Assessment of medical student clinical competencies in the neurology clinic

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Abstract—Objective evaluation of medical student clinical skills is difficult. In this study, medical students and neurology faculty independently completed a form on new clinic patients documenting anatomic localization, diagnosis, diagnostic tests, and management. We found students and faculty agreed significantly more often in anatomic lesion location and diagnosis than in ordering diagnostic tests or planning optimal treatment. This form improved student clinical competency assessment and enhanced teaching in clinics.

NEUROLOGY 2007;68:597–599

Publications discuss the key elements of neurology that should be taught to medical students during their clinical clerkship.^{1–4} Students are expected to learn to conduct a complete history and neurologic examination, understand important neurologic diseases, and grasp the basics of the neurologic tests. Students also should be able to anatomically localize the suspected lesion in the CNS and develop a plan for evaluation and treatment.

Faculty evaluations of student abilities are usually done by direct observation of the neurologic exam or by a videotape review of a patient interview and exam^{5,6} but are seldom done more than once per student during the clerkship. Multiple-choice examinations are usually administered to students at the end of the rotation, but they do not detect and help students with deficiencies early in their clerkship and do not assess knowledge application for clinical competence.

Rarely evaluated is the student's ability to apply neurologic knowledge to patients they encounter during the clerkship. One survey reported 50 to 70% of the student's final grade was based only on recollections of case presentations.⁷ We report a method that successfully evaluated medical students' clinical competency on different parts of the patient encounter on multiple occasions in a general neurology clinic.

Methods. We conducted this prospective study from July 2000 through December 2002 at the New Mexico VA Health Care System. Seventy-eight consecutive clinical clerkship students attending VA general neurology clinics participated in a study approved

by the VA Research Committee and University of New Mexico Human Research Review Committee.

Medical students completed forms on their new patients. Students had available the written consultation request and the electronic medical record. Having conducted a history and examination, they then completed a form before they presented their patient to one of five academically appointed neurology attendings. The form requested information about the 1) anatomic location of the suspected lesion, 2) key diagnosis, 3) student's level of diagnostic certainty, 4) diagnostic tests they would order, and 5) management they recommended.

After the student's oral patient presentation, the attending and student returned to the patient where the attending independently conducted a focused history and examination and separately completed on the student's form the same questions. The attending then reviewed the student form and discussed with the student the strengths and weaknesses of the presentation and workup.

The forms were collected and scored by the authors. The attending neurologist scoring was considered the definitive answer. The form's anatomic locations included major parts of the central and peripheral nervous system plus areas such as psychiatry, multiple sites, and cannot localize. Differences in anatomic localization were defined as close (two sites were anatomically adjacent in the nervous system) or anatomically distant from each other. Broad diagnostic groups used in analysis corresponded to disease chapters found in most neurologic textbooks. Differing key diagnoses were scored as close (i.e., both diagnoses in the same broad category as in tension headache and chronic daily headache) or very distant (i.e., brain tumor and tension headache). When the proposed diagnostic tests differed, they were subscored as different on neuroimaging tests, physiologic tests, blood tests, and diagnostic consultations as students could differ from faculty in more than one test category. When the student proposed tests, we recorded whether the student ordered fewer, more, or a similar number of tests than the attending. Proposed treatments were scored as identical, close (such as different commonly used medication for the same condition), or distant (such as tryptan vs anticonvulsant for seizures). We scored categories blank when the student placed a question mark in the area, entered only information not pertaining to the question, or left the space entirely

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Disclosure: The authors report no conflicts of interest.

Received July 26, 2006. Accepted in final form October 20, 2006.

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blank. Data without patient or student identifiers was entered onto a Microsoft Access database. Similarities and differences between the two responses were statistically analyzed using chi-square methods.

Results. Eight-seven neurology clerkship students completed 425 new patient forms over 30 consecutive months. Nine forms could not be scored because faculty failed to complete their side of the form. Compared with faculty, students localized the lesion identically in 50%, closely in 22%, distantly in 23%, and left the question blank in 5%. Regarding diagnostic agreement, students and attendings were identical in 53%, in the same ballpark in 23%, very different in 20%, and not answered by students in 4%. There was an association between student level of certainty and category of agreement with faculty diagnosis (χ^2 [4 df] = 24.84; $p < 0.001$). Among 86 cases where student diagnostic certainty was high, the student-faculty agreement was identical for 66% compared with only 38% identical agreement for 71 students reporting low certainty.

In 32% the students and faculty diagnostic test requests were identical, in 47% they differed, and in 22% the student left the question blank. When both completed that part of the form, the students and faculty ordered the same number of tests in 45%, students ordered more tests in 45%, and faculty ordered more tests in 10%. Regarding proposed tests, the two differed in neuroimaging tests in 22%, in physiologic tests in 17%, in blood tests in 17%, and consultant requests in 5%. For proposed treatments, students and faculty were identical in 29%, close in 26%, distant in 12%, and not answered by students in 33%. The percentage of students demonstrating identical agreement with faculty differed by parts of the patient encounter (χ^2 [3 df] = 74.04; $p < 0.001$). Identical agreement was 50% for anatomic lesion location, 53% for key diagnosis, 32% for diagnostic tests recommended, and 29% for proposed treatment.

