Effectiveness of interactive case-based learning in medical microbiology

Anila A Mathews[1,*], Prathyusha K[2], Thomas V. Chacko[3], Amudha G[4]

[1,3,4]Professor, [2]Assistant Professor, [1,2]Dept of Microbiology [3]Dept of Community Medicine and Medical Education, [4]Dept. of Anatomy, [1,2]Government Medical College, Palakkad Kerala, [3]Believers Church Medical College, Thiruvalla, Kerala, [4]PSG, Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India

*Corresponding Author:
Email: mathewsanila3@gmail.com

Abstract

Introduction: In Indian medical schools, most of the undergraduate teaching is mainly theoretical and mostly teacher centric, though now it is slowly changing to learner centric. In Microbiology, the second year medical students are taught "organism based" instead of "infection based". Interactive Case-based learning (CBL) helps in better understanding of the basic concepts and helps in clinical correlation.

Objective of the Study: To evaluate the effectiveness of an interactive case based learning methodology in teaching microbiology to undergraduate medical students.

Methodology: The crossover interventional study was undertaken at government medical college, Palakkad. The second year MBBS students were briefed regarding the study and were divided into two groups (test and control group). The case-based learning modules were prepared after discussion with the department- faculty and clinician and then validated by renowned faculties from different medical colleges and implemented. Pre and post tests were conducted and the results analyzed using unpaired T test. Feedback from students and faculty too were obtained and analyzed.

Results: The study showed that there was significant difference in the post test scores of students who were part of Case based learning methodology. The feedback analysis using the Likert scale also gave a positive feedback for the CBL sessions.

Conclusion: The interactive case based learning helped the students to understand the basic microbiological concepts better. It also motivated the students and helped them in clinical correlation.

Keywords: Case based learning, Learning modules, Microbiology.

Introduction

Present day Educational training programs in microbiology are mainly theoretical and concentrate more on micro-organisms rather than on common infections in the medical schools in India. In this process, students become disinterested, as they don't realize its clinical importance. Current attitudes of medical students towards basic science courses points to a need to change the training methodology. The method of teaching clinical microbiology based on clinical concepts will facilitate higher ordered learning, critical thinking and self-directed learning.[1] The goal of case-based learning is to prepare the students for clinical practice through the use of authentic clinical cases.[1] It prepares the students to become better clinicians.

Goal: To help the MBBS students understand and apply the Microbiological concepts in the diagnosis of common infectious diseases

Objectives

1. To design learning modules for the case based learning sessions
2. To apply the designed CBL modules as a routine to teach clinical microbiology to MBBS students
3. To evaluate the effectiveness of case based learning methodology

Methodology

Institutional human ethical clearance was obtained. Informed consent was taken from the students for the interventional study. The learning modules were prepared based on KEMPs instructional design model.[2,3] The clinical cases were decided after discussion with five department faculty and a clinician and 20 learning modules were prepared for the selected clinical cases. The learning modules comprised of the clinical case scenario, few important learning objectives, few critical thinking questions and reading material on the same.[1] The learning modules were validated for construct and content validity with the help of external subject experts (belonging to the same specialty but from different colleges in India) and FAIMER faculty based on Waltz and Bausell's criteria.[4]

After validation, the case- based modular learning (CBL) was implemented. The second MBBS students (82 students) were randomly divided into study group and control group. The students were divided into small groups of 8-10 students. Each CBL sessions were held for two hours each. Informed consent was obtained from the students. All the students had the regular lecture class, which was followed by interactive case-based learning for the study group. Pre and post test questions were prepared and they were validated by subject experts and then they were administered to both the groups. A pre-test before the CBL session followed by the post test was administered. The results of the pre

and post-tests of the study- group were analyzed and compared with that of the control group (Kirkpatrick level 2). Feedback from the students (Kirkpatrick level 1) using 5 point Likert Scale and faculty feedback were also obtained. After the post test, the students belonging to control group were also exposed to the CBL sessions.

