

EDUCATIONAL DEFICIENCIES IN MUSCULOSKELETAL MEDICINE

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Background: We previously reported the results of a study in which a basic competency examination in musculoskeletal medicine was administered to a group of recent medical school graduates. This examination was validated by 124 orthopaedic program directors, and a passing grade of 73.1% was established. According to that criterion, 82% of the examinees failed to demonstrate basic competency in musculoskeletal medicine. It was suggested that perhaps a different passing grade would have been set by program directors of internal medicine departments. To test that hypothesis, and to determine whether the importance of the individual questions would be rated similarly, the validation process was repeated with program directors of internal medicine residency departments as subjects.

Methods: Our basic competency examination was sent to all 417 program directors of internal medicine departments in the United States. Each recipient was mailed a letter of introduction explaining the purpose of the study, a copy of the examination, and our answer key and scoring guide. There was no mention of the results of the first study. The subjects were requested to rate the importance of each question on the same visual analog scale, ranging from "not important" to "very important," as had been used by the orthopaedic program directors. These ratings were converted into numerical scores. The program directors were also asked to suggest a passing score for the examination, and this score was used to assess the examinees' performance on the examination. The results on the basis of the internal medicine program directors' responses and those according to the orthopaedic program directors' responses were compared.

Results: Two hundred and forty (58%) of the 417 program directors of internal medicine residency departments responded. They suggested a mean passing score (and standard deviation) of $70.0\% \pm 9.9\%$. As reported previously, the mean test score of the eighty-five examinees was 59.6%. Sixty-six (78%) of them failed to demonstrate basic competency on the examination according to the criterion set by the internal medicine program directors. The internal medicine program directors assigned a mean importance score of 7.4 (of 10) to the questions on the examination compared with a mean score of 7.0 assigned by the orthopaedic program directors. The internal medicine program directors gave twenty-four of the twenty-five questions an importance score of at least 5 and seventeen of the twenty-five questions an importance score of at least 6.6.

Conclusions: According to the standard suggested by the program directors of internal medicine residency departments, a large majority of the examinees once again failed to demonstrate basic competency in musculoskeletal medicine on the examination. It is therefore reasonable to conclude that medical school preparation in musculoskeletal medicine is inadequate.

Musculoskeletal care is provided by a variety of practitioners, including internists, family practitioners, rheumatologists, emergency physicians, pediatricians, and orthopaedic surgeons. Mastery of the basics of musculoskeletal medicine is therefore essential for many, if not all, medical students. Ideally, a solid knowledge base would be acquired in medical school and refined during postgraduate training.

We previously evaluated the quality of musculoskeletal knowledge among a cohort of recent medical school graduates¹. In that study, we administered a basic competency examination in musculoskeletal medicine to eighty-five residents on their first day of residency at our institution. We validated this exami-

nation by surveying orthopaedic program directors. These experts were asked to review the examination, rate the importance of each question, and establish a minimum passing score. According to their criterion, 82% of our test group of recent medical school graduates failed to demonstrate basic competency in musculoskeletal medicine.

On the basis of these data, we suggested that medical school training in musculoskeletal medicine is inadequate. Still, we recognize that some may believe that orthopaedic surgeons are not the best group to validate the examination. It could be argued that orthopaedists provide only a minority portion of musculoskeletal medical care and thus may not appreciate what points are important to the average practitioner.

Also, it is possible that surgeons overvalue topics with surgical relevance.

To respond to these critics, we surveyed a cohort of program directors who were not surgeons. We wished to first determine whether standards are similar and then to use this second, nonsurgical standard to ratify (or negate) our conclusion that many examinees failed the basic competency examination. Our second purpose, no less important, was to identify topics that both surgeons and nonsurgeons rate as important. Our hope was that the set of topics with broadly acknowledged importance could then be used to generate a consensus curriculum for medical students.

