ORIGINAL ARTICLE

Effectiveness of Case-Based Learning Versus Traditional Lectures on Clinical Reasoning Skills in Undergraduate Medical Students

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ABSTRACT

Background: Clinical reasoning is a fundamental component of medical education and is essential for accurate diagnosis and appropriate patient management. Conventional lecture-based teaching is widely used but often promotes passive learning and may be insufficient for developing higher-order clinical reasoning skills. Case-based learning (CBL) has been proposed as an interactive instructional approach that enhances analytical reasoning by integrating theoretical knowledge with real-life clinical scenarios.

Objective: To compare the effectiveness of case-based learning and traditional lecture-based teaching in improving clinical reasoning skills among undergraduate medical students.

Methods: This quasi-experimental comparative study was conducted from January 2021 to February 2022 at an undergraduate medical college. A total of 80 undergraduate medical students in the clinical phase of training were included and divided into two groups: case-based learning (CBL; n = 40) and lecture-based learning (LBL; n = 40). Both groups were taught the same subjects over an identical period using different instructional approaches. Clinical reasoning skills were assessed before and after the intervention using a structured and validated assessment tool. Data were analyzed using paired and independent t-tests, with a p-value ≤ 0.05 considered statistically significant.

Results: Both groups demonstrated comparable baseline clinical reasoning scores. Post-intervention scores showed significant improvement in both groups (p < 0.001). However, the improvement was significantly greater in the CBL group compared to the LBL group (mean post-test score: 72.4 ± 7.8 vs. 62.3 ± 8.1; p < 0.001).

Conclusion: Case-based learning is more effective than traditional lecture-based instruction in improving clinical reasoning skills among undergraduate medical students. Incorporating case-based learning into undergraduate medical curricula may better prepare students for clinical practice by promoting active learning and critical thinking.

Keywords: Case-based learning, Lecture-based learning, Clinical reasoning, Undergraduate medical education, Teaching methods.

INTRODUCTION

The conventional teaching approach to the delivery of the fundamental knowledge to undergraduate students in medical education has been the didactic and lecture-based teaching[1]. Although lectures can be effective in imparting a lot of information to a big group of learners, they tend to encourage passive learning which involves memorization and not comprehending and practicing the information[2]. In the contemporary clinical practice, however, clinicians are not merely expected to memorize facts but also synthesize them, analyze patient data and make quality clinical judgments. This increased disparity between knowledge learning and application to actual clinical practice has led to educators considering more dynamic and learner based pedagogical methods[3].

Clinical reasoning is an essential skill in medical education which involves the capacity to gather pertinent patient data, provide differentials, process investigations, and create the right management policies[4]. Lack of clinical reasoning is a significant source of diagnosis errors and inappropriate patient care. Hence, the teaching method that involves the active involvement of learners in problem-solving and decision-making is gaining popularity in medical undergraduate education[5]. Case-based learning (CBL) has been introduced as an organized mode of instructional approach to fill the gap between theory and practice. CBL involves students acquiring knowledge in real-patient scenarios in the form of real or simulated clinical cases. This methodology involves active engagement, discussion, critical thinking and application of fundamental and clinical sciences in context[6].

Through case work, the students get a glimpse of what clinical medicine is about in its complexity and uncertainty, and this experience can lead them to better clinical reasoning than lectures do[7]. Although the integration of case-based learning in medical schools across the globe increases, there is indeed no consistent evidence on how it measures up to the traditional methods of lecture-centered teaching, especially in terms of training trainees on clinical reasoning skills. Learning outcomes can be affected by curriculum design, student background, faculty training and institutional resources. As such, there is a need to discuss and compare these instructional practices in certain schools[8].

This study aims to determine whether case-based learning or the conventional lectures are the most effective teaching methods in promoting clinical reasoning among undergraduate medical students. The study aims to offer evidence-based knowledge on how these two teaching methods can be compared via a systematic comparison as a way of influencing the development of curricula and optimal teaching methods in undergraduate medical education[9].