Statistical Analysis

The pre and post tests were analyzed using the unpaired T test. Feedback from students and faculty's perception also were analyzed.

Results

Table 1: Effectiveness of intervention – Students learning (i,e Kirkpatrick level 2)

Post test score	N	Mean	SD	Standard error/mean	T value	P value
Control group	38	5.01	2.05	0.33	12.09	<0.001
Test group	37	9.95	1.09	0.18		

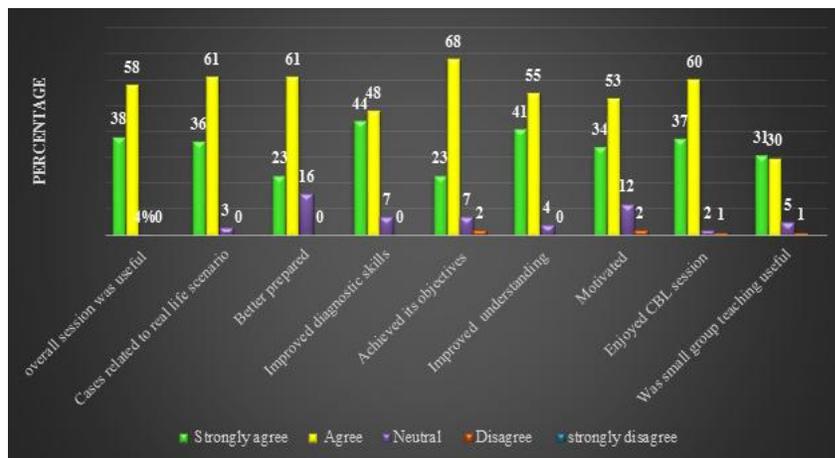The effect size (Cohen d) is 2.98 total marks -12

Fig. 1: Students perception (Kirkpatrick Level 1) (No of students- 75)
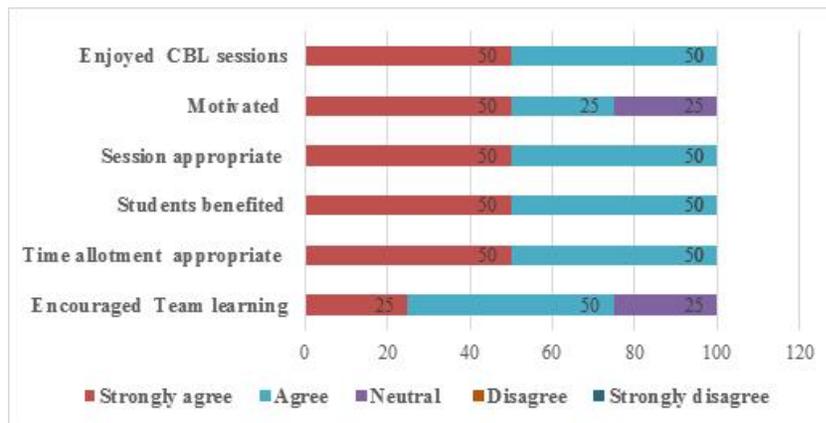

Fig. 2: Faculty feedback on CBL sessions (Total no of faculty- 5)

Among the 82 second MBBS students, 75 students participated in both pre and post tests and their scores were analyzed. The scores of 7 students could not be analyzed as they took part in the post test only. The students perception (Kirkpatrick Level 1) and Students learning (Kirkpatrick Level 2) were analyzed. Fig. 1 shows the perception of students on case- based learning. Table 1 shows the Effectiveness of intervention- Student's learning (I,e Kirkpatrick level 2).

The study showed that there was significant difference in the post test scores of students, who were part of case based learning methodology than the control group. The feedback analysis using the 5 point Likert Scale also showed a positive result for the CBL sessions. Fig. 2 shows the feedback from faculty on CBL sessions. It was found that all faculty were satisfied with CBL sessions conducted and 75% of faculty were motivated to read more on the topic and they felt that the sessions benefited the students, though

they had to prepare more for the CBL sessions, they felt they were also enriched by the experience.

