

# Tratamento de Osteomielite Crónica com Técnica de Papineau

## Papineau Technique for Treatment of Chronic Osteomyelitis

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### Resumo

A abordagem da osteomielite crónica assume-se como um desafio para os Ortopedistas, não obstante a constante evolução de técnicas cirúrgicas e antibioterapia.

Reportamos o caso de um homem de 66 anos, diagnosticado com osteomielite crónica da diáfise tibial direita, complicação de fratura exposta, com 37 anos de evolução. Após várias tentativas de controlo com antibioterapia e extração de material de osteossíntese, procedeu-se à técnica de Papineau em 2 tempos, com desbridamento exaustivo, preenchimento do espaço morto com enxerto ósseo esponjoso autólogo de crista ilíaca, encerramento de tecidos moles por segunda intenção, com auxílio de vacuoterapia e antibioterapia dirigida.

Têm sido descritas várias técnicas para o tratamento de tão devastadora complicação, surgindo o método de Papineau como uma opção viável e atual, apesar dos seus quase 50 anos de existência, sendo alvo de constante interesse e modificações, acompanhando a evolução da medicina, com vista aos melhores resultados.

### Abstract

The approach to chronic osteomyelitis is a challenge for orthopedic surgeon, despite the constant evolution of surgical techniques and antibiotics.

We report the case of a 66-year-old man diagnosed with chronic osteomyelitis of the right tibial shaft, an open fracture complication, with 37 years of evolution.

After several attempts to control it with antibiotics and extraction of osteosynthesis material, the Papineau technique was performed in 2 stages, with exhaustive debridement, filling the dead space with cancellous iliac bone autograft, soft tissue coverage by second intention, with the aid of vacuum-assisted closure and antibiotic therapy.

Various techniques have been described for the treatment of such devastating complication, with the Papineau method emerging as a viable and current option, despite its almost 50 years of existence, being the target of constant interest and modifications, following the evolution of medicine, aiming the best results.

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**Palavras-chave:** Antibacterianos/uso terapêutico; Osteomielite/cirurgia; Transplante Ósseo; Vácuo

**Keywords:** Anti-Bacterial Agents/therapeutic use; Bone Transplantation; Osteomyelitis/surgery; Vacuum

## Introduction

Over the last few decades, we have witnessed several advances in the area of antibiotic therapy and surgical techniques, however, the treatment of infected pseudarthrosis or chronic post-traumatic osteomyelitis remains a challenge.<sup>1</sup>

Extensive bone and soft tissue defects are serious consequences of open fractures caused by high-energy impacts, compromising the consolidation and healing capacity, making them more prone to infection.<sup>1-3</sup> Several techniques have been described for the treatment of such devastating complications, with no consensus on the best option.<sup>2-4</sup>

Several techniques have been described for the treatment of bone defects, such as non-vascularized cancellous bone grafts, the Papineau method, bone transports using the Ilizarov method or vascularized bone grafts.<sup>1,3</sup>

The Papineau method presupposes, after bone stabilization, the application of a cancellous bone graft in a bed of granulation tissue, achieved through multiple debridements of infected necrotic tissue, maintaining the posterior cortex and consequent delayed healing, by second intention or skin graft.<sup>1,5</sup> It is essentially used in the treatment of chronic osteomyelitis or infected pseudarthrosis. In fact, Papineau, in 1973, described this technique for the first time in the treatment of 37 people with infected pseudarthrosis of the tibia<sup>6</sup> and in 1979, in the treatment of 180 patients with chronic osteomyelitis, with a success rate of 93%.<sup>7</sup>

Modifications to the original technique have been developed, such as the modern Papineau, which adds the use of an external fixator, the addition of cement with antibiotics and coverage with a myocutaneous graft; the Cardiff Protocol that simplifies the technique in a single step; the Masquelet technique, which temporarily uses cement, assuming the formation of a pseudosynovial membrane; or the combination of vacuum therapy, advocated by Archdeacon.<sup>2,8</sup>

## Case Report

We present the case of a 66-year-old man, with a history of biological aortic valvuloplasty, diabetes mellitus, pulmonary emphysema and dyslipidemia.

