

Transcranial Doppler Cerebral Blood Flow Velocity Characteristics in Patients Undergoing Extracorporeal Membrane Oxygenation

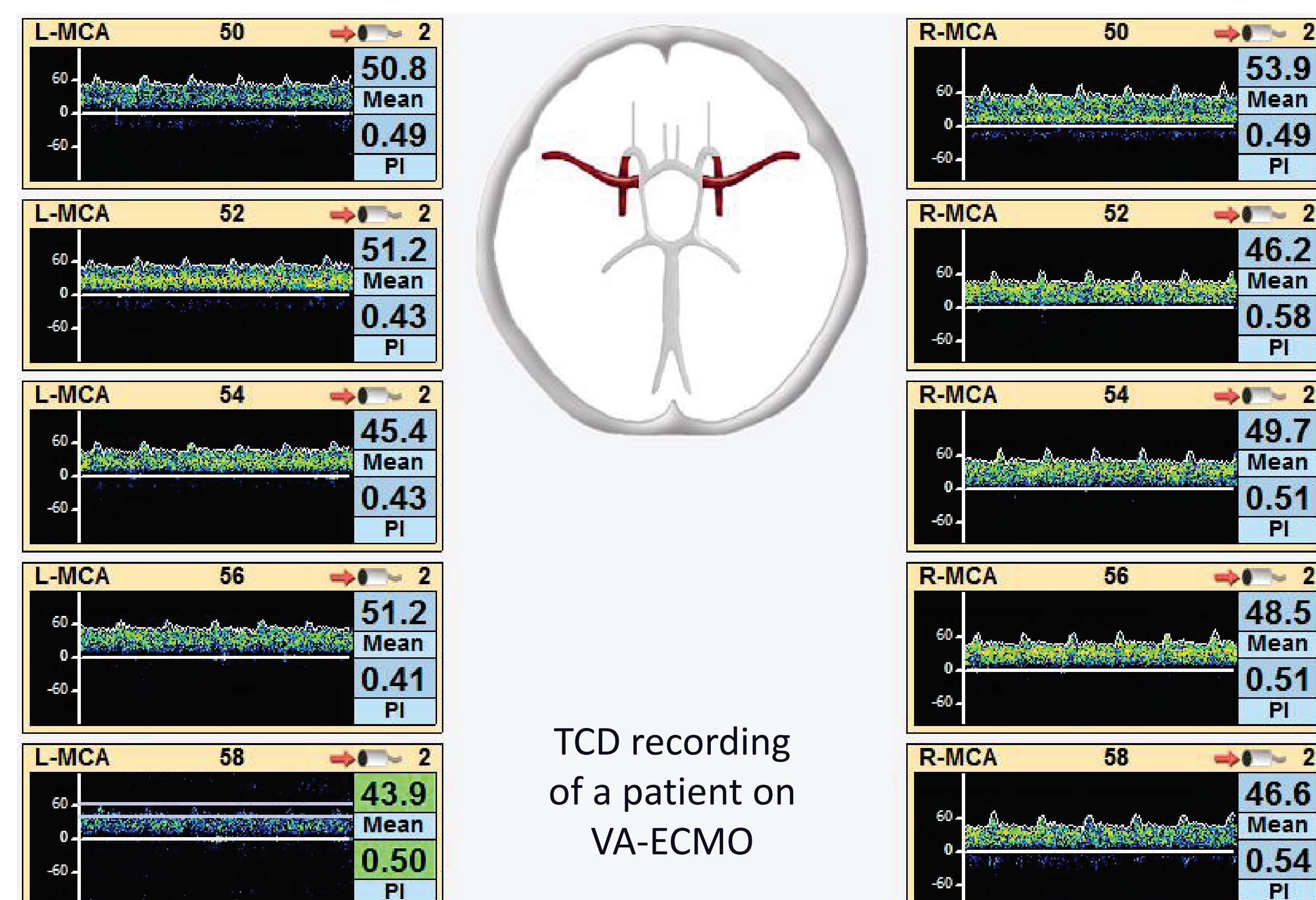
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INTRODUCTION

The rate of cerebrovascular complications in patients treated with extracorporeal membrane oxygenation (ECMO) is estimated to be around 10 to 15%^{1,2} which may possibly be due to alterations in cerebral blood flow mechanics. The aim of this study is to describe TCD-CBFV patterns in patients undergoing Venovenous (VV) and Venoarterial (VA) ECMO.