Methods

As previously reported¹, a sample of topics in musculoskeletal medicine with which all physicians should be familiar was selected and then elaborated into twenty-five short-answer questions (Table I). Needless to say, not all important topics could be included or represented by the number of items commensurate with their importance. An open-response format was selected to eliminate the possibility of the examinees scoring points on the basis of random guessing. A formal answer key and scoring system were developed prior to administration of the examination. To validate our examination, all 157 directors of orthopaedic residency programs in the United States were asked to review it. The program directors were asked to rate the importance of each question on a visual analog scale ranging from “not important” to “very important.” Their responses were converted to an “importance score” for each question, ranging from 0 (not important) to 10 (very important). After reviewing the examination, the orthopaedic program directors were asked to “suggest a passing score (as a percentage) for all medical school graduates to demonstrate basic competency in musculoskeletal medicine on this examination.”

The examination was administered to all eighty-five medical and surgical residents who were in their first postgraduate year at our institution. The residents completed the examination on their first day of residency. There was no time limit for completion of the examination. Demographic information was obtained by questionnaire; these data included each resident’s medical school of origin and his or her participation in required or elective courses in orthopaedic surgery, neurology, rheumatology, and rehabilitation medicine in medical school. The examination was scored anonymously according to the answer key, with a 1-point maximum for each of the twenty-five questions. Partial credit was given for some questions. This raw score was then multiplied by four in order to obtain a percentage score for the examination.

Prior to publication of the first study¹, this basic competency examination was sent to all 417 program directors of internal medicine departments in the United States². Each recipient was mailed a letter of introduction explaining the purpose of the study, a copy of the examination, and our answer key and scoring guide. There was no mention of the results of the first study. The internal medicine program directors were requested to rate the importance of each question on

the same visual analog scale, ranging from “not important” to “very important,” as had been used by the orthopaedic program directors. With use of instructions identical to those given to the orthopaedic program directors, the internal medicine program directors were asked to suggest a passing score for the examination.

The responses of the internal medicine program directors and those of the orthopaedic program directors were compared and serve as the basis of this report.

Results

Two hundred and forty (58%) of the 417 program directors of internal medicine residency departments completed and returned the survey. The passing score (that is, the score above which an examinee “demonstrate[s] basic competency in musculoskeletal medicine”) proposed by the internal medicine program directors was $70.0\% \pm 9.9\%$ (mean and standard deviation). This score was very similar to the previously reported score of 73.1% proposed by the 124 orthopaedic program directors¹. As reported previously¹, the subjects scored a mean of $59.6\% \pm 12\%$ (range, 35% to 86%) on the examination. Sixty-six (78%) of the eighty-five subjects scored below 70.0% and thus failed to demonstrate basic competency on the examination according to the criterion set by the internal medicine program directors.

The internal medicine program directors assigned a mean importance score of 7.4 of 10 to the questions on the examination; the mean score assigned by the orthopaedic program directors was 7.0. Twenty-four (96%) of the twenty-five questions were given an importance score of at least 5 of 10—a score that previously was deemed to indicate that the topic was at least “important”—by both sets of respondents. The internal medicine program directors gave seventeen (68%) of the twenty-five questions an importance score of at least 6.6.

Comparison of the ratings of the questions on the 10-point visual analog scale between the orthopaedic and internal medicine program directors revealed that the scores assigned by the two groups were within one point of each other for fifteen of the twenty-five questions and were within 2 points of each other for twenty-two of the twenty-five questions.

Discussion

According to the standard suggested by the program directors of internal medicine residency departments, a large majority of the examinees once again failed to demonstrate basic competency in musculoskeletal medicine. It is reasonable, therefore, to conclude that medical school preparation in musculoskeletal medicine is inadequate. The use of a second criterion to evaluate the musculoskeletal competency examination further validates the use of the examination and confirms the conclusions from our previous study¹.

