

Education Research: Evaluating acute altered mental status Are incoming interns prepared?

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ABSTRACT

Background: Clinical evaluation of hospitalized patients with acute altered mental status (AMS) is a common task of interns, regardless of medical specialty. The effectiveness of medical education to ensure competence in this area is unknown.

Objective: To measure competency of new interns in the evaluation and management of AMS using an Objective Structured Clinical Examination (OSCE).

Methods: A cohort study was conducted with 61 medical school graduates entering internship at a single teaching hospital in 2006. Interns from all major specialty fields were included. The OSCE consisted of a 12-minute simulated encounter with a human patient simulator and nurse actor. Each intern's performance was graded by the same neurologist, using criteria agreed upon by consensus of the neurology faculty. Competency in obtaining a history, performing a neurologic examination, generating a differential diagnosis, and ordering diagnostic studies was graded. Overall performance was scored on a percentage scale from 0 to 100.

Results: Overall performance scores ranged from 19 to 43 with a mean of 31.4 (SD \pm 5.6). Hypoglycemia was identified as a potential cause of AMS by 72.1% of interns, while fewer identified urinary tract infection (45.9%) and seizure (13.1%). While many interns ordered a CXR (86.9%) and head CT (80.3%), few requested a toxicology screen (21.3%) or lumbar puncture (3.3%). Only 41% of interns performed a neurologic examination.

Conclusion: New interns are not well-prepared to evaluate patients with altered mental status in the inpatient setting as measured by an Objective Structured Clinical Examination.

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GLOSSARY

AMS = altered mental status; **OSCE** = Objective Structured Clinical Examination.

Altered mental status (AMS) is a general term used to describe the undifferentiated presentation of a group of disorders affecting cognitive function or alterations of consciousness. Approximately 5–10% of patients presenting to the emergency department have AMS,¹ and an estimated 10–50% of hospitalized patients will experience acute AMS, or delirium.² Clinical evaluation of patients with acute AMS is a common task encountered by the intern on call, regardless of medical specialty. The effectiveness of medical education to ensure competence in this area is unknown.

The Objective Structured Clinical Examination (OSCE) is being increasingly used in medical schools and postgraduate training programs across the United States and Canada. The OSCE provides a standardized means of assessing skills in obtaining a history and performing a physical examination, communicating with patients and members of the health care team, formulating a differential diagnosis, and developing a management plan.³ An OSCE most often uses standardized patients as the primary assessment tool; however, other simulation tools may be utilized, including data interpretation, technical skills stations (e.g., suturing

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practicum), and clinical scenarios with human patient simulators (i.e., programmable mannequins). The advantages to simulations are that they incorporate a wide array of options for diagnosis, allow the examinee to reason through the problem with little or no cueing, permit participants to make life-threatening mistakes with no danger to real patients, and provide opportunity to take corrective action.²

The purpose of this study was to measure the competency of new interns in the evaluation and management of acute AMS using a clinical scenario with a human patient simulator as part of an OSCE. We also sought to correlate performance with surgical vs nonsurgical specialties, and with prior neurologic clerkship exposure.

METHODS A cohort study was conducted with 61 medical school graduates entering internship at a single military teaching hospital in 2006. Interns from 10 specialty fields were included (table 1). There were 43 allopathic and 18 osteopathic physicians in the group, matriculating from 39 different US medical schools. The AMS station was one of eight stations utilized as part of an OSCE to assess competency in a variety of areas pre-internship. The combined data of the eight-station OSCE will be presented elsewhere. The AMS OSCE consisted of a 12-minute encounter with a human patient simulator (computer-programmed mannequin) and a nurse actor (the examiner). Each intern's performance was graded by the same neurologist, using a modified checklist with criteria agreed upon by consensus of the neurology faculty. Competency in obtaining a history, performing a neurologic examination, generating a differential diagnosis, and ordering diagnostic studies was graded. Elements in the areas of patient care and medical knowledge were scored as "performed" or "not performed." Elements in the areas of interpersonal communication skills and professionalism were scored using a five-point Likert scale from "poor" to "excellent." Overall performance scores were converted to a percentage scale from 0 to 100. Scores were compared between surgical and nonsurgical specialties, and for those with neurology clerkship experience vs no prior experience using an unpaired Student *t* test.

