

Feasibility and Validity Evidence for Use of Multimedia Vignettes

in a Year One Neuroscience Examination

BY

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THESIS

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JWS

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PAGE</u>
I. INTRODUCTION.....	1
A. Background.....	1
B. Purpose.....	2
II. METHODS.....	3
A. Design and Setting.....	3
B. Test Development.....	3
C. Standard Setting.....	4
D. Validity Evidence.....	4
E. Feasibility and Acceptability.....	5
F. Student Questionnaire.....	5
G. Data analysis.....	6
1. Test Statistics.....	6
2. Qualitative Analysis.....	7
III. RESULTS.....	8
A. Test Statistics.....	8
B. Qualitative Analysis.....	9
C. Feasibility.....	13
D. Validity Evidence for the Video Multiple-choice Examination.....	13
1. Content Evidence.....	13
2. Response Process.....	14
3. Internal Structure.....	14
4. Relationship to Other Variables.....	14
5. Consequences.....	14
IV. DISCUSSION.....	15
V. CONCLUSIONS.....	17
CITED LITERATURE.....	18
APPENDIX.....	20
Appendix 1.....	20
Appendix 2.....	22
Appendix 3.....	40
Appendix 4.....	43
VITA.....	51

<u>TABLE</u>	LIST OF TABLES	<u>PAGE</u>
I.	STUDENT SURVEY QUESTIONS.....	6
II.	TEST DATA ANALYSI OF 43 ITEMS OF MULTIMEDIA MULTIPLECHOICE EXAMINDAITONS AND 100 QUESTION FINAL EXAMINATION ADMINISTERED TO 50 FIRST YEAR MEDICAL STUDENTS.....	8

SUMMARY

Multiple-choice questions using multimedia clips of clinical phenomena can provide reliable assessments in medical school clerkships and licensing examinations. The purposes of this study were to develop a test, using multimedia clips for a pre-clerkship course and to demonstrate its validity, feasibility and acceptability. A 50 question computer-based test with 25 multimedia vignettes (2 questions/vignette) was developed and administered to 50 medical students at the conclusion of a Year One neuroscience block (course). Each vignette portrayed a patient's findings or history; questions were blueprinted to course content with a focus on neuroanatomy/localization, diagnosis, neurophysiology, neurochemistry, neuropharmacology or neuropathology. Seven poorly performing items were deleted in the final scoring. The mean raw score on the remaining 43 items was 37.92 (88%) with a standard deviation of 3.34 (7.7%). Cronbach's alpha was 0.66. There was a moderate correlation between this test and the standard 100-item multiple choice question final examination (Pearson's correlation coefficient=0.63). Forty-seven of fifty (94%) students responded to a survey regarding the test and their responses were analyzed using qualitative methods to identify themes. Students overwhelmingly indicated that the multimedia questions more realistically reflected the clinical context in which they will function as physicians and were appropriate for assessment. Faculty members agreed that the test was appropriate for student assessment. Validity evidence, along with student and faculty perceptions of acceptability, supports using multimedia-based items as an assessment component in a neuroscience course. The results of this study support the further development of multimedia vignettes for assessments in preclinical courses.

I.INTRODUCTION

A. Background

Multimedia recordings of patients have been used in medical education to portray clinical findings for decades (Danna, 1980), providing a number of curricular benefits. Multimedia recordings depict phenomena more authentically than a written description; while ideally every student would directly observe patients with a variety of abnormal clinical findings, this is often not practical due to limited patient availability and curricular time constraints. Multimedia resources, once developed, can be stored for repeated use in instruction. The use of multimedia resources in the first and second years of medical school aids in preparation of students for clinical clerkships (Kamin, O'Sullivan, Deterding, & Younger, 2003), perhaps by helping students to see potential transfer implications of learning to other contexts (Anderson, Reder, & Simon, 1996). The use of audiovisual materials is supported by the dual-coding theory that suggests that the use of images improves learning and recall because images and language are synthesized in distinct locations of the cerebral hemispheres (Paivio, 1991).

Computer-based testing allows for the conduct of examinations with multimedia material. Two groups have reported about multimedia multiple-choice question tests (MMCQTs) to assess medical students' ability to identify neurologic findings at the conclusion of neurology clerkships, and showed acceptable test reliability (Lieberman, Frye, Litwins, Rasmusson, & Boulet, 2003; Millos et al., 2003). The National Board of Medical Examiners (NBME) reported a controlled trial of the use of multimedia depictions of heart sounds and chest and neck vein movements in the United States Medical Licensing Examinations (USMLE) Steps 1 and 2, content-matched to text descriptions of the findings (Holtzman, Swanson, Ouyang, Hussie, & Allbee, 2009). Multimedia test items were more difficult than matched narrative questions, were less discriminating, and required

the findings being described, there may be a sufficient gain in validity to justify the additional testing time, assuming auscultation skills are viewed as important and among those to be assessed in licensing examinations(Holtzman et al., 2009).”

B. **Purpose**

The purpose of this study was to gather validity, feasibility, and acceptability evidence for a MMCQT demonstrating neurologic findings in a pre-clerkship neuroscience course.

II. METHODS

A. Design and Setting

The study was conducted in the first year neuroscience block (course) of 5 weeks duration, comprised of 50 students at Mayo Medical School (MMS) in Rochester, Minnesota. Case-based teaching was utilized with large group presentations, small group discussions facilitated by faculty members, and laboratory sessions. Video clips demonstrating a wide variety of neurologic findings were used in instruction to show clinical conditions. Examples of disorders portrayed with video clips during the block included seizures, eye movements, gait disorders, movement disorders and language disorders. The purpose of the video vignette test was to help assess student competency in interpretation of the clinical history and findings.

B. Test Development

Twenty-five topics blueprinted to block learning objectives were selected for the test (Appendix 1). Video clips of patients collected by the Department of Neurology for teaching were identified or developed for each topic and were edited for content and length; these specific clips were not used as examples for teaching during the block. Each demonstrated a neurologic finding(s) and/or a standardized patient providing a history. Brief text introductions provided context for each video clip; two multiple-choice questions (MCQs) were written for each vignette for a total of 50 questions. Each MCQ focused on a specific testing point related to the vignette from one of the following categories: neuroanatomy/localization, diagnosis, neurophysiology, neurochemistry, neuropharmacology or neuropathology. Each MCQ in a pair was written to be answered independently from the other (i.e., the information in one question did not provide the answer to the other).

Faculty members reviewed each vignette and question. Two other individuals with extensive MCQ writing experience independently reviewed the test and two neurology residents .

C. Standard Setting

Standard setting was undertaken using the Angoff method (Thorndike & Angoff, 1971). Three members of the faculty participated, along with the author, in the standard setting exercise. This examination was only one contributor (14% of the total points upon which a grade was based) to each student's overall grade, and accordingly no minimum score was required on the video vignette exam to pass the block, although one was set for the purposes of this study.

D. Validity Evidence

Evidence of test validity was sought from five sources (American Educational Research, American Psychological Association, National Council on Measurement Education, 2014). The evidence examined for each source was:

Content

- Use of an examination blueprint
- Content experts' review of test content
- Use of evidence-based MCQ writing guidelines
- Pilot testing of items done by administration to two neurology residents with modification of questions based on feedback

Response process

- Student familiarity with testing format and procedures
- Test scores reported as raw and percent correct
- Feedback from students regarding test

Internal structure

- Item statistics analysis
- Summary statistics [exam difficulty, mean discrimination and reliability (Cronbach's alpha)]

Relationship to other variables

- Item and test statistics for the 100 point final examination compared to video vignette examination
- Pearson's correlation coefficient calculated for the video examination and the 100 MCQ final examination

Consequences of testing

- Cut score developed using the Angoff method
- Feedback from an anonymous online survey of examinees regarding advantages and disadvantages of the video vignette test and from a student focus group to address student experience and attitudes with video vignette test
- Faculty acceptance of video test

E. **Feasibility and Acceptability**

Feasibility and acceptability were examined. This included reporting exam development time, technical issues related to development and administration of the examination, and establishment of acceptability of the test for faculty members and students.

F. **Student Questionnaire**

Following the examination, each student was asked to complete an anonymous on-line questionnaire, seeking their feedback regarding the value of the use of videos in testing (Table I).

Table I.
STUDENT SURVEY QUESTIONS

- 1) In the neuroscience exam, the use of video clips in the vignettes was more effective in the assessment of your knowledge than vignettes utilizing only written text. (Yes/No) (open text)
- 2) In this test, were the video clips representative of conditions that you had encountered during the neuroscience block? (Yes/No) (open text)
- 3) What were the advantages of the use of video clips in this test?
- 4) What were the disadvantages of the use of video clips in this test?
- 5) Would it be useful to use video clips in other tests of medical knowledge? (Yes/No) (open text)
- 6) How did you prepare for the test with video clips? (open text)
- 7) Did your preparation for a test with video clips differ from your usual preparation? (Yes/No) (open text)
- 8) Any additional comments?

A focus group of four students met with a facilitator (JWS) to review and to discuss each of the questions in the questionnaire; the discussion was audio recorded. The recording was transcribed and comments de-identified to allow further analysis.

G. Data analysis

1. Test Statistics

The proportion of examinees answering correctly and point-biserial correlations were calculated for each question. Cronbach's alpha was calculated as a measure of internal-consistency reliability for the MMCQT and the 100-question MCQ final examination, and Pearson correlation coefficients for the two sets of test scores were calculated. Statistics were also calculated for the 100

question final examination. Statistical analyses were performed using SAS version 9.2 (SAS Inc., Cary NC).

2. Qualitative Analysis

A grounded theory method was utilized to perform the qualitative analysis of questionnaire responses completed by students and the transcription of the focus group discussion (Glaser & Strauss; Harris, 2003). The approach of constant comparative analysis (Harris, 2003) was utilized to identify themes and categories in the questionnaires by two of the authors (JWS, IBH). The units of analysis were sentences and words. Exemplar comments were chosen to demonstrate significant themes and to contribute to thick description. Quotations were modified to correct grammatical errors, and syntax was sometimes altered (designated by brackets) to enhance readability. Member checking, a strategy to help establish the trustworthiness of the content analysis (Fraenkel, 2009), was undertaken by reviewing the themes with four MMS students who participated in the study.

The University of Illinois at Chicago and the Mayo Clinic Institutional Review Boards approved the study.

III. RESULTS

A. Test Statistics

Fifty (50) students took the MMCQT. The psychometric results of the test were calculated after seven poorly performing questions were dropped from the examination because of a negative point-biserial (five items) or no agreed upon correct answers (two items) (Appendix 3).

The mean score on the 43 retained items was 37.9 (90%) with a standard deviation of 3.34 (7.7%) and the median score was 38 (90%); the range was 29-43 (67%-100%). Cronbach's alpha was 0.66. The mean point-biserial value was 0.16 (range: 0–0.54) (Table II).

Table II.

**TEST DATA ANALYSIS OF 43 ITEMS OF MULTIMEDIA MULTIPLE-CHOICE
EXAMINATION AND 100 QUESTION FINAL EXAMINATION ADMINISTERED
TO 50 FIRST YEAR MEDICAL STUDENTS**

Test statistics	43 Question Test with Video Vignettes	100 Question MCQ Test
Mean raw score/percent correct	37.92/88%	85.2/85%
Median raw score	38	87
Standard deviation raw score/percent	3.34/7.7%	6.79/6.8%
Minimum and Maximum raw score/percent correct	29–43/67-100%	70-99/70-99%
Internal consistency reliability (Cronbach's alpha)	0.660	0.787
Standard error of measurement	1.94	1.20
Mean Point-biserial	0.16	0.16

The mean item difficulty (proportion correct) was 0.85 (range: 0.54-1.00). The Spearman-Brown prophecy formula predicts that the addition of 9 similar performing items would result in a Cronbach's alpha of 0.70 (Jum C. Nunnally, 1994).

The cut score for the video vignette test, using the Angoff method, was 71%. Two students (4% of examinees) did not attain the cut score, each with scores of 63%.

The mean time for completion of the exam was 1 hour and 17 minutes, and the median time was 1 hour 18 minutes (range: 45 minutes–1 hour and 53 minutes).

The mean score for the 100-item MCQ traditional vignette final examination was 85.2% (SD 6.78%). The range of scores was 70%-99%. Cronbach's alpha was 0.79. The mean item difficulty was The Pearson correlation coefficient between the scores of the 43-question multimedia exam and the traditional final examination was 0.63 (p-value <0.0001).

B. Qualitative Analysis

Forty-seven (47) students completed the survey (response rate of 94%). A qualitative analysis was conducted (Appendix 4). The following themes were identified from the students' responses. Examples of student responses are in quotations.

Survey question 1: In the neuroscience exam, the use of video clips in the vignettes was more effective in the assessment of your knowledge than vignettes utilizing only written text.

Sixty-eight percent (68%, 32/47) answered this statement in the affirmative, with the following major themes identified, with exemplar quotations.

Video clips provide a visual representation of patients' symptoms and findings and are more clinically relevant, practical and applicable. "The use of video clips better portrayed the patients' conditions and gave the test a more practical feel." "Videos were helpful in that you had to discern the problem yourself rather than just being told what the issues were." "[Video clips] made us apply our knowledge in a more realistic, clinical setting."

Video clips are more effective only for certain situations or as a supplement to written vignettes. "I found [videos] to be a helpful supplement, but not necessarily more effective."

Some video questions were more effective than others, given item flaws. "Some questions had a stem that gave the answer away. Others required careful attention to the video." "Some questions could be answered without needing to view video and it was unclear in a few videos what specific symptom was being portrayed."

Videos assessed different skills than written vignettes and also assessed critical thinking. "I thought [videos] were useful in testing a different skill, learning how to directly observe patients." "The video clips forced critical thinking."

