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Disability and deformity in Early Medieval Milan: bioarchaeology and pathography of two cases from the Ad Martyres cemetery of the Basilica of Saint Ambrose

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Abstract

Disability and deformity in Early Medieval Milan

Started in 2018, the vertical excavation of the *Ad Martyres* cemetery at the Basilica of Saint Ambrose unearthed 307 tombs dated 1st-15th century. Bioarcheological studies are still underway at the Laboratory of Forensic Anthropology and Odontology (LABANOF) aiming to construct a biological profile and osteobiography for each individual. From the phases attributed to the Early Middle Ages, two individuals revealed signs of skeletal deformity: one was a woman of 50-

60 years with a severe idiopathic thoracic scoliosis buried in a brick box tomb; the other was an achondroplastic dwarf of 7-9 years. Both conditions probably led to serious and debilitating complications. Through a paleopathological, clinical, and historical multidisciplinary analysis, the present paper investigates the impact of these physical deformities on the daily life of the examined individual, discusses the potential disability they may have caused and explores how disability and deformity were experienced in the Early Middle Ages in Milan.

Keywords: Disability - Bioarchaeology - Paleopathology - Pathography

1. Deformity and disability in the past

Disability is defined as "the interaction between individuals with a health condition and personal and environmental factors" [1], meaning a corporeal or mind impairment that hinders or limits full social participation and interaction on an equal basis with others. As such, disability is not a personal attribute, restricted to a medical impairment, but results from attitudinal, physical, communication and financial barriers, which may be improved.

According to the World Health Organization, to this day, over 1 billion people (that is, about 15% of the world population) experience disability. This number is said to be rising because of demographic trends, namely population ageing, and chronic diseases increase. The World Health Organization goes so far as to estimate that almost everyone will experience some form of disability, whether temporary or permanent, in their lifetime[1].

Estimating the frequency of people living with disability in the past is particularly challenging, especially given that it is a cultural construction that depends on the understanding of the time of what constitutes health, impairment, and disability, as well as on what each linguistic term encompasses in historical texts. Despite these limitations, authors have suggested that frequency of disability in past societies, for both physical and mental impairments, may be assumed to be similar to what we observe today[2].

From historical sources, we know how people with disabilities were perceived in Antiquity. In fact, from the Law of the Twelve Tables of ancient Rome (5th century BC), in Plato's writings (the Republic, for example), in Homer's Iliad (for classical Greece), and throughout Antiquity, the physically disabled (that is, people with esthetic evidence of disability) were considered 'useless'. Physical impairment was seen as a sign of guilt, punished by the gods by tampering with the integrity of the body[3,4]. As a culprit, the human being with a disability at birth was to be eliminated by Law, while as an adult he or she was excluded from the community as noted in Plutarch's "Parallel Lives" and as already provided for in the "Leges Regiae" (8th century BC) and later codified in the "Laws of the Twelve Tables"[3]. Regarding the medieval age, and in particular the Early Middle Ages, disability studies are still very few [2,4,5,6,7]; thus, those that do exist must be considered a starting point and not a finish line of research, which must be enriched, discussed, and revised, especially

for the early medieval period. Given the paucity of historical analysis on the subject, it is important to not fall into the trap of a one-dimensional interpretation of the conception of disability in the past and consider the multifaceted and variable consideration that medieval society may have had of the physically disabled, which varied depending on the nature and extent of the disability. On this subject, Richard H. Godden wrote:

> *Disgust, pity, fear, love, charity, sympathy, suspicion - the encounter with disabled people in the Middle Ages provoked a range of emotional and social responses both from the nondisabled and from institutions that were sometimes tasked with distinguishing one group from the others. Charting and describing some of these responses can illuminate the often ambivalent and ambiguous space that the physically impaired occupied in medieval society* [8].

However, we definitely know that the advent of Christianity contributed to a certain change in the perception of people with disabilities compared to Antiquity, since the narrative of Christ's life and his miracles includes various people with physical impairment. In evangelical texts, these individuals are suffering souls imprisoned in a deformed cage (i.e., the body) because of their sins; hence, the son of God actually heals their souls by healing their bodies. People with disabilities are part of the broader category of the poor toward whom Christians exercise charity, useful in earning the salvation of the soul[9]. The healing of the body that Christ offers them is symbolic of the healing of their souls and of the remission of their sins whose horrific evidence lay in their physical impairment. Like the sick and the poor, persons with disabilities thus become spokesmen for the Gospel message and represent all humanity[4]. Christ's message is clear: pity, compassion, and help must be given to those afflicted by deformity that, nevertheless, remains emblematic of their sin.