Each intern was given the clinical scenario by the nurse actor and allowed 8 minutes to examine the human patient simulator, which was programmed with heart sounds, pulses, breath sounds, and blood pressure. A stethoscope, penlight, and reflex hammer were provided. The clinical scenario was read as follows: "There you are, Doctor. I just paged you to come take a look at Mrs. Gray. My name is Ms. _____, one of the nurses on this general medicine ward. I know you are covering call and normally don't follow Ms. Gray, but she is not acting like herself and I need you to evaluate her and tell me what needs to be done. She appears somewhat agitated, her arousal waxes and wanes, she seems confused, she is difficult to understand, and does not answer questions appropriately. Since she is not responding well to

Table 1 Specialty fields of the interns and overall performance scores

	Medical specialty (n)	Overall performance score (average)
Family medicine	8	31.0
Emergency medicine	8	31.8
General surgery	5	30.5
Internal medicine	10	34.3
Neurology	3	31.0
Obstetrics-gynecology	4	32.9
Otolaryngology	2	25.9
Pediatrics	8	30.8
Orthopaedics	3	30.2
Transitional year	10	31.1

questions, I can give you some additional history from what I know since starting this shift."

The interns were allowed to ask questions of the nurse, verbalize their diagnostic considerations, order diagnostic tests and consultations, and request treatments to be administered. At the completion of 8 minutes, each intern was given an additional four minutes to write their responses to the following questions: 1) List the possible causes of altered mental status in any patient. 2) What laboratory studies would you consider in a patient with altered mental status? 3) What other diagnostic tests would you consider in a patient with altered mental status? 4) What is the treatment plan for this patient? The examiner positively scored any item given by the examinee in verbal or written form.

RESULTS Sixty-one interns were evaluated on a total of 103 items divided into the following Accreditation Council for Graduate Medical Education core competency categories: medical knowledge (27 items), patient care (55 items), interpersonal communication skills and professionalism (8 items), and systems based practice (3 items). The overall performance score ranged from 19 to 43, with a mean of 31.4 (SD \pm 5.6). There was no significant difference between surgical and nonsurgical interns or between those interns with or without previous neurology exposure (table 2).

In the combined areas of interpersonal communication skills and professionalism, the mean raw score was 21.2 ± 7.03 (from a possible 40 total points) or $52.9\% \pm 17.6$. There was no significant difference between surgical (n = 25) and nonsurgical interns (n = 36) with respect to these scores, or between those who had prior neurologic clerkship exposure (n = 44) and those who did not (n = 17) (table 2).

The mean subset scores were 25.2 ± 6.1 in medical knowledge and 38.4 ± 6.8 in patient care. Most interns performed a heart and lung examination (96.7%), but only 41% performed a neurologic examination of any kind. A total of 80.3% of interns requested vitals signs, and 67.2% requested any past

	All interns	Surgical specialty	Nonsurgical specialty
No. of interns	61	25	36
Mean overall performance score (percentage)	31.4 ± 5.6	31.5 ± 5.3	31.4 ± 5.7
Mean subset score			
Patient care	38.4 ± 6.8	37.2 ± 6.6	39.3 ± 7.1
Medical knowledge	25.2 ± 6.1	24.6 ± 6.1	25.6 ± 6.2
Professionalism and interpersonal skills	53.2 ± 17.6	53.1 ± 16.9	52.9 ± 18.3
		Prior neurology exposure	No neurology exposure
No. of interns	61	44	17
Mean overall performance score	31.4 ± 5.6	31.2 ± 5.6	32.0 ± 5.2
Mean subset score			
Patient care	38.4 ± 6.8	36.6 ± 6.9	37.6 ± 6.9
Medical knowledge	25.2 ± 6.1	25.0 ± 6.2	25.6 ± 6.2
Professionalism and interpersonal skills	53.2 ± 17.6	53.4 ± 18.2	52.1 ± 16.3

medical history. The most common etiologies (table 3) given for altered mental status were hypoglycemia (72.1%), sepsis (65.6%), and hypoxia (60.6%). Less commonly identified etiologies were alcohol intoxication/withdrawal (36.1%), seizure (13.1%), meningitis/encephalitis (11.4%), and hypo/hypernatremia (9.8%). While many interns ordered a chest x-ray (86.9%) and head CT (80.3%), few requested a toxicology screen (21.3%) or lumbar puncture (3.3%). More striking, only 4.9% (3/61) of interns called their supervising resident or attending, even when planning to transfer the patient to a higher level of care. This particular result may be falsely low, however, taking into consideration the artificial nature of the OSCE.

DISCUSSION This study measured the competency of incoming interns to clinically evaluate a patient with acute AMS using an OSCE. AMS may

occur in 14–56% of hospitalized patients at a cost of about \$4 billion annually.² Identification of risk factors and a systematic approach to management can improve the outcome of the syndrome. We found that incoming interns performed quite well in certain areas and quite poorly in others, particularly in formulating differential diagnoses pertinent to neurologic disease or diagnostic evaluations specific for neurologic disease.