Survey question 2: The video clips were representative of conditions students had encountered during the neuroscience block.

Forty-five (45) of 47 students (96%) agreed with this statement. General comments included: "The clips were representative of clinical scenarios we saw in class." and "There was a fair representation of material covered."

Yes, except for syncope, spells, speech disorders, and seizures. Students felt that most conditions had been appropriately demonstrated on videos in class; however, some students felt that syncopal episodes, spells, speech/ language disorders, and seizures were not typical of cases illustrated in class.

It would have been helpful to have more faculty selected video samples "... it would be helpful to see plenty of examples of videos of a given condition during the block so we can appreciate the spectrum of findings with a given condition."

Survey Question 3: Advantages of use of video clips in the test.

Videos assessed applied knowledge of observation and history taking because they portrayed clinical disorders in a more realistic manner. Students felt that the videos added benefits beyond word vignettes by being more faithful to patients' presentations. Comments

included: “Seeing patients even through video clips was more clinically relevant than a written test.” “Great to see how certain diseases/conditions will present in clinic.” “It is a closer representation to actual clinical evaluation.”

Videos provided additional information beyond text and helped learning. “Video clips gave you a better feel as to what they were describing in vignettes.” “The videos convey a lot of content without a lot of writing/words.” “The videos forced more critical thinking.”

Survey question 4: Disadvantages of use of video clips in the test

Poor Quality: Volume; quality of exam; length and repetition of videos. Some students commented that it was difficult to see the finding that was being demonstrated. In some cases, students felt that the absence of three dimensions in the videos made it difficult to interpret exam findings. In a few cases, students felt that the length of some video clips was longer than necessary to demonstrate pertinent findings. Students commented that variability in the volume of the recordings was distracting.

Takes longer to respond to questions/take a test. Some students also commented that it requires more time to answer a question with a video than a question with only a written vignette and leads to more time required for test completion.

Students did not have access to review video clips for study. Another issue mentioned was that although video clips were shown in class, they were not generally available outside of class due to faculty member concerns about maintenance of patient confidentiality. Students felt that videos should be readily available for review.

Survey Question 5: Potential usefulness of video clips in other tests of medical knowledge

Forty-four (44) of 47 students (94%) affirmed there is a potential role for video clips in tests in other disciplines besides neuroscience.

Yes, depending on subject, exactly what is tested and what is presented in the video.

Twenty-four (24) students (51%) commented that the appropriateness is dependent on the type of knowledge that students are being asked to demonstrate and the video. For example, students

commented that listening to a patient describe her/his history is more realistic and requires skills different than reading an abstracted history.

Yes, assesses application of clinical knowledge. “(The videos are) more applicable and more closely approximates what we may see in the clinic.” “Videos can be readily used for medical histories. For instance, the question with a history of migraine headaches was really good. Listening to a patient’s own story is really important. This opens up the opportunity to use videos in many situations.” “I would support the use of videos in testing in other disciplines. For example, in pulmonary one could have lung sounds.”

Yes, helpful for learning. “It would be helpful to see videos of patient exams to help us become familiar with the appearance of abnormal findings.” “Seeing a video of a particular condition better prepares us for diagnosing and understanding the disorder in the clinic.”

Survey Questions 6 & 7: Student preparation for the video vignette exam. A majority of students indicated that their study prior to the test with video clips did not differ from their usual preparation for the examination; they reviewed resources such as PowerPoint presentations, lecture notes and other materials. There was a lack of availability of videos for review outside of class time. Some students watched videos that were found on YouTube, but students did not feel that the examples available reliably demonstrated characteristics of disorders. Some students focused on association of localization of pathology with the physical findings, commenting, “I reviewed the pathology associated with each gait and that helped consolidate the information.” Some students reviewed the video quiz that had been administered in the block. Some students studied in groups and “played charades” with students mimicking movement disorders and gait disorders. Students recommended that videos of patients be made available outside of class time for study and review. The video test was administered the day before the final examination so students commented that their preparation was focused on that test.

C. Feasibility

JWS invested 75 hours in development of the video vignette test. Each of five faculty members and two non-faculty reviewers spent approximately two hours each reviewing the questions and associated videos and providing feedback. Most of the videos in the test were culled from the Mayo Clinic Department of Neurology's existing video resources from patient videos, done as a part of clinical care or for teaching. Each subject had signed a release for use of the videos. All faculty members of the neuroscience block were of the opinion that the MMCQT added an important dimension to assessment and supported its use.

D. Validity Evidence for the Video Multiple-choice Examination

1. Content Evidence

The MMCQT was based on an examination blueprint, evidence-based MCQ writing guidelines were used (Haladyna, T. M., Downing, S. M., & Rodriguez, M. C., 2002), faculty members reviewed questions, and the test was piloted with two neurology residents. Questions were modified based on feedback from these sources.

Despite these practices, students pointed out that there were some questions with content which did not receive emphasis during the block and hence, students felt that they were not representative of what were identified to be important concepts. For example, the video of a patient suffering a syncopal episode and the video of a simulated patient describing migraine visual aura were confirmed by the author of the study not to be representative of topics covered in detail in the block. Three items associated with these videos accounted for three of the seven items that were removed from the test. On item analysis, these items performed poorly with a negative point-biserial and/or a low percentage of students answering them correctly.

Students only had access to multimedia examples of disorders during time in class. This limited their opportunities to review the video examples for study and hence, mastery of the material.

2. Response Process

The students were familiar with the testing format and procedures; there were no technical problems with test administration. Because the format was new and it was unclear how much time for testing was needed, three hours were allotted. All students completed the exam in less than two hours. Test scores were reported as raw and percent correct scores. In some cases, students judged findings to be difficult to identify in a two-dimensional video and some students commented that some videos were not ideally edited. Some students found the variable volume of the audio of video clips to be distracting. Some students commented that the written introduction sometimes allowed a question to be answered without the video.

3. Internal Structure

Seven poorly performing questions were not included in the final scoring. The mean score on the remaining 43 items was 37.92 (standard deviation of 3.34). The median score was 38 with a range of 29–43 and a Cronbach's alpha of 0.66 (Table II)

4. Relationship to Other Variables

The Pearson correlation coefficient showed a strong correlation between scores on the MMMCT and on the final examination. The mean percentage correct on each exam and the range of percent correct answers were similar (Table II).

5. Consequences

Two students did not attain the cut score for passing the examination; this did not result in a change in pass-fail decisions for the block. The test did not, based on review of the student responses on the questionnaire, result in any negative outcomes for students. The student survey results showed that positive consequences accrued from the use of videos as part of the block assessment. The students commented that videos of patients were more realistic than written descriptions of clinical neurologic disorders. Students felt that responding to questions based on video representations required different skills than those necessary for the interpretation of text descriptions.

IV. DISCUSSION

This study extends the research focused on use of video vignette multiple-choice questions in neurology clerkships and in USMLE Step examinations to a pre-clerkship basic neuroscience block, and demonstrates that an MMCQT can be developed and used to complement standard assessments in a pre-clerkship setting.

Cronbach's alpha approached 0.70, the level necessary to consider the test as a reliable measure for assessment for low stakes examinations (Downing & Yudkowsky, 2009). A straightforward way to increase Cronbach's alpha is to replace the poorly performing items with better performing items. Another option is the addition of more test items; however, this would require additional videos and would increase the time necessary for test completion.

The Pearson correlation coefficient between the scores on the MMCQT and on the final examination was moderate, as was expected since each test focused on the same basic neuroscience concepts and their use in clinical problem-solving contexts. The MMCQT also assesses skills such as the ability to identify and interpret findings.

Although the time and resources invested were significant, it was worthwhile to create an MMCQT which tests students' ability to identify, interpret, and use clinical observations, skills not as fully assessed with standard MCQ tests. The use of videos in testing provides an added incentive for medical students to learn concepts that clearly link to clinical care (Bransford, Brown, & Cocking, 2000). This resource, that can be used repeatedly, adds to the validity of student assessment and is well accepted by students and faculty. Many departments of neurology have libraries of videos that could be repurposed for use in examinations. Alternatively, videos of some findings can be created with standardized patients.

This study has limitations. It was conducted with 50 students at a single medical school; while specific results may not be generalizable to other medical schools or disciplines; our findings are consistent with other studies showing that multimedia exams can play an important role in

assessment of clinically-relevant skills. Next steps could include investigating whether student experiences with video vignettes on a pre-clerkship test impacts student performance on future assessments such as the USMLE Step 1. The contextual, visual presentation of clinical findings during a basic science course may also help students to better recall this basic science when they encounter patients with similar findings in a clinical setting.

V. CONCLUSIONS

This pilot study provides preliminary evidence for the validity, feasibility and acceptability of a multimedia vignette test as part of the assessment in a pre-clerkship neuroscience course. This type of exam helps place an emphasis on the clinical application of neuroscience concepts and connects basic science concepts to clinical practice. In addition, it provides medical students with experience in a new question format utilized in licensing examinations and can help prepare students for these high stakes examinations. Faculty should consider using multimedia questions to assess the identification and interpretation of clinical findings relevant to pre-clinical courses.

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Appendix 1: Test question topics (with question numbers)

Topic/Video: Test Question Numbers	Neuroanatomy Localization	Diagnosis	Neurophysiology	Neurochemistry	Neuro-pharmacology	Neuro-pathology
1: 1,2 Neglect/ parietal lobe stroke	1,2					
2: 3,4 Subarachnoid hemorrhage		3				4
3: 5,6 Simple partial seizure	5			6		
4:7,8 Parkinson's disease	7			8		
5:9, 10 Chorea (Huntington's)		9				10
6: 11, 12 Fasciculations/ ALS		12	11			
7: 13,14 Cerebellar gait ataxia	13, 14					
8: 15, 16 Radial neuropathy	15					16
9: 17, 18 peripheral neuropathy (HMSN type 1)	17		18			
10: 19, 20 3 rd nerve palsy due to uncal herniation	19					20
11: 21,22 Spastic gait due to cord lesion	22	21				
12: 23, 24 Gait apraxia	24	23				
13: 25, 26 Cataplexy		25		26		

14: 27, 28 Right hemiparesis due to left cerebral tumor	27					28
15: 29, 30 6 th nerve palsy, cavernous sinus	29, 30					
16: 31, 32 INO	32	31				
17: 33, 34 Complex partial seizure	33				34	
18: 35, 36 Frontotemporal Dementia						35, 36
19: 37, 38 Syncope	37		38			
20: 39, 40 LEMS			40	39		
21: 41, 42 Absence seizure			41		42	
22: 43, 44 Apraxia	44	43				
23: 45, 46 Broca aphasia	46	45				
24: 47, 48 Wernicke aphasia	48	47				
25: 49, 50 Migraine with aura	50				49	

Appendix 2: Neuroscience Multimedia Test Questions

1. A 66 year-old man is hospitalized, following the abrupt onset of left sided symptoms. Muscle strength examination is normal. A brief history and some other exam findings are shown in the video (01 clip, sound).

Which of the following is the most likely location of the lesion responsible for the patient's impairment?

- A. frontal lobe
- B. insular cortex
- C. occipital lobe
- *D. parietal lob
- E. temporal lobe

2. Which of the following most likely underlies his visual problem?

- A. bitemporal hemianopsia
- B. central scotoma
- C. homonymous hemianopsia
- *D. inferior quadrantanopsia
- E. superior quadrantanopsia

3. A 42 year-old woman comes to the emergency department because of a severe headache that began 2 days ago. The history is outlined in the video (02 clip, sound). Her neurologic examination is normal.

Based on the history provided in the video, which of the following is the most likely cause for the headache?

- A. cerebral abscess
- B. cerebral hemisphere neoplasm
- C. epidural hematoma

*D. subarachnoid hemorrhage

E. subdural hematoma

4. Rupture of which of the following was the most likely cause of the patient's condition?

A. abscess wall

*B. anterior communicating aneurysm

C. arteriovenous malformation

D. middle meningeal artery

E. neoplastic endothelial cells

5. A 68 year-old woman presented with spells of one year duration. One of the patient's spells is presented in the video (03 clip, sound).

Which of the following is the most likely location of the lesion responsible for the patient's disorder?

A. opercular gyrus

B. postcentral gyrus

*C. precentral gyrus

D. superior frontal gyrus

E. supramarginal gyrus

6. A reduction of which of the following neurotransmitters most likely plays a role in the pathogenesis of this patient's spells?

A. acetylcholine

* B. GABA

C. dopamine

D. norepinephrine

E. serotonin

7. A 72 year-old man comes to his physician because of the gradual onset of gait difficulties over the last 18 months. The patient's findings are shown in the video (04 clip, no sound).

Which of the following is the most likely site of neuronal loss in this patient's brain?

- A. caudate nucleus
- B. globus pallidus externa
- C. globus pallidus interna
- D. putamen
- *E. substantia nigra

8. Which of the following neurotransmitters is most likely decreased in this disorder?

- *A. dopamine
- B. GABA
- C. histamine
- D. norepinephrine
- E. serotonin

9. A 60 year-old man comes to the physician accompanied by his wife because of abnormal movements that began gradually, approximately 3 years previously. The video (05 clip, sound) demonstrates the patient's movements.

Which of the following best describes this patient's movements?

- *A. chorea
- B. dystonia
- C. hemiballismus
- D. tics
- E. tremor

10. The patient underwent an MRI of the brain. Findings consistent with which of the following are most likely to be present?

- *A. atrophy of the caudate nuclei
- B. communicating hydrocephalus
- C. demyelination of the corpus callosum
- D. hemosiderin deposition in the red nuclei
- E. lacunar infarctions in the globus pallidus

11. A 53 year-old man comes to the physician because of an 8 month history of progressive weakness and muscle atrophy. He first noted weakness of dorsiflexion of the right foot and subsequently weakness of the right hand and the proximal left lower extremity. In the last two months he has had a change in his voice in that it is slower and strained. Bowel and bladder function are unaffected.

