



**A NARRATIVE REVIEW OF THE PROCUREMENT AND PROCESSING OF HUMAN BONES FOR EDUCATIONAL PURPOSES IN MEDICAL INSTITUTIONS**

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**Abstract**

It is essential for students of medicine to have access to human bones for the purposes of educational research and study. The acquisition and subsequent processing of human bones is an integral part of this procedure. The goal of this narrative review is to investigate the many strategies that are utilized by educational institutions in the medical field to acquire and process human bones for pedagogical reasons. In this study, the ethical issues and regulatory requirements that must be adhered to in the process of acquiring and processing human bones are discussed. These considerations and regulations are discussed in detail. In addition to this, it conducts an analysis of the various methods for conserving and keeping human bones so that they can be used for medical education over an extended period of time. The acquisition and processing of human bones for educational purposes is a complicated procedure that involves a variety of different concerns, including ethical, legal, and practical issues. In the field of medical education, human bones can be put to a variety of different uses, including research, anatomical instruction, and surgical practice. The acquisition and processing of human bones, on the other hand, present a number of problems, the most notable of which are the scarcity of human bones, the expense of bone processing, and the presence of legal and regulatory concerns. There is a need for improved knowledge of anatomical donations, collaboration among medical institutions, study of alternative ways of bone processing, and the formulation of clear standards and regulations in order to improve the procurement and processing of human bones. These things are all necessary in order to accomplish this goal.

**Keywords:** Human bones, medical education, bone procurement, bone processing, ethical considerations

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## **Introduction**

Since ancient times, educational institutions dedicated to medicine have made use of human remains, particularly bones [1-3]. When it comes to medical education, the use of human bones is especially significant in the areas of anatomy and orthopedics, both of which emphasize the need of hands-on learning for the development of surgical skills [4]. Bones from humans can be obtained from a number of different places, including forensic investigations, anatomical donations, and osteoporotic instances [2]. The acquisition and processing of human bones for educational purposes is a complicated procedure that involves a variety of different concerns, including ethical, legal, and practical issues [4-10].

## **Procurement of Human Bones**

The process of getting bones for the purpose of medical education involves a number of steps, one of which is the acquisition of human remains. There are a number of different ways to get human bones, the most common of which being cadavers, surgical operations, and bone banks. [1] The procurement of cadavers is normally accomplished through the use of an official donation program, as the use of cadavers for the purpose of medical teaching is a regular practice that is carried out at a variety of medical institutions. [2] The procurement of bones from surgical procedures is also a regular practice. This is especially the case in orthopedic surgery, in which bones that are removed during surgical procedures are frequently used for educational purposes in the field of medicine. [3] Bone banks are another source of human bones that can be used for educational purposes in the field of medicine. Bone banks often collect bones from individuals who have passed away through donation programs. [4] In order to assure the safety of the specimens and their ability to be conserved in a manner that is suitable for use in medical education, the acquisition and processing of human bones for educational purposes require special approaches. The procedures differ from one another due to the factors of the planned application of the bones, the anticipated length of the educational program, and the ethical considerations involved in the process of bone procurement. The acquisition of human bones for educational purposes typically includes the gift of the cadavers by the donors or their relatives, after obtaining the proper agreement from the relevant parties. In most cases, medical schools, universities, or other types of educational institutions that have a requirement for human bones as part of their curriculum are involved in the procurement process [5-10].

## **Processing of Human Bones**

The processing of bones is an essential stage in the acquisition of human remains by educational institutions interested in their instructional potential. The procedure entails a number of procedures, the purpose of which is to prepare the bones for use in medical education. These steps include cleaning, sterilization, and preservation of the bones.

The cleaning procedure is one of the initial processes in the processing of bones. This requires the removal of any connective soft tissue, such as muscle and ligaments, that may have been linked to the bones. The process of cleaning usually involves a mix of manual and

mechanical techniques, such as scraping and brushing, and it may also include the application of chemicals to dissolve any remaining soft tissue.

After the bones have been cleaned, they need to be sterilized to remove any harmful bacteria or other pathogens that could still be present. This will ensure that the bones are safe to use. The process of sterilization often involves the use of chemicals or heat, such as in the case of autoclaving or irradiation. This successfully eliminates any bacteria or other microbes that may have been present before.

