

# Introducing Clinical Pathology Course to Fourth Year Medical Students as a Bridge between Pre-clinical and Clinical Medical Sciences

Upadhyaya Kafle S,<sup>1</sup> Singh M,<sup>1</sup> Kafle N,<sup>1</sup> Sinha A,<sup>1</sup> Guragain P,<sup>2</sup> Rimal HS<sup>3</sup>

<sup>1</sup>Department of Pathology,

<sup>2</sup>Department of Community Medicine,

<sup>3</sup>Department of Pediatrics,

Birat Medical College Teaching Hospital,

Morang, Nepal.

## Corresponding Author

Santosh Upadhyaya Kafle

Department of Pathology and Medical Education

Birat Medical College and Teaching Hospital,

Morang, Nepal.

E-mail: drsantoshkafle@gmail.com

## Citation

Upadhyaya Kafle S, Singh M, Kafle N, Sinha A, Guragain P, Rimal HS. Introducing Clinical Pathology Course to Fourth Year Medical Students as a Bridge between Pre-clinical and Clinical Medical Sciences. *Kathmandu Univ Med J.* 2022;77(1):97-101.

## ABSTRACT

There isn't any vertical integration of pre-clinical and clinical sciences subjects in the existing Kathmandu University MBBS curriculum. Many of the graduates are not able to correlate the clinico-pathological aspects of various diseases as a result the rational use of investigations for diagnosing various diseases is compromised. There are few published examples of implementation of pathology instruction courses during the clinical years of medical training but it is not universally practiced. This lack of exposure to pathology may lead to poor understanding of laboratory testing and the role of pathologists in patient care.

To set and implement an exemplary vertical integration of pre-clinical science with clinical science.

A 12 credit hours clinical pathology education course comprising clinical hematology, cytopathology and histopathology was developed. Students belonging from the ongoing fourth year MBBS course of Birat Medical College were enrolled in the course. All of the interactive lecture sessions were delivered via an e-learning interface, using the Zoom platform as the main teaching methods. Evaluation of students' achievement of learning objectives was conducted through distributing pre and post-test online multiple-choice questionnaires. Chi-square tests were used to compare the variables between pre-test and post-test questionnaire responses.

Results suggested that the designed clinical pathology course is valuable. The pre-test and post-test questionnaire responses revealed the positive impact regarding the importance of introducing clinical pathology courses within the clinical year of MBBS undergraduate curriculum. Response rate to the online session was 100%. The point of agreement between the pre-test and post-test questionnaire responses were highly achieved after intervention of the clinical pathology course. A statistically significant result ( $p < 0.05$ ) between all of the pre-test and post-test questionnaire responses was noted. There was a strong positive recommendation for incorporating clinical laboratory medicine courses within the MBBS clinical science curriculum.

The improvement observed among fourth-year MBBS students on learning the importance of clinical pathology courses was encouraging. This experience thus contributed to set and implement an exemplary vertical integration of pre-clinical science with clinical science.

## KEY WORDS

*Clinical pathology, Clinical sciences, Pre-clinical sciences, Vertical integration*

## INTRODUCTION

Vertical integration in medical training may be a philosophy of maturation and engagement with the profession.<sup>1,2</sup> The regularly cited definition of vertical integration is “the integration between the clinical and basic science parts of the curriculum”.<sup>3</sup> Within the existing undergraduate medical course curriculum of Kathmandu University (KU) Nepal, there is a point of horizontal integration among pre-clinical subjects, but there isn’t any vertical integration of pre-clinical and clinical sciences subjects. Many of the graduates are not able to correlate the clinico-pathological aspects of varied diseases as a result they are unable to form the rational use of investigations for diagnosing various diseases.

There are few published samples of implementation of pathology instruction courses during the clinical years of medical training but it’s not universally practiced. This lack of exposure to pathology may cause poor understanding of laboratory testing and the role of pathologists in patient care.<sup>4</sup> Within the United States, a report from the Centers for Disease Control and Prevention concluded that current medico training in laboratory medicine is “inadequate” and “despite the integral role of laboratory testing within the practice of medicine, formal teaching of laboratory medicine is a relatively neglected component of the medical school curriculum.”<sup>5</sup>

We introduced a clinical pathology course to fourth year MBBS students to set and implement an exemplary vertical integration of pre-clinical science with clinical science in the existing KU curriculum. Also to develop a distant link that would be important to support the global issue in improving the medical curriculum.

