

CONCOMITANT ADMINISTRATION OF INTRAVENOUS DRUGS IN THE ICU : EVALUATION OF PHYSICO-CHEMICAL COMPATIBILITIES

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Background and objective

Patients in the ICU often get many intravenous (iv) drugs at the same time. Even with three-lumen central venous catheters, the administration of more than one drug in the same iv line (IVL) is frequently necessary (fig. 1).

The objective of this study was to observe how nurses managed to administer these many medications and to evaluate the proportion of two-drugs associations (TDA) that are compatible or not, based on known compatibility data.

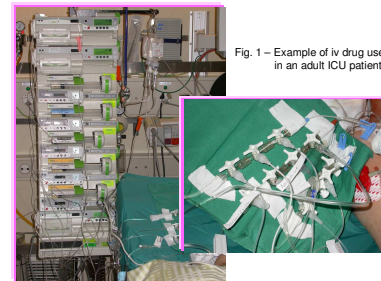


Fig. 1 – Example of drug use in an adult ICU patient

Design

Observational prospective study over 4 consecutive months. All patients receiving simultaneously more than one drug in the same IVL (Y-site injection or mixed in the same container) were included. For each patient, all iv drugs were recorded, as well as concentration, infusion solution, location on the IVL system, time, rate and duration of administration.

For each association of 2 or more drugs, compatibility of each drug was checked with each other. Compatibilities between these pairs of drugs were assessed using published data (Trissel LA. *Handbook on Injectable Drugs*. 15th ed. Bethesda : American Society of Health-System Pharmacists, 2009 - Trissel LA, Leissing NC. *Trissel's Tables of Physical Compatibility*. 1st ed. Lake Forest : MultiMatrix, Inc.; 1996 - *King Guide to parenteral admixtures*. Napa : King Guide Publications, Inc.; 2005 - *Micromedex® Healthcare Series* (electronic version). Greenwood Village, Colorado, USA : Thomson Micromedex; 2009 - *Compendium Suisse des Médicaments*. 30^{ème} ed. Bâle : Documed; 2009 – *Thériaque, banque de données sur le médicament*, www.theriaque.org, CNHIM, 2009) and visual tests performed in our quality control laboratory (fig. 2-3).



Fig. 2 – Drug compatibility tests realised in the quality control laboratory

4 tests for each pair of drugs :
 ■ 1:1 mix with agitation ■ 1:4 mix with agitation
 ■ 4:1 mix with agitation ■ 1:1 mix without agitation (checking an Y-site administration where mixing is not necessarily homogeneous)

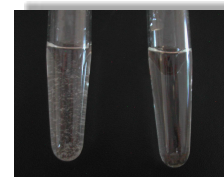


Fig. 3 – Visual incompatible drugs (left) or compatible drugs (right)

Setting

34 beds university hospital adult ICU.

Main outcome measures

Percentage of compatibilities and incompatibilities between drugs administered in the same IVL.

Results

We observed 1913 associations of drugs administered together in the same IVL, 783 implying only 2 drugs. The average number of drugs per IVL was 3.1 ± 0.8 (range: 2-9). 83.2% of the drugs were given by continuous infusion, 14.3% by intermittent infusion and 2.5% in bolus (fig. 4).

The associations observed allowed to form 8421 pairs of drugs (71.7% drug-drug and 28.3% drug-solute).

According to literature data, 80.2% of the association were considered as compatible and 4.4% incompatible. 15.4% were not interpretable because of different conditions between local practices and those described in the literature (drug concentration, solute, ...) or because of a lack of data.

After laboratory tests performed on the most used drugs (furosemide, KH_2PO_4 , morphine HCl, insulin, KCl, heparin, propofol, midazolam, remifentanyl, sufentanyl, MgSO_4 , amiodarone, norepinephrine, dopamine, dobutamine, sodium nitroprusside, sodium thiosulfate), the proportion of compatible TDA raised to 85.7%, the incompatible stayed at 4.6% and only 9.7% remain unknown or not interpretable (fig. 5).

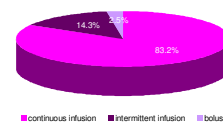


Fig. 4 – Different ways of administration (%)

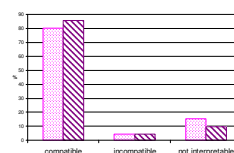


Fig. 5 – Evaluation of (in)compatibilities between drugs administered in the same IVL based only on literature data (pink dotted bars) and after laboratory tests (purple striped bars)

Conclusion

Nurses managed the administration of iv medications quite well, as only less than 5% of observed TDA were considered as incompatible. But the 10% of TDA with unavailable compatibility data should have been avoided too, since the consequences of their concomitant administration cannot be predictable.

For practical reasons, drugs were analysed only by pairs, which constitutes the main limit of this work. The average number of drugs in the same association being three, laboratory tests are currently performed to evaluate some of the most observed three-drugs associations.