Research Article

Effect of case based learning in understanding clinical biochemistry

Kedar. B. Joshi[*1], Anup N. Nilawar[2] and A. P. Thorat[1]

[1]Department of Biochemistry, Government Medical College, Aurangabad, Maharashtra, India
[2]Department of Biochemistry, SBKS Medical College, Vadodara, Gujarat, India

*Correspondence Info:
Dr. Kedar B. Joshi,
Department of Biochemistry,
Second Floor, Government Medical College Building,
Panchakki Road, Aurangabad Maharashtra India,
E-mail: drjoshikedar@gmail.com

Abstract

Introduction: Case based learning (CBL) is an established method which uses a guided enquiry method of learning. It deals with real world problems or situations. It is more structured and facilitators or instructors play a major role in conducting sessions.CBL can play a substantial role in education of first year medical graduate students. We aimed to measure effect of CBL on academic performance of students and also compare it with lecture method and to study the perception of students towards CBL.

Methodology: We randomly selected sixty medical students of first year and divided into two batches. One batch was taught by case based learning method and other by routine lecture method. Both the batches were evaluated by pre and post test. The pre and post test scores for both batches and also post CBL and post lecture scores were compared by Students't' test. The students perception was also studied using a five point Likert scale by questionnaire method

Results: After CBL method, students had improved scores in evaluation test. The difference between pre and post CBL scores and also post lecture and post CBL scores was statistically significant. Majority of students opined that CBL was useful, interesting and motivating and also better than lecture method in understanding clinical biochemistry topic.

Conclusion: Case based learning is a useful method for clinical biochemistry topics and should be used as a regular method at appropriate places in curriculum of biochemistry.

Keywords: case based learning, clinical biochemistry, medical education

1. Introduction

The medical education in India is rapidly progressing and improving since last decade. Establishment of independent medical universities in most of the states has impacted positively on the course of medical teaching. Medical graduation course is of total four and half years duration with one year clinical training in India. First year of this course mainly deals with basic medical science subjects like Anatomy, Physiology and Biochemistry. The subject of biochemistry is a key subject which forms the base of laboratory medicine and includes diagnostic methodology. Clinical biochemistry topics link the basic knowledge with clinical content. Hence, these topics are extremely important in learning process and for practice of medicine in future.

In medical colleges in India, biochemistry is mainly taught by didactic lectures, practicals and tutorials. These are popular teaching methods which can deliver loads of information to the students. The approach of students towards learning depends upon learning styles, environment and context. Main types of learning styles are surface, deep and strategic.[1] Deep learning identifies the general principles, integrates material across subjects and relates ideas to evidence. Deep learning can be achieved 1) by forming course objectives which encourage higher intellectual skills, 2) by developing appropriate attitudes, 3) by reducing didactic methods and increasing small group and self directed learning, 4) by interactive approach that encourage questioning, and 5) by developing end of firm assessments that reward deep learning.[2]Case based learning (CBL) in context with clinical biochemistry can be an important learning tool to achieve deep learning. Clinical biochemistry integrates basic science with clinical science.

Case based learning addresses all abovementioned pathways to achieve deep learning. It is an established pedagogical method that uses case studies as active learning tools. CBL uses a clinical case or problem or inquiry to stimulate and underpin the acquisition of knowledge, skills and attitudes.CBL uses a guided enquiry method and provides structure during small group sessions. The role of facilitator is also important who assists the students, engage in analysis and helps in arriving at solutions or strategies.[3] Case method involves learning by doing and developing analytical and decision making skills which is closely related to learning objectives in clinical biochemistry[4].

1.1 Aims and Objectives

The aim of this study was to use CBL as a teaching method and to assess the improvement in academic performance. We also aimed to compare the effectiveness of CBL over didactic lecture method. This is an interventional and comparative study. We aimed to collect the feedback on students' perception on CBL to include this method in teaching on regular basis.

2. Methodology

This study was carried out in Department of Biochemistry, government medical college, Aurangabad, after obtaining institutional ethical approval. Informed consent was taken from all the participants. Sixty students including males and females were randomly selected from first year medical batch. Then these participants were randomly divided into batches A and B of strength thirty each. For these participants, a clinical biochemistry topic was selected. All the sixty participants were evaluated with pretest in the form of multiple choice questions with one best possible answer related to the topic selected. This score evaluates all participants and is the pre test score for batch A and batch B. Then batch A was divided into five groups of 6 participants each and only these thirty students were presented with a case based on the same clinical biochemistry topic (annexure 1). The batch B remains as a group and undergoes routine lecture method for same topic. The case for batch A was

