

Personal Identification of Homicide Skeletal Remains in Taiwan Through Combined Contribution from Pathological, Odontological, Anthropological, Entomological, and DNA-STR Analyses

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Abstract

In 2014, parts of skeletonized human remains were exposed in a shallow grave along the hill in Taoyuan, Taiwan. After careful excavation, skeleton of human remains were reconstructed to be one deceased, and the blunt forced injury found in the skull indicated that it is a homicide case. The corpse was found to be in a high degree of decay. The face and fingerprints of the corpse was unable to be recognized. The lack of clothes, accessories and personal belongings also made it difficult to recognize the victim. Forensic pathologist and police tried to identify the remains with multidisciplinary. Forensic pathology provided the injury of the victim and the cause of death. Forensic anthropology provided the ante-mortem biological information of the remains such as gender, height and age. Forensic entomology provided the minimum post-mortem interval (PMI) of the victim. Forensic odontology provided the preliminary personal identification by comparing the teeth of the victim and dental records. After initial personal identification, the identity of victim was confirmed by DNA analysis. The suspect was soon caught by police after the identity of the remains was confirmed. This case report illustrated the important contributions from multidiscipline team including forensic pathology, anthropological, entomological, odontological and DNA analysis to the identification of unknown homicide victim.

Keywords: forensic science, forensic pathology, forensic anthropology, forensic odontology, DNA STR, forensic entomology.

Introduction

Fingerprints and DNA are currently the powerful techniques to identify unidentified human remains but they are still encountered some challenges. They might not be comparable because of the deliberate destruction by suspects or the highly corruption of the corpse. In addition, it may be a negative identification due to lack

of victim's profiles. It is not always available to rely on fingerprints and DNA for personal identification. Forensic anthropology and odontology have been used to personal identification in forensic criminal investigation. The physical characteristics of human skeletons and teeth could provide the information such as gender, age, height, and cause of death. Forensic anthropology and odontology have been widely applied in various types of

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disasters to identify the victim from unknown remains [1,2]. The more severe the body corrupted and damaged, the more forensic anthropology can play an important role in the remains identification [3,4]. In addition, the surgical artifacts and medical records can be used as the characteristic for personal identification [5]. Forensic entomology is an important method for PMI estimation. In general, the successions of insects on corpses can be predicted and that can be used to estimate post-mortem interval (PMI) for crime investigation [6,7]. It also can be used to determine whether the body has been displaced according to the insect habits [8]. Sometimes, it could help to find out cause of death like drug abuse or poisoning [9].

By combining the above techniques, they can be used to estimate or predict the possible biological characteristics, cause of death, and time of death for unknown human remains [10]. In this paper, we will report how forensic multidisciplinary applied on human remain which was hidden by suspect deliberately.

Case History

In 2014, parts of skeletonized human remains exposed in a shallow grave along the hill in Taoyuan, Taiwan. The burial location surrounded by thick growth of thick grass where obviously indicated few people tread. It was buried in the hole about 30 cm depth covered with soil but exposed with two femur bones and little leather skin (Fig. 1A). After careful excavation by police, a naked skeletonized human corpse was recovered from the hole. The skull and four limbs were totally ossification so that the face and fingerprints were unable to be recognized. The ribs were exposed and there was still a small amount of corrupted tissue and numerous insect larvae found on the body. The external genitalia could not be identified due to serious corruption. The back of the body was completely covered with leather skin. These remains were reconstructed and found to be one deceased, however, no clothes, accessories or personal belongings were found in the remains or nearby after investigation.



Fig. 1 (A) The victim was buried under the soil with two legs exposed. (B) The remains was reconstructed.

Material and Methods

Autopsy and Pathology Analysis

The forensic autopsy of this deceased was taken by the Institute of Forensic Medicine, Ministry of Justice. The scattered hair was collected and cleaned thoughtfully to regain its color and length for identification. The most of soft tissue was disappeared due to corruption. None

obvious penetrated trauma was found on the outward appearance, skin and bones of the remains. The tissue of the remains was carefully dissected and removed for reconstruction the skeletonized characteristics of the human remains (Fig. 1B). The black blood clots found on the skull indicated that the victim's head got blunt forced injury before death. This case was considered as doubt homicide case after the forensic autopsy examination.

A sample collected from left femur of human remains operated for DNA analysis. Remains was confirmed to be a female from DNA data. Although STR DNA genotypes were obtained, the victim was not identified due to the STR DNA genotype of victim was not included in the DNA database of Criminal Investigation Bureau. In this particular case, the medical examiner and crime squad decided to rely on a combination of anthropological and odontological study of the remains to provide a biological profile to the public for narrow down the possible candidates.