As we noted previously¹, the average amount of time spent in courses or rotations dedicated to orthopaedics was only 2.1 weeks for all examinees, and 33% of them graduated from medical school with no such exposure. One or two weeks, representing <2% of the entire typical curriculum, is probably in-

TABLE I Basic Competency Examination in Musculoskeletal Medicine

Question	Answer	Residents' Mean Score	Mean Importance Score*	
			Internal Medicine Program Directors	Orthopaedic Program Directors
1. What common problem must all newborns be examined for?	Congenital dislocation of the hip (CDH, dislocation, subluxation also accepted): 1 point	0.99	5.6	9.1
2. What is a compartment syndrome?	Increased pressure in a closed fascial space: 1 point	0.95	8.7	9
3. Acute septic arthritis of the knee may be differentiated from inflammatory arthritis by which laboratory test?	Any analysis of fluid from aspiration (cell count, gram stain, culture): 1 point	0.76	9.3	8.5
4. A patient dislocates his knee in a car accident. What structure(s) is/are at risk for injury and therefore must be evaluated?	Must mention popliteal artery: 1 point	0.70	6.7	8.4
5. A patient punches his companion in the face and sustains a fracture of the 5th metacarpal and a 3-mm break in the skin over the fracture. What is the correct treatment, and why?	Irrigation and débridement; risk of infection: 1/2 point each	0.54	7.3	8.4
6. A patient comes to the office complaining of low-back pain that wakes him up from sleep. What two diagnoses are you concerned about?	Tumor and infection: 1/2 point each	0.33	8.8	8
7. How is compartment syndrome treated?	Fasciotomy (surgery also accepted): 1 point	0.94	8.1	7.9
8. A patient lands on his hand and is tender to palpation in the "snuff box" (the space between the thumb extensor and abductor tendons). Initial radiographs do not show a fracture. What diagnosis must be considered?	Scaphoid fracture (carpal bone fracture also accepted): 1 point	0.54	7.4	7.8
9. A 25-year-old male is involved in a motor-vehicle accident. His left limb is in a position of flexion at the knee and hip, with internal rotation and adduction of the hip. What is the most likely diagnosis?	Hip dislocation: 1 point	0.35	7.5	7.6
10. What nerve is compressed in carpal tunnel syndrome?	Median nerve: 1 point	0.94	8.5	7.4
11. A patient has a disk herniation pressing on the 5th lumbar nerve root. How is motor function of the 5th lumbar nerve root tested?	Dorsiflexion of the great toe (toe extensors also accepted): 1 point	0.20	8.5	7.2
12. How is motor function of the median nerve tested in the hand?	Any median function (metacarpophalangeal finger flexion; thumb opposition, flexion, or abduction): 1 point	0.75	8	7
13. A 12-year-old boy severely twists his ankle. Radiographs show only soft-tissue swelling. He is tender at the distal aspect of the fibula. What are 2 possible diagnoses?	Ligament sprain and Salter-Harris I fracture (sprain, fracture also accepted): 1/2 point each	0.67	6.3	7
14. A patient presents with new-onset low-back pain. Under what conditions are plain radiographs indicated? Please name 5 (example: history of trauma).	Age >50; neurological deficit; bowel or bladder changes; history of cancer, pregnancy, drug use, or steroid use; systemic symptoms (night pain, fever); pediatric population: 1/4 point each, full credit for 4 correct responses	0.50	8.6	7

TABLE I Basic Competency Examination in Musculoskeletal Medicine (continued)

