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Case-Based Learning and its Application as a Teaching Tool for Medical Graduates in Competency-Based Medical Education in Clinical Microbiology

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Abstract

Background: Microbiology is taught using traditional methods, and its practical application is scarce among medical practitioners. As a result, "active learning" is essential to aid pupil learning. One such strategy is case-based learning (CBL), which helps to improve understanding as well as therapeutic applications of microbiology in everyday practice. **Aim:** CBL was first used as a teaching and learning method in clinical microbiology for medical students. **Methodology:** At IQ City Medical College and Hospital in Durgapur, an educational intervention study was undertaken for the 2nd phase MBBS students. A total of 82 people took part in the study, and two groups were formed. After sensitizing the faculty using CBL, the project was carried out. The first group was given a CBL, whereas the second group was given a didactic talk with crossover. A pre- and post-test was done, and student and instructor perceptions were recorded and assessed. **Results:** CBL was warmly received by both students and teachers. Students and teachers' perceptions were rated on a Likert scale ranging from strongly disagree to strongly agree. In comparison to Didactic Lecture, around 76.8% of students believe that in CBL, we interact more with teachers, followed by 65.9% who believe that CBL has helped me retain the material and its clinical application, and 62.2% who believe that CBL has stimulated self-study. **Conclusion:** CBL in microbiology is an effective technique for improving and changing students' attitudes toward microbiology's applicability in clinical practice. It also helps students gain a better understanding of microbiology.

Keywords: Active learning, Case-based learning, CBME, Didactic lectures, Microbiology

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Introduction

Microbiology is primarily taught using traditional methods, and it has been shown that retention of microbiology is weak. Active learning is necessary to support an interactive student-centered technique of active learning strategy comprising a study of real-life case scenarios. CBL cases are real-life scenarios that offer students with a patient's history and symptoms, as well as clinical indicators and laboratory investigation data.[1-3] Clinical microbiology teaches students about different bacteria and conditions that cause disease. In reality, patients display a variety of signs and symptoms that must be linked to infectious agents and the host's reaction.[4] This linkage is not conceivable in a didactic lesson. This difficulty can be solved by incorporating case-based learning into microbiology. CBL is learner centered and encourages students to pursue self-directed learning. It also improves subject clinical connection, increases skill, and improves teacher-student relationships, all of which increase interest in microbiology. As a result, the current the following goals and objectives guided the research: To introduce case-based learning as a teaching method for undergraduates studying clinical microbiology. Case-based learning has been shown to be an effective teaching approach in clinical microbiology. The goal of this research was to see how the 2nd year medical students and faculty felt about this new methodology.

Methodology

It is an Educational Intervention Study at IQ City Medical College and Hospital in Durgapur's Department of Microbiology. The study duration was 6 months from June to November of 2019. The study was conducted in the 2nd phase of MBBS study under CBME. After getting permission from the Institution Ethics Committee, 82 students from the 2nd phase MBBS (2014) batch participated in the study. The students were sensitized about the project and divided into two groups (Group 1 and Group 2). All the faculties from the department of microbiology were sensitized about case-based learning (CBL) methods in microbiology. Two clinical cases were prepared for CBL session and topic for didactic lecture (DL) was also discussed in the department with all faculties. The questionnaires prepared for the CBL session were finalized and validated properly. Group 1 had one CBL session and Group 2 had DLs on same topic of 45 minutes session for each learning method. After one session, the groups were crossed over and each session was followed with pre- and post-test in the form of MCQ. The department validated

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15 student feedback questionnaires and nine faculty feedback questionnaires. A sample case scenario used to teach urinary tract infection (UTI) is shared below. A sample case scenario for UTI: A young female was admitted to hospital with a history of fever and increased frequency of micturition for the past 4 days. She also complains of burning sensation while passing the urine.

