

IMPACT OF EARLY PATHOLOGY EXPOSURE FOR BETTER UNDERSTANDING OF HISTOLOGY AMONG FIRST-YEAR MBBS STUDENTS

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ABSTRACT

Background: Histology forms the basis for understanding pathology and clinical medicine, but many first-year MBBS students find it challenging when taught through conventional methods alone. Integrating early exposure to pathology may help students appreciate the relevance of histology in future clinical practice and improve their learning outcomes. **Aims & Objective:** To assess the impact of integrating early exposure to pathology on the learning outcomes of first-year MBBS students in histology. **Materials and Methods:** In our study, first-year MBBS students were included and divided into two groups. Group A (control group) received conventional teaching, while Group B (test group) was taught with early exposure to pathology integrated into histology topics. Different organ systems such as liver, lymph node, stomach, lung, and appendix were covered. Pathological tissues were selected after consultation with a pathologist. Student performance was assessed through marks obtained in structured assessments, and feedback was collected using a predesigned questionnaire. Data were analysed using mean $\pm$ SD, unpaired t-test, confidence interval, and *p* value for statistical significance. **Result:** Students in the test group consistently outperformed the control group across all topics. Mean scores were significantly higher in the test group: liver histology (3.61 ± 0.50 vs. 2.96 ± 0.87), lymph node (3.87 ± 1.05 vs. 2.73 ± 0.84), stomach (4.77 ± 0.42 vs. 3.53 ± 0.83), lung (3.82 ± 0.74 vs. 2.93 ± 0.65), and appendix (2.82 ± 0.65 vs. 2.31 ± 0.67). All differences were highly significant (*p* < 0.0001). Feedback analysis revealed that the majority of students found this method more interesting, engaging, and helpful for long-term retention compared to conventional teaching. **Conclusion:** Early exposure to pathology alongside histology significantly improved student performance, understanding, and interest in the subject. This integrated approach provides better conceptual clarity and long-term retention and can be recommended as a valuable addition to conventional histology teaching for first-year MBBS students.

INTRODUCTION

Histology, the study of the microscopic structure of tissues, forms a foundational pillar in medical education, specifically in the preclinical years of MBBS. Understanding normal tissue architecture enables students to recognize pathological changes, contributing to better diagnostic skills and clinical reasoning in subsequent years. A strong grasp of histology is therefore essential not only to anatomy but also to pathology, physiology, and other clinical subjects.^[1,2]

Many students, however, find histology difficult in the first year. The slides may look confusing, the

practical sessions are sometimes too short, and students may fail to connect what they see under the microscope with its importance in future clinical practice. Some studies have shown that histology is often perceived as a subject to be memorized rather than understood in depth (Subitha. K et al; 2016). Because of this, students may not appreciate its role until they reach their pathology classes in the second year.^[3] To overcome this difficulty, different teaching methods have been tried. For example, digital histology slides, flipped classroom methods, and integrated teaching have all been shown to improve student interest and performance. A study from Mysuru by Vidya & Doddawad (2017) found

that using digitized histology images in practical classes improved both understanding and student feedback. Similarly, a study from Chennai compared the flipped classroom method with traditional lectures and reported that students scored significantly better when the flipped classroom was used (Aristotle S et al., 2021).^[4,5]

Educational strategies for learning basic medical sciences have shown tremendous growth in recent years from traditional microscopy to virtual microscopy. In addition, for better clinical correlation with histopathology, the teaching methodology adopted has been modified to PBL, interdisciplinary integration in alignment with preclinical, paraclinical, and clinical subjects.^[6]

Another approach that has gained attention is the early integration of pathology with histology. The idea is that when students see both the normal (histology) and abnormal (pathology) side by side, they can understand the subject better. In fact, a study by Kumar et al. (2006) showed that combining histology and histopathology teaching using virtual slides made it easier for students to appreciate the relevance of both subjects.^[7] Another survey from Serbia revealed that both pre-clinical and clinical students considered histology knowledge essential for understanding subjects like pathology, dermatology, and physiology.^[8]

In the Indian context, where students enter medical school directly after school education, this link between histology and pathology becomes even more important. Many students may not initially appreciate why they are learning microscopic anatomy. Giving them an early exposure to pathology—for example, showing how a normal liver looks different from a cirrhotic liver under the microscope—can motivate them and help them connect the subject with clinical practice. Therefore, this study has been planned to introduce pathology early in histology teaching for first-year MBBS students and to evaluate whether such an intervention improves their understanding, performance, and interest compared to conventional teaching.