Question	Answer	Residents' Mean Score	Mean Importance Score*	
			Internal Medicine Program Directors	Orthopaedic Program Directors
15. A patient has a displaced fracture near the fibular neck. What structure is at risk for injury?	Common peroneal nerve (peroneal nerve also accepted): 1 point	0.62	7.1	6.8
16. A 20-year-old injured his knee while playing football. You see him on the same day, and he has a knee effusion. An aspiration shows frank blood. What are the three most common diagnoses?	Ligament tear, fracture, peripheral meniscal tear (capsular tear, patellar dislocation also accepted): 1/2 point each, full credit for 2 correct responses	0.44	6.3	6.8
17. What are the five most common sources of cancer metastatic to bone?	Breast, prostate, lung, kidney, thyroid: 1/4 point each, full credit for 4 correct responses	0.86	8.3	6.7
18. Name two differences between rheumatoid arthritis and osteoarthritis.	Any two correct statements (e.g., inflammatory vs. degenerative; proximal interphalangeal joint vs. distal interphalangeal joint, etc.): 1/2 point each	0.76	8.7	6.6
19. Which malignancy may be present in bone yet typically is not detected with a bone scan?	Myeloma (full credit for hematological malignancies — leukemia, lymphoma): 1 point	0.51	8.3	6.4
20. What is the function of the normal anterior cruciate ligament at the knee?	To prevent anterior displacement of the tibia on the femur: 1 point	0.53	5.9	6.2
21. What is the difference between osteoporosis and osteomalacia?	Osteoporosis — decreased bone density; osteomalacia — decreased bone mineralization (any true statement about epidemiology, pathophysiology — e.g., estrogen vs. vitamin D — also accepted): 1 point	0.40	7.9	5.7
22. In elderly patients, displaced fractures of the femoral neck are typically treated with joint replacement, whereas fractures near the trochanter are treated with plates and screws. Why?	Blood supply to femoral head (avascular necrosis, non-union also accepted): 1 point	0.40	5.9	5.2
23. What muscle(s) is/are involved in lateral epicondylitis (tennis elbow)?	Wrist extensors (full credit for any wrist extensor — extensor carpi radialis brevis, extensor carpi radialis longis, extensor digitorum communis): 1 point	0.18	5.7	5.1
24. Rupture of the biceps at the elbow results in weakness of both elbow flexion and ____?	Supination: 1 point	0.49	5.5	5.1
25. What muscle(s) control(s) external rotation of the humerus with the arm at the side?	Infraspinatus or teres minor accepted (full credit for rotator cuff): 1 point	0.28	4.9	4.6

*On a scale of 1 to 10 points.

sufficient, and even if all students were to receive two weeks of instruction, it would be important that the emphasis of that exposure be on topics of acknowledged importance. (The standard rotation in orthopaedic surgery probably emphasizes too many particulars of surgical practice.) The ideal course in musculoskeletal medicine should concentrate on common outpatient orthopaedic problems, orthopaedic emergencies, and the musculoskeletal physical examination. As seen from the re-

sponses of program directors of internal medicine departments, topics such as fractures, back pain, arthritis, and infections are recognized as important. Indeed, for sixteen of twenty-five questions, the importance score given by the internal medicine program directors was higher than that given by the orthopaedic program directors.

It should be noted that the mean absolute difference in importance scores was <1 for fifteen of the twenty-five ques-

tions and <2 for twenty-two. Still, some of the areas of disagreement are instructive. One of the three questions for which the difference in the importance scores was >2 (question 1) asked about perinatal hip dislocation; this question addresses a topic that is no doubt important but perhaps not to a group of program directors of internal medicine departments. It is fair to say that the patients seen in their departments do not present with this condition. Likewise, the other two questions (18 and 21), which asked about differences between rheumatoid arthritis and osteoarthritis and between osteoporosis and osteomalacia, can be thought of as more typical issues for internists. Accordingly, the internal medicine group ranked the importance of these questions higher than the orthopaedic group did. Thus, if only one group of doctors contributes to curricular design, it is likely that some important topics will be omitted. These data suggest that a concerted effort will be most productive.

Medical school curricula must place a greater emphasis on musculoskeletal medicine. Because of the aging of the population, the prevalence of bone and joint diseases in the United States—already the primary reason that people seek

medical care—is sure to rise. Thus, the demands will soon be even greater. Students must master the topic of musculoskeletal medicine. The results of these studies suggest that they have not. ■

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References

1. **Freedman KB, Bernstein J.** The adequacy of medical school education in musculoskeletal medicine. *J Bone Joint Surg Am.* 1998;80:1421-7.

2. **Accreditation Council for Graduate Medical Education.** *Directory of graduate medical education programs.* Chicago: American Medical Association; 1997.