



# Jean-Louis Petit (1674–1750): a pioneer anatomist and surgeon and his contribution to orthopaedic surgery and trauma surgery

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## Abstract

**Purpose** The purpose of this review is to summarize the life and work of Jean-Louis Petit, his inventions, his discoveries, and his impact on the evolution of surgery of his era.

**Method** A thorough search of the literature was undertaken in PubMed and Google Scholar as well as in physical books in libraries to summarize current and classic literature on Petit.

**Results** Jean-Louis Petit (1674–1750) was an eminent anatomist and surgeon of his era with an invaluable contribution to clinical knowledge, surgical technique, and instrumentation as well as innovative therapeutic modalities and basic scientific discoveries.

**Conclusion** Jean-Louis Petit was an innovative anatomist and surgeon as well as an excellent clinician of his era. He revolutionized the surgical technique of his era with a significant contribution to what would later become orthopaedic surgery.

**Keywords** Jean-Louis Petit · Invention of tourniquet · Amputation · Orthopaedics · History of surgery · Trauma surgery

## Introduction

Jean-Louis Petit (1674–1750) (Fig. 1) was an eminent anatomist and surgeon of his era with an invaluable contribution to clinical knowledge, surgical technique, and instrumentation as well as innovative therapeutic modalities and basic scientific discoveries. He made a particular impact in the surgical technique of his era with his observations and inventiveness, and he was one of those who paved the way for the nineteenth to twentieth century surgical revolution [1].

The purpose of this historic review is to summarize his life, his work, and his contribution to anatomy and surgery with a special interest in his innovation of orthopaedic surgery.

## The life and career of Jean-Louis Petit

Jean-Louis Petit (Fig. 1) was born in Paris on March 13, 1674. In the house where he lived also lived a famous anatomist, Alexis Littré (1654–1726). The anatomist allowed him to reach the room where the impressive dissections of animals or fragments of human corpses were performed. The little man of five to six years developed an exceptional interest in the work of the master. His talent, his great youth (his small size forced him to get on a chair to be seen!), helped him to acquire a kind of reputation [2, 3].

In the six or seven years that followed, Jean-Louis soon advanced in all the anatomical knowledge of his age; one rarely sees specialization so exclusive at this era [3, 4]. Guided by Littré, Jean-Louis worked, from 1690, with a known practitioner, Castel, with whom he remained for two years, having free hours only to go to other courses or various hospitals. The practice of surgery was not very different to that of anatomy. Soon, his extraordinary greed could no longer be satisfied with Castel. The young student was anxious to leave for war surgery [2, 5].

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**Fig. 1** Portrait of Jean-Louis Petit (1674–1750)

He joined the army of Luxembourg during the siege of Namur. Even in military life, he worked to complete his education, working tirelessly. Having quickly gained the esteem and confidence of his superiors, Jean-Louis, a 20-year-old surgeon, was called for the seriously wounded, and he was preferred to surgeons who were much older than him. They did not only admire his dexterity, the lightness of his hands, but, despite his young age, he showed judgment and operated only when it was impossible to do otherwise, after long reflections and evaluation of the risks and consequences [1, 3, 5]. Finally, he became a staff assistant at the hospital of Tournai. Back in Paris, he once again modestly placed himself on the benches of study, in order to receive a master's degree in surgery. He was awarded this title two years later. As soon as he had it, he started teaching and he did not stop for 30 years [1, 2, 4].

In 1724, Francois Gigot de La Peyronie thought of getting the king to appoint five demonstrators of the Schools of Surgery, so that the instruction of the students “would cease to be exposed to chance events.” Petit was one of those Royal Demonstrators, as they were called (a milestone in the progress of surgery) and his name is the only one of the five that passed into posterity [1–3].

In December 1731, Petit, who was a member of the Royal Academy of Sciences since 1715, was appointed director of this Academy of Surgery. The first annual public session took place on June 10, 1732, in the assembly hall of Saint-Côme. Georges

Mareschal and François Gigot de La Peyronie remained at Compiègne near the king but they confided to Petit the presidency of this new body, dedicated to the perfection of the operative art by experiment and observation [1, 2, 5].