## METHODS

This is a cross-sectional study carried out in the Department of Pathology, Birat Medical College and Teaching Hospital (BMCTH), Morang, Nepal after receiving the institutional research permission. Ongoing fourth year MBBS students (n=89) of BMCTH, Morang, Nepal were enrolled in the study. The study was conducted after obtaining the consent of all the involved students and the process of the study was well explained to them. Students denied to be involved were not included in the study. A twelve (12) credit hours clinical pathology education course comprising clinical hematology, cytopathology and histopathology was delivered via an e-learning interface, using zoom platform. Before commencing the formal course, all of the involved students were explained briefly about the objectives, process and subject contents of the study.

The course comprise of four classes having two credit hour each and two classes with one and half hour each respectively. The final credit hour was for topic on demand with question and answer sessions. The introductory

sessions was focused on different clinical laboratory medicine components along with the rationale use of individual tests in Clinical Laboratory Services (CLS). The subsequent sessions was discussed on the laboratory approach to case of hematological disorders, cytopathology on early diagnosis of cancer and the role of histopathology in diagnosis and patient management. Individual quality indicators for monitoring hematology, cytopathology and histopathology tests was also discussed. Likewise, the clinico-pathological correlation (CPC) in daily clinical practice was introduced focusing on its role and importance in daily clinical practice. In addition, the overview on the “laboratory medicine practice in Nepal” was also kept in the session. Finally, some topic on demand session was also offered followed by questions and answer sessions.

Evaluation of students’ achievement of learning objectives was conducted through distributing pre and post-test online multiple-choice questionnaires. These adopted questionnaires were validated by departmental faculties, FAIMER (Fellowship in Advancement of International Medical Education and Research) fellow and Head, Department of Medical Education in BMCTH. A pretested questionnaire comprising eleven (11) multiple-choice questions (as Annex) prepared in Google Form was used to access the online pre-test and post-test knowledge outcome. The link to the online questionnaire was sent to the participants via email. The first page consisted of a consent form and subsequent pages were followed by each questionnaire as mentioned in the annex. The response to the questionnaire was in 5-point likert scale, which was re-coded to 3-point likert scale while analyzing the result. “Strongly disagree” and “disagree” was categorized as 1, “neutral” as 2 and “strongly agree” as 3. The data generated was entered in SPSS 20 (Statistical Package for the Social Sciences) software and statistical analysis was done. The point of agreement between the pre-test and post-test questionnaire responses were analyzed using Chi-square test,  $p < 0.05$  was set for the level of significance.

### Annex: Questionnaires

1. “Clinical Pathology” is one among the different components of “Clinical Laboratory Medicine Course”.
2. Ideal time to introduce “Clinical Pathology Course” for MBBS curriculum is “in the late clinical year (fourth year)”.
3. A competent clinician should have adequate knowledge regarding “Clinical Laboratory Medicine”.
4. Inadequate integration between pre-clinical and clinical science courses results in difficulty during patient management.
5. “Quality Control Mechanism” in Clinical Laboratory Services (CLS) is mandatory for all “pre-analytical, analytical and post-analytical phase”.
6. “Achieving Clinical and Pathological findings correlation” is a positive way of managing clinical cases.

7. Learning “Clinical Pathology Course” within an integrated curriculum encourages being active during clinical posting.

8. Introducing “Clinical Pathology Course” in the existing MBBS clinical year curriculum will increase stress load.

9. The organizational structure of integrated “Clinical Pathology Course” teaching helps to better understand and even manage clinical cases.

10. Overall the integrated structure of “Clinical Laboratory Medicine” course as an independent with other subjects in the integrated curriculum is important.

11. Recommendation for incorporating “Clinical Laboratory Medicine” Course within MBBS Clinical Science Curriculum is justified.

### RESULTS

Total of 89 students were enrolled in the study with a larger number of boys students. Majority of the students were within 21-25 years of age group, table 1.

