Teaching the Concept of Brain Death in Undergraduate Medical Education

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OBJECTIVE: To establish and evaluate a new approach to teach medical students how to assess brain death in patients.

DESIGN, SETTING, AND PARTICIPANTS: A total of 120 fourth-year medical students at Münster Medical School (Germany) participated in a 1-hour lecture on how to assess brain death in patients. After this lecture, students were assigned to 2 groups. One group attended an additional practical course on the evaluation of brain death and received training using a new high-fidelity simulation device. The other group did not participate in any additional training session. All students completed a questionnaire before the lecture and a second questionnaire at the conclusion of the study. For the group undergoing the additional training, the second questionnaire was completed after the additional training session.

RESULTS: The additional practical training session significantly improved the students' performance in assessing brain death and promoted the self-assessment and motivation of the medical students.

CONCLUSIONS: The establishment of a new practical teaching concept led to significant improvements in medical students' assessments of brain death in a practical session. These improvements in medical education could have significant implications for the clinical assessment of patients in the future. (J Surg 72:504-508. © 2015 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: undergraduate medical education, patient simulation, clinical competence, brain death

COMPETENCIES: Medical Knowledge, Professionalism, Practice-Based Learning and Improvement

OBJECTIVE

The concept of brain death is widely accepted, and the evaluation of brain death is applied in a large number of countries.[1-3] As the diagnosis of brain death (DBD) is very rare, teaching DBD is often underrepresented in medical schools, and the characteristics of the training differ significantly between medical school programs.[4,5] Regarding organ donation, it is essential for medical doctors to diagnose brain death correctly in patients. As shown in several studies from different countries, a better understanding of the concept of brain death increases the willingness of medical doctors to perform DBD, advances the safety of the diagnostic procedure, and, consequently, also leads to a better understanding of the perspective of the patient's relatives.[6,7]

At Münster Medical School, DBD is currently taught in a 45-minute lecture during the fourth year of the 6-year medical curriculum. In recent years, medical education in Germany has changed to include increasingly more practical elements designed to teach skills relevant for professional life.[8] It is broadly accepted that medical students benefit from early contact with patients in their medical education, as this contact results in improved hands-on skills.[9] However, patients have to receive optimal therapy, and their safety must be guaranteed. Thus, medical training takes place between the competing contexts of the quality of medical education and the safety of patient care.[9]

This area of conflict can be partially bypassed by simulation (simulation device),[10] which was used as early as the 1950s to teach cardiopulmonary reanimation techniques[11] and has been optimized in the last decades. Interactive, realistic patient simulators can now be applied to simulate normal and abnormal heart murmur, cyanosis, pupil reaction, changes in blood pressure, and heart frequency.[12]

The efficiency of simulation in practical medical education has already been accepted.[13] The special learning

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environment provided by simulation can reduce students' fears, protect patients from inexperienced students,[14] and permit repetition of learning topics as often as indicated.[15] However, it is clear that simulation can complement but not replace clinical education involving patients.[16]

In this pilot study, we aimed to compare the effect of teaching DBD with a high-fidelity simulation device in small student groups to the effect of the traditional DBD teaching method at Münster Medical School (Table).

DESIGN, SETTING, AND PARTICIPANTS

Students and Study Design

A total of 120 students (winter term 2009/2010) participated in our pilot study, which was integrated into the "interdisciplinary transplantation teaching module"[17] at the University Medical Center, Münster. In this module, students work together in clinical study groups consisting of 6 students to address difficult learning tasks such as DBD. This approach has been found to be an advantage for learning. In total, 20 groups of 6 students were randomly assigned to either the intervention group receiving additional practical training ($n = 60$) or the control group that did not receive such training ($n = 60$). All students completed a questionnaire before attending a classic lecture (45 minutes) on the "brain death concept." The same questionnaire was completed again after the lecture, either with or without having received the additional practical training.

Practical Course

The *Study Hospital, Münster* provides 6 patient rooms, 2 of which have realistic intensive care equipment. The 1-hour practical course was conducted in one of these rooms. All students were instructed by the tutor (M.H.) in an intensive care room using a high-fidelity simulation device (MegaCode Kelly with VitalSim, Laerdal Medical GmbH, Puchheim, Germany). A total of 6 students were instructed at a time. Several aspects of brain death *determination* were assessed according to the German national guidelines[3]:

- Obligatory requirements
  - underlying primary (e.g., trauma) or secondary (e.g., resuscitation) brain injury
  - determination of coma (after stopping anesthesia and eliminating other reasons for coma, e.g., metabolic, septic, and iatrogenic)
- determination of brain stem areflexia by triggering
  - strong trigeminal reflexes
  - pupillary reflex
  - corneal reflex
  - oculocephalic reflex
  - pharyngeal reflex
  - tracheal reflex
  - apnea testing
- confirmation of irreversibility of brain functions by interpreting
  - electroencephalograms
  - transcranial Doppler sonography
  - auditory evoked potentials
  - cerebral angiography

Subsequently, students were asked to carry out DBD themselves using the simulation device. The tutor created different scenarios by

- giving variable information about patient history (e.g., metabolic disorders),

TABLE. Results of the Questionnaire. Number of Students Taking Part in the 2 Groups is Given (*n*). Mean, Standard Deviation (SD), Difference of Means (Diff), p Value (p), and Quantification of Effect (ES; *d*) are Shown

	Intervention	*n*	Mean	SD	Diff	p	ES (*d*)
I have enough knowledge concerning the evaluation of brain death	0	56	2.30	0.952	1.28	$p \leq 0.001$	1.45
	1	45	3.58	0.812			
I feel confident with respect to evaluating brain death	0	56	1.84	0.826	1.67	$p \leq 0.001$	2.04
	1	45	3.51	0.815			
I have no issue with evaluating brain death	0	56	3.48	1.236	0.9	$p \leq 0.001$	0.84
	1	45	2.58	0.917			
I am motivated to engage with the topic: evaluation of brain death	0	56	4.16	0.804	0.02	$p = 0.908$	0.03
	1	45	4.18	0.650			
The instruction was effective	0	42	3.60	0.885	1.0	$p \leq 0.001$	1.30
	1	45	4.60	0.654			
The instruction was fun	0	42	3.48	0.943	0.94	$p \leq 0.001$	1.07
	1	45	4.42	0.812			
The instruction broadened my knowledge/ changed my attitude on discussing organ donation	0	52	2.63	1.067	1.67	$p \leq 0.001$	1.75
	1	43	4.30	0.832			
This training course was/is a strong motivation form me to specialize in neurosurgery later on	0	56	2.38	1.001	0.22	$p = 0.260$	0.23
	1	45	2.16	0.928			