

TREATMENT OF BONE AND JOINT INFECTIONS : RECOMMENDATIONS OF A BELGIAN PANEL

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A multidisciplinary panel of Belgian specialists describes the overall therapeutic approach for bone and joint infections. Classification, general methods of investigation, therapeutic options, special circumstances, the role of aminoglycosides and of glycopeptides are described. The possibility of home treatment is discussed, as well as some pharmacoeconomic insights.

Keywords : osteomyelitis, arthritis, glycopeptides, outpatient parenteral antibiotic therapy, pharmaco-economics.

Mots-clés : ostéomyélite, arthrite, glycopeptides, traitement antibiotique parentéral à domicile, pharmacoeconomie.

INTRODUCTION

Bone and joint infections can take several forms: arthritis, osteomyelitis or infection of implanted foreign material, both acute and chronic. Except for infectious disease specialists and orthopaedic surgeons, most physicians have only limited experience with these entities, owing to their relative rarity. However, the treatment modalities and implications are very important.

Therefore, this panel of Belgian experts, composed of one orthopaedic surgeon and traumatologist, two adult infectious disease specialists, one paediatric infectious disease specialist, one neonatologist, one hospital pharmacist with special interest in pharmacoeconomics and one expert in the field of antibiotic toxicity, developed recommendations for the treatment of the various forms

of the disease, with special attention to the role of glycopeptides in those entities where methicillin-resistance of staphylococci, both *S. aureus* and coagulase-negative staphylococci pose a special problem.

For further reading, we also refer to several excellent recently published reviews on bone and joint infections (6, 9, 15).

GENERAL PRELIMINARY RECOMMENDATION

Adequate microbiological sampling, allowing precise identification of the pathogen(s), is an absolute prerequisite to treatment. Indeed, therapy will depend for a large part on the type of pathogen involved. This documentation can be obtained

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either by needle aspiration or by arthroscopic (or open) drainage and rinsing.

In addition, blood cultures should always be obtained, as a bacteraemic phase is common.

RECOMMENDATIONS IN THE CASE OF ACUTE ARTHRITIS

As stated in the introduction, it is essential to obtain an etiological diagnosis, both in children and adults, in order to make the right antibiotic choice and to determine the duration of treatment. Therefore, direct aspiration of articular fluid is mandatory. It allows determination of the leucocyte count with differentials, Gram staining and cultures (aerobic and anaerobic). Blood cultures must also be obtained.

1. Etiologic agents

a) IN THE CHILD

Acute arthritis is mainly a disease of the paediatric ages. Because the microorganisms are different in each age group, as shown in table I, it is clinically useful to divide this population into 3 classes :

- neonates and infants younger than 3 months
- children less than 4 years of age
- children older than 4 years

Table I. — Etiologic agents of acute arthritis in the child in percent of total*

	Infants (< 3 months)	Children 3 months- 4 years	Children > 4 years
<i>S. aureus</i>	34	5	27
Streptococci	30	12	14
<i>H. influenzae</i>	3	30**	3
Other Gram neg.	11	6	6
Miscellaneous	22	4	14
Unknown	—	32	36

* Adapted from Reese (18).

** Since the introduction of anti-Haemophilus influenzae type b immunisation, the prevalence of this pathogen as an etiologic agent has steadily declined.

In the newborn, the distinction between arthritis and osteomyelitis is somewhat blurred, as many cases of arthritis are an extension of a contiguous osteomyelitis. Indeed, the neonatal cortex is very thin, and epiphyseal extension of an infection is the rule, with invasion of the adjacent joint.

In children older than 3 months, pyogenic arthritis is usually haematogenous in origin, or spreads from a contiguous focus of osteomyelitis. Besides the pathogens mentioned in table I, *S. pneumoniae* and fastidious Gram-negative organisms (e.g. *Kingella kingae*) should also be considered. Note that *Haemophilus influenzae* deserves special mention in this group, if no specific immunisation took place.

b) IN THE ADULT

If one excludes arthritis caused by *N. gonorrhoeae*, distribution of pathogens in acute arthritis is as indicated in table II (18).

