Cost-effectiveness analysis of meropenem dose optimisation in critical patients

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Abstract: 4CPS-045
ATC code: J01

Background and Importance

In critical patients (CP), meropenem dose adjustment following pharmacokinetic/pharmacodynamic monitoring (TDM) presents a clinical benefit. An economic analysis could facilitate its use.

Aim and Objective

To conduct a cost-effectiveness analysis of meropenem TDM in CP versus standard dose (SD) according to the package insert recommendations.

Materials and methods

Study design: Naturalistic retrospective observational cohort study.
Setting: University Hospital
Patients: CP receiving meropenem from May/2011 to Dec-2017.
Two cohorts: COHORT A → patients with meropenem TDM
COHORT B → patients with SD meropenem

Main effectiveness variable: % of patients with a reduction of at least 80% in the procalcitonin value at the end of meropenem treatment with regard to the maximum value during meropenem treatment.

Costs included:
- Drug (Meropenem)
- Adverse Drug Reactions (ADR)
- Material for compounding
- TDM
- Hospitalizations
- Re-entries
- Time (for compounding, administration, surveillance).

Study phases (*and statistical analysis*):

Patient selection
Propensity score (PS) matching

Effectiveness
difference between cohorts
Chi-square

Costs
difference between cohorts
Boostrap

Cost-effectiveness
Deterministic and probabilistic sensitivity analysis

Results

154 patients included (from 173 recruited) after PS matching

COHORT A 77 patients → TDM (Therapeutic drug monitoring) → 51 patients (66.2%) required meropenem dose change
90.2% of them OVERDOSED

COHORT B 77 patients → SD (Standard dose) → Dose adjusted by renal function if necessary

Safety: No significant differences in ADR between both cohorts.

Table 1:Effectiveness

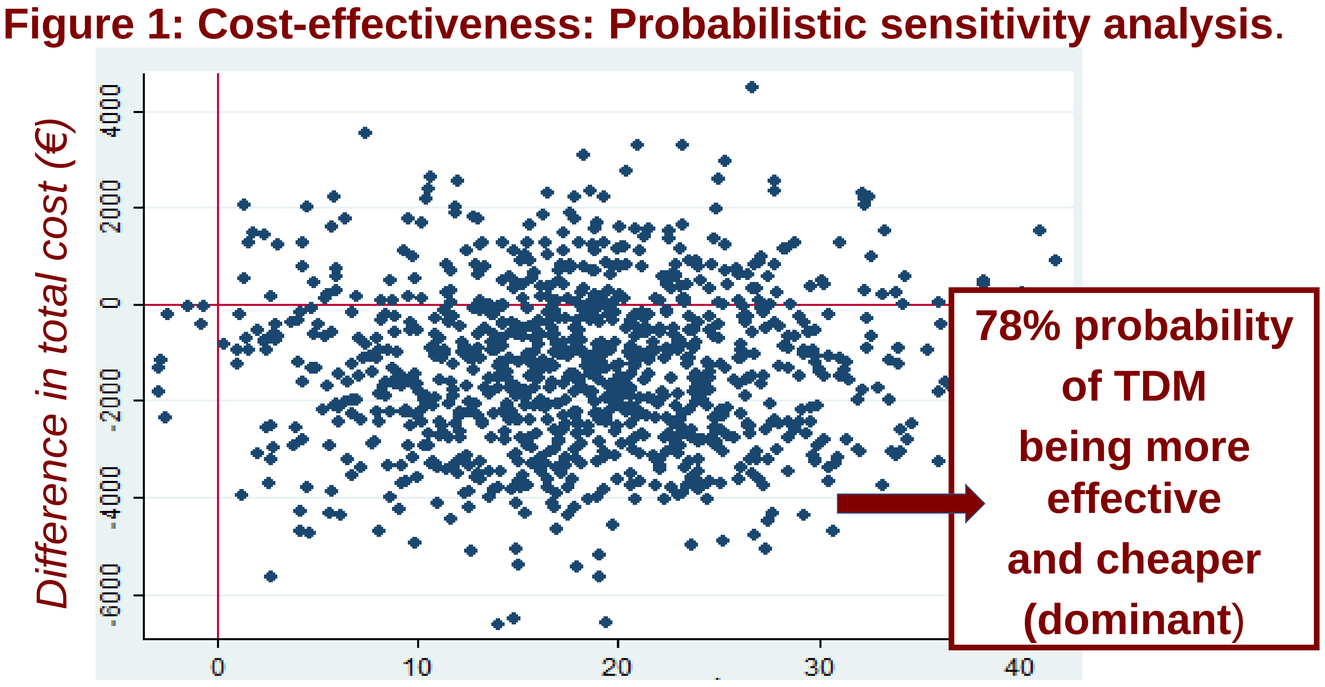
	Cohort A (n=77)	Cohort B (n=77)	Difference (95%CI)	P value
Reduction ≥ 80% in procalcitonin, n (%)	**55 (71 %)**	**41 (53 %)**	**18% (3-33)**	**0.020***
% procalcitonine reduction median (P25-P75)	93 (77-97)	85 (69-95)		0.004**
Procalcitonin <0.5 ng/mL at the end of meropenem treatment n (%)	49 (64 %)	32 (42 %)	22% (7-37)	0.006*