About 44 years ago he suffered an accident while on military duty in Angola, with trauma to his right leg due to compression

between two vehicles, resulting in an open fracture of the leg bones, with comminution of the proximal 1/3 of the tibial diaphysis. Skeletal traction was applied for 3 months. He was transferred to Portugal with a closed plaster cast, later developing a soft tissue infection. He underwent to osteosynthesis with plate and screws.

Five years after the accident, he began to experience swelling of the anterior surface of the leg and drainage, with a diagnosis of osteomyelitis, and the osteosynthesis material was removed. After 20 years he relapsed, suffering frequent episodes of drainage.

He was referred to the Orthopedics consultation by Cardiology department, for post-operative follow-up of the valvuloplasty he underwent, due to the risk of bacterial endocarditis.

He then presented an ulcer with devitalized tissue, without bone exposure, approximately 1x1 cm in size and a fistula draining purulent content in moderate quantities, associated pain (Fig. 1) and 2 cm of shortening of the right lower limb. This situation is compatible with what is found in chronic osteomyelitis, since cyclical manifestations of pain are frequent, of increasing intensity, which are relieved when there is drainage through the fistula.<sup>9-11</sup>



**Figure 1.** Ulcer with devitalized tissue and fistula orifice with purulent drainage

When clinically evaluating a patient with chronic osteomyelitis, it is important to check for the presence of Marjolin's ulcer, a consequence of the malignant transformation of squamous cells.<sup>12</sup>

He presented analytical negative inflammatory parameters, which does not exclude the diagnosis of chronic osteomyelitis.

Preoperative culture of the exudate revealed positive for *Pseudomonas aeruginosa*, and he was treated with ceftazidime. Plain radiographs and computed tomography (CT) scan revealed cortical thickening, areas of osteolysis with sequestrations, a bone defect, measuring approximately 2x1 cm, and destruction of the anterior cortex (Fig. 2). Osteomyelitis type III, Bs (Cierny and Mader classification) was classified. Despite being indicated for the study of bone marrow and soft tissues, magnetic resonance imaging (MRI) was not performed due to its cardiac surgery.



**Figure 2.** Plain radiograph showing osteomyelitis



**Figure 3.** Axial CT section that reveals cortical thickening, geodes with sequestrations, bone defect and destruction of the anterior cortex.

He underwent to the Papineau technique in 2 stages. In the first stage, debridement, curettage and filling of the bone cavity with moistened gauze were carried out, renewed periodically. This debridement was carried out until the Paprika sign

appeared, that is, until the bone actively bled through small bone channels.<sup>12</sup> It was also a concern to ensure a good resection of soft tissues with the aim of preparing an adequate and healthy vascular bed. In the second stage, carried out 2 weeks after the first one, after verifying that the wound bed was clean, the dead space was filled with an autologous cancellous bone graft from the iliac crest (Fig. 4), an alteration to the classic technique of Papineau, who used sheets of corticocancellous bone,<sup>13</sup> subsequently covering it with paraffin gauze dressings, promoting healing by second intention (Fig. 5).



**Figure 4.** Autologous cancellous bone graft from the iliac crest



**Figure 5.** Healing by second intention

Intraoperative bone tissue cultures, performed in the first stage, were positive for *Pseudomonas*. It is argued that multiple samples are needed for culture, in order to increase sensitivity, overcoming the problem of contamination, with a consensus that samples from five or more locations should be obtained.<sup>12</sup>

