

Effectiveness of Case Scenario-based Learning Compared with Didactic Lectures in Undergraduate Pathology Teaching: A Quasi-experimental Study

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ABSTRACT

Introduction: Traditional didactic lectures have long been a mainstay in MBBS curricula, yet they are often met with limited enthusiasm from the students. Integrating clinical case scenarios into pathology teaching may enhance student engagement, stimulate curiosity, and improve analytical and diagnostic capabilities.

Aim: To assess the effectiveness of case scenario-based learning compared to didactic lecture classes for understanding the basic pathophysiological mechanisms; in Phase Two MBBS students.

Materials and Methods: This quasi-experimental non randomised study was conducted in the Department of Pathology at Government Medical College, Kannur, Kerala, India, from May 2022 to August 2022 (four months). A total of 78 second-year MBBS students were divided into two groups (n = 39 each) based on their roll numbers. Group 1 received conventional didactic lectures, while Group 2 was taught through case scenario-based modules. Six predesigned modules were delivered by the same faculty member to both groups. Pre-tests, immediate post-tests, and delayed assessments (after two weeks) were conducted for each module. Following the completion of assessments, Group 1 was subsequently exposed to case scenario-based learning while Group 2 received didactic lectures on the same six modules. Students performance was statistically analysed, and perceptions regarding both teaching methods were collected

using a 5-point Likert scale questionnaire. Data were entered in MS Excel and analysed using Statistical Package for the Social Sciences (SPSS) version 18.0.

Results: The case scenario group consistently scored higher than the didactic lecture group in post-tests (Mean scores= 40.56±6.00 vs 39.02±7.45) and two-week assessments (Mean scores 33.23±5.53 vs 30.08±7.53), though significant differences emerged in only two modules. Both groups showed distinctive improvement in post-test scores. Notably, 29/31 (93.5%) and 32/33 (97%) of students in Group 1 and 2, respectively, preferred case scenario-based learning, describing it as more interesting, effective, and thought-provoking than didactic lectures. In perception analysis both the groups mostly had a median of four, but Group 1 showed a lower variability, indicating more consistently positive responses. Mann-Whitney U analysis showed statistically significant differences for all perception parameters (p-value <0.05), indicating a stronger positive perception toward case scenario-based learning among students in Group 1.

Conclusion: While both didactic and case scenario-based approaches are effective in enhancing pathology learning, the latter promotes greater interest and active engagement. Case scenario-based learning aligns theoretical knowledge with real-world clinical contexts, suggesting it may be a more impactful teaching strategy for fostering deeper understanding and critical thinking in medical education.

Keywords: Medical students, Pathology learning, Perceptions

INTRODUCTION

Pathology is a fundamental discipline in medical education, serving as a critical bridge between basic sciences and clinical practice. It provides essential insights into disease mechanisms, enabling students to understand the basis of diagnosis, treatment, and prevention. However, pathology teaching in many medical institutions continues to rely predominantly on traditional didactic lectures, which are largely teacher-centred and promote passive learning. This approach often limits student engagement, restricts the development of clinical reasoning, and makes it difficult for learners to integrate theoretical knowledge with real-world clinical applications [1].

With the implementation of Competency-Based Medical Education (CBME), there has been a paradigm shift from knowledge acquisition to the application of knowledge and development of higher-order cognitive skills. CBME emphasises active learning, integration of disciplines, cultivation of clinical reasoning and decision-making abilities in undergraduate students. In this context, innovative teaching-learning methods such as Case-Based Learning (CBL)

have gained increasing attention as effective alternatives to conventional lectures [2].

CBL is a learner-centred pedagogical approach that uses real or simulated clinical scenarios to contextualise theoretical knowledge and promote active engagement. By encouraging students to analyse, discuss, and solve clinical problems, CBL facilitates deeper understanding, improves retention, enhances critical thinking and problem-solving abilities [3].

Evidence from systematic reviews suggests that CBL significantly improves rational thinking, teamwork, communication skills, and student satisfaction compared to lecture-based learning, although its impact on knowledge acquisition alone may be comparable to traditional methods [4].

Similarly, meta-analytic data indicate that CBL enhances higher order thinking skills and analytical reasoning abilities by linking theoretical concepts to practical decision-making scenarios [5].

In pathology education, CBL is particularly relevant because it enables students to connect morphological and pathophysiological

concepts with clinical manifestations. Studies have shown that CBL promotes active learning, improves analytical skills, and enhances students' ability to apply knowledge in clinical contexts, making it a valuable tool in bridging the gap between theory and practice [6]. Additionally, CBL has been found to increase student motivation, engagement, and satisfaction, while fostering self-directed learning and intellectual reasoning essential for future medical practice [7].