a clearly defined clinical problem consisting of symptoms and laboratory data .The batch A thirty participants in small groups were given time to identify, discuss and resolve the problem in case. Subsequently they were provided with specific learning objectives (annexure 2) for the case and then facilitators motivated and guided them to discuss the case. The facilitators ensured that all batch A participants were involved in discussion. When these participants began to explore tangents, the facilitators guided with relevant questions to bring them back to main learning objectives. Participants were encouraged to ask the questions. Then batch A and batch B were evaluated with the post test in the form of same set of multiple choice questions. To evaluate participants' perception towards CBL for batch A, we administered a qualitative questionnaire with Likert scale[5] consisting ten questions (annexure 3). The questionnaire was validated prior to the use by participants. Questions 1-5 were related to the response regarding usefulness of CBL as a learning method, 6-9 to critical thinking, analysis and interpretation of topic and question 10 was related to comparison with lecture method. The response obtained was in terms of strongly agree, agree, no opinion, disagree and strongly disagree.

2.2 Statistical Analysis
         The data was analyzed by Graph Pad Prism software. The numerical data of pre and post tests is expressed in terms of mean ± SD. Students't' test was used to compare the continuous variables between the groups. For pre and post test comparison of batch A and batch B, paired't' test was used. For post lecture score and post CBL score comparison, unpaired't' test was used. The p value of <0.05 was considered to be statistically significant.

Annexure 1:
         A 64 year old man reported to medicine opd with complaints of loss of appetite, weakness, malaise, and nausea. He also reported that his eyes were dark yellow since last few weeks, urine was turning deep yellow and stool color was pale. He gave history of previous admission. There was no history of fever, drug intake or alcoholism. His laboratory report was showing:
Blood biochemistry
Total bilirubin 11.2 mg%   Indirect bilirubin   1.4 mg%   Direct bilirubin 9.8 mg%
 SGOT 25IU/L   SGPT 31IU/L   Serum ALP 210 IU/L
Urine examination:
Bile salts- positive
Bile pigments- positive
Urobilinogen - negative

 Annexure 2:
Specific learning objectives:
What are sources of bilirubin?
What are the steps and enzymes involved in hemoglobin breakdown?
How the bile pigments are metabolized?
How bilirubin is transported in plasma?
What is conjugated and uncongjugated bilirubin?
What are enzymes involved in conjugation of bilirubin?
What are congenital causes of conjugated and unconjugated hyperbilirubinemia?
What is jaundice and what are causes of prehepatic, hepatic and post hepatic jaundice?
What is physiological jaundice?
How will you comment on these reports?
What is most probable diagnosis?

Annexure 3
Feedback- questionnaire
Respond in terms of strongly agree, agree, no opinion, disagree and strongly disagree.
Q 1) In understanding today's topic, CBL session was very useful.
Q 2) CBL motivated us for learning.
Q 3) Clinical case was relevant to the topic discussed.
Q 4) The clinical case arouse the interest in clinical biochemistry topics.
Q 5) Role of facilitator was important in CBL session.
Q 6) CBL session was important in terms of development of critical thinking.
Q 7) CBL helped to link clinical knowledge with basic biochemistry.
Q 8) CBL helped to interpret the laboratory results.
Q 9) CBL will help in diagnosis in future.
Q 10) CBL is better than lecture method for clinical topic.

3. Results

         Table 1 shows comparison of pre and post evaluation test for CBL and table 2 shows the comparison of pre and post evaluation test after lecture method .This comparison shows that post CBL score and post lecture score are improved and both changes are statistically significant. Table 3 shows comparison between post CBL and post lecture score which is extremely statistically significant. Regarding perception of the students, no one thought that CBL session was not useful. Majority of students (73%) opined that CBL was useful in understanding the topic, sessions motivated them for learning and arouse interest in clinical biochemistry topic. Sixty nine % of the students marked "strongly agree" on importance of role of facilitator. Majority of students thought that the case discussion helped them in critical thinking and to link basic knowledge with applied. Majority of students (77%) opined that CBL will help them in diagnosis in future and 83 % students opined that sessions helped them to interpret the results better. Most importantly, 90% of the students felt CBL to be better than lecture method in understanding clinical biochemistry topic.

Table 1: Comparison of pre and post evaluation test for CBL of batch A

	Pre test score of batch A	Post test score of batch A	P value
MCQ evaluation	5.36 ± 1.38	9.32 ± 2.04	<0.0001*

         * Extremely statistically significant

Table 2: comparison of pre and post test for lecture method for batch B

	Pre test score of batch B	Post test score of batch B	P value
MCQ evaluation	5.33 ± 1.30	6.28 ± 1.77	$0.0062^{\dagger}$

[†]statistically significant

Table 3: The comparison of scores obtained after CBL method (batch A) and lecture method (batch B)

	Post CBL Score of batch A	Post lecture Score of batch B	P value
MCQ evaluation	9.32 ± 2.04	6.28 ± 1.77	$<0.0001^{*}$

