Tyburn, Tadcaster Road, York

Osteology Report

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1. Summary

Osteological analysis of the human remains recovered from Tyburn, Tadcaster Road, York was undertaken in order to establish age, sex, pathology and any additional skeletal traits. A total of twelve articulated individuals were analysed. These were found to represent ten adults and two sub-adults. Of the adults, nine were identified as male and one was indeterminate. The majority of the individuals demonstrated a range of pathological conditions. It is thought that the skeletons date from the medieval to post-medieval period and the results of radiocarbon dating of two individuals are awaited to confirm this interpretation.

2. Introduction

York Archaeological Trust undertook excavation of twelve individuals at Tyburn, Tadcaster Road, York between the 16th and 28th November 2013. This work was undertaken on behalf of Interserve during the excavation of a trench for the installation of an 11v cable (Savine 2014). The recovered human remains were submitted to the Dickson Laboratory for initial rapid assessment in April 2014 (Whyte 2014) and were subsequently approved for complete osteological analysis.

3. Methodology

Osteological analysis was performed to gain an understanding of the identity of each individual and a profile of the collection overall. In order to do this, each inhumation was assessed for MNI, preservation, age, sex, metric and non-metric variation, and pathological conditions. Methods for each criterion are detailed below.

3.1 Minimum number of individuals

A count of the minimum number of individuals (hereafter MNI) was carried out as standard procedure, in order to establish the minimum number of people represented in the assemblage. The MNI was calculated by counting all major skeletal elements (cranial elements, long bones and pelvises). Each type of element was then divided into complete and incomplete, before being subdivided by side, sex and age where possible. The greatest number was then taken as the MNI. The MNI of a site is often lower than the true number of skeletons originally interred, but demonstrates the minimum number of individuals that can be proved categorically to be present.

3.2 Preservation and completion

Recording the level of completion helps us to understand the limits of the information gained from analysis, as well as indicating possible post-mortem disturbance and extrinsic taphonomic factors. The level of completion of the inhumations was recorded using five percentage categories; <5%, 6-25%, 25-50%, 51-75%, 76%+.

The preservation of each burial was also recorded. The preservation of bone is known to be affected by a wide range of factors, from age and size of the individual to the method of deposition. Preservation was assessed with reference to the six grades of erosion/abrasion to human bone detailed in Brickley and McKinley (2004), taking into account surface degradation and post-mortem breaks. Additional terminology was assigned to the grades to aid understanding; grades 0-1 – excellent, grade 2 – good, grade 3 – fair, grade 4 – poor, grade 5 – very poor. It should be noted that preservation was assessed independently to completion; thus it would be possible for an individual to have excellent preservation but be highly incomplete.

3.3 Sex determination

For each adult individual, sex was determined through consideration of a variety of factors across the body. Five sexually dimorphic cranial features; the nuchal crest, the mastoid process, the supraorbital margin, the supraorbital ridge, and the mental eminence; were scored on a 5 point scale, where 1 denotes a probable female, 2 a possible female, 3 indeterminate, 4 a possible male,

and 5 a probable male. This was completed with reference to diagrams of each stage from Walker, in Buikstra and Ubelaker (1994). As recommended in Brickley and McKinley (2004), additional sexually dimorphic aspects of the mandible were observed subjectively; namely the overall size, the width of the ascending ramus, the flaring of the gonial angle and the shape of the chin.

Four elements of the pelvis were recorded to aid sex determination. The greater sciatic notch was scored in a scale from 1-5, as before, with reference to diagrams from Walker in Buikstra and Ubelaker (1994). The ventral arc and subpubic concavity, which are only present in females, were also considered. Similarly the difference in the shape of the media aspect of the ischiopubic ramus, which is sharp in females and blunt in males, was observed.

Once all available factors were recorded, the results were assimilated in order to give an estimation of sex. As noted by Mays (1998) the pelvic area is the most reliable source when sexing, and thus was given more weight when determining final results.

3.4 Age determination

As with sex, age was determined using a number of different factors across the body. For juvenile individuals age was estimated through observation of the stages of fusion and epiphyseal closure for each skeletal element, with reference to Schaefer, Black and Scheuer (2009). The stage of eruption of dentition was also considered, with reference to Ubelaker (1978), Hilson (1996), and Schaefer, Black and Scheuer (2009).

