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TREATMENTS OF DISLOCATIONS AND FRACTURES OF THE JOINTS OF THE KNEE IN ANCIENT ROME: 27BCE-476 CE

***Valentine J. Belfiglio**

Professor Emeritus in the Department of History and Government at Texas Woman's University in Denton, Texas, USA.

***Corresponding Author: Valentine J. Belfiglio**

Professor Emeritus in the Department of History and Government at Texas Woman's University in Denton, Texas, USA.

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ABSTRACT

Roman physicians and surgeons developed diagnostic and treatment protocols for dislocations and fractures of knee joints that were remarkably advanced for ancient times. **Methodology:** This study uses historiography and conceptual analysis to compare ancient and modern medical writings. **Results:** The diagnostic protocol involved gathering atients' subjective reports, recording physicians' objective findings, assessing those findings in relation to comparable cases, nd creating and revising treatment plans based on outcomes. Treatment protocols included nonoperative care, surgery when needed for accompany wounds, and recovery through convalescence and physical therapy. **Conclusion:** Roman physicians and surgeons developed diagnostic and treatment protocols for dislocations and fractures of knee joints that were remarkably advanced for ancient times.

KEYWORDS: Orthopedics, Fractures, Dislocations, Knee Joints.

INTRODUCTION

Knee joint dislocation occurs when the femur and tibia separate, often with displacement of the fibula. These injuries may occur alongside knee fractures, particularly in Roman warfare, where metal weapons often caused deep wounds and broken bones. To treat such trauma, Roman physicians (medici) developed protocols for dislocations, fractures, and related joint injuries, drawing on Egyptian and Greek medicine as well as their own experience. After Greece became a Roman province in 146 BCE and Egypt in 30 BCE, Roman medicine incorporated knowledge from both traditions. Medici used sophisticated instruments, including metal scalpels, bone drills, and bronze or steel levers. However, they did not repair fractured bones with implanted metal. Instead, they treated wounds associated with dislocations and fractures through noninvasive or surface-level methods (Aegineta 6.107).

Roman medicine included many specialties, but orthopedics was not one of them. Orthopedic procedures were performed by surgeons (Medicus Chirurgus) who had advanced training at medical schools in Alexandria, Egypt, or at Cnidus and Cos in Greece. Like modern physicians, some ancient doctors chose to focus on particular areas of practice. Some specialized in preventing, diagnosing, and treating injuries to bones, joints, ligaments, tendons, and muscles. Most, however, were generalists who treated wounds, dislocations, and fractures of the hip, knee, foot, shoulder, elbow, hand, and spine (Aegineta 1846a).

SCOPE AND METHOD

Although orthopedics and orthopedic surgery did not emerge as distinct specialties until the eighteenth century, Roman physicians between 27 BCE and 476 CE developed early approaches to diagnosing and treating musculoskeletal disorders. This study presents a conceptual analysis of writings by ancient and modern physicians and historians. Like modern orthopedists, Roman physicians used nonsurgical methods and, when severe wounds were involved, surgical treatment to manage orthopedic conditions. However, they did not develop arthroplasty for damaged joints. Modern diagnosis and treatment still rest on foundations laid in

antiquity, even though contemporary techniques and technology have advanced dramatically (Dutton 2025).

Primary Sources

Aulus Cornelius Celsus (first century CE) devoted a chapter of his medical work to fractures. Pedanius Dioscorides (40–80 CE) compiled an extensive catalog of drugs and other medicinal materials (2005). Claudius Galen wrote extensively on these subjects (2011), and Paulus Aegineta (1846a) compiled a seven-book medical encyclopedia that discusses the treatment of dislocations and fractures in detail. Flavius Renatus Vegetius (fourth century CE) included a chapter on the physical fitness and mental acuity required for service in the Roman legions (1993). Quintus Martialis (third century CE) specialized in dietetics and emphasized the role of nutrition in treating disease. Scribonius Largus (first century CE) compiled 271 prescriptions and recognized the connection between dietetics and convalescence.

