Osteological Report on the Human Skeletal Remains from Burtle Priory, Somerset

Amanda Bailey (MSc Osteoarchaeology)

Non-Technical Summary

A single partial skeleton was recovered from a grave during the excavations in the summer of 2013 at the site of the former Priory at Burtle in Somerset. They were dated to the late medieval period, prior to the destruction of the Priory in 1536. The remains were estimated to be those of an adult male, aged between 36 and 50 years, with a stature of 176.4cm. Preservation of the skeletal material was good despite disturbance to the remains at some period after burial. However, as a result of this, the remains were less than 25% complete.

Palaeopathology present on these skeletal remains included osteoarthritis, periostitis, partial sacral clefting, possible Osgood-Schlatter's disease, Schmorl's nodes, osteophytosis and enthesophytes.
Contents

Non-Technical Summary ................................................................. 2
1  Introduction and Background ...................................................... 4
2  Methods .................................................................................. 4
  2.1 Examination of the material .................................................. 4
  2.2 Assessment of Preservation and Completeness .......................... 4
  2.3 Determination of Sex ........................................................... 4
  2.4 Estimation of Age at Death ..................................................... 5
  2.5 Metrical Analysis ................................................................. 5
  2.6 Non-Metric Traits ................................................................. 6
  2.7 Dental Status .................................................................. 6
  2.8 Palaeopathology ................................................................. 6
3  Results for Skeleton 080 (Context 026, 038) .............................. 7
  3.1 Position ............................................................................ 7
  3.2 Preservation and Completeness .............................................. 7
  3.3 Sex and Age-at-death .......................................................... 8
  3.4 Metrical Analysis ............................................................... 8
  3.5 Non-metric traits ............................................................... 8
  3.6 Palaeopathology ............................................................... 8
     3.6.1 Sacral Clefting / Spina Bifida Occulta ............................... 8
     3.6.2 Osgood-Schlatter’s Disease ........................................... 9
     3.6.3 Osteoarthritis ............................................................ 11
     3.6.4 Osteophytosis ............................................................ 11
     3.6.5 Schmorl’s Nodes ........................................................ 11
     3.6.6 Enthesophytes ............................................................ 12
     3.6.7 Periostitis ................................................................. 12
4  Discussion .............................................................................. 13
5  References ............................................................................... 15
1 Introduction and Background

The human skeletal remains analysed in this report were excavated in 2013 from the site of Burtle Priory in Somerset. A single truncated skeleton was recovered from a grave at the site.

The remains were examined using standard anthropological methods following the guidelines for the recording of human remains set out by BABAO and the Institute of Field Archaeologists (IFA) (Brickley & McKinley, 2004).

2 Methods

2.1 Examination of the material

The skeletal elements were identified and laid out on a workbench in standard anatomical position. A macroscopic osteological examination was then undertaken and an inventory of the presence and preservation of all surviving elements produced. Coding systems, where possible, were based on the guidelines in (Brickley & McKinley, 2004) and (Buikstra & Ubelaker, 1994). The reconstruction of elements from fragments was undertaken where it would add to the information to be gained.

2.2 Assessment of Preservation and Completeness

The preservation of each element was recorded using the coding system of Brickley & McKinley (2004) based on the integrity of the cortices and joint surfaces. An overall preservation was assigned to each skeleton, where good (Grade 0 – 1) indicated that the majority of cortices and joint surfaces were free from any erosion and poor (grade 4 – 5+) indicated that the majority of surfaces were affected by erosion and/or many elements were fragile or crumbling.

Completeness was unrelated to preservation and was recorded on the basis of the percentage of the skeleton that was present, 75 – 100% being the most complete.

2.3 Determination of Sex

The methods used to determine the sex of skeletal remains are observations of morphological differences in the skull and pelvis. An additional method is the measurement of the dimensions of postcranial elements, although poorly preserved skeletal remains cause problems when assigning sex using this method. None of these methods can be applied accurately unless a skeleton is fully mature (Cox & Mays, 2000). The pelvis is considered the most reliable element for sex determination (Buikstra & Ubelaker, 1994:16) with an
accuracy level of up to 96% compared to up to 90% for the skull alone (White & Folkens, 2000).

The methods commonly used to examine the pelvis are set out in Buikstra and Ubelaker (1994:16-18). Greater weight is given to the traits of the pelvis, which include the method of Phenice (Phenice, 1969). For this skeleton only a few fragments of pelvis were available for determining sex however a fragment of the anterior portion of the pubis was recovered which allowed the method of Phenice to be used. No parts of the skull were recovered. Where possible, the general size and robusticity of elements was noted and any measurements of particular elements were taken that have been shown to have strong sexual differences, such as the diameters of the heads of the humerus, femur or radius. (For the radial head, >23mm implies male, <21mm implies female.)

