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STUDY ON AVAILABILITY, STOCK, AND PRICE OF ESSENTIAL ANTIDOTES OF COMMON POISONING IN HOSPITAL PHARMACY OF KATHMANDU VALLEY

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ABSTRACT

Background: Acutely poisoned patients sometimes require immediate treatment with an antidote and delay in treatment can be fatal. Antidote is a therapeutic substance used to counteract the toxic actions of a specified xenobiotic. The purpose of our study was to determine the availability of 13 selected antidotes at general hospitals of Kathmandu Valley.

Methods: A cross-sectional study was carried out in 69 general hospitals of Kathmandu valley. The data was collected by interviewing representative of hospital pharmacy using semi-structured questionnaire.

Results: The most frequently encountered poisoning was found to be Organophosphate poisoning (93.1%). 32.8% poisoning cases were encountered twice in a month. No hospitals in Kathmandu valley stocked all 13 antidotes. The highly available antidote was Atropine 82.6% while least available was Antivenom (2.9%). Large teaching hospitals and Government hospitals have large availability of antidotes than Small Non-teaching hospitals and Non-government. 81.2% hospitals were available with at least one antidote,

8.7% hospitals were unavailable with any antidote while 10.1% hospitals do not take and treat poison cases. Majority of antidotes are manufactured by India (72.2%) while least by Nepal (11.1%). 36.2% hospitals refer while 46.4% borrow the antidotes from nearby hospital. Only 17.4% hospitals perform formal stock review of antidotes by pharmacist and nurses.

Conclusion: There is not sufficient and uniform availability of all the antidotes in any hospital of Kathmandu valley. Majority of hospitals don't have activity of performing stock review by health care professionals. Local guidelines for accessibility of antidotes need to be developed and made available to hospital pharmacies and emergency department.

Keywords: Poisoning, Antidotes, Availability, Stock, Price.

Background of the study

Poison – a substance (solid, liquid or gaseous) which is introduced in the living body or brought into contact with any part thereof will produce ill health or death by its constitutional or local effects or both. Thus, almost anything is a poison. Acutely poisoned patients sometimes require immediate treatment with an antidote and delay in treatment can be fatal [1]. Poisoning is an internationally recognized burden on healthcare systems. [2]

An antidote, as defined by World Health Organization (WHO), is a therapeutic substance used to counteract the toxic action(s) of a specified xenobiotics. Although emergency supportive care is considered the foundation of toxicological emergency management, unintentional and intentional poisoning can be a major contributor to annual mortality rate worldwide [3]. Morbidity, mortality and the length of hospitalization may be reduced by the appropriate and well-timed use of antidotes. The main stay in the proper management of a patient in need for an antidote is the immediate administration of the needed antidotes and its availability in the hospital emergency. Therefore hospital should self-sufficient with regard to antidote stocking. Thus in proper stocking or unavailability of the required antidote is a major factor that leads to mismanagement of the poisoned patients. [4]

Antidotes stocking is a critical component of hospital care for poisoned patient in emergency. Antidote stocking represents a major health challenge worldwide and in Kathmandu valley. [1]

Thus, it has been the serious matter of priority to manage and decrease the mortality rate from such poisoning case, the country should have accessible availability of all the antidotes that is required by the country.[3] As antidote is an emergency medicine and most of the antidotes are also listed in the National

Essential list of Nepal. So as antidote has already been enlisted in the list of essential medicine, its availability is the prime aspect of government to monitor regularly.

In Nepal, the development of applied chemistry in industry, agriculture and household use has been more rapid than the development of child safety, worker protection and environmental health concern, poisoning has become the major health problem such fatalities can be prevented and minimized worldwide only if there is proper management of availability of respective antidotes. The pharmacy department of each hospital is responsible for the provision of antidote and their replacement after expiration. Each department should also participate in developing protocol for the treatment of poisoning with stocking requirement.

This study aims to determine whether the problem of inadequate antidote supplies prevails within our hospital system despite differences in hospital administration. Antidotes being emergency requirements a little delay in treatment can take the life of patient so there should be sufficient and uniform availability in every hospital. So our study identifies the availability and stocking of different required antidotes in the hospitals of different categories. This study aim to identify the major poisoning cases being encountered and problem behind inadequate stocking.

