



Using of Bleaching Powder for Cleaning Embalmed Cadaveric Bones

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Abstract:

Introduction: A new technique for cleaning bone specimens from embalmed cadavers after the dissection to study bone anatomy.

Materials and Methods: Long bones from embalmed cadaver after completion of whole body dissection were taken and removed fleshy tissue manually as far as possible. A new method was used for cleaning the bone specimens. For that all collected long bones were divided into three groups (Gr.I, Gr.II and Gr.III.)

Gr.I- Bones were immersed into chlorine solution of 50%, 70% & 90% consecutively for 10 (ten) days in each solution

Gr. II- Bones were directly immersed into clean tap water for 30 days at 10 (ten) days interval.

Gr. III- Bones were buried under superficial surface of soil during rainy season continuously for 30 days.

Results: Use of chlorine solution was found to be one of the more effective methods for cleaning of long bones in terms of time, cost and hygiene. Bones of Gr. I were found to be cleaned properly without any morphological distortion. Bones of Gr. II were not cleaned at all while bones of Gr. III were partially cleaned. **Discussion:** Use of chlorine solution for cleaning bones collected from dissected embalmed cadaver for preparation of bone specimen has of immense importance, which is less time consuming, less laborious and more hygienic as well as very much cost effective technique.

Conclusion: By using this technique, medical institutes can collect bone specimen from the dissected cadaver within a short period of time for the teaching as well as research purpose.

Keywords: Bones, Cleaning, Embalming, Cadaver, Chlorine solution.

Introduction

Anatomy is one of the basic streams of medical science. The knowledge of anatomy helps the medical students in the better understanding of medical as well as the surgical problems in various clinical fields. The teaching of anatomy has been based on the dissection of human cadaver since the ancient time. Gradually, the teaching of anatomy has become a challenging job due to the scarcity of the supply of human cadaver. Osteology, the study of normal structures of bones, is one of the important branches of anatomy teaching curriculum. The knowledge of bones anatomy is not only important for anatomists but is also having a great importance for medico legal experts, anthropologists, orthopaedic surgeon. Normally, we study the anatomy of bone by using the bones that are collected from the cadaver. But now-a-days, due to the unavailability of cadaveric bones students are using the artificial bones to study the anatomy of bones. But, the artificial bones cannot give the sufficient amount of authentic information about a bone as compare to a cadaveric bone. Therefore, the proper collection and preservation of bones from the cadaver is one of the important tasks for the anatomist.

The techniques for the removal of soft tissues from the bony skeleton have been documented since the 11th century, where the bones were boiled and the skeletal remains were collected.¹ Gradually, different group of workers as well as forensic scientists has developed several methods to clean and preserve skeletal remains. Bone consists of a structural protein (collagen) and mineral (hydroxyapatite crystals- $\text{Ca}_{10}[\text{PO}_4]_6[\text{OH}]_2$).² Generally, techniques for removal of soft tissues from the bones are focused on removing fresh tissue along with the microorganisms by bacterial maceration, chemical maceration, corrosion, enzymatic digestion. The formaldehyde is used as one of the embalming fluids either alone or in combination with other fixative agents to make the fluid more effective fixative agent.³ The collagens are the ideal

molecules for anchoring muscle and connective tissue to the bone because of its extensive cross-linking.⁴ The use of formaldehyde as fixative agent causes an increased number of inter and intrafibrillar cross-links of the collagen fibres and thus hampering the action of defleshing agents.^{5,6,7} Some workers think that burying and allowing nature to do its work is the best way of cleansing skulls and skeletons.⁸ In the ancient time, some of anatomists cleaned the skeleton by removing the flesh part manually. Afterwards, they would put the dissected body into a long box, filling the whole box with lime and then sprinkling some water on it. After eight days, they cleaned the dissected cadaver with rapid stream of water so that the lime together with the decaying remains of the flesh would wash out over time and leave all parts of the bones. After several days, the skeleton was taken out and cleaned all over with knives.⁹

Burial method was the most commonly used technique by different group of workers to collect bones from cadaver. Burial method is still using as a traditional method to collect bones from human cadaver. This traditional method for collecting bones is very much cost effective but more laborious, more time consuming and unhygienic to person handling them as well as to the environment. All these were keeping in mind; we had conducted a study with the aim of evolving new procedure of less time consuming as well as hygienic for collecting bones from dissected cadaver in the department of anatomy, NEIGRIHMS, Shillong.

Materials and Methods

The study was conducted on long bones specimens collected from dissected embalmed cadaver of the dissection hall of NEIGRIHMS, Shillong. The fleshy part attached to bones was removed manually as far as possible. Afterwards, they were disarticulated by cutting the articulating ligaments and cartilages. Then collected long bones were divided into three groups- Gr-I, Gr-II and Gr-III. Each group was having a humerus, a

radius, an ulna, a femur, a tibia and a fibula. Then bones of Gr-I were treated with ascending concentration of chlorine solution (50%, 70% and 90%) while Gr-II and Gr-III were tried to clean by immersing into tap water and by burial method respectively to observe the efficacy of different methods. Commercially available bleaching powder was taken as a source of chlorine solution.