The age of adult individuals was recorded using a range of factors. The surface of the pubic symphysis was observed with reference to Todd's (1920) ten age phases of pubic symphysis modification, and the Suchey-Brooks six phase pubic symphysis scoring system from Brooks and Suchey (1990). Similarly the auricular surface was observed with reference to Lovejoy's scoring system of modal changes to the auricular surface with age from Lovejoy et al. (1985). The level of dental attrition was also recorded with reference to Brothwell (1981) and Hilson (1996).

Where applicable, pathological conditions commonly associated with age have been used as a secondary indicator of age. However, as advised in White and Folkens (2005), degenerative conditions have not been used as a primary deciding factor for age of individuals.

Once all available factors were recorded the results were then considered as a whole for each individual, in order to give an estimate of age. Each individual had been assigned into one of the following categories; foetus (up to 40 weeks in utero), neonate (around time of birth), infant (newborn to 1 year old), juvenile (1-12 years old), adolescent (13-17 years old), young adult (18-25 years old), middle adult (26-45 years old), mature adult (46+ years old), and adult (where age could not be determined more accurately than 17+). Where possible, more specific age approximations have been suggested, however these are not definitive.

3.5 Pathology

For each individual, all skeletal elements were examined closely in order to ascertain the presence of any pathological conditions. This was done in reference to Brothwell (1981), Hilson (1996), Mays (1999), Brickley and McKinley (2004), White and Folkens (2005), Waldron (2009), Roberts (2009) and Roberts and Manchester (2010). As always it must be remembered that only a small minority of pathological conditions affect the skeletal system. An assessment of skeletal pathology gives insight into the conditions present, but does not provide a complete picture of health or disease.

3.6 Stature

Where possible, stature was estimated for each adult through measurement of complete long bones. These lengths were then placed into Trotter's (1970) formulae for stature estimations. As stated by White and Folkens, Trotter's stature formula for tibiae demonstrated too high an error rate (White & Folkens 2005). Tibiae were consequently not measured. As with sex, stature

estimations were not attempted for sub-adult individuals. Stature estimates have been presented as either a single number or a range, depending on the number of complete long bones available for measurement. It should be noted that mathematically, an estimated stature range derived from multiple long bone measurements is more reliable than a single measurement.

3.7 Non-Metric Variation

Non-metric traits are minor skeletal anomalies that are recorded by presence, not measurement. The causes of many traits are currently unknown, although some are thought to have genetic or lifestyle influences (Mays 1999). Any non-metric traits present in the individuals were recorded, with reference to Berry and Berry's (1967) 30 points of cranial non metric variation, and Finnegan's (1978) 30 points of sub cranial non-metric variation.

4. Results

The results of the osteological analysis are detailed below, organised by category. A summary of results per individual can be found in appendix 1. Due to the relatively small number of individuals in the assemblage, the data has not been used to create quantitative models. The data has instead been discussed in a qualitative manner.

4.1 Minimum Number of Individuals

The minimum number of individuals in the recovered assemblage is 10. This is the most conservative estimate of individuals that can be proven mathematically to be present. This is lower than twelve, the number of individuals thought to be in the collection. This is a consequence of many of the individuals being only partially recovered. When burial details are taken into account, we can be confident that the actual number of individuals present is twelve.

4.2 Preservation & Completion

The preservation of the twelve individuals was generally fair to good, with only three (SK6, SK10, and SK12) rated as grade 4, i.e. poor. Age of individual did not appear to have any effect on preservation. However, there was a slight difference between the graves. Most notably mass grave (1008) displayed some of the best preservation, and mass grave (2009) the poorest. This may either be due to a difference in date of deposition, or alternatively due to slight differences in localised environment.

The level of completion was generally quite low, with only 4 of the individuals being over 50% complete. However, this does not take into account the known limits of excavation. SK6 – SK12 all extended past the limits of excavation, and consequently were all only partially recovered. When this is taken into account, the low levels of completion can be understood more fully. The individuals recovered in their entirety; SK1 – SK5; demonstrated better completion, with three of the five being over 76% complete.

4.3 Demography (age and sex)

Although this is a relatively small assemblage, the distribution of both sex and age was note-worthy. Two individuals, SK1 and SK11, were sub-adult. SK1 was found to be adolescent, approximately 17-19 years old. SK11 was deemed to be younger and was recorded as juvenile. Unfortunately very low completion meant that this age range could not be narrowed down any further.