DIAGNOSIS OF KNEE-JOINT DISLOCATIONS AND FRACTURES

The Roman protocol for evaluating knee-joint dislocations and fractures included seven steps:

1. Subjective information from the patient, if the patient was awake and coherent:
   Severe pain; inability to move or bear weight; a sensation that the knee is buckling; and inability to bend, straighten, or stand on the leg.
2. Objective findings of the medicus included knee deformity, such as crooked alignment, an abnormal shape, or bulging to one side, along with rapid inflammation and discoloration around the joint. In fractures, the medicus assessed the extensor mechanism and passive range of motion to detect swelling, exposed or displaced bone edges, or inability to move the joint. Specific tests included the active straight-leg raise, passive extension and flexion, extension against resistance, and assessment for hemarthrosis, in which blood collects in the joint space and causes painful, tense swelling. Above all, palpation was essential: the medicus carefully felt the front and sides of the knee for jagged, displaced bone edges beneath the skin.
3. Diagnosis by the primary physician in consultation with other medici and healthcare personnel.
4. Treatment of knee-joint dislocations and fractures relied on noninvasive or surface-level techniques.
5. Monitoring and evaluating the safety and effectiveness of the treatment plan.
6. Revising the treatment plan as needed.
7. Convalescence (Celsus 1831).

TREATMENT OF KNEE-JOINT DISLOCATIONS

Roman medici believed that a dislocated joint should be mechanically separated and, when possible, returned to its proper position. They sometimes used devices such as wooden bars to provide the leverage needed to realign the femur and tibia. After reduction, they immobilized the knee to prevent redislocation. The knee and leg were wrapped firmly with linen bandages soaked in cerate—a mixture of olive oil and beeswax—to stiffen and stabilize the joint. Wooden splints were then secured over the bandages for added support, and the patient remained on bed rest with the injured leg elevated on pillows or a box splint after the inflammation subsided (Celsus 1831).

Knee dislocations accompanied by an open wound required special care. Roman physicians applied mashed comfrey (Symphytum officinale) roots and leaves to broken bones, torn ligaments, and severe cuts. Because comfrey contains allantoin, which promotes cell regeneration, patients also drank comfrey tea to treat internal bleeding (Dioscorides 4.10). In Roman warfare, wounds often occurred together with dislocated or fractured joints. Such cases usually required surgery in Roman military hospitals, where surgeons (medici chirurgi) followed a systematic operative approach (Celsus 1831).

ROMAN SURGICAL PROCEDURES

Capsarii (medical corpsmen) received training to render advanced first aid to wounded legionnaires on the battlefield. The capsarii bandaged the wound with a linen bandage, applied a hemostatic tourniquet when necessary, and evacuated the soldier by stretcher or wagon pulled by horses to the closest valetudinarium (field hospital). The preoperative step included a bath, abstinence of food or drink, and sleep the evening prior to surgery. In critical situations, involving immediacy, this step could be eliminated (Celsus 1831). A common local anesthetic used by Roman physicians was henbane seeds in asmall quantity of wool fat. Most musculoskeletal fractures or dislocations caused in combat required a general anesthesia. Roman Medici employed the dissociative (sedation) (twilight)method of anesthesia. The patient received a sedative, and analgesic in a draught of wine. The analgesic of choice was powdered opium or mandrake (Mandragora officinarum) (Dioscorides2005). A common sedative was corn poppy8 (Papaver rhoeas) (Dioscorides 2005). Meanwhile, a medical assistant applied the henbane ointment to the surgical site. After the analgesics took effect, the assistant cleansed the surgical site with vinegar, and the Medicus Chirurgus (surgeon) began to operate (Largus 1786).

Roman surgeons operated on fractures and dislocations throughout the body, including the knee. Speed was essential in all procedures. Treatment of knee fractures was especially delicate and therefore rarely attempted (Aegineta 1846a). Surgeons followed the principles of proximity, immediacy, and expectancy. Celsus described procedures for knee dislocations and for dislocations accompanied by wounds (Celsus 8.21, 25). As he noted, “Should the naked bone project, the projecting portion must be cut away” (Celsus 8.25). Two assistants, the milites medici (medical orderlies), attached leather thongs or linen bandages to the injured knee while the medicus aligned the bone fragments. If the area was

inflamed, the surgeon treated the inflammation before permanently setting the bones. He applied an ointment containing thyme, white willow bark, and frankincense, then wrapped the knee and surrounding limb with linen cloths soaked in olive oil and vinegar and folded two or three times. After aligning the fracture, Celsus applied six bandages of increasing length, beginning with the shortest. Hospital aides then covered the bandages with cerate to keep them in place (Celsus 1831). Meanwhile, the patient received anti-inflammatory remedies such as turmeric. Galen recommended delaying application of the splint until the seventh day, allowing inflammation to subside, and leaving the splint in place for 21–24 days (Martialis 1875).

