

IMPACT OF INTRODUCING PREFILLED ATROPINE SYRINGES IN OCULAR SURGERY: PROACTIVE ASSESSMENT OF DRUG COSTS AND MEDICATION SAFETY

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Background and importance

Intravenous atropine injection is used to treat acute bradycardia during ocular surgery. It has been observed that significant amount of ampoule-drawn atropine injections was unused and wasted yearly in a large ocular surgery unit. Some potential medication safety risks have also been recognized. Although ready-to-use prefilled atropine syringes are recommended to improve medication safety of intravenous drugs, they are still rarely used in Finland.^{1,2}

Aim and Objectives

The aim of our project was to compare the drug costs and medication safety risks associated with the use of atropine ampoules and atropine prefilled syringes to treat acute bradycardia in ocular surgery.

Materials and methods

First, the effects of prefilled syringes on drug costs were investigated by a literature search and by gathering data from other surgical units that already used prefilled syringes. Atropin-related drug costs of other surgical units were calculated before and after transition to prefilled syringes. After that, a Failure Mode and Effects Analysis (FMEA) conducted by an interprofessional expert group was used to evaluate risks associated with the medication management and use process of both atropine products.³

Results

The introduction of prefilled syringes had decreased the costs of atropine injections in other surgical units more than 50% in average when compared to atropine ampoules. The savings we observed resulted mainly from wastage minimization, because the shelf life of ampoule-drawn atropine injection is limited. Our literature search supported this observation.⁴

The FMEA analysis identified more medication safety risks related to the use of atropine ampoules (n=14, risk profile number RPN 297) when compared to the prefilled syringes (n=7, RPN 74). The most significant difference came from the risks related to preparation of atropine injection (i.a. limited shelf life) and look-alike, sound-alike (LASA)-risks associated with the use of atropine ampoules. (Figure 1.).

Conclusions and relevance

Based on cost analysis and proactive risk assessment by FMEA the transition to prefilled syringes appears to decrease costs and increase medication safety.

Figure 1. Look-alike ampoules and labels may cause errors (LASA, look-alike, sound-alike medication safety risk).



References: 1. The Institute for Safe Medication Practices: ISMP Safe Practice Guidelines for Adult IV Push Medications © ISMP 2015. 2. Billstein-Leber M. ym.: ASHP Guidelines on Preventing Medication Errors in Hospitals (Am J Health-Syst Pharm. 2018; 75:1493-517). 3. Anjalee J. ym.: Application of Failure Mode and Effect Analysis (FMEA) to improve medication safety: a systematic review (Postgraduate Medical Journal, Volume 97, Issue 1145, March 2021, Pages 168-174) 4. Benhamou D. ym.: Ready-to-use pre-filled syringes of atropine for anaesthesia care in French hospitals - a budget impact analysis (Anaesthesia Critical Care & Pain Medicine, Volume 36, Issue 2, April 2017)

Table 1. Risk assessment for situation, when atropine is drawn from an ampoule

Risk number	Potential failure mode	Process step	Potential failure effect	Severity	Occurrence	Detectability	RPN	
1	The atropine packages dispensed from hospital pharmacy (usually) have an exceptionally short shelf-life	dispensing	The incoming product has a short shelf life	1	4	1	4	
2	Shortages in the supply of the equipment needed for the preparation of ampoule-drawn injection (needles, syringes, labels)	dispensing	Need to use different and possibly less compatible equipment, resulting in additional work steps and increased risk of error	2	2	1	4	
3	Package of 25 ampoules expires partly or completely unused	storage	Wastage and increased costs	1	4	1	4	
4	Expired package stays in a storage place	storage	Administering of an expired product by accident	1	2	3	6	
5	Numerous LASA-risks, especially when individual ampoules are stored in an anesthesia cart	storage and preparation	A wrong medicine is administered	5	3	2	30	
6	Pharmacist draws a wrong medicine into the syringe or puts a wrong label on it	preparation	A wrong medicine is administered	5	2	5	50	
7	Nurse draws atropine into a syringe in the operation theatre prior to the procedure (shelf life 2h) and the expiration time is not documented on the label	preparation	Administration of an expired product increases the risk of infections	2	5	4	40	
8	Patient needs atropine urgently and it is not drawn into a syringe in advance	preparation	Delay in atropine administration and possible escalation of the situation	3	3	2	18	
9	Variation in the amount of atropine drawn into a syringe in advance: one ampoule or patient-specific dose	preparation	Administration of the whole syringe content to a (pediatric) patient, who needs a smaller dose	3	3	2	18	
10	Failure to dilute the solution to 0,1 mg/mL according to the Pediatric Medication Guide's guidelines when needed	preparation	Use of undiluted solution, too large dose for a pediatric patient	4	2	3	24	
11	Possible mix-ups between similar-looking 1 mL syringes drawn in advance for pediatric patient	storage of the syringe prepared in advance	A wrong medicine is administered	5	3	3	45	
12	Misunderstanding of the physician's verbal order	administration	A wrong dose is administered	3	2	3	18	
13	Error in calculation or measurement of the dose	administration	A wrong dose is administered	3	2	3	18	
14	Expired syringe meant to be disposed of in a wrong place	disposing of a prepared syringe	Administration of an expired product increases the risk of infections	2	3	3	18	
							RPN sum	297

Table 2. Risk assessment for situation, when prefilled ready-to-use atropine syringe is used

Risk number	Potential failure mode	Process step	Potential failure effect	Severity	Occurrence	Detectability	RPN	
1	Short shelf life of the prefilled atropine syringes stocked in the hospital pharmacy	dispensing	The incoming product has a short shelf life	1	2	1	2	
2	Shortage in supply of the prefilled atropin syringe	dispensing	Need for replacement, increased error risk	2	2	1	4	
3	Package of 10 prefilled syringes expires partly or completely unused	storage	Wastage and increased costs	1	2	1	2	
4	Expired package in a storage place	storage	Administration of an expired product increases the risk of infections	1	2	3	6	
5	Atropine and ephedrine are both in prefilled syringes → possible LASA risk	storage	A wrong medicine is administered	5	3	1	15	
6	Misunderstanding of the physician's verbal order	administration	A wrong dose is administered	3	2	3	18	
7	Error in calculation or measurement of the dose	administration	A wrong dose is administered	3	3	3	27	
							RPN sum	74

LASA: Look-alike, sound-alike

RPN: Risk profile number

Bold text and background coloring are used to highlight processes associated only with the use of ampoules