The remaining ten individuals were adult, of which three were insufficiently complete to allow more definitive aging. The seven individuals that could be aged further were all assigned to the category of middle adult. Their age clustered almost exclusively between 35-45 years old, with the exception of SK2, who was approximately 25-30 years old.

The distribution of sex was similarly clustered. In accordance with common protocol, the two sub-adult individuals were not sexed. Of the ten adults, nine were recorded as either possible or probable male. Only one individual, SK12, was too incomplete to sex.

4.4 Stature

Of the ten adults recovered, seven had complete long bones suitable for stature measurements. Of these seven, six individuals demonstrated estimated stature ranges of between 165cm – 171cm ±4.32cm (c. 5'4" to c. 5'8"). The remaining individual was 182.08-182.31cm ± 3.27cm (c. 5'11"). This range of heights is certainly not unusual for a group of men from the medieval to post-medieval period.

4.5 Non-metric variation

Only one non-metric trait was found in the entire assemblage. This was a transverse foramen bipartite of the 5th cervical vertebra of SK2. This is noted by Finnegan to be a frequently recorded trait (Finnegan 1978). On its own, however, this tells us very little about the individual or the population from which they originated. As demonstrated here, profiling of non-metric variation cannot be completed meaningfully in such a small assemblage.

4.6 Skeletal Pathology

4.6.1 Joint disease

Degenerative joint disease (hereafter DJD) was one of the most prevalent conditions in the assemblage. Seven individuals demonstrated DJD in the spinal column to varying degrees. The youngest of these individuals was SK2, aged 25-30. As Roberts and Manchester note, DJD at this age is not uncommon (Roberts & Manchester 2010: 140). Yet, increased prevalence is also associated with older age. DJD is thought to be a stress related condition. The level of occurrence of DJD in relatively young individuals in this assemblage may indicate that they had an increased level of physical activity.

4.6.2 Infectious disease

A single case of generalised infectious disease was noted in SK3, where periosteal new bone formation (hereafter PNBF) was present in both tibiae (Figure 1). PNBF is an inflammation of the periosteum, or outer bone surface, caused by an accumulation of bacteria. Pathological causes can range from varicose veins to tuberculosis and various forms of cancer. The exact cause is impossible to trace in the archaeological record, however the presence of it is notable as a general indicator of pathology.

4.6.3 Trauma

Several cases of trauma were recorded in the collection. SK1 demonstrated a healed break in the right clavicle (Figure 2). SK3 demonstrated a badly healed break in the distal third of the right humerus (Figure 3), in addition to healed breaks in two right ribs and four left ribs. The most notable case of trauma was in SK5. An unhealed break was observed in the distal third of the left ulna (Figure 4). The fracture was in the first cellular phase of healing, indicating that the individual died within two weeks of gaining the injury. SK5 also displayed compression fractures in two mid thoracic vertebrae from an earlier date.

4.7 Dental pathology

4.7.1 Caries (cavities)

Dental caries are one of the most common of dental conditions both in modern day and in archaeology (Roberts & Manchester 2010: 65). Caries were recorded in SK1 and SK10. The fact that they were not recorded in any other individuals may indicate a diet low in sugars and starches. Alternatively this may be a statistical anomaly of a small population. It is likely to be a combination

of both; dental caries were certainly less prevalent in the medieval period than they are today, however it is impossible to note reliable trends in a sample this small.

4.7.2 Calculus (plaque)

Dental calculus is another highly common dental condition. This was recorded in six of the seven individuals for whom teeth were recovered. Calculus is the mineralised form of dental plaque; a build up of oral bacteria. The prevalence noted in this collection is not surprising, as Roberts and Manchester note that calculus is common in all periods (Roberts & Manchester 2010).

4.7.3 Periodontal disease

Periodontal disease, more commonly known today as gum disease, is a common condition, and one of the most common causes of ante-mortem tooth loss (Roberts & Manchester 2010:73). Periodontal disease was recorded in four individuals. However none of these individuals displayed significant tooth loss, indicating that the periodontal disease was not at a critically advanced stage.

