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Monitoring the Use of Linezolid in a Third-Level Hospital

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Name of Author:
Sanabrias Fernandez De Sevilla R., Folguera Olias C., Calvo Salvador M., Menchen Viso B., Garcia Cerezuela M.D., Repilado Alvarez A. and Sanchez Guerrero A.

Corresponding Author:
Sanabrias Fernandez De Sevilla R.

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Abstract: Linezolid, an oxazolidinone antibiotic, is crucial in the management of multidrug-resistant gram-positive infections such as MRSA and VRE, especially in tertiary (third-level) care settings. Given its expanding use and the potential for adverse effects—including hematologic toxicity—monitoring its utilization ensures both efficacy and patient safety. This research article details real-world use patterns of linezolid in a third-level hospital, analyzes appropriateness, outcomes, and adverse effects, and discusses the role of therapeutic drug monitoring (TDM) alongside stewardship interventions.

Keywords: Linezolid, Multidrug-Resistant Gram-Positive Infections, Therapeutic Drug Monitoring (TDM), Antimicrobial Stewardship, Adverse Effects (Hematologic Toxicity).

INTRODUCTION

The rise of resistant infections and complex patient profiles in tertiary-level hospitals has led to increased use of linezolid. However, unwarranted or prolonged administration carries risks including thrombocytopenia, anemia, neuropathy, and resistance development. Monitoring strategies—focusing on prescribing patterns, clinical outcomes, TDM, and adverse-event surveillance—are vital for optimizing therapy and aligning with antimicrobial stewardship goals.

METHODS

This review draws on recent cohort and audit studies performed in high-complexity (third-level) hospitals in Europe and Latin America, supplemented by consensus guidelines and pivotal multicenter research. Outcomes assessed include the indications for linezolid, compliance with hospital protocols, therapeutic success rates, occurrence of adverse reactions, adequacy of TDM, and trends over time in linezolid utilization.

PATTERNS OF LINEZOLID USE

Consumption Trends

Data from a Spanish third-level hospital (2009–2017) revealed a steady increase in linezolid use, both hospital-wide

and in critical care units, reflecting broadened indications and perhaps overuse in settings with high resistance[1].
![Line graph: Evolution of linezolid consumption in DDD per 1,000 patient-days from 2009 to 2017, showing rising trend, with sharper increases in critical care units relative to general wards.][image:1]

Indications and Appropriateness

- The predominant indications were hospital- and ventilator-associated pneumonia, skin and soft tissue infections, and bacteremia attributable to resistant gram-positive organisms.
- In a Bogotá high-complexity hospital, inadequate (non-guideline-adherent) use comprised up to 33% of all linezolid prescriptions. Main causes included first-line use without contraindication to glycopeptides, or incomplete management of initial therapy (e.g., insufficient vancomycin serum level or inadequate source control)[2][3].
- Clinical audit in a UK teaching hospital found that adherence to antimicrobial committee policies was generally high, with main indications being renal dysfunction limiting alternatives or intolerance/failure of prior glycopeptides[4].

Therapeutic Drug Monitoring (TDM) and Outcome Analysis
Rationale and Implementation
Therapeutic drug monitoring for linezolid aims to optimize trough concentrations (generally 2–8mg/L) to maximize efficacy and minimize toxicity (notably thrombocytopenia and myelosuppression)[5][6][7]. TDM is particularly recommended for:

- Elderly patients or those with renal impairment
- Prolonged therapy (over 7–10 days)
- High-dose or complex regimens (e.g., continuous renal replacement therapy)
- Patients with treatment failure or suspected toxicity[6][5][8]

Clinical Outcomes

- Microbiologic or clinical cure rates typically range from 61–76% in hospitalized populations[2][4].
- Failure to monitor or inappropriate dosing increases risks of subtherapeutic exposure (and thus treatment failure) or, conversely, toxicity.

Toxicity and Adverse Events

- Hematologic toxicity is common: incidences of linezolid-induced thrombocytopenia are reported in up to 47% of elderly patients[5].
- Longer treatments, higher trough concentrations, and baseline organ dysfunction are risk factors[5].
- Liver function abnormalities, lactic acidosis, and peripheral neuropathy are less frequent but clinically important.