Preparation of Chlorine solution from bleaching powder

Chlorine solution was prepared by dissolving bleaching powder into water. The bleach solutions give off chlorine. It was prepared in a well-ventilated area. Plastic containers were used for mixing and storing bleach solutions as metal containers could be corroded rapidly and would affect the bleach action.¹⁰ The bleaching powder is chemically Calcium Oxychloride or Chlorinated Lime with chemical formula of CaOCl_2 .¹¹ Commercially available bleaching powder contains 33% available chlorine. 20 grams of this bleaching powder was dissolved in one litre of water to prepare a 0.5% chlorine solution.¹²

Formula for preparing 1 litre of required concentration of chlorine solution is

$0.5 \div 20 =$ required strength of chlorine solution (%) \div required amount of bleaching powder (gm).
Therefore, to prepare 1 litre of bleaching powder of particular concentration, the required amount of bleaching powder (gm) = $40 \times$ required strength of solution (%)

Universal precautions were observed to prevent any chemical and physical injury to persons involved in the study.

Group-I: The bone specimens of this group were immersed into chlorine solution of graduated strength of 50%, 70% and 90% successively for 10 days in each solution (Fig.1). The bones were cleaned manually at each 10 days interval before putting into successive concentration of bleaching powder solution.

At the end of the 30th day, bones were kept outside, cleaned manually with clean tap water

and allowed to dry in sunshine for 2-3 days. Subsequently, bones were cleaned properly with light sand paper and cotton.

Group II: The bones of group II were immersed into clean tap water without any detergent or chemical for 30 days. Water was changed regularly at 10 days interval along with manual cleaning of bones (Fig.2).

Group III: The bones of the group III were buried for 30 days continuously under superficial surface of soil during rainy season. After 30 days, bones were excavated and rinsed under tap water (Fig.3).

Results and Observations

In our experiments, we observed that soft tissues attached to the bones of the Group I were started decomposing in the first 10 days while in the subsequent 10 days, the decomposition of soft tissues were more rapid than previous 10 days. In the subsequent 10 days, decomposition of the soft tissues was completed and bones were found to be cleaned. On 31st day onwards after the proper drying of bones for two days, bleaching action of bleaching powder was observed without any morphological distortion of the bones.

Whereas, decomposition of soft tissues attached to the bones of Group II were started in the first 10 days and partially completed at the end of the period of 30 days. Though these bones retained all the morphology of bone, these were not suitable for study from the hygienic point of view.

It was seen that the soft tissues attached to the bones of group III were decomposed more neatly than the bones of group II. But these bones require more time to complete the decomposition of the soft tissues as well as they are also not safe from the hygienic point of view. Moreover, the carnivorous animals destroyed some of these bones as they were buried under superficial surface of soil.

In our various observations, it was observed that bones of group I were cleaned and bleached properly within a time of 30 days, which were safe hygienically and retained all the morphology-

ical features of the bones. On the other hand, the bones of the group II and III were cleaned partially by using clean tap water and by superficial burial method respectively. They required more time as well as more laborious for complete cleaning and not safe hygienically.



Fig 1: Bones of group I which were immersed into chlorine solution of graduated strength of 50% (A), 70% (B) and 90% (C) successively for 10 days in each solution



Fig 2: Bones of group II which was taken out from clean tap water after 30 days with 3 consecutive changes at 10 days interval



Fig 3: Bones of the group III which was taken out after 30 days continuous burial under superficial surface of soil during rainy season

Discussion

Dry human bones are one of the important tools for teaching anatomy as well as for evaluating the efficacy of different orthopaedic devices. It was observed that biological activity is higher at the surface and in the upper soil layer due to the availability of oxygen and food.¹³ It is observed that decomposition of soft tissues in one week in the air is equivalent to two weeks in water and eight weeks in soils.¹⁴ Thus, the depth of burial will influence the decomposition of organic materials; with greater depth slowing down the process of decomposition.¹⁵ It was observed by Hartnett *et. al* that bleaching agent had no structural effects on the hard tissues of the human body.¹⁶ It was seen that there was no effect on the mechanical properties of bone after storage periods of one year and these bones can be used for mechanical testing at least for storage periods of up to one year.¹⁷ Bacterial maceration in water or soil was one of the oldest documented

techniques for defleshing^{18, 19} but these methods were more expensive.

In our present study, it was observed that bones were neatly cleaned by burial method as well as by using bleaching powder solution as a source of chlorine solution. However it was seen that the burial method was more time consuming, more laborious and also found that carnivores' animals damaged some bones. On the other hand, it was observed that bones retained their complete morphological features along with the proper cleaning and bleaching only after treating them in graded concentrated chlorine solution prepared from bleaching powder. This technique was found to be one of the less expensive, less time consuming and safer from hygienic point of view.

Conclusion

The study of bones could be considered as one of important subjects in medical science. We have to collect and preserve the bones from all possible sources. The present study revealed that commercially available bleaching powder could be used as chlorine solution for proper cleaning and bleaching of the embalmed bones collected from dissected embalmed cadaver. The use of bleaching powder as one of the sources of chlorine solution has of enormous importance, as it is less time consuming, less laborious and more hygienic as well as very much cost effective material. By using this, medical institutes can collect the bone specimen from the dissected cadaver within a short period of time for the teaching as well as research purpose. There are many more things, which have to be adapted or rediscovered in this field of research, which has been neglected so far.

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