2.4 Estimation of Age at Death

Various methods are used in an attempt to estimate the age at death of an adult from skeletal remains. All measure biological ageing, which is fundamentally a process of degeneration and as such is affected by genetic predisposition, environment, nutrition, sex (hormones), behaviour and socio-economic status (Rosen, Glowacki, & Bilezikian, 1999). This may not therefore be the same as the chronological age of an individual. Furthermore, the sample populations used to develop the methods will have been affected by very different factors to the population in this report, and may themselves have been of unknown age, compounding any errors (O'Connell, 2004).

Since none of the methods used are accurate enough to assign age to within a few years (see White and Folkens, (2000:340-341) and Cox and Mays, (2000:61-82) among others for a discussion of the problems) it is prudent to instead concentrate on assessing whether the individual has reached skeletal maturity and then to assign the skeleton to either young adult (18 - 25 years), prime adult (26 – 35 years), mature adult (36 - 45 years) or older adult (45+ years). Since degenerative changes are harder to distinguish in older individuals, these are all assigned to the very broad 45+ age range.

To improve accuracy, several methods should ideally be used, the most accurate methods being selected dependent on the skeletal elements available. For this skeleton the method using pubic symphysis degeneration was applied (Brooks & Suchey, 1990) (Suchey & Katz, 1986).

2.5 Metrical Analysis

The stature of an individual increases until adulthood and decreases in old age. Genes determine up to 90% of an individual’s height but environmental factors (nutrition, climate) affect the rest (Brothwell, 1981). On average females are shorter than males.
Stature can be estimated by measuring the maximum length of long bones and applying them singly or in combination to the regression formulae developed by Trotter and Gleser (1952, 1958), which were derived from studies of skeletons from modern Americans of known living stature. This may not be accurate when applied to an earlier British skeletal population, but since they are the standard currently used, they do allow for inter-population comparisons. However there may still be problems with inter-site comparisons if there were a difference in the bones (single or combinations) used in the estimations for the sites being compared (Waldron, 1998a).

The postcranial measurements taken for this sample were those listed in the IFA guidelines (Brickley & McKinley, 2004). An osteometric board was used to take measurements and the standard regression formulae were used to estimate stature. The long bone used was complete and unaffected by pathology. No adjustment was made for an individual being over 45 years using the corrections of Giles (Giles, 1991), since a broad older adult age category was used so that Giles’s corrections could not be accurately applied.

2.6 Non-Metric Traits

Non-metric traits are variations in the normal morphology of skeletal elements that are not related to disease or activity. These may take the form of extra bone (bony spurs, ossicles within cranial sutures), ossification or fusion failure (septal aperture of the humerus, metopism) or variations in foramina (Buikstra & Ubelaker, 1994). The significance of these traits in contemporary studies is based on the suggestion that they show familial inheritance (ibid.) however whether one or many genes control the expression of these traits and how much environmental factors influence their expression is uncertain (Brothwell, 1981). (For example, auditory exostoses are closely related to exposure to cold water (White & Folkens, 2000)).

For this report the traits recorded are those cranial and postcranial non-metric traits listed in the IFA guidelines (Brickley & McKinley, 2004). They were noted as being present, absent or unobservable (missing or damaged bone).

2.7 Dental Status

No dentition was available for analysis for the skeleton from Burtle Priory.

2.8 Palaeopathology

All skeletal elements were examined for signs of pathology. Any lesions noted were examined using a 10x magnifying glass and described using standard anatomical terminology. Where possible a diagnosis was made with reference to standard texts ((Aufderheide & Rodriguez-Martin, 1998), (Ortner, 2003)). It should be noted that poor preservation, fragmentation and incompleteness of remains will lead to the loss of evidence for many disease processes.
3 Results for Skeleton 080 (Context 026, 038)

3.1 Position

The lower legs of the truncated skeleton from Burtle priory were found in a supine position. Some period after burial, the grave was disturbed and elements from the spine, pelvis, hands, both patellae and some elements from the left foot were re-deposited. There were no obvious disarticulation cut or chop marks around the proximal tibiae, or any other joints. One vertebral body had a 2cm long, oblique cut mark on the anterior surface and another vertebral body had the posterior portion removed completely by a vertical chop. Both these marks had characteristics consistent with post-mortem damage. This pattern suggests that the disturbance to the grave occurred sometime after burial when the body was in a skeletonised, or near, state and the elements would have naturally disarticulated once disturbed.