Despite these advantages, the implementation of CBL in undergraduate pathology education remains inconsistent, and the existing evidence is limited by methodological heterogeneity, variable study designs, and a lack of robust comparative data in specific educational contexts. Many studies focus primarily on student perceptions rather than objective learning outcomes, and there is a paucity of well-structured comparative studies evaluating both immediate learning and knowledge retention among undergraduate medical students.

Therefore, there is a need for well-designed studies that systematically compare case scenario-based learning with traditional didactic lectures in pathology, particularly in the context of Phase II MBBS students. Such studies are essential to generate context-specific evidence on the effectiveness of CBL in improving learning outcomes and to frame curriculum design within CBME schema.

Research question: Is case scenario-based learning better than didactic lecture classes at improving the academic performance of Phase Two MBBS students in Pathology?

Hypotheses

Null hypothesis: There is no difference in the arithmetical means in the achievement tests of undergraduate medical students in Pathology when they are taught either by didactic lecture alone or by case scenario-based learning methods.

Alternate hypothesis: There is a significant difference in the arithmetical means in the achievement tests of undergraduate medical students in Pathology when they are taught either by didactic lecture or case scenario-based learning.

Objectives

- To assess the effectiveness of case scenario-based learning compared to didactic lecture classes for understanding the basic pathophysiological mechanisms; in Phase Two MBBS students.
- To determine the perceptions of Phase Two MBBS students towards case scenario-based learning versus didactic lectures.

MATERIALS AND METHODS

This quasi-experimental non randomised study was conducted in the Department of Pathology, Government Medical College, Kannur, from May 2022 to August 2022 among Phase two MBBS students attending pathology classes. Initially, 100 second-year MBBS students were considered for inclusion in the study. However, 22 students who had failed the first-year examination were excluded resulting in 78 eligible participants and were divided into two equal groups based on their roll numbers, with 39 students in each group. Group 1 was taught using conventional didactic lectures, whereas Group 2 received case scenario-based learning. Ethics committee clearance was obtained. (IEC NO. 13/2022/GMCK dated 5/5/2022). Students provided informed consent before starting the study.

Inclusion criteria: All Phase Two MBBS students attending pathology classes and willing to participate in the study included in the study.

Exclusion criteria: Students who did not provide consent were excluded from the study.

Intervention: Six teaching modules were designed after consulting pathology faculty, each covering case scenarios addressing two competencies from chapters of similar complexity. Specific learning

objectives were set for each competency. Students were divided into two groups based on roll numbers, taught either through didactic lectures or case scenario-based learning. Both groups underwent six intervention cycles across different topics. Pre- and post-tests assessed student interest and learning. All the assessment questionnaires were validated by three subject experts and included multiple choice questions, multiple correct answers questions, true or false and picture based questions and there were 10 questions in each test.

On same topics Group 1 received didactic lectures covering definitions, clinical features, aetiopathogenesis, classification and morphology. Group 2 was taught using a case scenario-based learning method, in which structured clinical scenarios were incorporated to teach the pathological concepts. Post-tests were held immediately after each session for both groups by Google forms. No mingling of groups was allowed before these tests. After an interval of two weeks, post assessment was conducted for each topic to test students' retention ability. Following completion of all assessments and prior to perception data collection, Group 1 was introduced to case scenario-based learning and Group 2 received didactic lectures on the same six modules by the same faculty. Anonymous feedback questionnaires were used to collect student perceptions.

STATISTICAL ANALYSIS

Data were entered in MS Excel and analysed in SPSS version 18. The scores at the three-assessment time points were summarised as mean and Standard Deviation (SD). Student's t-test was used to compare the score between the two groups at each of these time points. A repeated-measure ANOVA was used to compare the mean score between the three time points in each group. Bonferroni post-hoc test was used for multiple comparison after repeated-measure ANOVA for pairwise comparison. Qualitative variables like preference of method were summarised as frequency and percentage. Students' perceptions regarding the teaching methods were evaluated using a structured 5-point Likert scale questionnaire. Normality of perception scores was assessed using the Shapiro-Wilk test. Since the data showed non normal distribution, results were expressed as median with Interquartile Range (IQR), and comparisons between the two groups were performed using the Mann-Whitney U test. A p-value <0.05 was considered as statistically significant.

RESULTS

The study involved 78 Phase two students, though only 64 attended all classes with 31 students in didactic lecture group (Group 1) and 33 in Case scenario group (Group 2). Others were absent due to illness or personal reasons. Six teaching modules covered were myeloproliferative neoplasms, multiple myeloma, Human Immunodeficiency Virus (HIV), autoimmune diseases, amyloidosis, and hypersensitivity reactions.