Acute AMS with alterations in arousal, or delirium, is associated with high mortality and morbidity in older hospitalized patients and indicates severe illness in younger patients. Some of the most common causes of acute AMS presenting to the emergency department include neurologic (28%, including stroke, intracranial hemorrhage, and seizure), toxicologic (21%, including alcohol, illicit drugs, and medication adverse effects), infectious (10%), and

Etiology	Interns identifying as potential etiology of AMS (%)	Diagnostic test	Interns requesting (%)
Hypoglycemia	72.1	Chemistry panel	96.7
Sepsis	65.6	CBC	81.9
Ischemic stroke	62.3	Head CT	80.3
Hypoxia	60.6		
Medication effects	49.2	Tox screen	21.3
Intracranial hemorrhage	47.5		
Urinary tract infection	45.9	Urinalysis	68.8
Alcohol intoxication/withdrawal	36.1	Blood alcohol level	8.1
Seizure	13.1	EEG	0
Meningitis/encephalitis	11.4	Lumbar puncture	3.2
Hyper/hyponatremia	9.8		

metabolic (5%).¹ Among hospitalized elderly patients with AMS, common etiologies are drug toxicity (56%), acute cardiovascular disease (48%), acute metabolic disturbances (43%), and neurologic disease (37%).^{4,5}

The results of this study raise some concern about the preparedness of new interns. Fewer than half of the interns tested recognized common neurologic etiologies, including intracranial hemorrhage or seizure as a cause of AMS, despite neurologic causes accounting for approximately one-third of all cases of AMS.^{1,4,6} Medication toxicity accounts for approximately 20–50% of acute delirium, depending on the study population, yet this was identified by only about half of the cohort. It is also important to note that only 41% of the interns tested even performed a neurologic examination.

The OSCE has been increasingly used over the past several years in both undergraduate and graduate medical education facilities to test a variety of skills, including cardiac physical examination skills with live patients and human patient simulators,^{7,8} competency in performing the neurologic examination,⁹ and clinical skills mastery in obstetrics and gynecology during medical clerkships.¹⁰

There are several limitations to this study. The study sample was small and was limited to one incoming class of interns at a single teaching hospital. Although the interns evaluated in the study were all graduates of US medical schools, the findings may not be representative of all medical schools or teaching hospitals. Additionally, performance on the OSCE, which is an artificial time-limited scenario, may not fully reflect performance in real situations. It may be that overall percentile scores were lower due to the large number of items on the scoring form and the inherent time limitation of the OSCE. Finally, the absence of published practice guidelines for AMS necessitated that we establish our own performance standards based on faculty consensus.

The results of this study suggest opportunities for improving the training and education of medical stu-

dents and interns. Further studies are needed to compare pre- and post-internship competency, impact of participation in a neurology rotation during internship, and teaching modules specifically designed for the evaluation of AMS in the hospital setting.

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REFERENCES

1. Kanach W, Brady WJ, Huff JS, et al. Altered mental status: evaluation and etiology in the ED. *Am J Emerg Med* 2002;20:613–617.
2. U.S. Bureau of the Census. *Statistical Abstract of the United States*. Washington, DC: US Bureau of the Census; 1991.
3. Accreditation Council for Graduate Medical Education and American Board of Medical Specialties Joint Initiative. *Toolbox of Assessment Methods. Objective Structured Clinical Examination. Version 1.0, Summer 2000*. Available at: http://www.acgme.org/acWebsite/RRC_380/380_toolboxVersion.pdf. Accessed February 21, 2008.
4. Camus V, Gonthier R, Dubos G, et al. Etiologic and outcome profiles in hypoactive and hyperactive subtypes of delirium. *J Geriatr Psychiatry Neurol* 2000;13:38–42.
5. Schor JD, Levkoff SE, Lipsitz LA. Risk factors for delirium in hospitalized elderly. *JAMA* 1992;267:827–831.
6. Pandharipande P, Jackson J, Ely EW. Delirium: acute cognitive dysfunction in the critically ill. *Curr Opin Crit Care* 2005;11:360–368.
7. Hatala R, Issenberg SB, Kassen BO, et al. Assessing the relationship between cardiac physical examination technique and accurate bedside diagnosis during an objective structured clinical examination (OSCE). *Acad Med* 2007;82(10 suppl):S26–29.
8. Jones JS, Hunt SJ, Carlson SA, Seamon JP. Assessing bedside cardiologic examination skills using “Harvey,” a cardiology patient simulator. *Acad Emerg Med* 1997;4:980–985.
9. Schrauth M, Schmulius N, Zipfel S, Haarmeier T. Practical examinations for neurology. The Tuebingen model. *Nervenarzt* 2006;77:1464–1468.
10. Elzubeir MA, Rizk DE. Assessing confidence and competence of senior medical students in an obstetrics and gynecology clerkship using an OSCE. *Educ Health* 2001;14:373–382.

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