3.2 Preservation and Completeness

Plate 1 shows the elements of skeleton 080 (SK 080) that were present. SK 080 was less than 25% complete, consisting of both hands and feet, the lower half of the both legs, the lower thoracic spine and rib, sacrum and pelvis fragments. Preservation was good with slight and patchy surface erosion at the ends of bones, intact cortices and joint surfaces. Some patina was present on the external non-articular surfaces and on some joint surfaces which could be confused with the eburnation (polishing) associated with osteoarthritis (OA). The elements present were largely complete and unfragmented.
A sesamoid bone (isolated bones embedded within tendons) was found with the elements of the feet and would have been within the tendon of the flexor hallucis brevis at the base of the big toe (1st metatarsophalangeal joint). There are often two sesamoid bones at this joint.

An oval red stain (15mm x 12 mm) with some concretions was present on the medial surface of the proximal third of the shaft of the left tibia. This appeared to be the result of iron oxidation (iron nails were found with the skeletal material).

3.3 Sex and Age-at-death

The skeleton from Burtle priory was male. Despite few elements being available for examination, the morphology of the fragment of pubis present allowed the method of Phenice (Phenice, 1969) to be applied and indicated that the skeleton was male. The diameter of the radial head fragment confirmed this, giving a minimum diameter of 24mm (>23mm indicates male). The general size and robusticity of the elements added further support to the assessment.

All elements present had fused completely, indicating that these were the remains of a mature individual. A fragment of the left pubis which included the symphyseal face allowed the age at death of this individual to be estimated at between 36 and 50 years.

3.4 Metrical Analysis

The height of this individual was estimated at 176.4cm +/- 3.37cm (5 feet 9.4 inches), using the complete right tibia. This is taller than the average height of males across multiple late-medieval sites of 171cm (Roberts & Cox, 2003).

The platycnemic indices for the tibia were 84.32 on the right and 84.19 on the left.

3.5 Non-metric traits

Only the following traits could be noted for presence or absence: tibial squatting facets and vastus notches (patella). Both were absent bilaterally.

3.6 Palaeopathology

3.6.1 Sacral Clefting / Spina Bifida Occulta

Spina Bifida is the most common of all spinal congenital defects, affecting 5 - 25% of modern populations (Aufderheide & Rodriguez-Martin, 1998), and is the result of incomplete midline closure of one or more neural arches in the
spine very early in intra-uterine development. The majority of cases affect the lumbosacral area or the sacrum (Aufderheide & Rodriguez-Martin, 1998). There is a strong familial tendency which, combined with environmental factors (in particular low maternal dietary zinc, folic acid and selenium in early pregnancy) can lead to its expression (Barnes, 1994). When it affects the sacrum predominantly and leads to no clinical symptoms it is termed Spina Bifida Occulta (Waldron, 2009), although it can also be referred to as sacral clefting (Mulhern & Wilczak, 2012).

A section of the posterior arch of the first three sacral segments was present in the individual from Burtle (Plate 2). The first sacral segment (S1) exhibited clefting (a lack of fusion and resulting separation between the two sides of the posterior neural arch). The lack of outward bulging/spreading of the margins of the opening indicates that in this case there was a major delay in the development of the neural arch, but no neural tube defects (more often associated with maternal nutritional deficiency) (Barnes, 1994)(Mulhern & Wilczak, 2012). This is a case of partial sacral clefting, sometimes referred to as a very minor expression of Spina Bifida Occulta, but would have been unlikely to have led to any physical symptoms or impairment and was a very minor defect.

3.6.2 Osgood-Schlatter’s Disease

Osgood-Schlatter’s disease affects the tibial tuberosity of the knee at the attachment of the patellar tendon. Seen most commonly in boys of 10 to 15 years it is considered to be traumatic in origin, the result of excessive strain on the tendon pulling on the developing area of bone. Avulsion (pulling away)

Plate 3 Anterior view, right tibial tuberosity

Plate 4 Anterior view, left tibial tuberosity

In the Burtle individual both tibial tuberosities are rugged and irregular at their distal poles (Plate 3 and Plate 4). On the left, the distal portion has spicules of
bone at its margins (proximally). There are depressions in the area of the tuberosities proximal to this and some lateral deviation of the tuberosities. The changes are more marked on the left. These changes have similarities to Osgood-Schlatter’s disease (Digangi, Bethard, & Sullivan, 2010) and this is a possible diagnosis here. Symptoms would have been local pain and tenderness but the condition would have resolved with rest and once skeletal maturity had been reached (with the tibial tuberosities fully fusing to the metaphysis (proximal end of the shaft)).