In the Early Middle Ages[4], the elimination by Law of creatures born with physical impairment is no longer acted upon, yet the idea that the deformed body is a symptom of a sick soul remains. The needy become the instrument of the exercise of Christian charity. According to St Augustine, deformed or physically impaired persons were not to be rejected by their community as they embodied the divine will to offer believers living warnings and, at the same time, were objects of pity whose exemplary behavior would guarantee them liberation[10]. It is believed that from the 10th century onwards, the idea spread that those afflicted with bodily pains should be helped, becoming mediums on earth for the exercise of divine mercy. In the Christian collective conception, therefore, these people were transformed from 'useless' to 'needy and sick', particularly, according to historiography, from the 10th century with the birth of hospitals[7]. Monasteries, *xenodochia* and hospitals, as places of refuge, would have served to remove from view those who were different in body and could generate feelings of fear, hostility, revulsion. However, this removal from the community was also meant to protect them [7].

2. The necropolis Ad Martyres of the Basilica of Saint Ambrose

The Basilica of Saint Ambrose was constructed between 379 and 386 AD by decision of Ambrose himself, as he wanted to make it his place of burial. He chose a location outside of the city walls, adjacent to a Roman necropolis where Christians fallen during the roman persecutions were buried. It is said that, in this place, Ambrose himself found the bodies of two saints: Gervasius and Protasius. To honor the death of their parents, victims of the roman persecutions, Gervasius and Protasius donated all their goods to the less fortunate and dedicated their lives to prayer and helping those in need, until they were arrested, imprisoned, tortured, and decapitated (probably in the 3rd century AD). In their honor, Ambrose decided to name the new church "*Basilica Martyrum*". The presence of the martyrs, alongside the construction of the new basilica, favored the gathering of the faithful and the growth of the necropolis, who sought the protection granted by the proximity of burial to the relics, a phenomenon known as burials *ad Sanctos*[11,12].

The area occupied by the necropolis is located in front of the entrance to the basilica and extends over a surface of about 270 m^2. The archaeological site started in 2018 as an emergency excavation for the construction of the new urban metropolitan line. A total of 307 tombs were uncovered, 269 of which were inhumations and the remaining 38 were incinerations. Based on stratigraphic and cultural material analysis, these 307 graves could be subdivided into three major chronological phases: Roman (1st-5th century AD), Early Middle Ages (6th-10th century AD); Late Middle Ages (11th-15th century AD). Both woman and child discussed in this paper were recovered in the stratigraphic units dated to the early medieval phase. This phase counts a total of 98 burials, with variable orientations and a chaotic arrangement, showing a high utilization of the area. Among those 98 burials, the most common method of burial was the direct deposition of the bodies in earthen pits, both for adults and juveniles[13].

The tombs seem to be organized in groups, probably because of the dense utilization of the graveyard, unlike in the late medieval phase where they are displayed in rows. Regarding grave goods, objects are not always present, and when there are, it is generally a single and simple item, such as ceramics or individual coins. Based on the available evidence, and in particular the modesty of the burials and associated grave goods, this necropolis appears to have been populated by individuals of a common socioeconomic background[13].

3. Bioarchaeology of ancient remains and pathography

While historical texts constitute the main source of knowledge regarding the past, they are not the only one. Skeletal remains are sponges full of information gathered all throughout the life of an individual and by correctly examining them, they can reveal much about a person's life history. Bioarchaeology is the discipline that explores the lives of past peoples through the multidisciplinary scientific investigation of their

skeletal remains. This scientific study of human skeletons from archaeological or historical sites aims to reconstruct the general identity (or "biological profile") and life history (or "osteobiography") of past individuals, including sex, age-at-death, population affinity, stature, health, and trauma. Sex estimation is based on the interpretation of dimorphic features, including morphometric traits of the skull[14] and pelvis [15,16] on fused innominate bones, as well as postcranial metric traits[17] of mature individuals. Age-at-death estimation is performed based on skeletal growth and maturation in juvenile individuals, by looking at dental eruption[18], bone length[19] and epiphyseal fusion[20]; whereas in adult or mature individuals, it relies on the evaluation of the degree of degeneration of stable articulations, specifically the pubic symphysis[21], auricular surface[22,23] and acetabulum[24], and sternal end of the fourth rib[25], as well as radiological dental measurements to assess pulp/tooth ratio[26,27]. Stature is estimated based on the application of regression formulae to long bones measurements[28]. This information provides a biological profile of the individual, using a set of a set of criteria determinable from skeletal remains after death but describing the individual during life.

Paleopathology is the discipline that focuses on the study of diseases on human remains, including both pathology and traumatic injuries. The study of bone trauma aims to identify antemortem (i.e., occurring before death) and perimortem (i.e., occurring around the time of death) injuries to reconstruct traumatic events[29]. Pathological analyses repose on the observation and interpretation of bone abnormalities to understand disease burden at the individual and populational levels, as well as the evolution of diseases and medicine[30,31]. Bones are adaptative and their study can reveal events of biological and mechanical stress experienced throughout life, leading to a true "osteobiography" of the individual.