Anthropological Analysis

Routinely, physical anthropology was performed by medical examiner to identify human remains, when they were skeletonized or nearly skeletonized in Taiwan. In this case, the victim was concluded to be a female according to the features of cranial and pelvis remains. It is a reliable method for gender identification [11]. Age can be estimated by using a number of skeletal markers, the amount of cranial suture fusion is one of them. In this case, the cranial suture fusion provided the information of age ranging between 35 and 55 at the time of death. The range of height were estimated to be 159.5 ± 6.5 cm by metric examination of the long bone according to the available data published by Zhang [12].

Entomological Analysis

In forensic entomology, necrophagous insects are useful in studying postmortem interval (PMI). In this case, the corpse was in an advanced-decay stage with larvae colonized on the tissue inside the body. These larvae have sharp head and flat body with hairs, they were identified to be larvae of family Stratiomyidae (Fig. 2), but species was not identified. The main insects of forensic entomology on human corpse in Taiwan were Calliidae, Sarcophagidae and Muscidae [13], but there was no larvae of Stratiomyidae had been reported from human corpse before this case. However, the adult of Stratiomyidae had been found on a pig carrion in decomposition stage in Taiwan [14]. It also had been used for estimation of the minimum PMI (minPMI) of the advanced-decay stage human corpse in Brazil and other area [15,16]. Its common species (*Hermetia illucens*) was found to appear in the warm environment, the adults of *Hermetia illucens* began to lay eggs 20-30 days (27.8 °C) after the death of human, life cycle of the larvae up to 55 days. In this case, the average temperature record by the closest weather station of Central Meteorological Bureau is 27.6°C from 2014.08 - 09 (max 37.4°C min 21.5°C) [17]. From those data, we estimated the reasonable minPMI was more than 1 month.



Fig. 2 The larvae found in the remains have sharp head and flat body with hair. (Family : Stratiomyidae)

Odontological and Radiological Analysis

In this case, forensic odontology played an important role in the human remains identification. After police provided those profiling information and dental picture of remains to the public, one of missing female was considered to be the best fit to the profile described information among six missing persons that were reported by their families. Teeth of remains were observed and documented carefully and found that No.17, 18 of teeth were fell during the identification process, No.25, 26 were the sealed dental cavity, No.36, 38, 48, 28 were agomphosis (missing), No.47 was dental prosthesis, No.46, 47 were one and half dental bridge. There was a small size of dental prosthesis (No. 47) inserted between two big size

teeth (No. 48 and 46). When crime investigators visited local dental clinic and showed them this dental picture, one dentist remembered that he made a small size of dental prosthesis for one of his female patient. The small dental bridge was a special case in the dental treatment, so he was very impressed. After searching the patient's record he found that one name of his patient was matching to that one of missing female.

The clinics provided X-ray film of teeth for further comparison. After careful examination, the characteristics of teeth such as surgical trace, arrangement and abrasion of teeth of skeletal remains was match to the x-ray film of the patient (Fig. 3A-D). It provided the key information to target a specific victim.

