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Bones

Orthopaedic Pathologies in Roman Imperial Age

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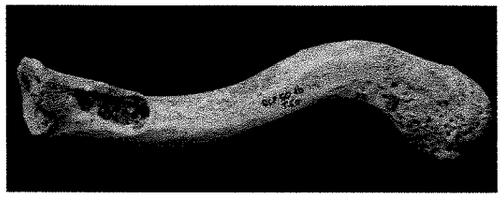


Fig. 1.9 Erosion at the insertion of the costo-clavicular ligament (Grave 60 Quarto Cappello del Prete)

been recorded as "ND" (that stands for:. not detected). For the discrete markers, the presence/absence of traumas, fractures and arthropathies has been detected; for fractures and arthropathies also the site has been evaluated, recording the cases of politraumas.

1.2 History of Medicine in Rome

Valentina Gazzaniga and Silvia Marinozzi

Ancient Rome is, for the historian of medicine, an extremely rich reality due to the theoretical development, the available and highly intellectual, methodological and technical written sources, and the rich evidence provided by the archaeological findings and remains [53].

The chronological period, the anthropological and palaeopathological study dwells on in this book is one of the most representative of the whole ancient times: in Rome, a rich Italics heritage of herbal and therapeutic competence faces the medical knowledge acquired in Greece since the classical times, rising increasingly complex pharmacological theories, whose peak is Galen of Pergamon's "grades theory" but also the flourishing of encyclopaedic essays and manuals addressed to a wide and less refined public [55].

The worship of thaumaturgic gods, which only changes the name to the really wide number of Greek gods somehow involved in the treatment and in the promise of healing, is not only stifled by the importation of the rational medicine from Hippocrates, but, in a syncretistic way, it is enriched by the contributions from the Etruscan civilization first and then from the oriental esoteric religions; the survival of templar medical practices, which can be wholly superposable to the pre-classical and classical Greek ones, is well documented by Ovid's poetical tale on the importation of the worship of Asclepius and, in more recent ages and in a geographical and cultural Greek background, by the rhetorician Aelius Aristides' autobiographical *Sacred tales*, which tells his experience in healing.

As regards the rational medicine, the physicians claiming a medical training regularly gained in famous schools and teachers, have already learnt the lessons of the Hippocratic medicine suggesting a reworking which comes to an amazing complex degree (one of the most striking examples are Galen of Pergamon's writings) [54].

The heritage of the Alexandrian medicine, whose history is halfway the third century B.C. in a very short-term and extremely important period, is seen in Rome with a meaningfully increased anatomical awareness compared to the Greek experience: the human body, which was conceptualized as a hollow vessel intended to hold fluids in almost all the Hippocratic writings, is seen as an elaborate system of parts interacting to each other in the innovative Galenic medicine, completely able to exploit the Alexandrian Herophilus' and Erasistratus' medical experience on dissection and autopsy. Every part of the body has got its own function, which leads to health if successfully achieved; the change in the anatomical structure involves an impairment and so a disease [55].

The medical sects question the method as well as the epistemological nature of medicine [56]; the Empire opens up to imported cultural phenomena and faces with experiences, the therapeutic ones too, from the conquered countries and from the ones with an active trade, leading to wonderful opportunities of theoretical and practical enrichment particularly seen in pharmacopoeial works, as the *Compositiones*, dated around 47–48 A.D. and written by Scribonius Largus, a physician operating under emperor Claudius. In these works new substances of vegetable, animal and, in small percentage, mineral origin, spread by the maritime trade, meet the earliest pharmacological expertise, raising a really varied pharmacopoeia, where features of folk medicine merge, as well as the scientific ones. [57]

Moreover, in their preface letter sent to Callistus, Scribonius' *Compositiones* are an example of how the Roman medicine achieves original results as regards the moral and ethic thought; the suggestion to judge every patient equal and worth of treatment, even the enemies of the homeland, enriches a moral "inner" tradition coming from the Hippocratic Oath with new elements [58].

So, a very rich "medical marketplace" [59], characterized by different professional competences and by a progressive refinement of the medical knowledge comparing to the Greek origin, practised together by physicians from the Hippocratic tradition, traditional healers, specialist surgeons, obstetricians, priests of Asclepius and Gods and heroes skilled in the art of medicine, military doctors and slaves.

Consulting the several available historical sources, Roman Imperial medicine looks like a field of knowledge deeply related to the civil and social life, a field where different expectations and waitings join with an increasingly rising market demand [60]. The geographical borders expansion with the high variability of the socio-economic status of the inhabitants of the Empire, also followed by the change of the risk factors, of the onset conditions and spread of infectious diseases, in a word of the whole pathological background (called "pathocenosis" by Mirko D. Grmek, who coined a highly important neologism for the future study of the ancient Greek–Roman diseases) makes the Roman world a privileged place to investigate on the sanitary ancient history.

This work has favoured some of the available sources, because of their connection to the history of the treatment of orthopaedic injuries and trauma: first of all, the Hippocratic treatises, which directly or indirectly regard the healing of fractured and dislocated limbs, head trauma and wound's general treatment. As well-known, these works are not entirely attributable to the Kos master, although some of them were by the earlier reviewers, in particular Erotian, who lived under Nero, and author of a *Lexicon*, one of the first work trying to sort out the complex issue regarding the attribution of the works passed on under the name of Hippocrates. All these writings, however, share a rather early dating (end of the fifth – beginning of the fourth century A.D.) in unison with Hippocrates' real life span and are the basis of the "technical" reflection on a Roman "specialized" orthopaedic competence. In particular, operating from the medical and encyclopaedic point of view, Galen and Celsus regard them the starting point to process again bone, skeleton and limbs technology and intervention.

Celsus (1st cent. A.D.), as well known, has not got a medical background, but he is a highly brilliant data collector showing the best example of technical refinement ever reached in the Roman encyclopaedic field in his work *De Medicina*; in his survived book on surgery many pages regard the orthopaedic techniques and the description of the tools used for the treatment of bone injuries in Rome during the first Empire [61] .

Galen (130–200/210) is the well-known intellectual giant of medicine in antiquity; a versatile, very lucky and rich man, Marcus Aurelius' doctor first and then his son Commodus', he spends almost his whole life in Rome being on duty of the higher social classes. During his long Roman years, Galen collects books and makes up one of the most important medical library in the ancient times (destroyed by the Temple of Peace fire in 192 A.D. it was rebuilt by Galen himself, book by book, buying again what could be found on the market and writing "ex novo" his own works, when he didn't manage to find a copy among friends and acquaintances). His work, which survived almost entirely through the Syriac and Arabic translations, includes several essays on the treatment of fracture and dislocation, the instruments and technique [62].

The available written sources are very rich. We can also add the support of the material history, thanks to archaeology [63]: the healing temples, consecrated to Asclepius and to a huge number of principal and secondary deities, all involved in disease healing, which carry on their task during the Empire, a task confirmed by the richness of anatomical ex voto (Fig. 1.10a–c), a wide field of documents on diseases and deformity affecting the Romans and the Empire inhabitants, although unable to

