Introduction. Traumatic brain injury (TBI) is a worldwide health issue that is the leading cause of death and disability in people under forty (1, 2). TBI research has improved our understanding of the pathophysiological processes underlying TBI, giving rise to potential new therapies. However, no specific treatments have been found to have positive effects on outcomes for patients (3). The development of Neurocritical Care Unit (NCC) and parameter guided therapy to meliorate the potentially devastating effects of secondary brain injury have demonstrated positive improvements to patient mortality rates and neurological recovery post TBI (4, 5). Length of stay, which is often used as a surrogate marker for the quality of care, varies between studies that have examined TBI patients cared for in a dedicated NCC compared to those, cared for in a General Critical Care unit (GCC) (6, 7). The extended Glasgow Outcome Score (GOS-E) (8).is a validated tool for stratifying neurological recovery post TBI. It is the most widely used disability tool in TBI research and has been demonstrated to have good correlations with other psycho-cognitive assessments (9).
Objectives. The aim of this study is to determine whether there is a difference in outcome for patients who have sustained a TBI and cared for in a dedicated NCC or a GCC unit. The hypothesis is that there will be a difference in patient outcomes when comparing the four different units and that the TBI patients cared for on the NCC will have better outcomes than those patients cared for on the GCC units. Therefore the null hypothesis is that there will be no difference in patient outcome when comparing NCC to GCC.
The primary outcome of this study will be the GOS-E score at 28 days and three months.
The secondary outcomes will be hospital and Critical care length of stay and mean days ventilated.
Methods. Single centre retrospective longitudinal cohort study that used data collated from the Intensive Care National Audit and Research Centre (ICNARC) database. The GOS-E was scored for each patient at twenty-eight days, three months. The score was calculated by the researcher using the electronic patient record. Statistical analyses were conducted using Statview. All data are expressed and displayed as mean ± standard deviation (SD) unless otherwise stated. Results were compared using analysis of variance (ANOVA). All P-values are quoted after Bonferroni corrections (where appropriate), and corrected P-values < 0.05 were considered significant.
Results. In total 396 patients were admitted to the four co-located Critical Care units following TBI, situated at a tertiary neurosciences and major trauma centre in the West Midlands over two years. The primary outcomes of GOS-E, no statistical difference was detected comparing the NCC to the three GCCs at 28 days ($p = 0.4539$) or three months ($p = 0.2431$). Multi-variate analysis of the secondary outcomes detected no statistical difference for critical care length of stay ($p = 0.2233$),hospital length of stay ($p = 0.2272$), and number of days ventilated ($p = 0.427$).
Conclusion. The research study conducted demonstrated no statistical difference in the primary and secondary outcomes comparing the NCC to the 3 GCCs in Europe's largest co-located Critical Care unit. This is attributed to the implementation of a protocol-driven therapy guideline in all 4 Critical Care Units. This has resulted in standardised practice in the management of ICP and CPP post TBI and reduced variability in patient outcomes. The results support the use of protocol-driven therapy guidelines in the management of patients with TBI.

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000811

Distinct waveforms of peripheral arterial blood pressure tracings reveal preload-, cardiac contractility- and afterload- deficient hemodynamic instability: an in-silico simulation study

M. Mulder[1]; M. Broomé[2]; D. Donker[3]; B. Westerhof[1]
[1]Cardiovascular and respiratory physiology, University of Twente, Enschede, Netherlands; [2]Anesthesia and intensive care, dept. of physiology and pharmacology, Karolinska Institutet, Stockholm, Sweden; [3]Department of intensive care medicine, UMC Utrecht, Utrecht, Netherlands
Correspondence: M. Mulder
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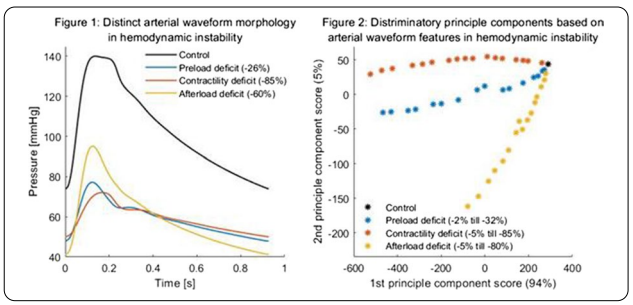
Introduction. Critically ill patients frequently suffer from hemodynamic (HD) instability, basically driven by decreased preload, cardiac contractility or afterload, or a combination of those. Since peripheral arterial blood pressure waveforms hold information on both cardiac and vascular function, we hypothesized that these signals allow to distinguish underlying causes of HD instability, which is relevant for guidance of HD treatment.
Objectives. To investigate whether peripheral arterial waveform morphology differs between distinct causes of HD instability.
Methods. In this in-silico experimental study, we used 'Aplysia CardioVascular Lab', a closed-loop lumped parameter model to study patient-specific hemodynamics [1]. We defined a 60-year-old individual with normal physiology as control. We simulated HD instability based on well-defined preload, contractility and afterload reduction by stepwise decrease of these three input variables separately: blood volume (2%-steps), left ventricular contractility and systemic vascular resistance (both 5%-steps). The peripheral arterial waveforms were analysed using MATLAB® software. We defined

45 features describing the waveform morphology, such as absolute and relative pressure, and slopes of different parts of the waveform. The calculated features were used as input for a principle component analysis (PCA), to quantitatively analyse the variance in waveform morphology between the underlying causes.