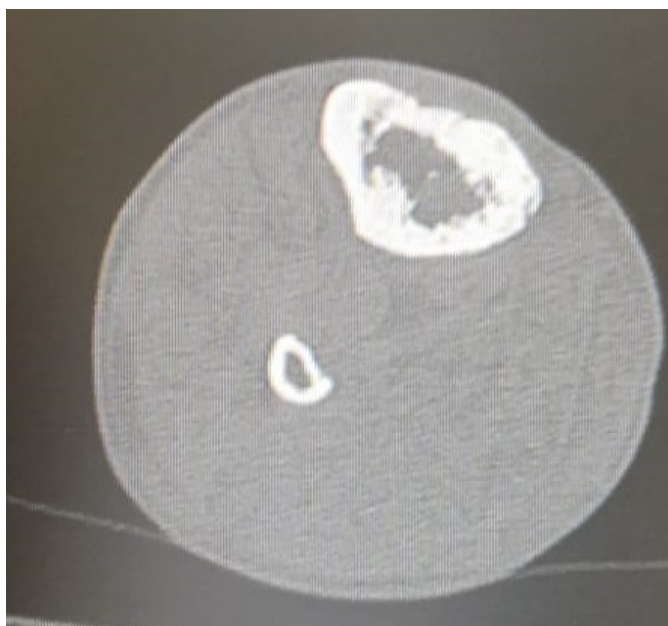
Wound treatment was complemented with vacuum therapy, replacing it every 3-4 days, with the aim of increasing vascularization and consequently the formation of granulation tissue and eliminating the accumulation of interstitial fluid, which promotes the development of fibroblasts, vascular endothelial cells and reduces the bacterial count, contributing to good healing progress by second intention.<sup>3,14</sup>



Treatment was complemented with parenteral antibiotic therapy for 6 weeks, showing no clinical or radiological evidence of infection at this stage, switching to oral therapy until 6 months were up, as supported by scientific evidence. No recurrence in 2 years of follow-up (Fig. 6). Imaging also confirms control of the infection. A new CT scan revealed signs of consolidation, reduction of the cortical defect and less thickening of the supra-adjacent soft tissues (Fig. 7).



**Figure 6.** Wound healed, without recurrence after 2 years



**Figure 7.** Axial control CT section that reveals a reduction in the cortical defect and less soft tissue reaction.

## Discussion

Osteomyelitis is a complex and potentially devastating condition, representing one of the biggest clinical challenges in Orthopedics. Its definition, cited for the first time by Nelaton in 1844,<sup>10</sup> is understood as an inflammatory state, caused by a microorganism, which may involve the cortical and cancellous bone, bone marrow and periosteum.<sup>9</sup> In chronic osteomyelitis, a sequestration develops infected, separated from the remaining bone during the development of necrosis.<sup>11</sup>

With this case we review the application of the Papineau method in a patient with chronic post-traumatic osteomyelitis, refractory to various antibiotic treatments.

The Papineau method was developed with the aim of treating complex and challenging complications such as bone defects and post-traumatic osteomyelitis. The objective of treatment is to eradicate the infection, maintaining only viable tissue, with recovery of function. Adequate debridement is of particular importance, including the removal of all infected and necrotic tissue. For this purpose, this technique involves curettage and removal of necrotic and devitalized tissue resulting from chronic osteomyelitis or infected pseudarthrosis, followed by the application of a bone graft and respective hematoma to the defect bed, with coverage with soft tissues not being mandatory, proceeding then to dressing care, renewed until healthy and viable granulation tissue develops, care that can be complemented with vacuum therapy, as suggested by Archdeacon and Messerschmitt in 2006.<sup>1,2,5</sup>

This ancient but revolutionary technique does not contraindicate the use of bone transport or muscle flaps.<sup>1,4</sup>

In this case, the Papineau method was developed in two phases, with some authors opting to develop it in three phases or even one phase, in this case increasing the risk of recurrence due to inadequate debridement and removal of devitalized tissue.<sup>13</sup>

Despite the unquestionable need for surgical debridement, it is not realistic to expect that all infected or necrotic tissue will be removed, and surgery must then be complemented with local and systemic antibiotic therapy.

## Conclusion

The Papineau technique appears as a useful and effective tool in the prevention/control of infection, bone consolidation and soft tissue coverage, in cases of chronic osteomyelitis or infected pseudarthrosis.

Extensive surgical bone debridement is a vital step in the treatment of chronic osteomyelitis, as the removal of necrotic

tissue, avascular periosteum and fibrotic scar tissue is essential for the success of the procedure. With the removal of fibrotic tissue and bone sequestrum, a favorable environment for bone consolidation is promoted, enhanced by the ease of drainage through the wound.

The treatment of chronic osteomyelitis with the Papineau technique appears as an available, current, highly successful therapeutic gesture, at a time when there is extensive study and several therapeutic options, not always achieving the best results.

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**ASC:** Elaboração do artigo

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**ASC:** Preparation of the article

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