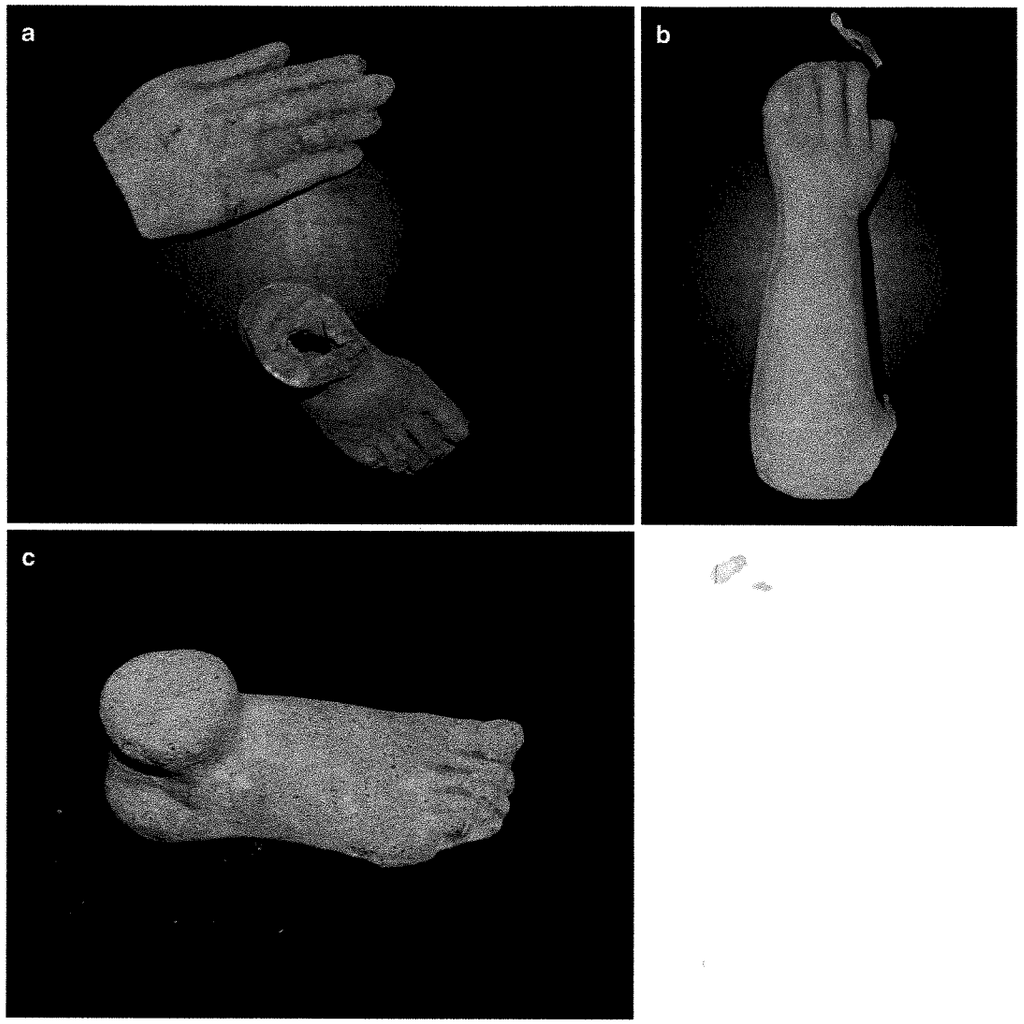


Fig. 1.10 (**a**) Roman ex-voto: hand and foot, ca. I-II. Cent. A.D. (Museo di Storia della Medicina, "Sapienza" Università di Roma). (**b**) Roman ex-voto: harm, ca. I-II. Cent. A.D. (Museo di Storia della Medicina, "Sapienza" Università di Roma). (**c**) Roman ex-voto: foot, ca. I-II. Cent. A.D. (Museo di Storia della Medicina, "Sapienza" Università di Roma)

originally repeat the typologies already documented by the Greek and Etruscan clay production in forms and genres [64]; the treatment centres for slaves and soldiers (above all established at the borders of the Empire, the valetudinarian are complex buildings where wounded soldiers are admitted and where a military competence is practised, also extended to the orthopaedic treatments) [65]. We can add some most singular events: the ruins of private surgeries, as the Surgeon's House in Rimini, a second century A.D. building, where the Hellenic physician Eutyches lived and worked. When his house was destroyed by a fire, maybe in the third century after a barbarian raid, he left one of the richest surgical legacy of the ancient times; a hundred and fifty tools, of different material and dating, testifying their owner's high specialized level, and, maybe, the "military" origin of his medical knowledge [66].

Epigraphy helps to recreate the profile of the physicians working around the Empire, testifying the wandering features of the medical profession practised till the end of the Empire, excepting some cases concerning very famous physicians, settled for long periods in the same town. As regards, a slight difference between the practice of the Roman medical knowledge and its wandering organizational features in the Greek world, is the really wide dimension of the territories where doctors practice and the different cultures they meet: often coming from the eastern and Greek lands, not rare sepulchral statements testify their profession at the opposite edges of the great Empire.

A last notation goes to the "specialisms", characterizing the Roman medicine, unlike the classical Greek; the work of orthopaedists, eye specialists, doctors caring the women reproductive period and the first stages of the human life, surgeons of great technical competence, experts in difficult operations as trepanation, is documented by the equipment, by specific written works, as the case of Soranus of Ephesus' book on women diseases, and by important palaeopathological evidence [67]. In particular, a highly valuable example is the so-called Child of Fidene's skeleton (Fig. 1.11), belonging to the Soprintendenza Speciale per il Colosseo, il Museo Nazionale Romano e l'Area Archeologica di Roma and preserved in the Museum of the History of Medicine at the Sapienza-University of Rome. The outcomes of his trepanation testify a surgery performed only to relieve the pain caused by a cerebral tumour in a very young person, according to the technique described by Galen [68].

In the last years many valuable studies have regarded the different features of the intellectual and professional landscape of the art of medicine in Rome we have given a hint of; to mention the most meaningful contributions, the writings of V. Nutton, R. Jackson, D. Gourevitch, J. M. André, V. Boudon-Millot, V. Dasen, H. King, A. E. Hanson, M. Green, A. Krug, J. Scarborough, Ph. van der Eijke, L. Bliquez, I. Mazzini, S. Fortuna, S. Sconocchia, Ph. Mudry, F. Stok and A. Touwaide [69].

The study of these authors have demonstrated that the art of medicine in Rome is more than a simple reflection on the cultural background acquired from the classical Greece [70]; the new ideas, the outlook changes, the technological and methodological innovation make the Roman medicine a peculiar and highly complex competence, able to set again the "long terms" of its theoretical base unit adapting them to the sanitary and social needs of a very wide population, characterized by deep habits and customs differences.

Fig. 1.11 The child of Fidene, imperial age (Soprintendenza Speciale per il Colosseo, il Museo Nazionale Romano e l'Area Archeologica di Roma, at Museo di Storia della Medicina, "Sapienza" Università di Roma)

1.2.1 Orthopaedics, An Ancient "Specialty"?

Valentina Gazzaniga and Silvia Marinozzi

Generally speaking, ancient medicine is a non-specialized discipline. Hippocratic texts founding later medical rational tradition describe the image of a physician able to face fevers, cuts and traumas equally. Within this picture of generic medical competence, the surgical treatment of skin and skeletal lesions certainly fell into the category of the most successfully treatable medical practices [71]; in ancient times, traumatic lesions of varying origin must have been particularly frequent, due to wars, and accidental or occupational hazards (the type of lesions that wrestlers, gladiators or slaves employed for building or mining must have suffered): an empirical competence of their treatment had to be shared by the various health care "professionals". Hippocratic physicians, surgeons, medical practitioners and 'rhizotomoi' often dealt with traumas, assessed their outcome and gauged their potential complications from different perspectives, it being a chronic inflammation, a gangrene or an invalidating outcome [72] (Fig. 1.12a–c).

It is not surprising that in ancient Rome the competence of doctors who treated walking defects and limb problems in general rises to the level of specialistic discipline, capable of implementing some more practical features already belonging to the Greek Hippocratic medicine; the books of the *Corpus Hippocraticum* for general surgery and for the treatment of fractures and dislocations already had them, together with other scientific technical topics, such as obstetrics and pharmacology. Once again, it is not surprising

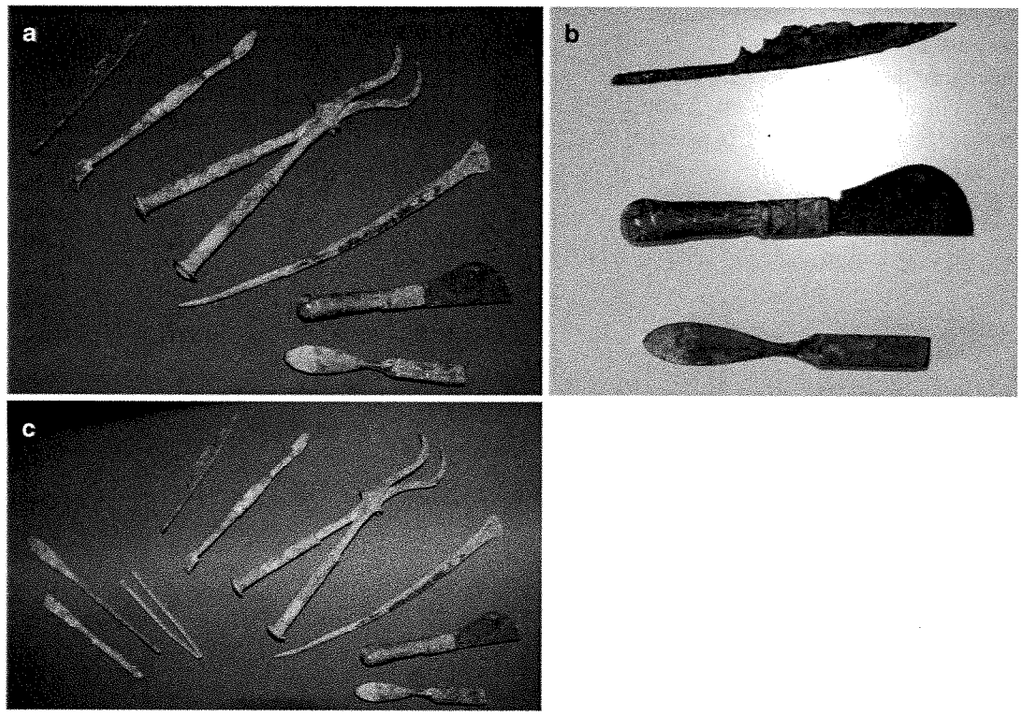


Fig. 1.12 (**a**) Roman surgical instruments, Imperial age (Museo di Storia della Medicina, "Sapienza" Università di Roma). (**b**) Roman surgical instruments, Imperial age (Museo di Storia della Medicina, "Sapienza" Università di Roma). (**c**) Roman surgical instruments, Imperial age (Museo di Storia della Medicina, "Sapienza" Università di Roma)

that orthopaedic competence has a high level of specialization in ancient Rome [73]; here, the highly educated Greek tradition (as transmitted by the Alexandrian sources) joins the empiric trait of the Italic and Roman tradition in a perfect balance.