Examination shows weakness and atrophy of distal right leg muscles, left proximal arm muscles, and right intrinsic hand muscles. Muscle stretch reflexes are increased. Sensory examination is normal. The video (06 clip, no sound) in the exhibit shows the proximal right arm and shoulder.

Involvement of which of the following structures most likely underlies the findings in the video?

- *A. alpha motoneurons
- B. gamma motoneurons
- C. Golgi tendon organs
- D. motor interneurons
- E. muscle spindles

12. Which of the following is the most likely diagnosis?

- *A. amyotrophic lateral sclerosis
- B. chronic inflammatory polyradiculoneuropathy
- C. cervical spinal cord tumor
- D. multiple metastases to the central nervous system
- E. multiple sclerosis

13. A 45 year-old woman comes to the physician because of a 3 month progressive history of difficulty walking. She denies weakness and numbness. Romberg sign is not present. The remainder of

the neurologic examination is normal except for her gait that is demonstrated in video (07 clip, no sound).

Which of the following most likely underlies the patient's gait difficulties?

- A. apraxia
- *B. cerebellar ataxia
- C. deafferentation
- D. spasticity
- E. parkinsonism

14. Which of the following is the most likely site of neurologic damage in this patient?

- A. cerebellar hemispheres
- *B. cerebellar vermis
- C. dorsal spinocerebellar tract
- D. posterior columns
- E. substantia nigra

15. A 68 year-old man awoke with left upper limb weakness, dominated by a wrist drop. There was no arm or neck pain. A portion of his exam is demonstrated in the video (08 clip, sound).

A lesion of which of the following structures is most likely responsible for the patient's weakness?

- A. cervical spinal cord
- B. C5 nerve root
- C. median nerve
- *D. radial nerve
- E. ulnar nerve

16. The patient returns 6 months later. There is weakness and atrophy of the muscles previously noted to be involved. Which of the following pathologic changes are most likely to found in the axons that innervate the muscles with abnormal findings?

- A. central chromatolysis
- B. invasion by microglia
- C. segmental demyelination
- *D. Wallerian degeneration

17. A 58 year-old man comes to the physician because of the gradual onset of distal limb weakness, more pronounced in the lower limbs, accompanied by muscle wasting. His examination is shown in the video (09 clip, sound). In addition to the findings demonstrated, there was also a decrease in pin sensation over the lower limbs to just below the knees and a decrease to vibration over the toes and fingertips.

Which of the following is the most likely site of the pathologic process that accounts for this patient's findings?

- A. anterior horns of spinal cord
- B. cauda equina
- C. central spinal cord
- *D. peripheral nerve
- E. muscle

18. Pathologic involvement of which of the following most likely account for the findings on muscle stretch reflex examination of the lower limbs?

- A. B efferents
- B. gamma efferents
- *C. Ia afferents

D. III afferents

E. type I muscle fibers

19. A 40-year old woman was hospitalized 3 hours ago because of acute onset of right limb weakness and a language disturbance. He shortly thereafter became comatose. One hour ago the pupils were equal and responded briskly to light and both eyes were midline. The video (10 clip, no sound) shows the current eye findings.

Which of the following best describes the abnormality on the eye exam?

A. left internuclear ophthalmoplegia

* B. left cranial nerve III palsy

C. left cranial nerve VI palsy

D. right nerve VI palsy

E. right Horner syndrome

20. Which of the following most likely explains the ocular findings?

A. left tonsillar herniation

*B. left uncal herniation

C. right tonsillar herniation

D. right uncal herniation

E. central (transtentorial) herniation

21. A 50 year-old man comes to the physician because of a two-year history of slowly worsening gait difficulties. He has developed urinary urgency and incontinence in the last three months. Examination shows increased quadriceps and Achilles reflexes and extensor plantar reflexes.

Which of the following best characterizes the patient's gait in the video (11 clip, no sound)?

A. apraxic

B. ataxic

C. parkinsonian

*D. spastic

E. steppage

22. Which of the following is the most likely neurologic localization of the process that underlies the patient's gait disturbance?

A. supratentorial

B. posterior fossa

*C. spinal

D. peripheral

23. A 70 year-old woman comes to the physician because of an 18 month history of progressive gait problems and imbalance. Three months ago she developed intermittent, sudden urinary incontinence. Her family also comments that she has had some mild memory difficulty that has developed in the last 6 months. His neurologic examination shows a mild, symmetric increase in muscle stretch reflexes of upper and lower limbs. Plantar reflexes are flexor, and limb tone is normal. The patient's gait is demonstrated in the video (12 clip, sound). The patient's arm is in a sling due to a fracture.

Which of the following is the best description of the patient's gait?

*A. apraxic

B. ataxic

C. spastic

D. steppage

E. Trendelenburg

24. Which of the following is the most likely localization of this patient's clinical picture?

* A. supratentorial

B. posterior fossa

C. spinal

D. peripheral

E. multiple levels

25. A 20 year-old man has a 6 year history of daytime sleepiness. He has frequently fallen asleep in school and has fallen asleep while driving a car. In addition he has spells. An example of a spell is shown in the video (13 clip, sound).

Which of the following is the most likely diagnosis of the episodes illustrated in the video?

- A. absence seizures
- *B. cataplexy
- C. complex partial seizures
- D. myoclonic seizures
- E. syncope

26. Dysfunction of which of the following neurotransmitter systems is the cause for this patient's disorder?

- A. GABA
- B. glutamate
- *C. hypocretin
- D. norepinephrine
- E. serotonin

27. A 60 year-old woman is seen because of slowly progressive right limb weakness for six months. She has mild right facial weakness. Her gait is shown in the video (14 clip, no sound).

Which of the following is the most likely localization to account for this clinical picture?

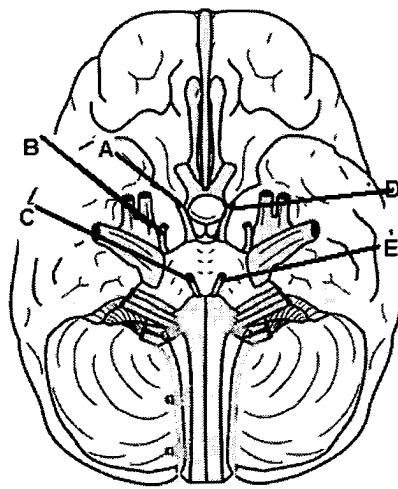
- A. right supratentorial
- *B. left supratentorial
- C. right posterior fossa
- D. left posterior fossa
- E. multiple levels

28. Which of the following is the most likely underlying process for the patient's findings?

- A. vascular
- B. inflammatory
- *C. neoplastic
- D. degenerative

29. A 15 year-old girl has a one day history of double vision. The eye examination is shown in the video (15 clip, no sound).

A lesion of the following structures (on the inferior surface of the brain) is most likely responsible for the patient's abnormality?



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- A.
- B.
- *C.
- D.
- E.

30. If the examination also showed decreased sensation to pin over the forehead ipsilateral to the eye abnormality, which of the following would be the most likely site of the lesion?

*A. cavernous sinus

B. midbrain

C. medulla

D. pons

E. orbit

31. A 52 year-old man has a one month history of double vision. The patient's exam is shown in the video (16 clip, sound).

Which of the following best characterizes the abnormality that is demonstrated?

A. III nerve palsy

B. IV nerve palsy

C. VI nerve palsy

*D. internuclear ophthalmoplegia

E. oculosympathetic paresis

32. Which of the following is the most likely site of the lesion to explain the patient's findings?

A. Edinger-Westphal nucleus

B. frontal eye fields

*C. medial longitudinal fasciculus

D. pontine paramedian reticular formation

E. superior colliculus

33. A 42 year-old woman has a one month history of spells. The patient notes that the spells are preceded by an unpleasant smell. She has no memory of the spells. She has a history of An example of the spells is shown in the video (17 clip, sound).

Which of the following is the most likely localization of spell onset?

- *A. mesial temporal lobe
- B. postcentral gyrus
- C. precentral gyrus
- D. occipital lobe

34. A medication with which of the following mechanisms of action is a first choice agent for management of these episodes?

- *A. blockade of voltage-gated Na⁺ channels
- B. facilitation of glutamatergic transmission
- C. inhibition of GABAergic transmission
- D. blockade of T channels

35. A 45 year-old woman has a one-year history of a change in behavior. She is an office manager and has had difficulty in her job. She has difficulty completing work tasks and has become disinhibited. The video (18 clip, sound) contains a history provided by her sister. The neurologic examination is normal, including preservation of memory.

Which of the following most likely underlies her disorder?

- A. atrophy of the dorsomedial nuclei of the thalamus
- B. demyelination of the corpus callosum
- *C. frontal lobe atrophy
- D. atrophy of the caudate nuclei
- E. medial temporal lobe atrophy

36. What is the most likely histopathology of the brain in this patient?

- A. amyloid plaques
- *B. ballooned neurons
- C. demyelination
- D. Lewy bodies
- E. neurofibrillary tangles

37. A 74 year-old man has a 3 month history of episodes of loss of consciousness. These are sometimes preceded by a sensation of lightheadedness. His wife notes that he is alert and oriented immediately after the spells. An example of a spell is shown on the video. Which of the following is the most likely diagnosis?

- A. absence seizure
- B. cataplexy
- C. generalized tonic-clonic seizure
- D. simple partial seizure
- *E. syncope

38. Which of the following is the most likely underlying principal pathophysiologic process for this event?

- *A. failure of ATP-dependent pumps
- B. impaired astrocyte buffering of extracellular K^+
- C. impaired activity of GABAergic interneurons
- D. imbalance between excitatory (glutamate) and inhibitory (GABA) synaptic influences on individual neurons
- E. recurrent cortico-thalamo-cortical discharges

39. A 65 year-old man has a one year of proximal weakness of the limbs which is worse late in the day. He has also noted dryness of his mouth. He has recently been diagnosed with lung cancer. A portion of the neurologic exam is shown in the video (20 clip, sound). Sensory and cognitive testing are normal.

Which of the following is the most likely level of nervous system involvement?

- A. supratentorial
- B. posterior fossa
- C. spinal
- *D. peripheral
- E. More than one level

40. Which of the following is the most likely underlying pathophysiology of this patient's disorder?

- A. blockade of action potentials
- B. facilitation of GABAergic transmission
- *C. impairment of acetylcholine release
- D. impairment of activity of GABAergic interneurons
- E. loss of anterograde axonal transport

41. A six year-old boy has a three month history of spells. An example of a typical spell is shown in the video (21 clip, sound).

Which of the following is the most likely underlying mechanism for the spells?

- A. depolarization in the rostral pontine reticular formation
- B. hyperpolarization of neurons in the posterior hypothalamus
- C. impaired activity of GABAergic interneurons
- *D. recurrent cortico-thalamo-cortical discharges
- E. repeated synaptic glutamatergic excitation between pyramidal cells

42. Which of the following medications would be most appropriate to treat this disorder?

- A. carbamazepine
- B. levetiracetam
- C. phenobarbital
- * D. valproate
- E. zonisamide

43. A 63 year-old man comes to the physician because of a six month history of difficulty using his right hand. Muscle strength, muscle tone, and muscle stretch reflexes are normal. Language testing is normal. A video of the patient is shown (22 clip, sound). The examiner's first direction is "Show me how you would light a match."

Which of the following best describes the findings shown in the video?

- A. abulia
- B. anosognosia
- *C. apraxia
- D. bradykinesia
- E. neglect

44. Which of the following is the most likely site of the lesion that accounts for the findings on the video?

- A. angular gyrus
- B. anterior temporal cortex
- C. arcuate fasciculus
- D. frontal operculum
- *E. premotor cortex

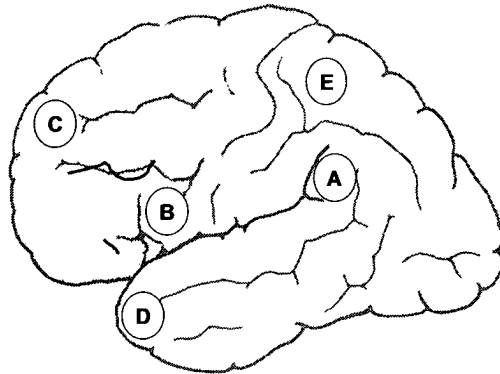
45. A 38-year-old right-handed woman suffered a cerebral infarction 3 months ago that has resulted in a language disorder. Her language examination is shown on the video (23 clip, sound).

Which of the following is the most likely type of aphasia?

- A. anomic
- *B. Broca
- C. conduction
- D. global
- E. Wernicke

46. Which of the following sites on the diagram is the most likely location of the infarction responsible for this patient's aphasia?

- A.
- *B.
- C.
- D.
- E.



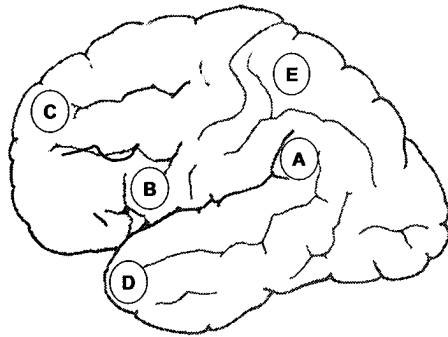
47. A 59-year-old right-handed man suffered a cerebral infarction 6 months ago that resulted in a language disorder. His language examination is shown on the video.

Which of the following is the most likely type of aphasia?

- A. Broca
- B. global
- C. transcortical motor
- *D. Wernicke

48. Which of the following sites on the diagram is the most likely location of the infarction responsible for this patient's aphasia?

- *A.
- B.
- C.
- D.
- E.



49. A 30 year-old men comes to the physician because of headaches. His history is provided in the video.

A medication with which of the following actions is most likely to be helpful for acute treatment of the headache?

