

Biochemistry Teaching for Competency Based Medical Education in Musculoskeletal System

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Abstract

Background: Competency Based Medical Education (CBME) programs have increased significantly over the past decade in response to a changing higher education environment. This dramatic increase in CBME programs has been supported by faculty tasked with developing curriculum composed of competency statements, assessment strategies, and learning content. Yet, little is known about the types of training and support provided to faculty and faculty- perceived levels of competence in CBME curriculum development. In the present study, was to investigate biochemistry teaching for CBME in musculoskeletal system for MBBS students.

Methods: This study was conducted in Meenakshi Medical College Hospital and Research Institute. In this interactive teaching methodology, 150 1st year MBBS students were involved. We have evaluated all the 150 students and we focused on whether this method could be useful for the remaining modules.

Results:Biochemistry CBME in musculoskeletal system of 1st year MBBS students knowledge were significantly increased based on skills, verticle integration, Early clinical exposure (ECE) Seminars were compared with normal teaching education.

Conclusion: In the present study we conclude that the Biochemistry teachingcompetencybased medical education in musculoskeletal system is very helpful to learning and also to improve integrated knowledge for medical students.

Keywords:Competency Based medical education, Early clinical exposure and musculoskeletal

I. Introduction

Interest in competency- based medical education (CBME) has been growing over the past decade and Medical Council of India has also implemented the CBME system of education. Development of CBME programs requires new approaches to theCurriculum design process. This new framework for designing courses is based oncompetencies, knowledge, and skills, rather than class time. [1]

This educational model is adjudged to be most suited for rapidly changing health needs of individual communities and is increasingly being adopted by medical schools worldwide including USA in order to equip graduates with the skills required for contemporary medical and dental practice in the continent.[2,3]

In the present study, biochemistry teaching was totally transformed according to system and module wise in alignment with Anatomy and Physiology. Attitude ethics and communication (AETCOM), Early clinical exposure based teaching and Integrated teaching were all used as tools in this module based learning.

II. Materials and Methods

In the Department of Biochemistry in Meenakshi Medical College, we conducted the pedagogical research work. We used certain interactive teaching methods by using charts, spotters, qualitative and quantitative practical tests. Topics which we have chosen are based on Musculoskeletal system module from competency based medical education (CBME). In this interactive teaching methodology 150 1st year MBBS students were involved. We have evaluated all the 150 students and we focused on whether this method could be useful for the remaining modules. Separate schedule were prepared, approved and signed from all three department HOD`s including anatomy, physiology and biochemistry. All the three departmental faculties were included in this CBME program.

a. The objectives of the Musculo Skeletal System of CBME

At the end of the ECE, the student will be able to

1. Enumerate the observational features in a child with suspicion of rickets (Dept of Paediatrics) .
2. Describe some symptoms or signs of myopathies / Myalgia (Dept of Medicine)
3. Discuss briefly the radiological features in diagnosis of skeletal deformities / disease (Dept of Radiology).
4. Enact in a simulated environment to communicate with a patient recovering from musculoskeletal disease / injury (Dept of Ortho).
5. Demonstrate the appropriate method of eliciting reflexes / or coordinated muscle function (Skill Lab Mannequin / Standardized patient)
6. Define the specific steps adopted in Physiotherapy related to Musculoskeletal system (Dept of Physiotherapy).

b. General Instruction:

1. Early clinical Exposure in Musculoskeletal system is aimed at exposing students to some patients with diseases related to muscle and skeletal disorders.
2. No case discussion expected from both clinician and faculty accompanying the students.

3. When clinician is carrying out his routine work, the students will observe and record their input.
4. After observational time, the recorded information will be discussed in groups to understand the expected objectives.
5. Students are divided into small groups of 15 - 25 members.
6. Each group will be accompanied by a faculty not below the rank of Assistant Professor. The faculty will coordinate with clinician, patient / students
7. They will collect reports for discussion.

III. Results

1. Musculo Skeletal System

Table.1 shows that the Teaching schedule of Biochemistry, anatomy and physiology -Teaching schedule for CBME in Musculoskeletal System includes the skills, vertical integration, early clinical exposure and seminars.