Table II. — Etiologic agents of septic arthritis in the adult in percent of total*

PATHOGEN	INCIDENCE (in % of total)
<i>S. aureus</i>	68
Streptococci	20
<i>H. influenzae</i>	1
Gram-negative bacilli	10
Miscellaneous and mixed	1

* Adapted from Reese (18).

2. Therapy

Arthroscopic rinsing (or repeated needle aspiration) should be the first step in treatment. It allows sampling but also aims to evacuate as much purulent material as possible. One should take care not to damage the cartilage surfaces. Drainage of the joint fluid relieves the pain, provides adequate emptying of the enclosed space and removes inflammatory material. It thus prevents abscess formation (unfavourable pH or oxygen tension conditions) and destruction of the articular cartilage. Whether arthroscopic rinsing or repeated needle

aspiration is preferable is still an unsettled debate (11). The latter offers the advantage of allowing to monitor the effectiveness of antimicrobial treatment, by checking that the fluid becomes sterile after a few days.

a) ANTIBIOTIC TREATMENT IN THE CHILD

The first step in treatment involves orthopaedic evaluation, as open drainage might be necessary (e.g. hip arthritis).

Below the age of four years, empiric antibiotic treatment consists of third-generation cephalosporins without antipseudomonic activity. From four years onward, oxacillin or derivatives, with or without the addition of third generation cephalosporins, are recommended. Treatment is started parenterally until improvement of the clinical signs and of the inflammatory parameters. A switch to oral therapy is then possible, for a total of 3-4 weeks of treatment. Determination of serum bactericidal activity, however useful, is too cumbersome to be recommended in most circumstances.

b) ANTIBIOTIC THERAPY IN THE ADULT

Empiric treatment relies upon oxacillin derivatives, in combination with aminoglycosides or fluoroquinolones, until the results of the cultures are known.

Documented infection is treated for a period no shorter than two weeks in case of streptococci or *Haemophilus*, and may require three or up to four weeks in case of enterobacteriaceae, pseudomonas or *S. aureus* (18). A reasonable choice of antibiotics is presented in table III, depending on the clinical conditions.

RECOMMENDATIONS IN THE CASE OF CHRONIC ARTHRITIS

1. Etiologic agents

In this review, only infectious monoarticular chronic arthritis will be discussed, without referring to the rheumatoid-like systemic diseases. The most common causes are mycobacteriae (tuberculous and nontuberculous), fungi (especially *Can-*

didia spp.) and reactive arthritis (post-viral, *Yersinia spp.*, *Salmonella spp.* etc.) (20). Another more and more frequently recognised cause is the chronic arthritis associated with Lyme disease.

The importance of determining the causative pathogen in chronic arthritis must be stressed as strongly as in the case of acute forms. In addition (e.g. in tuberculous arthritis), synovial biopsy may be useful, to collect material for histological and microbiological examination.

Table III. — Specific parenteral antibiotic treatment of arthritis in the adult, depending upon the causative pathogen

Pathogen	Drug	Dosage
<i>S. aureus</i>	oxacillin ± gentamicin or netilmicin	2 g, q4h usual dosage
MRSA*	vancomycin or teicoplanin	15 mg/kg, q12h 12 mg/kg/d**
Streptococci	ampicillin or penicillin G	2 g, q4h 2-3 million U, q4h
Enterobacteriaceae	cefazolin or cefuroxime or cefotaxime or ceftriaxone or ofloxacin or ciprofloxacin	2 g, q8h 1.5 g, q8h 2 g, q8h 2 g, oad 400 mg, q12h 400 mg, q8h
<i>Pseudomonas aeruginosa</i>	ceftazidime + tobramycin or amikacin	2 g, q8h (usual dosage)

* Methicillin-resistant *S. aureus*.

** after loading dose.

2. Therapy

Once the causative organism is known, pathogen specific antibiotic treatment will be used.

RECOMMENDATIONS IN THE CASE OF ARTHRITIS RELATED TO IMPLANTS

Immediate rinsing and drainage of the arthroplasty can sometimes salvage the joint in the acute phase. However, the basic rule in chronic infections of prosthetic material should be removal of the implant. In very rare cases, the disability caused by resection is such that one prefers to try long-term antibiotic suppression therapy. In some rare cases,

e.g. streptococcal hip or knee prosthesis infection, or early device-related *S. aureus* infection, cure can be expected with prolonged antibiotherapy. Treatment will be parenteral in the former case (β -lactams), oral in the latter (quinolones and rifampicin). It must be emphasised, however, that only very selected cases, generally with stable implants and infection recognised within the first month after implantation, will benefit from this attitude (12).

