

Use of Chilean Conservative Fixative Solution in Veterinary Anatomical Parts

Uso de la Solución Conservadora Chilena en Piezas Anatómicas Veterinarias

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SUMMARY: The conservation of anatomical pieces goes back five thousand years, beyond ancient Egypt for political and religious purposes. In the 12th century, with the appearance of the University, new techniques were implemented as the corpse became a necessary tool for teaching. During the last two centuries, since the year of its discovery in 1867, formaldehyde has been used as the main source for conservation. However, several years ago, anatomy laboratories around the world have resorted to new techniques and mixtures in order to reduce its use and its reported negative effects on health, such as cancer. This work shows the obtaining of anatomical pieces, by means of the Chilean Conservative Fixative Solution (SFCCh), its process, analysis and experience are described in the following pages.

KEY WORDS: Anatomy; Conservation; Solution; Technique.

INTRODUCTION

The implementation of new techniques for the conservation of anatomical pieces in the anatomy laboratory of the Faculty of Agricultural Sciences of La Salle University in Bogota, Colombia, led us to experiment with the Chilean Conservative Fixative Solution. This has been used successfully in some human anatomy laboratories, that describe it with the necessary characteristics for bodies to be maintained in good condition, facilitating the study of anatomical structures and thus, achieving appropriate learning of anatomical topics in practical classes in the amphitheatre. In addition, it showed to be a very good alternative to improve the conditions and preservation of corpses as well as decreasing toxicity levels (Ortega, 2014).

However, the use of anatomical samples in the education of future health professionals has been considered essential (Díaz Martínez *et al.*, 2006; Azer & Eisenberg, 2007; Collipal & Silva, 2011). In the same way, Babinski *et al.* (2003) showed that practical study on the cadaver was considered very important by 80 % of the students, increasing to 85.1 % when they were asked about the influence on learning after the use of cadavers during the practical training.

In addition, given the low cost, fixing and conservation techniques have usually been developed with solutions containing formaldehyde. These have several disadvantages such as irritating odor, rigidity, changes in the color of the structures, as well as toxicity with carcinogenic, teratogenic and mutagenic potential for those who handle it (Ballenguer, 1984; Olsen *et al.*, 1984; Moret de Arcia, 1990; Wolff, *et al.*, 2012).

This has led to the development of several techniques that include the use of formulas composed of sodium chloride, sodium nitrate, glycerine, methyl alcohol, benzalkonium chloride, eucalyptus essence and small concentrations of formaldehyde (Hammer *et al.*, 2014; Tiznado-Matzner *et al.*, 2019). There are also other techniques, such as plastination in which the preservation of tissues is done by means of a forced impregnation of polymers, epoxies or resins, obtaining anatomical specimens of natural appearance which are dry, odorless and durable (von Hagens *et al.*, 1987; Pandit *et al.*, 2015; Acevedo-Arroyave *et al.*, 2018). Furthermore, techniques such as the Prives method, which is based on the principle of a substance of high hygroscopic level such as glycerine, which constantly captures water from the atmosphere surrounding the piece, so that it does not lose weight, retains its volume and takes on a soft

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consistency (Correa Alarcón, 2005; Silva *et al.*, 2008; Garcia Karam *et al.*, 2016).

It is thus understood that the development of the Chilean Conservative Fixative Solution corresponds to the search for alternatives that minimize the use of formaldehyde, in an attempt to preserve fixing and conservation characteristics. According to Ortega, the solution was developed in Chile by Dr. Alberto Rodríguez Torres from the University of Chile, and Dr. Ismael Concha Albornoz, a veterinary doctor, has presented the method in different congresses and conferences on Morphology. The components of the solution (SFCCh) are sodium chloride, sodium nitrate, glycerine, methyl alcohol, benzalkonium chloride, eucalyptus essence and formaldehyde. For the application of this technique in this study, it was necessary to modify it, replacing sodium nitrate with urea and eucalyptus essence with citronella. Accepted variants in its formulation.

MATERIAL AND METHOD

For the elaboration of anatomical pieces by means of the Chilean Conservative Fixative Solution, an equine and a goat destined to the animal anatomy laboratory were used. The corpses used were donated to the laboratory, the equine corresponded to a six-year-old male of approximately 400 kilos and the goat to a 3-year-old female of 25 kilos.

