

## RESEARCH ARTICLE

### Comparison of case-based learning and traditional lectures in physiology among first year undergraduate medical students

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#### ABSTRACT

**Background:** Physiology is basic and applied medical science. The traditional system of teaching in physiology is teacher centered with minimal participation from the students. Case-based learning (CBL) is a self-directed learning method based on instruction by the use of stories about individuals. It is a student-centered learning. It is helpful to improve the students' scores in knowledge-based and clinical application-based examination. **Aims and Objectives:** Objectives were to introduce CBL as an innovative teaching/learning (T/L) method in physiology and to evaluate its impact on learners and faculty. **Materials and Methods:** Two groups' crossover study was done in 26 first year MBBS students. Cases of hyperglycemia and hypothyroidism were identified and taught in tutorial as traditional and CBL as self-directed learning methods. Evaluation was done by pre-post multiple choice question tests. Feedback of the faculties and learners were taken. **Results:** Comparing pre-post difference in the marks in CBL and tutorial methods in both the groups - no significance difference observed in Group A ( $P = 0.170$ ), significant difference in Group B ( $P = 0.003$ ) were observed, so CBL as better T/L method only in the Group B and not in Group A. Learners agreed that CBL helps them in achievement of learning objectives, increase in the interest, integration of topic, better interaction with instructors. **Conclusion:** CBL can be used as an adjunct to the lectures to strengthen traditional T/L methods through active learning. It stimulates the desire to learn, develop clinical reasoning.


**KEY WORDS:** Case-based Learning; Lectures; Physiology; Teaching/Learning Methodology

#### INTRODUCTION

In this era of medical education, a combination of teaching methodologies can be acquired to facilitate learning among students who have different learning approaches.<sup>[1]</sup> Physiology is both basic and applied medical science. It has

to be taught and learned effectively so as students graduate and practice in the community.<sup>[2]</sup> The traditional conventional system (didactic lecture) of teaching is teacher centered with minimal or no active participation from the students, it has minimal or no integration of subject both horizontal and vertical. Teaching of physiology in this context is an art that transfers knowledge from instructor to student using competent teaching/learning (T/L) exchange process.<sup>[3]</sup> The subject needs to be taught with comprehension of concepts and mechanisms together with the orientation of clinical aspects of disease.<sup>[4]</sup>

Case-based learning (CBL) is "active learning method based on instruction by the use of stories about individuals

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facing decisions or dilemmas.” It is a guided inquiry and instructional method within the context of student centered learning. The CBL strategy is helpful to improve the students’ scores in knowledge-based and clinical application (critical thinking) based examination. There can be no single best way of learning with merits alone, so the effectiveness of any teaching tool can only be acquired by student’s feedback.<sup>[5]</sup> The aims of study to observe the preliminary effects of the introduction of CBL in the teaching of physiology and to evaluate the perceptions of students regarding the CBL.

CBL is an interactive, student-centered, instructor-led learning approach that is closely related to PBL.<sup>[6]</sup> This innovative learning approach was first applied in medical education by the Anatomy Department of a Medical School in Newfoundland, Canada. CBL promotes active learning by utilizing clinical case scenarios which reflect real life experiences that students will face during the clinical phase of their medical education.<sup>[6]</sup> Cases are generally written as problems that provide students with the history, physical findings, and laboratory results of a patient. Hence, this study was planned with objective to evaluate the impact of this method on learners and faculty, in comparison to didactic lectures.