4.7.4 Dental Enamel Hypoplasia

Dental enamel hypoplasia is characterised by misshaping of the enamel surface; most commonly in horizontal grooves. Enamel hypoplasia occurs in the developmental stages of the teeth, and consequently persists through adulthood. It is commonly known as an indicator of stress at the time of dental development, and has been associated with trauma, disease and dietary deficiency (Roberts & Manchester 2010:75). Four individuals in the assemblage displayed enamel hypoplasia. This prevalence is not abnormal for the medieval to late-medieval period. Associations have been made between prevalence and low socio-economic status; however these links are not simple as there are a number of possible causes of enamel hyperplasia.

5. Discussion

This collection contains a group of twelve individuals; ten adults and two sub-adults. The ten adults represent nine men and one indeterminate individual, with an age at death range of 25-45 years old. The height range of these individuals was 165cm to 182cm. The two sub-adults included a juvenile of unknown age and an adolescent between approximately 17-19 years old. The pathology present in the assemblage displayed distinct themes with a prevalence of fracture traumas and degenerative joint disease, but an absence of metabolic and neoplastic (tumourous) diseases.

None of the results displayed here are unusual in themselves. The demographic of individuals and pathological conditions on display are common throughout the past. Yet a distinct profile of these individuals begins to emerge. A group of men of similar age and stature with similar types of pathology, buried together, suggest that they may have had similar backgrounds in life. Particular individuals appear particularly interesting on their own, such as SK3 with a healed break in their right arm and several healed breaks in the ribs, degenerative wear in their vertebrae and periosteal new bone formation in their tibiae. Similarly interesting is SK5, who died with an unhealed broken arm.

Care must be taken in the interpretation of these results. A population size of twelve is too small to give an idea of true patterns. Any trends that are present may be down to statistical anomalies. Consequently we cannot put too much interpretative weight behind these patterns. This is of particular relevance given that further individuals were noted as present at the time of excavation, but were not recovered (Savine 2014). The recovered individuals are only a sub-sample of the true population. Therefore absence of evidence cannot be taken as evidence of absence.

We can, however, begin to put the results into historical context. Savine notes that the geographical placement and lack of grave goods, along with their level of preservation in sandy acidic soil, indicate that the inhumations were post Romano-British; most likely medieval to post-medieval. This is further supported by their location in relation to the Tyburn monument. Savine concludes that it is likely that the individuals were executed at the Tyburn, and that their atypical non-Christian burial

orientation is indicative of criminal burials (Savine 2014). This is supported by the fact that the majority of the individuals were recovered from mass graves, as opposed to individual burial events.

When this information is combined with the results of the osteological analysis, these individuals become very interesting. For example, the possibility that the juvenile individual was executed for criminal activity is highly emotive; equally so the adolescent. The number of traumas and stress markers may indicate individuals that have had 'hard' lives; it could be reasonably speculated that they may have been soldiers. The unhealed broken arm noted in SK5 may well have been sustained while the individual was being detained for criminal activity. Of course, it is important to note that the medieval definition of criminality is different to ours today; in a time where vagrancy was a strongly punishable offence, we cannot assume that these individuals were criminals in the way we might imagine them today.

Any further osteological analysis of these individuals is unlikely to provide new information. There are, however, a number of further avenues of research in bioarchaeological directions. A lack of grave goods means that dating of the burials has been assessed predominantly on type of burial and geographical placement and it is anticipated that radiocarbon dating will enable a more accurate chronology to be assigned. Since the majority of the inhumations came from two mass graves, two dates have been applied for; one from each grave, to give further interpretative scope.

If the individuals were late medieval criminals, there may be documentary evidence of their execution. Further studies such as stable isotope analysis would also be possible. It is understood that as part of the radiocarbon dating process, we will be provided with the $\delta^{15}N$ and C/N ratio needed for stable isotope analysis. It is strongly suggested that we make use of this data to give us information about these two individuals' diets. This would give insight into the diets of the individuals, and possible migration. Proteomic analysis of dental calculus could also provide further information on the pathology of the individuals. However, it is recognised that although these avenues of research would provide additional, interesting information, they are not compulsory to our understanding of the collection, nor are they a priority at this junction.