The classical approach of removing prostheses uses a two-step procedure : surgical removal of foreign material and necrotic tissue, followed by at least 6 weeks of parenteral antibiotic therapy ; then reconstruction.

Alternatively, one-stage revision arthroplasty is favoured by some, whereby a new prosthesis is immediately inserted, after thorough mechanical rinsing and the adequate use of antibiotic-containing cement. This technique carries a higher risk of recurrence, particularly in case of *S. aureus* infection.

RECOMMENDATIONS IN THE CASE OF ACUTE OSTEOMYELITIS

1. Acute osteomyelitis in the child

This paragraph is divided into two distinct entities : before and after the age of 3 months. In the child, osteomyelitis is often located in the metaphysis of long bones when it is haematogenous in origin.

a) INFANTS

In the infant, the microorganisms causing osteomyelitis are usually bloodborne : *S. aureus* (75% of cases), group B streptococci (5-10%), other streptococci and Gram-negative rods. In premature babies and those in the neonatal intensive care unit, *Candida spp.* are also observed.

As far as treatment is concerned, pus should be evacuated : surgical drainage is therefore mandatory. Then, only after adequate microbiological samples have been obtained, can antibiotherapy be started. In case of truly septic conditions, one cannot wait until all samples are taken.

Treatment is administered parenterally, and consists of either an oxacillin derivative or a glycopeptide in case of methicillin-resistance, or a third-generation cephalosporin plus an aminoglycoside, depending upon the Gram stain. There are no data to support oral therapy in this age group, and treatment duration should be 3 to 4 weeks after deferescence. Ambulatory parenteral therapy is an option in centers with adequate facilities and experience, taking advantage of drugs with a long plasma half-life (e.g. teicoplanin, ceftriaxone ...).

Infants between 1 and 3 months of age can also acquire the "older infant type" of osteomyelitis, with organisms such as *S. pneumoniae* or *H. influenzae*. In this case, a combination of oxacillin or derivatives and a third-generation cephalosporin is recommended, until full documentation.

b) CHILDREN OLDER THAN 3 MONTHS

From the age of three months onwards, the same microorganisms as in the adult are encountered. As is the case with acute arthritis, oral therapy may be an option after resolution of clinical signs and improvement in the inflammatory parameters.

2. Classification of osteomyelitis in the adult

For all practical matters, osteitis and osteomyelitis are discussed simultaneously since they behave in the same way. In osteitis, only the cortex is infected and there is no need to perforate it to obtain microbiological samples. In osteomyelitis, one needs to go through the cortex in order to reach the marrow as well. There are two widely used classifications of osteomyelitis.

Cierny and Mader (3) classify the infections in long bones with reference to the physiological status of patients, the severity of the bone destruction and some other prognostic factors, as shown in table IV. Waldvogel uses a simpler classification, of more clinical relevance as summarized in table V.

As a consequence, one can encounter two entities in the immunocompetent adult : (i) acute osteomyelitis due to haematogenous spread and (ii) contiguous osteomyelitis (vascularisation defect, post-traumatic, iatrogenic). In the latter case, the distinction between acute or chronic is uncertain.

Table IV. — Clinical classification of bone infections*

– according to disease factors:	
I only medulla :	endosteal infection
II superficial cortex :	surface infected due to coverage defect
III local :	sequestrum, possibility of easy removal
IV diffuse :	instability, even after debridement
– according to host factors :	
A healthy :	immunocompetent, normal vascularisation
B compromised :	local or systemic risk factors
C prohibitive :	prohibitive morbidity expected, poor prognosis

* adapted from Cierny and Mader (3).

Table V. — Clinical classification of bone infections*

– Haematogenous osteomyelitis (including vertebral osteomyelitis)
– Osteomyelitis secondary to a contiguous focus :
– with normal vascularisation
– with compromised vascularisation

* adapted from Waldvogel (23, 24, 25).