## MATERIALS AND METHODS

A cross-sectional, interventional study was conducted in GMERS Medical College, Gandhinagar, for students of the first year undergraduate medical students. This study was part of the fellowship in medical education course. Total 26 students were enrolled into the study according to convenient sampling design. Ethical approval was provided by the Institutional Ethics Committee in Compliance with the Helsinki Declaration for Ethical Principles of Medical Research Involving Human Subjects. Written consent was sought from participants after the purpose and nature of the study were explained. It was an experimental study conducted on the first year MBBS students. The academic hours allocated to interactive lectures were according to the Medical Council of India, out of which 6 h were allocated for two CBL of endocrinology of 3 h each. Each clinical case scenario was jointly prepared by a team of physiologists and clinician, focused on the objectives of the content related to basic physiological principles. The case scenario included the clinical problem, history of the patient (including personal, family history), laboratory investigations, provisional diagnosis, and treatment chart (if related to physiological intervention) of the patients.

The course objectives were displayed 2-3 days before CBL, and all sessions were carried out by senior faculty members of the Department of Physiology. Two cases were selected. They were hyperglycemia and hypothyroidism. Sensitization of faculties to CBL was undertaken. All the students were

explained about the nature and purpose of the study to students ( $n = 150$ ) and asked them to participate voluntarily in the study ( $n = 26$ ). Written informed consent was taken from the students.

Total students were divided into two groups: Group A ( $n = 13$ ) Group B ( $n = 13$ ). The CBL involved two sessions. In the first session, the group selected a leader and a recorder to lead the session and record all points regarding case, respectively. The case progressed in a stepwise manner, from the known to the unknown facts. The case chiefly focused on identifying key learning issues, patient problems, investigations, and their treatment from the physiological point of view. The students were encouraged to work and discuss with the group members the physiological basis of treatment of the patient with a faculty acting as facilitator. In the second session, all the points were revised and the doubts of students about the case scenario were clarified by the facilitator. The questions were focusing all the domains. Project was implemented as described in Figure 1.

Statistical analysis was performed using unpaired Student *t*-test. Scores were expressed as mean $\pm$ standard deviation and  $P < 0.05$  was considered to be statistically significant. Comparison of improvement of score of Groups A and B after Cases 1 and 2 was done. Comparison of improvement in score in CBL group versus traditional group, analysis of student feedback, analysis of faculty feedback were also done.