Methods

This is a cross-sectional survey study using questionnaire. This study was carried out in different hospital pharmacies of Kathmandu valley i.e. Kathmandu Bhaktapur and Laitpur The pharmacy was selected to observe the availability of antidotes. Kathmandu valley is developed and access to huge range of medicines, cases and ethnicity. Additionally, place is convenient to researcher for data collection. The study site includes pharmacies of general hospitals of Kathmandu, Lalitpur and Bhaktapur districts.The sampling method is Purposive. The duration of this study was around six months. The total number of sample was 69 hospital Pharmacies, 49 from Kathmandu, 13 from Lalitpur and 7 from Bhaktapur.

Data Management and Analysis

Data entry, data checking and editing were done manually and data analysis was carried out in Microsoft Excel 2013 and Statistical package for social science (SPSS) version 23 software.

Results

Frequently encountered poisoning cases.

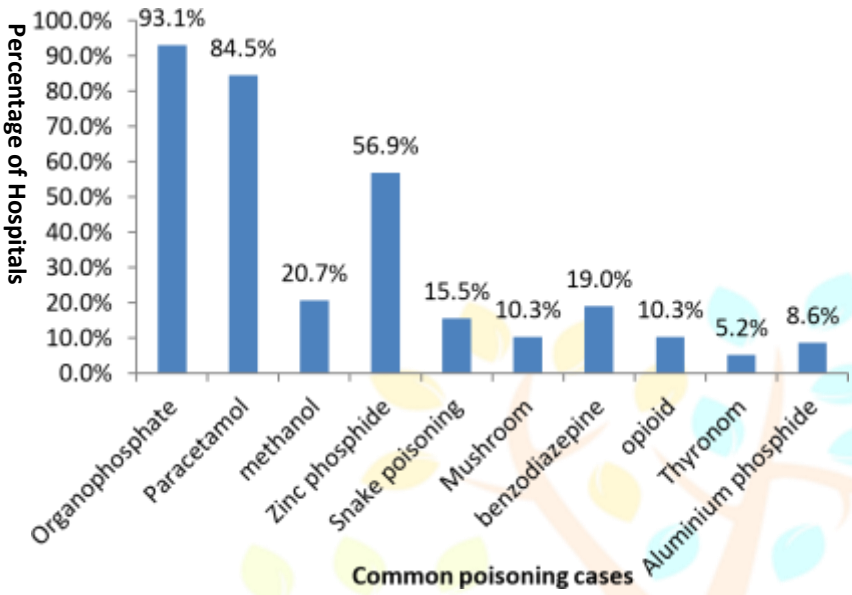

Figure no 1: frequently encountered poisoning cases.

Above figure shows that the most frequently encountered poisoning case was Organophosphate poisoning i.e. 93.1% while the least was Thyronorm toxicity i.e. 5.2%.

The other poisoning cases were observed to be Paracetamol (84.5%), zinc phosphide (56.9%), benzodiazepine (19%), snakebite (15.5%), mushroom and opioid (10.3%), methanol (20.7%), aluminum phosphide (8.6%).

Frequency of poisoning cases encountered

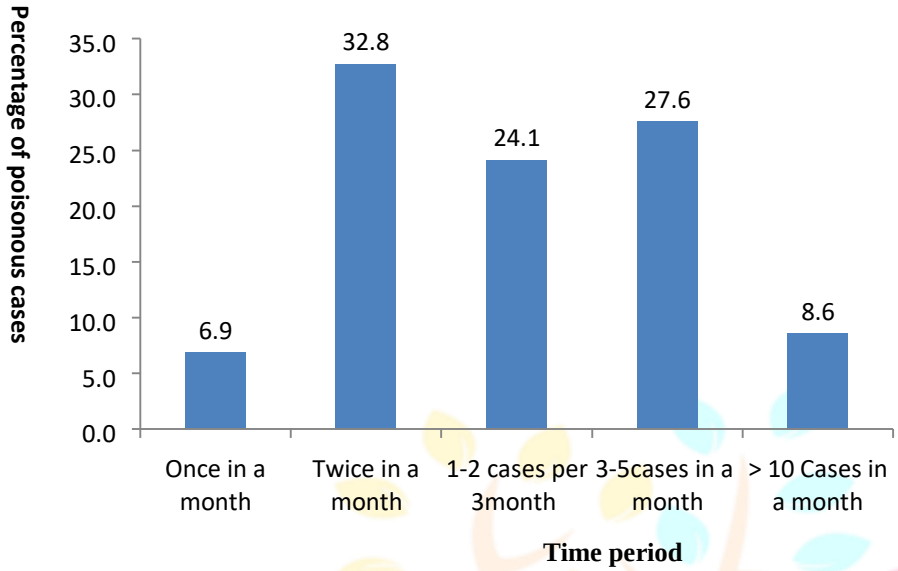

Figure no 2: Frequency of poison case encountered.