3. Treatment of acute osteomyelitis in the adult

Bacteriological sampling is mandatory, either by means of a bone biopsy, under CT-scan guidance if necessary, or through surgical sampling. Cultures of draining sinuses are often misleading. Blood cultures should be obtained. When oral antibiotic treatment had been started blindly, it should be halted (for at least 14 days) to obtain meaningful bacteriological samples.

a. ACUTE HAEMATOGENOUS OSTEOMYELITIS

S. aureus is the main pathogen, but Gram-negatives can be encountered in high-risk patients (debilitating diseases, intravenous drug use, haemodialysis, diabetes). When started empirically, treatment consists of oxacillin or derivatives (plus an aminoglycoside or fluoroquinolone in high-risk patients). A third generation cephalosporin can be added. However, treatment should be

initiated only after bacteriological documentation. A reasonable choice of antibiotics is shown in table VI.

Table VI. — Antibiotics for the treatment of acute osteomyelitis in adults

Pathogen	Drug	Dosage
<i>S. aureus</i> MRSA	oxacillin	2 g, q4h
	vancomycin or teicoplanin	15 mg/kg, q12h 6-12 mg/kg/d*
Gram-negative bacilli	ceftriaxone or cefotaxime or ofloxacin or ciprofloxacin	2 g, q8h 2 g, oad 400 mg, q12h 400 mg, q8h

* after the usual loading dose.

In case of penicillin allergy, either cephalosporins or glycopeptides are a valuable alternative (17).

One should remember that, in people over 50 years of age, haematogenous osteomyelitis is often located in the vertebrae (spondylitis, spondylodiscitis).

b. ACUTE CONTIGUOUS OSTEOMYELITIS

This category encompasses all forms of osteomyelitis originating from a nearby focus : e.g. abscess, wound, surgery, open fracture, foreign material. The last two will be dealt with separately (see below).

Contiguous osteomyelitis can be divided into two main classes : infections in normally vascularised regions and infection in areas of impaired vascularisation, mainly the so-called “diabetic foot”. This is by far the most common form of contiguous osteomyelitis. It is mostly polymicrobial, involving Gram-positive and Gram-negative aerobic bacteria as well as anaerobes. Therefore, precise microbiological evaluation is needed. Superficial samples (e.g. from skin ulcer or fistula) are misleading. One should attempt to obtain deep material, either by curettage, puncture-biopsy or a surgical approach. The laboratory request form should specify the need for anaerobic cultures. The management of osteomyelitis in a diabetic patient (2) will always require a multidisciplinary ap-

proach : aseptic dressing of all skin wounds, avoidance of pressure damage, improvement of the vascularisation, eradication of the causative pathogens and protection of the limb (limitation of amputation). The antibiotic choice will be guided mainly by the microbiological results. Otherwise, empiric therapy will be started according to the staging of the lesions. One such staging has been proposed by Wagner (1), as described in table VII.

Table VII. — Wagner's staging of lesions in the diabetic foot*

grade 0 :	no ulcer
grade 1 :	superficial ulcer
grade 2 :	deep ulcer but intact bone
grade 3 :	abscess formation to the bone
grade 4 :	local gangrene (e.g. toes, heel)
grade 5 :	generalized gangrene of the foot

* Adapted from Calhoun (1).

Depending on the stage in Wagner's classification, empiric treatment will be as follows :

1) *Cellulitis without skin ulcer*

This condition is usually caused by *S. aureus*, and treatment will rely on oral oxacillin derivatives, 500 mg, q6h, for a duration of 10-14 days.

2) *Skin ulcer without cellulitis*

The causative pathogens are usually *S. aureus* and anaerobes. Local therapy is the mainstay of treatment, and, if needed, oral antibiotics will be clindamycin, 300 mg, q6h-q8h, or amoxicillin/clavulanate, 500 mg, q6h-q8h, for 10-14 days.

3) *Skin ulcer accompanied by cellulitis*

The causative flora is likely to be mixed (Gram-positive and -negative, anaerobes). Treatment will consist of a combination of clindamycin (same dosage as in 2) and oral fluoroquinolones for at least two to four weeks. In case of osteomyelitis (suspected or documented), oral clindamycin, 600 mg, q8h, will be given for at least 6 weeks in combination with oral fluoroquinolones. Admission for parenteral therapy (amoxicillin/clavulanate, 1 g q6h or intravenous/oral fluoroquinolones, plus clindamycin) should be considered.

