



Procurement of Bones from Formalin Fixed Specimens-Method to Prepare Bone Sets

Dr Ramadevi G^{1*}, Dr Radha Ramani B²

^{1,2} Assistant professor, Department of Anatomy, GIMSR
GITAM University, Visakhapatnam, Andhra Pradesh, 530045.

***Corresponding Author:**

Dr Ramadevi G

Assistant professor, Department of Anatomy, GIMSR

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Introduction: For the first year MBBS students, understanding osteology (study of bones) is vital to study the muscle attachments and movements of joints. Original bones are essential as the muscle markings on the bones and exact structure will not be there for artificial bone. Scarcities and involvement of complex legal issues concerning cadavers has reduced availability of bones for anatomical teaching. **Materials & methods:** In this study we have used donated bodies which have been donated for academic and research purpose. After completion of routine cadaveric dissection, skeletal remains were buried, left it for about one year and then dug for the remains. Bones after retrieving, cleaned the soft tissue if any, immersed in solution of washing soda for 18 to 20 hours, and then immersed in hydrogen peroxide solution of various concentrations till we get the desired changes, bones were then cleaned, dried, painted with turpentine to increase the shelf life. **Results:** We retrieved long bones of upper and lower limbs, ribs, vertebrae, scapulae, skulls, pelvic bones, and also short bones- carpal and tarsal bones. All were separated accordingly and stored for future purpose. **Conclusion:** Bones procured in natural state with all morphological features were well preserved, made bone sets out of it to give the students for study purpose on loan basis

Keywords: Formalin fixed specimens, procuring bones, Anatomy teaching, Hydrogen peroxide

INTRODUCTION

For the first year MBBS students understanding osteology (study of bones) is vital to study the muscle attachments and movements of joints. For this student require a bone set with them, although artificial bone models are available for academic purpose, but they are not good enough when it comes to teaching medical students. Original bones are essential as the muscle markings on the bones and exact structure will not be there for artificial bone. Although medical college have the bone sets, they are inadequate for teaching batch of 150 students. Procuring real human bone was a major hurdle for medical students due to various regulatory and legal restrictions.

Main objective of present study is to pool up the bonesets and give it to the students (one set for each

two students) on loan basis, at the time of joining so that they can use it throughout the year and submit back after final exam.

We tried to retrieve bones from the donated bodies after they have been used for dissection. Cadavers which have been buried for a period of about one year were dug for the remains with help of technicians, processed through various steps to get life like bones. Bones procured are in natural state with all morphological features well preserved.

MATERIALS AND METHODS:

Present study was carried out at our GITAM institute of medical sciences, in the department of Anatomy, after completion of routine first year MBBS dissection, formalin fixed specimens and cadavers

were buried and left for period of one year and then dug for the remains. (FIG-1) Bones were segregated according to region wise (FIG-2&3) and washed in running tap water to remove the dirt. Bones were then kept in metal container, completely immersed in water mixed with washing soda, boiled for 7 to 8 hours. Bones are now freed of soft tissue. Washing soda leads to saponification of remnants of muscles, tendons, ligaments and other soft tissue and also helps in

degreasing of bones. Bones were then immersed in hydrogen peroxide of various concentrations till we get the desired changes. Hydrogen peroxide bleaches the bone and give the clean look and it prevents the further degrading. Bones were air dried for 2 to 3 days depending upon atmospheric condition, finally painted with turpentine which increases the shelf life of bones keeping the pets away and also prevents them for further decomposition.



FIG- 1: Unclean bones after digging



Fig- 2 &3: Segregation of unclean bones

RESULTS:

Buried bones were excavated after one year and if any amount of soft tissue was still attached, bones were reburied for removal of soft tissue. Bones with minimal soft tissue were cleaned to remove dirt and mud, and then allowed to dry. Dried bones with minimal amount of soft tissue were immersed in different concentration of hydrogen peroxide and left it over by 24hr and then cleaned and dried up for 2-3 days, painted with turpentine, stored for academic purpose. (FIG-4)



Fig-4: Bones after cleaning

DISCUSSION:

Dissection of cadaver is most effective method to teach anatomy for undergraduate students. The disposal of cadavers after dissection, usually done by burying it in burial ground of anatomy department which is a part every medical college. Burying and letting nature to do its work is the best way of cleaning bone. [1] Scarcities and involvement of complex legal issues concerning cadavers has reduced availability of bones for anatomical teaching. [2] Bonesets are also required by dental students, nursing students, anthropologists, and students of other paramedical courses. In short, the supply demand position of bonesets is highly unsatisfactory at least for today. Because of non-availability of number of original bones, and limited working hour of department, it is difficult to study the subject by keeping bones in their hand.

