

## EVALUATION OF TECHNIQUES FOR CLEANING EMBALMED CADAVER BONES

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### ABSTRACT

**Objective:** The present study was conducted to find new technique for development of bone specimens from cadavers.

**Material and methods:** Long bones, skull and other bones from embalmed cadaver were taken and cleansed by various methods. Four methods were employed for preparing specimens. In 1<sup>st</sup> method bones were boiled in tap water for 7-8 hours on gas stove. In 2<sup>nd</sup> method bones were immersed in water with addition of detergent at constant temperature. In 3<sup>rd</sup> method bones were kept at constant temperature in water without addition of detergent. In 4<sup>th</sup> method bones were buried for one month under superficial surface of soil during rainy season after boiling the bones for 7-8 hours

**Observations:** Use of detergent in warm water (65°C) was good for cleaning long bones while best result for long bones as well as skull was seen with boiling followed by burial of embalmed specimens. Results were found as expected. Time consumed in the present study was less than old classical methods. Bones specimens formed were of high quality.

**Conclusions:** Preparation of bone specimen by embalmed cadaver can be of immense value and time saver for many research institutes to get their self-prepared specimens. There are many more ways which has to be modified or rediscovered in this area of research, which has been neglected so far.

**KEYWORDS:** Bones, Cleaning, Embalming, Cadaver.

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### INTRODUCTION

Anatomy teaching has become a challenging task. Anatomy evolved as a keystone of medical education through ages. Bones are very essential part of anatomy teaching curriculum. Knowledge of bones is not only important for anatomist but also of equal importance from clinical and medico legal aspect. There are many ways to procure bones. Some anatomists think that burying and letting nature do its work is the best way of cleansing skulls and skeletons [1]. Another method commonly practised by

anatomist in ancient time was hanging of dead to free the cadaver of most of its flesh and to cut out the inner organs without taking apart any joint of the body [2].

However recently there has been scarcity in availability of bones for teaching in India. This is probably because of the following facts: 1) donation of body is not a common practice therefore causing scarcity of cadavers which has further led to less availability of bones, 2) Increase in demand of bones is due to increase of medical, dental and physiotherapy

colleges. There has been increase in medical colleges by 31% since last 5 years (leading to over 50,000 students getting admitted in India to MBBS course) which has increased the demand of bones too [3, 4]. Traditional methods of getting bones are being very tedious and time consuming and are not able to meet the requirement of bones. All these have arisen the need for evaluating methods to procure bones from available materials i.e. wet specimens which are less time consuming. Therefore present study was conducted with the aim of evaluating the least time consuming and practical method to procure bones from embalmed cadavers and wet specimens in the department of anatomy. Embalmed cadavers differ from un-embalmed ones in this context.

### MATERIALS AND METHODS

The study was conducted on four sets of dissected specimens each set of which was having a skull, a scapula, a humerus, a radius, an ulna, a femur, a tibia and a fibula. Each set was subjected to separate method for cleaning & processing bones. Universal precautions were observed to prevent any chemical and physical injury to persons involved.

**Method I:** The specimens were kept in metal container, completely immersed in water. The water in it was boiled for 7-8 hours on gas stove[5].

**Method II:** soft tissue was removed with dissecting instruments. Partially cleaned bones were immersed in 20 litres warm water (65° Celsius) containing 40 grams detergent powder [1].

**Method III:** soft tissue was removed as in second method and partially cleaned bones were immersed in 20 litres of warm water (65° Celsius). The temperature of the water was maintained at 65° C. The bones were kept in warm water for 24 hours.

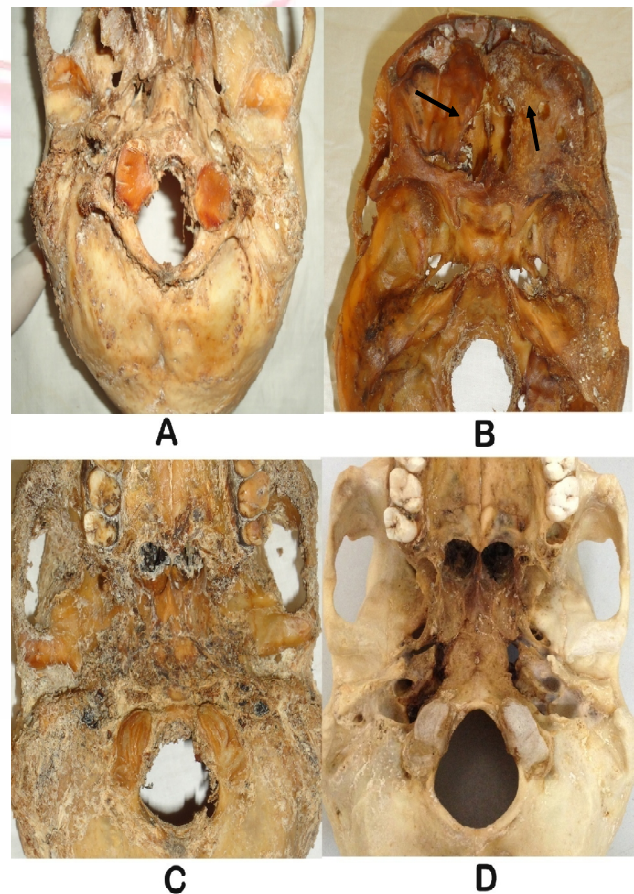
**Method IV:** bones were cleared and cleaned as described in first method then these bones were buried under ground (which was not specially prepared). This procedure was done in humid weather (rainy season). After 30 days bones were excavated and rinsed under tap water. Debris was removed with soft brush.