4) *Skin ulcer and cellulitis plus risk for sepsis*

In this case, the patient will be admitted and broad spectrum parenteral therapy (for instance carbapenems) will be started, 1 g I.V. three times a day. In case of methicillin-resistant staphylococci, glycopeptide treatment will be added.

c. OSTEOMYELITIS RELATED TO AN OPEN FRACTURE

Osteomyelitis evolving after an open fracture poses a special problem, as excision of necrotic bone is necessary for cure. Such an approach can however cause major functional loss. Therefore, partial excision and chronic suppression may be preferred in selected cases, depending on the likelihood of cure and the patient's functional demands in relationship to lifestyle. Special classification, such as that of Cierny and Mader (3), or Gustilo (8), can help in choosing the most appropriate approach.

Various techniques are available to judge the surgical healthy bone margin as far as viability is concerned (disulfine blue dye, laser-Doppler). Afterwards, treatment consists of adequate antibiotic therapy for a prolonged period of time and surgical measures. Good coverage of the soft tissues and bone defects is essential. One chooses rotation flaps and/or free flaps, such as the M. latissimus dorsi and M. rectus abdominis muscle flaps, allowing adequate blood supply. Free vascularised bone grafts from the fibula and cancellous bone grafts are used to fill the bone defects. Antibiotic-impregnated beads (28) and antibiotic-loaded collagen may be of great help in these complicated cases. Finally, stabilisation of the fracture is mandatory, by means of an external fixator. Local delivery of antibiotics remains a controversial issue, as closed suction-irrigation devices, plaster pellets, fibrin, collagen, porous calcium hydroxyapatite, polymethyl methacrylate bone cement have all been used with some success.

d. OSTEOMYELITIS AT THE SITE OF PROSTHETIC MATERIAL

Osteomyelitis at the site of prosthetic material (e.g. fracture fixation device) should be treated by

local surgical measures and general antibiotic therapy. It shows many similarities with osteomyelitis related to an open fracture. In this case, however, the origin of the infection is most likely to be found in the initial surgical procedure. Treatment will depend upon the stability of the osteosynthesis.

1. Stable osteosynthesis

If clinical examination and xrays exclude loosening of the osteosynthesis, and if no bone is left exposed to the external surface, treatment can be conservative. Systemic antibiotic therapy will be administered for a long period of time, and the evolution should be assessed clinically and according to inflammatory parameters or radionuclide imaging (bone scintigraphy and leucocyte isotopic scan). The fracture and the infection should be cured after three months. One should always take into account the possibility of a recrudescence of the infection originating from the foreign body.

2. Signs of instability

If there are clinical signs of loosening, or if xrays show loosening lines around the prosthetic material (screws, nails, plates ...), removal of the foreign material is mandatory. One then needs to perform thorough cleaning of the anatomical site and broad bone toiletage. An external fixation device should be used, rather than simple immobilisation. From then on, management is identical to that described in the above paragraph on open fracture.

SPECIAL CONSIDERATIONS RELATED TO THE TREATMENT OF BONE AND JOINT INFECTIONS

As treatment is of long duration, side effects of some antibiotics should be closely monitored.

a. TREATMENT WITH AMINOGLYCOSIDES

In case of sepsis, a short course of aminoglycosides (3-5 days) should be added. As far as their nephrotoxicity is concerned, table VIII lists factors to be considered as additional risks. Amongst these factors, age is very important. The incidence of

aminoglycoside-related nephrotoxicity increases from approximately 7% below the age of 30 to 20% after 75 years of age. A possible explanation is the systematic overestimation of glomerular filtration rate by routine tests (e.g. serum creatinine). Other factors frequently contributing to excessive nephrotoxicity are intravascular volume depletion, the presence of sepsis and coadministration of other nephrotoxic drugs. Preventive measures for the toxicity of aminoglycosides consist in limitation of the duration of treatment – this often being impossible in the case of osteomyelitis, elimination of possible concomitant risk factors and a once-a-day administration regimen.