The figure shows that 32.8% poisoning case was encountered twice in a month, followed by 27.6% cases encountered 3-5 times in a month, 24.1% cases encountered 1-2 times per month, 8.6% cases was encountered greater than 10 times in a month and least percentage

i.e. 6.9% poisoning case was encountered once in a month.

Availability of antidotes in hospitals of Kathmandu Valley

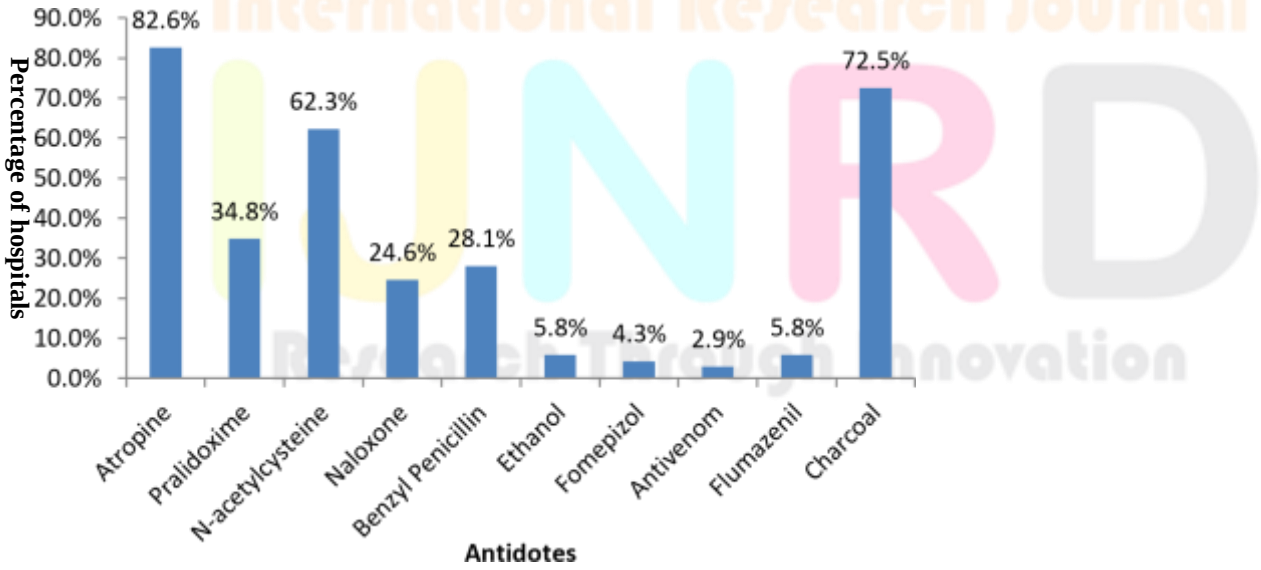

Figure no 3: Availability of antidotes in hospitals of Kathmandu Valley.

Figure 3 shows that not a single hospital of Kathmandu Valley stocked all the 13 antidotes. Maximum number of antidote available in most of the hospitals of Kathmandu Valley were Atropine (82.6%), Charcoal (72.5%) and N-acetylcysteine (62.3%) whereas remaining antidotes were available in minimum hospitals Pralidoxime (34.8%), Benzyl penicillin (28.1%), Naloxone (24.6%) Ethanol and Flumazenil (5.8%), Fomepizol (4.3%) and least with Antivenom (2.9%).