Results. A total of 50 waveforms were simulated and analysed. The arterial waveforms of the control and of three hemodynamic instability cases all with a MAP of 60 mmHg, are shown in Fig. 1. During hemodynamic instability the waveform changed characteristically and it was possible to differentiate between the three causes based on the morphology. The waveform features describing this morphology were further investigated with PCA: the first principle component explained 94% of the variance in the features and a second explained 5%. Shown in more detail in Fig. 2, the three underlying HD instability causes can be distinguished from each other using only the first two principle components. Features with the highest correlation with these principle components are describing the systolic upstroke and downstroke, and anacrotic and dicrotic notches of the waveforms.



Conclusion. In this simulation study we identified distinct peripheral arterial waveform morphologies that distinguish between deficits in preload, contractility and afterload during HD instability. This sets the stage for personalised clinical decision support based on arterial line tracings to optimise HD treatment in critically ill patients.

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000825

The profile of organ failure at ICU admission and outcomes in elderly COVID-19 patients

H. Flaatten[1]; C. Jung[2]; M. Beil[3]; J. Fjølner[4]; B. Guidet[5]; P. Vernon Van Heerden[3]; S. Leaver[6]; S. Sigal[7]; W. Szczeklik[8]; RP. Moreno[9]
[1]Department of anaesthesia and intensive care, Haukeland University Hospital, Bergen, Norway; [2]Dep. of cardiology, pulmonology and angiology, University Hospital of Düsseldorf, Düsseldorf, Germany; [3]Medical intensive care unit, Hadassah Medical Center, Jerusalem, Israel; [4]Department of intensive care, Aarhus University Hospital, Aarhus, Denmark; [5]Réanimation Médicale, Hôpital Saint-Antoine, Paris, France; [6]Research lead critical care directorate, St George's Hospital, London, United Kingdom; [7]Medical intensive care unit, Hadassah Medical Center, Jerusalem, Israel, Israel; [8]Intensive care and perioperative medicine, Jagiellonian University Medical College, Kraków, Poland; [9]Unidade de cuidados intensivos neurocríticos, Hospital de São José, Centro Hospitalar de Lisboa Central, Nova Médical School, Lisbon, Portugal
Correspondence: H. Flaatten
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Introduction. The occurrence of organ failure in elderly ICU patients during the pandemic are seldomly reported in papers from this pandemic, although have been suggested as a triage criterium.

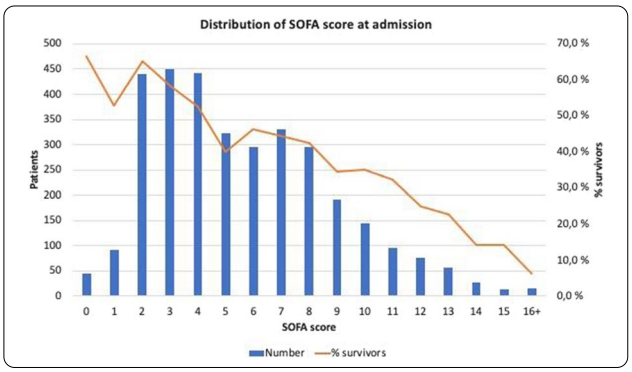
Objectives. This study is a part of the COVIP, a prospective clinical study conducted by the VIP network within the HSRO section of ESICM, with the aim to study the elderly ICU patients during the pandemic. Organ failure (OF) assessment was a part of the study. Our aim is to describe the occurrence of OF at admission and the short-term outcomes of our patients.

Methods. Study period was from mid-March 2020 until January 2021, using an online Case Record Form (1). Participating countries were responsible for obtaining National Ethical Clearance. At ICU admission all patients were scored using the Sequential Organ Dysfunction Assessment (SOFA) score (2), within the first 24 h. Organ failure (OF) was described as any individual SOFA score > 2. Frailty was obtained using the clinical frailty scale (CFS). Common ICU procedures (mechanical/non-invasive ventilation, use of vasoactive drugs and renal replacement therapy) were registered as well as their start and duration. Outcome was measured as 30 days mortality.

Results. In total 3383 patients were admitted to 207 ICUs in 35 countries. Mean age was 76.9 years and 69.6% were male. Table 1 reveals the individual SOFA scores in the patients. Acute respiratory (55%) and circulatory failure (31%) were most prevalent. Very few had hepatic or coagulation failure (< 1%). The mean SOFA score was 5.7 and Fig. 1 reveals the distribution of sum SOFA score. Overall, 30-day survival was 50.8%.

The occurrence of organ dysfunction and failure (SOFA score)

SOFA score	Respiratory	Circulatory	Renal	CNS	Hepatic	Coagulation
1	167	397	723	533	303	480
2	1123	82	363	194	97	182
3	1041	489	114	130	9	24
4	824	561	119	181	3	5
Sum failure	1823 (55.1%)	1050 (31%)	233 (6.9%)	311 (9.2%)	12 (0.4%)	29 (0.9%)



Conclusion. Most patients had severe respiratory or circulatory failure but comparatively few with other OF. Deterioration beyond the first day in hepatic and coagulation functions cannot be ruled out (3). SOFA score was inversely correlated with 30-day survival and a score of ≥ 10 was associated with survival < 20%. Our study confirms that severe acute OD is important to understand short-term mortality in elderly ICU COVID-19 patients.

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