2. Musculo Skeletal System- Skills

Table.2. shows that the qualitative analysis of calcium and phosphorus

3. Musculo Skeletal System- Vertical Integration

Table.3. shows that the vertical integration of students with clinical department. Students should be able to describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency

4. Musculo Skeletal System- ECE

Table.4. shows that the ECE of students should be able to enumerate the observational features in a child with suspicion of rickets.

5. Musculo Skeletal System- Seminar

Table.5. shows the Students Seminar schedule-Students should be able to mention the vitamin deficiency and explain the manifestations of the disease conditions and correlate the features with that of the vitamin's biochemical role.

IV. Discussion

Competency is the ability of a health professional which can be observed. It encompasses various components such as knowledge, skills, values, and attitudes. Competency is the application of competencies in an actual setting, and an individual who is able to do so is considered competent. The core competencies required of a medical graduate are predetermined in the curriculum and are contextual to the environment in which the medical graduate would eventually practice his profession. For example, six domains of general competency, namely, patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice have been described by the Accreditation Council of Graduate Medical Education in the USA.[3] Three broad outcomes have been specified for medical graduates in the UK, namely, doctor as a scholar and a scientist, doctor as a practitioner, and doctor as a researcher.[4] The Canadian Medical Education Directions for Specialists specifies seven roles of a specialist, namely, medical expert, communicator, collaborator, manager, health advocate, scholar, and professional.[5]

The Medical Council of India (MCI) has also suggested that competency-based learning must be implemented in all the medical colleges. It would include designing and implementing a curriculum that would focus on the desired and observable ability in real life situations.

Teaching – Learning methods in competency based Medical Education

Since CBME is learner-centered, offers flexibility in time, and focuses on all the three domains of learning together; the teaching–learning activities would need a change in structure and process. Since it focuses on outcomes and prepares students for actual professional practice, teaching–learning activities would be more skill-based, involving more clinical, hands-on experience. The students just entering medical profession would also get to see cases/patients

and would have a stethoscope right in the beginning of their course, which would enhance their motivation for learning medicine.

Some examples of teaching methods adopted in CBME by a couple of African medical colleges include problem-based learning in the preclinical years and case-based learning in the clinical years, clinical pathological conferences, clinical audits, and early clinical exposure. Skills' training was imparted in the laboratory and via practical sessions. Community-based research and service were also included. Information communication technology was additionally used to enhance learning.[6] For significant learning to happen by a competency-based curricular design, novel instructional methods such as a “flipped classroom” approach and “team-based learning” have also been suggested.[7]

V. Conclusion

In the present study we conclude that the Biochemistry teaching competency based medical education in musculoskeletal system is very helpful in learning and also to improve integrated knowledge for medical students.

VI. Financial Support and Sponsorship

Nil

VII. Conflicts of Interest

There are no conflicts of interest.

References:

1. Frank JR, Snell LS, Cate OT, et al. Competency-based medical education: theory to practice. *Med Teach.* 2010;32(8):638–645.
2. Boelen C. Adapting health care institutions and medical schools to societies' needs. *Acad Med.* 1999;74(8 suppl):S11–S20.

3. Iputo JE, Nganwa-Bagumah AB. The innovative medical curriculum of the University of Transkei Medical School. Part II. Community-based learning. *S Afr Med J*. 1996;86(6):651–652.
4. General Medical Council. *Tomorrow’s Doctors: Education Outcomes and Standards for Undergraduate Medical Education*. [Last accessed on 2016 May 16].
5. Frank JR, Danoff D. The CanMEDS initiative: Implementing an outcomes-based framework of physician competencies. *Med Teach*. 2007;29:642–7.
6. Medical Council of India *Regulations on Graduate Medical Education*. 1997. [Last accessed on 2016 May 16].
7. Kiguli-Malwadde E, Olapade-Olaopa EO, Kiguli S, Chen C, Sewankambo NK, Ogunniyi AO, et al. Competency-based medical education in two Sub-Saharan African medical schools. *Adv Med EducPract*. 2014;5:483–9.

