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Early rehabilitation management strategy for septic arthritis of the knee

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Introduction

Septic arthritis is a serious diagnosis with incidence in 2 to 10 per 100,000 patients [1]. Many risk factors exist and the risk of mortality is estimated at 5-20%. Functional complications with loss of joint mobility are found in 10-73% [1-3] of patients. According to Lim et al, the average length of hospital stay is 13.5 ± 12.1 days with an average readmission rate of 80% [2].

While medical and surgical management of these acute infections has made it possible to limit morbidity and mortality, rehabilitation management remains poorly codified and is often delayed. No codified rehabilitation protocol currently exists. While the 2015 HAS (*Haute Autorité de Santé*) and 2010 SPILF (*Société de Pathologie Infectieuse de Langue Française*) [3] guidelines for management of septic arthritis on non-native joint recommend an initial immobilization period followed by passive mobilization, they take place without a defined protocol.

At the pathophysiological level, septic arthritis is considered to be the condition entailing the most rapid joint destruction [4,5]. Cartilage damage begins as early as the 8th hour and continues, despite the early initiation of appropriate antibiotic therapy [6].

Various studies on animal models have highlighted the anabolic effect of cyclic physical stress on the cartilage extracellular matrix [7] and the anti-inflammatory character of early passive mobilization via the regulation of cytokine synthesis [8,9]. In the septic arthritis model, only continuous passive mobilization has shown a beneficial effect in reducing the formation of osteophytes, synovial pannus and microscopic chondral alterations [10,11]. In humans, these effects have remained poorly studied. While early mobilization protocol could improve the functional prognosis, early rehabilitation management remains poorly codified.

The aim of our study is to develop an early rehabilitation strategy for septic knee arthritis in native joints based on data from the literature and expert opinion.

Material and method

The protocol was developed in five stages according to the formalized HAS consensus recommendation method [12]:

A systematic review of the literature on PubMed, in French and in English, on the rehabilitative management of septic arthritis of the knee, from 1966 to 2016, in humans and in animals, was carried out with the following keywords: *“septic arthritis”, “knee”, “rehabilitation”, “continuous passive motion”, “immobilization”, “algorithm”, “protocol”, “chondrolysis”*. An initial version of the protocol was written by a multidisciplinary team experienced in the management of septic arthritis (infectious disease physicians, physical and rehabilitation medicine (PRM) specialists, orthopedic surgeons, physiotherapists). The version was modified after critical review by a panel of experts from the same specialties, the objective being to obtain a final version of the protocol. Seventeen experts were solicited: 4 PRM physicians, 2 infectious diseases physicians, 3 rheumatologists, 2 general practitioners, 2 orthopedic surgeons and 2 physiotherapists (Figure 1) in Clermont-Ferrand and Cochin University Hospital, France. The relevance of each item was rated on a Likert scale ranging from 1 to 9. Free comment was requested for each item when the rating was <5. Items were validated outright in case of high panel agreement (7 to 9) without modification except for relevant comments. Any score below 5 was modified in accordance with the comments received.

Results

Out of the 17 professionals, 6 (35%) responded to the numerical evaluation requested, but only 5 questionnaires were complete and analyzable (1 PRM physician, 1 infectious disease physician, 1 rheumatologist, 1 orthopedic surgeon and 1 physiotherapist). Out of the 24 rehabilitation items proposed, 19 (79.2%) obtained scores above 7 without any modification required. Only 5 items were rated less than or equal to 5 with free comments (Figure 2)

An item on performing early joint mobilization was scored below 5 for all 6 experts. It was emphasized that an acute septic knee is not mobilizable. No changes were made to this item. However, it was specified that mobilization should be carried out according to the patient's tolerance and pain.

Concerning the item on passive or motorized manual mobilization, 2 experts did not validate the item due to a lack of precision on the duration of mobilization. The indication of a minimum time threshold of 15 minutes was specified. Passive mobilization should be carried out at least once a day, depending on the patient's tolerance and with effective analgesic coverage.

As for the items concerning open-chain muscle strengthening and proprioceptive work, they were maintained but without any notion of obligation, with the indication having to be adapted to the clinical context.

Lastly, the item concerning restoring weight bearing was not modified. Some experts mentioned the risk of rapid chondrolysis, which remains a rare complication. Consequently, a return to weight-bearing may be envisioned as soon as the pain and muscle control allow it. It should be progressive and carried out with technical aids.

The different modifications enabled us to obtain a final version of the rehabilitation protocol (Figure 3).