*Chi^2 ** Wilkoxon test. P25:percentil 25, P75:percentil 75, n:number of patients, CI95 95%:confidence interval*

Table 2: Cost (€) per patient (basal analysis)

	COHORT A	COHORT B		
	COST (€) mean (min-max)	**COST (€)** mean (min-max)	**Difference (€)*** mean (95%CI)	**P value***
1. Meropenem	364 (86-1,091)	427 (110-1,140)	-62 (-116; -4)	**0.027**
2. Preparation material	122(29-330)	134 (55-354)	-12 (-29; 4)	0.147
3. Monitoring	47 (46-92)	0		
4. Nurse time	222 (52-666)	260 (67-696)	-38 (-71; -4)	**0.026**
5. ADR	347 (0-1,176)	324 (0-882)		
6. ICU stay	8,912 (750-74,250)	10,325 (1,500-53,250)	-1,412 (-4,455; 1,631)	0.363
TOTAL (1-6)	**10,016 (1,602-75,473)**	**11,470 (2,251-54,387)**	**-1,454 (-4,627; 1,720)**	**0.369**

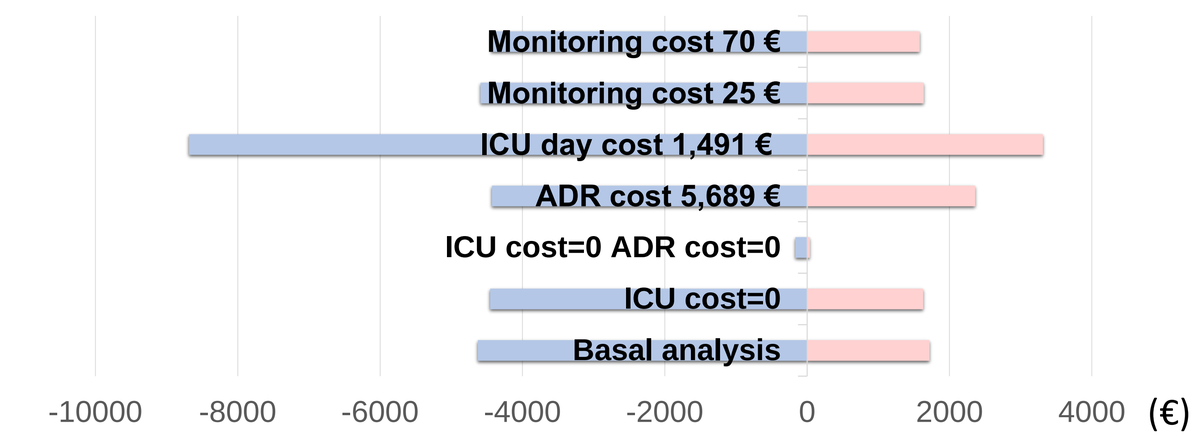
Figure 1: Cost-effectiveness: Probabilistic sensitivity analysis.



*Estimated by Bootstrap. min=minimum, max=maximum; CI= confidence interval, p=probability

Figure 2: Difference in costs: Deterministic sensitivity analyses

Influence of changing different unit costs on the 95%CI difference in costs (€) between the cohorts. In basal analysis unit costs are: monitoring 46€, Day in ICU 750€, ADR 294€.



Each bar represents the 95% confidence interval of the difference in costs between cohorts

Conclusion and relevance

Meropenem dose adjustment following PK/PD criteria is more effective, with similar safety and lower costs, than dosing according to package insert recommendations.

These results support the use of Meropenem TDM in critical patients care.

https://www.eahp.eu/25-4CPS-045