This is a rarely reported condition in archaeological material, with one possible case being reported from the Anglo-Saxon cemetery in Barton-on-Humber, Yorkshire (Roberts & Cox, 2003).

3.6.3 Osteoarthritis
Osteoarthritis (OA) is the most common disease of synovial joints found in archaeological (and modern) populations (Ortner, 2003). In palaeopathology it can be diagnosed by looking for changes in the contour of the joint surface, pitting or porosity of the joint surface, osteophytes and eburnation (polishing of the joint surface). For this report the diagnosis of OA has been made following the guidelines of Rogers and Waldron (1995:44) i.e. diagnosis was made in the presence of either eburnation alone or two of the other three criteria.

In the Burtle individual OA was present at the joints between the vertebral bodies of the thoracic spine and the ribs (one right rib and the left eleventh rib).

3.6.4 Osteophytosis
Osteophytes are growths of new bone found around the margins of joints (Rogers and Waldron, 1995). Osteophytes alone do not signify pathology in a joint although they are associated with osteoarthritis and degenerative disc disease, and instead appear to be part of the ageing process. Osteophytes of the vertebral bodies are associated with ageing (Rogers et al., 1987:192), can be seen as early as the 3rd decade and are seen in 60% of females and 80% of males by 60 years (Ortner, 2003:549). The presence of osteophytes in this individual was recorded and graded following Buikstra and Ubelaker (1994:121).

The following joints were affected by minor osteophytosis: right medial knee (tibia and patella), left knee (patella), right wrist (lunate-triquetral joint), left thumb (metacarpophalangeal joint), left ankle (talo-calcaneal joint) and right ankle (talo-fibular joint). Three thoracic vertebrae were also affected. All cases were minor and given the age of this individual were probably associated with ageing.

3.6.5 Schmorl’s Nodes
Schmorl’s nodes are the result of herniation of the intervertebral discs into the end plates of the vertebral bodies and are visible as indentations on the surfaces of the vertebrae lined with cortical bone. Trauma, axial loading of the vertebral column through heavy lifting at a young age have been implicated in
their incidence (Roberts & Manchester, 2010). They are common in the lower thoracic and lumbar regions. (Rogers and Waldron, 1995).

Two of the thoracic vertebra present had minor Schmorl’s nodes (< 3mm diameter) but these were unlikely to indicate significant heavy work undertaken by this individual.

3.6.6 Enthesophytes
Enthesophytes are outgrowths of new bone that occur at the insertion points of tendons or ligaments. They are part of the spectrum of enthesal changes which refer to the changes that are seen at the sites of attachments of ligaments and tendons to bone and range from pitting and porosity to new bone formation (nodular or spicules) which can be exuberant (Knusel & Villotte, 2013). They may be associated with repetitive muscular exertion and have been used as an indicator of activity, but they are also associated with other diseases such as Diffuse Idiopathic Skeletal Hyperostosis (DISH) (Aufderheide and Rodriguez-Martin, 1998). At what point they are considered a response to repetitive movements and when they become a sign of pain and pathology is not clear. For this report, the presence of enthesophytes was recorded and graded following Buikstra and Ubelaker (1994:121).

There were minor enthesophytes present on the superior right patella at the insertion of the quadriceps tendon, responsible for extension of the knee joint. The left tibia also had larger enthesophytes on the posterior surface at the origin of the soleus muscles, responsible for plantar flexing the foot when pushing off from the foot or walking. There was asymmetry between left and right indicating more force being regularly applied with this muscle on the left than the right.

3.6.7 Periostitis
Periostitis (inflammation of the periosteum, the thin tissue covering the outer surface of bone) is a basic inflammatory response to systemic stress or pathology in the underlying bone, such as infection (local or systemic) (Ortner, 2003 : 206). It can also occur in areas where the periosteum is close to the surface of the skin, such as the anterior tibia, secondary to trauma (ibid.) or as a result of infection extending from the surrounding soft tissues. However, even when not the result of direct trauma, the anterior tibia, the cranial vault and the clavicles are all commonly involved during systemic disease possibly due to their proximity to the surface and cooler temperatures (Larsen, 1997). The prevalence of periostitis can be used as an indicator of health and nutritional status, specifically as an indicator of poor nutrition, poor sanitation and increased population density (ibid.), since appearance of these lesions can imply that infection in the individual has developed so as to become chronic.