MATERIALS AND METHODS

This quasi-experimental comparative study was conducted at Ameer-ud-Din Medical College, Lahore, Pakistan, over a study period from January 2021 to February 2022. The study aimed to compare the effectiveness of case-based learning (CBL) versus traditional lecture-based learning (LBL) in improving clinical reasoning skills among undergraduate medical students in the discipline of Obstetrics and Gynecology.

A total of 80 final-year MBBS students enrolled in the clinical phase of their training were included in the study. Students who had previously received structured teaching on the selected topics or those who declined to participate were excluded. Participation was entirely voluntary, and written informed consent was obtained from all participants prior to enrollment. Ethical approval was granted by the Institutional Ethical Review Committee, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

The participants were allocated into two equal groups using a non-randomized consecutive sampling technique to ensure comparable academic standing between groups. The case-based learning group (CBL; n = 40) received instruction through structured clinical cases relevant to Obstetrics and Gynecology that simulated real-life patient scenarios. Each session began with the presentation of a clinical problem, followed by guided group discussions in which students identified key clinical features, formulated differential

diagnoses, interpreted investigations, and proposed appropriate management plans. Faculty members acted as facilitators, promoting active participation, critical thinking, and peer interaction rather than didactic instruction.

The lecture-based learning group (LBL; n = 40) was taught the same topics during the same period through conventional didactic lectures delivered by experienced faculty members using multimedia presentations. Teaching in this group primarily focused on content delivery with limited student interaction.

Clinical reasoning skills were assessed using a structured and validated assessment tool, administered before (pre-test) and after (post-test) the teaching intervention. The assessment consisted of case-based multiple-choice questions and short-answer questions designed to evaluate diagnostic reasoning, interpretation of clinical data, and clinical decision-making. Baseline comparability between the two groups was ensured using pre-intervention scores. Demographic variables, including age and gender, were recorded.

To maintain confidentiality, assessment scores were anonymized using coded identifiers. Data analysis was performed using SPSS software. Quantitative variables were expressed as mean ± standard deviation. Paired t-tests were used to compare pre- and post-intervention scores within each group, while independent t-tests were applied to compare post-intervention scores between the two groups. A p-value ≤ 0.05 was considered statistically significant.

RESULTS
A total of 80 undergraduate medical students were included in the study, with 40 students allocated to the case-based learning (CBL) group and 40 students to the lecture-based learning (LBL) group. All participants completed both the pre-intervention and post-intervention assessments, and their data were included in the final analysis. Baseline comparability between the two groups was confirmed, as there were no statistically significant differences in terms of age, gender distribution, or pre-test clinical reasoning scores, as shown in Table 1.

Pre-intervention assessment demonstrated comparable clinical reasoning scores in both groups, indicating baseline equivalence. Following the teaching intervention, both groups showed significant improvement in clinical reasoning scores; however, the magnitude of improvement was greater in the CBL group, as shown in Table 2.

Paired t-test analysis revealed that the increase in clinical reasoning scores within both groups was statistically significant (p < 0.001). However, the post-intervention scores were significantly higher in the CBL group compared to the LBL group. Independent t-test comparison of post-intervention scores confirmed this difference, as shown in Table 3.

The difference in post-intervention mean scores between the two groups was statistically significant (p < 0.001), indicating superior performance of students in the case-based learning group. Overall, while both teaching approaches improved clinical reasoning skills, case-based learning resulted in significantly greater gains in analytical thinking, diagnostic reasoning, and application of clinical knowledge among undergraduate medical students.

Table 1: Baseline demographic characteristics of students

Variable	CBL Group (n = 40)	LBL Group (n = 40)	p-value
Mean age (years)	22.4 ± 1.3	22.6 ± 1.4	0.58
Male, n (%)	21 (52.5%)	20 (50.0%)	0.82
Female, n (%)	19 (47.5%)	20 (50.0%)	—

Table 2: Comparison of pre- and post-intervention clinical reasoning scores within each group

Group	Pre-test score (Mean ± SD)	Post-test score (Mean ± SD)	p-value
CBL (n = 40)	48.6 ± 6.9	72.4 ± 7.8	<0.001
LBL (n = 40)	49.1 ± 7.2	62.3 ± 8.1	<0.001

Table 3: Comparison of post-intervention clinical reasoning scores between CBL and LBL groups

