STUDENTS' MISCONCEPTION IN RESPIRATORY PHYSIOLOGY

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Background: Misconceptions in Physiology are common and are carried into later years of medical education, perhaps leading to difficulty in understanding Pathology and Medicine later on. To find the prevalence of misconceptions in Respiratory Physiology, one question was asked to 1st, 2nd, 3rd and 4th year MBBS students while they were still studying basic sciences and the response was analyzed accordingly. **Methods:** The question was asked "What happens to the tidal volume during exercise?" to 153 MBBS medical students during their first to fourth year medical education and they were asked to pick the right answer from three choices. **Results:** The correct answer was picked by 35 % of students from all four classes. Furthermore, class wise distribution of the data revealed that correct answer was given maximally by first year students (45%) and fourth year students (43%). But, only 27% and 8% of second and third year students answered the question correctly. **Conclusion:** This data shows the extent of prevalence of misconceptions in Respiratory Physiology among medical students during their years of medical education at one medical institute in Pakistan.

Key words: Physiology, misconceptions, students, laboratory, tidal volume

INTRODUCTION

Concept difficulties are often referred to as misconceptions. The problem with misconceptions is that they are often quite persistent, and they seriously interfere with student's ability to learn Physiology.[1] If students understand correctly that how the normal body works (Physiology) then it becomes much easier to understand abnormal body functions (Pathology). Better understanding of Physiology and Pathology ultimately leads to become a good Physician.

Studies have shown students have faulty mental models of many of the things which we expect them to learn in Physiology.[1,2] Unless and until these misconceptions are identified, no remedial measures could be taken.

So, the first challenge is to find a misconception and then what to do with that misconception? Questions asked during oral examination or classroom sessions are the diagnostic probes and the given answers are diagnostic signs of possible presence of a misconception. During questioning or follow up questioning, if the answer is wrong or given in an unexpected odd way, means student has faulty mental model of that concept.

Once it is found that a particular misconception is quite prevalent, you try to provide your students learning resources and activities that will assist them in remediating the misconception [3]. The present study is an attempt to identify the prevalence of one misconception in Respiratory Physiology at one medical school in Pakistan.

MATERIAL AND METHODS

A very prevalent misconception about respiratory Physiology is the "tidal volume". Students believe that tidal volume is fixed and it cannot increase if breathing frequency increases as occurs during exercise.[4]

Keeping in view this fact, the following question was asked to 153 medical students of 1st, 2nd, 3rd and 4th year classes at our institution. Students were asked to pick the correct answer. To further explore the reasoning behind the misconception, a space was provided for explanation of their answers at the end of questionnaire.

The question asked was:

"Your friend runs up the stairs to the 5th floor because the exam is about to start. When he/she sits down, you observe that his/her breathing frequency (no. of breaths/minute) is increased. At that time, his/her breathing (amount of air he/she takes in each breath) is ------- at rest:

a. Greater than
b. less than
c. the same as

Students were briefed about the objectives of the study, were given five minutes to complete the questionnaire and they were not allowed to consult with each other during this exercise.

RESULTS

Approximately 34 % of all students (1st, 2nd, 3rd and 4th. year) picked "a" (the correct answer) whereas more than half (59 %) picked answer "b" and the remainder (6%) picked "c" (Table 1).

An interesting observation was that 45 % of the first year students picked the right answer which is more than any other class. As compared to that 27 % of second year and 8 % of third year students picked the right answer. Again, 43 % of fourth year students picked the right answer.

Table 1: Class wise response to the question

Class	No. of students	Response to the Question					
		Greater than		Less than		The same	
		No.	%	No.	%	No.	%
1st yr	60	27	45	28	46	5	8
2nd.yr	37	10	27	26	70	1	3
3rd.yr	26	2	8	21	80	3	12
4th Yr	30	13	43	16	53	1	3
Total	153	53	34	91	59	10	6

When asked to explain their answers, most students (59%) wrote that depth of breathing (tidal volume) must decrease when breathing frequency is increased because there is not enough time for more air to move in. So, less air will move in during decreased time of breathing.

Majority of students who picked option “b” (6%) gave the explanation that during exercise only the frequency of breathing changes but tidal volume remains same.

Some very strange and interesting explanations were also given. One student who picked the correct answer “a” wrote in explanation that “while running up, the oral cavity (mouth) will be wide open so greater amount of air will enter the air passages”.

DISCUSSION

Majority of students picked the wrong answer (59%) which does indicate the prevalence of misconception in the important subject of Respiratory Physiology. A wide range of explanations in relation to their answers are also suggestive of problems in concept building.

From the written explanation of the answers, it would appear that majority (59%) of students do not understand the mechanism by which an inspiration is produced; as the inspiratory muscles are made to contract more strongly, alveolar pressure will become more negative, and the pressure gradient driving air into the lungs will be increased. Thus, even if the time available is deceased, more air will flow into the lungs with each breath.

Students also think that tidal volume cannot change because it is defined as the amount of air that moves in a single breath at rest. While this definition is not incorrect, it appears that these students have not incorporated into their understanding of this parameter, the idea that it can be, and is, varied by the body to contribute to homeostasis.[4]

When we breath harder, such as during exercise, both ventilatory rate and the tidal volume increase, although tidal volume tends to increase more than ventilatory rate. Because dead space does not change, a greater fraction of the tidal volume reaches the alveoli at higher tidal volumes.[5]

Class to class variation observed could be due to a number of reasons. One of the reasons could be the quality of students in one particular batch or class. Better performance of first year students as compared to other classes could be because they had recently studied respiratory Physiology. Relative poor performance of second and third year students could be due to diversion of their attention as they move to higher classes, to learning other subjects and start forgetting Physiology.

Another surge with correct answer was seen in fourth year. Again, the reason could be due to class to class variation or somehow they reinforced their concept in clinical years with practical experience of dealing with patients.

Now the challenge is that what to do about these misconceptions? In one study, standard student laboratory experiment (spirometry at rest and during exercise) was used to allow students to discover for themselves that tidal volume does increase during exercise.[1] However, such an experiment is most effective at helping students correct their faulty mental model if you can get them predict the outcome they expect to see, then do the experiment, and finally compare their results with the predictions. With such a protocol, 75 % of the students who entered the laboratory with the misconception left having corrected it. Only 30 % of the students with this misconception remediated it by use of the standard “cookbook” protocol.[1]

CONCLUSION

Misconceptions in Physiology are quite prevalent among medical students. Once perceived they are carried over to later medical years. The best way to correct these misconceptions is to identify them at very first stage and should be corrected with help of laboratory experiments and active discussions.

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