Table no 1: Number (and %) of hospitals of Kathmandu Valley with adequate availability

Antidote	Kathmandu	Lalitpur	Bhaktapur
Atropine	39(79.5)	12(92)	5(71.4)
Pralidoxime	13(26.5)	7(53.8)	4(57.1)
N-acetylcysteine	29(59.2)	10(76.9)	4(57.1)
Naloxone	10(20.4)	5(38.4)	1(14.2)
Benzylpenicillin	12(24.4)	4(30.7)	0
Fomepizol	0	1(7.6)	0
Ethanol	2(4)	2(15.3)	0
Antivenom	1(2)	1(7.6)	0
Flumazenil	2(4)	0	0
Charcoal	34(69.3)	11(84.6)	4(57.1)

Table no 1 represents that among selected 13 antidotes, not a single hospital in Kathmandu Valley has availability of all the antidotes. As compared to Bhaktapur, and Lalitpur, Kathmandu was found to be in highest number.

Table no 2: Number and (%) of Teaching and Non-teaching hospitals with adequate availability

Antidote	Teaching	Non-teaching
Atropine	5(100)	52(75.3)
Pralidoxime	4(80)	20(31.25)
N-acetylcysteine	5(100)	38(59.3)
Naloxone	3(60)	14(21.8)
Benzylpenicillin	4(80)	12(18.7)
Ethanol	0	4(6.25)
Fomepizol	0	1(1.56)
Antivenom	0	2(3.1)
Flumazenil	1(20)	2(3.1)
Charcoal	4(80)	45(70.3)

Above table describe that Teaching Hospitals have 100% Availability of Atropine and Nacetylcysteine, 80% of Pralidoxime, Benzyl penicillin and Charcoal and 20% of Flumazenil. But they do not have Ethanol, Fomepizol and Antivenom. While non-teaching hospitals have less availability of all antidotes ie.75.3%, 31.25%, 59.3%, 21.8%, 70.3%, 18.7% and 6% of Atropine, Pralidoxine, Nacetylcysteine, Naloxone, Charcoal, Benzyl-penicillin and Ethanol, Fomepizol, Anivenom and Flumazenil respectively.

Table no 3: Number and (%) of Government and Non- government hospitals with adequate availability

Antidotes	Government	Nongovernment
Atropine	9(100)	48(80)
Pralidoxime	4(44.4)	20(33.33)
N-acetylcysteine	7(77.8)	36(60)
Naloxone	3(33.3)	14(23.33)
Benzylpenicillin	4(44.4)	12(20)
Ethanol	1(11.1)	0
Fomepizol	1(11.1)	3(5)
Antivenom	1(11.1)	1(1.67)
Flumazenil	0	3(5)
Charcoal	9(100)	40(66.7)

Government hospitals have maximum availability of 3 antidotes, they are Atropine, Charcoal, N-acetylcysteine, 44.4% of Pralidoxime and Benzylpenicillin33.3%Naloxon, Ethanol Fomepizol and Antivenom with 11.1% only while Flumazenil is not available in the Government Hospital. On the other hand Non-government Hospitals have less availability of all the antidotes than Government Hospitals i.e. Atropine (80%), Charcoal (66.7%), N-acetylcysteine (60%), Naloxone (23.3%), Benzylpenicillin (20%), Fomepizol (5%), Antivenom (1.67%), Flumazenil (5%) and Ethanol (nil).

Table no 4: Number and (%) of different bed size hospitals with adequate availability of antidote

Antidotes	Bed size<100	Bed size 100-500	Bed size> 500
Atropine	24 (72.7)	27(84.37)	4(100)
Pralidoxime	10(30.3)	9(28.1)	4(100)
N-acetylcysteine	14(42.4)	22(68.75)	4(100)
Naloxone	3(9.1)	9(28.12)	3(75)
Benzylpenicillin	1(3.03)	10(31.25)	2(50)
Ethanol	0	2(6.25)	2(50)
Fomepizol	0	1(3.1)	0
Antivenom	0	1(3.1)	1(25)
Flumazenil	1(3.03)	1(3.1)	1(25)
Charcoal	18(54.5)	26(81.2)	3(75)

Above table illustrated that among the different size hospitals only large size Hospitals of bed size >500 have 100% availability of 3 antidotes i.e. Atropine, Pralidoxime and N-acetylcysteine and (75%) Naloxone and Charcoal, (50%) Benzylpenicillin and Ethanol, only one hospital with (25%) antivenom and Flumazenil and do not have Fomepizol. Likewise other hospital with bed size 100-500 and <100 were found with only (84.37%, 72.7%) Atropine (81.2%, 54.5%) Charcoal, (68.75%, 42.4%) N-acetylcysteine respectively while remaining antidotes were found below 35%. There was no availability of Ethanol, Fomepizol and Antivenom in any hospitals with Bed size<100.