Skeletal remains thus offer us a direct testimony of past ways of life directly from the people who lived it. Contrary to most sources, these testimonies are not influenced by social, gender or cultural biases, but instead reflect the true diversity of past peoples. Corporeal sources do not pretend to substitute written ones; quite the opposite, they should be read in complement and confrontation to textual sources to reach a more thorough vision of the past.

After bioarchaeological and paleopathological analyses of the early medieval phase of the *Ad Martyres* necropolis, two skeletons in particular showed signs of skeletal deformity: skeleton TB 267 US 974, a woman with a severe scoliosis, and skeleton TB 178 US 616, a young achondroplastic dwarf.

4. The crooked old lady: a case of severe scoliosis

Skeleton TB 267 US 974 corresponds to a woman of 50-60 years about 156.59 ± 3.66 cm tall. The skeletal remains were almost complete but fragmented, with only a few ribs, hand and feet bones missing. Oriented in a South-North axis, this is one of the

few burials of the early medieval phase that was not a simple earthen pit; the woman, in fact, was found in a box tomb made of tiles and bricks[13] (Fig.1).

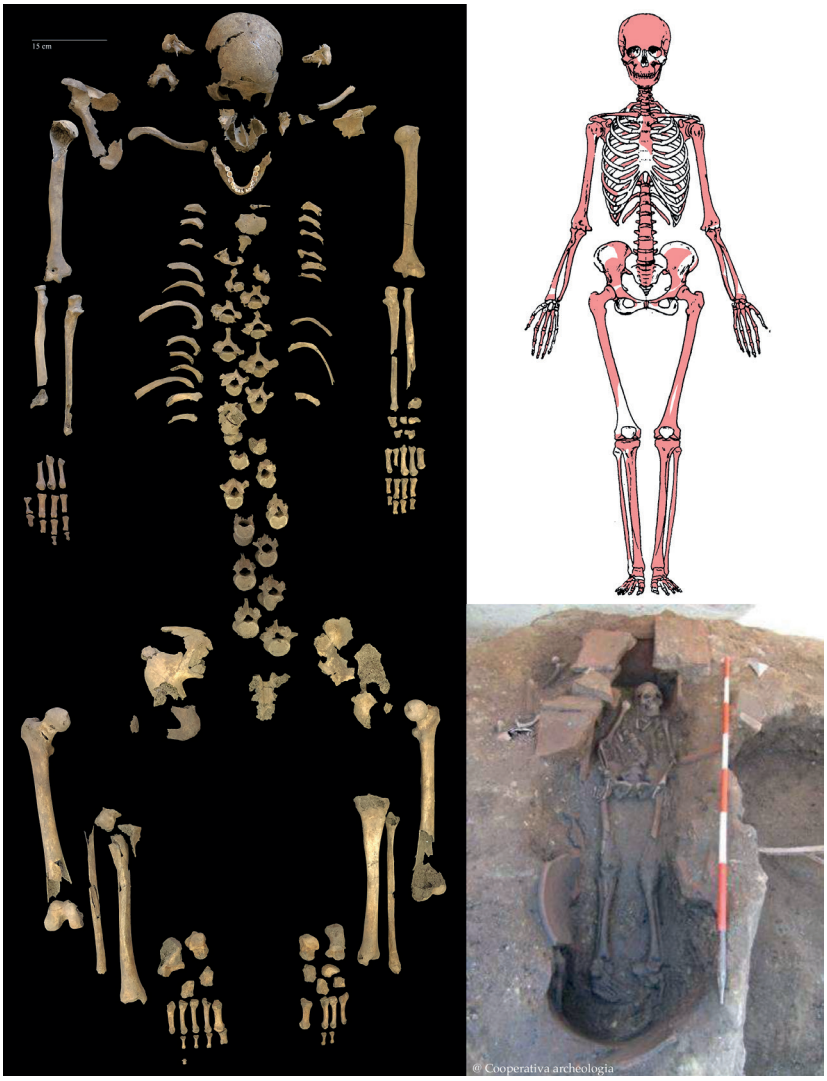

Fig. 1. Skeleton TB 267 US 974 (left: photograph of the skeletal remains; top right: skeletal preservation - colored bones are present; bottom right: photograph of the tomb)

