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Can neurointensive care units decrease mortality rate and improve outcome of neurocritically ill patients in developing countries?

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Dear Editor,

Neurointensive care (Neuro-ICU) is a relatively new, emerging subdivision of intensive care specialized in the management of critically ill neurological and neurosurgical patients. There are a lot of debates and controversies about the necessity of Neuro-ICU in developing countries and the main question that hospital administration often asks: "Do we really need a separate Neuro-ICU? We already have one general intensive care unit".

Over recent years several studies have shown the positive effects of creating the Neuro-ICUs [1,2] and there is substantial evidence that supports how a dedicated Neuro-ICU unit helps decrease mortality, complication rates, and shortens the length of hospital stay [3,4]. Setting up a new Neuro-ICU is always challenging because of the resistance of hospital administration mainly due to additional expenditure which come from staffing, expensive equipment, and inadequate hospital reimbursement for critically ill neurological and neurosurgical patients. We present our experience and observations on the creation of a Neuro-ICU with implementation of international guidelines on the management of neurocritically ill patients in the University Medical Center, Astana, Kazakhstan that led to a dramatic reduction in mortality rate by 48% (from 68% to 20%) over a one-year period (Table 1).

Before we opened a Neuro-ICU, important components of secondary brain injury such as hypotension, hypoxia, hyperthermia, and others were not properly monitored, prevented and treated. Patients developed more episodes of hypoxia, hypotension, hypertension and electrolytes disturbances such as hyper- and hypo-natremia that are especially detrimental for the neurological outcome.

The guidelines on the intensive management of neurocritical conditions were not appropriately or completely implemented and used when needed. Pathological intracranial events including cerebral edema, elevated intracranial pressure, cerebral ischemia, infarction and herniation were not systematically monitored and in some cases - not timely diagnosed and treated. This contributed to worsen the overall outcome. Due to the absence of an adequate neuroimaging and neuromonitoring modality, the management of neurological patients was sometime delayed and not successful.

Starting the Neuro-ICU brought us several benefits

1) Since the main focus of Neuro-ICU was the management of critically ill neurological and neurosurgical patients, we acquired new equipment with advanced neuromonitoring functions such as intracranial pressure monitoring, cerebral metabolism (cerebral blood flow monitoring, near-infrared spectroscopy), transcranial Doppler ultrasound, brain electrical activity (continuous electroencephalography—cEEG). The advanced neuromonitoring allowed us to diagnose intracranial pathology earlier and start therapy immediately.
2) Personnel training and development played an important role in our Neuro-ICU. After we opened the Neuro-ICU, our neurointensivists acquired better knowledge and proper training in the management of critically ill neurological and neurosurgical patients as well as in neurophysiology, neuropathophysiology, neurology, neuropharmacology, neuroimaging, and neuromonitoring in neurocritical care accordingly to the international guidelines (Neurocritical Care Society, Brain Trauma Foundation). Training was conducted by internationally recognized leaders in the field from Israel, Europe and the USA. The training program included practical sessions with hands-on experience, lectures, round tables for anesthesiologists/intensivists, neurologists, neurosurgeons, nurses as well as administrators. All

Table 1

Characteristic	Before creating Neuro-ICU	After creating neuro-ICU
Mortality rate of neurocritically ill patients in ICU (n/absolute number, %)	102/150 (68%)	30/150 (20%)
Adherence to international guidelines [6,7,8,9,10];	Partial	Total
Neurocritical care-trained doctors (anesthesiologists and intensivists); (n/absolute number, %)	6/30 (20%)	14/14 (100%)

Note: You can see that the number of patients in both groups is equal (n = 150). We excluded "transitory" neuro-ICU patients (those who stayed in ICU for short time, e.g. for monitoring) in order to make the two groups more equal by severity of patients' condition. After "creation of neuro-ICU" more "transitory" patients were hospitalized, therefore, we equaled two groups by excluding "transitory" patients.

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mentors also reported their visions on how improvement of patient care can be achieved.

3) Implementation of guidelines and protocols for management of critically ill patients including Guidelines for the Management of Aneurysmal Subarachnoid Hemorrhage, AHA/ASA Guidelines for the Management of Acute Ischemic Stroke, Guidelines for the Evaluation and Management of Status Epilepticus, Critical care guidelines on the endovascular management of cerebral vasospasm, Consensus Summary Statement of the International Multidisciplinary Consensus Conference on Multimodality Monitoring in Neurocritical Care, Intracerebral Hemorrhage Guidelines for the Management of Severe Traumatic Brain Injury (Brain Trauma Foundation) [5–10]. The assessment of guidelines implementation was conducted on the daily basis by the head of Neuro-ICU, the head of the division of anesthesiology and critical medicine and the medical director.
4) The communication between the emergency department, operating room, neurology department, neurosurgery department, radiology department was improved, and it led to better patient care without delays and misunderstandings between doctors of different departments and specialties involved in the management of those patients. The training process, masterclasses, round tables which were attended by all participants of the neurocritical team contributed to the creation of a team-building environment and improvement of continuity of patient care.

In some situations, it was difficult to determine whether certain group of patients absolutely needed to be hospitalized/transferred to Neuro-ICU. It has been documented that Neuro-ICU admission criteria vary from institution to institution and depends on available resources and local characteristics [11]. As it was recommended in the recent publication [11], we also used a “case-by-case” assessment approach for admitting patients to Neuro-ICU.

The creation of the Neuro-ICU resulted in multiple positive changes, however, the costs of treatment increased by approximately 30% due to the increase of costs based on purchase of equipment and training as well as the cost per patient care.

The principal weakness of this short report is the difference in the time window of recorded data. Patients with neuro-diseases (brain and spine) were admitted and treated in a general ICU before a dedicated Neuro-ICU became available. This could have influenced the selection criteria for ICU admission and once the Neuro-ICU became available a broader case selection was admitted. Although this is an important point, we do consider that it is another aspect of the advantage inherent to having the option for a more dedicated and tailored neuro treatment and it has a causative relationship with the improvement in functional outcome and reduction in mortality rate. Another limitation is related to the limited ability in recording the actual adherence to evidence-based driven treatment protocols and to available guidelines for the specific subgroups of neuro patients. We know that the quality of delivered medical and nursing care significantly improved and the perspective on the specific need of neuro patients have led the entire group to grow in subspecialty competencies.

In conclusion, our experience showed that starting the Neuro-ICU with implementing international guidelines in developing countries can significantly improve the survival rate (in our Neuro-ICU survival was reduced from 68% to 20%), while the main downsides of Neuro-ICU are an increased number of disabled patients and expenses.

2. Financial disclosures

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Conflicts of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tacc.2019.04.006.

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