ORIGINAL ARTICLE

Role of Forensic Osteolgy in positive identification for Forensic investigations to solve medicolgal cases in Punjab, Pakistan

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ABSTRACT

Background: Positive identification of human skeletal remains is prime importance to solve the medicolegal cases in unidentified dead bodies. In case of mass disasters, genocide, mass graves, manslaughter and other medicolegal cases, the skeletal data provides enough information to solve the question of identification of the deceased human beings to provide justice even many years after their death.
Aim: To see evidentiary value of skeletal data to determine the positive identification by using race ,age sex, stature and other parameters of identification in medicolagal cases of human skeletal remains in medicolegal forensic investigations in Punjab from 2015 to 2022.
Study design: In this retrospective study 100 medico-legal cases where positive identification was done from skeletal remains in different medico-legal work performing Forensic departments of Punjab, were analyzed.
Methods: In this retrospective study 100 medico-legal cases where positive identification was done from skeletal remains. This skeletal data was collected from different medico-legal cases where the identification was done on bones from five district of Punjab. This data was collected from the District Head Quarter hospitals of these cities from their medico-legal offices to conduct this research study. All the information collected were interred in predesigned Performa before analyzing the data. Descriptive statistics was implied on all the medico-legal cases for data collections and analysis of skeletal data from different bones recovered from the crime-scenes in this research study. Furthermore, standard deviation, F-statistics, and Chi test p-value were also applied to see the association of these parameters of identification with different skeletal remains with highest probability of positive identification from different bones.
Results: Forensic anthropological data (skeletal data) was found very high probability to solve the medicolagal cases of forensic investigations to solve the issue of identification of the victims of crimes and mass disaster. Skull bone had high percentage of accuracy (92%) to provide positive identification of race whileage and Sex was a little less (82%). Hip bones alone and with whole pelvic girdle had very high percentage in determining sex with 96% accuracy. Appendicular skeletal (limbs) data had provided very significant (92%) to solve the stature, age and sex for positive identification (90%). Axial skeletal data provided good percentage of Identification (82%) for stature as a parameter of identification in all the medico-legal cases analyzed.
Conclusion: Forensic investigations without skeletal data found incomplete to provide positive identification of victims of violent crimes and mass disasters. Skull bone was found very important for positive identification of victims especially identifying race and age , the parameters of identification. Pelvic bone and whole bony pelvis provided the best identification for sex as a parameter of identification. Axial and appendicular skeletal data demonstrated good accuracy for stature estimation for the purpose of identification of skeletal remains. Many social and demographic factors play their role for the prevalence of medico-legal cases where the perpetrators of crime dismember or skeletonise the dead body to hide their identification. By the virtue of research and modern sciences all skeletal remains are identified and brought to justice in medico-legal system.
Keywords: Osteology, Forensic anthropology, skeletal data, positive identification.

INTRODUCTION

Forensic value of skeletal data is a fact which cannot be undermined in any medico-legal investigations as they provide bulk of information about the identification of victims of crime. Forensic Osteology is new emerging branch of forensic medicine which covers all the issues related to identifications of medicolegal cases in crime solving situations from the skeletal data (bones). Facial reconstruction, superimposed photograph, body parts reconstruction, Forensic Odentoloy and Forensic biometric identification have extensively utilized skeletal data for positive identification that is main concern for all medicolegal investigations. Forensic investigations are very challenging in those medico-legal cases where small fragments of bones are found at the scene of crime or some bones. In these situations, the bones suffer very degrading atmospheric condition before recovered for medico-legal investigation. They are found in highly degraded forms that makes Forensic investigation more difficult to find out their positive identification for the victims of crime[1,2,3,4,5,6].

The schematic procedure is adopted for positive identification of skeletal remains. In this scheme first of all, the

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discovery of bones is done from the scene of crime this part is usually done by local police. Then, the skeletal or dismembered remains undergo preliminary forensic examinations by Forensic expert Osteologist. This preliminary examination aims first to determine the difference between human or animal bones. If the confirmation is achieved for human bones, the process of identification starts. First they determine is it one individual skeletal or more than one individual before proceeding for their sex, age, race and stature. Meanwhile, they try to determine the dating of remains for determination the time since death for solving the forensic medico-legal investigations in crime-scenes. Forensic investigations try further to find out number and location of trauma on these fragmentary skeletal remains. They also use medical knowledge to find out the cause and manner of death in theseskeletal remains before making a positive identification by DNA finger printing[7].

