Impact of Real-Time Therapeutic Drug Monitoring on the Prescription of Antibiotics in Burn Patients Requiring Admission to the Intensive Care Unit

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Abstract

Purpose: As pharmacokinetics after burn trauma are difficult to predict, we conducted a 3-year prospective, monocentric, randomized controlled trial to determine the extent of under and overdosing of antibiotics and further evaluate the impact of systematic therapeutic drug monitoring (TDM) with same day real-time dose adaptation to reach and maintain antibiotic concentrations within therapeutic range.

Methods: Forty-five consecutive burn patients treated with antibiotics were prospectively screened. Forty fulfilled inclusion criteria; after one refusal and one withdraw consent, 19 were randomly assigned to an intervention group (real-time antibiotic concentration determination and subsequent adaptations), and 19 to a standard-of-care group (antibiotic administration at physician's discretion without real-time TDM).

Results: Seventy-three infectious episodes were analyzed. Before intervention, only 46/82 (56%) initial trough concentrations fell within the range. There was no difference between groups in initial trough concentrations (adjusted HR=1.39 [95%CI: 0.81-2.39], p=0.227) or time to reach the target. However, thanks to real-time dose adjustments, trough concentrations of the intervention group remained more within the predefined range (57/77 [74.0%] vs. 48/85 [56.5%], adjusted OR=2.34 [95%CI: 1.17-4.81], p=0.018); more days were spent within the target range (193 days / 297 days on antibiotics [65.0%] vs. 171/311 [55.0%], adjusted OR=1.64 [95%CI: 1.16-2.32], p=0.005); and fewer results were below target trough concentrations (25/118 [21.2%] vs. 44/126 [34.9%], adjusted OR=0.47 [95%CI: 0.26-0.87], p=0.015). No difference in infection outcomes was observed between study groups.

Conclusion: Systematic TDM with same day real-time dose adaptation was effective in reaching and maintaining therapeutic antibiotic concentrations in infected burn patients, which prevented both over- and under-dosing. A larger multicentric study is needed to further evaluate the impact of this strategy on infection outcomes and the emergence of antibiotic resistance during long-term burn treatment.

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