Spine Pathology and Disability at Lesbos, Greece
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Introduction
Lesbos is the largest island in the Aegean Sea, located to the north-east of Athens. The restoration of the Early-Byzantine (324-610 AD) church of Taxiarhis Myritzou near Mytilene, the island’s capital city, led to a small salvage excavation just north of the foundations. Five graves containing six inhumations were discovered, possibly part of a larger cemetery. The site is subject to marked erosion and soil drainage, which led to slope wash deposits hundreds of meters away and disturbance of the burial context. The dating of the Christian burials is not secure, as the church has been in use for centuries, but the excavator, M. Fountouli (pers. comm.), believes that all burials belong to the same level. According to excavation notes, the dead face to the East, and no grave goods were found.

Materials, methods, and results
Both sexes are present, with adults and subadults represented. Almost all of the individuals have interesting pathologies, among them an acutely kyphotic spine fused at the lumbar area with several collapsed vertebrae, severe bone degeneration, bony bridging, and formation of paravertebral abscesses. This preliminary report focuses on description of this case: the pathology, its aetiology, and its complications for the individual.

The skeleton is that of a young adult female, aged 25-35 years old by Brothwell’s molar attrition stages (1981). The pubic symphyses are missing, and bone preservation is fair. The bones are light in weight, possibly due to postmortem bone loss. However, osteopenia should also be considered, as erosion and porosity are observed symmetrically in the skeleton, mainly at cancellous bone areas and the margins of joints, and also involving the bones of hands and feet. Further investigation is needed to document the distribution pattern of the erosive lesions for evidence of early stages of rheumatoid arthritis. The onset of RA is between 20-50 years of age (Aufderheide and Rodríguez-Martín 1998) and research has discovered cases where RA onset is significantly associated with physical trauma in the preceding 6 months (Al-Allaf et al. 2001). Radiography would undoubtedly reveal more details, and will be applied if possible (Roberts and Manchester 1997; Rogers and Waldron 1995).

The sacrum and the lumbar vertebrae are very brittle and in poor condition. There is partial sacralisation of L5 (Figure 1). L4-T12 are fused together (Figures 2 and 3) with a slight bend towards the right (scoliosis); their collapse created a very marked kyphosis. The spinous and transverse processes were damaged postmortem, but the spinous process of the collapsed T12 shows some evidence of remodelling. The condition has also affected the sacroiliac joints, and proliferative new bone formation is evident on the right sacral articular surface. Due to the sacroiliac involvement, ageing of the individual based on the auricular surfaces cannot be applied.

Erratum: p.13, L1-T9 are fused together; ...the collapsed T9 shows...
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Discussion
One must remember that an individual may suffer from more than one disease. In this case, it is likely that the deformation of the vertebrae and the subsequent sacroiliac involvement are the result of complications of spinal fracture(s) caused by an accident or violence, especially if osteopenia was a pre-existing condition which made the individual prone to fractures (Grmek 1991). Although it is tempting to speculate, an exact diagnosis of the cause of this severe inflammatory condition of the spine is very difficult to establish. The following differential diagnoses should be considered:

1. Non-specific pyogenic inflammation as a response to severe trauma, leading to collapsed vertebrae, bony bridging, destruction of several adjacent vertebrae, angulation of the spine and formation of paravertebral abscesses: Ortner and Putschar (1981:116-7) call this condition "destructive spinal osteomyelitis" and note that the appearance may be indistinguishable from tuberculous gibbous. Vertebral fractures may be caused either by a forward shearing force associated with hyperflexion, or by a vertical force. The lumbar area is most frequently affected. Compression fractures by a vertical force result in wedge-shaped vertebrae, and can lead to scoliosis and kyphosis (Roberts and Manchester 1997). If the vertebral bone has been weakened by another disease process, such as osteoporosis, the degree of compression may be severe, resulting in a marked degree of kyphotic deformity or multiple vertebral collapse, called by Aufderheide and Rodriguez-Martín a "concertina fracture" (1998: 25).

2. Tuberculosis of the spine: The lumbar vertebrae are most frequently affected, but the vertebral arches are not usually directly involved in TB (Ortner and Putschar 1981:145). However, the extensive lytic destruction and collapse of one or several adjacent vertebral bodies may be combined with pathologically induced spinal fracture and lead to sharply angular kyphosis, bony fusion of the remnants of the involved vertebral bodies with residual cavity defects, and secondary bony ankylosis and ossification of the interspinous ligaments. The sacroiliac joint may be involved by extension of the lumbar-sacral focus unilaterally or bilaterally. The sacral wing may also be affected with some reactive osteosclerosis (Aufderheide and Rodriguez-Martín 1998: 134-137; Ortner and Putschar 1981: 145-149). It should be mentioned that in the case of the female under study there were no other bone changes suggestive of TB, e.g., rib lesions (Roberts et al. 1998).

