Medicina Historica 2017; Vol. 1, N. 1: 23-28

A probable case of gout

Gaspare Baggieri[1], *Francesco Mallegni*[2]
[1] Museo delle Civiltà; [2] Department of Biology, University of Pisa, Italy

Abstract. We hypothesize that there is the presence of gout in the remains of a male skeleton of [showing] incipient senility, dating back to the VI-VII century A.D. The remains lay in anatomical connection in a marble sarcophagus located inside the Church of Saint Susanna, in Rome. Some bones of the feet present considerable pathologies. A meticulous macroscopic analysis, supported by x-rays, and a differential diagnosis with other diseases which can give a similar pathological framework, allowed us to deduce that the disease was due to gout.

Key words: gout, male skeleton, late ancient times, Rome (Italy)

Introduction

The church of Saint Susanna is located in Rome in the Trevi quarter (in XX September Street). The church was originally named *Ad duas domos* (that means: close to the Gambino and Caio homes), and has a basilican shape. It was built on the remains of Saint Susanna's family house. In fact, according to sources, young Susanna underwent martyrdom in this place for having refused to marry the Emperor Diocletian's son. Her remains were placed, together with her father's remains, inside the crypt of the church. The latter is a paleochristian church, founded in 280 A.D., and became the place of Christian worship, during Constantine's reign, in 330 A.D. We know from sources that Pope Sergius I (687-701: *Liber Pontificalis*, I, p. 375) made many donations to the church, due to the fact that he had been titular priest at that very location (*ibid.*, p. 371).

The building underwent several renovations. Pope Adrian I very likely restructured the roof (772-795: *Liber Pontificalis,* I, p. 507), and it appears that shortly afterwards Pope Leo III (795-816: *Ibid.*, II, p. 3) rebuilt the church, due to its small dimensions and to its ruin. Leo III endowed it with three naves, a baptistery, and mosaic decorations.

Between the XV and the XVI century (1), the definitive building was reduced to a single aisle, but it was also equipped with a circular apse, a transept, and two lateral chapels. The present façade has two orders, and was rebuilt with baroque elements by architect Carlo Maderno in 1603.

The archaeological research

Fragments of plaster from a fresco (2-4) were found in contact with the skeleton and also above it at the time the coffin was opened. The typology of this sarcophagus indicates a particular social status of the subject that could be also confirmed by the discovery of the plaster fragments (about 7.000 pieces) that make up a fresco. These pieces were found above the skeleton. Some of the fragments shifted below it, partially filling the spaces underneath the bones, while some authors incorrectly presumed that the positioning of the fragments under the body was intentional. The placement of the fragments above the skeleton allows us to infer that the skeleton was deposed in the sarcophagus in a period before the fragments existed and that the skeleton and the sarcophagus could be contemporary.

But we can not exclude that the sarcophagus could be recycled. The disposition of these fragments probably occurred in the iconoclastic period (717-843), at the same time of the restoration of St. Susanne Church carried out by Pope Leo III, in the last decades of the VIII century. The intentional fragmentation of the wall painting very likely goes back to a period preceding the restoration of Leo III, and it was made in order to save the painting from the iconoclast persecution.

The restoration of the fragments revealed a Madonna with Child, Saint Agata on the right side and, probably, Saint Susanne on the left side. These figures are represented on a gabled cornice (fronton) which in his turn portrays the Agnus Dei, St. John the Baptist and St. John the Evangelist. Moreover, it was possible to reconstruct, from other fragments, 5 faces of Saints that it was not possible to identify.

Between 1990 and 1992 Margherita Cecchelli (University "La Sapienza", Rome) carried out archaeological investigations unearthing a marble sarcophagus. It was found in the center of the Church, right in the area corresponding to the old left aisle, the nave rebuilt by Leo III in 796. The sarcophagus was close to three capuchin tombs which were orthogonally disposed. Another burial coffin, containing the skeletal remains which are the topic of this study, was found nearby. This coffin is composed of marble sheets, and its top is formed by bricks. It was partially hidden by the foundations of the colonnade of Leo III.

