More about...Bacterial diseases

Duration of antimicrobial therapy

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The appropriate duration of therapy is often open to question. Extended antimicrobial therapy is associated with selection of resistant organisms, adverse events, expense and poor patient compliance. Evidence suggests that a short duration of treatment is as effective as a longer course of treatment for certain common community-acquired infections, such as acute otitis media, acute bacterial sinusitis, infectious exacerbations of chronic bronchitis, community-acquired pneumonia,and acute pyelonephritis.[1]

Acute otitis media

In a meta-analysis (MA) comparing short-duration with long-duration therapy, treatment of fewer than 7 days was compared with treatment of more than 7 days. No statistical difference was found between the 5-day and 8 - 10-day regimens, with primary outcome defined as treatment failure (lack of clinical resolution, relapse or recurrence).[2]

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Acute bacterial sinusitis

In an MA involving adult patients with radiologically confirmed sinusitis no difference in clinical outcome was found between a 3 - 7-day course compared with a 6 - 10-day course of treatment. Comparing a 5-day with a 10-day regimen revealed fewer adverse events with short-course treatment.[3]

Chronic bronchitis

Falagas *et al.*[4] studied 7 randomised controlled trials (RCTs) of patients with acute exacerbations of chronic bronchitis, comparing short-duration (5 days) with long-duration (7 or 10 days) antimicrobial treatment. No difference was found between the two groups with regard to treatment success.

Community-acquired pneumonia

A short-treatment arm of 3 - 7 days was compared with a long-treatment arm of 7 - 10 days in an MA of 7 RCTs. No difference was found with regard to clinical success at the end of therapy, microbiological success, relapses, mortality or adverse events.[5]

Acute pyelonephritis

No difference was found between short-duration treatment (7 - 14 days) compared with long-duration treatment (14 - 42 days) in terms of clinical success, relapse, recurrence or bacteriological efficacy in an MA of 4 RCTs.[6]

Cystitis

Three days of treatment was compared with 5 - 10 days of treatment in women with cystitis. Although there was no difference in symptomatic failure between the two groups, bacteriological cure rates were improved with longer duration of treatment, both at 2 weeks and at 8 weeks of follow-up.[7] However, in another MA of elderly women with cystitis no difference was found with regard to persistence of the infection.[8]

For certain community-acquired infections duration of therapy can be shortened, with a resultant reduction in cost, better patient compliance, less selection pressure for resistant organisms and fewer adverse effects. On the other hand, infections such as endocarditis, osteitis, and septic arthritis, to name a few, still require extended duration of antimicrobial therapy.

References

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Importance of minimum inhibitory concentration (MIC) values

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Some pathology laboratories are currently reporting minimum inhibitory concentration (MIC) values on antimicrobials in addition to the susceptible, intermediate and resistant category results.

The MIC of an isolate is the lowest concentration of an antimicrobial agent that prevents visible growth of that particular micro-organism in an agar or a broth-dilution susceptibility test. The susceptible, intermediate and resistant interpretative categories are based on extensive studies correlating MICs

with achievable serum levels for each antimicrobial agent, particular resistance mechanisms and successful therapeutic outcomes.

The MIC can guide the choice of antimicrobial used in treatment by predicting efficacy. If pharmacokinetic and pharmacodynamic (PKPD) principles are met by careful selection of a specific antimicrobial given at an appropriate dosage, it will lead to clinical cure, eradication of carrier status of a specific organism, and prevention of selection of resistance.

The interpretation of MICs requires an understanding of the mode of activity of the different antimicrobial classes.

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Antimicrobials can be classified according to time-dependent or concentration-dependent activity. Beta-lactam antimicrobials have time-dependent activity, whereas quinolones and aminoglycosides have concentration-dependent activity.

Time-dependent antimicrobials

With beta-lactam antimicrobials the goal of treatment is to maximise the time that the free serum concentration of the drug exceeds the MIC (T>MIC), with killing of bacteria being optimal at 4 - 5 times the MIC *in vitro*. There is a correlation between the duration of the antimicrobial concentration exceeding the MIC, and the time it takes to eradicate the pathogen. If beta-lactam antimicrobials are administered by constant (most penicillins and cephalosporins) or extended (carbapenems) infusion, a prolonged duration above the MIC is achieved, which reduces the time to achieve bacterial eradication – especially in critically ill patients.[1] Some beta-lactams are not stable over time, e.g. amoxicillin and carbapenems; these antimicrobials cannot be infused constantly.

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Concentration-dependent antimicrobials

For quinolones the goal of treatment is to maximise the achievable peak serum drug concentration (C_{max}) in relation to the MIC. A C_{max}:MIC ratio of 10 - 12 ensures clinical cure and prevents selection of resistance. The area under the plasma concentration versus time curve (AUIC):MIC ratio is another predictor of outcome in this class of antimicrobial. When treating Gram-negative infections, maximum efficacy is achieved when AUIC:MIC values are in the region of 100 - 125. Lower values may relate to less rapid bactericidal activity and development of resistance. Although an antimicrobial with a low AUIC value may still lead to clinical cure, a higher value will also eradicate carrier status and will be less likely to select resistance.

Both T>MIC and AUIC values are directly dependent on the MIC value, and dosing should be optimised according to these values.[2] When selecting an antimicrobial with the lowest MIC in a specific class, the chances will improve that target PKPD values are achieved. It is important to note that a low MIC value for a specific class of antimicrobial cannot necessarily be compared with a low value for another class.

References

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Single Suture

Instant muscle boost from energy drinks

Even if you spit out your energy drink after taking a sip, you can still boost your strength. According to Nicholas Gant and colleagues of the University of Auckland, New Zealand, this pre-digestive effect is immediate and is apparently due to a newly discovered neural pathway linking taste buds to muscles.

The team have previously shown that mouth-rinsing and spitting out the carbohydrate solution immediately improved performance at sprinting and cycling, even though it takes at least 10 minutes for carbohydrates to be digested and used by muscles.

In this study, the 16 participants tired out their biceps by flexing them for 11 minutes before rinsing their mouths with either a carbohydrate drink or a non-calorific, taste-matched drink. One second after rinsing, the researchers applied transcranial magnetic stimulation to the participants' scalps to detect activity in the motor cortex.

The team found that volunteers who rinsed with carbohydrates were able to flex with more force immediately afterwards and had a 30% stronger neural response compared with those given placebo. Gant thinks that the taste receptors detect carbohydrates, resulting in a signal to fatigued muscles that 'help is on its way' and so they continue working.

Gant N, *et al. Brain Research,* doi:10.1016/j.brainres.2010.04.004.