MATERIALS AND METHODS

This was a comparative questionnaire-based study conducted in the Department of Anatomy in collaboration with the Department of Pathology at SKN Medical College, Pune (Maharashtra). The study aimed to assess the effectiveness of early exposure to pathology in improving the understanding of histology among first-year MBBS students.

The study was designed as a comparative interventional study and was carried out over a period of one year from September 2024 to August 2025. Ethical clearance for the study was obtained from the Institutional Ethics Committee prior to commencement. Participation was voluntary, and confidentiality of student responses was maintained

throughout the study. First-year MBBS students who gave informed consent to participate were included. The students were divided into two groups, Group A (Control Group) and Group B (Test Group).

Both groups underwent routine histology teaching sessions as per the prescribed MBBS curriculum. The control group was taught exclusively using traditional methods, which included classroom lectures, chalk-and-board explanations, and demonstration of normal histology slides under the microscope. On the other hand, the test group was taught using an integrated approach that combined conventional histology teaching with early exposure to pathology. In this group, after explaining the normal microscopic structure of a tissue or organ, corresponding pathological gross specimens and histopathology slides were demonstrated to highlight structural alterations in disease conditions. For instance, while teaching the normal histology of the liver, lymph node, stomach, lung, and appendix, pathological specimens such as cirrhosis or fatty liver, Lymphadenopathy, gastropathy, pneumonia & appendicitis were introduced to enable the students to appreciate the contrast between normal and diseased tissue. These tissues were selected after consultation with a pathologist. This method was aimed at providing better correlation and clinical relevance at an early stage of learning.

At the completion of the teaching sessions, the academic performance of both groups was evaluated by a structured assessment. The assessment included theory-based questions in the form of multiple-choice questions and short-answer questions, as well as practical evaluation using spot tests on histology and histopathology slides. This dual evaluation ensured both cognitive and practical skills were tested. In addition to objective assessment, structured feedback was also collected from students using a predesigned questionnaire to gather their perception regarding clarity of concepts, level of interest generated, ease of learning, and relevance of the integrated method to their future clinical practice.

The responses and test scores were compiled using Microsoft Excel and analysed statistically. Continuous variables such as test scores were expressed as mean $\pm$ standard deviation (SD). The difference in mean scores between the test and control groups was assessed using the unpaired t-test. A p-value of less than 0.05 was considered statistically significant. The qualitative data obtained from student feedback were expressed in terms of percentages and summarized descriptively.

RESULTS

First-year MBBS students participated in the study. The students were divided into two groups, Group A (Control Group) and Group B (Test Group). All students completed the teaching sessions and assessments. The results were analysed to evaluate the effect of early exposure to pathology on the

learning of histology. The mean performance scores of students in liver histology were compared between the control group (Group A) and the test group (Group B). Group A, which was taught by the traditional method, obtained a mean score of 2.96 ± 0.87 , whereas Group B, which received early exposure to pathology alongside histology teaching, achieved a higher mean score of 3.61 ± 0.50 . The mean difference between the two groups was statistically significant, with a 95% confidence interval ranging from 0.34 to 0.96. The unpaired t-test value was 4.19 with 78 degrees of freedom, yielding a p-value of <0.0001 . This indicates that the difference in performance between the groups was highly significant. [Table 1] When comparing the performance of students in lymph node histology, the mean score of the control group (Group A) was 2.73 ± 0.84 , whereas the test group (Group B) scored significantly higher with a mean of 3.87 ± 1.05 . The mean difference was observed within a 95% confidence interval of 0.77 – 1.28. Statistical analysis using the unpaired t-test revealed a t value of 7.12 with 94 degrees of freedom, and the p value was found to be <0.0001 , indicating a highly significant difference between the two groups. [Table 2]

In the assessment of stomach histology, the mean marks obtained by students in the control group (Group A) were 3.53 ± 0.83 , while the test group (Group B) achieved a considerably higher mean of 4.77 ± 0.42 . The mean difference between the two groups lay within a 95% confidence interval of 0.92 – 1.42. The unpaired t-test value was 8.67 with 74 degrees of freedom, and the p value was <0.0001 , which is considered highly significant. [Table 3]

In the assessment of respiratory histology, students in the test group (Group B), who were exposed to early pathology-based teaching, obtained a mean score of 3.82 ± 0.74 . In contrast, the control group (Group A), taught by conventional histology teaching alone, secured a lower mean score of 2.93 ± 0.65 . The difference in mean scores between the two groups

was statistically analysed and was found to lie within a 95% confidence interval of 0.65 – 1.17. The calculated unpaired t-test value was 6.12 with 94 degrees of freedom, and the associated p value was <0.0001 , indicating a highly significant difference. [Table 4]