Fragments of plaster from a fresco (3, 4) (Fig. 1) were found in contact with the skeleton, and above it, at the time the coffin was opened. The typology of this sarcophagus indicates a particular social status of the subject that could be also confirmed by the discovery of the plaster fragments (about 7.000 pieces) that reproduce a fresco. These pieces were above the skeleton. Some of them moved below it, partially filling the spaces underneath the bones, while some authors incorrectly presumed that the positioning of the fragments under the body was intentional. The placement of the fragments above the skeleton allows us to infer that the skeleton was deposed in the sarcophagus in a period before the fragments and that the skeleton and the sarcophagus could be contemporary. But we cannot exclude that the sarcophagus could be recycled. The disposition of these fragments probably occurred in the iconoclastic period (717-843), at the same time of the restoration of St. Susanne Church realized by Pope Leo III, in the last decades of the VIII century. The intentional fragmentation of the wall painting very likely goes back to a period antecedent to the restoration of Leo III, and it was made in order to save the painting from the iconoclast persecution.

The restoration of the fragments revealed a Madonna with Child, Saint Agata on the right side and, probably, Saint Susanne on the left side. These figures are represented on a gabled cornice (fronton) which in his turn portrays the Agnus Dei, St. John the Baptist and St. John the Evangelist. Moreover, it was possible to reconstruct, from other fragments, 5 faces of Saints that it was not possible to identify.

The skeletal remains were rather fragmented due to the fact that they were preserved for over a thousand years in an empty space, without any contact with the soil and with infiltrated water, but disturbed by the frescoes plaster fragments mentioned above. The skeleton is actually a light sub-fossil.

The skeletal remains were recorded and collected by one of the writers and moved to the Paleoanthropological Laboratory of the University of Pisa The paleo-biological analyses performed in the laboratory allowed us to assume that the remains belong to a male individual, of old age, probably older than 60 years, because of the complete reabsorption, both internal and external, of the cranial sutures. Moreover, the individ-

Figure 1. Image that reproduces the fresco.

ual had a sturdy build (when he was alive), and was of an average height 1.68 m (5).

State of health of the individual

The individual has different pathologies connected with the lower appendicular district. Particularly interesting in this regard, as we shall see below, is the state of the bones of the feet: metatarsus and phalanxes.

A careful macroscopic assessment points out the following observations:

a) We can emphasize an extensive osteophytosis with sharp borders, on the margins of the vertebral bodies (especially on the lumbar ones) on the tibial plate, on the distal epiphyses of the fibulas, on the joints of the tarsus, of the metatarsus and of the phalanxes of the feet.
b) The right femur is affected by an exuberance of the external compact bone, at the level of the posteromedial side of the upper third of the diaphysis. It can be interpreted as osteomyelitis, likely caused by trauma (due to a fall?), with the results of a muscle strain on the tendinous attachment of the gluteus maximus (Fig. 2).
c) We can observe explicit signs of a quite significant cavitated osteolysis at the level of many of the bones of the feet (on the distal epiphysis of the first metatarsal bone, on the proximal side of the epiphysis of the first phalanx on the right side, and on the homologous on the left side, on the distal epiphysis of the fifth metatarsal bone on both sides). All these lesions are cavitated and invasive, and each of them shows a thin and small sclerotic border.

Therefore, only the lumbar tract of the vertebral column and some appendicular lower bones show the signs of osteophytosis. The latter can be interpreted with a certain confidence as the result of an active life in which the age at death of the individual had an important role in the pathology.

