Impact of Plastinated Tracheobronchial Tree Cast on Students’ Learning in a South Indian Medical School- A Quasi-experimental Study

SV UMA¹, LEELAVATHY²

ABSTRACT

Introduction: Plastination is a technique used in anatomy to preserve body parts or whole body by indefinitely replacing water and lipids contained in it with a curable plastic. This process renders human tissue dry, non toxic, and odorless. The students consider these specimens as user friendly in enhancing their learning.

Aim: To evaluate and compare the knowledge gained and its long term retention, between two groups of students, by the use of plastinated specimens and that of routine lecture class of same topic, respectively.

Materials and Methods: This quasi-experimental study was conducted in the Anatomy Department of a Medical School in Bangalore, Karnataka, India, between November 2018 and January 2019. Total 150 Bachelor of Medicine and Bachelor of Surgery (MBBS) students from first year were divided into two groups- G1 and G2 of 75 students each. G1 was taught bronchopulmonary segments with tracheobronchial tree cast and a regular theory class was conducted on the same topic for G2. Both the groups were evaluated with a written questionnaire on the same day (T1) after the session and after 10 weeks (T2). The test scores of both the groups were compared using independent sample t-test and paired sample t-test was used to compare T1 and T2 scores of same groups.

Results: The number of students taken for analysis among G1 was 48 (28 girls and 20 boys) out of 75 and G2 was 47(30 girls and 17 boys) out of 75 and their mean age was 19±1 years. The mean score of G1 for T1 was 6.30 and for T2 it was 8.60, whereas the mean score of G2 for T1 was 11.05 and T2 was 8.58. Statistically significant difference was observed within the groups G1 (p-value=0.023) and G2 (p-value=0.002) for T1 and T2. There was a statistically significant difference on inter group comparison for T1 (p-value<0.01), whereas, on comparing the test scores for T2 of G1 and G2 there was no significant difference.

Conclusion: The results bring about the importance of visual and tactile learning of bronchopulmonary segments which has an impact on the memory for a longer period rather than didactic lecture classes. The use of plastinated specimens as an adjuvant to dissection in anatomy teaching will help in better understanding of the subject and retention for a longer period of time.
MATERIALS AND METHODS

This quasi-experimental study was conducted during November 2018 to January 2019 in the Anatomy Department of Sapthagiri Institute of Medical Sciences and Research Centre Bangalore, Karnataka, India after obtaining ethical clearance from Institutional Ethical Review Board (IECC no: SIMS&RC/IECC/08/2017).

Inclusion criteria: All the first year medical students who were willing to participate in the study were included.

Exclusion criteria: Those students who were absent either for T1 or for T2 and were not willing to participate were excluded.

Total 150 first year MBBS students were enrolled in the study by convenient sampling and were divided into two groups of 75 each.

Group 1: The first group of students having roll numbers 1 to 75 were taught with plastinated whole lung [Table/Fig-1] to get an orientation regarding the tracheobronchial tree and also the painted silicon luminal cast of human lung [Table/Fig-2] was used for teaching the bronchopulmonary segments. Both the specimen was prepared in the Anatomy Department of the institute. Various segments were shown and surgical importance of the same was discussed in the group of 10-11 students by the facilitator for half an hour each. At the end of the session all 75 were given a chance to hold the plastinated lung and tracheobronchial luminal cast to revise for 1 hour.

Group 2: The second group of students having roll numbers 76 to 150 (G2) were taught in the lecture hall. A routine theory class was delivered on bronchopulmonary segments for an hour with the help of a power point presentation highlighting the segments and their surgical importance without the specimen.

Study Procedure

Immediately after the lecture or practical session, both groups were given test (T1) on the same day. Questionnaire was designed by the author and validated by the faculty members of the Anatomy Department by pilot testing of the questionnaire on a small group of 10 students. The reliability of the questionnaire was found to be satisfactory (Cronbach’s alpha of 0.70). The questionnaire consisted of twelve questions regarding the anatomy of bronchopulmonary segments of lung and its applied clinical importance (Annexure-1). The questions were open ended with a maximum score of 1 for each correct answer and 0 score for incorrect answer, hence maximum total score was 12 and minimum 0.

A follow up test after 10 weeks (T2) was conducted without any prior information to check the long term retention of the knowledge gained. The set of questions given for both T1 and T2 were same. The other group of students (G2) who were not taught using silicon luminal cast of lung were also taught using the same plastinated models in the practical class after data collection.