METHODS

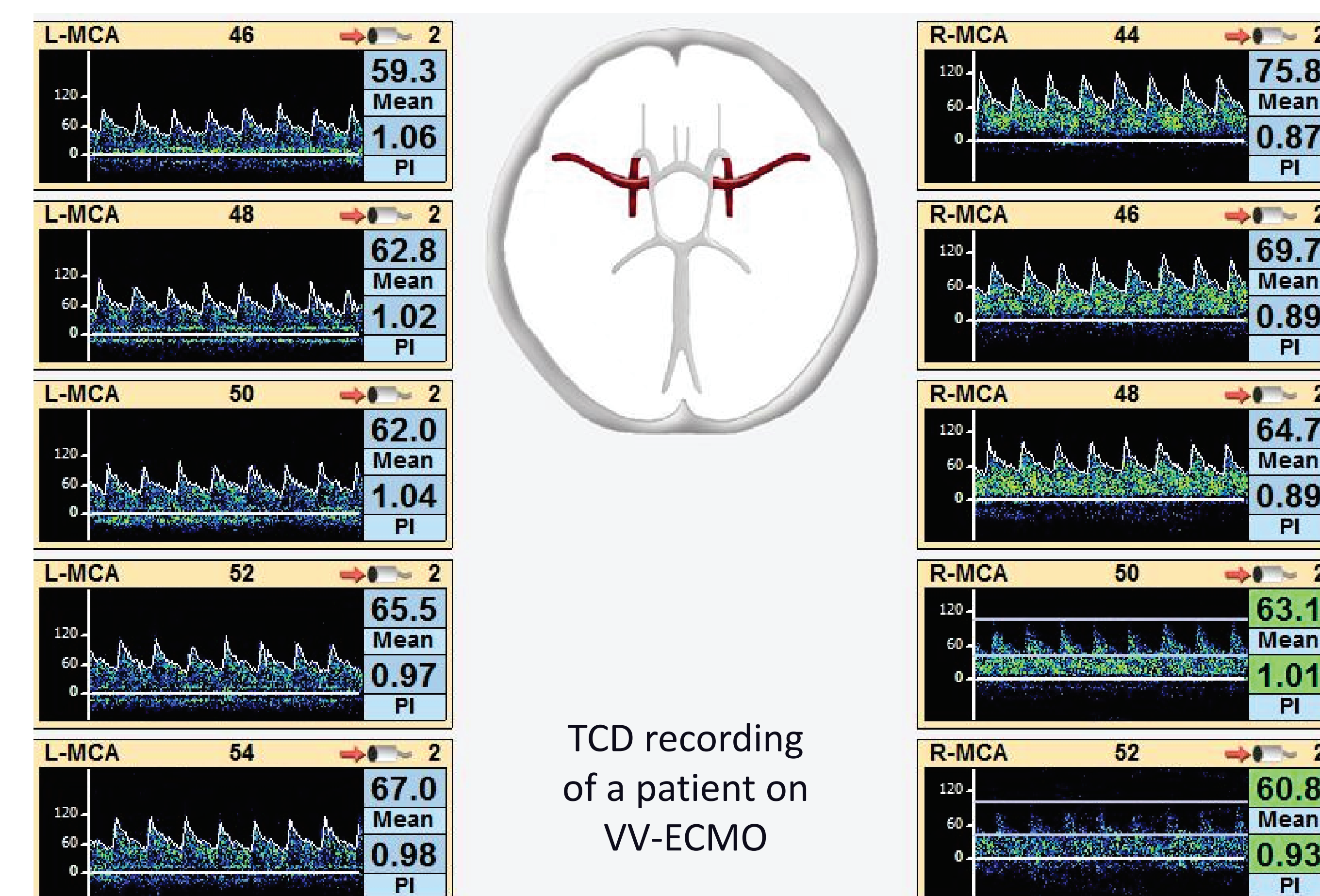
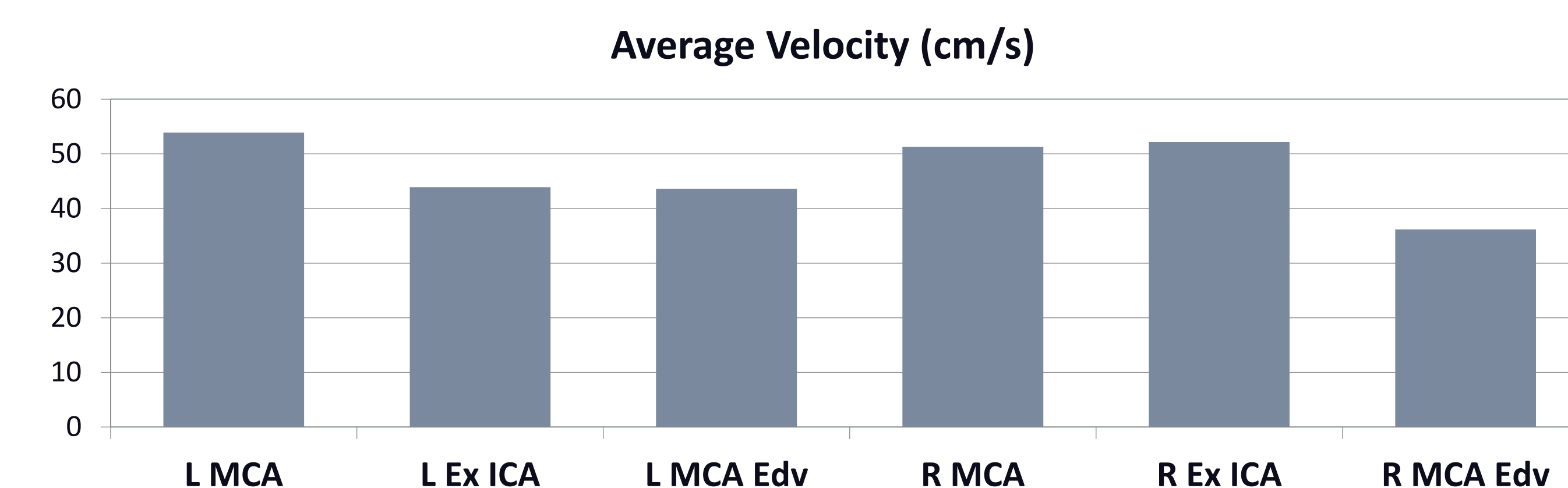
We conducted a prospective, consecutive patient, observational study at our institution on patients undergoing VV and VA-ECMO from March 2017 to May 2017. A neuro-surveillance protocol was initiated which included daily neurological exams, daily TCDs, computed tomography of the head (CTH) on days one and three and 24 hour continuous electroencephalogram (EEG). Patient demographics, clinical and imaging data were collected for the duration of ECMO support. TCD parameters including CBFVs, lindegaard ratios (LR), pulsatility index (PI), resistivity index (RI) and end diastolic velocity (Edv) were collected.