1. What is your most probable diagnosis?
2. Which part of genitourinary tract is likely to be affected?
3. Enumerate common etiological agent in above condition.
4. Keeping in mind, the age and gender of the patient identify the most likely pathogen.
5. Explain the pathogenesis and complications of the clinical condition.
6. What are the investigations required in the case?
7. Do you need to give some instructions to the patient for appropriate sample collection, if yes which instructions are needed?

Feedback was taken from student immediately after each session and for faculty after 1 month. The feedback questionnaires were based on 5-point Likert scale to assess perception toward CBL and DLs in microbiology. The statistical analysis was carried out using the trial versions of the statistical program SPSS 21. For standard mean deviation, a one-sample *t*-test was employed, and statistical significance was determined using $P = 0.05$.

Results

About 82 students from the 2nd phase MBBS were participated out of 100 students. The mean score of DL in pre-test was 7.91 ± 2.20 and post-test was 10.54 ± 1.94, which was statistically significant, as shown in Table 1. The mean score of CBL in pre-test was 8.73 ± 2.81 and post-test was 9.41 ± 2.44. In DL, the score of the students was high in post-test as compared to pre-test. Approximately 91.5% of students score more than 50% marks in post-test, whereas only 35% of students score more than 50% marks in pre-test. Similarly, in CBL, the performance score of the student was good in post-test as compared to pretest. Around 68.3% of students score more than 50% in post-test which were higher than pre-test (52.5%), as shown in Figure 1: CBL has been well received by all faculties and undergraduate students. As indicated in Tables 2 and 3, student and instructor perceptions were rated on a Likert scale ranging from strongly disagrees to strongly agrees. Approximately 76.8% of students claimed that in CBL, we interact more with teachers, followed by 65.9% who stated that CBL has assisted me in remembering the material and its clinical application, and 62.2% who believe that CBL has stimulated self-study. Out of six faculties, two faculties were strongly agree that CBL helps to increase student's interest in microbiology, CBL imparts factual knowledge to the students, and CBL improves long-term retention of the knowledge.

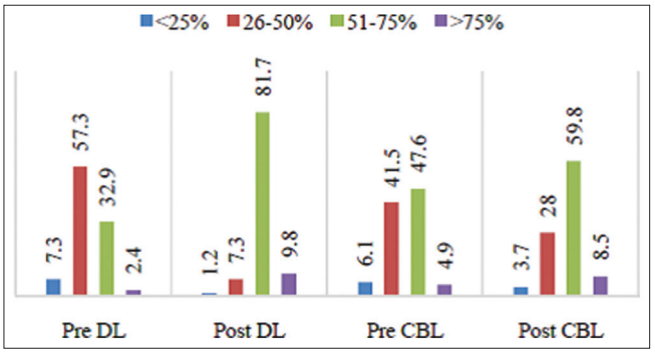

Figure 1: Score percentage of students in didactic lecture and case-based learning during pre- and post-test session

Discussion

The use of case-based learning as a teaching strategy in microbiology can help MBBS students gain a better understanding of clinical applications and their usefulness in patient diagnosis and treatment. Microbiology is taught in classrooms and practical laboratories at most medical colleges, and its clinical application is essentially non-existent, which is why students struggle to understand its clinical use in their daily patient management.[5] As a result, the students' responses to CBL in this study clearly demonstrate that CBL has aided in the recall of microbiology themes and their clinical applications, which are consistent with Garg and Singh work's.[6] We found that 76% of students believed that in CBL, we interact more with teachers than in a DL, which was similar to a study done by Hashim *et al*.[7-9] In a research, whereas in our study, it was found that 51%, 47%, and 50% were less than Tayem study.[10] In our study, 47% of student reacted that CBL helped them in preparing for examination, whereas Suresh Chari showed 62.6%.[11] Student feedback was positive for CBL. We have observed that more than 50–76% of the students were strongly agree that CBL helped in clearing basic concepts (59.8%), motivates self-study (62%), analytical skill (50%), clinical application (65%), interest in topic (61%), increase attention in class (59%), more interact with teachers (76%), and effective learning tool (51%). Similar findings were reported by various studies conducted by a number of authors from diverse parts of the country and medical schools with a variety of specialties.[12,13] Medical science is a subject in which students must recollect a great deal of information and abilities taught in medical school, as well as keep up with the latest research and technology. Various interactive teaching approaches are being used by medical colleges throughout the world to improve learning and retention as well as instill self-directed learning skills in medical students. However, medical institutions in this region of India continue to use the traditional methodology, while some colleges have begun experimenting with interactive teaching methods for active learning to evaluate how effective they are before incorporating them into the curriculum.[14] In this study, the perception of faculty regarding CBL was also noted. Among all faculties, one faculty was strongly disagreed and one was neutral for CBL, while rest four faculty were strongly agreed on positive aspects of CBL. Faculty also found that students were interacting nicely with the faculty facilitator.

