

A Study to Assess the Impact of Biochemical Laboratory Reports as a Tool to Promote Active Learning in Biochemistry Lectures

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ABSTRACT

Introduction: Didactic lectures are widely used means to deliver information to a large group of students. In view of this, majority of the teaching hours allotted by the Medical Council of India in biochemistry is utilized in the form of lectures. These lectures are usually teacher oriented and the students become passive listeners. Beside this, biochemistry is considered as a highly theoretical subject with minimal clinical relevance by students. As a result they are not motivated enough to read biochemistry. To make the lectures interesting and more productive we introduced an activity of interpreting laboratory reports as a method for active learning before the scheduled lecture.

Material and methods: This prospective education trial was conducted in the Department of Biochemistry on first year MBBS students. They were divided into two groups of 75 each. Group A was given an assignment to interpret the laboratory reports followed by a lecture. Group B students directly attended the lecture. The lecture was followed by a test. Following this a feedback was taken. Their marks and responses were compiled and analyzed using SPSS version 23.0. Results were expressed in percentages and mean (S.D). *P* value < 0.05 was considered significant.

Result: Sixty students from group A and 51 from group B appeared for the test. Group A students scored better. They felt more confident in answering and understood the topic better than the group B students.

Conclusion: Use of laboratory reports can be helpful in making biochemistry lectures interactive, interesting and easy to understand.

Keywords: Laboratory Reports, Lectures, Medical Students

INTRODUCTION

Biochemistry is introduced in medical colleges as a subject of basic sciences. Although taught only in the first year, biochemistry is the basis of medicine. It generally deals with important concepts such as regulatory cycles, signaling pathways, metabolic pathways, and structural and functional relationships between various molecules. It helps in understanding the basis of a disease at the molecular level. Besides, it also forms the therapeutic basis of mechanism of action of various drugs. The final goal of teaching biochemistry is to provide value learning experience to medical graduates which would help them to understand and diagnose a disease.¹ As per the recommendation of the Medical Council of India (MCI), biochemistry syllabus is to be covered in a minimum of 240 teaching hours.² Various universities across India allots majority of these hours to didactic lectures. Though lectures are the main means of imparting knowledge to a large audience, the students

are passive listeners during it. For this reason, didactic lectures are not popular among students and hence they are unmotivated.³ Students often fail to embrace the biochemical principles from the overload of information. This results in their inability to integrate and apply the biochemical knowledge into clinical situations.

With a vision of MCI to produce competent Indian Medical Graduates (IMG) many student-centered approaches such as self-directed learning (SDL), problem-based learning (PBL) and case-based learning (CBL) are being promoted^{4,5} to make the students more motivated and responsible for their own learning.⁶ As these methods are small-group teaching methods, it may not be feasible all the time due to paucity of faculty.

In order to make the biochemistry lectures more interesting and productive this study was designed to introduce an innovative teaching method to lecture. We tried to amalgamate a case based approach with the traditional didactic lecture by introducing laboratory case reports before the lecture. Hence this study was carried out with an aim to compare the learning experience and outcome of students sensitized to laboratory reports followed by traditional lecture vs. those exposed to traditional lecture alone.

MATERIAL AND METHODS

The study was designed as a randomized prospective educational trial and conducted at Rohilkhand Medical College and Hospital in the Department of Biochemistry. Institutional Ethical Committee clearance was sought before commencing the study.

Informed consent was taken from 150 first year MBBS students who were then randomized into two groups, A and B of 75 students each. After peer-consultation, the topic of lecture for the class was decided to be jaundice. Students of group A were given a clinical case finding and a series of related biochemistry laboratory reports. They were assigned a task to self-study and interpret the reports and submit their assignment within five days. Those who failed to submit the assignment were excluded from the study. Students of group

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B were used as a control, hence they were not given any assignment. Following the assignment submission, didactic lectures were taken for all the students. A test of total 30 marks comprising of Multiple Choice Questions (MCQs) and Short Answer Question (SAQ) was conducted one week after the lecture. The questions were constructed and validated after peer review keeping in mind that the level of difficulty varied. Ambiguous questions were discarded. Of the 30 marks, 15 marks was allotted for simple knowledge based question, ten marks for understanding and application based questions and the remaining five were for analyzing and evaluation based questions. Both group A and B students were asked to take the test. Only those students who appeared for both the lectures and the test were considered as part of the study. The mean scores of both the groups were compared to evaluate the impact of laboratory report interpretation on the performance of students. Scores of 50% and above was considered as pass. Both formal and informal feedback were taken to assess the learning experience of both the groups. Pre-validated questionnaires were distributed to obtain the formal feedback of the students after the lecture. CCTV footage after the lecture was analyzed by the faculties to study the interaction and participation by the students.