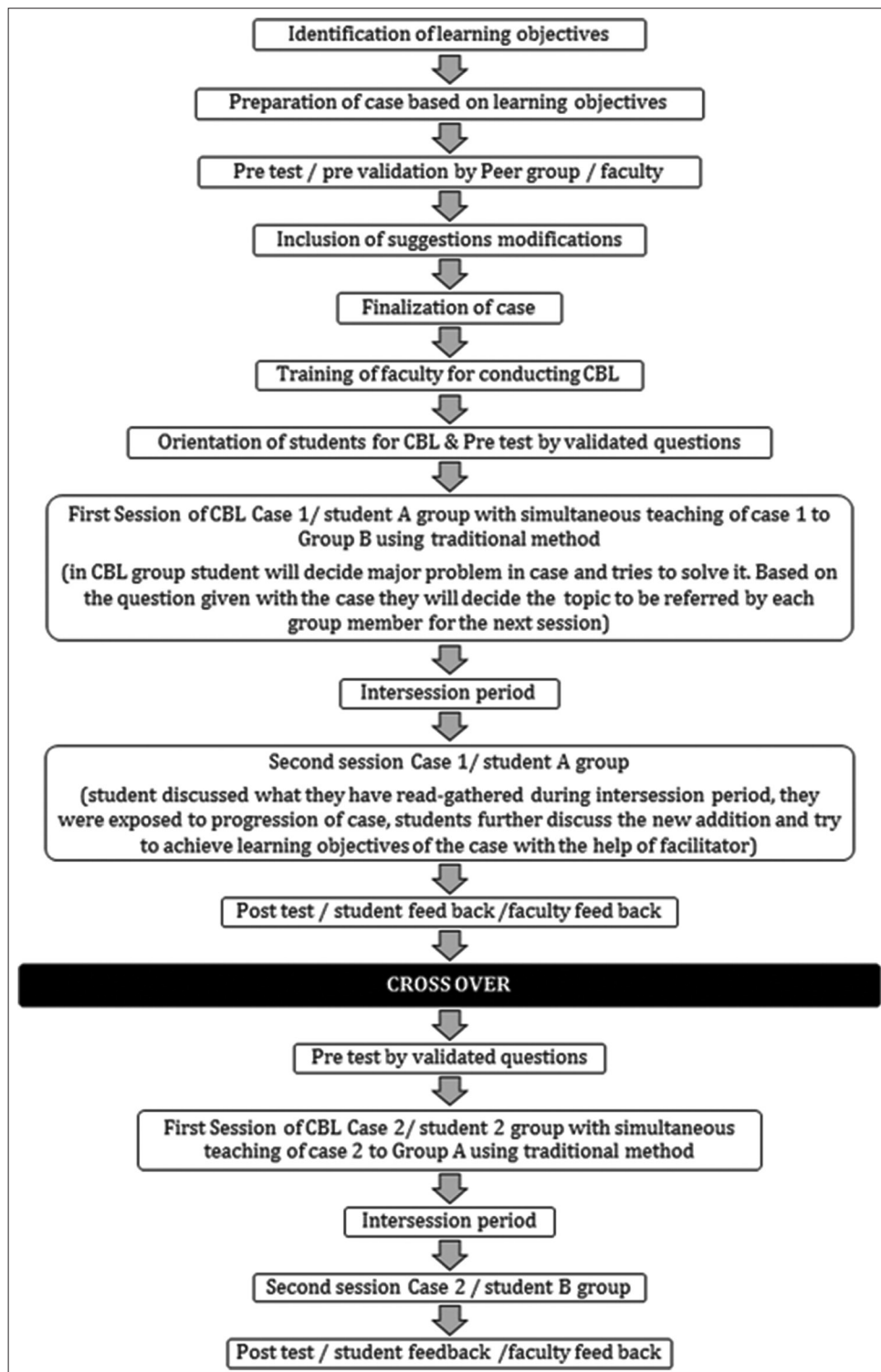
## RESULTS

Out of the 150 students of the major batch briefed about the study, 26 students consented for the study. They were randomly assigned to batches of CBL ( $n = 13$ ) and of tutorials ( $n = 13$ ).

The result of pre- and post-test of the multiple choice questions was compared in both the groups. Statistical analysis was performed using SPSS 16.0.

Table 1 shows pre-post difference in the marks in CBL and tutorial (traditional T/L) methods in both the groups. As we can see in that there is no significance difference between tutorial and CBL in group A ( $P = 0.170$ ), but we can find significant difference between tutorial and CBL in Group B ( $P = 0.003$ ).

Table 2 shows the difference between mean marks in tutorial and CBL methods between the groups. Here also, we can see that the Group B has more achievement in terms of improvement in marks. It may show that the students in the Group B may have more interest, intelligence in the topic and hence the improvement seen in them.



**Figure 1:** Study flow-chart

Regarding CBL in the present study, agreement was found from all learners that CBL enhances self-study through additional resource materials. 12 learners strongly agreed that CBL helps them in achievement of learning objectives, 16 learners strongly agreed that CBL has increased in the interest. 11 students strongly agreed with the cases and physiology content discussed. 13 learners agreed that CBL helped them in better retention of the subject discussed. 12 learners agreed

that CBL facilitated application of physiology to clinical reasoning. All the students agreed with the fact that CBL has facilitated collaborative learning among them.

## DISCUSSION

The present study was done to compare effects of CBL over traditional T/L method in 26 first year physiology students.

**Table 1: Pre-post test comparison within groups**

Groups	Tutorial	CBL
Group A		
Pre-test	5.69	5
Post-test	7.07	5.75
Group B		
Pre-test	4.92	4.38
Post-test	5.23	8

CBL: Case-based learning

**Table 2: Difference in Tutorial and CBL methods between the groups**

Groups	Tutorial	CBL
Group A	1.38	0.916
Group B	1.84	6.38

CBL: Case-based learning

Clinical-based studies have played a significant role in the continuing education of health education providers.<sup>[7]</sup> Learning through the means of CBL helps students to build on prior knowledge, integrate knowledge, and consider application to future situations.

