

# The Flow Error in Drug Delivery in Anesthesia: Prevention and Control

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## Abstract

Works on risk analysis focused on activity in the operating room or in intensive care is rare. In fact, the operating room remains one of the units where the patient's medication management process is complex, which tends to increase the risk of ME as well as the severity of its consequences. In anesthesia, attention should be paid more specifically to errors during the preparation and administration of drugs, because these are actions that are performed many times every day. The analysis of this adverse event in our patient made it possible to classify this adverse event in the category of administrative errors. The administration of vancomycin should be done by slow infusion when it has been administered to our patient by direct intravenous route, this type of error is part of the volume or flow errors. Medication administration error can be prevented by providing coaching and continuing education for practitioners. It is also necessary to label the medication storage compartments of the anesthesia cart; the correct identification of drug ampoules and to ensure that there is only one packaging of the same product.

**Keywords:** Medication error, error in administration rate, adverse event, preventive measures.

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## INTRODUCTION

Medication error is the unintentional omission or performance of a medication act, which can cause patient risk or adverse event [1]. While the majority of these MEs have no significant consequences for the patient, some may be fatal or cause serious sequel [2]. They are observed at all stages of the medication circuit (prescription [3, 4], dispensation, reconstitution, administration [5, 6]. According to data in the literature, the error occurs from 1 in 100 to 1 in 10 times at each stage of the medication circuit. In general, 1% of these errors lead to avoidable serious adverse events (SAEs) [7]. ME is the 4th leading cause of reported SAE in the United States [8] and is responsible for around 7,000 preventable annual deaths [9]. Whereas in France, EM cause an SAE every 2,000 days of hospitalization [10], or around 70,000 SAEs per year. Hence the interest in our discussion of the subject of errors in administration through a clinical case having been the victim of an error in the rate of drug administration in anesthesia.

## CLINICAL CASE

In the clinical case presented, this is a medication error that occurred at the last stage of the medication circuit, the administration, considered according to certain studies as the second source of medication error after prescription [11]. We are talking

about a 47-year-old male patient admitted to the operating room for a post-traumatic right femoral fracture for orthopedic treatment with osteosynthesis equipment. In his antecedents, the notion of a penicillin allergy is noted on the pre-anesthetic consultation file. The planned and consented anesthesia with the patient was spinal anesthesia with a mixture of 12.5 mg of bupivacaine and 25 µg of fentanyl. After conditioning in the operating room, the planned antibiotic prophylaxis was vancomycin 30 mg / kg. This dose was prepared and injected direct intravenously instead of a slow infusion as recommended at a maximum rate of 1 g per hour, or even more slowly [12, 13]. Immediately after the injection, the patient began to report the sensation of generalized pruritus, especially predominant in the trunk, face and scalp with rapid appearance of erythematous patches and generalized redness suggesting hives. Simultaneously, a tachycardia appears at 145 beats per minute with a drop in blood pressure to 87/31 mmHg then a 75% desaturation under oxygen therapy at 5 liters per minute. The increased pruritus and hemodynamic and respiratory instability prompted control of the situation by rapid induction with hypnomidate, fentanyl and rocuronium.

Management was carried out without delay, the diagnosis of a Red man syndrome related to the rapid injection of vancomycin was mentioned and the

management of rapid management was the injection of a corticosteroid, an antihistamine and hemodynamic control by filling with physiological saline with the necessity at the start of small doses of adrenaline in addition to control of the upper airways by intubation and assisted ventilation. Intubation was easy without finding any edema of the oropharyngeal mucosa or edema of the tongue. Assisted ventilation was also easy. Pulmonary auscultation did not show crackling groans and airway pressures were normal. After hemodynamic and respiratory stabilization and the gradual disappearance of the cutaneous cupboards, the intervention was carried out without any notable incident and the patient was extubated on the table approximately two hours and thirty minutes after the start of the incident.