Two elements in the individual from Burtle showed signs of periostitis in the form of woven or lamellar new bone formation, striated and pitted, on the surfaces of the bone.
The postero-lateral surface of proximal third of the shaft of the left fibula had subperiosteal new bone covering the majority of the surface and extending 10 cm distally from proximal end. It was a mix of smooth, lamellar, plaque-like and porous, woven bone implying the process causing the lesion was ongoing at the time of death. The unilateral nature and location of the lesion would favour a traumatic origin.

Two rib shaft fragments had healed (smooth, lamellar) subperiosteal new bone formation on their external surfaces. Due to its location this was likely to have been caused by direct trauma (blow or fall) in the past.

Although periostitis affecting multiple sites can be indicative of systemic disease/infection, the location and the asymmetry of these lesions would make it more likely that some or all of them were the result of trauma.

4 Discussion

Table 1 Summary of osteological data for SK 080

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preservation</td>
<td>Good, grade 1 (Brickley &amp; McKinley, 2004)</td>
</tr>
<tr>
<td>Completeness</td>
<td>&lt; 25%</td>
</tr>
<tr>
<td>Age</td>
<td>36 – 50 years</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
</tr>
<tr>
<td>Stature</td>
<td>176.4 cm +/- 3.37 cm (5'9&quot;)</td>
</tr>
<tr>
<td>Non-metric traits</td>
<td>None observable</td>
</tr>
<tr>
<td>Pathology</td>
<td>Joint Disease</td>
</tr>
<tr>
<td></td>
<td>Possible Osgood-Schlatter’s bilaterally</td>
</tr>
<tr>
<td></td>
<td>Osteoarthritis: costovertebral joints x 2</td>
</tr>
<tr>
<td></td>
<td>Osteophytosis: bilateral knees, bilateral ankle, right wrist, left thumb</td>
</tr>
<tr>
<td></td>
<td>Spinal Schmorl’s nodes, osteophytosis of vertebral bodies</td>
</tr>
<tr>
<td></td>
<td>Infection/ inflammatory</td>
</tr>
<tr>
<td></td>
<td>Periostitis: left proximal fibula (active), external surface rib x 2 (healed)</td>
</tr>
<tr>
<td></td>
<td>Congenital/ developmental</td>
</tr>
<tr>
<td></td>
<td>Partial Sacral Clefting (Spina Bifida Occulta)</td>
</tr>
<tr>
<td>Enthesophytes</td>
<td>Right quadriceps tendon insertion, left inferior soleal line</td>
</tr>
<tr>
<td>Other</td>
<td>Sesamoid bone from 1st metatarsophalangeal joint</td>
</tr>
</tbody>
</table>

The skeletal remains recovered from the site of the priory at Burtle, although incomplete and disturbed, have revealed a surprising amount of information about the life of this individual.

The tibiae, fibulae and bones of the hands and feet were present in the Burtle skeleton. These particular elements, by revealing little or no evidence for pathology, have allowed certain diseases that affected Britain at this time to be ruled out, for example leprosy and chronic infectious and systemic diseases. The individual from Burtle lived beyond the normal life expectancy for this period of 36 years (Roberts & Cox, 2003) and had also attained an adult stature above the average for the late medieval period (ibid.). This latter would indicate that, at least during childhood, he did not suffer from extreme malnutrition or deprivation.
The thoracic spine showed a general lack of degenerative disk disease and osteoarthritis suggesting that this individual did not engage in heavy, repetitive work during adolescence or as an adult. However, this area of the spine shows no evidence for Diffuse Ideopathic Skeletal Hyperostosis (DISH) either which has been associated with rich diets, obesity and diabetes, and possibly even monastic lifestyles (Rogers & Waldron, 2001). No OA was apparent at the knee. Although some periostitis was observed, it was unlikely to be associated with local or systemic infection and was probably the result of local trauma.

As a young boy, this individual probably suffered from Osgood-Schlatter’s disease, a rarely reported painful condition affecting the anterior knees, possibly activity related. In adulthood the asymmetry in the enthesophytes observed in the lower legs indicates some sort of one-sided repetitive activity favouring pushing up off the left foot. What OA was present, at the junctions between the ribs and the vertebrae, may have been secondary to mild trauma to the ribs from a direct blow.

A minor developmental anomaly was present in the form of partial sacral clefting sacrum which, although clinically insignificant, may have familial tendencies.

The skeletal evidence uncovered at Burtle Priory revealed the remains of an adult male, who was taller than average, of late middle age and with no indication that he was suffering from chronic illness or painful conditions at the time of his death. However, this is a picture based on a very incomplete skeleton and the incident or disease that resulted in his demise remains unknown.
5 References