The total number of students present for the test on same day were 108 and for test after 10 weeks were 125 out of the total of 150 respectively. Excluding the absentees on either of the days the number of students taken for analysis among G1 was 48 out of 75 and G2 was 47 out of 75 [Table/Fig-3].

<table>
<thead>
<tr>
<th>Test</th>
<th>Group 1</th>
<th>Group 2</th>
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<tbody>
<tr>
<td>T1</td>
<td>6.30</td>
<td>11.05</td>
</tr>
<tr>
<td>T2</td>
<td>8.60</td>
<td>8.58</td>
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</table>

[Table/Fig-3]: Flowchart of students distribution.

STATISTICAL ANALYSIS

The test scores of both the groups were calculated using software Statistical Package for the Social Sciences (SPSS) version 16. The mean score was calculated for test 1 and 2. Paired sample t-test was used to compare the marks obtained by the respective group for test 1 and 2 and independent sample t-test for comparing the results of test 1 among G1 and G2 and also the results of test 2 between G1 and G2.

RESULTS

The number of students present for the test on same day were 108 and for test after 10 weeks were 125 out of the total of 150 respectively. Excluding the absentees on either of these days the total number of students taken for analysis among G1 was 48 (28 girls and 20 boys) out of 75 and G2 was 47 (30 girls and 17 boys) out of 75 and their mean age was 19±1 years.

The [Table/Fig-4] shows the mean test scores T1 and T2 for groups G1 and G2. Comparing the test scores, T1 for both G1 (6.30) and G2 (11.05), there was a significant difference (p≤0.01) whereas on comparing the test scores, T2 of G1 (8.60) and G2 (8.58) no significant difference was observed between them (p=0.674).

The mean score of G1 for T1 was 6.30 and for T2 it was 8.60, whereas the mean score of G2 for T1 was 11.05 and T2 was 8.58.
On comparing the mean test scores between T1 and T2 separately for both groups statistically significant difference was observed; G1 (p-value=0.023) and G2 (value=0.002) [Table/Fig-5].

Murillo OR et al., (2006) in his study on 179 second year medical students of Spain, also revealed that students expressed their satisfaction in learning neuroanatomical structures with plastinated specimens [13]. Fruthorster BH et al., (2011) on conducting a study on 125 first year medical students of UK, revealed that students appreciated the three dimensional structure and relations but the majority of them felt the specimen lacked emotional and tactile perceptions [14]. Desouza FM et al., (2016), India, reported that these plastinated luminal casts of tracheobronchial tree had an advantage of providing dynamic information of the structure which otherwise would not be observed by the students [15].

**Limitation(s)**
In the present study, the cross-over teaching of the groups was not done for data collection, due to lack of time, but the clarifications were done for both groups during the practical classes. The proportion of high achievers and low achievers were not equally distributed in the two groups.

**CONCLUSION(S)**
The conclusion could be that in G1, where students practically studied the bronchopulmonary segments with plastinated specimen, could retain the knowledge for a longer period of time after the class, whereas the students in G2 who were given passive didactic lectures about the same topic, scored well immediately after the class even more than G1 but over the period of time their scores reduced. It is recommended to do cross over teaching studies between plastination and lectures in future. The use of plastinated specimens as an adjuvant to dissection in anatomy teaching will help in better understanding of the subject and retention for a longer period of time. Moreover the convenient handling of the specimen enhances studying of anatomy in all times and places.

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**REFERENCES**

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Annexure -1: Questionnaire

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Questions</th>
<th>Answer</th>
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<tbody>
<tr>
<td>1</td>
<td>Define bronchopulmonary segment</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>How many segments are there in each lung</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Clinical importance of bronchopulmonary segment</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Does each segment has its own connective tissue covering</td>
<td></td>
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<tr>
<td>5</td>
<td>What structure accompanies the segmental bronchus</td>
<td></td>
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<tr>
<td>6</td>
<td>Name the segments in the middle lobe of right lung</td>
<td></td>
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<tr>
<td>7</td>
<td>The pulmonary arteries carry</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>The order of division of tracheobronchial tree is</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Name the extrapulmonary parts of the tracheobronchial tree</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>What structure runs in the intersegmental plane</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Name the common segments for lung abscess</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Is bronchopulmonary segment a bronchovascular segment? Why?</td>
<td></td>
</tr>
</tbody>
</table>