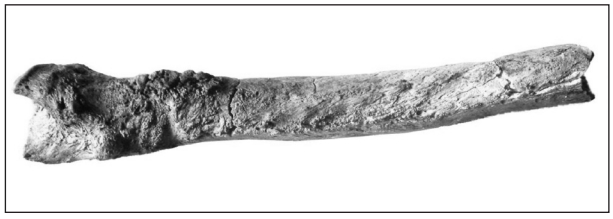

Figure 2. Femoral diaphysis (first superior side) affected by a destructive periostitis.

Differential diagnosis for the pathologies of the bones of the feet

The bones of both feet were anatomically reassembled in order to perform the x-ray examination of the whole (Fig. 3).

The x-ray obtained allowed us to more precisely formulate a differential diagnosis, writing out the schedule of the pathologies producing similar results, and comparing the prospective analogies with the observed resemblance (Fig. 4).

In order to explain the pathological signs on the bones of the individual in study, we report here a series of pathologies whose nature and effects are described in the works of Campanacci (1985), Aufderheide and Rodriguez-Martin (1998), and Roberts – Manchester (1995) (6, 7).

We considered arthrosis, rheumatoid arthritis, psoriatic arthritis, pseudo-gout (or chondro-calcinosis), osteomyelitis, leprosy, gout (Table 1). All these pathologies sometimes produce similar results on the bones.

Differential diagnosis

The following scheme is intended to be a summary table of the pathological signs detectable on the bones of the remains under examination. These signs may by provoked by the pathologies briefly described above, according to their specific characteristics.

a) It is an ankylosing and progressive chronic inflam-

Table 1. Lower limbs

Rheumatoid arthritis	Psoriatic arthritis	Pseudo-gout (chondro-calcinosis)	Osteomyelitis	Leprosy	Gout
a	b	c	d	e	f

matory poly-arthritis, with an autoimmune pathogenesis of unknown etiology, even if there is definitely a genetic influence. We can found this pathology on the synovial articulations, mainly on the hand articulations, and in a symmetrical way. Women are most affected with a ratio of 3 to 1. The disease affects 1-2% of the population, and the number of cases increases with age. In fact, the female sex over 55 years is the most affected by 5%. The pathology begins for the most part at the end of adolescence, or between the 4th and the 5th decade of life. We can observe a second peak between 60 and 70 years (8).

We can exclude this pathology in the individual that is being studied because in our case only the long bones of the feet are affected, but not the ones of the hands (9).

b) It is a chronic inflammatory pathology, often associated to psoriasis which usually precedes it. It is an oligo-arthritis (that is: involving a few joints), and affects only the distal and proximal interphalangeal points. It can be mutilating (extremely destructive) and symmetrical, or it can involve predominantly the vertebral column (the clinical frame reminding the one of the ankylosing spondyloarthritis) especially in the presence of HLA-B27 (human leucocytic antigen subtypes B 2701-2759), coded by locus B on the 6 chromosome.

This pathology is strongly challenged in the case being studied because the vertebral column (except for the osteophytoses on the anterior margins of the lumbar bodies described above) does not present stigmata due to psoriatic arthritis, which is, inter alia, very infrequent (10).

c) This disease is caused by accumulation of pyrophosphate dihydrate calcium crystals. The latter cause swelling attacks and pain at the level of knees and wrists, of ankles, and at the level of the larger joints of ancient people (>80 years).

It is complex to associate this pathology with the case being studied because of its peculiar characters compared to what we can observe on our bones (11).

d) This is an infection of the osteoarticular apparatus. It is related at the same time to the bone and the concerning medullar cavity. It is supported by bacteria (the most famous is the staphylococcus aureus). The most common pathogens change with age: other types of gram-negative are more common in adults (i.e.: *Klebsiella spp.*, *Enterobacter spp.* e *Pseudomonas spp.*). Less commonly it can also be caused by fungi, viruses, parasites. The bone infection may derive from several causes: hematogenous spread of a distant focus of infection, deep traumatic lesions, or serious open fractures, orthopedic surgical operations, or for spread of the bacteria from a close infected structure (12).