1.2.2 "Noble" Origins

The theoretical lineage from the Greek Hippocratic knowledge is represented by the constant reference by Roman authors such as Celsus and Galen to a group of works belonging to the "Corpus"; these works document a rather high anatomical and osteologic competence: the essay "The Nature of Bones", which despite its title is a book on angiology, does contain a chapter on bones; the essays "Fractures and Joints", written by the same author between the end of the V and the beginning of the fourth century B.C. include directives on the treatment of arm and leg fractures, the reduction and treatment of dislocations of elbow and knee (Fig. 1.13), humerus and shoulder, collarbone, hip and fingers and correction techniques for backbone deviations; the essay "Mochlikos", already attributed to Hippocrates by Erotian, takes its name from the lever instrument used in the


COMMENT. II. 171

Non modò minùs moleſta ſunt, quàm quæ in primâ palmæ parte, ſed multò magis, quàm quæ in pede. Sed quoniam de pede & manu communiter tractauit, ideò abundè exiſtimat alterius partis duntaxat meminiſſe, quæ, quod ad moleſtiam pertinet, media eſt inter crus & pedem. quàto enim maiorē moleſtiam affert, quàm crus, tanto minorem, quàm pes, & præcipuè quàm calx, de quo paulo ſuprà egit.

NAm vel rotæ modiolū defigere oportet, vel aliud quid ſimile: tum molli aliquâ re pedem obuoluere, bubuliſque loris latis circumligare, & eorum capita, vel ad piſtillum, vel ad aliud lignum deuincire, eiuſque imam partem, in modiolum demittere, ſummam recuruare: alios verò & ab humeri capite, & à poplite in contrariam partem extendere.

A Rotæ modiolus.
B Lorum latum.
C Piſtillum.
D Ab humeri capite extendentes.
E A poplite extendentes.

Lignum defigi iubet, quod recipere poſſit imam partem vectis, per quem membrum debet ab inferiori parte extendi. tibi verò ignotum eſſe non credo, rotæ modiolum ἀπὸ μετωνυμίας ab Ionibus appellari. cùm apud poëtam hoc quoque vocabulum legatur. Commonet autem Hippocrates, vt vbique ex iis, quæ ad curationem conducunt, illis vtamur, quæ in promptu ſunt: & nunc etiam meminit modioli rotæ, qui præſto nobis eſſe poteſt vbiuis gentium: ſimiliter piſtillo pro vecte nunc ad extendendum vtitur. Sed quâ viâ adhiberi hæc debeant, ipſe ſuis verbis, ſi animaduertantur, apertè declarauit.

SEd à ſuperiori quoque parte adhibere vim licet.

Vim, hoc eſt, valentem in vtramque partem intentionem ἀνάπαλιν appellauit, vt vehementem eius potentiam indicaret.

Fig. 1.13 Repairing dislocated knee from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544 (Wellcome Library)

reduction of fractures and dislocations; the essay *Head Injuries*, dating between the end of the V and the beginning of the fourth century, is a very technical text giving indications on the correct clinical approach towards a patient with head injury, who may need both specific diagnostic techniques, and specialized skills in the use of drilling tools. These essays all address a type of treatment which would be nowadays defined as "orthopaedic", and extracts from other works can also be added to them, for example "The doctor's workshop", with the description of mechanical tools for the reduction of dislocations and fractures, among which Hippocrates' s bench (Fig. 1.14); how to build this traction table was already found in the text *Joints*, and it will be discussed by future generations of doctors, from Rufus from Ephesus, to Galen, Oribasius and Paul from Aegina, thus becoming a very popular topic, and the reference point for corrections and constant modernizations that will occur in the history of orthopaedic surgery up until the modern era [74]. Most probably, some orthopaedic information must have been contained in a lost work by Hippocrates on war injuries, where working as an army physician was recommended as a way to acquire anatomical knowledge and rapidly effective therapeutic techniques [75]. Since its origins, a specific feature of the ancient orthopaedic competence is the self-perception of how spectacular the techniques of intervention on the bone are; the use of considerable tools, such as beams or ladders to hang the patient and bring the dislocated bone back to its anatomical site (Fig. 1.15), but also the immediate perception of the healing process and the external visibility of complex bandaging techniques, make orthopaedics an easy field to acquire fame and consensus, and to impress patients even without especially high medical qualities. A good doctor must regard orthopaedic tools – swings, levers, ladders and benches (Fig. 1.16) – as what they actually are tools that are often not designed for therapeutic goals, but directly borrowed from carpentry or other forms of craftsmanship, just like some other surgical tools for orthopaedic use, survived because they were made of metal, and difficult to identify today even by an archaeologist specialized in the history of ancient surgical instrumentation [76]. Tools cannot replace the doctor's professional skills, just like a planer, a saw, or a hammer cannot guarantee a good carpenter's work: "… the same is true for mechanical tools: they must be conceived correctly or not conceived at all: it is dishonourable and contrary to art when mechanical tools are designed to take the talent away from their designer" [77]. (Fig. 1.17). Orthopaedics, like any other branch of Hippocratic medicine, finds its ethical justification in its being correction "according to nature", a balanced technique which can bring things back to their natural course, where disease is its temporary discontinuation [78]. Its main goal is to limit a potential permanent damage caused by an error in the bone

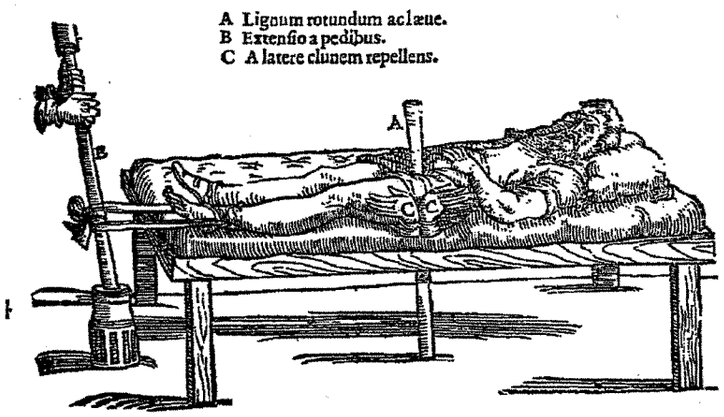


Fig. 1.14 Scamnum (Hippocratic bench), from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544

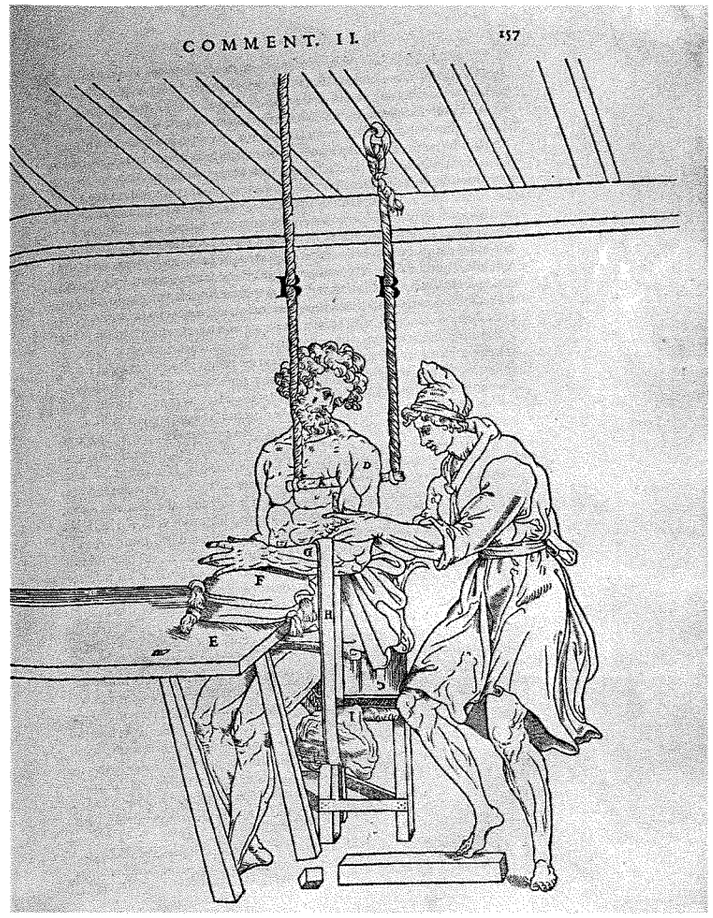


Fig. 1.15 Repairing a dislocation to the arm, from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544 (Wellcome Library)

remodelling; the main interventions on fractures, for instance, include the removal of minute particles, the filing of the fracture's indented margins, the chiselling of overabundant or defective bone callus or the correction of congenital bone deformities [79] (Fig. 1.18a, b). All unnecessary pain must be limited, if not avoided; to this aim, an in-depth knowledge of the nature and arrangement of bones, together with the careful respect for the patient's needs are helpful; the faster the medical act, painful in itself, the more competent and morally correct. Medical texts and palaeopathology both offer the perception of the profound and impressive technical expertise required to bone surgeons: the high number of well-healed bone fractures on ancient human finds suggests good levels of treatment, even though a spontaneous healing can be hypothesized in most cases, also favoured by patients' long periods of immobilization and consequent care [80]. Immobility could also be guaranteed by specific items, such as wooden crates or cages made of flexible sticks tied together and bandaged to the broken limb; the use of long strips of bark and fresh soft branches is documented in pharaonic Egypt, in the Iron Age in Italy, and in the eruption of Mount Vesuvius in 79 by a young fugitive from Ercolano, who was forever immortalized by the lava together with the ferula blocking his fractured arm [81]. An increasing "orthopaedic" competence is also