Discussion

Based on data in the literature and expert opinion, this study led to the development and validation of a protocol for early-phase rehabilitation management of septic arthritis of the knee in a native joint. Out of all the experts contacted, only 35% responded to our questionnaire, with a consensus on the majority of the items proposed in our protocol (79.2%). The 5 items with the lowest scores were discussed and modified according to the comments made in order to obtain the final protocol. Despite the lack of existing studies in humans in the literature, early rehabilitation management of patients with septic knee arthritis in native joints should improve functional prognosis and help reduce oedema and pain.

The reluctance of health professionals to mobilize a painful joint early may make it difficult to implement this type of protocol in daily practice. Gentle, repeated and short duration mobilization, with appropriate analgesic coverage, could improve tolerance. Similarly, pain and discomfort ratings should be assessed before and after each session in order to optimally adapt the management.

The second point highlighted in the comments received concerned the patient's handover phase. It was decided following feedback from the experts to evolve the rehabilitation protocol according to clinical criteria: muscle control, pain evaluation, and not exclusively a time criterion. While a discharge phase will still have to be respected, it will be adapted to the patient's evolutionary profile.

The risk evoked is that of rapid chondrolysis. According to the literature, rapid chondrolysis is a serious but rare complication occurring mainly after arthroscopy or surgery in adults [13,14]. From a pathophysiological standpoint, the mechanisms are still poorly understood and often multi-factorial. Immobilization is one of the incriminating factors [15]. A premature return to weight-bearing could probably accelerate this process. Rehabilitation must be progressive, systematically using a technical aid (crutch, cane), which will be weaned progressively according to clinical evolution and type of surgery.

Among the professionals contacted, only one third completed the questionnaire, which is one of the main limitations of the study. On the other hand, at least one representative of each profession

responded, which ensures good representativeness. It is not possible to equate all types of septic arthritis. It is necessary to take into account the clinical evolution according to germ, clinical and biological evolution, and occurrence of a surgery.

Validated on the basis of available literature and expert opinion, this rehabilitation strategy should be validated prospectively in a limited number of patients in order to assess its clinical tolerance before considering a prospective randomized trial.

Conclusion

Early rehabilitation management of patients with septic knee arthritis in native joints should improve the functional prognosis of patients and help reduce oedema and pain. The apprehension of mobilizing a painful joint could make it difficult to implement this protocol in daily practice. Appropriate analgesic treatment is essential to enable early continuous passive mobilization. Pain and discomfort scores should be assessed before and after each session in order to best adapt the management.

The use of a rigorous methodology has enabled us to obtain a consensual strategy for early rehabilitation management. A prospective validation of this strategy is necessary to confirm its feasibility and effectiveness. A prospective randomized trial including patients infected with the same germ and matched on function and occurrence of surgery would be highly relevant.