Many archaeologists also utilize the same techniques to find out the age of old bones recovered from old mummified skeletal remains. They follow the same scheme to find out the identification of skeletal remains by using every possible modern technology from x-ray to CT scan, MRI, CAT scanning and DNA fingerprinting. But, in medico-legal investigation positive identification must be beyond any doubt with nearly 100% accuracy[8]. The first question in forensic investigation is about the nature of bones, discovered

from the crime-scene regarding whether they are animal or human bones. It is important question needs expert forensic or anatomy expert osteoloist to be answered by utilizing plenty of experience plus using the modern technology. Some Forensic osteoloist may rely on heating the bones in microwave to differentiate from the smell after heating bones that may leads to error. Sometime a small piece of bone turns out to be some other material instead of bone as well in some forensic investigations[9]. So, careful and cautious approach, must be adopted that based on proper scientific method that should be highly accepted by the law and order agencies.

Forensic value of the medico-legal evidence of bones depend on the interval in years after their discovery to see whether these bones are medico-legally importance or may be used for archaeological purpose . The criteria established is to see if 70 years old bones are recovered ,they are more archaeological importance than for medico-legal concern . This criterion is based on the logical fact that after 70 years it is difficult to convict an offender only on the basis of skeletal data in Forensic investigation. Furthermore, the degradation of skeletal remain play important role . In cases of very hot and dry burial condition the dead body is skeletonised early in two to three months time but preserved for loner period for medico-legal excavation and forensic examination for their identification[10,11]. Another important factor is discovery of bones is usually done by some non-technical person from the crime-scene without having adequate knowledge of evidence collection and Osteology. Usually, the bag of bones is presented to local Forensic department or Anatomy department of medical college by local police for identification of individuals, is a common practice. Ideally the forensic expert should present at the scene of crime from where excavation of human skeletal remains is done. After exhaustion to find out the lines of investigation, the forensic Osteology expert is called to get advice to solve the issue of identification of bones.

Forensic investigations aims at to find out the biological identity of the excavated skeletal human remains for forensic medicolegal case work. Their prime concern is to find out the age, sex, stature and ethnicity background or race for the skeletal remains[12,13]. It depend the parts of bony skeletal remains discovered and their state of preservation before forensic examination is carried out by forensic Osteologists. The uses of modern technology like DNA fingerprinting have revolutionized the early identification of the skeletal remains. DNA extraction and fingerprinting provide an individual profile that can be searched in different DNA databases which are available for different offenders or suspects. Furthermore, DNA profile can be searched in the family members or in nearby population from were skeletal remain were excavated[14,15]. In order toproceed for DNA analysis in forensic investigation expert man power and highly expensive instruments are needed that are now available in Forensic Science Agency in Lahore, Punjab.

The objective of the study was to determine the positive identification by using race, age, sex and other parameters of identification and their evidentiary value from different bones was compared.

Practical Implication: Many social and demographic factors play their role for the prevalence of medico-legal cases where the perpetrators of crime dismember or skeletonise the dead body to hide their identification. By the virtue of research and modern sciences all skeletal remains are identified and brought to justice in medico-legal system.

METHOD AND MATERIALS

After permission from Institutional Ethical Committee, in this retrospective study 100 medico-legal cases were analyzed where positive identification was done from skeletal remains. This skeletal data was collected from different medico-legal cases where the identification was done on bones from five district of Punjab (Sargodha, Faisalabad, Mianwali, Kushab & Jhang). This data was collected from the District Head Quarter hospitals of these cities from their medico-legal offices to conduct this research study. All the information collected were interred in predesigned Performa before analyzing the data.

Descriptive statistics was implied on all the medico-legal cases for data collections and analysis of skeletal data from different bones recovered from the crime-scenes in this research study.