Paleopathological macroscopic analysis revealed the fusion of three contiguous vertebrae, the fourth, fifth and sixth thoracic vertebrae (T4-T5-T6) through bony bridging at the antero-lateral left portion of the vertebral body. At this level, the vertebrae showed lateral wedging and the space left to the intervertebral disks was minimal to non-existent. In addition, an inferior angulation and torsion towards the left on

the sagittal axis of the vertebrae was also noted (Fig. 2). The corresponding ribs appeared sturdier than the others and showed osteophytes and porosity on the head and tubercles[32]. The cervical, thoracic, and lumbar vertebrae also showed osteophytes and porosity, in particular on the right articular facets, and Schmorl's nodes (i.e., negative impressions of herniated disks) were noted on T6, T9 and T11. By reconstructing a longer segment of the thoracic spine through the anatomical connection of the contiguous superior and inferior vertebrae, this angulation and torsion was confirmed, showing a true deformity of the spine: the vertebrae inferior to T6 were oriented on the median plane, whereas superior to T4, the spine presented a lateral progression, rotating towards a transverse plane (Fig. 2). Such deformity is consistent with a scoliosis. The articular changes on the ribs and vertebrae, Schmorl's nodes and morphological alteration of the costal bodies may be read as signs of secondary osteoarthrosis and compensation for the stress caused by the lateral bending of the spine.

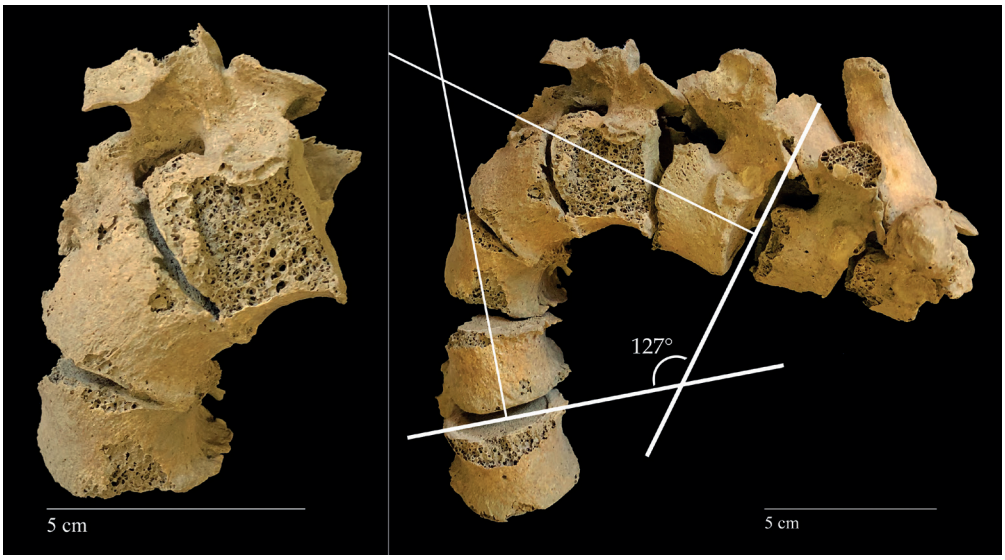

Fig. 2. Scoliosis of the thoracic spine (left: anterior view of vertebrae T4-T5-T6; center: anterior view of the thoracic spine T1 through T8; right: plain radiograph of C7 through T6, showing no evident sign of fracture)

Scoliosis (from the Greek σκολίωσις or "skoliosis" meaning curvature) is an abnormal lateral curvature of the spine characterized by the rotation of the vertebrae and spinous processes towards the concave apex of the curvature. In the concavity that is formed by the lateral angulation of the spine, several features may be noted: the ribs are sequentially closer together, the lateral sides of the vertebral bodies are wedged, the pedicles and laminae are thinner and shorter, the horizontal torsion of the vertebral bodies lead to a deviation from the midsagittal plane and the disc space are short-

ened[33]. Therefore, scoliosis is a complex structural deformity of the spine observable on all three spatial planes: on the coronal (or frontal) plane, a lateral bending; on the sagittal (or longitudinal) plane, an alteration of the orientation of the curves of the spine; and on the transverse (or axial) plane, a rotation of the vertebrae[30,32]. Although it may be secondary to a vertebral malformation (referred to as "congenital scoliosis"), an underlying condition or a trauma, it is most commonly idiopathic, though a hereditary component may play a role[33].

Measured to quantify the degree of curvature of the spine, and thus the severity of the spinal deformity, the Cobb angle [34] at the thoracic segment was of 127°. A Cobb angle of over 10° is a diagnostic feature of scoliosis; over 45°, the scoliosis is considered "severe". In the present case, the angle was almost three times over the "severe" threshold. Based on the known linear progression of the condition[35] and the severity of the deformation, the woman most likely developed the condition much earlier and, over the years, the situation slowly worsened. Because of the strain created by the curvature, secondary osteoarthrosis developed. Furthermore, the curvature of the spine created a reduction of stature of an estimated 14.055 cm based on Stokes' formula[36], leading to an actual height of 142.53 ± 3.66 cm.