Table VIII. — Risk factors for nephrotoxicity of aminoglycosides*

Patient factors	Aminoglycoside factors	Concomitant therapy
Pre-existing renal disease	Recent aminoglycoside therapy	Amphotericin B
Older age	Larger doses	Cephalosporins
Mg, K or Ca deficiency	Treatment \geq 3 days	Cisplatinum
Volume depletion	Drug choice	Clindamycin
Hypotension	Frequent dosing interval	Cyclosporine
Hepatic syndrome		Foscarnet
Sepsis syndrome		Furosemide
		IV radiocontrast agents
		Piperacillin
		Vancomycin

* Adapted from Verpooten G. A., Tulkens P. M., Bennett W. M. (22).

b. TREATMENT WITH GLYCOPEPTIDES

Resistance to glycopeptide has emerged in various enterococcal species (especially in the US) and in coagulase negative staphylococci (world-wide). Recently, decreased susceptibility in *S. aureus* has been described in Japan, the US and even Europe. For this reason, many European countries recommend the HICPAC guidelines (10). Practically, this means glycopeptides will be reserved for mandatory indications, such as multi-resistant enterococci, MRSA and proven severe β -lactam allergy.

Vancomycin, whose toxicity when used alone is relatively low, is known to potentiate the nephrotoxic potential of aminoglycosides. The same applies to regimens combining vancomycin and cyclosporin. Some studies have indicated a lower nephrotoxic potential for teicoplanin in this situation (14).

C. ALTERNATIVES IN CASE OF PENICILLIN ALLERGY

In the event of penicillin allergy (0.7 to 8% of all treatments) (17), one will choose first generation cephalosporins (e.g. cefazolin), or glycopeptides. This topic has been reviewed in 1994 (13). The incidence of cross-reactivity between penicillin and other β -lactams (cephalosporins, carbapenems) has not been accurately determined. It seems that 5 to 15% of true allergy to penicillins, i.e. IgE-mediated anaphylaxis, for which reliable skin tests are available, exhibit cross-sensitivity to cephalosporins as well.

Allergic reactions after administration of cephalosporins to patients with a history of penicillin allergy occur in 3 to 7% of cases (19). For all practical matters, in case of a history of severe penicillin allergy (e.g. anaphylactic shock, bronchospasm, angioedema ...), β -lactams should be avoided and drugs belonging to other classes (such as glycopeptides) should be chosen. In case of benign penicillin hypersensitivity (e.g. skin rash), cephalosporins can be safely used. As an alternative, penicillin desensitisation can be considered in case of IgE-mediated allergy.

SPECIAL ASPECTS RELATED TO OUTPATIENT AND HOME PARENTERAL ANTIBIOTIC TREATMENT (OHPAT)

American guidelines for parenteral antibiotic treatment at home were published in 1997 (26), taking the following aspects into consideration: patient selection criteria, patient assessment parameters, necessary utilities to start an OHPAT program, role of the various members of the pluridisciplinary team, choice of antimicrobials and of their route of administration, standards for final

evaluation, economic aspects, risks and benefits analysis. In most European countries, budgetary restrictions and the increasing cost of advanced medical techniques also require a move in that direction (16). In addition, patients are more and more aware of the quality of life aspects of medical care, and hence value the comfort of home treatment. Treatment of osteomyelitis is one of the favoured indications, once the initial diagnostic check-up is completed and initial response to treatment is satisfactory (7). In the absence of official guidelines in Belgium, questions concerning three main aspects should be answered.

1) Qualitative aspects : Does OHPAT allow the best possible treatment (medically) ? Is OHPAT acceptable to the specific patient from a psychological and social point of view ? When is the right time to start OHPAT ?

2) Practical aspects : Does the patient fall into the category of stable clinical condition, with a favourable response to initial treatment and satisfactory evolution of the inflammatory parameters ? Does the chosen antibiotic possess the desired pharmacologic and pharmacokinetic properties ? Are the ambulatory conditions of drug administration adequate ? Is there enough access to medical care for follow-up evaluation or emergency measures (if necessary) ?

3) Financial aspects : To the present day, in spite of the likely overall savings associated with OHPAT, funding is still inadequate in our country.