Table. 1. MUSCLO SKELETAL SYSTEM

DAYS	8.30-10.30	11.00-12.00	12.00-1.00	1.00-2.00	2.00-3.00	3.00-4.00
9.10.19 (WEDNESDAY)	Anatomy Practical-Introduction of locomotor system Pectoral region	Anatomy SGT/Prac- Mammary Gland	Physiology Types, Functions & Properties of Nerve Fibres, Degeneration, Regeneration	LUNCH	Physiology Neuro Muscular Junction	COMMUNITY MEDICINE
10.10.19 (THURSDAY)	Anatomy Practical-Axilla	Physiology Molecular Basis of muscle contraction – Skeletal muscle	Anatomy SGT/Prac -Axilla, lymph nodes, Axillary artery		Biochemistry Vitamin D & role of Calcium as messenger	
11.10.19 (FRIDAY)	Anatomy Practical- Shoulder joint, Trapezius, Lattismus dorsi, Serratus anterior, Axillary nerve injury Scapular region – Muscles,and anastomosis,	Anatomy SGT/Prac- Brachial plexus	Anatomy SGT/Prac- Shoulder Joint		Anatomy Integrated teaching- Shoulder joint (Ortho)	Physiology Molecular Basis of muscle contraction – Skeletal muscle

DAYS	8.30-10.30	11.00-12.00	12.00-1.00	1.00-2.00	2.00-3.00	3.00-4.00
14.10.19 (MON)	Anatomy Practical- Arm	Physiology Gradation of muscular activity, Muscular dystrophy, Myopathies	Anatomy SGT/Prac - Scapular region and anastomosis and Brachial artery	LUNCH	Anatomy SGT/Prac -Intermuscular spaces around shoulder	AETCOM
15.10.19 (TUE)	Anatomy Practical- Arm	Physiology Specific Gravity - Osmotic fragility Instruction and Demo -Hypertonicity -B Batch Biochemistry – Practicals 11.11 Demonstrate the estimation of Ca & P in serum, vitamin D charts			Physiology Molecular Basis of muscle contraction – Smooth muscle	SPORTS
16.10.19 (WED)	Anatomy Practical- Arm	Physiology Specific Gravity - Osmotic fragility Instruction and Demo -Hypertonicity - A Batch Biochemistry – Practicals 11.11 Demonstrate the estimation of Ca & P in serum, vitamin D charts			Anatomy Cubital fossa-SDL	COMMUNITY MEDICINE
17.10.19 (THUR)	Anatomy Practical-Forearm	Anatomy SGT/Prac -Front of Forearm	Biochemistry Calcium & Phosphorus		Physiology Composition & functions of blood components	Biochemistry Calcium & Phosphorus
18.10.19 (FRI)	Anatomy Practical- Back of Forearm	Anatomy SGT/Prac Back of Forearm	Biochemistry Energy source & muscle metabolism		Anatomy SGT/Prac - Fore arm	Biochemistry Glycogen metabolism & disorders
19.10.19 (SAT)	Anatomy & Biochemistry National Conference					

Table-2. Musculoskeletal System - Skills

1	2	3	4	5	6	7	8
Competency	Objectives	Date completed: dd- mmyyyy	Attempt at activity First or Only (F) Repeat (R) Remedial (Re)	Rating Below (B) expectations Meets (M) expectations Exceeds (E) expectations	Decision of faculty Completed (C) Repeat (R) Remedial (Re)	Initial of faculty and date	Feedback Received Initial of learner
<p>BI 11.4 Perform urine analysis to estimate and determine normal and abnormal constituents</p>	<p>TEST FOR CALCIUM Students should be able to identify the presence of calcium in the given sample</p>						
<p>BI 11.4 Perform urine analysis to estimate and determine normal and abnormal constituents</p>	<p>TEST FOR PHOSPHATE Students should be able to identify the presence of phosphorus in the given sample</p>						
<p>BI 9.1 List the functions and components of the extracellular matrix (ECM).</p>	<p>Collagen Students should be able to Identify the structure and mention the most repeating amino acid in this compound.</p>						
<p>BI 6.5 Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency</p>	<p>Students should be able to identify the vitamin present in this fruit and name the protein that needs this vitamin to maintain its normal structure</p>						