After being sterilized, the bones might go through certain extra processing stages in order to keep them in usable condition so that they can be used for educational purposes in the medical field. Use of chemicals like formalin or ethanol, which aid to prevent decomposition and ensure that the bones remain intact throughout time, is typically used in preservation procedures. The preservation methods that are used may vary depending on the purpose for which the bones are meant to be used.

When treating human bones so that they can be used in medical education, in addition to the processing stages that have been discussed above, there are several other considerations that need to be taken into consideration. For instance, the technique of processing that is applied should be chosen with great care to guarantee that it will not cause any harm to the bone or affect the natural qualities that it possesses. This is of utmost significance when bones are being utilized for the purpose of research or surgical training, since it is imperative that the natural qualities of the bones be maintained to the greatest extent feasible.

When processing human bones for use in medical education, the potential for contamination or cross-infection is another factor that should be taken into consideration. When dealing with and processing human bones, medical facilities have a responsibility to exercise the appropriate level of caution so as to prevent the transmission of infectious diseases. This may involve using personal protective equipment such as gloves and masks, in addition to strictly adhering to the established standards for infection control.

In addition to these factors to take into account, it is essential to keep in mind that the processing of human bones for the purpose of using them in medical education is subject to both ethical and legal factors to take into account. As was said earlier, the collection and processing of human bones are required to be carried out in a manner that is compliant with the established ethical and legal standards. These requirements include the acceptable use of human remains as well as the respect for the dignity and integrity of the individual who has passed away.

In conclusion, the processing of bones is an essential stage in the acquisition of human remains by educational institutions that are intended for didactic reasons. The procedure entails a number of procedures, such as cleaning, sterilization, and preservation, which are all aimed at preparing the bones for application in educational settings related to medicine. When processing human bones for use in medical education, it is important to take into consideration a variety of factors, including the possibility of contamination or cross-

infection, as well as ethical and legal considerations related to the appropriate utilization of human remains. Medical institutions can ensure that the processing of human bones for use in medical education is done in a way that is safe, effective, and ethical by giving careful consideration to the factors listed above and by adhering to the protocols and guidelines that have been established [11-15].

### **Ethical Considerations and Regulatory Requirements**

The acquisition and processing of human bones for the purpose of educational purposes in the medical field raises a number of important ethical questions and statutory prerequisites. Respect for the dignity of the person who has passed away and the requirement to get informed consent from donors or their relatives are two examples of ethical considerations. [7] Compliance with local and national legislation that govern the acquisition and use of human remains for educational purposes in the medical field is required as part of the regulatory requirements. [8] In addition, institutions of higher learning in the medical field have a responsibility to ensure that they have proper policies and processes in place to regulate the acquisition and utilization of human bones for educational purposes. It is crucial to ensure that donors are fully informed of the use of their bodies and that their desires are honored [14]. The use of donated bodies for the purpose of medical education requires the approval of the donors or their families. This consent must be obtained from the donors themselves. It is essential to guarantee that the human remains are treated with care and compassion [15]. The use of human remains in medical education also presents ethical concerns regarding the dignity and respect for the person who has passed away. It is necessary to take into account people's cultural and religious beliefs while using human remains in educational settings related to medicine [16]. There are ethical questions raised by the acquisition of human bones for the purpose of educational research [5]. The respect for the dignity of the person who has passed away is one of the most important ethical considerations. It is of the utmost importance to make certain that the process of acquisition is courteous and considerate of the feelings of the members of the family [6]. In the case of anatomical contributions, it is very necessary to acquire the donors' or their next of kin's agreement after providing them with adequate information [7]. In addition to this, it is absolutely necessary to make sure that the specimens are only used for educational reasons and to protect the donors' right to remain anonymous [8].

### **Preservation and Storage Techniques**

The preservation and storage of human bones for the purpose of medical education is an essential component in guaranteeing that these bones will continue to be suitable for long-term use while also retaining their safety and efficacy. Freeze-drying, embalming, and storing in a solution of formalin or ethanol are among methods that can be utilized during the preservation process. The process of freeze-drying entails eliminating all of the water from the bone, which stops the growth of harmful microorganisms like bacteria and fungi. [9] In the process of embalming, a preservative solution is injected into the bone. This not only stops the formation of bacteria and fungus in the bone, but it also causes the bone to become

more dense and resistant to breakage. [10] Another typical method of preservation is to store the substance in a solution of either formalin or ethanol. Ethanol is particularly useful for limiting the growth of germs and fungi, which makes it an excellent choice for the preservation of bone structure. [11] It is vital to store the bones in a controlled environment in order to avoid any degradation from occurring, regardless of the method of preservation that was used. This includes storing the bones in an area that is cold, dry, and shielded from direct sunlight while also ensuring that the necessary levels of humidity are maintained. [12]