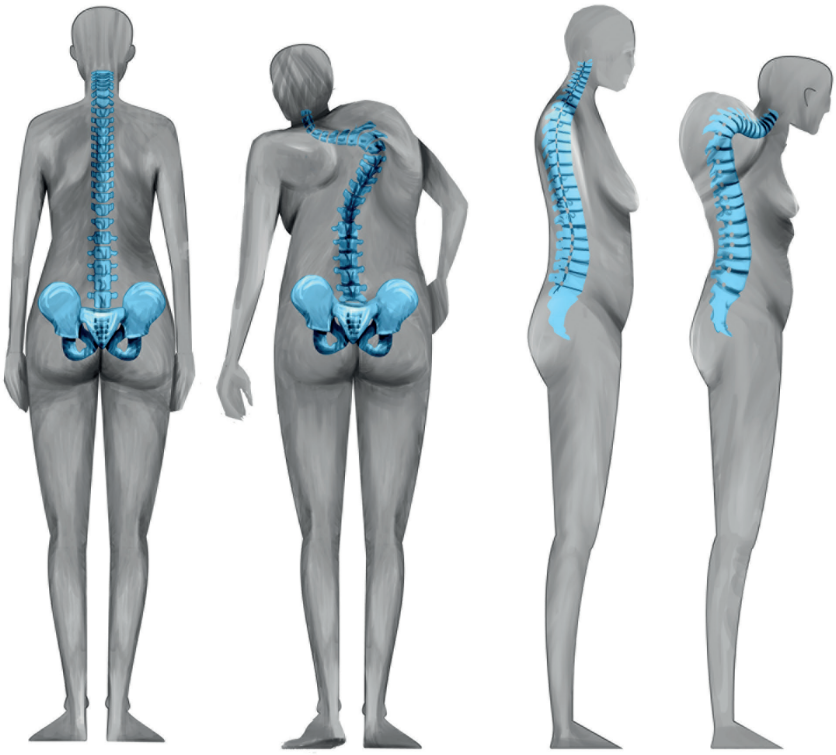

Fig. 3. Representation of the physical deformity of the woman TB 267 US 974 and confrontation with a healthy individual (on the left, posterior view; on the right, lateral view)

Although generally scoliosis does not significantly affect everyday life, patients with high thoracic curves and a high Cobb angle have elevated risks of respiratory and cardiovascular complications. Because of the deep deformation of the spine and thoracic cage (Fig. 3), the capacity of expansion of the chest is reduced, rendering breathing significantly more difficult and potentially causing long-term restrictive lung defects. Airway obstructions may also occur due to the displacement or rotation of the trachea. The decrease in the diameter of the chest and the consequent displacement of internal organs can lead to a displacement and/or compression of the heart and prevent its correct function, hindering the increase in the systolic output necessary to the body during conditions requiring metabolic effort, such as physical exercise or work[37,38]. Severe scoliosis is generally associated with significant alterations in the breathing pattern at rest, during exercise and during sleep, with a respiratory rate higher than normal which, however, corresponds to a reduced lung volume, thus leading to shortness of breath and muscle fatigue of the lungs, which may be accompanied by breathing disorders[37,38]. Scoliosis, especially in cases with wide thoracic curves, is also associated with back pain[39], inability to sustain daily job activities[40], and higher mortality rates[41]. It is therefore likely that the woman experienced breathing difficulties as well as chronic and acute back pain that further limited her movements and the ability to participate in everyday social life. Given these difficulties, it is possible that the woman received some accommodation from her community, potentially through economic and/or physical support. This need for accommodation must have grown over time given the slow progress of the condition. However, the woman had managed to survive up to 50-60 years, reaching the oldest age group of the necropolis, which shows resilience, strong health in spite of her condition and its complications, and argues in favor of her having received assistance from her community. Her burial was also exceptional, with a box made of tiles and bricks, demonstrating economic ability in her low socioeconomic community, care, and acceptance from her community despite her disability.

This case constitutes evidence of the attitude of inclusion, care, acceptance and, most probably, respect reserved for a person with an obvious deformity, even though she could not perform the same actions and tasks as other of her contemporaries (e.g., domestic care, craftwork, etc.).

5. An 8-year-old dwarf: standing on the shoulders of giants

Skeleton TB 178 US 616 was a child of 7-9 years. The bones were well-preserved, and the skeletal remains were almost complete, with only a few bones of the hands and feet missing. Because of the unreliability of sex estimation methods in juvenile individuals, rendered even more so in this pathological case, sex estimation could not be performed. The juvenile was found in a simple burial, an earthen pit, oriented in a Northeast-Southwest axis, laying in a supine position with the superior limbs folded over the abdomen[13] (Fig. 4).

