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Short Article

Antidote Stocking at Hospitals in North Palestine

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Abstract:

Objective: The purpose of this study was to determine the availability and adequacy of antidote stocking at hospitals in north Palestine based on published guidelines for antidote stocking.

Methodology: This study is a cross sectional survey of all hospitals at north Palestine (n=11) using a questionnaire which was completed by the director of the pharmacy department at each hospital. The questionnaire was divided into 2 parts. The first part contained a list of 25 antidotes while the second part contained a list of 12 antidotes. This classification is based on the guideline proposed by the British Association for Emergency Medicine (BAEM). The net antidote stock results were compared with the American guidelines as well.

Result: The overall availability of each antidote in the first list varied widely from zero for glucagon to 100% for atropine. The number antidotes of the first list that were stocked in the 11 hospitals ranged from 5 to 12 antidotes but none of the hospitals stocked all the 25 antidotes. Additionally, availability of antidotes in the second list varied widely from zero for polyethylene glycol to 100% for dobutamine. The number of antidotes stocked ranged from 5 to 9 but none of the hospitals stocked all the 12 antidotes.

Discussion and Conclusion: hospitals in north Palestine do not have adequate stock of antidotes. Raising awareness of the importance of antidotes by education, regular review of antidote storage, distribution plans, and appropriate legislation might provide solutions. Coordination between Palestinian hospitals and the PCDIC at An-Najah National University is also important.

Key Words: Antidote, Hospital, Palestine, Stocking, Poisoning.

Introduction:

Accidental and intentional poisoning remains a major worldwide problem which results in significant annual morbidity and mortality.[1-4] In general, decontamination followed by supportive care have been regarded as the essentials of clinical poisoning management.[5] However, in certain circumstances specific antidotes can reduce morbidity, mortality, and the duration of hospitalization.[3,5] The prompt use of appropriate antidotes is especially important in countries in which high rates of poisoning do exist. Over the past 20 years, many studies have demonstrated that antidotes are very essential and yet insufficiently stocked in health care facilities.[6-14] The precise cause of this problem is unknown, but appears to be related to limited hospital resources, cost and possible unfamiliarity with antidotes.[3,8]

The Joint Commission on Accreditation of Healthcare Organizations requires that hospitals stock antidotes, but does not provide specific requirements on the amounts. Several regional poison control centers in the United State and some textbooks have developed recommendations for antidote stocking.[3,8] In 2000, the first evidence-based consensus guideline for stocking antidotes in the United States was published. These guidelines recommended that 16 essential antidotes should be stocked in each health care facility that treats acutely poisoned patients.[15] Antidotes were considered essential if they were both effective and necessary within the first hour of patient presentation. The quantity of antidote recommended was based on the dose necessary to treat one or two 70-kg acutely poisoned patients for the first 4 hours.[15] In 2005, The British Association for Emergency Medicine (BAEM) and Guys & St Thomas' Poisons Unit developed the first guidelines on the stocking of antidotes. The BAEM guideline has divided antidotes into those that should be immediately available in the emergency department and those that should be available in the hospital for use within one to four hours of poisoning.[16] The BAEM guideline was having similarity

to the WHO guidelines for poisoning control about antidotes and their availability.[17]

There has been no study addressing antidote stocking in Palestinian hospitals. Therefore, the purpose of this study was to determine the availability and adequacy of antidote stocking at hospitals in north Palestine based on the published guidelines for antidotes stocking. This will help the Poison Control and Drug Information Center (PCDIC) in poison management.

Materials and Methods:

This is a cross sectional survey study using a questionnaire. The study included all hospitals (n=11) in north Palestine that provide emergency department and more than 20 acute care beds. The hospitals names and addresses were obtained from the Palestinian ministry of health. A questionnaire was designed by the PCDIC at An-Najah National University in Nablus and sent directly to the director of each hospital on February 15, 2006, accompanied by an official document explaining the purpose and importance of the survey. The director of the hospital was asked to assign a pharmacist to complete the questionnaire.

The questionnaire has two lists of antidotes and the director of the Pharmacy at each hospital was asked to report the amount of each antidote currently in stock anywhere in the hospital (Table 1,2). The two lists contained the various antidotes and the adjunctive agents used for the treatment of poisoning. The first list contained 25 antidotes, those that should be available in the hospital for use within the first four hours of poisoning; the second list contained 12 antidotes, those that should be available in the hospital for use within the first hour of poisoning. The two lists were classified as such according to the guidelines on the antidote availability for accident and emergency departments as published by the BAEM and Guys & St Thomas' poison units.[16]

For each hospital, antidote stocks were categorized as either adequate or inadequate based on the published recommendations.[15,18,19] The recommended amounts constitute the approximate quantities of antidotes needed to initiate treatment for 1 case of severe poisoning in an adult. The availability of antidotes in each hospital were compared to the 16 antidotes considered essential in Dart *et al* guidelines for stocking antidotes.[15] The 16 antidote and their clinical use with the recommended dose to treat one patient for the first 4 hours are given in Table 3.