- A. dopamine antagonist
- *B. 5HT₁ agonist
- C. pre-synaptic calcium channel blocker
- D. sodium channel blocker
- E. TRPV-1 agonist

50. Which site is the most likely localization of the patient's visual symptoms?

- A. lateral geniculate
- *B. occipital cortex
- C. optic radiations
- D. optic tract
- E. retina

Appendix 3: Test Item Statistics				
(* Denotes Question removed due to poor test statistics)				
		Lower Quartile	Upper Quartile	
Question	point biserial	% correct	% correct	Proportion correct
1	0.052	84.62	100	0.920
2	0.333	30.77	77.78	0.680
3	0.096	84.62	100	0.960
4	0.070	76.92	100	0.880
5	0.022	100	100	0.980
*6	-0.150	100	100	0.980
7	.	100	100	1.000
8	.	100	100	1.000
9	0.128	92.31	100	0.960
10	0.128	92.31	100	0.960
11	0.052	92.31	100	0.920
12	.	100	100	1.000
13	0.096	92.31	100	0.960
*14	-0.008	100	100	0.940
*15	-0.061	84.62	88.89	0.840
16	0.143	76.92	100	0.920
17	0.237	76.92	100	0.920
18	0.103	84.62	100	0.900
19	0.206	76.92	100	0.880
20	0.336	76.92	100	0.900
21	0.123	84.62	100	0.900
22	0.204	61.54	88.89	0.800

23	0.196	53.85	100	0.720
24	0.421	30.77	88.89	0.680
25	0.154	92.31	100	0.980
26	0.121	92.31	100	0.940
27	0.287	92.31	100	0.980
28	0.144	84.62	100	0.920
29	0.147	76.92	100	0.880
*30	-0.127	53.85	55.56	0.520
31	0.423	30.77	100	0.760
32	0.174	84.62	100	0.940
33	0.121	84.62	100	0.920
34	0.062	76.92	100	0.800
35	.	100	100	1.000
36	0.326	30.77	77.78	0.540
*37	.	0	0	0.000
*38	.	0	0	0.000
39	0.540	30.77	100	0.740
40	0.233	38.46	88.89	0.680
41	0.0543	46.15	88.89	0.580
42	0.154	92.31	100	0.980
43	0.022	100	100	0.980
44	0.021	92.31	100	0.840
45	0.154	92.31	100	0.980
46	0.043	92.31	100	0.940
47	0.154	92.31	100	0.980
48	0.043	92.31	100	0.940
49	0.043	76.92	88.89	0.780

*50	-0.026	15.38	33.33	0.300
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Appendix 4

Qualitative Analysis of Student Survey Responses—Multimedia Neuroscience Video Test

During the neuroscience block, the video clips were a useful learning tool.

Yes. Videos were useful for learning, understanding, and remembering because we could actually see and visualize clinical disorders in a realistic/ clinical context. (29)

"Makes sense to actually see conditions that we will have to diagnose." "Videos showed what symptoms looked like clinically." "I thought it was useful to see what the patients would actually look like." "Good exposure to clinical content." "No question. Seeing the examples was vastly preferable to reading about them, as it no longer seems to be possible to have real patients presented during a medical school class." "They helped put the clinical context into perspective." "Yes, they helped me better understand what the words in the text meant within a clinical setting." "The videos were very useful and allowed us to apply our knowledge to classical clinical presentation of neurological symptoms." "Good to see real life examples." "Very helpful since we couldn't really see the patients. This gave a clinical look into what real neurology is." "The clips are very educational and far more relevant than lectures." "Video clips really helped me understand different disorders in a real life context." "It was helpful to see the condition instead of just talk about it." "It was nice to be able to see examples of gait, eye movements, etc." "For the gaits, for instance, I used You Tube videos almost exclusively to learn that because it just was not enough to tell what a spastic gait looked like. I had to actually see it." "But it was helpful to hear from patients about their symptoms as they express them and even how their voice changes (as they discuss their symptoms) was very effective." "Video clips in tests and in class helped me remember disorders better than if they were simply described in words or acted out by a professor in a lecture." "Great visualization tool." "Yes. I'm a visual learner. I have to see it to get it etched in my mind." "Yes the videos helped provide a visual modality to understand the concepts covered in the course. "They were helpful in teaching the concepts. Some concepts can't be clear without seeing what it means." "Makes the material stick more when we see it in a video setting." "It was incredibly effective to watch videos of patients that have the diseases we were learning about in class. Being able to visualize the associated symptoms helped me process and learn the material." "It is helpful to see what you are learning about." "I liked the video clips; they were entertaining and helped those of us who like to visualize things." "Great way to help to remember the disease." "The video clips were helpful for the various parts of the exam, but were particularly helpful in the sections on speech, gait and eye movements." "Skills such as gait assessment cannot be tested simply using written tests." "The videos were especially helpful for the gait and speech portions."

Yes, helpful for learning with no further reason (8)

"They were essential." "I enjoyed them and felt that they were a very beneficial tool to my learning." "Videos were helpful in learning." "The video clips were a useful supplement to other materials." "I think videos are a useful learning tool, but they need to be at the appropriate quality." "They were very useful and applicable." "Very informative." "Useful."

Yes and General Positive Comments, No Reasons Given (7)

"Yes." (4) "Ok." "Agree." "Loved them."

Students would find it useful to have access to more video examples (2)

"Students need access to review videos, or suggestions of places (other than YouTube) where high quality videos can be found. Perhaps a CS or something stored at the LRC to be checked out on reserve might work." "I would have enjoyed using or having access to vetted video clips of aphasia. I believe the concepts for aphasia were clearly communicated, but examples did not properly reflect the examples used on the exam."

In the neuroscience exam, the use of video clips in the vignettes was more effective in the assessment of your knowledge than vignettes utilizing only written text?

Yes, Shows Visually How Problems Actually Present in Patients; More Clinically Relevant, Practical, Applicable (28)

"The use of video clips better portrayed the patients' conditions and gave the test a more practical feel." "More medically practical and relevant." "A picture is worth a thousand words, and a video is worth, well, a lot more." "Videos were helpful in that you had to discern the problem yourself rather than just being told what the issues were." "Very helpful in visualization of actual pathologies." "They were extremely helpful. The PPT presentations can be very wordy at times and it helps to simply see how some of the neurological conditions present in patients." "Not sure more effective in assessment is the best term to use, but they certainly are more realistic, and show the symptoms as they are." "The video clips were memorable and it is easy to remember. For instance shuffling gait after seeing it rather than having read about it." "We are certainly tested traditionally with written cases. The video exam allows us to be tested in a more real life clinical scenario that we will encounter in the future." "Though I do better at the written vignettes, in practice, we will be seeing visual manifestations of disease and it will be necessary to be able to recognize this." "The videos simulated a more real clinical experience that was incredibly effective." "Made us apply our knowledge in a more realistic, clinical setting." "I think showing real patients and getting a better feel for what we'll see in clinic is very helpful." "Seeing is believing." "It was good to actually see and hear what the vignettes talked about." "Good practice for clinical application of knowledge." "I will relate that back to the experience of shadowing a neurologist. We would read the patient's record but then we went in to see the patient clinically, that was important. The videos better reflect that patient interaction than do words." "I thought it was a direct application of what I had learned in neuroanatomy." "As he said, Is it an expectation—are we just testing rote memory, memorization, knowledge and we just regurgitate it on a test or are we actually being tested on a clinical application which I think is more important than being able to read a question and answer it. But if you can see this in a real patient and recognize it—if that if that's what we need to know then I think it is a better test (with videos)." "I agree that it depends on what kind of knowledge you are testing. As he said, Is it an expectation—are we just testing rote memory, memorization, knowledge and we just regurgitate it on a test or are we actually being tested on a clinical application which I think is more important than being able to read a question and answering it. But if you can see this in a real patient and recognize it—if that if what we need to know then I think it is a better test (with videos)." "I thought the reason why the video exam was so exciting—I was more interested in finding out how I did on the video exam because I thought it was a direct application of what I had learned in neuroanatomy." "I liked the challenge that you needed to have to look for findings." "Exactly what he said. I also liked that it is more humanizing. I know Dr. Silber a couple of times pointed out that this person has this spastic gait or whatever, but then when you actually see it you say, 'Wow that would be incredibly debilitating' and you see their face and it brings it home as to what it would be like to work with a patient like that. It's a different learning tool." "I think it was fun as well because when you go into the clinic you see these actual same things." "Yes, one of our classmates came to class and was excited because she had seen somebody with a Trendelenburg gait and she recognized it. It brings it to life." "It added helpful clues." "Video was helpful." "They were useful."

Yes, More Useful in Assessment; No Reasons Given (6)

"Yes" (2) "Ok" "Definitely." "Vignettes were more useful in assessing knowledge." "I think they should definitely be incorporated in the future."

Not More Beneficial, But Helpful, Useful, Interesting Supplement (4)

"I found them to be a helpful supplement, but not necessarily more effective." "Not more effective than written assessment, but still useful." "I thought the text from questions was very similar and the videos were supplementary." "I don't think it was necessarily more effective; it was interesting."

Useful in Assessing Different Skills/Observation, Critical Thinking (4)

"It tested the ability to clinically problem solve." "I am not sure about this. I thought that they were useful in testing a different skill, learning how to directly observe patients." "Forced more critical thinking." "It tested my ability to understand visually what we had discussed in lecture."

Yes, for Some Problems (3)

"For certain things, parkinsonism for instance, it is very helpful to have a video. However, most of clinical medicine requires interpretation of written text in a patient's chart so both are crucially important to our future success." "For things like gait or movement disorder; otherwise, written is fine." "Skills such as gait assessment cannot be tested simply using written tests."

Both Written Text and Video Necessary (3)

"I thought they were equally effective and important." "I like a combination of both, but the video clips help you visualize the issue." "I think both are necessary."

Not More Effective Than Written Assessment (3)

"The video clips, without a clear history or clinical exam information, were what I imagine to be unrealistic in diagnosing a patient's symptoms." "Perhaps, but I couldn't say with certainty that the videos are a more effective assessment." "I felt that it was no more or less beneficial."

Variable Effectiveness (2)

"Variable. Some questions had a stem that gave the answer away. Others required careful attention to the video." "Some questions could be answered without needing to view video and it was unclear in a few videos what specific symptom was being portrayed."

Uncertain which is More Effective For Assessment (1)

"I'm not certain which is a better assessment of knowledge."

Reinforced Classroom Instruction (1)

"Yes, the videos reinforced concepts discussed in class."

More enjoyable (1)

"I also thought that this is a more enjoyable exam. I could have done a hundred more questions on it."

In this test, were the video clips representative of conditions that you had encountered during the neuroscience block?

Yes: 45 students No: 2 students

"Yes, Representative." (22) "Yes." (6) "Yep". "Ok." "Definitely." "They were." "They did." "They were representative." "The clips were representative of clinical scenarios we saw in class." "Yes it seemed like care was also taken to choose clips in which the histories were relatively straightforward and clear so that we didn't have to spend too much test-taking time sifting through a messy history." "All conditions presented were fair." "Yes, we have talked about and seen some of these conditions." "For the most part, yes." "There was a fair representation of material covered." "Yes, we seemed to see a fair number of conditions that we were exposed to throughout the course of the course." "Good videos. content was clear." "Some of the clips had already been shown during lecture."

Yes, Except for Syncope, Spells, Speech, and Seizures (8)

"Some representations of 'spells' and speech were not representative of

the examples we saw in class." "We did not cover identification of seizures, their pathophysiology, and treatments in enough detail to answer a majority of the seizure questions." "Except for the syncope question the clip looked like a seizure, it was not clear." "Most of the situations were encountered, but a video on syncope was not very clear." "We had not previously seen an episode of syncope." "Some of the conditions we had not specifically covered (i.e. syncope)." "Except for syncope." "Mostly, the interview with Dr. Smith and the syncope clip were the only off ones." "As we discussed earlier, while most of the conditions were well-covered in the block, the syncope question was confusing."

It would have been helpful to have more faculty selected video examples (3)

"I think that's true. To really test this kind of knowledge we have to have been exposed to lots of different videos or even real patients. That way you've seen lots of different kinds so if there is one you've not seen before you are familiar enough with different examples of that condition (absence seizure) that you can pick it out easily." "...if you want to assess knowledge rather than have students memorize a patient that they have seen, a different example should be used in testing. So you can assess knowledge—not familiarity." "Also, it would be helpful to see plenty of examples of videos of a given condition during the block so we can appreciate the spectrum of findings with a given condition. For example, the patient with chorea on the test seemed quite a bit different than the example in class."

What were the advantages of the use of video clips in this test?

Videos assessed applied knowledge of observation and history taking because they showed clinical disorders in a realistic manner. (14)

"Practical application of knowledge/" "More realistic and practical way to approach patient assessment." "It is a closer representation to actual clinical evaluation." "Very realistic." "Using history taking skills to sort through information given in the videos rather than having obvious written cues handed to us in a written vignette." "I thought that it better to learn how to observe patients, but I thought that some of the views could have been improved." "Seeing patients even through video clips was more clinically relevant than a written text." "To see it as if we were in clinic assessing a patient." "Very accurate representation of clinical phenomena." "Great to see how certain diseases/conditions will present in clinic." "Clinical relevance." "It tested our knowledge on how patients would present." "Reality helps understand observation of scenarios rather than rote memorization of buzz words like pill rolling tremor." "...I think it is more relevant. I like that part of it."