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Figure 1. Flow chart

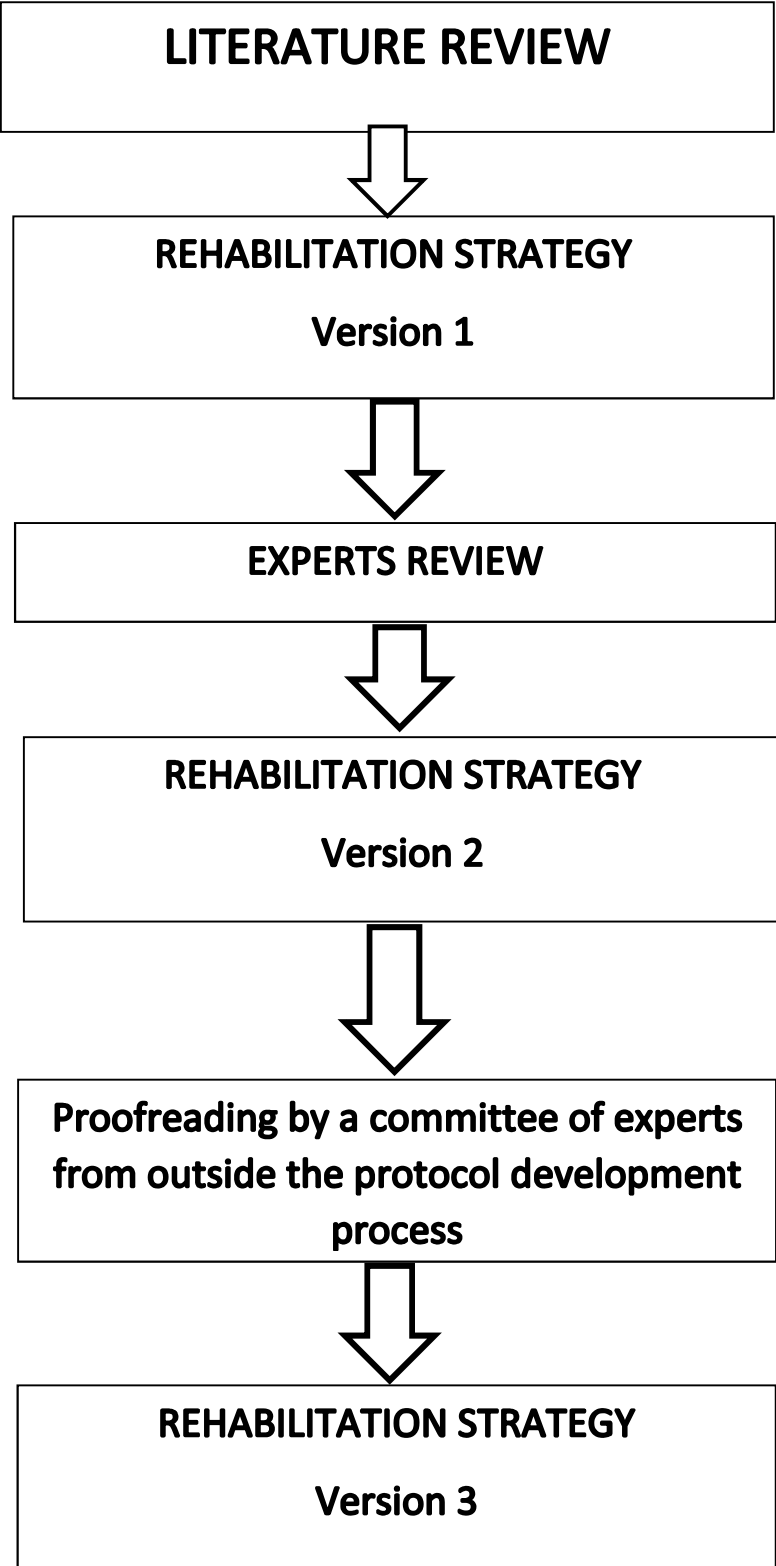


Figure 2. Development of an early rehabilitation protocol for the management of septic knee arthritis

- 1) Whatever the medical or medical-surgical management, it is not recommended to immobilize the knee in a Zimmer-type extension splint.
- 2) Rehabilitation management will begin on day 1 after diagnosis of septic arthritis of the knee.
- 3) An assessment of joint amplitudes (knee flexion and extension) will be carried out, with comparative examination of the contralateral limb. This assessment will take place at the time of the initial treatment and then regularly during follow-up.
- 4) It is recommended to evaluate tolerance to rehabilitation using the VAS pain scale at the beginning and end of each physiotherapy session.
- 5) Early rehabilitation, in the acute phase, should include analytical work aimed at progressive recovery of joint amplitudes.

A-From the recovery of joint amplitudes to the recovery of muscle strength

- 1) Rehabilitation must include the removal of muscle sideration, enabling not only voluntary contraction of the quadriceps and hamstrings, but also the sural triceps and the other muscles of the lower limb.
- 2) Rehabilitation must include gentle manual mobilization and/or on an athromotor depending on the patient's tolerance (pain controlled by the appropriate level of analgesics), up to 90° of flexion, at least 15 minutes once a day.
- 3) Rehabilitation must include self-passive mobilizations such as skateboarding, carried out autonomously after education with the physiotherapist
- 4) Rehabilitation must lead to a progressive increase in the areas of range of motion.

B- From muscle strength recovery to re-loading

- 1) Rehabilitation must include isometric contractions (cushion-crushing type of exercise) followed intermittent static work (6 sec of contraction, 6 sec of release).
- 2) Rehabilitation must enable active locking of the knee in extension.
- 3) Rehabilitation includes open-chain muscle strengthening work.
- 4) Rehabilitation must include proprioceptive reprogramming in the unloading phase.
- 5) Rehabilitation should include stretching in internal, middle and external running.

C) Achieving functional stability (transfer, balance, ambulation)

- 1) Rehabilitation must include muscle strengthening, particularly of the quadriceps and hamstrings, with progression from static to dynamic work and from the open to the closed chain.
- 2) Strengthening against resistance should be introduced progressively.

- 3) Re-loading as soon as muscle control and pain allow, using crutches
- 4) Assessment of active knee locking
- 5) Re-education of walking with the aim of regaining correct pattern and speed
- 6) Reprogramming of bipodal and then unipodal balance, eyes open and then closed
- 7) Neuro-muscular reprogramming on a stable and then an unstable plane.

Figure 3. Rehabilitation strategy