**Table 1. Distribution of involved students profile**

Characteristics	Frequency n (%)
Age group (years)	
21-25	81 (91.0%)
26-30	08 (09.0%)
Gender	
Boys	50 (56.2%)
Girls	39 (43.8%)
<b>Total responses</b>	<b>89 (100%)</b>

All of the students enrolled in the study responded well to both pre-test and post-test questionnaires; the response rate to the pre- and post-test questionnaire was 100%. Majority (94.4%) knew about the clinical pathology course as one of the different components of clinical laboratory medicine. Maximum of them (91.0%) felt about the ideal time to introduce clinical pathology courses in the late clinical year for MBBS curriculum. A strong agreement (94.4%) on adequate clinical laboratory medicine knowledge requirement for being a competent clinician was achieved. High number of students (89.9%) believed that, inadequate integration of basic and clinical science courses results in patient management difficulty. However, a variable number of students respond to an increase in stress load if a clinical pathology course is introduced in the clinical curriculum. But, there was a strong positive recommendation (85.4%) for incorporating clinical laboratory medicine courses within the MBBS clinical science curriculum, table 2.

The inferential statistical analysis was performed to correlate between different questionnaires distributed along with pre-test and post-test responses. The point of agreement between pre-test and post-test responses was highly achieved in all questionnaires, with a statistically significant result ( $p < 0.05$ ) between them, table 3.

**Table 2. Distribution of pre-test and post-test questionnaires response**

Ques. No.	Pre-test response N(%)			Post-test response N(%)		
	Disagree	Neutral	Agree	Disagree	Neutral	Agree
1.	12(13.5)	35(39.5)	42(47.5)	00	05(5.6)	84(94.4)
2.	22(24.7)	45(50.6)	22(24.7)	00	08(9.0)	81(91.0)
3.	04(4.5)	35(39.3)	50(56.2)	00	05(5.6)	84(94.4)
4.	04 (4.5)	41(46.1)	44(49.4)	00	09(10.1)	80(89.9)
5.	00	30(33.7)	59(66.3)	00	03(3.4)	86(96.6)
6.	00	34(38.2)	55(61.8)	00	15(16.9)	74(83.1)
7.	00	36(40.4)	53(59.6)	00	12(13.5)	77(86.5)
8.	09(10.1)	54(60.7)	26(29.2)	36 (40.4)	32(36.0)	21(23.6)
9.	02(2.2)	38(42.7)	49(55.1)	00	18(20.2)	71(79.8)
10.	00	32(36.0)	57(64.0)	00	18(20.2)	71(79.8)
11.	09(10.1)	39(43.8)	41(46.1)	00	13(14.6)	76(85.4)

### DISCUSSION

Integration has been a well-liked concept in medical education for many years. Curricular integration represents collaborations between several disciplines to determine a coherent curriculum. During a study conducted by Wijnen-Meijer et al. proposed to define vertical integration as “a deliberate educational approach that fosters a gradual increase of learner participation within the professional community through a stepwise increase of knowledge-based engagement in practice with graduated responsibilities in patient care”.<sup>6</sup> This successively become more comprehensive than its older conceptualization. Following these aspects, our study aimed to line and implement an exemplary vertical integration of pre-clinical science with clinical science.

In our study, the introduction of a clinical pathology course for fourth year MBBS students proved to be an effective curriculum component. This inturn reflects an honest example of vertical integration among existing curriculum. Most of the pre-test and post-test questionnaires revealed positive response after the flow of clinical pathology course to the students. The points of agreement between the pre-test and post-test questionnaire responses were highly achieved (table 3). The “disagree” and “neutral” answer choice of the pre-test questionnaire was upgraded to the “agree” choice after clinical pathology course intervention (table 2). This outcome reflected the effectiveness of the vertical integration implementation.

