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Original Research Article

PLASTINATION: A NEW MODEL OF TEACHING ANATOMY

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ABSTRACT

Anatomy subject is considering the basic foundation of learning medicine. So it is important to understand the anatomy in depth. Some of the complicated structure cannot be illustrated in didactic lecture and therefore could not be easily understood. Such structure can be best demonstrated by making models. In this study some plastinated model were made and taught to the students along with the cadaveric specimen. After teaching, the questionnaire based on comparative between plastinated and cadaveric specimens were distributed to the students of various courses. Their feedback were collected, compared and statistically analyzed.

KEY WORDS: Plastination, Anatomy Teaching, Questionnaire, Cadaveric Specimens.

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INTRODUCTION

Educational technology refers to ethical facilitation of learning and improving performance by creating, using and managing appropriate technological processes and resources. There are multiple new teaching tools that have emerged with the technical advancements. Human anatomy is a complicated structure and learning through traditional way like black board, diagram, charts, overhead project is not enough to make students understand. These traditional methods of teaching show the static pictures and being two dimensional they give only a partial impression of the spatial geometry of the objects illustrated. To increase the depth of knowledge in a shorter period of time different educational technologies are introduced in importing medical education. The teaching methodology has been revolutionized with the introduction of different types of models. Here, we describe a new model of teaching the

subject through plastinated specimen to make the student understand the vast subject like anatomy.

Plastination is a technique to preserve body or body parts. The water and fat are replaced by certain plastics, yielding specimens that can be touched, do not smell or decay, and even retain most properties of the original sample [1]. The tissue preserve by this technique is in the form of dry, non-toxic and durable than other form of preservation. This technique is first developed by Gunther von Hagens in 1977 [2]. There are different methods of plastination out of which, we selected luminal Plastination by using silicon gel [3-5].

MATERIALS AND METHODS

Materials used for Plastination were silicon gel, silicon gun and dissection box. Kidney with renal artery, arch of aorta with its branches and bronchus with lung were the organs selected for the study.

The study was completed in three steps.

1. Preparation of plastinated cast:

The lumen of the organ was washed with the running tap water. The four basic steps for luminal cast plastination were followed. They were fixation, dehydration, impregnation and hardening. Fixation is the process of preserving the tissue. It preserve the cells physical and chemical characteristics in a near life like state by preventing autolysis and putrification.. The most commonly used fixative is formalin. Ten percent buffered formalin was used in this processes. The second step followed was dehydration. Organs were thoroughly dehydrated by passing through increasing concentration of alcohol. In this procedure, water was completely removed from fixed tissues. Dehydration was followed by impregnation. Silicon gel was injected through the lumen with the help of the silicon gun [6]. The specimen was dried. Once the silicon gel got hardened, the remaining part of the organ was dissected and removed.

2. Teaching: Students of different courses (MBBS, BDS, B.P.Th, M.Sc.) were first taught on cadaveric specimen and then with plastinated cast of same specimen.

3. Providing a questionnaire:

A questionnaire based on teaching methods was given to the students. The results were tabulated, compared and statistically analyzed.

RESULTS

The following questionnaire were distributed to 350 students of different courses (MBBS, BDS, B.P.Th, M.Sc.) and the result were tabulated.

Questions	Option.	Result In Percentage.
Do you know plastination?	Yes. No.	1.74% 98.26%
Which specimen is clearly seen?	Wet Specimen. Plastinated Specimen	18.56% 82.94%
In which specimen the spatial orientation is clearly seen?	Wet Specimen. Plastinated Specimen.	7.54% 92.46%
Which specimen is easy to hold?	Wet Specimen. Plastinated Specimen.	0.58% 99.42%
Which specimen is easy to dissect?	Wet Specimen. Plastinated Specimen.	79.43% 20.57%
Which specimen is useful for understanding complicated structure?	Wet Specimen. Plastinated Specimen.	4.64% 95.36%
Plastinated specimen is useful for other subjects?	Yes. No.	80.86% 19.14%
Plastinated specimen is useful for understanding of relations?	Yes. No.	4.35% 95.65%

Many of the medical students were not aware of plastination technique. According to the feedback of the students, the three dimensional structure was clearly seen in plastination specimen than in wet specimen. This makes the students to understand the complicated structure of anatomical specimen. As many of the students agreed that plastinated specimens are dry, non toxic and light so it is easy to hold in the hand. Almost all the students were agreed that the spatial orientation was clearly seen in plastination specimen than in wet specimen. However, the students objected that the understanding of relations of the organs could not be made in plastinated organ.

Fig. 1: Kidney with renal artery.

Fig. 2: Plastinated cast of renal artery with its segmental branches. S: Superior, AS: Anteriosuperior, P: Posterior, I: Inferior AI: Anterioinferior.

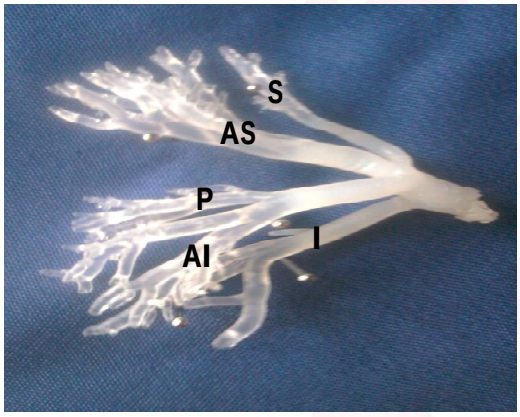


Fig. 3: Heart with arch of aorta.