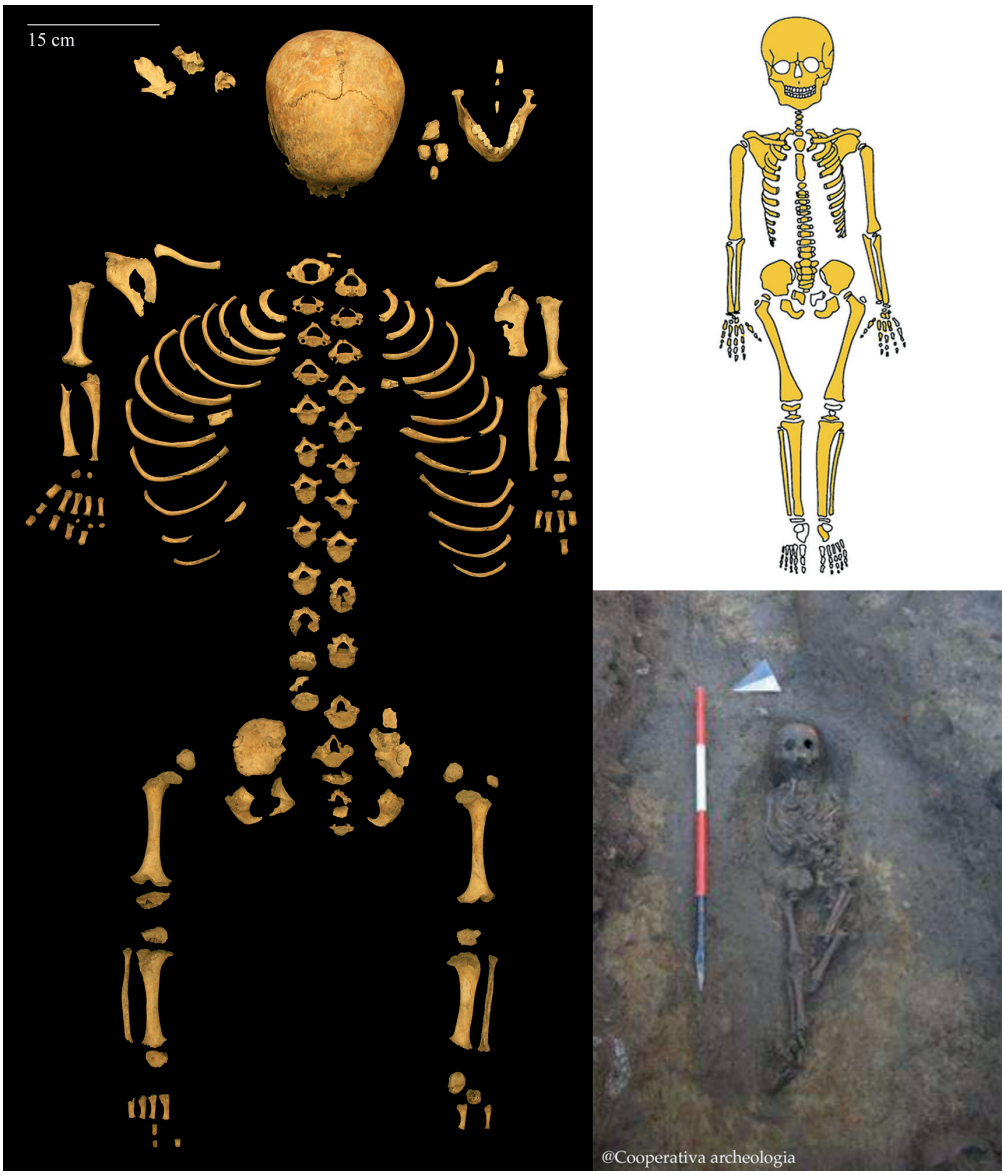

Fig. 4. Skeleton TB 178 US 616 (left: photograph of the skeletal remains; top right: skeletal preservation – colored bones are present; bottom right: photograph of the tomb)

Upon macroscopic observation, the skull appeared disproportionately larger than the rest of the body and presented a depressed midfacial area. In addition, the appendicular skeleton was much shorter than the axial skeleton. The skeletal elements are present but shorter than normal by varying degrees (Fig. 5 and 6). In fact, by comparison with a cohort of the same age group and originating from the same phase (Early Middle Ages) of the *Ad Martyres* necropolis, the length of the long bones of

the achondroplastic child are significantly shorter (Table 1). This skeletal dysplasia is characteristic of achondroplasia, a disproportionate dwarfism.