Brauer and Fergusson have provided a superb description of today’s use of integration in medical education.<sup>7</sup> They have described horizontal integration as “integration across disciplines but within a finite period of time”, usually pertaining to the basic or pre-clinical sciences and vertical integration means “integration across time”. The aim of vertical integration is to support meaningful learning. The vertical integration curricula provide relevance to basic

**Table 3. Cross tabulation between different questionnaires with its pre-test and post-test response (using Chi-square test)**

Questions No	Pre-test response	Post-test response	p-value		
1	Neutral	Agree	0.166		
	Disagree	02		10	
	Neutral	02		33	
	Agree	01		41	
2	Neutral	Agree	0.000*		
	Disagree	07		15	
	Neutral	01		44	
3	Neutral	Agree	0.000*		
	Disagree	02		02	
	Neutral	03		32	
4	Neutral	Agree	0.001*		
	Disagree	02		02	
	Neutral	07		34	
5	Neutral	Agree	0.013*		
	Neutral	03		27	
	Agree	00		59	
6	Neutral	Agree	0.000*		
	Neutral	15		19	
	Agree	00		55	
7	Neutral	Agree	0.000*		
	Neutral	12		24	
	Agree	00		53	
8	Disagree	Neutral	Agree	0.023*	
	Disagree	04	03		02
	Neutral	26	21		07
9	Neutral	Agree	0.000*		
	Disagree	02		00	
	Neutral	15		23	
10	Neutral	Agree	0.000*		
	Disagree	16		16	
	Neutral	02		53	
11	Neutral	Agree	0.002*		
	Disagree	04		05	
	Neutral	09		30	
	Agree	00	41		

sciences for clinical practice, by matching learning with the way the knowledge is to be used. In our study, majority of our students (91.0%) felt the ideal time to introduce a clinical pathology course in the late clinical year (fourth year) of MBBS curriculum. This clearly supports the importance and usefulness of vertical integration to be implemented.

Additionally there was strong agreement (94.4%) among the students for the requirement of adequate knowledge regarding clinical laboratory medicine in order to become a competent clinician. Within the existing MBBS curriculum of Kathmandu University, the courses related to laboratory sciences including pathology, biochemistry and microbiology are only included in pre-clinical sessions within the first and second year of the MBBS course. Though the implementation of such laboratory measures are within the clinical session of the MBBS course, the linkage between the pre-clinical and clinical sessions is totally absent. A proper teaching learning activity related to such laboratory courses seems lacking. Centers for Disease Control (CDC) USA reports update of May 2009 states: "medical education on laboratory testing is insufficient."<sup>8</sup> Despite the integral role of laboratory testing in the practice of medicine, formal teaching of laboratory medicine may be a relatively neglected component of the medical school curriculum. Without sufficient knowledge of laboratory tests, health care providers are more susceptible to inappropriate ordering and mistakes in interpreting test results, which may cause poor care management, increased costs per patient, and adverse outcomes". Similar kind of rationale was achieved in our study also. There was a high number of students (89.9%) who believed that inadequate integration of basic and clinical science courses leads to difficulty in patient management. Similarly, many students (79.8%) responded about the utilization of "clinical pathology correlation and its achievements" during clinical practice.

In a survey of United States medical schools, sponsored by the Academy of Clinical Laboratory Physicians and Scientists (ACLPS), evaluated the status of laboratory medicine education and estimated the quantity of teaching time available within the average curriculum.<sup>9</sup> It revealed that required courses were conducted in just 57% of schools. Small number of schools report minimum or may be no training in the least during this aspect of practice and a number of other authors have confirmed the entire exposure to be suboptimal.<sup>9-14</sup> One group among them responded solving this issue by creating a combined "mini-course" of lectures and workshops followed by insertion of other didactics within the remainder of the "integrated curriculum". This dual approach resulted in significant improvement within the pathology section of United States Medical Licensing Examination (USMLE) scores.<sup>14</sup>

Variable number of students in our study responded to a rise in stress load if a clinical pathology course is introduced within the existing clinical curriculum, as for agreement (23.6%), neutral (36.0%) and disagreement (40.4%) responses respectively. Considering and addressing such issues is required without compromising the important essence of vertical integration. Moreover, there was a strong positive recommendation (85.4%) for incorporating clinical laboratory medicine courses within the MBBS clinical science curriculum in our study. Therefore, introducing and incorporating clinical pathology courses

to fourth year MBBS students would be a perfect example of vertical integration in the existing MBBS curriculum of Kathmandu University.

The students involved were only from a single batch of our college, which may have influenced the research results. Additionally, switching on for online teaching mode due to COVID-19 pandemic revealed short exposure to the course.