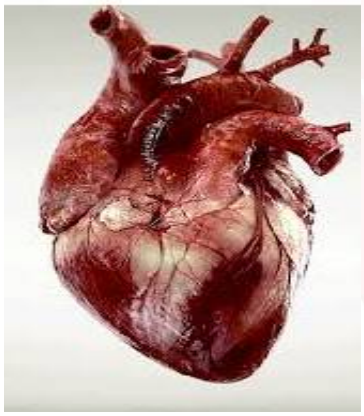


Fig. 4: Plastinated cast of arch of aorta (A).B: Brachiocephalic, LC: Left common carotid, LS:Left subclavian, RC:Right common carotid, RS: Right subclavian

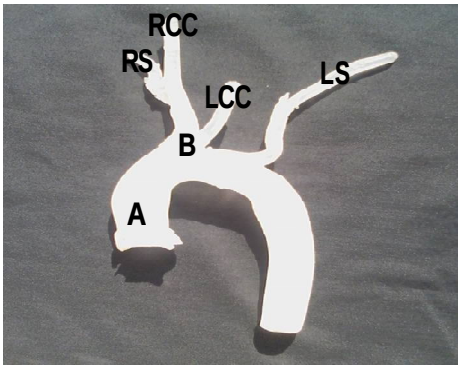
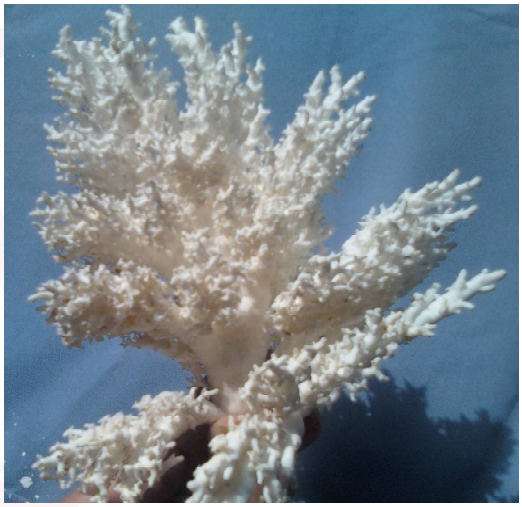


Fig. 5: Goat lung.

Fig. 6: Plastinated cast of goat lung (Bronchial tree).



DISCUSSION

Teaching with multiple techniques is very important to make the student understand the vast subject like anatomy. Anatomy is the foundation subject in the domain of medical science. However, this subject is very extensive in its contents; difficulty in understanding as well as in memorizing. Students are habituated of learning through books, CD, dissection, models. Students are force to imagine the complicated structure since 3D structure is not possible to illustrate in the book. The traditional teaching of human anatomy is based on didactic lectures and dissection of the cadavers. The brain, female reproductive system, joint capsule, gastrointestinal tract, branching pattern of the artery are very difficult to imagine. Such organ can be plastinated and demonstrated to the student for better understanding [7,8].

Plastination is a new approach to teach anatomy. It is a technique that allows tissue preservation in the form of dry, non toxic, durable and odorless state. It allows students to have hands on experiences in this field without exposure to chemical such as formalin. We selected the kidney with renal artery, arch of aorta and the lung with bronchus for luminal cast plastination as a method of our study.

Each kidney is supplied by a renal artery which is a branch of abdominal aorta [9]. The blood reaching the kidneys through the renal arteries is needed not only to supply the renal parenchyma but also to take part in the renal filtration. The renal artery is divided into the five segmental arteries corresponding to five segments of the kidney. These five segments of kidneys are superior, inferior, posterior, anterio-superior and anterio-inferior. The segmental artery is further divided into interlobar, arcuate and cortical arteries. In cadaveric specimen renal artery lies in between the renal vein anteriorly and pelvis of ureter posteriorly. The renal artery is also mingling with the peri renal fat, connective tissue in the hilum of the kidneys. So, it is difficult to isolate the branches of renal artery. Sometimes the renal artery divides into branches inside the kidney. These segmental arteries (Fig.2) are the end arteries which can also be seen in plastinated cast of renal artery. This view is not possible in the cadaveric specimen. So many of the students understood such complex organization of renal artery by plastinated specimen. Another plastinated specimen was arch of aorta with its branches. After the plastination (Fig. 4), its three branches brachiocephalic, left common carotid artery and left subclavian artery are clearly seen. The curvatures, diameter and its spatial configuration were clearly seen. As per the students feedback, the course of thoracic aorta from right to left was not clearly understood from the cadaver as it was hidden by the other structures present anteriorly. The students understood the complex structure of primary bronchus and its further division in plastinated specimen (Fig.6). According to the students, the bronchial tree was not visible and it was assumed in cadaveric specimen. As the plastinated specimen are dry, easy to hold, non toxic and non irritated, they preferred plastinated specimen than cadaveric specimen. The plastination of complex structure such as ventricles of brain, female reproductive tracts, coronary artery, cerebral artery etc, can be done and used as a model for teaching anatomy.

CONCLUSION

Plastination is not done only to preserve the tissue but can also be applied as a model of teaching tool. As the survey shows, students are not aware of plastination technique. Plastinated specimen is dry, easy to hold, non toxic and spatial orientation are seen more clearly than the cadaveric specimen. Students required more plastinated specimen to understand the complicated structure such as arch of aorta, segmental branch of renal artery and bronchial tree.

Conflicts of Interests: None

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