

Analysis of propofol, midazolam and atracurium in dried spots on a carpet

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Aim: In the case of an extended suicide, a stain of an infusing solution was found dried on a carpet. The mother put her daughter to death by strangulation with a tourniquet. Afterwards she committed suicide with an overdose of insulin, potassium, midazolam, atracurium and propofol, combined in an infusing solution. Packings of those medicaments were found in the trash can. The infusion line was dangling and the infusing solution had dropped on a carpet. **Methods:** Samples of the carpet were taken by moistened swabs. Eight swabs rubbed on the carpet, where the solution had obviously dropped on. Seven other swabs were taken in the same way from distant parts of the carpet to serve as a comparison. For analysis of propofol, five swabs were soaked with acetonitrile and derivatized with 2-fluoro-1-methylpyridinium p-toluenesulfonate. For analysis of midazolam and atracurium, one swab was soaked with reconstitution buffer. Internal standards were added to all samples before preparation. The extracts were analyzed by means of an LC-MS/MS-device with electrospray ionization operated in positive mode. **Results:** All substances analyzed for could be detected in the samples. Midazolam was found in a low amount, whereas atracurium and especially propofol were detected in high amounts. The results can just be taken indicatively in matters of concentrations because it cannot be reconstructed how much of the infusing solution was rubbed on the swabs. Insulin and potassium have not been screened for. **Conclusion:** It could be proved that the analyzed medicaments were stable when dried on the carpet. Especially propofol is known to be unstable at room temperature. Therefore these results show that sample storage at room temperature is feasible by use of dried spots and may be an alternative sampling strategy for whole blood as well.

1. Introduction

The analysis of dried blood spots has been well established in the screening of newborns for metabolic disorders since the 1960s [1]. There are also some publications about the analysis of dried urine spots [2]. The use of dried body fluid samples has proved to be very useful for shipping and mailing because of the improved stability of various analytes and the reduction of health risks via HIV or hepatitis. Articles related to the use of dried blood and urine samples concerning forensic toxicology are also available [2,3]. It is not only dried body fluids that can be a useful sample in forensic cases, as is shown in the case report below.

2. Case report

In the case of a murder-suicide of a mother and her seven year old daughter, a stain of dried infusion solution was found on a carpet at the scene. The mother strangled her daughter with a tourniquet. Additionally, the daughter was also connected to an infusion set. The mother then committed suicide with an overdose of insulin, potassium, midazolam, atracurium and propofol, mixed in with the infusion solutions (Fig. 1 & 2).

Packaging of the above mentioned pharmaceuticals were found in the refuse. Two infusion bags were also found at the scene, one (bag 1) nearly empty, because of an open valve with a small amount of milky liquid left in the line and the other (bag 2) with approximately 100 mL of clear liquid and a closed valve. Because the infusion lines were hanging from the bags, the infusion liquid of bag 1 had spilt onto the carpet (Fig. 3).