3. Brucellosis: Human brucellosis is a potentially life-threatening zoonotic disease of bacterial origin. It is common in the Mediterranean area and is transmitted through contaminated dairy products, direct contact with infected secretions, or inhalation of aerosols (Sauret and Vilissova 2002). It most commonly affects the sacro-iliac joints and the lumbar spine, often involving more than one vertebra. There tends to be more new bone formation than in TB and osteoporosis is not common. However, there are no pathognomonic signs, and some vertebral lesions may be difficult to differentiate from TB (Rogers and Waldron 1995). Paravertebral abscess formations in brucellosis are rare and classical radiological...
findings of spinal brucellosis involve narrowing of the disc space, lysis of adjacent bones, destruction of the vertebral body, sclerosis, and osteophyte formation (Ozgocmen et al. 2001). The characteristic lesion, both in the spine and the pelvis, is multifocal lytic cavitation. In contrast to TB, complete collapse of vertebrae with gibbous formation is unusual (Ortner and Putschar 1981: 138-139).

4. Fungal infections: In blastomycosis the vertebrae may be involved and vertebral collapse may occur, but this is rare. Lesions are usually purely lytic with sharp borders, and paravertebral abscesses occur, which may be difficult to distinguish from tuberculosis. However, it is an uncommon infection, and endemic to northeastern North America. In coccidiomycosis of the spine the lesion may be indistinguishable from TB. However, vertebral collapse with gibbous formation is unusual and involvement of posterior elements is common. This disease is endemic to the south-western US, Mexico, and South America. Aspergillosis occurs world-wide without sex, age, or race predilection. In the spinal form, vertebral collapse and gibbous deformity occur which may mimic TB, but involvement of the spine is very uncommon (Aufderheide and Rodriguez-Martín 1998; Ortner and Putschar 1981; Rogers and Waldron 1995).

5. Parasitic infections: The only parasite causing significant bone changes to humans is *Echinococcus*, a tapeworm which inhabits the small intestine of canines. At the larval stage it can also spread to sheep, cattle and pigs. The common manifestation is the hydatid cyst which is found world-wide. The parasites most often settle in areas of cancellous bone with hemopoietic marrow and usually infect the pelvis and the lower vertebrae and sacral region of the spine. Progressive destruction of one or several vertebral bodies may lead to angular kyphosis similar to a tuberculous gibbous, but the posterior elements are more often involved than in TB. The destruction of pelvic bones may be extensive in the later stages of the disease. Reactive osteosclerosis and new bone formation are uncommon, except in cases of secondary bacterial osteomyelitis (Ortner and Putschar 1981).

**Disability and Mortality**

Fracture of the vertebral column, either due to injury or to vertebral collapse as secondary complication of a disease, can affect the spinal cord and the spinal nerves leading to serious disruption of nervous supply to other parts of the body. The comminuted fragments may put pressure on the spinal cord or nerves, causing dysfunction or paralysis. Alternatively, a blood clot can result from a spinal fracture, producing pressure on the spinal cord or nerves. The blood clot will disappear in time if the individual reduces activity, and if paralysis occurs it may be temporary (Ortner and Putschar 1981: 65-66).

In the case under discussion, the very marked angular kyphosis and the collapse and deformity of the vertebrae are suggestive of a partially occluded neural canal, which could have led to permanent paralysis or paraparesis. It must be noted, however, that spinal cord compression sufficient to produce paraplegia only occurs in about 10% of the
cases. In any case, the bone and joint involvement would have caused mechanical dis-
abilities and limited physical support (Aufderheide and Rodríguez-Martín 1998: 123,
132, 242). Paralysis would result in bone atrophy of the paralysed limbs. However, none
of the limbs of the female appear to be atrophied. That could mean that either she was
capable of some degree of movement, or that she died before bone atrophy took place.

Death might have occurred from septicaemia, respiratory dysfunction secondary to the
marked kyphosis, or from secondary complications of paraplegia. The latter may in-
volve loss of normal voluntary bladder and bowel control, leading to further infections.
In the case of Pott’s disease in the past, up to 50% of patients showed spontaneous heal-
ing. The remainder might have lived for decades with chronic, active disease, deformed
and suffering from multiple draining sinuses and lower limb paralysis. Emaciation from
the chronic illness would have arrested ovulation and menstruation (Aufderheide and

Conclusions
A young adult female, 25-35 years old, buried to the north of a church at Lesbos pre-
sents severe spine pathology with sacroiliac involvement. The exact diagnosis of the
condition is difficult, but non-specific pyogenic inflammation due to injury or tuberculo-
sis of the spine seem to be the best candidates. The female would most likely have suf-
fered mechanical disability, physical dysfunction, or paralysis. Her illness may have
been chronic, and she may have died from septicaemia, respiratory dysfunction sec-
dary to the marked kyphosis, or from secondary complications of paraplegia.

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**Figure Captions:**

**Figure 1** Sacrum (anterior view)

**Figure 2** Fused T12—L4 (anterior view)

**Figure 3** Fused T12—L4 (lateral view, right side)

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