Group	Post-test score (Mean ± SD)	Mean difference	p-value
CBL (n = 40)	72.4 ± 7.8	10.1	<0.001
LBL (n = 40)	62.3 ± 8.1	—	—

DISCUSSION
In the current study, case-based learning was compared with undergraduate teaching based on lectures to test its effectiveness in enhancing clinical reasoning by undergraduate students in the medical field[9]. The results indicate that in as much as both instructional delivery models have led to a substantial change in the clinical reasoning score, learners using case-based learning were significantly more improved than those who were instructed using traditional lectures[10]. These findings indicate an educational benefit of active and student-centered learning approaches in the development of higher order thinking skills necessary in clinical practice[11]. The elaboration of clinical reasoning is a multifaceted process, which involves incorporation of knowledge, analytical ideas and decision making as far as patient care is concerned[12]. The conventional lecture-based instruction largely focuses on imparting information and factual memories which might not help students suitably to put into practice what they learn in actual clinical situations. Conversely, case-based learning issues place students in simulated clinical scenarios which reflect real life practice and forces them to actively process information, produce differentials, and support management choices[13].

This interactive and contextual character of case-based learning is probably the reason behind the better performance after the intervention in the CBL group[14]. The much greater improvement in the score of the clinical reasoning of students in the case-based learning group is in line with the educational theories, which can justify active learning and constructivism, when learners develop knowledge during engagement and reflections[15]. Case-based learning fosters in-depth learning and sustained learning of clinical concepts through the encouragement of discussion, peer engagement, and facilitator-guided inquiry[16]. In addition to this, clinical exposure to real clinical cases makes students understand the uncertainty and complexity involved in medical decision making that is not easily depicted in the conventional lectures[17]. The results of the study are considered to be consistent with the earlier published literature, which prove the beneficial effect of case-based learning on clinical reasoning, problem-solving skills, and the involvement of the learner in the medical education[18]. Various studies have found that students who are taught through the case-based or problem-based learning demonstrate better diagnostic accuracy and critical thinking and have more confidence in clinical settings than students taught through didactic lectures. The current study contributes to this evidence by presenting a context-specific data among undergraduate medical students, which supports the validity of such educational advantages[19].

Although the benefits of case-based learning are proven, one should not ignore conventional lectures. The lectures are still an effective way of presenting the background information, especially when time and funds are scarce[20]. A more integrated method of combing lectures with case-based learning can therefore be the best approach to use where students can gain the basic knowledge on lectures but can sharpen their clinical reasoning skills on the case discussions. Such integrated models of teaching cannot be successfully implemented without faculty development and multiple planning of the curriculum[7,9]. There are some limitations of this study. The lack of a randomized design and single-institution location might restrict the applicability of the results. Also, clinical reasoning was measured within comparatively brief period of time, and no long-term skill retention was measured. Further study that includes multi-center designs, randomized allocation and longitudinal follow-up would present more compelling evidence on the lasting effects of case-based learning on clinical competence[21,22]. To sum up, the findings of the study designate that

case-based learning is superior to the conventional lecture-based instruction in the development of clinical reasoning skills in undergraduate medical students. Structured case-based learning sessions applied to undergraduate medical programs can provide a more effective training to students in clinical practice and help produce competent and reflective future doctors[23,24].

CONCLUSION

The study has come to a conclusion that case-based learning is a superior approach to teaching clinical reasoning skills to undergraduate medical students compared to a traditional lecture approach. Though both methods of teaching resulted in a considerable rise in the performance of the students, the extent of the same was far higher in the students who were subjected to case-based learning. Through case-based learning, students develop an improved ability to think critically, reason diagnostically, and apply medical knowledge to a practical setting through active participation in realistic clinical scenarios. The results endorse the integration of case-based learning into the medical undergraduate curricula as the add-on method to the traditional lectures. Structured clinical cases together with the conventional teaching can perhaps close in the gap between theoretical learning and actual patient care so that medical students can be better equipped in practical application of the material taught in the classroom. Additional large and longitudinal study is suggested to determine the long-term effect of case-based learning on clinical competence and professional performance.

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