Provided for additional information, beyond text. Helped in learning. (14)

"Gave you a better feel as to what they were describing in the vignettes." "For gait and movement problems that are hard to describe in words." "There are times where I get lost in the text of the questions, but when I simply SEE the presentation it helps me to make the diagnosis." "They made it easy to remember different gaits and their associated pathology." "Great learning tool." "Convey a lot of content without a lot of writing/ words." "Forced more critical thinking." "Videos enabled us to see the things that were described in class." "Helped me visual[ize] the gaits much better." "Fun." "Seeing what we'll see in the clinic." "Visual learners." "I liked it because it makes you tie everything together. It is a test of your ability to synthesize rather than memorize. I think most students like that more than just "spitting back" information." "You can say, okay, I have learned enough that I can understand what the basis is and how to diagnose it and that is why it was a good test as well. I think it would be a good way to test the integration of what we have learned because we have the actual clinical setting."

What were the disadvantages of the use of video clips in this test?

Poor Quality: Volume; Quality of Exam; Length and Repetition of Videos (11)

"Poor quality in some instances; lack of familiarity with what constitutes an acceptable reflex (e.g. absent/present) and whether or not the examiner is actually proficient."

"Variable volume." "Subtle changes are especially hard to appreciate on a video because of the loss of the three dimensional aspects—also if the examiner is not good at demonstrating the finding." "The variation in volume of the videos. Some were too loud or too quiet. This was annoying." "Takes longer, and all of the technical difficulties that come along with AV requirements." "...the video link for each pair of questions so we did not have to go back to find it with the first question. I also was concerned at first that the sizing of the window for the video would be a problem, but this was easily adjusted." "Some limitation in determining weakness during the one video with strength exam. It's hard to ascertain weakness differences left vs. right without actually performing the exam yourself." "...the examiner may have a patient with myasthenia gravis and all he is concerned about is demonstration of some finding like fatigueability testing weakness and if the examiner goes quickly through the reflex testing, already knowing that is not the issue of importance, and then does not comment on it, and you are going into the case and do not know the patient (diagnosis) you (the student) want to pay equal attention to the entire video." "In the case when it is the same portion of the exam repeated over and over then it serves no purpose". "You Tube. Some of the gaits (on the test) I found to be kind of irritating because I could not look at them and say, 'Oh yeh, that's what it is' because we had a pretty quick overview of gait (during class time). Besides that, the eye questions were kind of difficult—that had more to do with the quality because you really could not see the pupillary response because of the shadow of the person doing the testing." "Also, the ataxic gait video lasted a minute and a half. She walked back and forth over and over. I was sitting and watching the video wondering if there was going to be something else. "Yes, sometimes there was extraneous material in the video that was not another part of the patient's exam. Are they going to do anything else?"

Takes Longer to Respond to Questions/Take Test (6)

"Takes longer, and all of the technical difficulties that come along with AV requirements." "There was ample time to take this test; for future video tests, it would be good to ensure adequate time just like we had so that students don't feel rushed and are able to watch videos over again." "Takes more time to go through each question." "Takes longer to watch the video than read a synopsis, especially for some of the straight forward questions." "Some clips were a little long made the test pretty long." "The use of videos lengthens the time that it takes to complete a test."

Some conditions not amenable to video demonstration or difficult to demonstrate(4)

"Not all neurological conditions are amenable to this format." "Some of the videos are narrated by the examiner—like the examiner might say, 'As you can see the reflexes were absent. Other times it's not clear if a reflex is normal or not and nothing is said—so I wonder, 'Is that normal or not normal?' "I mean the reflexes are the ones that really were tough to decide whether that is a normal reflex or mildly increased." "Sometimes additional background would have been helpful to aid visual observations on videos."

None (2)

"None."

Students did not have access to review video clips for study (2)

"We did not have access to clips to study from." "We did not have the ability to really practice with videos. We only got one session showing us different gaits."

Some Conditions Not Covered in Class (8)

"As we discussed earlier, while most of the conditions were well-covered in the block, the syncope question was confusing. I really wasn't sure—I just thought syncope was just passing out and regaining consciousness quickly. It was interesting from a learning point, I guess, that it is not so simple." "...only a brief mention of syncope in class and we did not have a video example of syncope." "The only video clip that I thought was misleading was the syncope clip." "We did not have much experience with this condition, so when I saw the clip, it did not even occur to me to consider syncope." " "The gaits, for instance, the spastic gait and the steppage gaits, for me we saw those once briefly, so I did

not have a reference to this. I did look them up on You Tube but the gait is inconsistent on..." "To an extent, however in the gait lecture with the video clips, Dr. Adams provided a false sense of security by pointing out the pertinent parts of the videos as hints without identifying ourselves without assistance." We had not covered some of the specific conditions." "Loop the eye videos Label videos that are repeated"

Would it be useful to use video clips in other tests of medical knowledge?

Yes: 44 No: 3

Yes; No Reasons Given (8): "Yes." (7)

"Please!"

Yes, Depending on subject, exactly what is tested, what is presented in video (24)

"Videos can be readily used for medical histories. For instance, the question with a history of migraine headaches was really good. Listening to a patient's own story is really important. This opens up the opportunity to use videos in many situations." "I do think it is subject dependent. I think in psychiatry it would be great to see videos of an interview and to assess what you can pull out of the history or physical exam." "I agree with the history part. It tests whether you can pull out the things in the history that are relevant." "More practical." "It depends on the subject material." "Only if particular patient exhibited typical presentation of symptom in question." "If they are relevant." "Whenever the patient presentation is better to watch than to listen about, it will be great to have videos." "If applicable." "For exams that are testing symptoms that we need to see to diagnose, video clips are very helpful." "But it depends on the type of medical knowledge. It's useful for showing physical exam findings." "Anytime there is a clinical correlation, it is helpful to see real patients and start correlating the clinical picture to appropriate diagnoses." "The use of video used in this course was very effective. Not the only method of testing but a nice adjunct." "I would support the use of videos in testing in other disciplines. For example, in pulmonary one could have lung sounds, in cardiovascular one could have echocardiograms or angiograms." "Or in anatomy, like showing a winged scapula." "Then there might even be other oddball opportunities for videos. For instance, in microbiology they have buzz words like, "the tumbling leaf motility" which means nothing but if you see a little video of the phenomena it would be useful." "I take a little different view. I definitely think that there is a lot of value to the videos but at the same time but you can still get a lot out of the information in a written vignette. You might be able to get just as much out of a paragraph describing the history as watching a five minute video. But there are definitely a lot of things you get out of a history provided by a patient in a video that you do not get from reading a vignette." "Perhaps the format would be great for a tele neurology course!" "Sure. You could include a video of asterixis to cover hepatic encephalopathy in the GI block (or neuro), or perhaps look at the falling leaf motility of certain microorganisms (again to see if students know how to memorize the key words or actually understand the concept)." "Would be useful especially in clinical blocks or in applied anatomy (eg:nerve palsies)." "Sure. Maybe in psychiatry." "I can see it working for anatomy and microbiology." "If Step 1 uses videos for different topics, then yes." "Maybe? I am not sure what classes you would use them in."

Yes: Assesses Application of Clinical Knowledge (14)

"It's helpful for application of knowledge to clinical situations." "I like this format because of its applicability to clinical settings." "It is more applicable and more closely approximates what we may see in the clinic." "Yes, I think video clips provide a more realistic measurement of clinical knowledge and skills." "The videos with audio allow us to be tested in a manner in which we will use the skills and knowledge learned to diagnose real patients disorders and can give us a faster insight in less time." "Good way to see clinical scenarios." "As I mentioned above, it is necessary to be able to do this when practicing medicine." "I think it would be useful to be tested beyond just text, as the practice of medicine requires more than just text vignettes." "Video clips simulate a more real clinical experience that helps translate the didactic material to a real patient experience. The best learning takes place with an actual patient, but because that is infeasible, a video clip of a patient is better than a written description." "Makes sense. Represents what we will see clinically." "Anytime we can see physical exam components on our written exams is beneficial." "Video is a closer correlation to clinic situations than just a paragraph of text." "Evaluation video clips is more like

what we will actually be doing in the clinic." "I believe so, but this format is (in my opinion) too video intensive."
"Yes, with the understanding that during didactics there will be similar videos presented in class by the instructors."

Yes, Helpful for Learning (7)

"It would be helpful to see videos of patient exams to help us become familiar with the appearance of abnormal physical exam findings." "Seeing a video of a particular condition better prepares us for diagnosing and understanding the disorder in the clinic."

"It is a good learning tool." "They will be great for visual learners." "Video clips are a supplement to other learning materials are a helpful aid (I was not able to answer yes without ISES throwing an error message at me)." "I like learning from a clinically based scenario. Learning how to identify key words works well for tests but in real life on the wards you have to be able to identify what these issues look like in real patients."

"Tests clinical observation skills as well as acquiring potential differential diagnoses from a history."

How did you prepare for the test with video clips?

Prepared as usual for a test (no mention of use of videos) (9)

"Nothing special. I prepared in general for the neuro final with no particular prep for the video portion." "like I normally would for a test." "I didn't. I just studied in general."

"The same way I prepared for the written exam." "Regular study" "I reviewed the pathology associated with each gait and that helped consolidate the information." "Reviewed lectures." "Same" "Classwork. I have found YouTube videos to be misrepresentative at times. If the course is to have video based assessment as a part of the course, videos should be made available to the students' viewing/preparation."

Prepared by watching YouTube videos (6)

"Watched YouTube Videos" "Obviously Youtube." "Nothing crazy except that I did look at Youtube videos as I was studying throughout the course so that I could see what some of these neuro exams/gaits/etc. looked like."

"Youtube." "I watched videos on Youtube." "Viewed videos on You Tube and Google"

Prepared by reviewing lecture notes, PowerPoint slides, and videos (7)

"Reviewed lecture notes, watched videos at <http://www.youtube.com/user/onlinemedicalvideo>, and reviewed lecture recordings which contained some of the videos shown in class." "Reviewing the contents for the course and watch some videos." "Studied powerpoints and watched videos online." "I looked at the videos that were shown to us in class."

"Watched you tube videos of conditions and paid attention in class. Reviewed notes/ PowerPoint slides" "I prepared by reading material for the course and taking the video quiz." "Watched the videos in class and in small group. Also took the video self assessment quiz."

Mimicked clinical findings (2)

Played charades with classmates w/ movement disorder themes." "Mimicked certain findings (gait disorders)"

Miscellaneous

"n/a" "I didn't"

"I'm not sure yet."

Did your preparation for a test with video clips differ from your usual preparation?

Yes: 11 No: 35 N/A: 1

No (12)

Did not prepare differently/prepared for final examination (15)

(Subtheme in many comments: Videos from class were not available for review.)

"It did not differ." "We had no access to the videos used in class and I did not take the time to go on Youtube to find examples because I was not sure how representative they would be." "Nope" "I honestly did not know how to

prepare for this test, as no material with videos was available. I instead prepared for the final exam and hoped that this would go OK." "No difference." "No" (2) "In retrospect, it should have." "No change in preparation needed." "Same preparation" "I didn't know what to expect so I didn't particularly prepare for the video exam I just prepared for the final exam." "The video clips did not alter my studying that much." "Preparation was similar" "I was preparing for the final during the same period of time." "I never utilize Youtube."

Yes. Watched videos (YouTube) (8)

"I don't usually watch YouTube videos in preparation for tests." "I tried to watch videos, whereas I usually never do that." "I just studied the written material as usual, although I did watch a few YouTube clips to prepare for the video exam. Our standardized patient exams also helped in associating neurological symptoms with a video rather than a written vignette." "Youtube" "I watched videos." "I watched videos of various conditions on youtube." "Spent a lot more time on youtube." "I usually wouldn't watch video clips to prepare for a written test."

Miscellaneous (3)

"But very helpful" "Definitely" "I was less interested in buzz words and more interested in truly identifying a patient with Parkinsons, Myopathy, etc."

Comments:

Videos helped me to learn about clinical features of disorders (3)

"I enjoyed the clips and I feel that they prepared me a lot more for what I will see in the clinic." "The video exam was a fairly good way help us learn the features of the diseases we were learning about." "I liked the test. I think it was a good evaluation of what we learned in the class and was very applicable to our future clinical experiences."

It would be helpful to have more access to videos. (3)

"Need to have more access to these videos for practice." "It would be wonderful if a site could be set up (maybe in blackboard) where it is possible to watch examples of clinical phenomena that we discussed during the block. While it is possible to go to YouTube, the accuracy of the videos is sometimes questionable, and there could be multiple symptoms presented when a student is trying to learn them in isolation." "Please secure IRB approval and make the videos available for students for review in their spare time. Or produce new videos. Thanks"

Miscellaneous/Positive Comments (4)

"Ok" "Interesting concept!" "It was a good experience." "Good tests."

CURRICULUM VITAE

Jerry W. Swanson, M.D.