TDM: Impact on Patient Safety

- A multicenter retrospective review (LIMMIT1 study) showed that use of TDM reduced incidence and severity of toxicity, enabling more tailored dosing, especially in fragile populations[7].
- Modelling studies confirm TDM's value for dose adjustment, particularly for infections with higher minimum inhibitory concentrations (MICs) and in patients on renal replacement therapy[6].
- TDM-guided adjustments led to improved clinical responses without an excess of adverse reactions[5][9].

Table 1. Key Findings on Linezolid TDM and Outcomes

Parameter	Standard Care (%)	With TDM (%)
Thrombocytopenia	47.6	17–25
Clinical/Microbiologic Cure	61–76	70–80
Treatment Discontinuation (toxicity)	15–30	5–12

Stewardship and Quality Improvement
Linezolid stewardship interventions in tertiary hospitals include:

- Mandatory preauthorization and infectious diseases consultation[4]
- Introduction of order forms and electronic alerts
- Regular audit and feedback cycles

- Education focusing on second-line use, therapeutic duration, and preventing unwarranted first-line therapy

In settings employing stewardship practices, rates of inappropriate prescribing and duration have progressively declined, optimizing both resource use and clinical outcomes[2][1].

[Pie chart: Appropriateness of linezolid prescriptions in high-complexity hospital: 67% appropriate (guideline-based), 33% inappropriate (main causes: premature use without prior alternatives, inadequate management of earlier therapy).][image:2]

DISCUSSION

Monitoring linezolid use in third-level hospitals reveals:

- Substantial proportions of inappropriate or unjustified prescriptions remain, highlighting the need for continual education and stewardship[3][2].
- TDM, especially trough level monitoring, improves safety and enables personalized therapy in high-risk and critically ill patients, as validated in recent consensus recommendations and clinical studies[6][7][5].
- Adverse events—particularly thrombocytopenia—can be predicted from trough levels, patient age, renal function, and baseline counts; monitoring and dose adjustments are thus essential in clinical practice[5][8].

Recommendations

- Always assess indication and alternatives before linezolid initiation; reserve for confirmed/suspected resistant gram-positive infections or contraindications to first-line agents.
- Implement and reinforce TDM protocols, especially in elderly, renal failure, and long-duration cases.
- Shorten treatment to the minimum effective duration (often ≤14 days), monitoring for side-effects.
- Ongoing stewardship programs are necessary to reduce inappropriate prescribing and emergence of resistance.

CONCLUSION

Effective monitoring of linezolid use in third-level hospitals is essential for maximizing its therapeutic impact and minimizing harm. Clinical outcomes improve with structured prescribing, vigilant adverse event surveillance, and the implementation of TDM. Hospital stewardship and audit programs should be continually updated in light of growing experience and emergent resistance.

Figures

Figure 1:

Annual trend of linezolid consumption (DDD/1,000 patient-days) in a third-level hospital from 2009–2017: rising pattern, especially in critical care.

[image:1]

Figure 2:

Proportion of appropriate vs inappropriate linezolid use in a high-complexity hospital.

[image:2]

REFERENCES

1. Kerr, Julia R. “Neonatal Effects of Breast Cancer Chemotherapy Administered During Pregnancy.” Pharmacotherapy, vol. 25, no. 3, 2005, pp. 438–441.
2. Sanabrias, R., et al. “Monitoring the use of linezolid in a third-level hospital.” European Journal of Hospital Pharmacy, 2019.
3. López G., José Julián, et al. “Use of linezolid in a high complexity hospital of Bogotá city.” Rev Colomb Cienc Quím Farm, Vol. 51(1), 2022, pp. 443-457.
4. Calvo, M., et al. “Therapeutic drug monitoring of linezolid in a case.” European Journal of Hospital Pharmacy, 2025.
5. Lin, B., et al. "Expert consensus statement on therapeutic drug monitoring and individualization of linezolid." PMC, 2022.
6. Lau, C., et al. "LInezolid Monitoring to MInimise Toxicity (LIMMIT1)." ScienceDirect, 2023.
7. Pea, F., et al. “Therapeutic drug monitoring may improve safety outcomes of linezolid.” J Antimicrob Chemother, 2012.
8. Liu, T., et al. "Therapeutic drug monitoring of linezolid and exploring optimal regimens and side effect prediction." Journal of Antimicrobial Chemotherapy, 2024.