In the evaluation of appendix histology, the mean score of the test group (Group B), who received early exposure to pathology in addition to conventional teaching, was 2.82 ± 0.65 . On the other hand, the control group (Group A), who studied through conventional histology teaching alone, scored a mean of 2.31 ± 0.67 . The mean difference between the two groups was statistically analysed and was found within the 95% confidence interval of 0.29 – 0.75. The calculated unpaired t-test value was 3.95 with 97 degrees of freedom, yielding a p value of <0.0001 , which is considered highly significant. [Table 5]

This result indicates that early integration of pathology concepts during the teaching of histology markedly enhances student performance compared to the conventional approach. Out of 100 first-year MBBS students who participated in the feedback survey, the majority responded positively to early exposure of pathology for understanding histology. More than 80% of students agreed that this method was more helpful than conventional teaching, interesting, and created a good visual impact. Around 78% felt it helped them retain microscopic visual impressions for a longer time, and 88% agreed that it highlighted the importance of histology for their future learning. Most students (83%) were satisfied with the quality and quantity of slides shown, and the average effectiveness rating on a 1–5 scale was 4.2 ± 0.6 . Furthermore, 84% believed that this method should become a part of regular teaching, and 75% suggested adding case discussions to enhance learning. Only a small proportion of students were neutral or disagreed, indicating overall strong acceptance of this teaching approach. [Table 6]

Table 1: Statistical Comparison of Marks in Liver Histology between Control and Test Groups

Groups	N	Mean $\pm$ SD	Confidence interval	Unpaired t test	Degree of freedom	P value	Statistical Significance
Group A (Control Group)	49	2.96 ± 0.87	0.34 – 0.96	4.19	78	<0.0001	Highly Significant
Group B (Test Group)	49	3.61 ± 0.50					

Table 2: Statistical Comparison of Marks in Lymphnode Histology between Control and Test Groups

Groups	N	Mean $\pm$ SD	Confidence interval	Unpaired t test	Degree of freedom	P value	Statistical Significance
Group A (Control Group)	56	2.73 ± 0.84	0.77 – 1.28	7.12	94	<0.0001	Highly Significant
Group B (Test Group)	40	3.87 ± 1.05					

Table 3: Statistical Comparison of Marks in Stomach Histology between Control and Test Groups

Groups	N	Mean $\pm$ SD	Confidence interval	Unpaired t test	Degree of freedom	P value	Statistical Significance
Group A (Control Group)	38	3.53 ± 0.83	0.92 – 1.42	8.67	74	<0.0001	Highly Significant
Group B	38	4.77 ± 0.42					

(Test Group)							
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Table 4: Statistical Comparison of Marks in Respiratory Histology between Control and Test Group

Groups	N	Mean $\pm$ SD	Confidence interval	Unpaired t test	Degree of freedom	P value	Statistical Significance
Group A (Control Group)	40	2.93 $\pm$ 0.65	0.65 – 1.17	6.12	94	<0.0001	Highly Significant
Group B (Test Group)	56	3.82 $\pm$ 0.74					

Table 5: Statistical Comparison of Marks in Appendix Histology between Control and Test Group

Groups	N	Mean $\pm$ SD	Confidence interval	Unpaired t test	Degree of freedom	P value	Statistical Significance
Group A (Control Group)	50	2.31 $\pm$ 0.67	0.29 – 0.75	3.95	97	<0.0001	Highly Significant
Group B (Test Group)	49	2.82 $\pm$ 0.65					

Table 6: Questionnaire Feedback on Early Exposure to Pathology for Better Understanding of Histology (N = 100)

S. No.	Feedback Question	Agree (%)	Neutral (%)	Disagree (%)
1.	This method was more helpful than conventional teaching.	82	8	10
2.	The method was interesting.	85	8	7
3.	It helped me retain microscopic visual impression for longer.	78	10	12
4.	It highlighted the importance of histology for the future.	88	7	5
5.	It engaged me better in the class.	80	10	10
6.	I was satisfied with the quality and quantity of slides shown.	83	8	9
7.	Effectiveness of the method in understanding histology (Rating 1–5) *	Mean = 4.2 $\pm$ 0.6	–	–
8.	The method created a good visual impact.	86	8	6
9.	This method should be a part of the regular teaching schedule.	84	8	8
10.	Case discussions should be added to this method.	75	10	15