Outcomes

What does this research offer to the table? CBL in microbiology is an effective method for improving and changing students'

Table 1: Mean test scores from didactic lecture and case-based learning pre- and post-test sessions (n=82, total score=16)

Teaching Methodology	*Mean score (SD)*		*P-value*
	Pre-test	*Post-test*	
Didactic lecture	7.92 (2.20)	10.53 (1.94)	<0.000
CBL	8.72 (2.81)	9.40 (2.44)	0.097
P-value	0.038	0.001	

Table 2: Percentage of students' views on case-based learning on a 5-point Likert scale

Questionnaire used for collecting feedback	*1*	*2*	*3*	*4*	*5*
CBL has aided me in understanding the fundamental ideas	1.2	1.2	1.2	36.6	59.8
CBL has motivated me for self-study	2.4	0	8.5	26.8	62.2
CBL has improved my communication skills	0	2.4	11.01	31.7	54.9
My analytical skills have been instilled and improved thanks to CBL	1.2	0	7.3	41.5	50
CBL has aided me in remembering the subject and applying it in a therapeutic setting	3.7	0	0	30.5	65.9
CBL has made the topic interesting	2.4	0	0	36.6	61
CBL has helped to increase my attention in class	2.4	0	3.7	34.1	59.8
In CBL, we have more interactions with teachers	2.4	0	0	20.7	76.8
CBL has proven to be a useful learning aid	1.2	0	1.2	46.3	51.2
CBL has improved my learning skills	2.4	7.3	42.7	47.6	47.6
CBL has facilitated independent learning abilities	1.2	2.4	3.7	46.3	46.3
CBL sessions helped me organizing my study material	1.2	2.4	18.3	34.1	43.9
CBL helped me gain skills on working with others	0	0	24.4	37.8	37.8
CBL has helped me in preparing for my examinations	3.7	1.2	13.4	34.1	47.6
CBL helped me better understand the difficult material by discussion with my classmates	2.4	3.7	13.4	34.1	46.3

Table 3: On a 5-point Likert scale, faculty perceptions of case-based learning

Questionnaire used for collecting feedback	*1*	*2*	*3*	*4*	*5*
CBL aids in piquing pupils' interest in microbiology	1		1	2	2
CBL enhanced students clinical reasoning abilities	1		1	3	1
CBL imparts factual knowledge to the students	1		1	2	2
CBL has helped improve peer interaction	1		1	3	1
Time (duration) allotted for CBL sessions were adequate	1		1	2	2
The topics selected for CBL sessions were appropriate	1		1	2	2
CBL makes the students better prepared for examinations	1		1	2	2
CBL improves long-term retention of the knowledge	1		1	3	1
The orientation program equipped me to conduct the CBL sessions effectively	1		1	2	2

attitudes toward microbiology's applicability in clinical practice. It also helps students develop a passion for learning and gain a better understanding of the subject of microbiology. CBL will also increase student-faculty contact, resulting in greater learning and a more pleasant environment.

Conclusion

This method is learner centered and motives the student for self-directed learning, better correlation of subject clinically, enhances skill and better teacher-student relationship which enhances interest in microbiology. CBL can be introduced as teaching-learning method in microbiology.

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