Various methods for preparation of human skeleton have been described by Schmitt et al; [3] Mc Donald has described Do's and Don'ts" to get best results for the preparation and preservation of skeleton; [4] Bones need to boil after excavating from burial ground to remove the attached left over tissue. Boiling with alkali-based detergents speeds the process and have used hot air oven to dry the bones. [5] Simonson et al in his study stated that degradation of soft tissue by use of enzymes very fast and bones are clean. [6] Use of larva to clean the skeletal part has been described by Hall and Russell, however it does not seem to work

well with formalin fixed specimens. [7] Swift in his opinion that detergent can be used to clean the bone. [8] Para jape VM et al in their study described the cost effective and user-friendly method for procuring bones in formalin fixed specimens. [9] Bhawani Sankar Modi et al in their study evaluated the techniques for cleaning embalmed cadaver bones and described various methods of cleaning and procuring bones.

All procedures like cleaning, washing, drying, boiling in washing soda and hydrogen peroxide done in dissection hall and in the premises of burial ground. Care was taken not bleach the bones too much. Proper protective equipment was worn by the technician to prevent hazards from chemical used in cleaning. Our aim of present study was making bones available for teaching purpose and make as many bonesets as possible to give it to the students on loan basis to study at their convenient time and get it back at the end of academic year and same can be circulated to the next batch of students.

Bone sets are sold at exorbitant costs illegally due to shortage of cadavers. Students in grave need have to share the bonesets or borrow them from the medical college. Increase of seats in medical college increase the demand of bones. [10]

CONCLUSION:

To overcome the severe shortage of bones for routine undergraduate teaching, we have developed in-house

method in the department. Bones procured in natural state with all morphological features very well preserved. Some of the first MBBS students, who cannot afford to buy a boneset due to financial constraints, procure it temporarily from the department if available, share the set with their colleagues, or study the muscle attachments or bone details (Osteology).

BIBLIOGRAPHY:

1. Cleaning methods - SEABIRD OSTEOLOGY. Available from: <http://www.shearwater.nl/index.php?file=kop131.php>. (last accessed on 25 June 2015).
2. Browne, Jaelyn Ashley. "The Bone Chilling Truth: Buying and Selling Human Skeletal Remains on the Internet." (2020).
3. Schmitt, D.M. 1966. "How to prepare skeletons." Ward's Curriculum Aid: 8 pp
4. H. Gregory Mc Donald Conserve O Gram. September 2006 Number 11/7.
5. Modi BS, Pure N, Patnaik VV. Evaluation of techniques for cleaning embalmed cadaver bones. *Int J Anat Res.* 2014; 2(4):810-13.
6. Simonsen KP, Rasmussen AR, Mathisen P, Petersen H, Borup F. A fast preparation of skeletal materials using enzyme maceration. *Journal of forensic sciences.* 2011 Mar; 56(2):480-4.
7. Hall ER, Russell WC. Dermestid beetles as an aid in cleaning bones. *Journal of Mammalogy.* 1933 Nov 13; 14(4):372-4.
8. Mairs S, Swift B, Ruttly GN. Detergent: an alternative approach to traditional bone cleaning methods for forensic practice. *The American journal of forensic medicine and pathology.* 2004 Dec 1;25(4):276-84.
9. Paranjape VM, Pandhare SR, Bahetee BH, Gaikwad A. A cost effective and user-friendly method for procurement of bones from formalin fixed specimens-a pilot study. *Indian Journal of Clinical Anatomy and Physiology.* 2017 Oct;4(4):558-61.
10. Annual Reports [Internet]. [cited 2014 May 7]. Available from: <http://www.mciindia.org/AboutMCI/AnnualReports.aspx>