## CONCLUSION

The improvement observed by fourth-year MBBS students devoting a short period on learning the importance of clinical pathology course was encouraging. This experience thus contributed to set and implement an exemplary vertical integration of pre-clinical science with clinical science, supporting the global issue in improving the curriculum.

The institute may encourage starting a similar approach of teaching-learning activities to other laboratory services-related departments. This can be done by introducing clinical topics with individual departmental inputs. Moreover, theory as well as practical aspects along with the short-term laboratory postings of student will be more beneficial. The university can be proposed for incorporating this into the curriculum.

## ACKNOWLEDGMENT

We would like to thank Prof. Dr. Bishnu Hari Paudel for valuable suggestions and Dr. Tara Kafle for support in statistical analysis. Special acknowledgement to Prof. Dr. Zhimin Jia, advisor for this educational project (the project was under SMU-FAIMER fellowship program of the principal investigator).

## REFERENCES

1. Bloom S. The process of becoming a physician. *Ann Am Acad Political Soc Sci.* 1963; 346:77-87.
2. Cruess RL, Cruess SR, Boudreau JD, Snell L, Steinert Y. Reframing medical education to support professional identity formation. *Acad Med.* 2014; 89(11): 1446-51.
3. Dahle LO, Brynhildsen J, Behrbohm-Fallsberg M, Rundquist I, Hammar M. Pros and cons of vertical integration between clinical medicine and basic science within a problem-based undergraduate medical curriculum: examples and experiences from Linkoping. *Sweden Med Teach.* 2002;24(3): 280-5.
4. Haspel RL, Bhargava P, Gilmore H, Kane S, Powers A, Sepehr A, et al. Successful implementation of a longitudinal, integrated pathology curriculum during the third year of medical school. *Archives of Pathology & Laboratory Medicine.* 2012 Nov;136(11):1430-6.
5. Smith BR, Aguero-Rosenfeld M, Anastasi J, Baron B, Berg A, Bock JL, et al. Educating medical students in laboratory medicine: a proposed curriculum. *American journal of clinical pathology.* 2010 Apr 1;133(4):533-42.
6. Wijnen-Meijer M, Broek SVD, Koens F, Cate Olle T. BMC Medical Education. 2020; 20:509. <https://doi.org/10.1186/s12909-020-02433-6>.
7. Brauer DG, Ferguson KJ. The integrated curriculum in medical education: AMEE Guide No. 96. *Medical teacher.* 2015 Apr 3;37(4):312-22.
8. Division of Laboratory Systems, Centers for Disease Control and Prevention. Patient-centered care and laboratory medicine: national status report: 2008-2009 update. [https://www.futurelabmedicine.org/reports%5CLaboratory\\_Medicine\\_National\\_Status\\_%20Report\\_08-09\\_Update--Patinet-Centered\\_Care.pdf](https://www.futurelabmedicine.org/reports%5CLaboratory_Medicine_National_Status_%20Report_08-09_Update--Patinet-Centered_Care.pdf). Published May 2009. Accessed August 1, 2009.
9. Gottfried EL, Kamoun M, Burke MD. Laboratory medicine education in United States medical schools. *Am J Clin Pathol.* 1993; 100:594-8.
10. Kumar K, Indurkha A, Nguyen H. Curricular trends in instruction of pathology: a nationwide longitudinal study from 1993 to present. *Hum Pathol.* 2001; 32:1147-53.
11. Marshall R, Cartwright N, Mattick K. Teaching and learning pathology: a critical review of the English literature. *Med Educ.* 2004; 38:302-13.
12. Wartman S, Davis A, Wilson M, Kahn N, Sherwood R, Nowalk A. Curricular change: recommendations from a national perspective. *Academic Medicine.* 2001 Apr 1;76(4):S140-5.
13. Pricard RW, Davis JS, Matsen JM. Teaching pathology to medical students in the 1990s: a 1989 symposium of the Association of pathology Chairmen. *Hum Pathol.* 1992; 23:98-103.
14. Clejan S, Crawford BE II. Modalities of teaching laboratory medicine/clinical pathology in the 21st century: how to make the most of limited options. *Pathol Educ.* 2001;25:70-81. <http://peir.path.uab.edu/griper/journals/v25n2.pdf>. Accessed August 1, 2009.