Student's t-test showed no significant differences in overall cumulative pretest scores between groups, except for myeloproliferative neoplasms and multiple myeloma. Group 2 generally scored higher in post-tests and assessments after two weeks compared to Group 1. These differences were not statistically significant except for HIV post-tests and hypersensitivity retention assessments.

Cumulative scores from all sessions showed significant improvement in post-test scores in both groups compared to pretest scores. Although scores declined after two weeks, they remained significantly higher than pretest levels, indicating knowledge retention. When comparing total post-tests and two-week assessments between groups, Group 2 (40.56 and 33.23) scored higher than Group 1 (39.02 and 30.08), but the difference was not statistically significant [Table/Fig-1]. Bonferroni post-hoc analysis confirmed significant differences across pretest, post-test, and two-week assessments (p-value<0.001) [Table/Fig-2].

Variable	Mean score±SD		t-value	df	p-value
	Group 1 (n=31)	Group 2 (n=33)			
Total pretest	22.04±3.92	21.98±3.96	0.06	62	0.96
Total post-test	39.02±7.45	40.56±6.00	0.92	62	0.36
Total retention test	30.08±7.53	33.23±5.53	1.91	62	0.06

[Table/Fig-1]: Total mean scores of pre-tests, post-tests and two weeks' assessment.

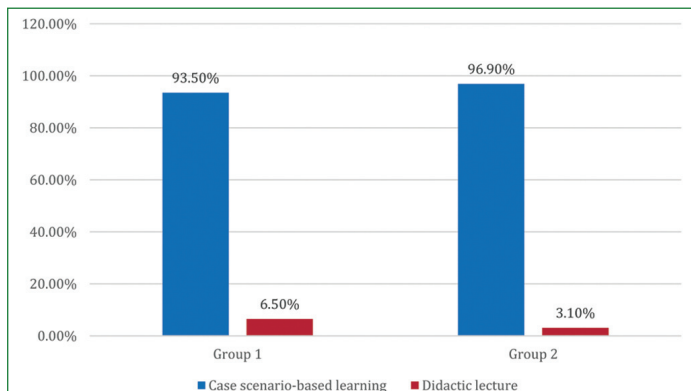
Comparison	p-value* in Group 1	p-value* in Group 2
Total pretest to total post-test	<0.001	<0.001
Total post-test to total retention test	<0.001	<0.001
Total pretest to total retention test	<0.001	<0.001

[Table/Fig-2]: Comparison of mean differences in scores between the different time periods in each intervention group.

*- p-values are based on the Bonferroni multiple comparison test

Regarding perceptions, across both the groups, the majority of students preferred case-scenario based learning (Group 1: 29 (93.5%); Group 2: 32 (97%)) over didactic lectures (Group 1: 6.5%; Group 2: 3.1%) [Table/Fig-3]. Both groups agreed more than disagreed on the Likert scale questionnaire (p-value <0.05). Median scores were predominantly four in both groups; however, Group 1 exhibited lower interquartile variability for several items, indicating more consistent positive perceptions among students. Shapiro-Wilk test demonstrated non normal distribution of perception scores (p-value<0.05 for all variables). Mann-Whitney U analysis revealed statistically significant differences between the groups for all perception domains (p-value<0.05), suggesting a stronger positive perception toward case scenario-based learning in Group 1. Mean perception scores were higher in Group 1 (32.69) than Group 2 (28.51). Students taught by didactic lectures expressed a stronger preference for the statement-case scenario-based learning making classes more interesting (p-value<0.001) [Table/Fig-4].

Students from both groups found case scenario-based learning more interesting, informative, interactive, and effective than lectures. They reported better correlation of scientific data, improved memory



[Table/Fig-3]: Preferred learning method by the participants.

Variable	Median (IQR)		Mann-Whitney U	p-value	Mean score±SD	
	Group 1 (n=31)	Group 2 (n=33)			Group 1 (n=31)	Group 2 (n=33)
Case scenario-based learning motivated me to learn pathology	4 (0.00)	4 (1.00)	493.50	0.002	4.13±0.73	3.69±0.66
My understanding of pathology concepts was increased by case scenario-based learning	4 (0.50)	4 (1.00)	487.00	0.002	4.13±0.70	3.67±0.58
I found retaining pathology concepts in memory easier with case scenario-based learning	4 (0.00)	4 (1.00)	483.50	0.002	4.08±0.66	3.51±0.79
Case scenario-based learning enhances critical thinking ability	4 (0.50)	4 (1.00)	500.00	0.005	4.13±0.70	3.59±0.85
The emphasis on clinical concepts helped me in learning pathology	4 (0.00)	4 (1.00)	450.50	< 0.001	4.05±0.79	3.54±0.64
Case scenario-based discussions improved my clinical reasoning ability	4 (0.00)	4 (1.00)	517.50	0.006	4.05±0.69	3.56±0.75
Case scenario-based learning makes classes more interesting	4 (1.00)	4 (1.00)	425.50	<0.001	4.28±0.76	3.59±0.82
Case scenario-based learning makes me interested to read textbooks	4 (0.00)	3 (1.00)	489.50	0.004	3.85±0.90	3.36±0.84

[Table/Fig-4]: Comparison of mean perception score between two groups.

retention, and greater engagement, feeling involved like investigators. Some students requested case scenario videos, noting that clinical scenarios helped them understand complex concepts and their practical application.