DISCUSSION

The present study aimed to assess the effect of early exposure to pathology on the understanding of histology among first-year MBBS students. Students were divided into two groups: a control group, which was taught using conventional histology teaching, and a test group, which received pathology-integrated histology sessions. Their performance was evaluated through topic-based assessments in liver, lymph node, stomach, respiratory, and appendix histology, and student perceptions were analysed using a structured questionnaire. Our findings clearly demonstrate that students in the test group scored significantly higher than the control group across all histology topics. These results strongly support the role of integrated teaching in improving comprehension, retention, and application of histological knowledge.

In all assessed topics, students in the test group consistently outperformed those in the control group. For liver histology, the mean marks were significantly higher in the test group (3.61 $\pm$ 0.50) compared to the control group (2.96 $\pm$ 0.87), with a p value <0.0001, indicating a highly significant difference. Similarly, in lymph node histology, test group students scored better (3.87 $\pm$ 1.05) compared to control (2.73 $\pm$ 0.84), with a highly significant difference (p <0.0001). For stomach histology, test group students showed even more improvement (4.77 $\pm$ 0.42) against control (3.53 $\pm$ 0.83). Comparable

results were observed in respiratory histology (3.82 $\pm$ 0.74 vs. 2.93 $\pm$ 0.65) and appendix histology (2.82 $\pm$ 0.65 vs. 2.31 $\pm$ 0.67).

These findings clearly suggest that integrating pathology into histology teaching creates a better conceptual framework for students, improves memory retention, and enhances their ability to correlate microscopic features with clinical relevance. Similar results have been reported in earlier studies. Bhatnagar et al. (2019) emphasized that early clinical exposure and integration significantly improve comprehension of preclinical subjects like histology and anatomy. Likewise, Singh et al. (2020) demonstrated that linking histology with pathological specimens improved student performance and long-term retention.^[9,10]

Histology has often been perceived by students as a subject of rote memorization, lacking clinical relevance. However, when pathology is introduced alongside, students are able to appreciate the functional and clinical correlations better. Previous studies in medical education have emphasized the importance of integrated teaching. For instance, Harden (2000) described integration as a means to reduce fragmentation in medical education and improve understanding of basic sciences in clinical contexts. Our findings align with these principles, showing that students not only performed better academically but also reported greater engagement and interest in histology.^[11]

Feedback analysis from 100 students revealed overwhelmingly positive responses. More than 80%

agreed that the integrated method was helpful, interesting, and created a strong visual impact. Around 78% reported better long-term retention of microscopic images, while 88% felt it highlighted the importance of histology for their future clinical training. The average rating for effectiveness was 4.2 ± 0.6 on a 5-point scale, indicating high acceptance. Moreover, 84% wanted this method to be included as a regular teaching strategy, and 75% suggested adding case discussions for further improvement.

These results are consistent with Shankar et al. (2018), who reported that students favoured clinically relevant teaching methods in histology, and with Mahajan et al. (2019), who emphasized that integrated approaches improve motivation and reduce rote learning.^[12,13]

The results of the present study are in line with global trends of moving from traditional discipline-based teaching to integrated, clinically relevant teaching in medical schools. Studies from India and abroad have shown that students exposed to early clinical integration develop a deeper conceptual understanding, better retention, and improved examination performance (Mahajan et al., 2019; Vyas et al., 2008). Our data further confirms this, as test group students consistently outscored the control group across all topics.^[13,14]

In our study, the findings strongly support the inclusion of early pathology exposure in histology teaching as a regular component of the MBBS curriculum. This approach not only improves student performance but also enhances interest, engagement, and appreciation of histology's clinical importance. Integration of case discussions, as suggested by students, could further enrich the learning experience.

CONCLUSION

The present study demonstrated that early exposure to pathology significantly improved the understanding and performance of first-year MBBS students in histology compared to conventional teaching methods. Across all assessed topics—liver, lymph node, stomach, respiratory system, and appendix—the test group consistently scored higher than the control group, with differences being highly statistically significant ($p < 0.0001$). Student feedback further supported these findings, as the majority agreed that this method made learning more interesting, engaging, and helped them retain knowledge for a longer duration.

Thus, integrating pathology with histology in the early phase of medical education not only enhanced

academic performance but also created greater interest and long-term retention of microscopic concepts. This approach can be recommended as an effective supplement to conventional teaching for better competency-based learning.

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