Annexure 1: Example of a case based learning module

Case 1

A 30 year old man admitted with history of fever and head ache for 3 day duration. On physical examination, he was febrile (103 C), had coated tongue and there was bradycardia. He also had mild liver enlargement and splenomegaly. There was no rash, no blood in urine and not on any antibiotics. How will you proceed?

Case 2

A 15 year old boy was admitted with fever and headache for past 10 days. He also complained of abdominal pain and constipation. On examination, he was febrile, had splenomegaly on examination. There is no blood in urine/ stool. He has a history of eating from way side eateries. How will you proceed?

Case 3 - ADD

A10 year old boy after his school picnic complained of vomiting and non-bloody diarrhoea within 36 hours of picnic. At the school picnic he ate vegetable salad, ice cream and roasted chicken. On physical examination, he was febrile. There was no rash, no blood in urine. He was not on any antibiotics either. Other vital signs were normal. Stool was sent for culture and sensitivity. The faecal examination demonstrated a watery stool that was negative for occult blood.

Objectives
1. Describe the pathogenesis of Enteric fever
2. List the clinical features
3. Complications and other manifestations of Salmonella Typhi infections
4. Lab diagnosis – relevant investigations as per the stage of infection
5. Treatment and Prevention

Critical thinking questions
1. Why do patients with sickle cell disease more likely to acquire salmonella infections?
2. Why are people on large amounts of antacids prone for enteric infections?
3. Which infection predisposes to Guillian Barre syndrome and why?

Discussion

The International Medical Education and Medical Council of India has put forward certain minimum learning outcomes that a medical student should demonstrate at the time of graduation and one of these is - need to be a competent clinician who is able to deliver quality health care to the society.[5] To deliver quality health care, a graduate should be a good clinician, who can correlate the symptoms, request for apt investigation, diagnose correctly and promptly and treat correctly. To achieve these objectives, the learner must understand the concepts. Case- based learning is learner- centered approach where the instructor role is that of a facilitator.

When students are given an opportunity to learn by understanding the concepts, it develops more interactive relationship with the subject, this helps in retaining of facts and facilitates active learning.[6]

Case based learning is structured so that the trainees can explore the clinically relevant topics using open ended questions with well-defined goals.[7]

The learners felt that during routine lectures they were unable to think and understand better, as they are busy writing down the notes. However these CBL sessions helped them understand the basic concepts better, the differential diagnosis, to correlate better and to decide the requisite investigation. They also expressed that they could remember the facts better. The involvement of the clinician in designing of the modules helped the students get the actual picture / real life scenario of a clinical condition as seen in the wards. The facilitator's feedback paved way for the improvement of the entire program.

The CBL sessions helped the students to understand the basic concepts better, helped in clinical correlation, made them to think critically and helped in retention of facts. The results of internal assessment exams, which were covered by CBL session, also showed that the students benefited from the interactive CBL sessions. The knowledge gained by the students helped in better application too, as it was evident from their perception, their responses in the practical class and by their responses to the post test and their response to the structured essay question in the internal assessment exam and university exams. It is also evident from the feedbacks given by clinicians that they did gain deeper knowledge on the different infectious disease conditions as compared to topics not covered by CBL. This knowledge/ skill acquired will help them apply their knowledge /skill, when they face similar conditions in the clinics/outpatient department and wards. This type of learning enhanced clinical knowledge, improved team work, improved clinical skills. In the long run, it will prepare the students to become competent physicians and in -turn help to serve the community better.

Conclusion

Interactive case- based learning enhanced active learning in Microbiology. This methodology can be a boon in teaching clinical microbiology to MBBS students instead of the usual microorganism based teaching as routinely done in most of the Indian medical schools.

Acknowledgement

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