PRESENT ACADEMIC RANK AND POSITIONS

Professor of Neurology, Mayo Clinic College of Medicine
Consultant in Neurology at Mayo Clinic, Rochester, Minnesota
Director for Program Evaluation, Mayo Medical School

EDUCATION

College: Wartburg College
B.A., Chemistry and Philosophy, 1973
Magna cum laude

Medical School: Northwestern University Medical School
M.D., 1977

Residency: Mayo Clinic
Neurology residency, completed 1982

Fellowship: EEG, completed during residency

Postgraduate: University of Illinois College of Medicine at Chicago
Master of Health Professions Education
(expected December 2015)

BOARD CERTIFICATION

1978 National Board of Medical Examiners

1981 American Board of EEG Qualification, Inc.

1984 Diplomate of American Board of Neurology and Psychiatry
(Voluntary Recertification 2012)

2006 Headache Medicine (United Council for Neurologic Subspecialties)

MEDICAL LICENSURE

Minnesota (Reg. No. 24124)
Arizona (Reg. No. 18480)
Florida-Inactive (Reg. No. 52149)

HONORS/AWARDS

America's Top Doctors®	1999-
Who's Who in the World	2001-
Who's Who in America	2002-
Who's Who in American Education	2006-
Mayo Medical School Faculty Service Award	2001
Gamson Lecturer, Evanston-Northwestern Healthcare	2007
Listed in America's Top Doctors for Women (Women's Health Magazine in conjunction with Castle Connolly, based on peer selection process)	2008
Mayo Medical School Dean's Recognition Award for Outstanding Contributions to Undergraduate Medical Education	2011
Wartburg College Alumni Citation	2015

PREVIOUS PROFESSIONAL POSITIONS AND MAJOR APPOINTMENTS

Instructor of Neurology, Mayo Medical School, 1982-1986
 Assistant Professor of Neurology, Mayo Medical School, 1986-1992
 Associate Professor of Neurology, Mayo Medical School, 1992-2002
 Vice-Chair for Education, Department of Neurology, Mayo Clinic 1996-1998
 Chair, Headache Division, Department of Neurology, Mayo Foundation 1998-2008
 Chair, Headache Section of Neurology, Mayo Clinic, Rochester 1998-2008
 Headache Medicine Fellowship Program Director, Mayo Clinic, Rochester 1998-2008

PROFESSIONAL MEMBERSHIPS AND SOCIETIES

<u>American Academy of Neurology</u>	1980
*Fellow	1989-
Undergraduate Education Subcommittee	1989-1994
A. B. Baker Section of Neurologic Education	1991- 2000
Councilor	
Chair-Elect A. B. Baker Section	2000-2002
Chair A. B. Baker Section of Neurologic Education	2002-2004
Past-Chair A.B. Baker Section	2004-2006
AAN Annual Meeting Scientific Program	1993- 1996, 2002-2003
Subcommittee	
Scientific Program Abstract Reviewer	1993-1999, 2005, 2006
Section on Headache and Facial Pain	1996-
Chair, Headache and Facial Pain Section Practice	2005-2011

Work Group	
Education Committee	2002-2004
<u>American College of Physicians</u>	1993-
*Fellow	1997-
<u>Institute for Clinical Systems Improvement</u>	1999-
Headache Guideline Committee	
American Medical Association	1987-2005
Minnesota Medical Association	1987-
<u>Minnesota Society for Neurological Sciences</u>	1995-
President	1999
* <u>American Neurological Association</u>	1996-
Member, History of the Association Committee	1997-1999
<u>Zumbro Valley Medical Society</u>	1987-
<u>Sigma Xi</u>	1983-
<u>American Headache Society</u>	1989-
Undergraduate Medical Education Committee	1996-1997
Member, Review Board for Grants and Awards	1998-2008
Annual Scientific Program Co-Chair	1999-2008
Member, Education Committee	1999-2008
Member, Board of Directors	1999-2001
* <u>American Academy of Orofacial Pain</u>	1991- 2000
White paper ("Guidelines") Committee	1992
<u>American Board of Psychiatry and Neurology</u>	
Examiner (Part II—Oral Examination)	1985-
Senior Examiner (Part II—Oral Examination)	1999-
Member, Part I ABPN (Neurology) Test Writing Committee	1999-2005
*Central Society for Neurologic Research	1992-
<u>National Board of Medical Examiners</u>	
Member, Medicine Test Committee	1993-1996
Member, United States Medical Licensing Examination Step 2 Test Material Development Committee for Medicine	1993-1996
Member, Clinical Neurology Task Force	1996- 1999
Member, United States Medical Licensing Examination Step 1 Introduction to Clinical Diagnosis Task Force	1999- 2000
Member, Step 1 Interdisciplinary Committee	2000-2010
<u>International Headache Society</u>	1995-
International Headache Congress Scientific Program	2001

Committee Member, Headache Classification Working Group on Headache attributed to non-vascular, non- infectious intracranial disorders	2002
<u>United Council for Neurologic Specialties</u> Member, Headache Medicine Examination Writing Committee	2005-2009

* Elected membership

EDUCATIONAL ACTIVITIES

Mayo Medical School

Mayo Medical School First Year Neuroscience Course Faculty Member
(1986-1992)
Mayo Medical School First Year Neuroscience Course Chairman (1988-1991)
Mayo Medical School First Year Curriculum Committee (1989-1990)
Annual Presentation to MMS III Students on coma, cerebrovascular disease, and
headache (1982-1988)
Mayo Medical School Task Force on Clinical Experience (1991)
Primary Medical Student Advisor (1991-1994)
Preceptor for MMS II Clinical Skills Acquisition Course (1994)
Organ System Course Committee Member (1992-2000)
Mayo Medical School Admissions Committee (1997- 2000)
Mayo Medical School Core Faculty Task Force (1998)
Leader for improvement of quality of MMS multiple choice test questions and
introduction of computer-based testing (2004-2006)

Mayo M.D.-Ph.D. Program Committee

member (2001-)

Mayo Graduate School of Medicine

Annual Neurology Resident Lecture on Demyelinating Disease (1986-1989)
Update in MS. Presented to Mayo Clinic Ophthalmology residents, December 29,
1987.
Annual Neurology Resident Lecture on the Approach to Headache Diagnosis and
Management of Migraine (1990-2002)
Annual Neurology Resident Lecture on Cluster Headaches and Cranial Neuralgias
(1992-2002)
Annual Internal Medicine Resident Lectures on Headache (2 per year) (1993-
1999)

Department of Internal Medicine Grand Rounds

1. Update on Migraine Headaches. Presented at Department of Internal
Medicine Grand Rounds, December 5, 1990 (with J. Keith Campbell)
2. Migraine Management at the End of the Millennium. Presented at
Department of Internal Medicine Grand Rounds, May 12, 1999. (with JD
Bartleson and WN Folger)

Mayo School of Health Sciences

Student Interim Program Preceptor (1984-1986)

Mayo School of Continuous Professional Development

Neurology in Clinical Practice, Lake Geneva, Wisconsin, February 1987.

Courses:

- Neurologic Emergencies
- Management of Fits and Faints
- Headache: Approach to Management
- Multiple Sclerosis: An Update and Practical Management

Practical Treatment of MS. Presented at Mayo Clinical Reviews, October 27 and November 9, 1987.

Neurology in Clinical Practice, Kauai, Hawaii, March 1988.

Courses:

- Common Neurological Problems in Pregnancy
- Headache Problems - Approach and Evaluation
- Management of Migraine Headaches
- Evaluation of Fits and Faints (workshop - 2 sessions)
- Multiple Sclerosis - Practical Management

Multiple Sclerosis Overview. Presented at Mayo Dental Reviews, March 18 and 25, 1988.

Headache Problems: Approach and Evaluation. Presented at Mayo Clinical Reviews, November 2 and 16, 1988.

Neurology in Clinical Practice, Cable, Wisconsin, March 1989.

Courses:

- Multiple Sclerosis - Practical Management
- Vascular Headache - Approach to Management
- Evaluation of Fits and Faints
- Treatment of Status Epilepticus

The Diagnosis and Management of Complex TMJ - Headache and Chronic Pain Disorders. Presented at Mayo Dental Reviews, March 31 and April 7, 1989

Neurology in Clinical Practice, Kauai, Hawaii, February 1990.

Courses:

- Headache Problems - Approach to Diagnosis
- Management of Migraine
- Selected Problems in Pain Management
- Multiple Sclerosis - Diagnosis and Management of Acute Exacerbations
- Management of Status Epilepticus

Neurology in Clinical Practice, Cable, Wisconsin, March 1991.

Courses:

- Headache: Is it Serious?
- Multiple Sclerosis: Practical Tips and Investigational Treatments
- Migraine

Neurology in Clinical Practice, Captiva Island, Florida, March 1992.

Courses:

Cranial Neuralgias
Chronic Daily Headache
Migraine

Neurology in Clinical Practice, Alexandria, Minnesota, February 1993.

Courses:

Managing Chronic Daily Headache
Diagnosis and Treatment of Migraine
Face Pain--Neuralgia or Not?

What's New in Migraine Headache Management. Presented at Mayo Clinical Reviews, October 26 and November 9, 1993.

Neurology in Clinical Practice, Keystone, Colorado, February 1994.

Managing Chronic Daily Headache
Diagnosis and Treatment of Migraine
Face Pain--Neuralgia or Not?

Sumatriptan: A New Agent for the Treatment Of Acute Migraine Attacks. Presented at Mayo Clinic, Practice of Internal Medicine, May 12, 1994

Course Director of the J. Keith Campbell Headache Symposium September 1999

Headaches. Presented at the 15th Biannual Course on Rhinology and Rhinoplastic Surgery sponsored by the Department of Otorhinolaryngology Rochester October 1999

Headaches in the Emergency Department. Presented at the Mayo Headache Course Scottsdale, AZ in March 2000

An Update in Migraine Presented at Mayo Dental Reviews, March 23, 2001.

Headaches. Presented at Assessment and Management of Pain in Clinical Practice sponsored by the Department of Psychiatry and Psychology Rochester October 12, 2001

Thunderclap Headache. Presented at Mayo Headache Course Sedona, AZ in February 2002

Perspectives in Women's Health: Migraine in Women. Presented at Mayo Clinic, Rochester, MN on May 9, 2003

Who Needs a Brain Scan? Presented at Mayo Clinic Neurology in Clinical Practice, Whistler, BC, July 2003

Is it Migraine or Something Else? Presented at Mayo Clinic Neurology in Clinical Practice, Whistler, BC, July 2003

Options for the Acute Treatment of Migraine. Presented at Mayo Clinic Neurology in Clinical Practice, Whistler, BC, July 2003

Prophylactic Management of Migraine. Presented at Mayo Clinic Neurology in Clinical Practice, Whistler, BC, July 2003

Migraine in Women. Presented at the Internal Medicine Outreach Conference at Rochester Methodist Hospital, March 19, 2004

Migraine Headaches in Women. Presented at the Mayo Obstetrics and Gynecology conference at Mayo Clinic, May 3, 2004

Who Needs a Brain Scan? Presented at Mayo Clinic Neurology in Clinical Practice, Hawaii January 2005

Is it Migraine or Something Else? Presented at Mayo Clinic Neurology in Clinical Practice, Hawaii January 2005

Options for the Acute Treatment of Migraine. Presented at Mayo Clinic Neurology in Clinical Practice, Hawaii January 2005

Prophylactic Management of Migraine. Presented at Mayo Clinic Neurology in Clinical Practice, Hawaii January 2005

Headache in the Emergency Department: Diagnosis and Management. Presented at Mayo Clinic Headache Symposium at Scottsdale, AZ, April 2, 2004.

Important Principles of Migraine Treatment. Presented at Mayo Clinic Practice of Internal Medicine at Rochester, MN, May 5, 2005

Important Principles of Migraine Management: FAQs. Presented at Mayo Clinic Practice of Internal Medicine at Rochester, MN, May 4, 2006

Why You Should Consider an Alternative Diagnosis in the Patient with 'Sinus' Headaches. Presented at ENT for the Primary Care Provider at Rochester, MN, May 12, 2006.

Co-Director of Mayo Headache Symposium, Chicago, Illinois, April 13-15, 2007. Presentations: Tension-Type Headache, Idiopathic Intracranial Hypertension, Headaches in the Elderly

Headache. Presented at Pain Management: A state-of-the-art Course in Pain Management for the Non-Pain Specialist, March 6, 2008, Marco Island, Florida.

Migraine treatment: acute and prophylactic options. Presented at Mayo Clinic Practical Clinical Neurology Review, November 1, 2008, Disney World.

Headache in the elderly. Presented at Mayo Clinic Practical Clinical Neurology Review, November 1, 2008, Disney World.

Headache. Presented at 3rd Annual Pain Management: A state-of-the-art Course in Pain Management for the Non-Pain Specialist, March 7, 2009, Marco Island, Florida.

Co-Director of Mayo Headache Symposium, Chicago, Illinois, April 3-5, 2009. Presentations: Tension-Type Headache, Idiopathic Intracranial Hypertension, Headaches in the Elderly

Headache. Presented at 4th Annual Pain Management: A state-of-the-Art Course in Pain Management for the Non-Pain Specialist, March 7, 2009, Marco Island, Florida..