RESULTS

A total of 11 patients were included in the study. Six patients were female, five were male. Caucasians comprised of 82% of the ECMO population with a mean age of 62 years. Eight (73%) patients received VA-ECMO, two (18%) patients received VV-ECMO and one (9%) patient received both VA and VV-ECMO. Median days on ECMO was seven days. A total of 40 TCDs were performed with the median number of TCD studies being 2 per patient and a mean of 3.45. Average TCD mean CBFVs (cm/sec) were as follows: Left MCA 53.9; Right MCA 51.3; LR: Left 1.33; Right 1.23. Average MCA PI: Left 0.91; Right 1.1. Average MCA RI: Left 0.48; Right 0.56.

Among VV-ECMO, the average L MCA PI was 1.14; R MCA PI was 1.18. Among VA-ECMO, the average L MCA PI was 0.69; Right MCA PI was 0.68. Median ICU length of stay was 25 days. Survival to discharge was 14.3%. None of these patients had neurological complications.



DISCUSSION

We observed higher mean flow velocities, pulsatility indices and MAPs in patients on VV-ECMO compared to VA-ECMO. Compared to normal ranges, our study is in accordance with prior studies that report overall lower mean flow velocities and lower pulsatility indices on TCD recordings on ECMO^{3,4}. To our knowledge this is the first study comparing TCD characteristics among VV and VA-ECMO. The patients in our study did not have any evidence of neurological complications. Our data can be regarded as “normal” cerebral blood flow velocity ranges in the absence of any obvious structural brain injury. Further studies to assess cerebral hemodynamic variations in neurologically injured patients while on ECMO need to be performed.

CONCLUSION

We observed an overall pattern of low-normal flow CBFVs and reduced pulsatility in patients on VA-ECMO in neurologically intact patients. Future studies to evaluate CBFVs in ECMO patients need to be conducted in order to develop a better understanding of cerebral blood flow characteristics leading to neurological injury.

REFERENCES

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