All data were entered and analyzed using Statistical Software for Social Sciences program version 10.0 (SPSS Inc., Chicago, IL). Data are presented as mean ± SD.

Results

All hospitals (n=11) responded to the sent questionnaire. The overall availability of each antidote in the first list varied widely, it ranged from zero (for glucagon and fomepizole) to 100% (for atropine and Naloxone) (table 1). The number of antidotes stocked in all hospitals ranged from 5 to 12 antidotes but no hospital stocked all the 25 antidotes (mean 8.2 ± 2.36). The mean number of antidotes stocked was. All hospitals stocked an adequate supply of atropine, naloxone, neostigmine, protamine sulphate and phytonadione (Vit. K_1). In contrast, digoxin-specific fab antibodies, folic acid injection, ethanol, fomepizole, glucagon, penicillamine, physostigmine, succimer, and thiamine were not available at any of the surveyed hospital (Table 1).

Availability of antidote in the second list varied widely from zero (for polyethylene glycol) to 100% (for dobutamine). The number of antidotes

stocked in 11 hospitals ranged from 5 to 9 antidotes (mean 6.5 ± 1.2) but no hospital stocked all the 12. All hospitals stocked an adequate supply of calcium gluconate, dobutamine, dopamine, diazepam, sodium bicarbonate. In contrast, polyethylene glycol was the only one from this list that was not available at any hospitals.

This study revealed that not all antidotes were available, however, those that are in stock were stocked in adequate quantities for the initial treatment of often one case of sever poisoning. No hospital had adequate stock of all the 37 antidotes present in the two lists. Overall, the average number of antidotes adequately stocked was 14.7 per hospital.

Analysis of data according to Dart *et al* guidelines for stocking of 16 emergency antidotes in the US showed that the rate of sufficient stocking for individual antidotes ranged from zero (for digoxin-specific Fab antibodies) to 100% (for atropine). Number of adequately stocked antidotes per hospital ranged from 4-7. Calcium gluconate, sodium bicarbonate, atropine and nalaxone antidotes were available at all hospitals (Table 3).

Table 1: Antidote list 1 (n=25): The frequency of stocking of the specific antidotes at different hospitals. The antidotes listed below should be available within four hours of poisoning.

Antidote	Frequency (n=11)	Antidote	Frequency (n=11)
Antivenin	1	Naloxone	11
Atropine	11	Neostigmine	11
N-acetylcystine	2	Octreotide	6
Digoxin immune Fab	NA	Obidoxime	4
Dimercaprol	1	Penicillamine	NA
Deferoxamine	4	Physostigmine	NA
Ethanol	NA	2-PAM	NA
EDTA	4	Protamine sulphate	11
Folinic injection	4	Sodium thiosulfate	1
Folic acid injection	NA	Succimer	NA
Flumazenil	10	Thiamine	NA
Fomepizole	NA	Vit k_1(Phytonadione)	11
Glucagon	NA		

EDTA: ethylenediamine tetraacetic acid, NA: not available, 2-PAM: pralidoxim

Table 2: Antidotes List 2 (n=12): The frequency of stocking of the specific antidotes at different hospitals. The antidotes listed below should be available within one hour of poisoning.

Antidote	Frequency (n=11)	Antidote	Frequency (n=11)
Activated charcoal	3	Methylene blue	3
Calcium gluconate	11	Diazepam	11
Dantrolene	1	Phentolamine	1
Dobutamine	11	Pyridoxine (B6)	1
Dopamine	11	Polyethylene glycol	NA
Epinephrine	9	Sodium bicarbonate	11

NA: not available

Table 3: The current availability of 16 selected antidotes at all hospitals of north Palestine and comparing it to the consensus guidelines for antidotes stocking in emergency departments in the US [15]