## DISCUSSION

### Context of Administrative Errors

Little work has been done on risk analysis centered on activity in the operating room or in intensive care. Indeed, the operating room is one of the units where the patient's medication management process is complex and marked by a few specific features which tend to increase the risk of ME as well as the severity of its consequences [14, 15]. This complexity is explained by the diversity of surgical procedures and anesthesia procedures, their variable degree of urgency and severity and the diversity of the patient's background. Hence the need for good management of moments of intense stress; the need for total trust between the workers and the need for them to be reactive immediately, especially when adverse events related to the administration of a drug occur. In the area of anesthesia, attention should be paid more specifically to errors during the preparation and administration of medication [16], as these are actions that are performed many times every day. Errors are then categorized into errors of inattention or memory, planning errors (poor application of a protocol or rule) and errors linked to insufficient knowledge. The frequency of occurrence of these active errors is notably increased in the presence of predisposing factors such as a high care load or operator fatigue [16]. In anesthesia, the rare published studies show that a medication error occurs from 1 in 900 times (0.11%) [17] to 1 in 130 anesthesia or (0.77%) [18]. However, this figure is probably underestimated because it comes from voluntary declarations, a method which is not very suitable for identifying medication errors. Indeed, it has been shown that the frequency of the errors observed could be 400 times higher than that of the declared errors [19].

### Analysis of the Adverse Event

Thus, in the reported case, the patient was the victim of an adverse event that occurred during the administration stage of the drug circuit. This is the administration of an antibiotic of the glycopeptide class (vancomycin) as part of antibiotic prophylaxis, this

administration was the cause of an allergic skin reaction with hypotension, which required taking fast and adapted load based on antihistamine and corticosteroids in addition to rapid control of hemodynamic and respiratory instability. The analysis of this undesirable event made it possible to classify it in the category of administrative errors. And since the administration of this molecule should be by slow infusion when it has been administered to our patient by direct intravenous route, therefore; this error is part of the volume or flow errors. Direct intravenous administration of vancomycin resulted in the release of histamine which was associated in our patient with the appearance of erythema in the neck, face and torso accompanied by pruritus and hypotension; which evokes the "red-man syndrome" [20].

The data in the literature report that the medication errors noted in anesthesia [21] concern EM syringes and ampoules in 50% of the cases; EM of administrative medical devices in 26% of cases; ME of the route of administration in 14% of cases. A New Zealand study based on a questionnaire sent to 75 anesthesiologists, reported that 89% of practitioners have committed at least one medication administration error in their professional practice and with a consequence for the patient in 12.5% of cases [22]. A prospective cohort study aimed at monitoring the administration of drugs in 36 hospitals showed that 19% (605) of the 3,216 drug administrations listed were incorrect. In 9% of cases, the error related to the administered dose [23]. Whereas a prospective questionnaire survey in two hospitals in New Zealand having covered nearly 11,000 anesthetics and showed a medication error rate of 0.75%, ie a medication error every 133 anesthetics [24]. The most frequent errors were dose errors (20%) and drug substitutions (20%). The errors occurred mainly with the agents administered as boluses (63%), then with the inhaled agents (15%) and finally with the infusions (20%). These data confirm the occurrence of administration error with infusions as in the case that occurred in our patient and the importance of rapid management and also highlights the frequency of errors at the time of the act of administration of where the importance of reflection for the implementation of preventive measures.

### The Prevention of Administrative Errors

In general, the prevention of these errors involves the combination of active control measures and passive measures intended to increase their efficiency and reduce the possibilities of reversal. For the prevention of errors in administration, labeling identifying the routes of administration has been recommended to facilitate control at the time of administration. This will prevent errors in the route of administration. While, the prevention of syringe errors used for direct or continuous administration also relies on systematic labeling of syringes [25]. The labeling of

syringes takes into account the international codes of colors and wefts corresponding to the different pharmacological classes [26, 27]. The success of these preventive measures requires the involvement of all staff. The prepared syringes should be stored in the trays according to a predefined plan, common to the entire structure. The anesthesia trays should be protected and bear the date and time of preparation and the identification of the preparer.

## CONCLUSION

Medication error can be prevented by providing coaching and continuing education for practitioners. It is also necessary to label the medication storage compartments of the anesthesia cart; the correct identification of drug ampoules and to make sure to get only one package of the same product.

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