### **Uses of human bones in medical education**

In medical education, human bones can be used for anatomical instruction, surgical training, and research [12]. Medical students who are learning anatomy are taught about the structure and operation of the human body using human bones [13]. Human bones are utilized during surgical training to instruct surgeons in a variety of procedures, including spine surgery and joint replacement [14]. Human bones are used in research to examine the biomechanics of the human body and to create innovative surgical procedures [15].

### **Advantages and Limitations of Using Human Bones in Medical Education**

The use of human bones in medical education has a number of benefits, including the capacity to perform surgical methods and procedures, a realistic and practical learning environment, and the chance to study human anatomy in three dimensions. A variety of abilities, including dissection, observation, and critical thinking, can be developed through the use of human bones in medical education [17]. Additionally, the use of human bones in medical education gives students the chance to grow in their empathy and respect for patients and the human body.

There are restrictions on the use of human bones in medical teaching, nevertheless. It can be costly to obtain and prepare human bones for instructional use, and there may not always be enough of them available [18]. Ethics issues are also brought up by the use of human bones in medical teaching, as was previously mentioned. Additionally, variations in bone structure and pathologies may not be adequately represented in the specimens, so the use of human bones in medical education does not always provide a complete picture of human anatomy [19]. Last but not least, using human bones to teach medical students may not effectively prepare them for the complexity and variety of real patients.

### **Challenges in the procurement and processing of human bones**

There are various difficulties in obtaining and processing human bones for educational purposes. The scarcity of human bones is one of the main problems. Due to the high demand and limited supply for human bones, medical facilities are competing more fiercely [16]. The expense of processing bones is another issue. The price of various bone processing techniques varies, and some techniques, like plastination, can be pricey [17]. The acquisition

and processing of human bones also bring up legal and regulatory difficulties, such as the requirement for correct documentation and conformity to national and international regulations [18].

### **Future Developments**

New methods and tools for the collection and processing of human bones may be required as medical education progresses. The use of 3D printing to make copies of bones for educational reasons is one potential development. [13] This might make it unnecessary to get and prepare human bones, offering a more practical and morally sound alternative. Furthermore, improvements in tissue engineering might make it possible to produce synthetic bone for use in medical education. [14] These technologies, nevertheless, are still in the early stages of development, so it might be some time before they become commonly used.

### **Recommendations for improving the procurement and processing of human bones**

Several recommendations can be made to enhance the collection and preparation of human bones for educational use. First and foremost, there is a need to raise awareness about the value of anatomical contributions and to motivate more people to donate their bodies to hospitals [19]. In order to pool resources and lessen rivalry for human bones, medical organizations must work together second [20]. Third, more affordable alternatives to current bone processing techniques must be investigated [21]. Fourth, there is a need to establish precise rules and procedures, including the documenting and tracking of specimens, for the collection and processing of human bones [22].

### **Conclusion**

An essential component of medical education is the acquisition and processing of human bones. In order to give students a realistic and hands-on learning experience and to help them understand the complexity of the human body, human bones are used in medical education. But the collection and preparation of human bones for educational purposes raises moral questions that demand careful thought. Medical education can supplement or substitute the use of human bones with alternative means of teaching anatomy, such as the use of digital and virtual technologies. These alternatives may also offer advantages including the flexibility to study at any time and place, the capacity to manipulate and investigate anatomical structures in a way that may not be possible with human bones, and the opportunity to study anatomy in a more immersive and interactive manner.

Overall, considerable consideration of ethical, legal, and practical considerations is required when obtaining and processing human bones for instructional purposes in medical institutes. Although alternative anatomical teaching techniques should be investigated to supplement or replace the use of human bones in medical education, the use of human bones in medical education offers students a variety of interesting and worthwhile learning opportunities. In order to maintain ethical and legal standards, maximize educational benefits, and minimize

any negative effects, it is crucial for medical institutions to establish clear protocols and guidelines for the collection and processing of human bones for educational purposes.

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