

Emergency toxicology: Timely antidotes and giving poisoned organs a second life

Sophie Gosselin

INTRODUCTION

In the January 2019 issue of *CJEM*, two articles feature topics pertaining to emergency toxicology. The first one: *A system-wide solution to antidote stocking in emergency departments: The Nova Scotia antidote program*¹ tells the story of a group of committed healthcare professionals working to bring life-saving antidotes to locations where they are needed, but often lacking. Poisonings and intoxications, whether unintentional events or deliberate self-harm, are frequently encountered in the emergency department. Although many of these situations do not require specialized antidotal treatment, every emergency department must be prepared to care for the eventual poisoned patient who requires a specialized antidote. Why is it an issue? Are antidotes so expensive that they can't be stocked in large quantities everywhere? The answer is complex: While some antidotes are indeed expensive, the main challenge for hospital pharmacists is balancing the expiration dates of unused antidotes with unpredictable needs. It is virtually impossible to plan who will be poisoned, much less when, where, and with what?

The economical thought of depending on larger hospitals to stock rare medications and share their supplies as needed with smaller hospitals, although theoretically feasible for some diseases, is unfit for toxicological emergencies. The reality of antidote administration can be viewed in a three-tiered fashion. Firstly, resuscitative antidotes need to be administered immediately, within seconds, upon diagnosis (such a hydroxocobalamin for cyanide), another group is required within a few minutes (calcium, insulin), and the last group of antidotes is for rarer poisonings (such as chelation therapy) and are seldom needed in the first few hours. One can thus

appreciate why antidote stocking needs to take into account both geographical and epidemiological data of poisoning. Fortunately, poison centres are uniquely positioned to provide these data, with the assumption that healthcare professionals duly report both poisoning and antidote use.

A province-wide antidote monitoring system supervised by a multidisciplinary expert group offers the potential for large-scale savings. As stated in the article's discussion, appraisal of scientific evidence allowed Nova Scotia to reduce stocking recommendations of expensive antidotes (glucagon and antidigoxin antibodies) for which new data informed on lower required amounts.

It is a relief to read how Nova Scotia successfully organized its antidote accessibility throughout its provincial geography based on networking between their hospitals over the last decade with increasing compliance of all of their emergency departments. One wonders whether or not the same antidote availability exists in every province to provide every Canadian with the security of knowing that their nearest emergency department would be able to treat their condition if the need arises, especially because some of our jurisdictions face different geographical challenges of remoteness than our maritime colleagues. One could even conceive of expanding the antidote-sharing networking across borders within North America to reduce distances. Isn't Seattle closer to Vancouver than Ottawa? Or Montreal closer to Burlington than New York?

The next leap forward in antidote management would be to use other published results to review the manufacturers' expiration dates and avoid discarding expensive efficacious medications. Multiple studies demonstrate that even with past expiration dates, enough medication is left to provide clinical efficacy in an emergency,

Correspondence to: Dr. Sophie Gosselin, McGill University Health Centre—Emergency Medicine & Medical Toxicology Service, Montreal, Quebec, Canada; Email: sophie.gosselin@mcgill.ca

especially with antidotes that are dosed to clinical effect.² This is especially true with naloxone, the antidote most used in this issue's article. Long and colleagues recently reported greater than 90% of labeled naloxone concentrations persisted in expired samples ranging from 1980 to 2016.³

Avoiding premature discarding of still effective antidotes can be viewed as sort of recycling strategy, which brings us to the next article in the issue: *Organ and tissue donation from poisoned patients in the emergency department: A Canadian emergency physician survey*.⁴ Despite published successes, traditionally, patients who die of poisoning are not routinely considered as organ or tissue donors, probably either for fear of perpetuating the poisoning to the recipient, or concerns over the appropriate diagnostic criteria for brain death when a drug overdose is involved.⁵⁻⁶ Over 20 years ago, Jones and Simpson discussed these very same issues, arguing that poisoning deaths might still be useful for organ and tissue donation after the exclusion of toxicity in the target organ.⁷ How have we progressed since 1998? Not very much according to the current article in this issue, which explores patterns of referrals of emergency physicians by means of a survey of various scenarios, including poisoning-related deaths. Only 75% of scenarios involving poisoning deaths were considered for organ or tissue donation compared with 92% of non-poisoned deaths scenarios. This stands in contrast to a 2003 study in the UK reporting that up to 100% of physicians involved with transplantation programs were willing to offer selected poisoned deaths' organs for transplantation.⁸ What's different for us, in Canada?

In 2016, Statistics Canada reported that people ages 20 to 64 years accounted for 91.5% of deaths from accidental poisonings and that drug overdoses accounted for 92.0% of the deaths in this category. Most poisoned deaths occur in patients with relatively few comorbidities, offering many potentially disease-free organs and tissues to patients in need of transplants. This represents an underused source of organ donation, which, if not even considered by emergency physicians will never be called to provincial transplant services.

In this issue of *CJEM*, these two articles give us food for thought and behoove us to challenge our preconceived notions about the oft-stigmatized poisoned population. In the face of our society's increased transplant needs, science has shown for the last 2 decades that other organs can be successfully used for transplant

once the toxin leaves the body and the organ is not permanently damaged or the site of primary toxicity. This process is facilitated by recent guidelines for determining brain death in overdose, which were developed to assist clinicians in making more timely decisions.⁹

Because we have a clear need to establish organizational readiness for toxicological emergencies to be able to provide timely antidotal services 24/7 across our Canadian landscape, what steps are we going to take to make this a reality? Faced with the rising costs of antidotes coupled with potential drug shortages, are we collectively willing to wait another decade before challenging the nebulous criteria justifying manufacturers' expiration dates on expensive antidotes when we know many of them are still effective?

Keywords: Toxicology, antidote stocking, organ donation, poison, emergency department

Competing interests: None declared.

REFERENCES

1. Murphy NG, Bona DR, Hurley TA. A system-wide solution to antidote stocking in emergency departments: the Nova Scotia antidote program. *CJEM* 2019;21(1):37-46.
2. Schier JG. Preparing for chemical terrorism: stability of injectable atropine sulfate. *Acad Emerg Med* 2004;11(4):329-34.
3. Freya J, Pruyne S, Bakera B, et al. Meeting the demand for naloxone: stability of expired naloxone solution. *Clin Toxicol* 2018;56(10):917.
4. Staple L, MacIntyre J, Murphy NG, et al. Organ and tissue donation from poisoned patients in the emergency department: a Canadian emergency physician survey. *CJEM* 2019;21(1):47-54.
5. Hantson P, Vekemans MC, Squifflet JP, Mahieu P. Outcome following organ removal from poisoned donors: experience with 12 cases and a review of the literature. *Transplant Int* 1995;8(3):185-9.
6. Roberts JR, Bain M, Klachko MN, et al. Successful heart transplantation from a victim of carbon monoxide poisoning. *Ann Emerg Med* 1995;26(5):652-5.
7. Jones A. Drug abusers and poisoned patients: a potential source of organs for transplantation? *QJM* 1998;91(8):589-92.
8. Wood DM, Dargan PI, Jones AL. Poisoned patients as potential organ donors: postal survey of transplant centres and intensive care units. *Crit Care* 2003;7(2):147-54.
9. Neavyn MJ, Stolbach A, Greer DM, et al. ACMT position statement: determining brain death in adults after drug overdose. *J Med Toxicol* 2017;74(23):1-3.