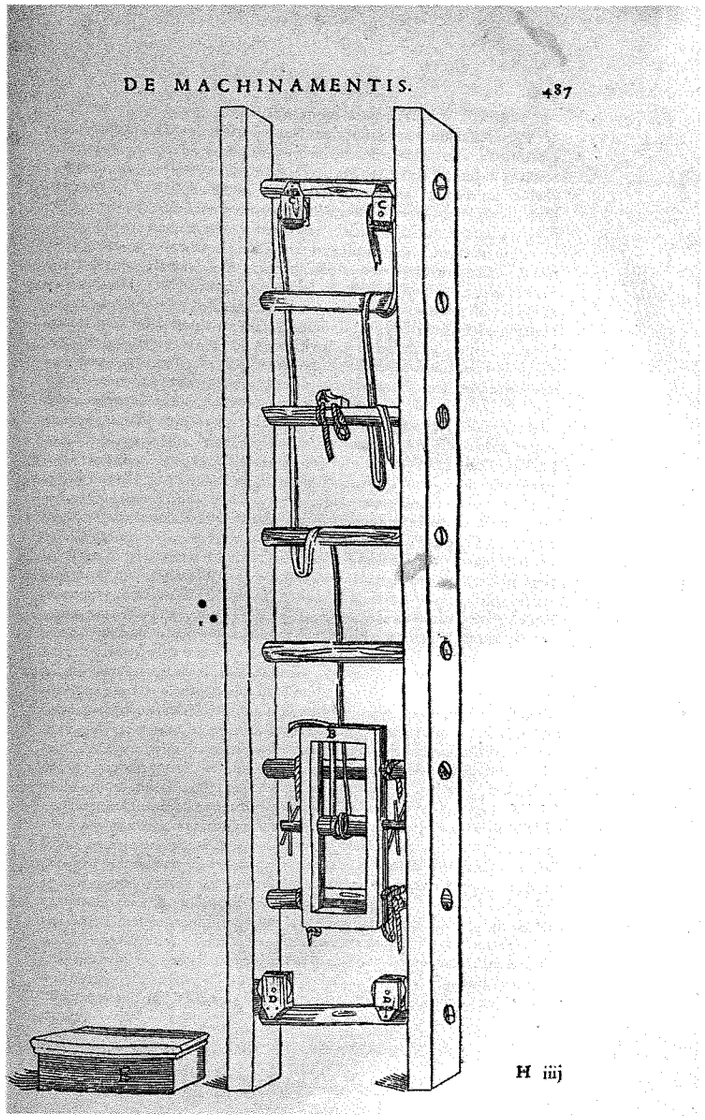


Fig. 1.16 Orthopaedics ladder, from Guido Guidi Chirurgia e Graeco in Latinum conversa, 1544 (Wellcome Library)

documented in the indirect tradition [82], which has passed on information about lost texts of medical authors, known as the inventors or renovators of tools for surgical correction of the bone: from Diocles of Carystus (fourth century B.C.), to Philotimus (IV B.C.), both specialized in the reduction of femur dislocation, to Nilaeus (III-I B.C.), the inventor of tools for the correction of out-of-site femur and humerus (Fig. 1.19), to Protarcus (II-I cent. B.C.) and Megetes (I B.C.), specialized in the knee; from Heliodorus (first century), with his technique of jaw reduction, to Archigenes (I-II cent.), an expert in amputation techniques, an increasing surgical specialization seems to have been established in the long series of centuries between the Hippocratic texts and their reinterpretation in Roman times, mainly by Celsus [83] and Galen.

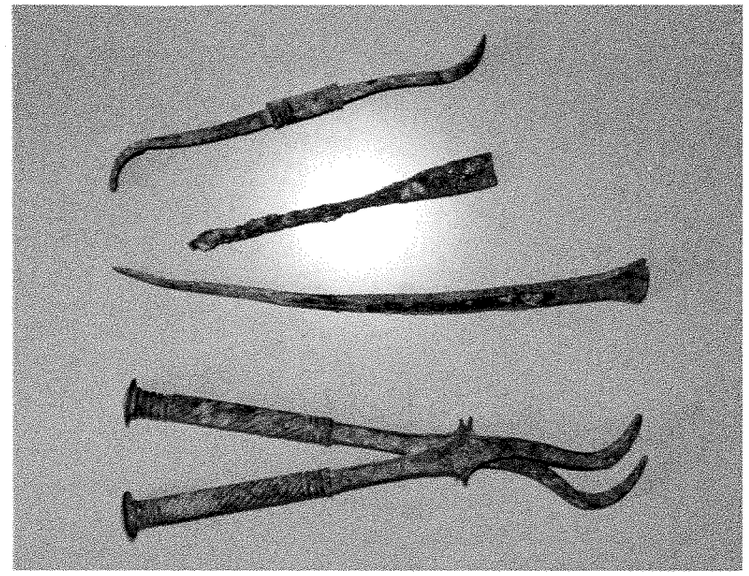


Fig. 1.17 Roman Surgical Instruments, Imperial age (Museo di Storia della Medicina, "Sapienza" Università di Roma)

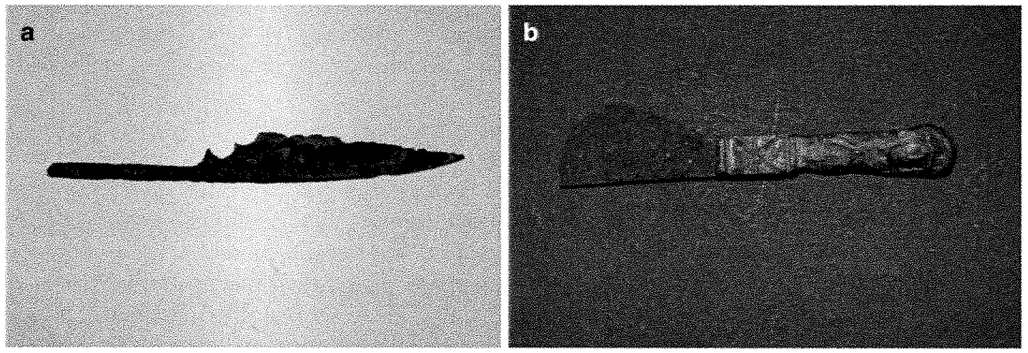


Fig. 1.18 (**a**) Roman surgical knife (Museo di Storia della Medicina, "Sapienza" Università di Roma). (**b**) Roman surgical knife (Museo di Storia della Medicina, "Sapienza" Università di Roma)

1.2.3 Orthopaedics in Rome

In Imperial Rome, the spectacular nature of some bone correction methods, already criticized in Hippocratic texts, seems to diminish; thus, the techniques are simpler than those described in Hippocratic texts, but the number of pathological situations where they can be used increases. Celsus and Galen, the main authors who provide indications on bone treatment in Rome, refine ancient techniques and propose innovative uses. In the *De Re Medica*, Celsus gives a more practical and realistic view of doctors' and surgeons' "modus operandi"; even with his pathological interpretations and some specific therapeutic treatments of Hippocratic tradition, Celsus is mainly interested in the praxis. On the other hand, Galen represents the Greek medical philosophical culture, and mirrors a Hippocratic approach also in the re-elaboration of orthopae-