Furthermore, standard deviation, F-statistics, and Chi test p-value were also applied to see the association of these parameters of identification with different skeletal remains with highest probability of positive identification from different bones.

RESULTS

The highest number of cases were found from the district Mianwali (30 cases) with 88% of accuracy of solution of identification followed by Faisalabad district (24 cases) where accuracy of solution of identification was found 96% (Figure 1). Furthermore, District Sargodha showed good percentage of accuracy (cases 22, accuracy 92%) as solved cases that are mostly done by FSA (Forensic Science Agency, Lahore). While, the Kushab (case 12, Accuracy 82%) and Jhang (cases 12, Acuuracy 80%) were found to have similar number of cases and accuracy of solution (Figure 1).

Figure 1.Number of cases and their percentage of identification done by skeletal data recovered from crime scene.
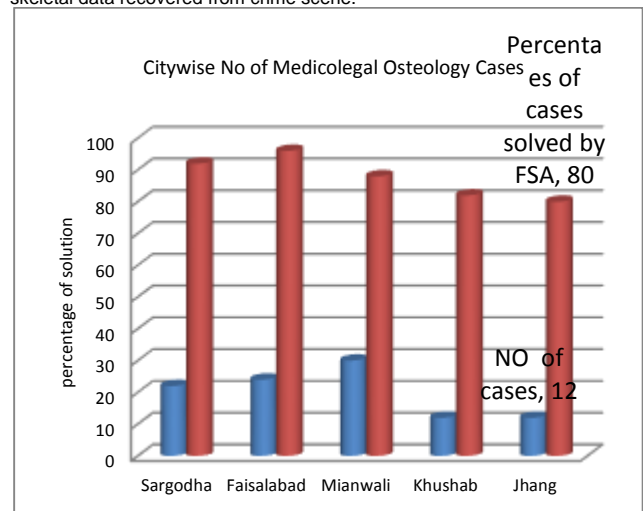
Demographic data collected for all the cases in this research study was analyzed to find out the association of different demographic factors that aids their identification via Osteoloy (Table 1). Male cases were predominant that constituted 56% of all the cases included in this research. The age group that was identified as the most prevalent in this research was 18 to 50 years of age that constituted nearly 50% of cases of this research and this data had statistical significance with p value 0.21. The most of the cases of this research found to have married as marital status with statistical significance and had 0.5 p value.

Furthermore, the most of the cases had rural residential area from where the discovery of medico-legal Cases (bones) took place in this research study. It was found that nearly 60 percent of cases were belonged to rural area and their statistical significance was evident with 0.5 p value as well. Social status related to economical situations of victim of crime, was also investigated in this research. It was found to have direct relation as with statistical analysis predicted 0.06 p value. Nearly, 78% cases were either belonging to middle class socioeconomically or lower in this research.

Table 1: Demographic data is tabulated for all the cases.

	Male	Female	Total	
	56	44	100	P Value
Age				
Below 18 years	8	12	20	
Between 18 to 50 years	28	20	48	0.21
Above 50 Years	22	10	32	
Marital status				
Married	32	28	60	0.5
Non Married	22	18	40	
Resident Area				
Rural	28	30	58	
Urban	20	22	42	0.5
Social Class				
Upper	10	14	24	
Middle	28	18	44	0.06
Lower	18	14	32	

Forensic anthropological data (skeletal data) was found very high probability to solve the medicolagal cases of forensic investigations to solve the issue of identification of the victims of crimes and mass disaster. Skull bone had high percentage of accuracy (92%) to provide positive identification of race while age and Sex was a little less (82%). Hip bones alone and with whole pelvic girdle had very high percentage in determining sex with 96% accuracy. Appendicular skeletal (limbs) data had provided very significant (92%) to solve the stature, age and sex for positive identification (90%). Axial skeletal data provided good percentage of Identification (82) for stature as a parameter of identification in all the medico-legal cases analyzed in this research.