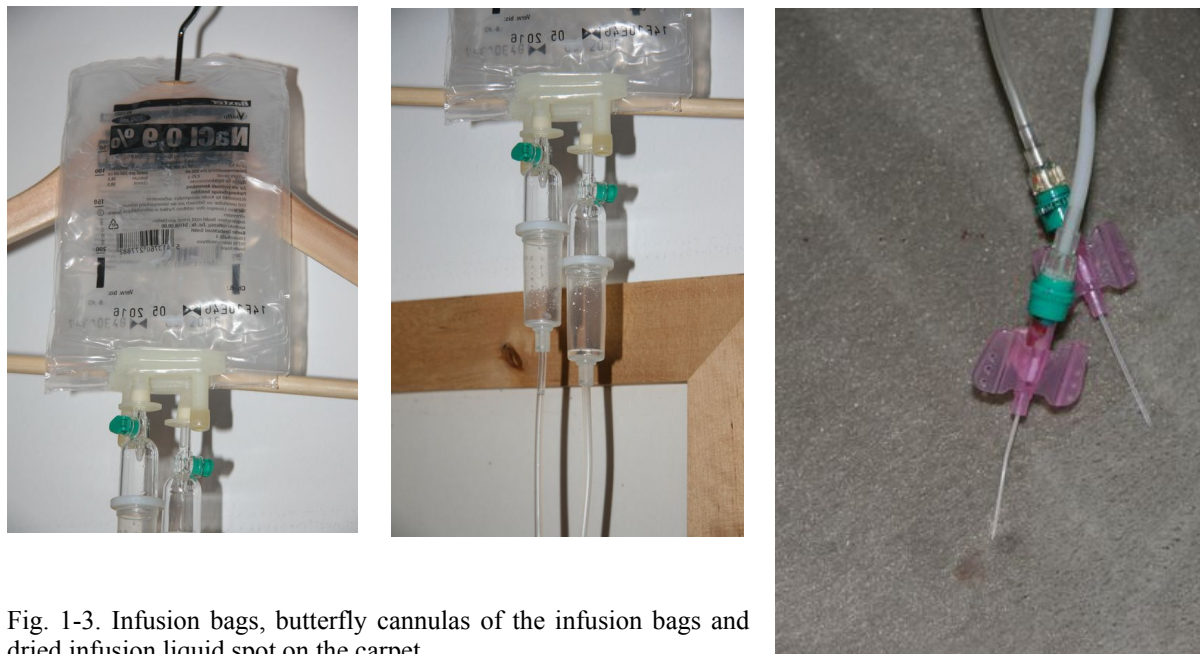


Fig. 1-3. Infusion bags, butterfly cannulas of the infusion bags and dried infusion liquid spot on the carpet.

The woman possibly suffered agonal convulsions and because of this the infusion line tore out of her arm and fell onto the floor. Two suicide notes were found at the scene.

3. Material and Methods

Various samples of the carpet were taken by water-moistened swabs two days after the discovery of the two deceased. Eight swabs were rubbed on the spot where the infusion solution had visibly spilt and seven other swabs were taken in the same manner from various other parts of the carpet without the infusion liquid to serve as a comparison. Analysis was carried out by means of LC-MS/MS with electron spray ionization operated in positive mode. For the analysis of midazolam and atracurium, one swab was soaked with reconstitution buffer, a mixture of internal standards was added and the sample was shaken for ten minutes. An aliquot of this solution was analyzed. A separate analysis for propofol was carried out by soaking five swabs with acetonitrile and adding the internal standard methyl-tert-butylphenol. The samples were then shaken for ten minutes and derivatized with 2-fluoro-1-methylpyridinium p-toluenesulfonate. For comparison, the swabs rubbed on the obviously unstained part of the carpet were prepared and analyzed in the same way. The extracts were analyzed by means of LC-MS/MS with electrospray ionization operated in positive mode.

4. Results and Discussion

Toxicological analysis of the infusion bags revealed midazolam, atracurium and its degradation product laudanosine, potassium and insulin in bag 2. In the nearly empty bag 1, of which the infusion solution had spilt onto the carpet, toxicological analysis revealed

midazolam, atracurium, laudanosine, propofol, potassium and insulin. All of the substances detected in bag 1 were also verified in femoral blood of the woman. The substances detected in bag 2 were verified in femoral blood of the daughter. Atracurium was detected in an amount that might have led to death, but during the autopsy, strangulation was verified as the cause of death of the daughter. As no propofol was detected in the post mortem specimen of the daughter, it is assumed that the daughter got the solution from bag 2 and the mother the solution from bag 1.

All substances analyzed for could be detected in the swabs taken from the carpet. Midazolam was found in a low amount, whereas atracurium and especially propofol were detected in high amounts. All swabs used as comparison from an unstained part of the carpet tested negative. The results obtained cannot indicate the precise concentrations of the pharmaceuticals mentioned above as it is unclear how much of the infusion solution was rubbed onto the swabs taken from the carpet.

It could be proved that the analyzed pharmaceuticals were stable when dried on the carpet, especially propofol, which is known to be unstable at room temperature. Therefore these results show that sample storage at room temperature is feasible by using dried spots and may be an alternative sampling strategy for whole blood as well.

5. References

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