Developing the Plastination Laboratory for the Technique S10

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Plastination, as technique, is a laboratory method used for preservation of biological structures in order to complete comparative morphological studies and for research. The resulted specimens are used in teaching and learning anatomy. The budget for the standard plastination technique S10 and for materials used in the first stand is limited. In addition, the location and the facilities are simple and required special arrangements and authorization. The difficulties and inconvenience of developing the laboratory for plastination S10 technique in the Anatomy department, Faculty of Veterinary Medicine of Timisoara is reported.

Keywords: biological structure, anatomy, teaching anatomy, plastinated specimens

Plastination is a method used to preserve perishable biological specimens in the field of anatomy and pathology. Is suitable in zoology, botany and can also find place in different fields of application [3, 9, 10], as well for biologically orientated museums [6].

Since the standard plastination S10 technique has been developed by prof. von Hagens many faculties and laboratories have adopted this method to improve research and teaching [1].

Plastinated specimens are perfect for teaching and research [4], being used to expand the learning experience of practical work beyond the practical dissections [5]. The plastinated specimens are resistant, odorless, and sustainable, and maintain its histological features. Their value is increased not only for anatomy, but also in some cases for basic investigations [1, 7, 8].

It is known that during the dissections and/or tissues or organs preservations the teaching staff and the students are exposed to the action of noxious fumes.

The location of the laboratory for plastination in the Faculty of Veterinary Medicine of Timisoara did not involve any changes of the structures or additional expenses for reconstruction. Water supply and electricity are available.

In the Faculty of Veterinary Medicine of Timisoara the anatomy is been teaching along four semesters. In each semester there are 14 weeks of the practical and theoretical activities. There are 108 h of theoretical lessons and 182 hours of practice sessions. During the semesters there is a total number of 128 h of dissections, students being actively involved in selection and preparation of the specimens.

The present survey reports our experience in developing the plastination laboratory for S10 technique, the difficulties and inconvenience we had. The objective of this project was to initiate the plastination by the easiest technique and consecutively to evaluate the technical success of the plastinated specimens related to study and research.

Experimental part

Materials and methods

The plastination laboratory of the Faculty of Veterinary Medicine of Timisoara, Romania was placed in the former dissection room of the anatomy department. The total cost of the equipment for a S10 medium size plastination lab was fully covered by the university. The polymers used for plastination were Biodur S10, Biodur S3 and Biodur S6 (Biodur Products Gmbh Heidelberg, Germany).

The method usually recommended to start plastination is the S10 standard technique because doesn‘t require neither large financial investment nor specific technical support [3].

According with Heidelberg plastination folder [3] the S10 technique consists of following procedures [3]:

- for the fixation procedure all the specimens were immersed in formalin 10% for 30 days;
- dehydration: after fixation step the specimens were placed into series of three dehydration baths of acetone at -26°C through freeze-substitution method. Degreasing was made at room temperature for one week (except the encephalon and spinal cord);
- forced impregnation is the main step in plastination. The specimens soaked with acetone were placed into the polymer solution at -22°C under the action of vacuum pump. Prior immersion the preparation of the polymer mixture was achieved by mixing S10 polymer 100kg with S3 hardener 1kg (100:1). The pressure was reduced starting from 285mbar in the second day of the procedure. Depending on the specimens texture the forced impregnation takes place between 3-4 weeks, meanwhile the pressure decrease to 3-5 mbar;
- curing was performed with S6 gas, two times daily, 5-10 min, in the gas curing unit using aquarium pump.

Results and discussions

Faculty of Veterinary Medicine of Timisoara represents the first educational and research place where the plastination has begun officially in Romania.

The laboratory-room had to be arranged in order to host the plastination line. Total area of plastination laboratory is 48.9 m^2 (8.15m x 6m) and has six large windows which are very important for providing a good ventilation. The freezers for dehydration, forced impregnation and the gas curing unit are ergonomically placed providing a free access to them. The freezer‘s compressors are located in a neighboring room of the laboratory. Due to the vapors isn’t recommended the presence of the compressors in the same room with the freezers and curing units.

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Also, very important is the flooring of the laboratory which was inadequate (holes, slippery when wet). During specimens' manipulation drops of acetone, silicone or other substances fall accidentally on the flooring. The new floor was set up according with these rules.