STATISTICAL ANALYSIS

Data was analyzed using Statistical Package for Social Sciences (SPSS) software version 23.0 (SPSS Inc, Chicago, IL, USA). Independent t-test was applied to compare the data and $P < 0.05$ was considered as the cut-off value for significance.

RESULTS

Out of 75 students from group A, 66 submitted the assignment

and attended the lecture. Of these 60 appeared for the test. Among group B students, 63 attended the lecture while 51 appeared for the test. About 79.82% students who had done the assignment on laboratory report interpretation before the lecture passed the test compared to 58.16% of students who attended the lecture directly. The marks of group A students ranged from 8 to 28, whereas those of group B ranged from 6 to 27. Table 1 depicts the mean total marks and the marks scored in different difficulty level question by the students of both the group. Though the range of marks scored were similar the mean marks scored by the group A students was significantly higher.

The formal feedback response of the students based on questionnaire is summarized in table 2. The questionnaire revealed that the group A students who were involved in interpreting laboratory reports prior to the lecture were able to follow the lectures better than those students who came for the lecture directly. As more number of Group A students found it easier to comprehend the concepts of the lectures and take down notes, they were more confident in answering the questions. Active learning in the form of laboratory report interpretation also stimulated and motivated the student to read further about the topic. Majority of the students from group A were confident that they could interpret more reports independently. All the students from group A who were involved in the interpretation of the laboratory reports opined that this topic would be relevant when they start their clinical posting.

DISCUSSION

Biochemistry is a fundamental subject which is not just restricted to preclinical science but also forms the basis of laboratory and diagnostic medicine. With diagnostic tests

	Maximum marks	Marks Scored [Mean (SD)]		<i>P</i> Value
		Group A (n = 60)	Group B (n = 51)	
Total Marks	30	19.35 (4.21)	16.39 (4.76)	0.004
Remembering Based Question	15	10.03 (2.24)	9.27 (2.16)	0.004
Understanding and Application Based Question	10	7.62 (2.12)	5.34 (2.41)	0.03
Analysis and Evaluation Based Question	5	2.6 (1.1)	1.2 (0.54)	< 0.001

Table-1: A table comparing the total mean marks (SD) and the mean marks (SD) scored by the students of both the groups in different type of question.

Questions	Expressed as percentage (number of students)	
	Positive response from students of Group A (n=60)	Positive response from student from group B (n=51)
Were you able to follow the lecture?	93.3% (56)	62.7% (32)
Do you feel motivated to explore more about the topic?	83.3% (50)	47.1% (24)
Were the concepts of lecture clearly understood?	73.3% (44)	49.5% (25)
Was it easy to take notes from the lecture?	83.3% (50)	60.7% (31)
Do you think this topic would be relevant during your clinical posting?	100.0% (60)	68.6% (35)
Do you feel confident in interpreting laboratory reports and diagnosing after the lecture?	90.0% (54)	15.6% (08)
Did you feel confident in answering questions on the topic?	65.0% (39)	49.0% (25)

Table-2: Response obtained by the students based on the feedback questionnaire at the end of the didactic lecture

playing a very vital role in health care management, there is exponential escalation in the scientific knowledge that every medical graduate should understand and apply to diagnose and treat the patients competently. Studies have shown that majority of the students take a superficial approach towards biochemistry with an intention to pass the exams only.⁷ Moreover, many medical students consider learning biochemistry as futile and have a perception that biochemistry has minimal relevance in practice of medicine.⁸ This is due to the abstract nature of the subject as the students do not have any visual impact about the content and a lot is left to imagine. Didactic lecture are most favored teaching learning methods in many colleges as it imparts vast amount of knowledge to a large group of student. This induced passivity among the students and they find the content boring.