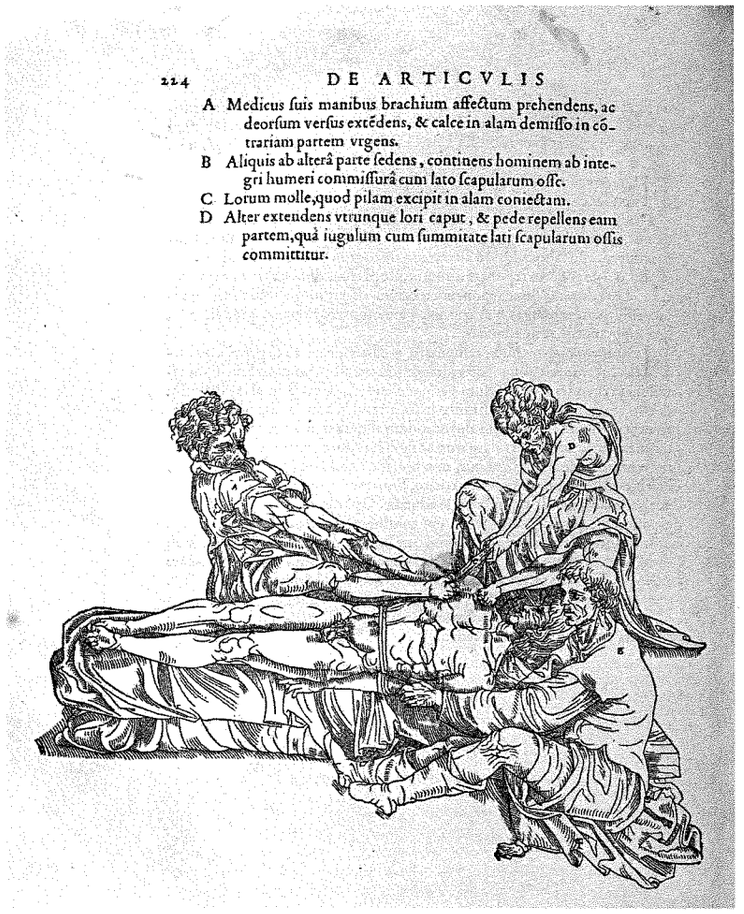


Fig. 1.19 Repairing broken arm, torn ligament or shoulder dislocation, from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544 (Wellcome Library)

dic surgery through the Alexandrian tradition, which had enriched it with the design of new mechanical tools [84]. In his philosophical view, the animal body is formed from the matter of masculine and feminine seeds, which collect and hand down the most refined and vital part of the humours and generate the three primary organs, the heart, the liver and the brain; arteries, veins and nerves develop from each of these organs. They instil matter and life into the other parts of the body, and the bone structure forms around them (thanks to the action of the animal bodies' earthy component giving solidity and hardness, of air moving and giving vital wind, and of heat). In this perspective, the skeleton is given the role of protecting the vital organs, since the first part to be developed is the rib cage, and then, as in a process similar to the development and ramification of vegetables (Galen thinks of trees in particular), come the spine and the skull; after that, when the connective tissues and the muscles form around the bones, the skeleton becomes the basic structure, which enables us to be supported, move and stand [85]. In his *Commentaria* to Hippocratic works on orthopaedics, in particular the *De articulis* and the *De fracturis*, and in other less specific ones, such as the *De medici officina*, *De usu partium*, *De methodo Medendi*, *De fasciis*, Galen implements the original doctrine with the description of techniques and tools, refined and developed over time, and most of all with clinical cases observed by later authors and by

himself. It is the case of humerus dislocation which Hippocrates believed occurring only inferiorly or anteriorly, because the head of the humerus can move forward while staying underneath the protrusion of the shoulder blade. Later Greek authors and Galen himself describe posterior and lateral (external) dislocations, mainly frequent in wrestlers because of the twisting movements they undergo; the same is true with the knee, which can dislocate laterally for the same reason. Celsus and Galen view the orthopaedic techniques differently: Celsus reflects the typical Roman encyclopaedic approach and the orthopaedical remedies and techniques he observes in Roman daily medical practice. On the other hand, both Celsus and Galen adopt a common method of explaining skeletal diseases of non-traumatic origins: they think an innate weakness or an inappropriate diet lead to heat deficiency and humoural imbalance. They both reclaim ancient indications in order to perfect them and propose some innovative uses. One example is the drilling of the skull, generally used to remove bone fragments, coming from compound fractures, that might damage the brain and induce humoural plethoras, accumulations of pathologic fluids, something very similar to our concept of infection; or, as is suggested in Galen, to allow the free flow of cerebral pneuma, which could be compromised by a depressed fracture, but also for the treatment of epilepsy or of persistent headaches [86] (Fig. 1.20).

Fig. 1.20 Drilled skull of the child of Fidene (Soprintendenza Speciale per il Colosseo, il Museo Nazionale Romano e l'Area Archeologia di Roma, at Museo di Storia della Medicina, "Sapienza" Università di Roma)

Among the most spectacular techniques available to ancient doctors, the drilling with the use of circular or crown drills (modiolus), or with the combined use of chisels (Fig. 1.21) to bore the circular section of the skull to be removed, also represents the therapeutic model for the removal of bone fragments in compound fractures of other skeletal parts [87]. Other specialistic and visibly striking interventions are those performed with the Hippocratic bench, a dedicated orthopaedic bed equipped with levers, strings and tie-rods for the extension and the reduction of fractures and dislocations; however, both Celsus and Galen also report less complex, but more widely performed procedures used by surgeons to reduce humerus, femur and vertebral dislocations, but

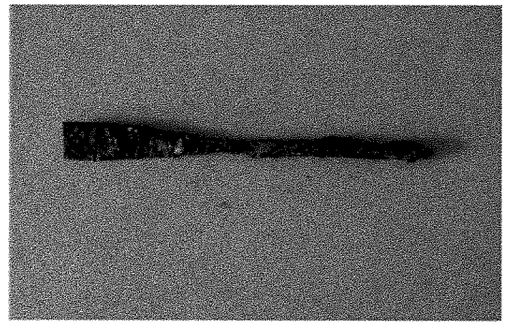


Fig 1.21 Roman Chisel, ca I-II cent. A.D. (Museo di Storia della Medicina, "Sapienza" Università di Roma)

also spine incline, using a simple ladder (Fig. 1.22), either to lever on the rungs in rearrangement operations for humerus or femur dislocation, or for "succussions", performed tying the patient along the ladder and repeatedly moving it vertically to treat hunchback and vertebral inclinations [88]. A "retrospective diagnosis" is difficult and risky, given the theoretical adhesion to a strictly humoural model: with an analysis of the written sources only, it is difficult

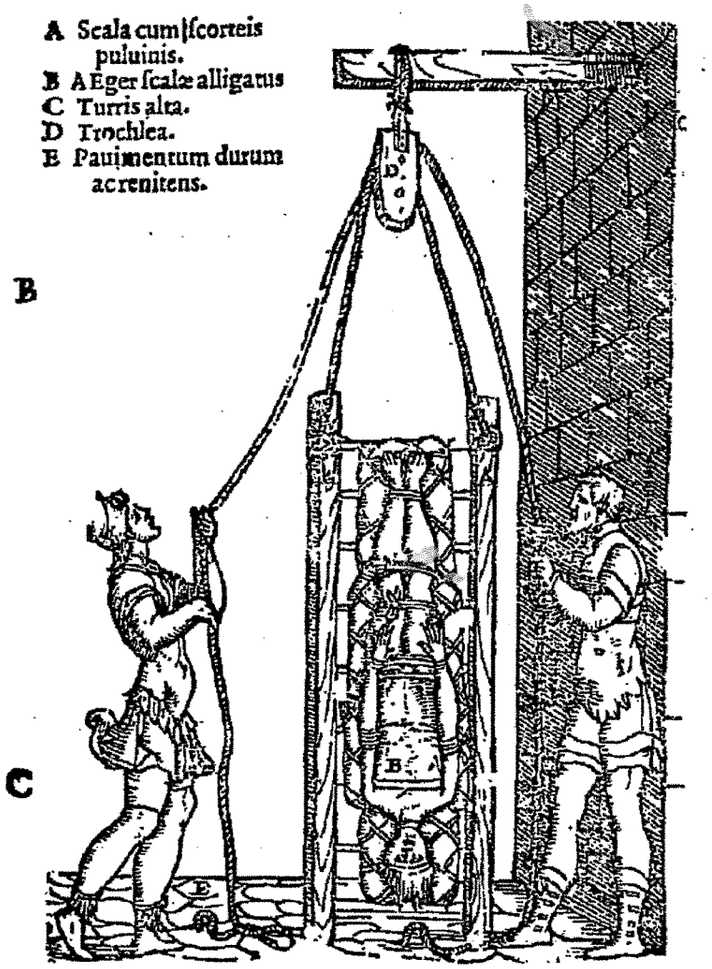


Fig. 1.22 Ladder for vertebral dislocation, from Guido Guidi Chirurgia e Graeco in Latinum conversa, 1544

to distinguish between rheumatic pathologies, pathologic arthritis or arthritis following excessive wear, load or strain from a simple description of symptoms. Pains in hands and feet, for instance, are often classified as podagra and chiragra, while the symptoms are nowadays attributable to a form of gout, which does not have a nosological classification in ancient times (Fig. 1.23a, b).

The same goes for the complex range of neoplastic diseases, whose description belongs to the ancient categories of "karkinos" or "phyma", but does not allow distinguishing a potentially malignant development from simple protrusions and swellings. Without a specific nosology to distinguish the various pathological processes, skeletal disabilities, including fractures and recurrent dislocations, are just a sign of innate weakness or inappropriate diet. This is why therapies are generally based on soothing compresses and local analgesics, diet, rest, laxatives, enemas and repeated bloodletting, so as to drain the corrupted humours clogging the lesioned part and leading to inflammation.