After the consultation of the Dauphin, the king proposed to him titles of nobility, but Petit did not have the least desire of distinctions, because he had lost a son of 27 years, an event that devastated him. Unfortunately, his health, which for three quarters of a century had allowed him a legendary overwork and punctuality, worsened, when he was 76 years old, rather abruptly. A chest tightness with attacks of suffocation aggravated and he underwent several bleeds. His breathing, despite these, did no longer find his normal ease and minimal effort tired him. On the 17 of April, 1750, a spitting of blood of considerable importance warned him of the danger only too late; he himself understood. Calmly and meticulously, he took all his precautions as a pious man and, without a complaint, succumbed [1, 2, 4, 5].

### The scientific work of Petit

At the Royal Academy of Sciences and later at the Royal Academy of Surgery, for 20 years, Petit wrote many scientific papers, almost all revealing important knowledge. One can even say that these years, partly thanks to him, constituted one of the greatest eras of the Royal Academy of Surgery. Petit's admission to the Academy of Sciences was mainly due to the success of his first book, “Treaty of Bone Diseases,” published in 1705 and translated into many languages, dedicated to Georges Mareschal, first surgeon to the King [1, 2, 6].

In an edition of Leiden, this work was placed between that of Cortial, physician of the king in the city of Toulouse, “On the anatomy of bones,” and that of Lémery, professor in the Faculty of Medicine of Paris, “On the feeding of bones.” Petit titled it: “The Art of treating Bone Disease,” followed by a long subtitle: “Where dislocations and fractures are treated, with the necessary instruments and a machine of new invention to reduce them; together exostoses and caries, ankylosis, diseases of the teeth and of rickets, ordinary illness to the children.” He had written the pages on the diseases of the skeleton at the request of the students who had attended the course he had been appointed to teach in the theatre of Saint Côme, in 1700, once he was awarded his mastery [4, 5].

Fame soon followed the publication of this book and one can note, in the correspondence of that time, his name appearing in the centre of several Parisian events. Nearly 20 years after this first edition of his book, Petit wrote a second edition; he increased its content and improved it a lot. In this edition, which arrived at its almost definitive form, there were new facts and innovative remarks, vivid clinical narratives, and a number of personal therapeutic methods. For Petit, not to share knowledge would be to commit a crime against humanity, to violate the laws of society, and, so to speak, to die insolvent [1, 5].

The principal achievements of Petit concerned the hemostatic tourniquet (Fig. 2), the spontaneous filling of the injured arteries, amputations, the cure of hernias, the treatment of breast cancer, various distensions of the gallbladder, and the traumatic sanguineous haemorrhages developed between the skull and the brain [2, 5].

In a case when persistent haemorrhage jeopardized the life of Marquis de Rothelin, a patient very famous in Paris, Petit applied the extremely ingenious device he had invented. During the time, a hand remained resting on the bleeding artery to control the blood loss, both in the groin and the bleeding point to compress the artery of the thigh. As a result of this well-known success, Petit closely studied an important physiological phenomenon: the formation of the clot which, spontaneously or after compression, stops the flow of arterial blood. His study of the clot in the forming has long been a classic model of objectivity [3].

With regard to the treatment of haemorrhages, it was surprising to see Petit rejects the ligature which Ambroise Paré had helped to show the advantages. Before condemning him for this error, it is advisable to remember the infectious and

gangrenous conditions caused by threads, used before the discovery of asepsis. Ironically, it was the tourniquet invented by Petit that made the amputation technique described by Ambroise Paré popular and applicable in the battle field without assistance for the surgeon of the era [7, 8].

With his experience as a highly consulted clinician, Petit prepared, for 25 years at least, the materials of his great work “General Treatise on Surgical Operations,” which was not published until after his death. In his study of wounds of the head and lesions of the skull and the brain, he specified, in seeking to determine the indications of a trephination, an important syndrome: that of the compressions of the brain by traumatic intra-cranial blood effusions [2, 4].

Through surgical procedures and autopsies, Petit had become acquainted with the mechanism and extent of the adhesions which sometimes surround the gallbladder. He gave a detailed description of his findings and his explanation [3, 4, 6].