PHARMACOECONOMIC ASPECTS OF THE TREATMENT OF BONE AND JOINT INFECTIONS

1. General considerations

As cost containment in health care has become an important issue in modern society, the use of antibiotics is submitted to intense scrutiny. Often, antimicrobial cost containment programs focus on drug acquisition cost (first level) only. This is but one part of the total daily cost of antibiotic therapy. The second level includes direct costs of drug

administration, such as preparation costs (labour and supplies), administration costs (nursing and supplies) and costs arising from untoward events or treatment failure. The third level of costs, hospitalisation costs, usually represents the largest part of all incurred expenses (4).

In addition, one needs to consider indirect costs related to loss of income or productivity, and the intangible cost advantage of psychological benefit of home treatment. Indeed, therapy administered once daily outside the hospital can also reduce the nonmedical costs by allowing continuation of work during treatment, and avoiding loss of working hours by relatives having to visit the hospital.

2. Types of outpatient antibiotic treatments

Oral treatment should be preferred, depending on the type of pathogen and after normalisation of the inflammatory parameters, when the pharmacodynamic and pharmacologic properties of the antibiotic are adequate for oral administration.

Parenteral antibiotic therapy on an outpatient basis can be implemented when there is no need for admission to hospital, other than for antibiotic treatment. Nowadays, a large choice of catheters and infusion devices is available (5). One should choose the route of administration most likely to improve drug efficacy. From this point of view, teicoplanin is preferable to vancomycin: it has a greater ease of administration (once-a-day bolus, IV or IM), requires less frequent monitoring of blood levels and has a better tolerability profile. Ceftriaxone is another antibiotic with favourable characteristics for outpatient treatment.

3. Relationship between pharmacoeconomic evaluations and budgetary systems

Nearly all pharmacoeconomic evaluations of antibacterial drugs are cost-minimisation studies. They assume equal efficacy amongst the various treatment alternatives. They use the healthcare provider (hospital) point of view as reference. They can be conflicting, depending on the following parameters: involvement of all costs vs. selected costs only, fixed regimen or true clinical situation.

In the setting of in-hospital treatment, acquisition costs alone do not always reflect the whole picture. Considerable financial savings are obtained by keeping the patient out of the hospital, i.e. home therapy (5, 21, 27). Unfortunately, the Belgian funding system is such that the cost perspective is shifted from the healthcare system to the patient in doing so. Indeed, the National Health System reimburses out-of-hospital expenses to a far lesser extent than hospital treatment.

CONCLUSION

Arthritis and osteomyelitis are entities requiring prolonged medical treatment. Every effort should be made to obtain a precise bacteriological diagnosis. In most instances, the first therapeutic step involves adequate use of surgery, which can sometimes be rather extensive. Glycopeptides should be used only when clearly indicated. Home treatment is possible in many instances after initial positive response to in-hospital management. A definite pharmacoeconomic analysis is still lacking in Belgium. It should include many more items than just drug acquisition cost.

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SAMENVATTING

J. LEVY, W. E. PEETERMANS, H. ROBAYS, J. P. THYS, S. VAN LIERDE, R. VERDONK, G. A. VERPOOTEN. Behandeling van bot- en gewrichtsinfecties : aanbevelingen van een Belgisch panel.

Een multidisciplinair panel van Belgische experts beschrijft de algemene therapeutische houding bij infecties van bot en gewrichten. Classificering, algemene diagnostische maatregelen, therapeutische alternatieven, bijzondere omstandigheden, rol van aminoglycosiden en glycopeptiden worden er beschreven. Men discussieert de mogelijkheid tot thuisbehandeling en farmaco-economische aspecten.

RÉSUMÉ

J. LEVY, W. E. PEETERMANS, H. ROBAYS, J. P. THYS, S. VAN LIERDE, R. VERDONK, G. A. VERPOOTEN. Traitement des affections ostéo-articulaires : recommandations d'un panel belge.

Un panel multidisciplinaire de spécialistes belges décrit la prise en charge des infections ostéo-articulaires. La classification, l'approche diagnostique et les options thérapeutiques de ces infections, le rôle des aminoglycosides et des glycopeptides sont présentés. Ensuite, on aborde la possibilité d'un traitement en ambulatoire et certains aspects pharmaco-économiques.