1.2.4 An Advanced Technique

The problems in the pathological interpretation are counterbalanced by the huge amount of data

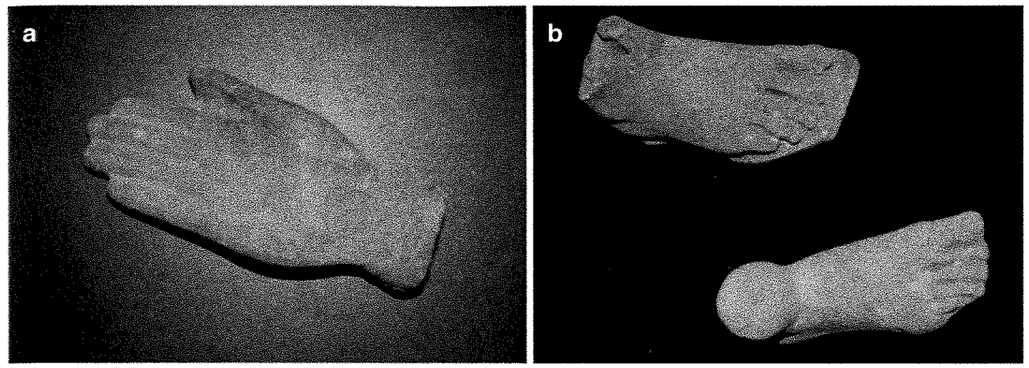


FIG. 1.23 (**a**) Roman ex-voto: hand, ca. I-II. Cent. A.D. (Museo di Storia della Medicina, "Sapienza" Università di Roma). (**b**) Roman ex-voto: feet, ca. I-II. Cent. A.D. (Museo di Storia della Medicina, "Sapienza" Università di Roma)

about therapies coming from Roman sources: it is particularly important for the historian to work together with physical anthropology and palaeopathology, which approach skeletal diseases and dysfunctions objectively, and allow tracing a consistent therapeutic and *pathocenotic* picture [89]. In Celsus and Galen, the corrective treatment of fractures and dislocations confirms the high level of structural knowledge of the skeleton and the muscular system reached through animal dissections, but also the high level of technical specialization of Roman surgery in the Imperial time. A high level of technical expertise is documented in very interesting sources, such as the so-called Child of Fidene, a find from Imperial Rome, now owned by the Soprintendenza Speciale per il Colosseo, il Museo Nazionale Romano e l'area archeologica di Roma and treasured at the Museum of Medical History of Sapienza-University of Rome. It documents a drilling technique which is very close to the Galenic model, and more complex than the techniques adopted for the simple removal of fractured segments from the skull [90]. The Child of Fidene actually shows the intracranial signs of a mass probably causing a considerable increase in endocranial pressure and, as a consequence, marked pain; there must have been the drilling and removal of a circular bone fragment to ease the symptom at least for some time [91]. Such a high surgical level is shown in the use of specific techniques of orthopaedic correction, of a specialized surgery and set of tools; and whereas Galen describes the various treatments and respective tools in detail, including their design, Celsus just mentions the more complex ones, and describes in detail the easier methods, the ones more commonly used by Roman surgeons. An example of such difference is the fastidiousness that Galen uses in his meticulous description of design, elements and uses of the Hippocratic bench for the reduction of fractures and dislocations of femur, vertebrae, long bones of lower limbs and ankle [92]; on the other hand, Celsus just mentions it as the tool of choice and of highest efficacy, without specifying its structure and functioning. In the absence of the Hippocratic bench, both Galen and Celsus provide precise indications on an alternative set of tools that can be used successfully: the extension can be performed with strings tied to the regions to be pulled, and connected to sticks (Fig. 1.24), so as to favour the traction in opposite directions; in case of fractures and dislocations of the lower limbs, two sticks can be set under the armpits to hold the body during the traction. The reduction and bandaging must be performed during the limb's extension, with manual replacement of the bone, and starting the bandaging from the protruding section of the dislocation; the use of more than one pad and one round of bandages allows the physician to make a greater pressure [93]. After this initial treatment, the affected part must be immobilized and positioned higher than the

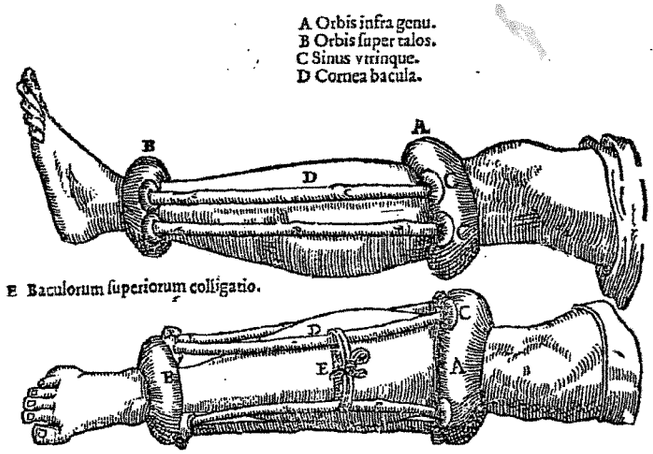


Fig. 1.24 Reduction of leg fracture, from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544

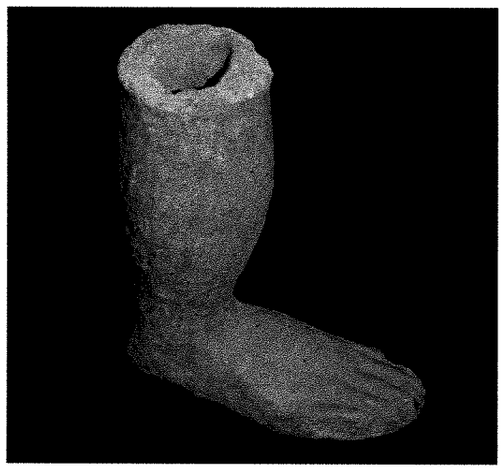


Fig. 1.25 Roman ex-voto: leg, ca. I-II. Cent. A.D. (Museo di Storia della Medicina, "Sapienza" Università di Roma)

rest of the body. The foot and the leg can be supported by a soft pillow. As a last option, not completely aligned with Hippocrates's rules of conduct, surgeons can use a ladder. The indications to reduce diaphysial fractures of tibia, fibula, humerus, ulna and radius are also similar; both authors recommend methods of extension with the use of bandages and pulls and in site repositioning of the bone, holding it in the correct position with repeated wrappings at different degrees of pressure (Fig. 1.25). We already mentioned the technique with wooden sticks inside the bandaging that Celsus calls ferulae [94]. A few years ago, one of these ferulae was identified by Luigi Capasso and his team, in the form of partially burnt grapevine wood fragments, on the arm of a child from Ercolano (case E8) with a double fracture of the right forearm, probably occurred 6 or 7 weeks prior August 25th, 79 [95]. In case of jaw fractures, the dislocated teeth must be tied with a gold or silk thread (a dental technique documented on Etruscan bone samples and inherited and well documented in Roman medicine), and then the bone must be immobilized with bandages. Galen suggests a peculiar type of bandage [96]: a strip of Carthage leather is stuck under the chin with some rubber, while another strip is applied starting from the fractured section; the two laces will be tied together on the head; in this way, a permanent traction better guarantees the reduction of the fracture (Fig. 1.26). The indications for the treatment of humerus and ankle fractures, and of dislocations, especially of the humerus, the femur and the vertebrae, are particularly detailed due to two reasons: the importance of reduction and bandaging methods when restraining or immobilizing structures are impossible; the high risk of stiffness and the frequency of irreversible inflammatory processes, that lead to gangrene, sepsis and death of the patient.

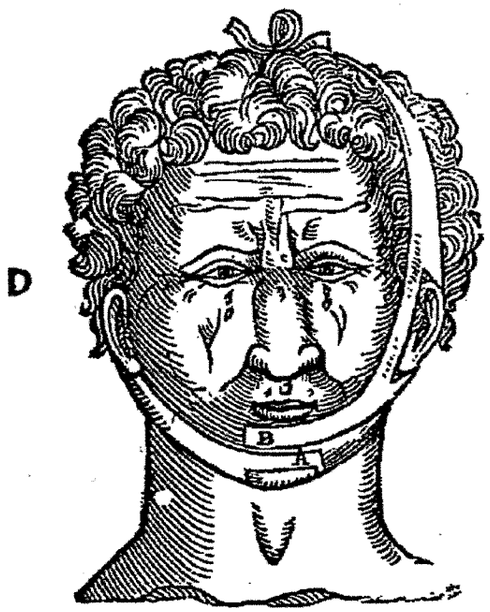


Fig. 1.26 Jaw bandage, from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544