Migraine headache. Presented at 5th Annual Pain Management: a state-of-the-art Course in Pain Management for the Non-Pain Specialist, March 4, 2011, Kauai, Hawaii

Headaches in the Elderly. Presented at 5th Annual Pain Management: a state-of-the-art Course in Pain Management for the Non-Pain Specialist, March 4, 2011, Kauai, Hawaii

Co-Director of Mayo Headache Symposium, Chicago, Illinois, April 29-May 1, 2011. Presentations: Tension-Type Headache, Idiopathic Intracranial Hypertension, Headaches in the Elderly

Migraine headache. Presented at 6th Annual Pain Management: a state-of-the-art Course in Pain Management for the Non-Pain Specialist, March 9, 2012, Marco Island, FL

Why You Should Consider an Alternative Diagnosis in the Patient with 'Sinus' Headaches. Presented at ENT for the Primary Care Provider, May 18, 2012 at Rochester, Minnesota

Peer Reviewer

Mayo Clinic Proceedings (1983-)
Neurology (1989-)
Journal of Craniomandibular Disorders: Oral and Facial Pain (1989-)
Archives of Internal Medicine (1991-)
Headache (1991-)
Clinical Journal of Pain (1992-)
Annals of Neurology (1997-)
Cephalalgia (2002-)
Medical Science Monitor (2003-)
American Family Physician (2005-)

Editorial Responsibilities

Headache Book Review Editor (1993-2001)
Current Neurology and Neuroscience Reports, Headache Section Editor (2003-2008)
Headache Currents, contributing editor (2004-2014)
Headache (editorial board and CME editor (2005-2008)
Seminars in Neurology, editorial board (2006-2014)
Headache, Associate Editor (2014-)

INSTITUTIONAL/DEPARTMENTAL AND DIVISION ADMINISTRATIVE RESPONSIBILITIES, COMMITTEE MEMBERSHIPS, AND OTHER ACTIVITIES

Mayo Clinic

Gamma Knife Working group (1988-1989)
Mayo Alumnus Advisory Board (1990-1991)
 Headache Disease Management Strategy Development Team (1994-1995)
 Higher Learning Commission Steering Committee (2008-2009)
 Education Finance Committee (2009-)

Department of Neurology

Department of Neurology Clinical Practice Committee (1983-85)
 Department of Neurology Resident Selection Committee (1982-1989)
 Co-organizer of Departmental Neuropathology Conferences (1985-86)
 Friday Neurology Clinical Conference Coordinator (1985-1988)
 Department of Neurology Paramedical Education Committee (1982-85)
 Department of Neurology Resident Assessment Committee (1982-1986)
 Department of Neurology Curriculum Committee (1989 - 1995),
 Chair (1993-1995)
 Department of Neurology Postgraduate Education Subcommittee (1987-1988)
 Chair, Ad Hoc Planning Committee for 75th Anniversary, Department of Neurology,
 Mayo Clinic (September 1988)
 Ad Hoc Committee for development of a Mayo Neurology National Residency
 (1990)
 Department of Neurology Resident Recruitment Committee (1991-1992, 1995-)
 Department of Neurology Consultation Appointment System Task Force (1992)
 Adult General Neurology Group Liaison (1991-1994)
 Visiting Clinician Liaison for Neurology (1992-1996)
 Cerebrovascular Division (1982-2000)
 Chair, Department of Neurology Headache Subspecialty Group (1994-1997)
 Chair, Department of Neurology Headache Division (1997-2008)
 Department of Neurology Council (1995-1997)
 Department of Neurology Hospital Practice Committee (1996-1998)
 Department of Neurology Education Chair (1996-1998)
 Department of Neurology Residency Program Director (1996-1998)
 Head of a Clinical Section of Neurology (1999-2002)
 Ad Hoc Advisory Committee on Clinical Operations (2001-2002)
 Chair of Headache Section, Rochester (2002-2008)
 Department of Neurology Scholarship Leadership Committee (2002-2003)
 Department of Neurology Academic Promotions Committee (2004-)

Mayo School of Graduate Medical Education

Mayo Graduate School of Medicine Medical and Laboratory Specialties Committee
 (1996-1998)
 Chair, Mayo Graduate School of Medicine Practice Management Curriculum
 Committee (1999-2002)

Mayo Medical School

Assistant Dean for Assessment and Evaluation (2006-2013)
 Executive Committee (2006-)
 Academic Affairs Executive Committee (2013-)
 Curriculum Committee (2006-2009)
 Basic Science Curriculum Theme Committee (2006-)
 Clinical Experiences Theme Committee (2007-2013)
 Block Leader committee (2010-2013)
 Finance Committee (2009-2012)
 Mayo Medical School LCME Self-study Task Force Chair (2009-2011)

Mayo Clinic College of Medicine

Finance Committee (2009-)
 Education Committee (2012-2013)

PRESENTATIONS AT NATIONAL MEETINGS

1. Basilar artery migraine: ten cases with an attack captured by EEG. Presented at AAN 29th Annual Meeting in Atlanta, Georgia, 1977.
2. A migrainous syndrome with CSF pleocytosis. Presented at the AAN 32nd Annual Meeting in New Orleans, Louisiana, 1980.
- *3. History and examination in headaches. Presented at the Head and Face Pain Symposium sponsored by Mayo Clinic and American Academy of Craniomandibular Disorders, in Rochester, Minnesota, October 10-11, 1986.
- *4. Resources for teaching neurology: education colloquium; trends in medical education - implications for teachers of neurology; education of the medical student in neurology. Presented at the AAN 42nd Annual Meeting in Miami Beach, Florida, May 1, 1990.
- *5. Teaching Neuroscience: a case-based small group discussion approach: educational colloquium avoiding neurophobia, the fear of neurology, in medical students. Presented at the AAN 43rd Annual Meeting in Boston, Massachusetts, April 22, 1991.
6. Problem-based preclinical neuroscience curricula (seminar) with Bleck TP, Smith MC at AAN 44th Annual Meeting in San Diego, CA, May 1992.
7. Moderator for a scientific session at the 34th Annual Scientific Meeting of the American Association for the Study of Headache, Toronto, Canada, June 27, 1992.
8. Headaches in the Emergency Room. Presented at the AAN 45th Annual Meeting, New York City, New York, April 25, 1993. (faculty member)
9. Audiovisual Resources for Teaching Neurology to Medical Students and Residents. Presented at the AAN 45th Annual Meeting, New York City, New York, April 30, 1993. (faculty member)

10. Moderator for a scientific session at the 35th Annual Scientific Meeting of the American Association for the Study of Headache, San Francisco, California, June 25, 1993.
11. Incidence of migraine and cluster headaches in Olmsted County, Minnesota: 1979-1981. Presented at the meeting of the Central Society for Neurologic Research, October 8-10, 1993.
12. The Use of an Objective Standardized Clinical Examination in a Neurology Residency (poster). Presented at the AAN 46th Annual Meeting, Washington, DC, May 3, 1994.
13. Headaches in the Emergency Room. Presented at the AAN 46th Annual Meeting, Washington, DC, May 7, 1994. (faculty member).
- *14. Cranial Nerve and Cervical Screening Examination. Presented at AAOP 20th Annual Scientific Meeting, Orlando FL, February 1995.
15. Headaches in the Emergency Room. Presented at the AAN 47th Annual Meeting, Seattle, WA, May 1995.
16. Moderator for a scientific session at the 37th Annual Scientific Meeting of the American Association for the Study of Headache, Boston, MA, June 1995.
17. Headache Diagnosis and Treatment in the Emergency Department. Presented at the AAN 48th Annual Meeting, San Francisco, CA, March 1996.
- *18. Treatment of Headaches in the ER. Presented at The November Scottsdale Headache Symposium. Scottsdale, AZ, November 1996.
- *19. Summary and Clinical Correlation. Presented at the American Academy of Orofacial Pain annual meeting, San Diego, CA, February 1997.
- *20. How to Perform a Cranial Nerve Exam. Presented at the American Academy of Orofacial Pain annual meeting, San Diego, CA, February 1997.
- *21. Headaches in the Emergency Department. Presented at the 49th Annual Meeting of the American Academy of Neurology, Boston, MA, April 1997.
22. The neurology residency: is the curriculum meeting the demands of clinical practice? Presented at the Education Colloquium at the 49th Annual Meeting of the American Academy of Neurology, Boston, MA, April 14, 1997.
- *23. Secondary Headache: "Difficult Diagnoses". Presented at the Scottsdale Headache Symposium, Scottsdale, AZ, November 1997.
- *24. Headaches in the ER. Presented at the Scottsdale Headache Symposium, Scottsdale, AZ, November 1997.
25. Headaches in the Emergency Department. Presented at the 50th Annual Meeting of the American Academy of Neurology, Minneapolis, MN, May 1998.

- *26. Headaches in the Emergency Department. Presented at the Scottsdale Headache Symposium of the AHS, Scottsdale, AZ, November 1998
- *27. Migraine and other headaches. Presented at Symposium on Emerging Issues in Employee Health at Mayo Clinic, Rochester, MN, April 22, 1999.
- 28. Headaches in the Emergency Department. Presented at the 51st Annual Meeting of the American Academy of Neurology, Toronto, Canada, April 1999.
- *29. Worrisome Headaches. Presented at the University of California San Francisco Headache Preceptorship, San Francisco, June 1999.
- *30. Prophylactic Treatment of Migraine. Presented at the University of San Francisco Headache Preceptorship, San Francisco, June 2000
- *31. Neurology in the 1960s. Part of the 125th Anniversary of the American Neurological Association History Exhibit, Boston, Massachusetts, October 2000.
- *32. Globalization of CME-The Internet as the First Step. Presented to the ACCME with John Parker, Gordon Matheson, Tamara Kary-Erickson Chicago, November 10, 2000.
- *33. Case presentations at didactic session. Presented at Headache Now 2002! (American Headache Society) Bal Harbour, Florida, January 19, 2002
- *34. Epidemiology and Impact of Headache. Presented at the Scottsdale Headache Symposium of AHS, Scottsdale, AZ, November 15, 2002.
- *35. Transient Syndrome of Headache and Neurologic Deficits with CSF Lymphocytosis (HaNDL). Presented at the Scottsdale Headache Symposium of AHS, Scottsdale AZ, November 16, 2002.
- *36. What is the Natural History of Migraine? Presented at the Scottsdale Headache Symposium of AHS, Scottsdale, AZ, November 14, 2003.
- *37. Testing and Red Flags in Headache: Neuroimaging. Presented at the Scottsdale Headache Symposium of AHS, Scottsdale, AZ, November 15, 2003.
- *38. Update on diagnosis and classification of headache for the pain specialist. Presented at the 20th annual meeting of the American Academy of Pain Management in Orlando, FL, March 3, 2004.
- *39. Headache in the Elderly. Presented at the Scottsdale Headache Symposium of AHS, Scottsdale, November 2004.
- *40. Headaches in the Elderly. Presented at AAN Annual Meeting, Miami Beach, FL, April 15, 2004.
- 41. Headaches in the ED. Presented with David F. Black at the AAN Annual Meeting, San Diego, CA, April 2, 2006

- *42. Emergency Neurology: Headache. Presented at AAN Annual Meeting, San Diego, CA, April 3, 2006.
- 43. Headache Specialty Practice: Coding—How to get paid for what you do and Practice Pearls from Headache Specialists (Symposium chair). Presented at the AHS Annual Scientific Meeting, Los Angeles, CA, June 25, 2006.
- 44. Headaches in the ED. Presented with David F. Black at the AAN Annual Meeting, Boston, MA, May 4, 2007.
- 45. Neurostimulation for headache disorders (moderator). Presented at 50th Annual Scientific Meeting of the American Headache Society, Boston, MA, June, 2008.
- 46. Headache Update. Presented at Neurology Update II at American Academy of Neurology 61st Annual Meeting, May 2, 2009.
- 47. Headache Update. Presented at Neurology Update I at the American Academy of Neurology 62nd Annual Meeting April 12, 2010.
- 48. Headache Update. Presented at Neurology Update II at the American Academy of Neurology 63rd Annual Meeting April 15, 2011.
- 49. Headache in the Emergency Department. Presented with Charles Flippen, II at the American Academy of Neurology 63rd Annual Meeting April 10, 2011.
- 50. Headache Update. Presented at Neurology Update I at the American Academy of Neurology 64th Annual Meeting April 23, 2012.
- 51. Thunderclap Headache: The Big, the Bad and the Ugly. Presented with Enrique Leira at the American Academy of Neurology 64th Annual Meeting April 26, 2012.
- 52. Continuum® Test Your Knowledge: A Multiple Choice Question Review on Headache. Presented at AAN Fall Conference 2013, October 26, 2013 in Las Vegas, NV
- 53. Headache Update. Presented at AAN Fall Conference 2013, October 27, 2013 in Las Vegas, NV

PRESENTATIONS AT INTERNATIONAL MEETINGS

- * 1. Neurologic manifestations of Wegener's granulomatosis. Presented at an International Colloquy on Wegener's granulomatosis and other vasculitides of the respiratory tract in Rochester, Minnesota, May 1986.
- * 2. An approach to the diagnosis of head and face pain: examination of the cranial nerves. Presented at the European Academy of Craniomandibular Disorders (closed meeting) in Istanbul, Turkey, September 1989.
- * 3. An approach to the diagnosis of head and face pain: examination of the cranial nerves. Presented at the International Symposium of Craniomandibular

Disorders and Pain sponsored by the Aegean University Faculty of Dentistry in Izmir, Turkey, September 1989.

4. Inferior alveolar neuropathy: a potential complication of osseointegrated implants. Presented at the Eighth Migraine Trust Symposium in London, United Kingdom, September 1990.
5. The incidence of cluster headache: a population-based study in Olmsted County, Minnesota. Presented at the Ninth Migraine Trust Symposium in London, United Kingdom, September 1992.
- *6. Chronic daily headache. Presented at the 7th International Symposium: The Pain Clinic, in Istanbul, Turkey, October 1996.
- *7. Headache diagnosis and treatment in the emergency department. Presented at the 7th International Symposium: The Pain Clinic, in Istanbul, Turkey, October 1996.
- *8. U.S. Headache Consortium Guidelines for Migraine Prophylaxis. Presented at Dutch Headache Meeting, April 2001.
9. Evidence of decreasing incidence of cluster headache: a population-based study in Olmsted County, MN. Presented at the 10th Congress of the International Headache Society, New York, NY, July 2001.
10. Use of the NBME customized examination service for a comprehensive year 1 medical school examination: student perceptions. Presented at AMEE, Prague, Czech Republic, September 1, 2008.
11. Use of patient video clips that demonstrate neurologic findings in computer-based testing in medical school. Presented at AMEE Glasgow, Scotland, UK, September 7, 2010.
12. Development of a Year 3 Neurology Clerkship Computer-based Multiple Choice Test Utilizing Patient Video Clips: A Pilot Study. Presented at APMEC, Singapore, January 12, 2012.

* Invited presentations

RESEARCH GRANTS AWARDED

Glaxo No. 5: Epidemiology of Migraine in Olmsted County, 10 percent Category I (1989-1991); Renewed 1992.

NS 17750-08P2: Epidemiologic Study of Multiple Sclerosis, 3 percent Category I (1989)

Sandoz: A Double-Blind, Multifactorial Study to Assess the Efficacy and Safety of D.H.E. 45 (Dihydroergotamine Mesylate) Nasal Spray, 2.0 mg and 3.0 mg Doses in Comparison with Placebo for the Acute Treatment of Migraine Headache (Principal Investigator at Mayo Clinic, Rochester - 1993-1994), 10% Category I.