Tab. 1. Comparison of the mean of bone length between the achondroplastic child TB 178 US 616 and a cohort of individuals of the same age from the *Ad Martyres* necropolis

Long bones	Mean length of long bones of TB 178 US 616 (mm)	Mean length of long bones of individuals without achondroplasia (mm)*	Two samples t-test *p*-value (significant values ≤0.05 in bold)
Humerus	97.5	193.3	**0.001208**
Radius	85	138	**0.04155**
Ulna	99	152.125	**0.0001881**
Femur	134	269.5	**0.004069**
Tibia	110	208.5	**0.03913**
Fibula	114	207	not enough observations

* mean values obtained from four individuals of the same age group (7-9 years) and chronological phase of the *Ad Martyres* necropolis as TB 178 US 616

Achondroplasia is a genetic cartilage disorder, with an incidence rate between 1 in 10,000 and 1 in 30,000 births[42]. To date, the condition affects over 250,000 people worldwide[42]. The disorder is due to a mutation of the FGFR3 (Fibroblast Growth Factor Receptor 3) gene (hereditary in 20% cases, and a *de novo* mutation in 80% of cases), which inhibits cartilage growth proliferation thereby limiting the normal process of endochondral ossification that leads to full bone maturation[43]. As a result, the bones with the quickest growth and few number of growth plates are most severely shortened. The long bones, and in particular the femur and humerus, as fast-growing bones with only two growth plates, are more severely affected than the spine, because of its many centers of ossification and growth plates[30].

The young dwarf presented a thinning of the anterior vertebral bodies of T12, L2 and L3, causing an anterior curvature of the spine. This is consistent with clinical studies, as kyphosis of the thoracic-lumbar spine is typical of achondroplasia. Either present at birth or developing within the first four months of life, this spinal deformation may resolve as the individual ages[42,44].

The head, as mentioned, is disproportionately large compared to the rest of the body, while the cranio-cervical junction is smaller than normal: this can contribute to an increase in venous pressure, due to the narrowing of the jugular foramen, and lead to the development of hydrocephaly and compression of the cervical cord[42]. In fact, foramen magnum stenosis is responsible for 2-5% of deaths in infants with achondroplasia[45]. Due to the underdevelopment of the mid-facial area, the Eustachian tubes and pharynx are reduced in size, making the normal-sized tonsils and adenoids too large for the available space: this favors the onset of recurrent infections and otitis (occurring

Fig. 5. Shortening of the upper (top image) and lower (bottom image) limb bones by comparison with an individual of normal height of the same age (on each image, the bones on the top belonged to an individual without achondroplasia of the same age TB 281 US 1037, on the bottom, the bones of skeleton TB 178 US 616)

in about 90% of cases), which may lead to early hearing loss [42], and affect language development[45], as well as breathing difficulties (over 50% of children affected by the disease experience snoring and apnea, both day and night) [46].

Intelligence is not affected by the disorder, but during the first two years of life, the so-called "milestones" of development are delayed due to neuromuscular hypotonia[47]: if a child can typically walk by 12-16 months, an achondroplastic child takes an average of 17 months[45]. Due to reduced mobility of the upper limbs and muscle weakness, at mid-childhood, achondroplastic children experience the greatest difficulty in personal care, often requiring assistance with clothing and personal hygiene[46]. Overall, physical activities are limited and people with achondroplasia experience difficulties in walking long distances or running, seating for long periods of time, climbing and descending stairs, and reaching for objects; these physical limitations, accompanied by pain, can lead to a loss of independence even in adults[48,49].

Today, life-expectancy in achondroplastic individuals appears rather similar to that of the population with normal stature, although a discrepancy of at least 10 years of life (shorter in affected individuals) exists[50]. This may be explained by the greater risk of cardiovascular and neurological complications in individuals with achondroplasia[46,51]. In addition, the risk of sudden death under the age of 5 is almost 50 times higher than that of the general population[46].