	Indian Goose berry						
	Lemon/orange						
BI 6.5 Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency	Rickets Students should be able to identify the disorder and mention vitamin deficiency in this condition						
BI 6.5 Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency	Rickets Students should be able to identify the disorder, mention vitamin deficiency in this condition and correlate the features with that of the vitamin's biochemical role						
BI 9.2 Discuss the involvement of ECM components in health and disease	Duchenne muscular dystrophy Students should be able to identify the condition and name the muscle protein which is deficient in this condition						
BI 6.5 Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency	Osteomalacia Students should be able to Identify the disorder and mention the vitamin deficiency in this condition.						
BI 11.4 Perform urine analysis to estimate and determine normal and abnormal constituents	TEST FOR CHLORIDES Students should be able to identify the presence of chlorides in the given sample						
BI 11.4 Perform urine analysis to	TEST FOR SULPHATES Students should be able to identify the						

estimate and determine normal and abnormal constituents	presence of sulphates in the given sample						
BI 11.4 Perform urine analysis to estimate and determine normal and abnormal constituents	TEST FOR AMMONIA Students should be able to identify the presence of ammonia in the given sample						
	ALKALINE HYPOBROMITE TEST						
	SPECIFIC UREASE TEST						
BI 6.14 Describe the tests that are commonly done in clinical practice to assess the functions of these organs (kidney, liver, thyroid and adrenal glands).	JAFFE'S TEST Students should be able to identify the presence of creatinine in the given sample						
BI 6.14 Describe the tests that are commonly done in clinical practice to assess the functions of these organs (kidney, liver, thyroid and adrenal glands).	Jaffe's test Students should be able to identify the name of the test and importance of the test						
BI 6.14 Describe the tests that are commonly done in clinical practice to assess the functions of these organs (kidney, liver, thyroid and adrenal glands).	Students should be able to identify the presence of uric acid in the given sample						
	BENEDICT'S URIC ACID TEST						
	SCHIFF'S TEST						



<p>BI 6.7 Describe the processes involved in maintenance of normal pH, water & electrolyte balance of body fluids and the derangements associated with these.</p>	<p>Urinometer Students should be able to Identify the instrument and mention its use</p>						
<p>BI 6.7 Describe the processes involved in maintenance of normal pH, water & electrolyte balance of body fluids and the derangements associated with these.</p>	<p>Students should be able to Measure the Specific Gravity of the urine sample and enumerate the conditions where specific gravity is altered–</p>						
	<p>a. Uurinometer</p>						
	<p>b. Ddip stick method</p>						

Table.3. Musculoskeletal System - Vertical Integration

1	2	3	4	5	6	7	8	9
Competency	Name of Activity	Department	Date completed: dd-mm-yyyy	Attempt at activity First or Only (F) Repeat (R) Remedial (Re)	Rating Below (B) expectations Meets (M) expectations Exceeds (E) expectations	Decision of faculty Completed (C) Repeat (R) Remedial (Re)	Initial of faculty and date	Feedback Received Initial of learner
BI 6.5 Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency	Vitamin deficiency manifestations Students should be able to describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency	General Medicine						

Table.4. Biochemistry-ECE

1	2	3	4	5	6	7	8	9
Competency	Objectives	Department	Date completed: dd-mm-yyyy	Attempt at activity First or Only (F) Repeat (R) Remedial (Re)	Rating Below (B) expectations Meets (M) expectations Exceeds (E) expectations	Decision of faculty Completed (C) Repeat (R) Remedial (Re)	Initial of faculty and date	Feedback Received Initial of learner
BI 6.5 Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency	Rickets (paediatrics) Students should be able to enumerate the observational features in a child with suspicion of rickets							

Table.5. Musculoskeletal system-- Seminar/SDL

1	2	4	5	6	7	8	9
Competency	Seminar/SDL	Date completed: dd-mmyyyy	Attempt at activity First or Only (F) Repeat (R) Remedial (Re)	Rating Below (B) expectations Meets (M) expectations Exceeds (E) expectations	Decision of faculty Completed (C) Repeat (R) Remedial (Re)	Initial of faculty and date	Feedback Received Initial of learner
BI 6.5 Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency	Rickets and Osteomalacia Students should be able to mention the vitamin deficiency and explain the manifestations of these conditions and correlate the features with that of the vitamin's biochemical role						
BI 6.9 Describe the functions of various minerals in the body, their metabolism and homeostasis.	Role of calcium as messenger Students should be able to describe the importance and functions of calcium.						