Forty litres of the Chilean solution were prepared in the following manner: 3 kilograms of sodium chloride dissolved in 12 litres of water, 2 kilograms of urea dissolved in 12 litres of water, 8 litres of methyl alcohol, 6 litres of benzalkonium chloride, 1 litre of formaldehyde, 1 litre of citronella, and 60 cc of red acrylic fabric paint.

For the application, the common carotid artery was channelled, the capillary was washed, and the solution was applied. 25 litres of the mixture were used for the equine and five litres for the goat. Both were kept in the laboratory for a week, making changes of position to facilitate a uniform distribution of the mixture in the tissues. Afterwards, the skin was removed and the dissection from superficial to deep, of the different muscular planes, was performed until reaching the viscera.

RESULTS AND DISCUSSION

After carrying out the conservation technique using the Chilean Conservative Fixative Solution and the dissections were started, the pieces were observed to have a deep red co-

lor similar to that of the former pieces. Tissues were found to be hydrated, soft and with a pleasant aroma due to the citronella essence, just as in Rojas Oviedo & Ruiz Diaz (2010).

The texture of the muscles was flaccid and easy to manipulate; within the week neck, thorax and limbs were dissected where a good conservation and a wide flexibility in the joints was found. Later the dissection of the abdominal and pelvic cavities was carried out where the soft organs showed an adequate conservation and a much softer texture, when compared to pieces preserved with formaldehyde.

At the beginning, specimens were kept outdoors and did not show any major changes; they were sprayed and covered with plastic sheets to avoid dryness. After 10 days, it was necessary to dismember the bodies and immerse them in the same solution, since several organs began to show dryness.

The anatomical pieces were used as class material for one semester, without significant changes, as long as they were kept in a moist form. When they were left exposed for more than 48 hours, the tissues began to deteriorate, mainly due to dryness, making it necessary to keep them submerged between the different dissection sessions.

When dissection of the cranial cavity was performed, the brain was found to have a liquefied texture in some areas, with signs of decomposition, bad smell and loss of morphological architecture. Likewise, the spinal cord was not properly preserved, and signs of autolysis were observed.

As for the blood vessels, they were in good condition, more flexible than those found in pieces conserved in formaldehyde, but also thinner, especially at the level of the arteries. Peripheral nerves were well preserved, but as in the arteries, they were smaller in calibre compared to nerves preserved in formaldehyde.

CONCLUSIONS

According to the results, the conservation of anatomical veterinary pieces by means of the Solution (SFCCh) in this study, allowed to obtain well conserved specimens, without unpleasant odors nor irritation in the mucous membranes of the people who handled the pieces. Therefore, this solution can replace the use of formaldehyde, allowing for efficient use in the conservation of organs and not showing harmful effects for students, teachers and laboratory assistants.

The intense red color found at the beginning of the

dissections was due to the addition of acrylic paint. This color gradually decreased as it became necessary to submerge the pieces to rehydrate them in order not to lose their properties when in contact with air (dryness).

When comparing pieces preserved in formaldehyde versus SFCCh pieces, a better flexibility was found in the latter, as well as a texture being more in line with the living tissues. As for the conservation of the central nervous system, it is worth noting that the Chilean solution does not have preservative characteristics on these tissues, so it is necessary to resort to another type of preservative technique in order to conserve them.

We agree with (Rivera Díaz, 2014; Villarroel & Troncoso, 2017) pointing out that among the different anatomical techniques that exist for the conservation of anatomical pieces in the teaching of anatomy, each one presents advantages and disadvantages, which should be analysed in order to use the one that best suits the teaching and learning objectives established within the micro curriculum of each course, the ideal is to use several techniques that facilitate and diversify the acquisition of knowledge.

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RESUMEN: La conservación de piezas anatómicas se remonta a cinco mil años, más allá del antiguo Egipto por motivos políticos y religiosos. En el siglo XII, con la aparición de la Universidad, se implementaron nuevas técnicas ya que el cadáver se convirtió en una herramienta necesaria para la enseñanza. Durante los dos últimos siglos, desde el año de su descubrimiento en 1867, el formaldehído se ha utilizado como principal fuente de conservación. Sin embargo, hace varios años, los laboratorios de anatomía de todo el mundo han recurrido a nuevas técnicas y mezclas con el fin de reducir su uso y sus reportados efectos negativos en la salud, como el cáncer. En este trabajo se muestra la obtención de piezas anatómicas, mediante la Solución Fijadora Conservadora Chilena (SFCCh), su proceso, análisis y experiencia se describen en las siguientes páginas.

PALABRAS CLAVE: Anatomía; Conservación; Solución; Técnica.

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