Bones from above methods were kept in acetone solution for degreasing and then all bones were kept in hydrogen peroxide either 4% or 6% solution for whitening the bones<sup>6</sup>

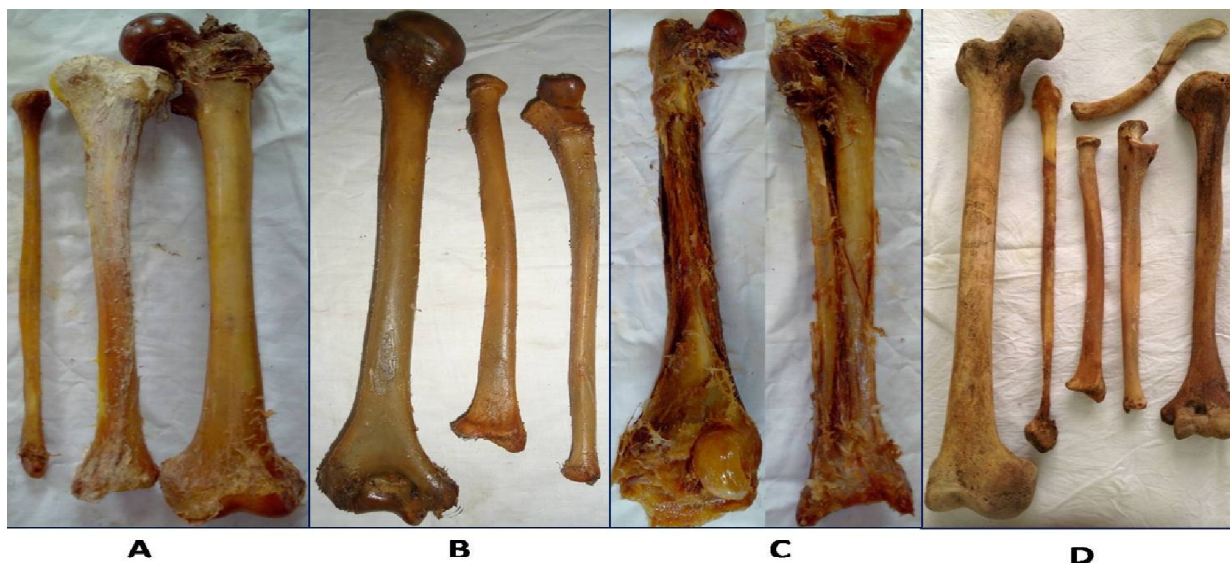
### OBSERVATIONS

In present study it was observed that boiling in water (Method I) could clean the long bones to greater extent however soft tissue from ends of the long bones and skull especially around foramina could not be cleaned [figure: 1-A]. Cleaning of long bones was effective in Method II however small bones of skull became brittle with use of detergent [figure: 1-B]. Cleaning of long bones and skull was not effective with Method III. Soft tissue could not be removed from ends of long bones and base of skull [figure: 1-C]. Bones cleaning was effectively done with Method IV, long bones as well as skull were clear of all soft tissue after excavation [figure: 1-D].

**Fig. 1:** Cleaning of skull: A) Incomplete removal of soft tissues from base of skull using method I, B) Broken cribriform plate and orbital plate of frontal bone of skull after using method II, C) Incomplete removal of soft tissue from skull after using method III, D) cleaning of skull with method IV.



**Fig. 2:** Cleaning of long bones: A) Ends of long bones containing soft tissue after using method I, B) Long bone procured after using method II, C) incomplete removal of soft tissue from long bones after using method III, D) Long bones procured after using method IV.



## DISCUSSION AND CONCLUSION

Dry human bones are important material not only for anatomy teaching but also for assessing the efficacy of orthopaedic devices [7]. Various methods causing soft tissue decomposition include a) boiling b) use of chemicals c) use of insects d) water decomposition and e) decomposition by burying in the soil. All these methods lead to complete skeletonization, and except boiling all other methods are effective for medium sized and large animals. However scarcities and involvement of complex legal issues concerning cadaver has reduced the availability of bones for anatomical teaching which has led to use of embalmed specimens for procuring human bones. In present study, boiling of embalmed specimen followed by burying under soil has given best results for procuring good quality bones. The specimens were buried under superficial surface of soil during rainy season. It has been reported that burying of human cadaver specimens in superficial surface of soil leads to early decomposition due to greater level of biological activity at the surface and in the upper soil layers because of the greater availability of oxygen and food [8]. Humid weather of rainy season is also helpful in accelerating decomposition leading to early skeletonization of specimen/cadaver. The time taken by method in present study was 30 days in comparison to one year by burying

the cadaver without embalming, while embalmed cadaver may take little longer. Generally, decomposition one week in the air is equivalent to two weeks in water and eight weeks in soil [7]. Standard reported methods for procuring bone are either boiling or burial. However, decomposition of soft tissue is delayed in embalmed bodies due to presence of formalin but boiling before burial of such specimens leads to enhancement of soft tissue decomposition due to decrease in formalin after boiling. Method II was easy and less time consuming method for procuring long bones (Figure: 2-B). Use of acid for removal of soft tissue removes calcium from bone making them brittle, hence, we use alkali in the form of detergent which by saponification of soft tissue without decalcification of bone [8]. It has also been proved that there is no effect on mechanical properties of bone after storage even if it has been procured from an embalmed specimen. Prepared bone specimens were having no decay or fracture and were intact with all normal features [9]. Methods used were not hazardous but also eco-friendly and economical. Microbiological safety for user is obtained by drying the bones with hot air blower followed by thin film of acrylic spray. Therefore, it concluded that preparation of bone specimen by embalmed cadaver can be of immense value and time saver for many research institutes to get their self-prepared specimens.

**Conflicts of Interests: None**

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