* Extremely statistically significant

4. Discussion

Case based learning is an interesting and useful learning method at first year medical graduation level. Based on results of evaluation test, this study shows improved academic performance by the students. In our study, the increase in score in post test after CBL is extremely significant than in post test after lecture method. This makes CBL educationally more valuable. These results are supported by other studies which show improved test scores post CBL session.[6,7,8] CBL session in biochemistry is a guided enquiry method in which students face case scenario. The students have to think, define, struggle with problem and try to resolve it.[3] This process enhances students' ability to synthesize, evaluate and apply information and concepts.[9] Other advantages of CBL are that it promote self directed learning, improves decision making and problem solving attitude.[10] Overall outcome of this process is that it allows students to undergo meaningful learning. Meaningful learning involves acquisition of knowledge that can be stored and accessed from many different starting points. Also, students have to integrate well with other knowledge areas.[11] Another important outcome of this exercise is faculty training and development which strengthen the quality of teaching in future. This allows faculty to grow as academicians. The drawback of this method at first year level may be that teaching style may not accurately match the learner stage. The learner at this level is dependent and interested and role of teacher in CBL is more of a facilitator.[12] Also, first year students are not thoroughly aware of pathology and medicine aspects of a clinical case. Hence all the aspects of a clinical case cannot be discussed at this level. Hence, formulating cases appropriately and stating specific learning objectives is challenging and crucial at first year stage. To summarize, we implemented a newer method of teaching with positive and encouraging results.

The results of this study showed that CBL is motivating, interesting and helps in critical thinking. Regarding clinical biochemistry topic, CBL can link clinical knowledge with basic biochemistry, helps in interpretation of laboratory results and is better than lecture method.

5. Conclusion

We conclude by saying that in understanding clinical biochemistry topic, case based learning is more effective than lecture method and should be used as a routine method at appropriate places in teaching the subject of Biochemistry. We should implement any new method of teaching method that can create interest among students about learning meaningfully and make them better medical professionals. We also conclude that many reforms are needed in Indian medical education system for better healthcare.

Limitation of the study

The limitation of this study is that CBL session was conducted for only one topic as extensive preplanning and faculty training is required for such exercise. We suggest larger study with appropriate cases in entire curriculum of biochemistry and studying its effect.

Acknowledgement

We sincerely thank our students for their participation in study and our co teachers who worked as facilitators.

References
1. Newble DI, Entwistle NJ. Learning styles and approaches: implication for medical education. *Medical Education* 1986; 20:162–75.
2. Jane E Dacre, Robin A Fox How should we be teaching our undergraduates? Series on education Series editors: Anthony D Woolf, Michael *Doherty Ann Rheum Dis* 2000; 59:662-67.
3. Setia S , Bobby Z , Ananthanarayanan P , Radhika M , Kavitha M , Prashanth T Case Based Learning Versus Problem Based Learning: A Direct Comparison from First Year Medical Students Perspective Webmed Central medical education 2011; 2(6):WMC001976.
4. Clyde freeman Harreid. Case studies in science-A novel method of science education *JCST* February 1994.
5. Likert, R. A Technique for the Measurement of Attitudes. *Archives of Psychology* 1932; 140, 1–55.
6. Usha Adiga, Sachinanda Adiga Case based learning in biochemistry *International Journal of Pharma and Bio Sciences* vol 2/issue2/APR – JUN 2011.
7. Surpaneni K M the Effect of Integrated Teaching with Case Based Learning (CBL) In the Biochemistry of Undergraduate Medical Curriculum *Journal of Clinical and Diagnostic Research*. 2010 Oct; (5):3058-3063.
8. Sandhya Pillai Nair *et al*., Case Based Learning: A Method for Better Understanding of Biochemistry in Medical Students. Journal *of Clinical and Diagnostic Research.* 2013; 7(8): 1576-1578.
9. Sandhya K. Kamat, Padmaja A. Marathe, Tejal C. Patel, Yashashri C. Shetty, and Nirmala N. Rege Introduction of case based teaching to impart rational pharmacotherapy skills in undergraduate medical students. *Indian Journal of Pharmacology* 2012; 44(5); 634-638.
10. Jill Elizabeth Thistlthwaite, David Davies, Samilia Ekeocha, Jane M. Kidd, Colin Macdougall, Paul Matthews, Judith Purkis & Diane Clay The effectiveness of case-based learning in health professional education. A BEME systematic review: BEME Guide No. 23 2012; 34: e421–e444.
11. Joel Michael In pursuit of meaningful learning; *Advances in physiology education* 2001; 25(3): 145-158.
12. Jürgen Abela Adult learning theories and medical education: a review *Malta Medical journal*; 2009; 21 (01): 11-1.