1.2.5 A Rich Set of Tools

In different and complementary ways, both literature and archaeology offer evidence of the tools used for the therapy of orthopaedic lesions. The archaeological findings from the digs in Ercolano, Pompei, the Domus of the Surgeon in Rimini and other sites [97], have allowed to grasp the uses and orthopaedic applications of chisels, bone levers, ostagrae (forceps for bones) cauteries, osteotomes and drills (Fig. 1.27a, b); these tools have survived, at least in their metallic parts, well enough to be evidence of the organizational techniques of ancient surgical tool sets. Other tools, made of wood or of other perishable materials, have only been passed on through their descriptions: among these, the already mentioned orthopaedic bench. This is made up of a board, with side groovings deep enough to fit the levers used as extenders and brakes. The external end is equipped with supports for planks holding in place the ropes tying the patient; the median section has a hole to fit the pole used for counter-extension; two pestles are secured to the two ends of the board, to tie the ropes and achieve a balanced extension [98] (Fig. 1.28). In fractures of the lower limbs, Galen suggests the glossocome, a sort of lime wood crate – its name reminds us of the one of a jewellery box largely employed in the Greek region Attica – with a platform to put the foot on. Two holes at the sides of the board hold the laces used to tie the extremities of the bones to be reduced, and go through hoists, so as to impose a continuous pressure and keep the bones in place. The ropes are composed of two strips each; the ones belonging to the lower rope go through the holes in the board, while the ones used for the upper tying slide through wheels, and reach the pole at the end of the glossocome. The extension is performed by simply turning the wheels to pull in opposite directions. The small boards are only positioned in the middle section of the leg, and in the areas near the joints in general, and not at its extremity, so as to avoid compression, and consequent further inflammation and ulcers [99] (Fig. 1.29). A similar device is described by Celsus for fractures of the femur, the knee and the leg: the bandaged limb is positioned into a canal with two holes for any drainage, and a support blocking the foot from sliding; the sides have holes for the laces tying the tool to the leg. In fracture of the femur, the canal holds the whole limb, from foot to hip, but can also just reach the knee [100]. Another restraining tool is the shower, a wooden concave structure, modelled to hold the leg or parts of it, a sort of premanufactured cast to immobilize it. Specific tools are described, both by Celsus and by Galen, for surgery of exposed fractures, where dressing of the wound is essential, together with the removal of fragments and sharp sections of bone stumps, which might tear the flesh. Galen proceeds to the reduction of the fracture by repositioning the bones using levers to lift and lower the bone stumps during extension; he uses the wedge to remove fragments that might cause further lesions, and the axis wheel [101] (Fig. 1.30). For limb reduction, he uses a tool composed of two leather rings positioned at the ends of the bone to be extended. These rings may be concave or pierced, so they can fit sticks of varying

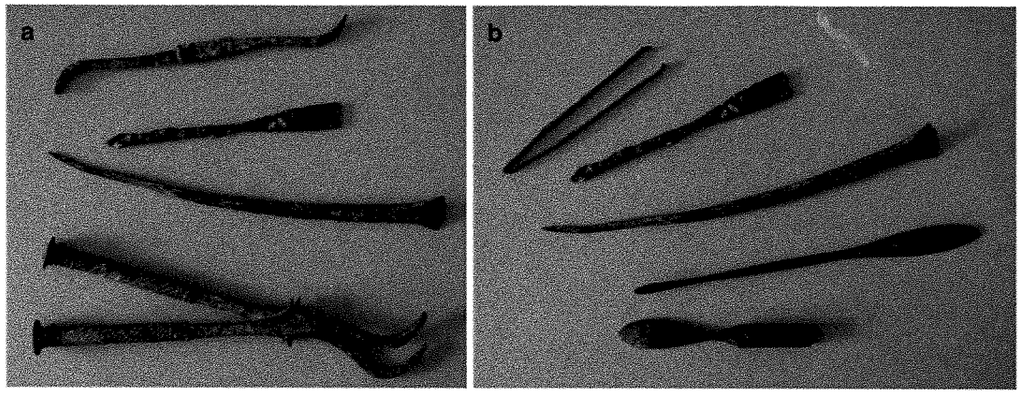


Fig. 1.27 (**a**–**b**) Roman Surgical Instruments, Imperial age (Museo di Storia della Medicina, "Sapienza" Università di Roma)

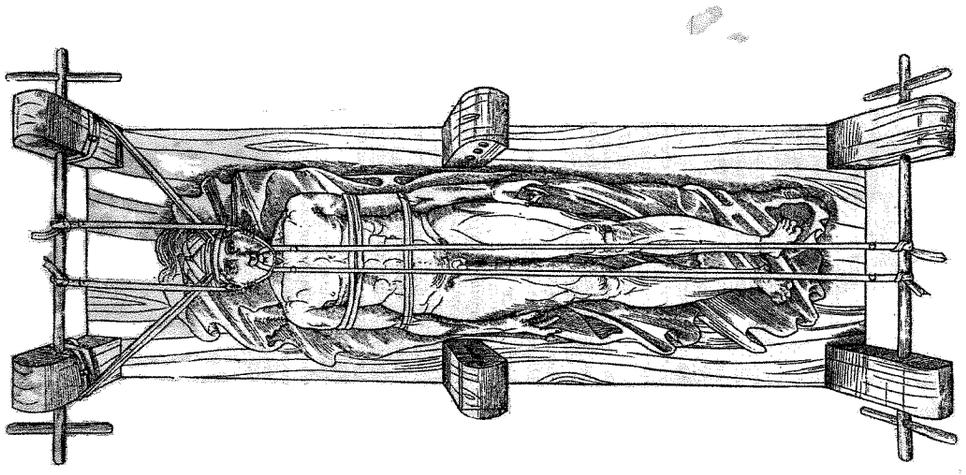
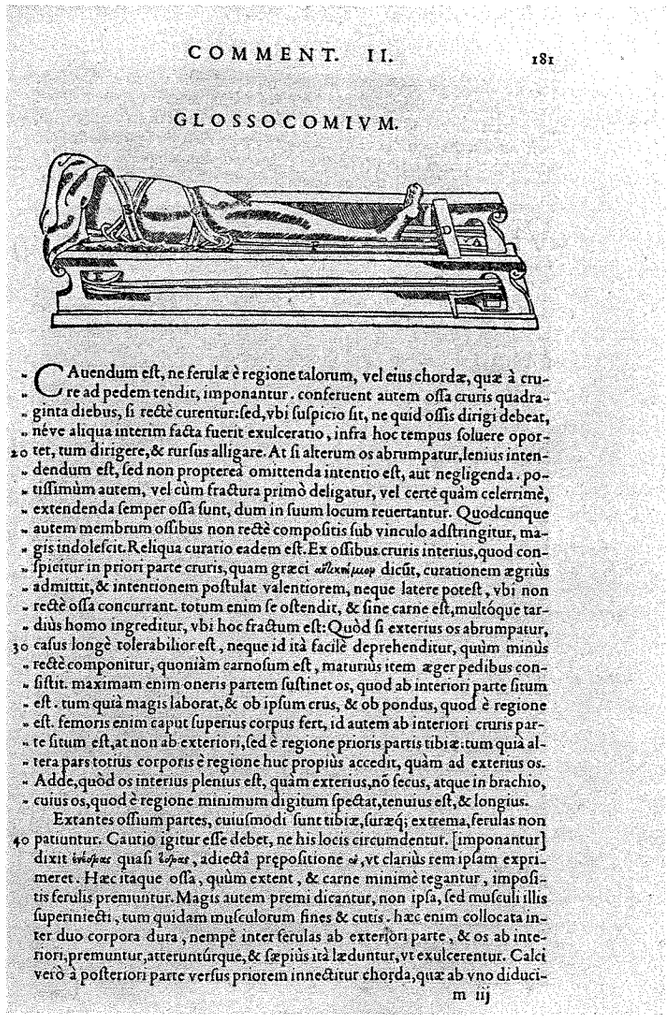


Fig. 1.28 The Hippocratic Scamnum (bench) for the correction of dislocation, from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544 (Wellcome Library)

length made of a rather elastic wood, capable of a natural pressure inducing bone extension [102]. Celsus cuts and files the sharp points using chisel and pincers, and inserts a small smooth pole into the wound; the pole naturally pushes the two stumps to distance and align them, and avoid the formation of bone callus. If the bones have stabilized, cutting through the flesh or shortening or deforming the limb too much, the bone callus must be removed, the stumps must be taken out and repositioned, and a bandaging must be wrapped with a stick pressing on the protruding section of the bone to align it [103]. In the most severe compound fractures, even the bandaging might compress the parts too much and sharpen the inflammation, so doctors

Fig. 1.29 The Glossocomium, from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544 (Wellcome Library)



COMMENT. II. 181

GLOSSOCOMIVM.