It is difficult to associate this pathology to the case in question, even if the femur of the individual presents a probable osteomyelitis likely due to trauma (due to a fall), with the results of muscle strain of the tendinous attachment of the gluteus maximus (see above). We cannot observe bone proliferation in the affected parts (medullar cavity of some metatarsi and phalanxes), on the other hand we can note some cavitations.

e) This pathology is also known as Hansen's disease (13). It is an infective, chronic illness, caused by *Mycobacterium leprae*, which affects the skin and peripheral nerves. Bones are infected directly, and are especially attached in addition to the nasal bones, the lower side of the pyriform opening, the alveolar process of the jaw bone, and feet and hands fingers.

We can exclude leprosy in the individual being studied, because of the absolute lack of any indication

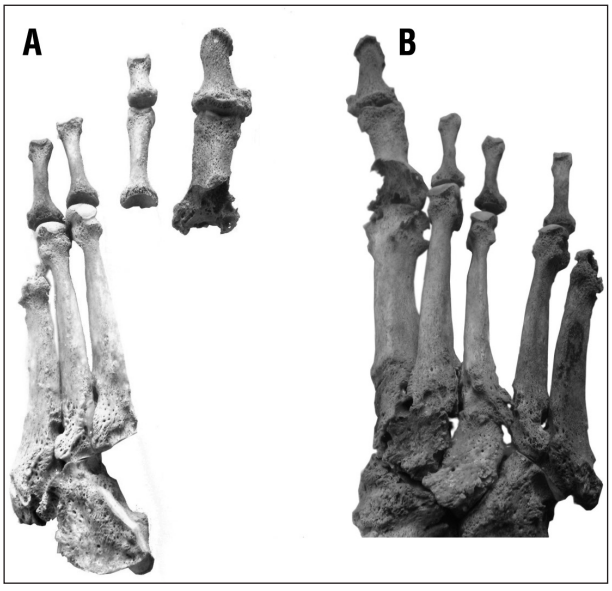

Figure 3. a) Metatarsals and some small phalanxes; b) Foot affected by cavitations on the epiphyses

of necrosis on the facial bones and on the bones of the hands. In fact, leprosy provokes the formation of the so-called "pencil" lesions, on the long bones of hands and feet. Bones appear increasingly streamlined and atrophic, up to the actual loss of fingers (especially in the feet).

f) It is a metabolism disorder (14, 15), characterized by five components which may occur in varying combinations: presence of high blood rate of uric acid (16); accumulation of monosodium urate crystals inside the articulations and in other tissues (tophus); intermittent acute attacks of arthritis due to the deposition of these crystals in the synovial liquid (17); renal alterations often associated with hypertension; formation of renal calculi of uric acid (18). Some halberd-shaped (or rounded) bone erosions, called geodes, are discernible on x-ray, after an extended period of latency (chronic gout), in addition to ineluctable joint mutilations.

Conclusions

We are therefore inclined to identify the pathology on the remains being studied as a case of gout, from the discussion above. This disorder causes an erosive and destructive arthropathy on the small feet bones. The age at death (modal value) of the individual was assessed to be over 60 years, and the type of burial in which he was found allows us to deduce that we are dealing with a character of well-off social conditions, this seems confirmed by the dental disease and paleonutritional analyses. A diet characterized by the use of non-coriaceous foods, rich in sugar foods, and by an elevate use of animal proteins emerged from the paleonutritional analyses.

The differential diagnosis allowed us to exclude the symptoms from other diseases, confirming that we are dealing with gout.

Gout comes from a genetic predisposition, and it is aggravated by a diet characterized by high consumption of meet and fat, this kind of diet being typical of the members of the richer social classes.

Moreover, the discovery of the skeleton in a marble sarcophagus inside a church (Saint Susanna, in Rome) with an interesting history (see above) precisely suggests that the individual was wealthy.

Figure 4. Rx-ray of the feet affected by the pathology. The arrows point out some of the most significant lesions.