Antidote	Frequency (n=11)	Poisoning Indication(s)	Presentation*	Dose (70 kg patient)
N-acetylcystine	2	Acetaminophen	200mg/ml,10 ml ampoule	19.6 g
Snake antivenin	1	Snake bites	10 ml/vial	10 vials
Calcium gluconate	11	Hydrogen fluoride (HF) or calcium channel blocker	10%,10 ml ampoule	100 mEq
Sodium bicarbonate	11	1) Tricyclic antidepressant, 2) cocaine, 3) salicylates	8.4%,50 ml vial	500 mEq
Deferoxamine	4	Iron	500 mg/vial	8.4 g
Digoxin specific Fab	NA	Digoxin, digitoxin, or natural products (plants, toads)	38 mg/vial	15 vials
Dimercaprol	1	Acute arsenic, inorganic mercury, lead	50 mg/ml,2ml ampoule	280 mg
Atropine	11	Carbamate or organophosphate insecticide	600 mcg/ml,1ml ampoule	75 mg
Cyanide antidote	1	Cyanide	30 mg/ml,10 ml ampoule	1 kit
Ethanol	NA	1) Methanol, 2) ethylene glycol	5ml/ ampoule	90.7 mL
Fomepizole	NA	1) Methanol, 2) ethylene glycol	5mg/ml, 20ml ampoule	1.05 g
Glucagon	NA	1) β-adrenergic antagonist, 2) calcium channel blocker	1 mg/vial	50 mg
Methlene blue	3	Methemoglobinemia	10mg/ml, 10ml ampoule	140 mg
Naloxone	11	Acute opioid poisoning	10mg/ml, 10 ml ampoule	15 mg
Obidoxime	4	Organophosphate insecticide	400 mcg/ml,1ml ampoule	1 g
Pyridoxine	1	Isoniazid (INH)	100 mg/1ml, 10 ml ampoule	10 g

NA: not available

* could be available in other different presentations

Discussion:

Antidotes are therapeutic agents intended to modify or counteract with the clinical effects of particular toxic substances in the human body; antidote availability may often be life saving for poisoned individuals.[5] Although their clinical importance should not be emphasized over good supportive care, delayed use or unavailability of antidotes could result in catastrophic consequences.[3,20] For example, the outcome in patients with severe methemoglobinemia is poor without intravenous methylene blue treatment [21]. In cyanide poisoning, the lack of prompt antidote treatment with nitrite and thiosulfate may result in anoxic brain injury or death.[3] Patients with severe cholinergic syndrome from organophosphate or carbamate insecticide poisoning are likely to die from respiratory failure without the early institution of atropine.[22] Since the timely use of antidotes is potentially lifesaving in certain poisonings, maintaining a sufficient stock of antidotes is a responsibility of any facility that provides emergency care. If a poisoned patient requires an antidote that is not stocked at a particular hospital, then either the patient must be transferred or the antidote must be obtained from another hospital. This is complicated by the fact that Palestine has longer

transport times than any other country due to political situation.

The availability and quantities of antidotes in Palestinian hospitals were not in accordance with recommendation and guidelines. Despite that, it is not considered a drawback for certain hospital not to have all antidotes because of the nature of the medical service they provide. Furthermore, the guidelines by which we compared the stocking of antidotes where those implemented in USA and UK. The nature of poisoning cases in Palestine might be different than those in the USA and UK.

Our study is the first in Palestine to compare provincial antidote stocking to an established consensus guideline. The results obtained were similar to those of other US studies, which suggest that antidote stocking is often inadequate.[3,6,8,9] In a recent Canadian study from Ontario, only 1 out 179 surveyed hospitals stocked adequate amounts of all 10 antidotes evaluated [10], while in a similar study from Quebec found that the number of adequately stocked antidotes per hospital ranged from 0 to 9 of 13.[11]

The major reasons of inadequate antidote stocking are probably a lack of awareness of the deficiencies and a belief that maintaining such stocks would be excessively costly [23, 24]. Prior to 2000, there were no concise, evidence-based guidelines for stocking of emergency antidotes [15]. In the absence of such guidelines, physicians and pharmacists may not know which antidotes need to be stocked. They may conclude, for example, that a rarely used antidote is not worth stocking, or they may be unaware of the need for timely administration of certain antidotes and assume they can obtain these from other facilities in the area at the time they are necessary [8]. In addition, centers that do not perform regular stocking reviews may be unaware of their actual antidote stocks. Although stocking shortages may occur for any of the reasons cited, our survey did not solicit explanations for antidote shortfalls; therefore at Palestinian hospitals.

We also found wide variation in availability among the different antidotes (Table 1, 2). As has been previously reported, antidotes used to treat conditions other than poisonings were more frequently stocked such as dopamine, dobutamine, calcium gluconate, diazepam and sodium bicarbonate.

The unavailability of some antidotes through normal commercial channels may also contribute to insufficient antidote stocking in Palestine and also some antidotes have never been marketed in Palestine. Some hospitals prefer to manage poisoned patients by referral to other medical facilities.

Insufficient stocking of antidotes is not a unique problem to Palestine. It has been identified as a worldwide issue and its consequences may be serious.[3,5,7,8,25,26].

Recommendation and Solutions: Based on the results presented, we recommend the following in order to improve the antidote stocking in Palestine: 1)New legislations should be adopted by the Palestinian ministry of health (PMOH) regarding the stocking of antidotes at private and governmental hospitals. The new legislation should take into consideration the international and WHO recommendations; 2) Coordination between PCDIC and hospitals should be established regarding the type and quantity of antidotes in each hospital for the PCDIC in order to direct the poisoned patients to the hospital where the appropriate antidote is available.

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