Cauendum eſt, ne ferulæ è regione talorum, vel eius chordæ, quæ à crure ad pedem tendit, imponantur. conferuent autem oſſa cruris quadraginta diebus, ſi rectè curentur: ſed, vbi ſuſpicio ſit, ne quid oſſis dirigi debeat, néve aliqua interim facta fuerit exulceratio, infra hoc tempus ſoluere oportet, tum dirigere, & rurſus alligare. At ſi alterum os abrumpatur, lenius intendendum eſt, ſed non propterea omittenda intentio eſt, aut negligenda. potiſſimùm autem, vel cùm fractura primò deligatur, vel certè quàm celerrimè, extendenda ſemper oſſa ſunt, dum in ſuum locum reuertantur. Quodcunque autem membrum oſſibus non rectè compoſitis ſub vinculo adſtringitur, magis indoleſcit. Reliqua curatio eadem eſt. Ex oſſibus cruris interius, quod conſpicitur in priori parte cruris, quam græci κνημὴν dicũt, curationem ægriùs admittit, & intentionem poſtulat valentiorem, neque latere poteſt, vbi non rectè oſſa concurrant. totum enim ſe oſtendit, & ſine carne eſt, multóque tardiùs homo ingreditur, vbi hoc fractum eſt: Quòd ſi exterius os abrumpatur, caſus longè tolerabilior eſt, neque id ità facilè deprehenditur, quùm minùs rectè componitur, quoniàm carnoſum eſt, maturiùs item æger pedibus conſiſtit. maximam enim oneris partem ſuſtinet os, quod ab interiori parte ſitum eſt. tum quià magis laborat, & ob ipſum crus, & ob pondus, quod è regione eſt. femoris enim caput ſuperius corpus fert, id autem ab interiori cruris parte ſitum eſt, at non ab exteriori, ſed è regione prioris partis tibiæ: tum quià altera pars totius corporis è regione huc propiùs accedit, quàm ad exterius os. Adde, quòd os interius plenius eſt, quàm exterius, nõ ſecus, atque in brachio, cuius os, quod è regione minimum digitum ſpectat, tenuius eſt, & longius.

Extantes oſſium partes, cuiuſmodi ſunt tibiæ, ſuræq; extrema, ferulas non patiuntur. Cautio igitur eſſe debet, ne his locis circumdentur. [imponantur] dixit ἐπιθήσει quaſi ἐφήσει, adiectâ præpoſitione ἐπί, vt clariùs rem ipſam exprimeret. Hæc itaque oſſa, quùm extent, & carne minimè tegantur, impoſitis ferulis premuntur. Magis autem premi dicantur, non ipſa, ſed muſculi illis ſuperiniecti, tum quidam muſculorum fines & cutis. hæc enim collocata inter duo corpora dura, nempè inter ferulas ab exteriori parte, & os ab interiori, premuntur, atteruntúrque, & ſæpiùs ità læduntur, vt exulcerentur. Calci verò à poſteriori parte verſus priorem innectitur chorda, quæ ab vno diduci-

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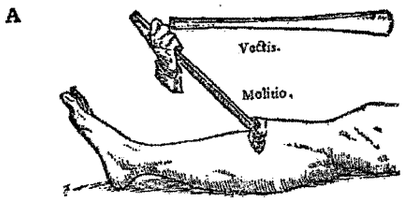
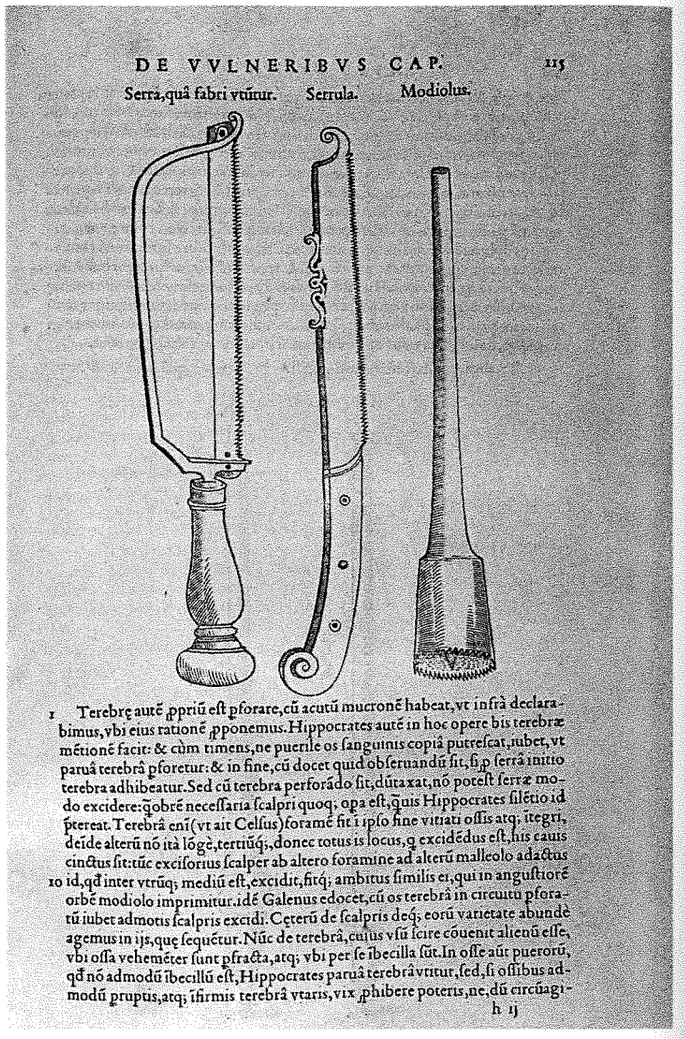


Fig. 1.30 Treating exposed fractures, from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544

should only dress the wound, and prescribe fasting, rest and absolute immobilization of the limb. Celsus describes exostotic formations of the bones, which discolour or develop ulcers or fistulas, which can progress and eventually erode them; if this is the case, surgeons must use a cautery, and a tool to curette the bone, and drain the blood. By digging into the cavity as far as the hard part containing black matter, the tissue must be removed until the bone is completely white. For this intervention, Celsus uses the drill or the modiolus (Fig. 1.31); the latter is composed of a pierced stick, fitted with a second stick ending in a metal cylinder with a saw-toothed lower edge. The trephines are screwed into this edge; the handles of the bow are pierced and hold the


DE VVLNERIBVS CAP. 115

Serra,quâ fabri vtũtur. Serrula. Modiolus.

1 Terebrę autẽ ꝓpriũ eſt pforare,cũ acutũ mucronẽ habeat,vt infrà declarabimus,vbi eius rationẽ ꝓponemus. Hippocrates autẽ in hoc opere bis terebræ mẽtionẽ facit: & cùm timens,ne puerile os ſanguinis copiâ putreſcat,iubet,vt paruâ terebrâ pforetur: & in fine,cũ docet quid obſeruandũ ſit,ſi ꝓ ſerrâ mitto terebra adhibeatur. Sed cũ terebra perforãdo ſit,dũtaxat,nõ poteſt ſerræ modo excidere: q̃obrẽ neceſſaria ſcalpri quoq; opa eſt,quis Hippocrates ſilẽtio id ꝓtereat. Terebrâ enĩ(vt ait Celſus)foramẽ fit i ipſo ſine vitiati oſſis atq; itegri, deĩde alterũ nõ ità lõgè,tertiũq;,donec totus is locus,q excidẽdus eſt,his cauis cinctus ſit:tũc exciſorius ſcalper ab altero foramine ad alterũ malleolo adactus id,qđ inter vtrũq; mediũ eſt,excidit,ſitq; ambitus ſimilis ei,qui in anguſtiorẽ orbẽ modiolo imprimitur. idẽ Galenus edocet,cũ os terebrâ in circuitu pforatũ iubet admotis ſcalpris excidi. Cęterũ de ſcalpris deq; eorũ varietate abundè agemus in ijs,quę ſequẽtur. Nũc de terebrâ,cuius vſũ ſcire cõuenit alienũ eſſe, vbi oſſa vehemẽter ſunt pfracta,atq; vbi per ſe ĩbecilla ſũt. In oſſe aũt puerorũ, qđ nõ admodũ ĩbecillũ eſt,Hippocrates paruâ terebrâ vtitur,ſed,ſi oſſibus admodũ pruptis,atq; ĩfirmis terebrâ vtaris,vix ꝓhibere poteris,ne,dũ circũagi-

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Fig. 1.31 Surgical instruments including Modiolus, from Guido Guidi, Chirurgia e Graeco in Latinum conversa, 1544 (Wellcome Library)

thread turning around the toothed crowns of the drill (it is pulled alternately from both sides to turn the trephines and bore a hole in the part to be removed). For wider and deeper lesions, surgeons use the drill, with a bit which enlarges itself and withdraws a larger amount of bone; some holes are bored around the affected area, so as to remove the whole affected area with a chisel [104]. In patients with recurrent joint dislocations of the humerus, especially if cartilage and bone tissue consumption is present, Galen cauterizes the armpit tissues to bore holes and insert a thin spatula to lift the skin and perform another eschar in the middle, with a thinner cautery, until he touches the shoulder blade. If necessary, some more cauterizations are performed anteriorly, to remove the tissues and directly handle the joint's cap [105].

Given the pain and crudeness involved, ancient medical competence must have been hard to bear, which goes to justify Galen's patients, whom he describes as willing to lie, in order to escape huge suffering [106].

This chapter is the product of collaboration of Valentina Gazzaniga and Silvia Marinozzi, Sapienza – University of Rome and is therefore attributable in equal measure to both the authors.