References

1. Krautheimer K, Corbett S, Frankl W. Corpus basilicarum Christianarum Romae 4. Città del Vaticano; 1970.
2. Andaloro M.S. Susanna. Gli affreschi frammentari. In: Arena MS, Delogo P, Ricci M, Saguì L. Venditelli L. Roma dall'Antichità al Medioevo. Archeologia e Storia del Museo Nazionale Romano Crypta Balbi. Milano: Electa-Mondadori; 2001; 643-5.
3. Cecchelli MM. S. Susanna. Le indagini archeologiche. In: Arena MS, Delogo P, Ricci M, Saguì L, Venditelli L. Roma dall'Antichità al Medioevo. Archeologia e Storia del Museo Nazionale Romano Crypta Balbi. Milano: Electa-Mondadori; 2001; 641-3
4. Andaloro M. I dipinti murali depositati nel sarcofago dell'area di Santa Susanna a Roma. In: Russo E. 1983-1993: dieci anni di archeologia cristiana in Italia. Atti del VII Congresso Nazionale di Archeologia Cristiana, 1993. Università degli Studi di Cassino. Cassino: Edizioni dell'Università degli Studi di Cassino; 2003; 377-86.
5. Mallegni F, Lippi B. Analisi antropologica dello scheletro rinvenuto negli scavi della chiesa di S. Susanna,Vol. 2. In: Venditelli L, Paroli L. Roma dall'antichità al medioevo. Contesti Tardo Antichi e Altomedievali. Milano: Electa-Mondatori; 2004; 328-41.
6. Aufderheide AC, Rodriguez-Martin C. The Cambridge Encyclopedia of Human Paleopathology. Cambridge: University Press; 1988.

7. Roberts CA, Manchester K. The Archaeology of Disease. Ithaca, New York: Cornell University Press; 1995.
8. Walker A. The lag time between onset of symptoms and diagnosis of rheumatoid arthritis. Arthritis and rheumatism 1994; 37(6): 814-20.
9. Hellman DB. Arthritis and Musculoskeletal Disorders. In: Tierney L, McPhee S, Papadakis M. Current Medical Diagnosis and Treatment. Stamford: Appleton & Lange; 1999; 805-11.
10. Hammadi AI. Psoriatic Arthritis Overview of Psoriatic Arthritis MD, FRCPC. In: Diamond HS. Treatment of Skin Disease: Comprehensive Therapeutic Strategies; 2012.
11. Moskowitz RW, Katz D. Chondrocalcinosis and chondrocalsynovitis (pseudogut syndrome). The American Journal of Medicine 1967; 43(3): 332-4.
12. Rin F, Ciotti M. Specific Bacterial Immunotherapy in Treating Chronic Osteomyelitis. In: Malizos KN and Soucacos PN Ed., Infections of the Hand & Upper Limb. P.M.P. Paschalidis Med. Publications 2007; 24: 197-206.
13. Burdick AE, Hendi A, Elgart GW, Barquin L, Scollard DM. Hansen's disease in a patient with a history of sarcoidosis. International Journal of Leprosy and other Mycobacterial Diseases 2002; 68 (3): 301-11.
14. Richette P, Bardin T. Gout. The Lancet 2010; 375(9711): 318-28.
15. Neogi T. Gout. New England Journal of Medicine 2011; 364: 443-52.
16. German DC, Holmes EW. Hyperuricemia and gout. Medical Clinics of North America 1986; 70: 419-36.
17. VanItallie TB. Gout: epitome of painful arthritis,Vol. 59 supplement 1. Metabolism Clinical and Experimental 2010; 59(1): S32-S36.
18. Seegmiller JE, Grayzel AI, Rodney Howell R. The renal excretion of uric acid in gout. Jounal Clinical Investigation 1962; 5(41): 1094-8.

Correspondence:
Gaspare Baggieri
Museo delle Civiltà.
E-mail: gaspare.baggieri@beniculturali.it