### The legacy of Petit in anatomy and surgery

The name of Petit has been given to the “hernia of Petit” which is a hernia located in the lumbar region, at the level of Petit’s triangle, “Petit’s Triangle” (lumbar triangle) which is a lumbar region limited by the large oblique and large dorsal muscles and the iliac crest, constituting a kidney approach, above the posterior portion of the iliac crest which is also one of the weak points of the region, the “ligament of Petit” (uterosacral ligament) passing posteriorly in the rectouterine fold to attach to the sacrum, “Petit’s Disease” which is a superior protrusion, usually lateral, of the abdominal organs through the diaphragm; the “operation of Petit” which refers to a technique of radical cure of a varicocele and “Petit and Larrey tourniquet” which is an external compressor for arteries, equipped with two bearings coming closer to each other by means of a screw; this device is currently abandoned [2, 4, 6, 9–11].

The mechanism of hemostasis was elucidated by Petit in 1731. Petit also gave an excellent clinical study of senile dysuria, although he did not attribute it systematically to its prostatic cause. In his works, Petit recommended the lavishing and sterilization of wounds with alcohol. As far as infections are concerned, Petit emphasized the dangers of stagnation of pus in deep foci and the reflux of these “deposits”; he saw the existence of metastatic abscesses of the liver. For tetanus therapy, he recommended amputation [1, 2, 6].

The trephination treatment of mastoiditis was theoretically proposed by Jean Riolan. In 1736, Petit performed a trephination, for the first time (Fig. 3). In 1708, Petit easily removed a dislocated cataract lens in the anterior chamber. Thereafter, the idea of extraction was common, and from 1745, the operation was systematically performed by Jacques Daviel on the cataract lens as a routine operation [3, 4, 6, 9].

The concussion was elucidated by Boirel (1677) and Alexis Littré (1705), who differentiated it from the fracture

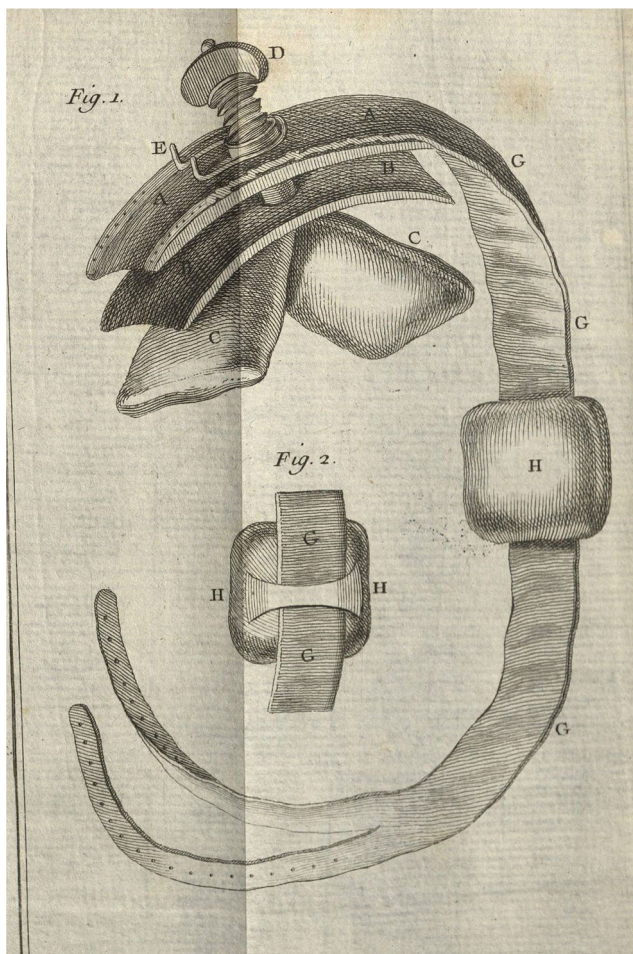


Fig. 2 The tourniquet of Petit from his book





**Fig. 3** Petit practicing a trephination

of the skull. Later, Petit, the apprentice of Littré, separated the concussion from the cerebral compression. He pointed out the great value of the free interval as a symptom of compression and elaborated the differential diagnosis between a skull fracture and an haematoma [2, 4, 6].

As far as breast cancer is concerned, the spread of the tumour to the pectoralis major muscle, sternum, and ribs, as well as costal pain and ulceration of the skin, was contraindications to surgery adopted by almost all surgeons. Until the time of Petit, this was also the case of axillary lymphadenopathy. On the contrary, Petit was a convinced interventionist. Petit used a hook to reduce the broken fragment of a posterior dislocated sternal fracture [1, 3, 5, 6].

