cohort (19%), and major hemorrhage was seen in 13% of those in PTAS group versus 4% in the medical management cohort.[2] Compared with Warfarin-Aspirin Symptomatic Intracranial Disease Trial,[3] the stroke rates were much lower in the SAMMPRIS medical cohort. It could be because in the former, patients were treated with risk factor management and either warfarin or aspirin while in latter, patients were treated with aggressive risk factor management along with aspirin and clopidogrel for 90 days followed by aspirin alone. The number of patients attaining blood pressure and low-density lipoprotein control was much higher in SAMMPRIS trial and concerns have been raised that aggressive medical therapy in SAMMPRIS does not reflect current practice and can explain the significantly higher number of patients lost to follow-up.

It is unclear about the number of patients in the interventional cohort who had significant in-stent stenosis or thrombosis. In Wingspan stent the rate may be >30%.[4] However, it is the only stent approved by US Food and Drug Administration for use in patients with atherosclerotic intracranial arterial stenosis. The limitations of the stent include the necessity of angioplasty with a separate balloon before stent deployment followed by a microwire exchange for stent placement. The patients with intracranial arterial stenosis experiencing repeated strokes after initiation of best medical therapy suggest it to be beneficial alternative. It may be a favorable therapeutic option in patients who could not achieve the goals of best medical therapy, including blood pressure, low-density lipoprotein, and diabetes control along with weight reduction and exercise.

REFERENCES

1. Chimowitz MI, Lynn MJ, Derdeyn CP, Turan TN, Fiorella D, Lane BF, *et al.* Stenting versus aggressive medical therapy for intracranial arterial stenosis. N Engl J Med 2011;365:993-1003.
2. Derdeyn CP, Chimowitz MI, Lynn MJ, Fiorella D, Turan TN, Janis LS, *et al.* Aggressive medical treatment with or without stenting in high-risk patients with intracranial artery stenosis (SAMMPRIS): the final results of a randomised trial. Lancet 2014;383:333-41.
3. Chimowitz MI, Lynn MJ, Howlett-Smith H, Stern BJ, Hertzberg VS, Frankel MR, *et al.* Comparison of warfarin and aspirin for symptomatic intracranial arterial stenosis. N Engl J Med 2005;352:1305-16.
4. Ding D, Starke RM, Crowley RW, Liu KC. Role of stenting for intracranial atherosclerosis in the post-SAMMPRIS era. Biomed Res Int 2013;2013:304320.

How to cite this article: Bala R. Journal club. J Neuroanaesthesiol Crit Care 2015;2:71-4.

Source of Support: Nil, **Conflict of Interest:** None declared.