Discussion. We found that neurology clerkship students met several competencies regarding the evaluation of new patients in a general neurology clinic. In almost three-fourths of patient encounters, students were able to identically or closely localize the likely site of the lesion similar to the faculty. This implies students often could integrate a complex history and neurologic exam to generate a reasonable disease hypothesis and knew sufficient neuroanatomy to localize the site of the problem. Our students practice taking histories from patients early in their medical school training and consequently possess considerable skill by the time they rotate on neurology. The neurologic exam is taught to the students several times before the clerkship, so students usually demonstrated ability to identify abnormal findings and synthesize them toward an anatomic location. Analyzing the most common errors in anatomic localization, we found that students frequently did not understand the functions of the cerebellum and mislocalized lesions produced by other parts of the nervous system to the cerebellum. The mislocalization to muscle, parietal cortex, and the peripheral nerve were the next most common errors.

We used the knowledge obtained from these student assessments to guide curriculum improvements.

In three-fourths of patient encounters, students correctly or closely identified the disease category. Again this demonstrated that students synthesized information gained from the history, examination, lesion location, and available medical information to generate a likely disease hypothesis.

Medical students had more difficulty recommending appropriate diagnostic tests. They were identical or very close to the faculty only one-third of the time. The most common differences lay in ordering too many tests, especially expensive neuroimaging and some physiologic tests. When attending physicians ordered more tests, the student's diagnosis usually differed markedly from that of the attending. Students also left this question blank over 20% of the time, indicating difficulty in proposing tests.

Students also had trouble proposing a management plan and left this section blank one-third of the time. The most common treatment difference lay in recommending different medications, but students often neglected to manage the patient's illness with education, life-style modifications, referral to support groups, and failure to recommend equipment to prevent secondary complications.

That students did less well in ordering diagnostic tests and recommending treatment is not surprising. These skills are not taught in the classroom phase of medical education and thus these skills develop more slowly. Some students acquire these clinical skills quickly during the rotation, whereas others focus mainly on understanding the clinical features, anatomy, and pathologic features of common neurologic diseases because their final grade and national board exam questions are heavily weighted in these areas. Interpretation of our results is complicated by the fact that students were able to review the written consultation request and the electronic medical record. Without knowing the extent to which the students' formulations correlated with what they read in those sources, our conclusions must be tentative. For example, students' diagnoses may have been more accurate simply because the original consultation requests were relatively accurate. Nonetheless, the observation remains that students had difficulty recommending diagnostic tests and proposing treatment, and this is valuable information for curriculum development.

The form made it easy for attending neurologists to evaluate a student's clinical competence during the patient encounter. Before its usage, some students, unable to synthesize the history and exam into a coherent picture, presented the history and exam and then paused without going further with the analysis. In a busy clinic, the attending physician often proceeded with the patient interview and exam, determined the diagnosis, and developed a plan of diagnostic tests and management without knowing if this matched the student's. By using this form, the student made these decisions in writing

and gave them to the attending before presenting the case. After the patient encounter terminated, the attending physician used the form as an aid to discuss the strengths and weaknesses of the student presentation. The form also helped the student develop “learning issues” for later independent reading. Reviewing several student forms, the attending could determine whether the student’s performance improved during the clerkship. This became particularly helpful for early detection of the student with difficulty applying basic neuroscience knowledge to a given patient. As the form objectively documents the student’s performance, it served as a basis for grading the student at the middle and end of the clerkship.

This study supports the Working Group for Neurology recommendation based on the Edinburgh Declaration that medical schools “build both curriculum and examination systems to ensure the achievement of professional competence and social values, not merely the retention and recall of information.”⁸

Acknowledgment

The authors thank the University of New Mexico medical students and Drs. John Adair, Glenn Graham, and Kurt Fiedler for participating in this study, Ms. Keena Neal for data entry, and Dr. Betty Skipper for statistical help.

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NeuroImages

Figure. CT of the thoracic spine demonstrates that the catheter enters the medulla at the level of T8/9 and leaves it at level T6 (A, B, C: transversal, coronary, and sagittal reconstruction). MRI (D: T1-weighted, E: T2-weighted) shows marked medullary edema (increased T2-signal, arrow) up to the level of T2.

Medullary impalement: A potential complication of epidural catheterization

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A 76-year-old woman had an epidural catheter inserted between the T8–T9 interspace at an outside hospital for treatment of postoperative pain after abdominal surgery. Five hours later she developed paraparesis and a sensory deficit to the level of T9. The same day she was referred to our institution to exclude an epidural hematoma compressing the spinal cord, a rare complication

of epidural catheterization.¹ The CT (figure, A through C) revealed that the catheter penetrated the spinal cord from the level of T8/9 to T6. The MRI showed medullary edema reaching the level of T2 (figure, E through F). The catheter was removed 12 hours later (after normalization of INR) but the neurologic deficits remained.

The differential diagnosis of paraparesis with epidural placement of a catheter includes medullary compression by epidural/subdural space-occupying lesion (hematoma or abscess), spinal cord ischemia from arterial injury or spasm, direct trauma from the needle or from the catheter, and injection of the anesthetic directly into the spinal cord. MRI is the method of choice to visualize spinal cord damage and epidural/subdural space-occupying lesions while CT can be used to localize the foreign body material exactly (depending on the material).

Disclosure: The authors report no conflicts of interest.

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Neurology 2007;68;599

DOI 10.1212/01.wnl.0000256346.58238.d6

This information is current as of February 19, 2007

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