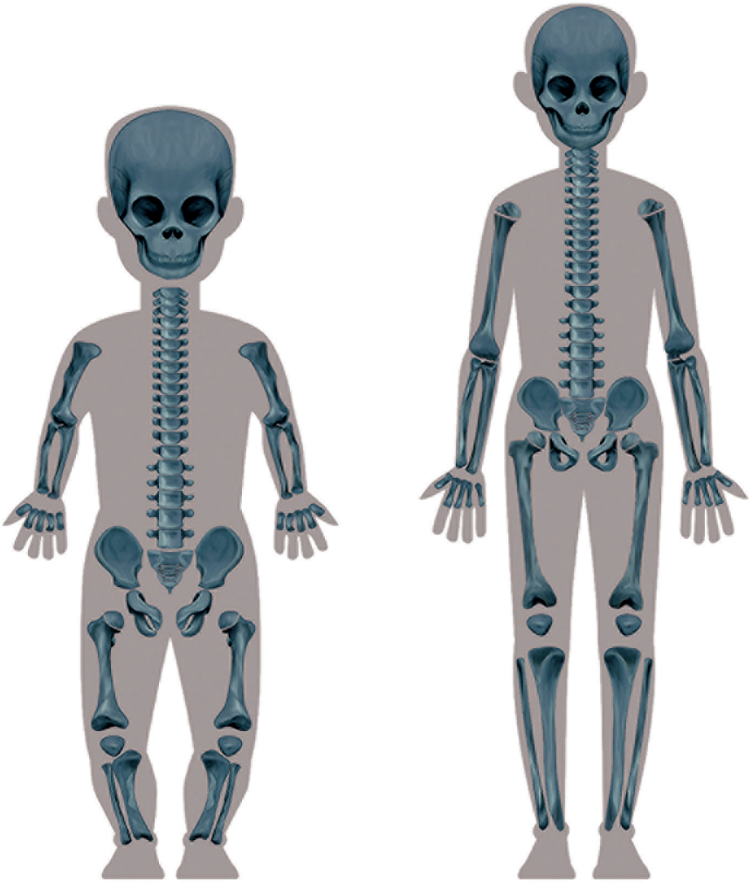

Fig. 6. Representation of individual TB 178 US 616 (on the left) and comparison with an individual of the same age without achondroplasia.

Consequently, the child of tomb 178 was most likely cared for by someone, probably from his own family. Like any child, he must have required help to sustain his physiological needs and allow him to survive to the age of 7-9 years old (i.e., food, drink, shelter, protection). Unlike the other children of his age, who were probably more independent, he must have required more attention and care. It may be hypothesized that he experienced difficulty in integrating fully within his own community, and in particular with the other children of his age, first because of his outward appearance, which could have been perceived as "different" and second because of his neuromotor difficulties, limiting his participation to activities along with other children his own age (for attitudes toward people with stature considered below normal in the 6th century, see Paul Deacon, *Historia Langobardorum*[52]. However, the individual subject of this study managed to survive and overcome the most critical years of his condition, indicating that he must have been cared for and assisted. Moreover, his type of burial is no different from that of the others of the necropolis and in no particular location,

showing that he was ultimately accepted by his community and treated equally in death, which, as we know, is a good proxy to understand social consideration in life. The material evidence from this case can serve to extend to the Early Middle Ages what has already been observed historically for both Antiquity and the Renaissance. Compared to other people with physical impairment, those with dwarfism enjoy a consideration that is quite different. For the Egyptians, they are the object of worship, considered as deities, like the god Bes, god of, among other things, fertility, childbirth, sleep and music[53]. In the city of Rome, dwarfs were a symbol of status; they were in demand as companions ever since ever since the emperor Augustus who owned a dwarf as a good luck charm; Tiberius had a dwarf advisor; Constantine a dwarf singer and musician; the cost of a dwarf was extremely high, as it was considered a luxury, indeed, and a symbol of social distinction[3]. Even the women of the aristocracy flaunted them, so much so that they created artificially dwarfed people by enclosing children in boxes[3,4]. Some scholars have argued that the consideration of dwarfs changed during the Early Middle Ages, only to reappear in a similar way from the 13th century onwards[3,4,54]. Dwarves have not been sufficiently studied for the 6th-10th centuries to be able to claim that they enjoyed a positive consideration – magical, divine, but also spectacular and comic – even if negative attitudes are not lacking[54], but this consideration was significant enough that they are also represented in a courtly context in the *Tapisserie de Bayeux*[54]: perhaps, since Antiquity, people's consideration of them had not changed. Instead, it is quite likely that they were included in communities, even and perhaps especially in high-level contexts such as courts, from the Early Middle Ages to the Renaissance. The skeleton 178 found in Milan could be an indication of an attitude of inclusion towards dwarves, even in childhood, that ran through the whole of society, given the longevity of the subject analysed in this study even though he came from a low socio-economic context.

6. Conclusion

In the present paper, two skeletons from the *Ad Martyres* cemetery of the Basilica of Saint Ambrose in Milan and dated to the Early Middle Ages were the subject of an in-depth bioarchaeological and paleopathological analysis. One belonged to an elderly woman with a severe idiopathic thoracic scoliosis. Given the severity of her spinal deformation, she probably experienced breathing difficulties and back pain limiting her movements. She was buried in a brick box, contrasting with most of her contemporaries. This, in addition to her advanced age and clinical complications impacting her daily life suggest an economic ability in her low socioeconomic group as well as care and acceptance from her community despite her disability. The other skeleton was an achondroplastic dwarf aged 7-9 years. His young age and his survival of the most critical years of his condition indicate that he may have been cared for, potentially by a relative. His common burial among the other members of his commu-

nity suggests that he was accepted by his community despite his physical difference. This archeological, anthropological, paleopathological and historical interdisciplinary analysis permitted to better understand and reconstruct the life experience of these two individuals from the Early Middle Ages with disability and demonstrate how interdisciplinary investigations can ultimately improve our knowledge of the past and of the history of medicine.

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