DISCUSSION

Innovative teaching methods are being introduced in preclinical and paraclinical MBBS subjects to engage students and highlight the relevance of their learning for future practice. Many medical schools have adopted vertical integration and early clinical exposure to achieve this [8]. However, most teaching still relies on didactic lectures, which students often find less engaging. This prompted us to explore the impact of case scenario-based learning compared to didactic lecture for MBBS students. Designing effective case scenarios is challenging. The present study developed scenarios based on real-life problems and triggering events, incorporating questions to help students connect patient stories to complex pathophysiological processes.

Baseline pretest scores were similar between groups. All students had improved post-test and two-week assessment scores, with higher gains in the CBL group. However, significant differences were noticed only in two topics, possibly due to the small sample size and the limited number of modules. Originally planned for 100 students, the study began with 78 (excluding those who failed the first-year examination), but only 64 completed all six modules. This attrition was primarily due to absenteeism related to illness and personal commitments.

A study conducted among 150 MBBS students at MAHSA University similarly demonstrated significant post-test improvements after CBL, than the control group taught by traditional didactic lectures [9]. In the present study, significant differences were observed across pretest, post-test, and two-week assessments (p-value<0.001).

In this study, more than 93% of students from both the groups preferred CBL over DL, finding it more interesting and helpful in understanding complex concepts and linking them to clinical practice. They reported enhanced critical thinking skills. A study from Sydney on international public health students, many of whom were from India, noted similarly improved critical thinking after CBL, suggesting differences between rote-based and analytical learning systems [10].

A comparative study conducted in Punjab on didactic lectures and CBL in Pharmacology demonstrated statistically significant improvements in student performance following CBL (p-value<0.0001). Students also reported that CBL would enhance their ability to apply concepts logically in future clinical scenarios [11]. The integration of clinical scenarios into pathology teaching deployed through digital platforms has previously shown to enhance student participation and interest, thereby highlighting the flexibility of this method [12]. Interestingly, students taught through didactic lecture in the present study showed an even stronger positive response to CBL. This may be attributed to its engaging and stimulating nature, compared to the didactic lectures initially received, case scenario-based learning was perceived as a more refreshing and interactive approach, thereby facilitating better topic comprehension.

The strengths of the study were that case scenarios and test questions were peer-reviewed by pathologists, classes conducted by the same faculty, and answered through Google Forms. Post-tests assessed students' analytical skills. To maintain the integrity of the study, no interaction or mingling between the two student groups was permitted until the completion of each post-test. Students were exposed to both teaching methods prior to completing the perception questionnaire, allowing them to provide informed and comparative responses. Case scenario-based learning could be regularly incorporated into the curriculum without financial burden.

Limitation(s)

The study sample size was limited by student attendance issues and the constraint of one-hour class durations, which also reduced the time available for both tests and in-depth reflection on the case scenarios. The exclusion of students who failed the first-year examination may have introduced selection bias and affected the generalisability of the findings. The students were allocated into groups based on their roll numbers which may have introduced selection bias. However, given the relatively homogenous study population, the impact of this bias was minimal. Although the efforts were made to minimise interaction between the groups, a possibility of cross-contamination cannot be entirely excluded. The questionnaire was reviewed by subject experts for clarity and relevance before use; however, formal validation and reliability testing were not performed, which may have influenced the assessment of students' perceptions. Additionally, 18% attrition rate would have also affected the study outcomes. It is recommended that clinical case scenarios be integrated into every lecture session to enhance student engagement, foster critical thinking, and improve the application of theoretical knowledge to clinical practice.

CONCLUSION

Both case scenario-based learning and didactic lectures were found to be effective in supporting pathology learning among MBBS students. However, case scenario-based learning proved superior in generating student interest and engagement. The majority of students expressed a clear preference for this method, perceiving it as more stimulating and beneficial for developing critical thinking, clinical reasoning, and a deeper understanding of complex disease mechanisms. Incorporating case-based approaches may therefore enhance the overall effectiveness of pathology education.

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