Burroughs-Wellcome: A multicenter, double-blind, randomized, placebo-controlled, parallel group to confirm the efficacy and safety of 311C90 in the treatment of acute migraine headache (Principal investigator at Mayo Clinic, Rochester), 10% Category I.

Burroughs-Wellcome: A multicenter, open study to investigate the long-term effects of oral 311C90 in the treatment of migraine headache (Principal investigator at Mayo Clinic, Rochester), 5% Category I.

Zeneca: A multicenter double-blind, placebo-controlled, randomized trial of zolmitriptan (ZomigTM) for the treatment of menstrual-associated migraine headaches (Principal Investigator at Mayo Clinic, Rochester) – 1998-1999, 10% Category I.

Pharmacia & Upjohn: Oral almotriptan (LA 531416) vs. oral sumatriptan in a double-blind, randomized, parallel group study of cost-effectiveness and quality of life in migraine (Principal Investigator at Mayo Clinic, Rochester) – 1998-1999, 10% Category I.

Ortho-McNeil: A Comparison of the Efficacy and Safety of Topamax (topiramate) tablets versus placebo for the prophylaxis of migraine. Protocol CAPSS-155 (Principal Investigator at Mayo Clinic, Rochester) – 2001, 8% Category I.

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Publications – Peer-Reviewed

1. **Swanson JW**, Vick NA. Basilar artery migraine: 12 patients with an attack recorded electroencephalographically. *Neurology* 1978; 28:782-786.
2. **Swanson JW**, Kelly JJ Jr., McConahey WM. Neurologic aspects of thyroid dysfunction. *Mayo Clin Proc* 1981; 56:504-12.
3. Neufeld MY, **Swanson JW**, Klass DW. Localized EEG abnormalities in acute carbon monoxide poisoning. *Arch Neurol* 1981; 38:524-27.
4. Bartleson JD, **Swanson JW**, Whisnant JP. A migrainous syndrome with cerebrospinal fluid pleocytosis. *Neurology* 1981; 31:1257-62.
5. O'Neill BP, **Swanson JW**, Brown FR, Griffin JW, Moser HW. Familial spastic paraparesis: An adrenoleukodystrophy phenotype? *Neurology* 1985; 35:1233-35.
6. Meissner I, Wiebers DO, **Swanson JW**, O'Fallon WM. The natural history of drop attacks. *Neurology* 1986; 36:1029-34.
7. **Swanson JW**. History, examination, and laboratory tests for headache. *Journal of Craniomandibular Disorders* 1987; 1:17-20.
- *8. Broderick JP, **Swanson JW**: Migraine-related strokes. Clinical profile and prognosis in 20 patients. *Arch Neurol* 1987; 44:868-71.
9. Wiebers DO, **Swanson JW**, Cascino TL, Whisnant JP. Bilateral visual loss in bright light. *Stroke* 1989; 20:554-558.
10. **Swanson JW**. Multiple sclerosis: update in diagnosis and review of prognostic factors. *Mayo Clin Proc* 1989; 64:577-586.
11. **Swanson JW**. Treatment of migraine: a review and update. *Comprehensive Therapy* 1989; 15:53-59.
12. Stang PE, Yanagihara T, **Swanson JW**, Beard CM, Melton LJ. A population-based study of migraine headaches in Olmsted County, Minnesota: Case ascertainment and classification. *Neuroepidemiology*, 1991; 10:297-307.
- *13. Maraganore DM, Folger WN, **Swanson JW**, Ahlskog JE. Movement disorders as sequelae of central pontine myelinolysis: report of three cases. *Movement Disorders* 1992; 7:142-148.
14. Stang PE, Yanagihara T, **Swanson JW**, Beard CM, O'Fallon WM, Guess HA, Melton LF: The incidence of migraine headaches. A population-based study in Olmsted County, Minnesota. *Neurology* 1992; 42:1657-1662.
- *15. Nishino H, Rubino FA, DeRemee RA, **Swanson JW**, Parisi JE: Neurologic involvement in Wegener's granulomatosis. An analysis of 324 consecutive patients. *Ann Neurol* 1993; 33:4-9.

16. Yamamoto Y, Coffey RJ, Wiebers DO, **Swanson JW**, Shaw EG. Treatment of large AVMs by gamma knife radiosurgery--obliteration rate may be independent of size and dose. *Acta Neurochirurgica* 122, Fasc. 1-2, pp 136, #6, Springer-Verlag, New York, June 16-19, 1993.
17. Siva A, Radhakrishnan K, Kurland LT, O'Brien PC, **Swanson JW**, Rodriguez M. Trauma and Multiple Sclerosis: a Population-Based Cohort Study from Olmsted County, Minnesota. *Neurology* 1993; 43:1878-1882.
18. **Swanson JW**, Yanagihara T, Stang PE, O'Fallon WM, Beard CM, Melton LJ, Guess HA. The incidence of cluster headaches: a population-based study in Olmsted County, Minnesota. *Neurology* 1994; 44:433-437.
19. Scherokman B, Cannard K, Miller JQ, and the American Academy of Neurology Undergraduate Education Subcommittee (Anderson D, Griffith P, Murphy F, Jozefowicz R, **Swanson JW**, Walker HK). What should a graduating medical student know about neurology? *Neurology* 1994; 4:1170-1176.
- *20. Sehgal M, **Swanson JW**, DeRemee RA, Colby TV. Neurological manifestations of Churg-Strauss syndrome. *Mayo Clin Proc* 1995; 70:337-341.
21. Foote RL, Coffey RJ, **Swanson JW**, Harner SG, Beatty CW, Kline RW, Stevens LN, Hu TC. Stereotactic radiosurgery using the gamma knife for acoustic neuromas. *Int J Radiol Oncology Biol Phys* 1995; 32:1153-1160.
22. Armon CA, **Swanson JW**, McLean JM, Westbrook PR, Okazaki H, Kurtin PJ, Kalyan-Raman UP, Rodriguez MR. Subacute encephalomyelitis presenting as stiff-person syndrome: clinical, polygraphic, and pathologic correlations. *Movement Dis* 1996; 11:701-709.
- *23. Rozen TD, **Swanson JW**. Post Gamma knife headache: a new headache syndrome? *Headache* 1997; 37:180-183.
24. Capobianco DJ, **Swanson JW**. Neurological contributions of Bayard T. Horton. *Mayo Clinic Proceedings* 1998; 73:912-15.
- *25. Boes CJ, **Swanson JW**, Dodick DW. Chronic paroxysmal hemicrania presenting as otalgia with a sensation of external acoustic meatus obstruction: two cases and a pathophysiologic hypothesis. *Headache* 1998; 38:787-791.
26. Mosek A, Dodick DW, Ebersold MJ. **Swanson JW**. Headache after resection of acoustic neuroma. *Headache* 1999; 39:89-94.
27. Mosek A, Novak V, Opfer-Gehrking TL, **Swanson JW**, Low PA. Autonomic dysfunction in migraineurs. *Headache* 1999; 39:108-117.
28. Rozen TD, **Swanson JW**, Stang PE, McDonnell SK, Rocca WA. Increasing incidence of medically recognized headache in a United States population. *Neurology*. 1999; 53(7):1468-73.
29. Rozen TD, **Swanson JW**, Stang PE, McDonnell SK, Rocca WA. Incidence of migraine headache: a 1989-1990 population-based study in Olmsted County, Minnesota. *Headache*. 2000;40(3):216-223.

30. Capobianco DJ, **Swanson JW**, Dodick DW. Medication-induced (analgesic rebound) headache, The North American Experience: Historical aspects and initial descriptions. *Headache* 2001; 41: 500-502.
31. Oliveira GHM, Seward JB, Stanson AW, **Swanson JW**. Paradoxical cerebrovascular embolism associated with pulmonary arteriovenous fistula: contrast transesophageal echocardiographic diagnosis. *Eur J Echocardiography* 2001; 2(3):201-211.
- *32. Eross EJ, **Swanson JW**, Krauss WE. A rare cause or “cough headache” in an adult. *Headache* 2002;42:382.
- *33. Rao RD, DeJesus R, Hunt C, Tefferi A, **Swanson JW**. Methotrexate-induced seizure associated with acute MRI change. *Leukemia and Lymphoma* 2002;43(6):1333-6.
- *34. Eross EJ, Dodick DW, **Swanson JW**, Capobianco D. A review of intractable facial pain secondary to underlying lung neoplasms. *Cephalalgia* 2003;23 (1), 2-5.
35. Eross EJ, **Swanson JW**, Dodick DW. Hemicrania continua: An indomethacin-responsive case with an underlying malignant etiology. *Headache* 2002;42(6):527-529.
36. Tyler K, York GK, Steinberg DA, Okun MS, Steinbach M, Satran R. Fine EJ, Manteghi T, Bleck TP, **Swanson JW**, Mishra S, Meador KJ, Clifford DB, Toole JF, Melson L. Part 2: history of 20th century neurology: decade by decade. *Annals of Neurology*. 2003;53 Suppl 4:S27-45.
37. Kumar N, **Swanson JW**. The “red ear syndrome” revisited: two cases and a review of the literature. *Cephalalgia*. 2004;24(4):305-308.
38. Black DF, Kung S, Sola CL, Bostwick MJ, **Swanson JW**. Familial hemiplegic migraine, neuropsychiatric symptoms and erdheim-chester disease. *Headache*. 2004;44(9):911-915.
- *39. Black DF, **Swanson JW**, Stang PE. Decreasing incidence of cluster headache: a population-based study in Olmsted County, Minnesota. *Headache* 2005;45 (3) 220-223.
40. Josephs KA, Uchikado H, McComb RD, Bashir R, Wszolek Z, **Swanson J**, Matsumoto J, Shaw G, Dickson DW. Extending the clinicopathological spectrum of neurofilament inclusion disease. *Acta Neuropathologica* 2005; (4):427-432.
41. Black DF, **Swanson JW**, Eross EJ, Cutrer FM. Secondary SUNCT due to intra-orbital, metastatic bronchial carcinoid. *Cephalalgia* 2005; 8:633-665.
42. Castillo PR, Woodruff BK, Vernino S, Caselli RJ, Lucchinetti C, **Swanson JW**, Noseworthy JH, Aksamit AJ, Carter JL, Sirven JI, Hunder GG, Fatourech V, Flemming KD, Mokri B, Drubach DA, Pittock S, Lennon VA, Boeve BF. Steroid-Responsive Encephalopathy Associated With Autoimmune Thyroiditis. *Arch Neurol*. 2006;63:197-202.

43. *Garza I, **Swanson JW**. Answers to frequently asked questions about migraine. *Mayo Clin Proc*. 2006;81:1387-1392.
44. *Garza I, **Swanson JW**. Prophylaxis of migraine. *Neuropsychiatry Disease and Treatment* 2006;2:281-291.
45. **Swanson JW**. Current Literature: Clinical Science
Migraine and ischaemic heart disease and stroke: potential mechanisms and treatment options. *Cephalalgia* 2007;27:988–990.
46. Garza I, **Swanson JW**. Successful preventive therapy in hypnic headache using hypnotics: a case report. *Cephalalgia* 2007;27:1080-1.
47. Johnson ME, **Swanson JW**. Procaine spinal neurotoxicity. *Anesthesiology* 2008;109(2):349-51.
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Publications - Abstracts

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2. **Swanson JW**, Bartleson JD, Whisnant JP. A migrainous syndrome with CSF pleocytosis. *Neurology* 1980; 30:418.
3. **Swanson JW**, O'Neill BP, Mulder DW, Auger RG, Griffin JW, Moser HW. Is familial spastic paraparesis (FSP) a variant of adrenomyeloneuropathy? *Neurology* 1983; 33 (suppl 2):154.
- *4. Hansen RB, **Swanson JW**, DeRemee RA, McDonald TJ, Weiland LH. Neurologic involvement in Wegener's granulomatosis. *Neurology* 1983; 33 (suppl 2):240.
5. Meissner I, Wiebers DO, **Swanson JW**, O'Fallon WM. The natural history of drop attacks. *Neurology* 1985; 35 (suppl 1):146.
- *6. Broderick JP, **Swanson JW**. Prolonged ischemia associated with migraine attacks. *Neurology* 1986; 36 (suppl 1):142.
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11. **Swanson JW**, Yanagihara T, Stang PE, O'Fallon PE, O'Fallon NM, Guess HA, Beard CM, Melton LJ. The incidence of cluster headaches: a population-based study in Olmsted County, Minnesota. Program of the Ninth Migraine Trust International Symposium in September 1992.
12. Yanagihara T, **Swanson JW**, Stang PE, Guess HA, O'Fallon WM, Beard CM, Melton LJ: Migraine and risk of stroke (abstract). Proceedings of the Second World Congress of Stroke, 1992: S107.
- *13. Nishino H, Rubino FA, DeRemee RA, **Swanson JW**, Parisi JE. Neurologic involvement in Wegener's granulomatosis: an analysis of 324 consecutive patients. *Ann Neurol* 1992; 32:294A.
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- *15. Sunku AJ, O'Duffy AE, **Swanson JW**. Benign intracranial hypertension associated with levonorgestrel implants. *Ann Neurol* 1993; 34:299.
- *16. Sehgal M, **Swanson JW**, DeRemee RA. Neurological manifestations of Churg-Strauss Syndrome. *Neurology* 1993; 43:A419.
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21. Capobianco DJ, **Swanson JW**. Neurological contributions of Bayard T. Horton. *Neurology* 1997; 48(suppl):A265.
- *22. Boes C, **Swanson JW**, Dodick DW. Chronic paroxysmal hemicrania presenting as otalgia with a sensation of external acoustic meatus obstruction: two cases and a pathophysiologic hypothesis. *Headache* 1998; 38:375.

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