With regard to liver abscess, Petit emphasized the importance of hepatocellular adhesions and pointed out the safety of surgical drainage performed through this area. He observed the removal of the gland after emptying the abscess. Petit also was the one to differentiate cholecystitis from a liver abscess [5, 6].

Petit and Jasser were the first to perform a trephination of the mastoid after the collapse of the temporal bone. He advised to operate from the first fluctuations to prevent the spread of infection and destruction of vital organs. In his “*Traité des maladies chirurgicales*” (1724), one can find the

description of the intervention as well as the illustrations of the instruments used. After opening the skull with a customized tool, Petit used an exfoliative trephin for the drainage of the pus contained in the mastoid [6, 9].

### The contribution of Petit to orthopaedic and trauma surgery

The tendon ruptures, and particularly those of the Achilles tendon, were successfully treated by Petit by a splinted bandage keeping the ankle and the foot extended [6].

In 1772, Petit gave a good natural history of coxalgia with its termination by bone necrosis and pathological dislocation. This condition, quite common and known since the antiquity, was explained in different ways: either by the accumulation in the articulation of fluid that repels the femoral head (Hippocrates, Galen, Paul d’Aegina, Fabrice d’Acquapendente, Heister, Morgagni, Brodie and especially Jean-Louis Petit); either by development of an intra-articular tumour: exostosis (Gorter), inflammatory osteochondritis (Desault, Bichat, Boyer), lipoma (Valsava, Portal, Fallopio), or hypertrophy of the head (Riest); either by necrosis of the head (Sabatier, Paletta) or of the acetabulum. For fractures of the tibia, Petit had a special splint like a box invented [6].

The routine amputation technique was the circular in that era (Celsus procedure). It was improved by Petit, who replaced Morel’s tourniquet with his screw tourniquet. Petit sectioned the soft parts into two stages: first the ligaments, then the muscles and bone, and the soft tissue were sawn around the bone to cover its edges [2, 4, 6–8].

In amputations-disarticulations, as in wounds, the ligation of the vessels advocated by Ambroise Paré had such inconveniences that Petit did not use it. Petit, considering that the best haemostasis is achieved by the formation of clots, used, during the operation, a tourniquet, manual compression and drainage, and, after the operation, appropriate mechanical dressing and supports to maintain in good place the soft tissue and compress the vessels through them. Haemostasis by ligation was imposed at the end of the eighteenth century when it was understood that to obtain a well-formed limb, it was necessary to close the soft tissue by a dry suture or suture without interposing anything between bone and skin [4, 5, 7, 8].

Perhaps, his greatest invention, with an impact in modern orthopaedics, was the invention of the screw compression tourniquet (Fig. 2). Tourniquets used before him were painful and too compressive. Gersdorff in 1517 advocated the elective amputation above the injury level for war injuries with the use of tourniquets proximal and distal to the amputation site. To control blood loss, he invented an haemostatic substance containing egg, and if that did not work, cauterizing could be employed or warm oil applied. He also proposed the coverage of the wound with a cow or pig bladder. Also, Ambroise Paré (1510–1590), the father of modern surgery, was a barber

surgeon who used tourniquets and vessel ligatures (forceps and sutures) for haemostasis. However, those tourniquets were difficult to apply and not quite as effective. In addition, they required an assistant to supervise and hold them in place. They were not practical for emergency amputations in the battle fields of the era [7, 8, 11, 12].

The tourniquet developed by Petit with the assistance and constructive genius of the mechanic Peron, as early as 1718, did not compress the region through where large arteries and veins were passing, and it could be deflated for a moment. The device compressed through a screw and once applied held firm without the help of an assistant, and it could be left in place in cases where secondary bleeding was feared; finally, its compression was not only better localized; it could also reach several degrees of compression. This tourniquet made possible the amputation of a devastated limb in a battle field with the technique described by Ambroise Paré by a surgeon without assistance, and it reduced the death rate due to blood loss. After that, the amputation surgery was gradually popularized to save the life of a seriously wounded soldier [7, 8, 11, 12].

## Conclusion

Jean-Louis Petit was an innovative anatomist and surgeon as well as an excellent clinician of his era. He revolutionized the surgical technique of his era with a significant contribution to what would later become orthopaedic surgery. Perhaps, his most significant contribution was the invention of an easily applicable and practical screw-compressed tourniquet which revolutionized amputation surgery and decreased its high mortality rate due to blood loss during the operation.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflicts of interest.

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