In the present study an innovative technique was tried to make the didactic lectures in biochemistry interesting and interactive which would stimulate students to become active learners. For this purpose, a clinical scenario with interpretation of laboratory reports was introduced before the lecture.

This study showed that the group A students who completed the assignment of interpreting the laboratory reports were more motivated and eager to learn. This could be inferred from the attendance of group A students which was higher in both the lecture and the test in comparison to those students who had no knowledge about the topic of the lecture and only attended without prior sensitization. Studies have shown that interest of a student in a lecture topic is a major determinant of attendance in the lecture.⁹ One of the principles of learning is that learners are more motivated and tend to learn better when they are involved in solving real-world problems.¹⁰ Preparation before a lecture also increased the participation of these students in discussion during the lectures. The CCTV footage of the classroom showed that there was more interaction and involvement of students from group A.

Student's feedback revealed that more number of students from the group A were able to understand the topic well and felt that the interpretation helped them relate the biochemical principles of the disease (Table 2). Similar findings were also reported by other studies employing case scenarios for promoting active learning.^{5,11,12}

In order to assess the impact of active learning on the learning process a test was conducted mainly comprising of MCQs and SAQs. As these types of questions are objective it would ensure uniform marking.¹³ This study showed that the students who were given the assignment of interpreting the laboratory reports performed better in the test. This finding was in line with other studies which used cases as means of active learning tool.¹¹ Analysis of the marks showed that the range of marks obtained by both the groups were similar. However, the pass percentage and mean marks of students of group A was significantly higher ($P = 0.004$). It was also observed that the students of group A scored better not only in the simple memory based questions but also in questions which involved understanding, application and analysis (Table 1). This can be attributed to the fact that when students

prepare in advance for a lecture, they are at a better position to comprehend the subject and assimilate the information imparted in the lecture.¹⁴ Active learning helps in facilitating in depth learning as opposed to superficial learning by those who attend lectures unprepared. Moreover, students who attend the lecture unprepared are usually overwhelmed by the amount of new material being taught. Significantly higher marks ($P < 0.001$) obtained by group A students in the analysis and evaluation based questions proves that active learning also promotes critical thinking thus correlate the principles of biochemistry with clinical manifestation (Table 1). Analyzing and interpreting a laboratory report drives the student to devote more time for self-study. More time spent on the topic translates into better performance in the test. Feedback from students revealed that report interpretation made it easier for them to follow the lecture, take notes and also helped them prepare for the test. They also opined that they felt confident that they could form a diagnosis and explain the biochemical basis of disease by interpreting biochemical laboratory reports in comparison to the control students who had no such exposure. This is because learning is enhanced when previous knowledge acts as a platform for building new knowledge. While working on the laboratory reports, the students are sensitized about the topic. Attending the lecture helped them to further consolidate the material and clarify the key points. Apart from some major advantages such as improved concentration, deeper understanding, improved performance and critical thinking, involving the students in the learning process also creates interest in a subject and motivates further reading. In this study all the student of group A opined that the topic is of clinical relevance and would be useful later when they start their clinical posting. Many group A students also admitted that their perception towards biochemistry had changed after realizing its importance in understanding a disease process and forming a diagnosis.

In spite of many positive responses in favor of providing laboratory reports prior to a lecture, some students were reluctant in completing the assignment. They felt that they would not be able to complete the assignment before each lecture because of time constraints and demands of other subjects. However, they thought it could be done for some major topics in biochemistry.

Limitation

It may not be feasible to provide laboratory reports before for every topic. However this can be overcome by providing them other sources for acting learning such as case scenarios, case reports and even pre-lecture assignment with an intention to make biochemistry more clinical oriented. Besides, this study was done as a pilot study and therefore it has to be carried out for a longer period of time to see what final impact such intervention has on the lectures from a student's point of view.

CONCLUSION

Lectures are the main mode of teaching as it is an economical and efficient method for dispensing vast amounts of

information to large groups. Encouraging active learning in students by providing them laboratory reports before a lecture can be helpful in making the biochemistry lectures passive and less teacher oriented and more thought stimulating. Such intervention before any lectures increases rational thinking, comprehension and creates interests for the topic and the concerned subject.

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