6. Appendix 1 – Individual result summary tables

Skeleton	SK1
context	1001-1002
Comleteness	51-75%
Preservation	Grade 2 – good
Age	Adolescent – 17-19 yo
Sex	N/D
Stature	N/D
Non metrics	None
Skeletal pathology	Healed break to right clavicle
Dental pathology	Dental calculus, dental caries in LLM2, URM2, ULM2, periodontal disease, dental enamel hypoplasia

Skeleton	SK2
context	1003
Completeness	76%+
Preservation	Grade 3 – fair
Age	Middle Adult – 25-30 yo
Sex	Possible male
Stature	167.80cm – 168.99cm ± 3.27cm (measurements from femora)
Non metrics	Transverse foramen bipartite on right side of 5th cervical vertebra
Skeletal pathology	DJD throughout spinal column, deformed shaping of ribs
Dental pathology	Dental calculus, dental enamel hypoplasia

Skeleton	SK3
context	1004
Completeness	26-50%
Preservation	Grade 3 – fair
Age	Middle adult – 35-40 yo
Sex	Possible male
Stature	169.35cm – 171.00cm ± 4.32cm (measurements from radius & ulnae)
Non metrics	None
Skeletal pathology	Healed break of distal end of right humerus, healed breaks to two right mid ribs, healed break to four left mid ribs, DJD in lumbar vertebrae, periosteal new bone formation on right and left tibias
Dental pathology	N/P

Skeleton	SK4
context	1011
Completeness	76%+
Preservation	Grade 2 – good
Age	Middle adult – 35-39 yo
Sex	Probable male
Stature	165.90cm – 171.17cm ± 4.32cm (measurements from humerus, radii, ulna, femora)
Non metrics	None
Skeletal pathology	DJD throughout spinal column
Dental pathology	Uneven dental attrition on right side of mandible, periodontal disease, dental calculus

Skeleton	SK5
context	1012
Completeness	76%+
Preservation	Grade 2 – good
Age	Middle adult – 25-39 yo
Sex	Probable male
Stature	168.60cm – 169.63cm ± (measurements from humerus & radius)
Non metrics	None
Skeletal pathology	Unhealed break in distal third of left ulna, compression of vertebral body of two mid thoracic vertebrae, DJD in thoracic and lumbr vertebrae
Dental pathology	N/P

Skeleton	SK6
context	2002
Completeness	5-25%
Preservation	Grade 4 – poor
Age	Adult
Sex	Possible male
Stature	N/P
Non metrics	None
Skeletal pathology	DJD in cervical vertebrae
Dental pathology	Dental calculus, dental caries URM3, ante-mortem tooth loss LLM1, dental enamel hypoplasia

Skeleton	SK7
context	2003
Completeness	5-25%
Preservation	Grade 3 – fair
Age	Adult
Sex	Possible male
Stature	169.93cm ± (measurements from humerus)
Non metrics	None
Skeletal pathology	None
Dental pathology	Periodontal disease, dental calculus, dental hypoplasia, dental caries in ULI2.

Skeleton	SK8
context	2005
Completeness	5-25%
Preservation	Grade 3 – fair
Age	Middle adult – 40-44 yo
Sex	Possible male
Stature	N/P
Non metrics	None
Skeletal pathology	DJD in articulating facets of sacrum
Dental pathology	N/P

Skeleton	SK9
context	2006
Completeness	26-50%
Preservation	Grade 2 – good
Age	Middle adult – 35-45 yo
Sex	Possible male
Stature	182.08cm – 182.31cm ± 3.27cm (measurements from femora)
Non metrics	None
Skeletal pathology	Early signs of DJD in spinal column
Dental pathology	N/P

Skeleton	SK10
context	2007
Completeness	5-25%
Preservation	Grade 4 – poor
Age	Middle adult – 25-39 yo
Sex	Possible male
Stature	171.36 cm ± 4.32cm (measurements from ulna)
Non metrics	None
Skeletal pathology	None
Dental pathology	Dental calculus, dental caries in URM1, URPM2, ULPM1, LRM2, periodontal disease, ante mortem tooth loss of URPM1, LLM1, LLM2

Skeleton	SK11
context	2012
Completeness	<5%
Preservation	Grade 3 – fair
Age	Juvenile
Sex	N/D
Stature	N/D
Non metrics	None
Skeletal pathology	None
Dental pathology	N/P

Skeleton	SK12
context	2013
Completeness	<5%
Preservation	Grade 4 – poor
Age	Adult
Sex	N/P
Stature	N/P
Non metrics	None
Skeletal pathology	None
Dental pathology	N/P

7. Figures

Figure 1 – SK3 Periosteal new bone formation on right tibia

Figure 2 - SK1 healed break in right clavicle

Figure 3 - SK3 healed break in right humerus

Figure 4 - SK5 unhealed break in left ulna

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