Figure 2: Percentage Comparison of evidentiary value of different bones for different parameters of identification is shown in medico legal cases in Punjab.
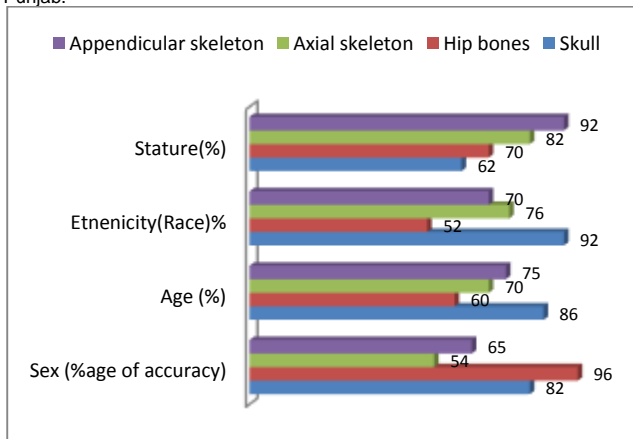
DISCUSSION

This research study analysed the issue of positive identification from skeletal remains in five districts of Punjab where the positive identification was done to solve medico-legal cases of murders, honor killing, property dispute killing, incest killing and others. All of these cases were tried to hide the dead body by dismembering and reduced to skeleton with time elapsed. These cases were reported accidentally or resulted by investigations done by police on intimation or reporting in police. The procedure adopted by investigating authorities primarily depended on the analysis done by Forensic Science Agency (FSA), Lahore. Some cases were sent to different Forensic Medicine or Anatomy departments of Medical Colleges in tertiary hospital of big cities to confirm the positive identification on these skeletal remains[14-18].

Most of the medico-legal cases were found from district Mianwali where identification was done only on the skeletal data. This predicted very high crime ratio due to lack of education, backwardness and the old tribal system in this district.

Furthermore, a little low accuracy (80%) in this district, have suggested some errors in police investigations wile processing the evidence along with sample collection from scene of crime and neglecting the chain of custody. From the big cities like from Faisalabad and Sargodha it was found good accuracy with high percentage 96% and 92% respectively. The reason behind this, was good training of police and other investigating agencies for the sample collection, processing and maintaining good chain of custody.

Demographic data have proved the finding of other research studies which were done earlier to find out the possible associations of many demographic factors for the prevalence of medico-legal cases for different crimes in the districts of Punjab, Pakistan[14,16]. Male were the victims in most of cases in this research due to their social participation in honor based male dominating society and thus sharing the crime dominance as well. Furthermore, rural areas shared the larger number of cases due to ignorance, backwardness and low literacy rate rural areas of Punjab. The age group and social class that was actively participating in all social and economical activities, ware also primarily affected in this research as well, with predominantly cases were with the age group 18 to 50 years of age & low /middle social like other research studies as well[17].

Skeletal data have shown great relevance for positive identification of medico-legal cases were Osteology played major part for identification purposes in this research, that was very in line with other research studies performed all over the world on skeletal data. Skull bone played major role in identification of ethnic background /race in this research study with a little less accuracy in age estimation as a parameter of identification. This fact was determined by many other research studies all over the world as well[16-19]. Hip bone alone and in pelvic girdle have demonstrated very percent of accuracy for sex determination as a parameter of identification in this research that was proven by other researches as well with high statistical value as well[19]. Axial and appendicular data have suggested very accurate prediction about the stature as a parameter of identification on the bones discovered in medico-legal cases in this research study. This fact was also well established and proved by the other researches performed on axial and appendicular skeletal data[18,19].

CONCLUSION

Forensic investigations without skeletal data found incomplete to provide positive identification of victims of violent crimes and mass disasters. Skull bone was found very important for positive identification of victims especially identifying race and age, the parameters of identification. Pelvic bone and whole bony pelvis provided the best identification for sex as a parameter of identification. Axial and appendicular skeletal data demonstrated good accuracy for stature estimation for the purpose of identification of skeletal remains. Many social and demographic factors play their role for the prevalence of medico-legal cases where the perpetrators of crime dismember or skeletonise the dead body to hide their identification. By the virtue of research and modern sciences all skeletal remains are identified and brought to justice in medico-legal system.

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