The present study found CBL as better T/L method only in the Group B and not in Group A. Intelligence of Group B learners, interest in the topic and teaching style of tutor can be responsible for the difference in the groups.

The present study findings are consistent with Rehman<sup>[8]</sup> who has done cross-sectional study titled “clinically oriented teaching of physiology through case-based lecturing” among second year medical students of Bahria University Medical and Dental College and found that majority of medical students were able to understand core content of physiology in context with structural and functional relationships and pathological aspects with identification of disease by case-based lectures.

The finding of this study is consistent with Panja *et al.* where CBL was applied on two batches, and they found a significant difference in students’ performance.<sup>[9]</sup>

Williams<sup>[10]</sup> in his study of “the implementation of CBL - Shaping the pedagogy in ambulance education” gave positives and negatives of CBL. In CBL, most of the main discussion points are aimed at promoting further questioning compared to the less narrative version, PBL.

Positives of CBL includes student-oriented subject; subject and topic relevance, e.g., the problem offered is similar to that within “real life;” synthesis of broad range of subjects and topics; development of intrinsic and extrinsic motivation, allowing individualized learning; encouragement for self-evaluation and critical reflection; need for scientific

inquiry and development of providing support for their conclusions; integration of knowledge and practice; development of learning skills.<sup>[11-13]</sup>

At the same time negatives of CBL includes resource-reliant, motivational issues for students, dissent with andragogy with its implicit work ethic; are the problems cognisant with the subject matter? Reliant on smaller size groups, removal the element of choice process, over emphasis of the process rather than outcome, a shift in assessment paradigm, adoption of new skills by students and teachers, and timetable and coordination difficulties.<sup>[14,15]</sup>

On analysis of student’s feedback regarding CBL in the present study, agreement was found from all learners that CBL enhances self-study through additional resource materials. 23 learners (88%) either strongly agreed or agreed that CBL helps them in the achievement of learning objectives, increase in the interest, system case coordination, integration of topic, better interaction with instructors. 13 learners (50%) agreed for CBL helps in better retention. 17 learners (69.2 %) agreed that CBL facilitates application of basic sciences to clinical reasoning.

Present study findings are also in agreement with Tayem.<sup>[16]</sup> In her study of the impact of small group CBL on traditional pharmacology teaching on 68 third year medical students.

The majority of students thought that CBL was an effective learning tool for them (82%) and that it improved their learning skills (83%), independent learning skills (74%), analytical skills (70%), and their level of preparation for exams (75%). Most students reported that team discussions addressed lecture objectives (84%). Regarding cases discussed, most responders said that the cases were appropriate to the lecture topics (96%) and that the time allocated for case discussion was sufficient (86%).

A large proportion of students thought that CBL improved their communication and collaborative skills (68% and 80%, respectively) and ability to work within a team (79%) which is inconsistent with present study findings, where none of the students have reported regarding the improvement of communication and collaborative skills.

Important feedback of the faculties regarding CBL was student motivation is crucial, and CBL is more time consuming.

### Limitation of the Study

Small sample size was one of the limitations of the study.

### CONCLUSIONS

From the above study, it can be concluded that CBL can be used as an adjunct to the lectures to strengthen traditional



T/L methods through active learning. It stimulates the desire to learn, develop clinical reasoning, build confidence among learners. Team-based approach can enhance the interest of the student in the subject of physiology.

CBL as a useful innovative T/L method that could be implemented as an adjunct to the conventional teaching methods in physiology. It promotes analytical skills, problem-solving abilities, communication skills, and self-learning among students. It should be implemented in an organized sustained manner.

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