The linen bandages remained in place for five days and were then replaced in the same manner. Physicians repeated this process until the inflammation subsided. They then permanently set the fractured bones, including any fragments when possible. Hospital staff reapplied the bandages, and the physician secured a wooden or metal splint to the affected arm, leg, or other injured area. The splint was positioned on the side toward which the fracture inclined and turned outward near the joint. Staff changed the linen bandages every three days (Galen 2011).

OPEN-WOUND FRACTURE

Fractures with open wounds are especially dangerous. Shock, bleeding and infection must be brought under control of the patient is to survive. Medici relied on on prolonged bed rest, manual bone realignment, and immobilization using splints and bandages. Medici managed Shock and bleeding by direct pressure, clamping, cauterization and securing the edges of the wound with fibulae (steel safety pins). The wound was closed with silk, linen or gut sutures. Before surgery, medical staff water. boiled lint, fibulae, surgical instruments and bandages in water. The Medicus sponged the area with acetum, and applied a mixture of lint, honey and aloe vera. Then he applied a plaster of barbarum or other suitable dressing. To immobilize the fracture and keep the poultice in place, they wrapped limb in linen bandages soaked in cerate-a waxy mixture made with beeswax and olive oil. the lAEginata (6.122) wrote: Place anti-inflammatory and soothing applications to the wounds at the beginning of treatment. Medical staff elevated the affected extremity to minimize edema. Ice packs applied in gauze for 20 minutes at a time can help with inflammation and pain. After inflammation subsides, in circa seven to nine days, the Medicus dislocated and adhered the fractured bones in their proper place with the help of comfrey. The medical staff then placed two splints on either side of the knee, Celsus recommended: “it is possible for the separated parts of the fracture to be conglutinated and bound to each other… we ought to carry out distraction of the bones, either with our hands or with ligatures surrounding the limb.” (Celsus 1831). Crushed knees required amputation and necrotic tissue had to be removed.

AMPUTATION

Celsus advised amputating above the knee or at the boundary between healthy and gangrenous tissue, even if some healthy tissue had to be removed, rather than leaving any diseased tissue behind. He also described ligating bleeding vessels, cutting the bone at a higher level, smoothing the bone and skin edges, and packing the wound with vinegar-soaked lint.

He acknowledged that amputation was highly dangerous and that many patients died during the operation, but he argued that the risk was acceptable when no other treatment remained (Celsus 1831).

Like Galen and other Roman physicians, Celsus had access to forceps, scalpels, saws, and other surgical instruments (Galen 2011).

Roman physicians also recommended wooden and metal prosthetic limbs for lower-extremity amputees, secured with leather straps (Galen 2011).

Survival after limb amputation depended on meticulous postoperative care.

Nutrices (nurses) and Miles Medici (soldier doctors)—former capsarii with extensive experience and noncommissioned rank—cared for amputees around the clock in shifts, while an on-call medicus stood ready for emergencies.

Immediately after surgery, a nurse or physician monitored vital signs, checked the dressing every two hours for bleeding, and recorded drain patency and the amount and character of drainage.

Staff assessed circulation in the remaining limb by checking proximal pulses, skin color, and fever, and they managed pain with oral analgesics.

Nurses and physicians encouraged the patient to walk, change position, and rest with proper alignment, keeping the residual limb extended rather than flexed to prevent contractures.

CONVALESCENCE

The foundation of convalescent care in ancient, Roman military hospitals was medical herbs, rest, appropriate exercise, proper diet, and sessions with the case manager, which could be a medicus or experienced nurse. Medical staff housed wounded and sick soldiers in separate wards (Celsus 1831). Once the initial bone-knitting phase passed, physicians used physical therapy, manipulation, massage, and gentle movement of the legs to prevent permanent muscle atrophy while the bones fully solidified. The patient received a a diet rich in foods believed to reduce inflammation, including berries, fatty fish, peppers, mushrooms, and grapes. Roman doctors gave the patients a mixture of vinegar and plant ash to ingest extra minerals, particularly calcium, to structurally

support bone remodeling from the inside. Patients with knee joint conditions were given deictically approved, then regular. meals. As recovery progressed, physicians prescribed Ankle Pumps, Quadriceps Sets, Short Arc Quads Straight Leg Raises, Heel Slides, Flexion Stretch, and Extension Stretch for injured knee patients. Proper bandaging and residual-limb conditioning reduced swelling and helped shape the limb. The Roman medical staff used Willow Bark as a draught internally, and turmeric as an ointment to treat inflammation. (Dioscorides 2017). To prevent Decubital from forming the staff often moved the position of the patient. They employed a lotion of frankincense and turmeric for this purpose as well. (Dioscorides 2017). The Medici used a mixture of alum and Oak Gaul as hemostatic agents. (Dioscorides 2107).