Due to the substances used for dehydrating, especially acetone, an authorization from national antidrug agency was obtained. No any other licenses were required.

The plastination unit was purchased in 2009 and the polymers in 2011, while the activity started in autumn 2011. During this time several visits for information and learning were made to the plastination laboratories of the University of Veterinary Medicine Wien and Faculty of Veterinary Medicine from Munich trying to accumulate experience.

The plastination technique which is processing is the S10 standard technique from Biodur® and the protocols for plastination were made according with Heidelberg Plastination Folder – Collection of technical Leaflets of Plastination [3].

In the laboratories of the Anatomy department of FMV Timisoara for long time the preservation of organs and tissues consisted of conventional methods, fixation in formaldehyde 37%. This method is easy, economical and moreover the only choice of preservation methods used in several countries [2, 9, 10].

Few years before the plastination was introduced, the fixation was done by immersion in a bath with mixed formaldehyde, phenol, propylene glycol and water. The specimens resulted following this method had some advantages, such as less noxious fumes, easy handling and the aspect of the tissues is not quantitate or qualitative modified.

After the process of plastination was completed and first trials were ready the results were evaluated.

Through the plastination technique the vapours are considerably reduced and thus the exposure of the teaching staff, students and technical personnel during practical sessions is diminished.

The plastinated specimens resulted in the S10 standard technique were dry, clearly in details and free of odors. The size, shape, color and macroscopically aspect were not modified. It is noticed that the specimens are durable and suitable for teaching and learning.

Especially the parenchymatous organs such as liver (fig. 4), spleen (figs. 5-7), kidneys fig. 2, 3) showed a good color and consistency. In other organs in which the fat tissue was not complete removed the later retained its yellow color.

Although for the plastination of encephalon are recommended other techniques, the specimens of brain were plastinated through the S10 technique. The color and consistency were satisfied even the shrinkage was obvious in this case (fig. 1).

Due to their motivation in identifying the structure and features of the different organs, the students were satisfied when handling the specimens. The self-learning process in the practical sessions became easier and attractive, motivating the students and increasing their vision, thus expanding the learning experience of the participants.

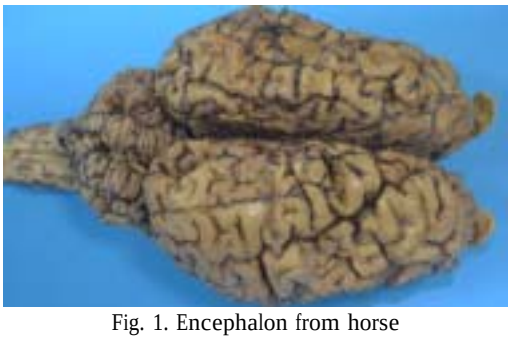

Fig. 1. Encephalon from horse

Fig. 2. Left and right kidneys of bovine (A-left kidney, B- right kidney) 1. Renal cortex; 2. Renal capsule; 3-3'. Ureters

Fig. 3. Kidneys of cat 1. Renal cortex and its vascular design; a-a'. Cranial extremity; b-b'. Caudal extremity.

Fig. 4. Liver of cow 1. Diaphragmatic surface; 2. Gall bladder; 3. Left lobe; 4. Quadrate lobe; 5. Right lobe.

Fig. 5. Spleen of horse 1. Visceral suface; 2. Hillus; 3. Proximal extremity; 4. Distal extremity; 5. Cranial border; 6. Caudal border.

Fig. 6. Spleen of the cow, parietal surface 1. Proximal extremity; 2. Distal extremity; 3. Cranial border; 4. Caudal border.

Fig. 7. Spleen of the sheep, visceral surface 1. Attachment area for rumen; 2. Area covered by peritoneum; 3. Hillus.

It is known that using fresh specimens the dissection is easier and more appropriate to reality, having the disadvantage of presenting a limited shelf-life.

Conclusions

Undoubtely, developing the plastination laboratory in the Anatomy department, Faculty of Veterinary Medicine of Timisoara was a succes and the results have rapidly developed.

The S10 standard technique required changes in the laboratory-room and an special licence for working officialy.

Based on the procedures of this technique a collection of organs and genuine specimens were realised.

Plastinations specimens allowed students, teaching staff and technicians to have a better anatomical approach. Moreover, plastinations specimens will have a better impact on the veterinary preclinically education and on the clinical researches.

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