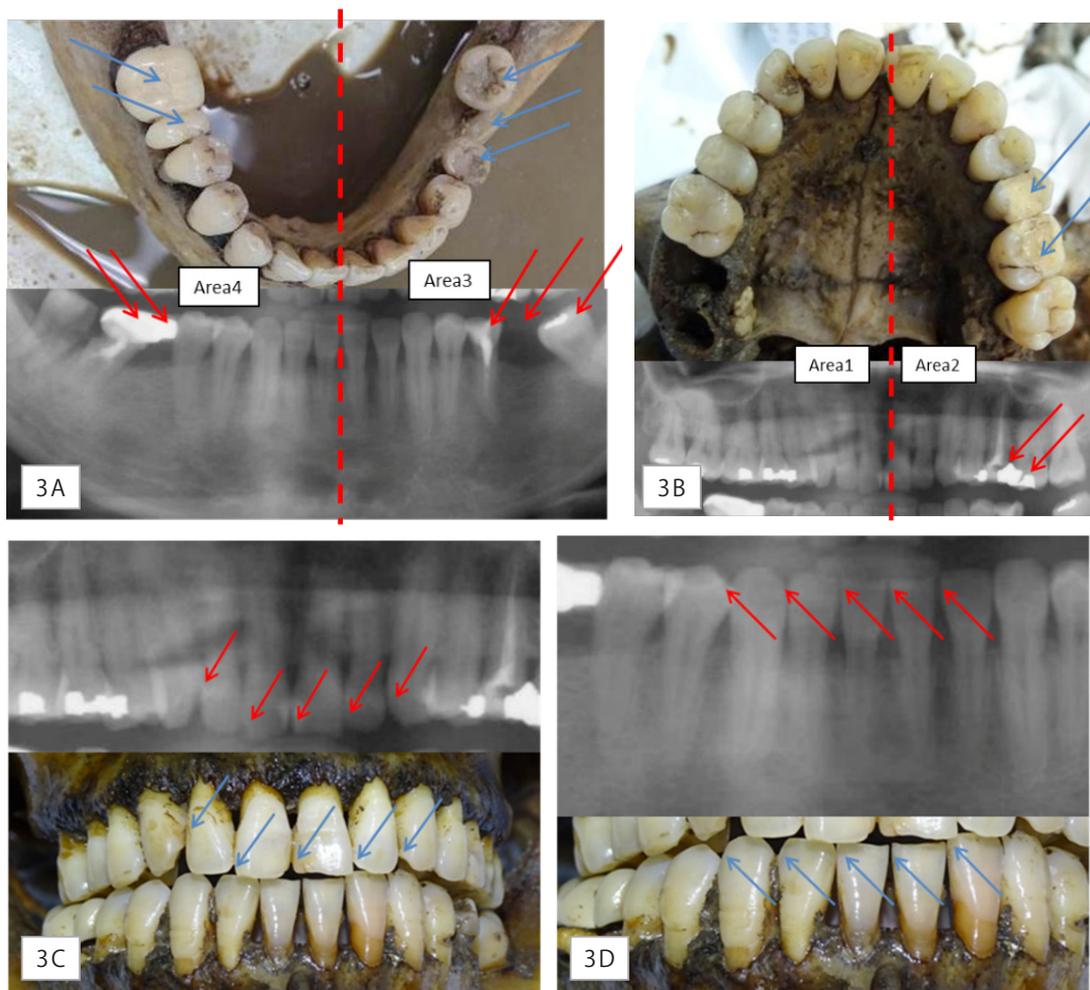


Fig. 3 (A) The comparison of lower teeth between the victim (up, top view) and the x-ray film from missing female (down, side view). The matching of the teeth are indicated by arrows. (B) The comparison of upper teeth between the victim (up, down view) and the x-ray film from missing female (down, side view). (C) The comparison of upper teeth between the victim (down, side view) and the missing female (up, side view) (D) The comparison of lower teeth between the victim (down, side view) and the from missing female (up, side view).

Paternity DNA Analysis

Although the DNA comparison was negative due to lack of database at the first searching. When a specific victim was targeted, paternity DNA analysis for further confirmation was performed. DNA was extracted from husband and child of the missing female. Extracted DNA was PCR amplification by using commercial kit (PowerPlex 16) and the 15 loci of STR DNA genotype were obtained by AB 3130xl analysis. The probability of paternity was calculated and the result showed that the probability of paternity for the victim and child is 0.999998, (CPI cumulated paternity index = 429465), which confirmed the identity of the victim.

Investigation

By surveying the relationship of the victim, police successfully targeted male suspect. He confessed attacking the head of victim with bat and strangled her to death. The motive for the killing is due to oral conflict. The time of the homicide occurred about two months before the corpse found.

Discussion

In the case, the suspect tried to hide the identity of victim. All personal belongings of victim were taken away to prevent from being recognized. The face and fingerprints of the victim were highly corrupt so that it could not be identified. The DNA comparison was negative by data search. The investigator tried to combine kinds of forensic science discipline to help identification of the victim.

Gender determination is accurately confirmed by both anthropology and DNA analysis. The values of age, height and PMI estimated from the remains were an range rather than a specific value. Although these values were not very precise, they can narrow down the range of the possible targets or to make preliminary identification.

In this case, the time of death (PMI) was only a rough estimate based on other foreign literature [15,16]. We might assume the species is *Hermetia illucens* (the most common species of Family Stratiomyidae in corpse). The estimate PMI would be 52 days by assuming there were 25 days (average of 20 and 30) before *Hermetia illucens* laying eggs and 27 days after laying eggs (about half of 55 days, which is total life

cycle of the larvae). This number is very close to the true PMI value. There have been more studies on Calliidae, Sarcophagidae and Muscidae in the past but less noticed on Stratiomyidae in Taiwan. It was the first time to report larvae of Stratiomyidae in forensic case in Taiwan. The relationship between human corpse and larvae of Stratiomyidae need further study such as species, habitats and characteristics. Those data will be helpful in the estimation of the PMI for long period or buried corpse.

The real age of victim was 40 years old, which was in the range of estimated value. The height of victim was about 160 cm, which was close to the estimated height. From these results showed that age estimated by cranial suture fusion and that body height estimated by long bone basing on the data of Zhang [12] are reliable.

Conclusion

In the beginning, fingerprints and DNA analysis in this case were not work due to the corpse decay and lack of DNA database. Combination of forensic pathology, anthropology, odontology, entomology and DNA paternity analysis here made important contributions to the investigation of severely decomposed bodies or skeleton. After identification of victim, the suspect was targeted. Given this, a forensic multidisciplinary investigation is recommended for investigating this kind of challenging case.

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