The surgeon covered the residual limb with a rigid resin-and-wax dressing. After removing it, hospital staff washed the limb daily with oil and water, rinsed and dried it gently, massaged the area, and checked for complications. They reported swelling, redness, excessive drainage, increased pain, rashes, blisters, or abrasions to the physician. The staff-controlled fever by sponging the patient with cold water and giving them a draught containing powdered Salix. (Dioscorides 2017).

As the patient improved, staff taught him to bandage the residual limb and apply a custom-fitted linen covering. Once the edema subsided, they fitted a custom prosthesis. Romans developed prosthetic devices for the arms, hands, and lower legs (Galen 2011; Aegineta 1846a).

Once a legionnaire was well enough to leave the hospital, he and his family were sent to one of the many coloniae across the Roman Empire. These colonies granted land to retired and disabled veterans, who also received 12,000 sesterces in severance pay and tax-exempt plots.

Each colonia had an infirmary staffed by personnel trained to care for disabled veterans.

The coloniae also provided supportive communities where veterans could cope with the physical and psychological effects of wartime service (Dio 1917; Sweetman 2011).

CONCLUSION

Roman physicians and surgeons developed diagnostic and treatment protocols for dislocations and fractures of knee joints that were remarkably advanced for ancient times. The diagnostic protocol included: gathering subjective reports, observing objective signs, comparing findings with similar cases, developing a treatment plan, and revising that plan as needed.

Treatment followed four broad stages: nonoperative care, surgery, when necessary, convalescence, and physical therapy, extensive bed est and phytotherapy.

Although these protocols resemble modern practice, today's orthopedists use diagnostic and treatment technologies unavailable to the Romans.

Modern diagnostic tools include the manometer, X-rays, computed tomography (CT), magnetic resonance imaging (MRI), and other volumetric imaging methods.

Galen describes some of the instruments used by Roman physicians (Galen 2011).

Common instruments in modern orthopedic surgery include Hohmann retractors, tenolysis instruments, wound VAC systems, self-retaining retractors, elevators, drum dermatomes, extraction tools, and K-wire and pin instruments (Dutton 2025).

nonoperative procedures, (2) surgical procedures, (3) convalescence, and (4) physical therapy. Modern orthopedists also rely on diagnostic and treatment technologies the Romans did not have. Examples of modern diagnostic tools include the manometer, X-rays, computed tomography (CT), magnetic resonance imaging (MRI), and other volumetric imaging methods. Galen describes some of the instruments used by Roman physicians (Galen 2011). Common modern orthopedic instruments include Hohmann retractors, tenolysis instruments, wound VAC systems, self-retaining retractors, elevators, drum dermatomes, extraction tools, and K-wire and pin instruments (Dutton 2025).

GLOSSARY

Aloe Vera Used as a gel it contains Aseemanand, glucomannans, Bradykinesia, phytosterols, amino acids, auxins and Gibberellins which produce a cooling and soothing effect on pressure points to help reduce swelling and protect the skin.

Alum is a natural mineral salt that as an astringent. Barbarum contained copper acetate, lead oxide, alum, dried pitch, pine-resin, olive oil, and vinegar. The mixture acted as a stypsis.

Cerates were unctuous preparations consisting of wax or resin, mixed with oil and lard and sometimes medicinal ingredients. They protected the skin and soothed inflammation.

Comfrey contains allantoin, which promotes cell regeneration.

Corn poppy contains rhodamine, a mild sedative.

Some foods like blackberries contain flavonoids or the polyphenol resveratrol that are anti-inflammatory compounds.

Frankincense contains terpenes and Boswellic acids to produce antiseptic and wound healing properties, anti-inflammation, and helps to prevent the worsening of decubiti.

Henbane seeds contain scopolamine and hyoscyamine.

Honey has several antibacterial components. These components include defensin-1, hydrogen peroxide, and methylglyoxal. The high sugar content of honey and its low pH add to tts antibacterial qualities.

Mandrake is an analgesic containing scopolamine, hyoscyamine, and atropine.

Oak gall are rich in tannic acid, which is a natural astringent that promotes rapid clotting.

Opium is a powerful analgesic containing morphine, codeine, and thebaine Turmeric contains the rhizome curcumin, an anti-inflammatory.

Vinegar contains acetic acid, an antiseptic.

Willow bark contains salicylic acid, an antifebrile and mild analgesic.

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