Table 5: Average stock of antidotes in different Hospitals

Antidotes	Overall	Government	Nongovernment	Kathmandu	Bhaktapur	Lalitpur
Atropine	745.20	1620.25	533.06	509.49	319.20	1068.50
Pralidoxime	140.96	316.75	105.80	101.17	138.25	236.43
N- acetyl cysteine	65.15	139.50	51.64	46.24	15.25	71.40
Naloxone	37.27	51.00	35.15	45.70	9.00	21.40
Benzyl penicillin	66.80	93.50	57.09	48.92	0	106.25
Ethanol	323.50	345.00	316.33	180.00	0	471.50
Fomepizol	5.00	5.00	0	0	0	5.00
Antivenom	19.00	36.00	2.00	36.00	0	2.00
Flumazenil	3.33	0	3.33	4.00	0	0
Charcoal	12.02	16.56	11.02	11.68	8	16.91

Table no.5 shows that almost all the antidotes were stocked with greater adequacy in Government Hospital than Nongovernment Hospitals except Flumazenil which is found to be stockless in Government Hospital and found stocked with low amount in Non-government Hospitals. Among the different Hospitals of Kathmandu valley, Lalitpur was found highly stocked with most of the antidotes except the two antidotes Antivenom and Flumazenil. While Kathmandu with no stock of Fomepizol and Bhaktapur do not have Benzylpenicillin, Ethanol, Fomepizol, Antivenom and Flumazenil.

Table 6: Average stock of antidotes in different hospital pharmacy

Antidote	Teaching	Nonteaching	Bed size<100	Bed size 100-500	Bed size more than 500
Atropine	661.20	756.86	134.89	801.12	3262.50
Pralidoxime	170.50	135.05	35.70	153.67	283.75
N- acetyl cysteine	80.25	62.41	16.13	52.83	220.00
Naloxone	36.67	37.42	5.33	53.29	27.33
Benzyl penicillin	28.25	80.82	0	75.90	81.00
Ethanol	0	323.50	0	124.50	522.50
Fomepizol	0	5.00	0	5.00	0
Antivenom	0	19.00	0	36.00	2.00
Flumazenil	3.00	3.50	2.00	5.00	3.00
Charcoal	28.20	10.22	4.00	10.85	48.00

Table 6 represents that Nonteaching hospitals were stocked with all antidotes and a bit larger quantity of some of the antidotes like Atropine, Naloxone and Benzylpenicillin as compared to teaching hospitals while there were no stock of Ethanol, Fomepizol and Antivenom in teaching hospital. Among the different sizes of hospitals found in Kathmandu valley, hospitals with bed size .> 500 were found to have maximum stock of antidote except 4 antidotes Naloxone, Antivenom, Flumazenil and Fomepizol, while all the antidotes were stocked in the hospitals with bed size 100-500 but in less amount than the hospitals with bed size >500

Table 7: Average price of antidotes in different Hospitals of Kathmandu valley

Antidote	Kathmandu	Bhaktapur	Lalitpur
Atropine	9.959	10.560	10.6
Pralidoxime	282.617	282.75	293.3
N- acetyl cysteine	187.9917	179.50	193.4
Naloxone	142.20	141.00	140.2
Benzyl penicillin	30.00	-	30.0
Ethanol	10.250	-	11.3
Fomepizol	-	-	1505.00
Antivenom	-	-	-
Flumazenil	1502.00	-	-
Charcoal	100.00	100.00	100

Above table shows that among the available ten antidotes Fomepizol and Flumazenil was the one with high cost around 1500, followed by Pralidoxime, N-acetylcysteine,Naloxone, Charcoal, Benzylpenicillin and Atropine with average selling price of 286.2, 186.9, 141.1, 100, 30 and 10.3 respectively. While comparing the selling price of antidotes among the hospitals of Kathmandu, Lalitpur and Bhaktapur no variation was observed. Antidotes Pralidoxime and N-acetyl cysteine was found with higher cost in Lalitpur compared to Kathmandu and Bhaktapur.

Availability of antidotes in different hospitals

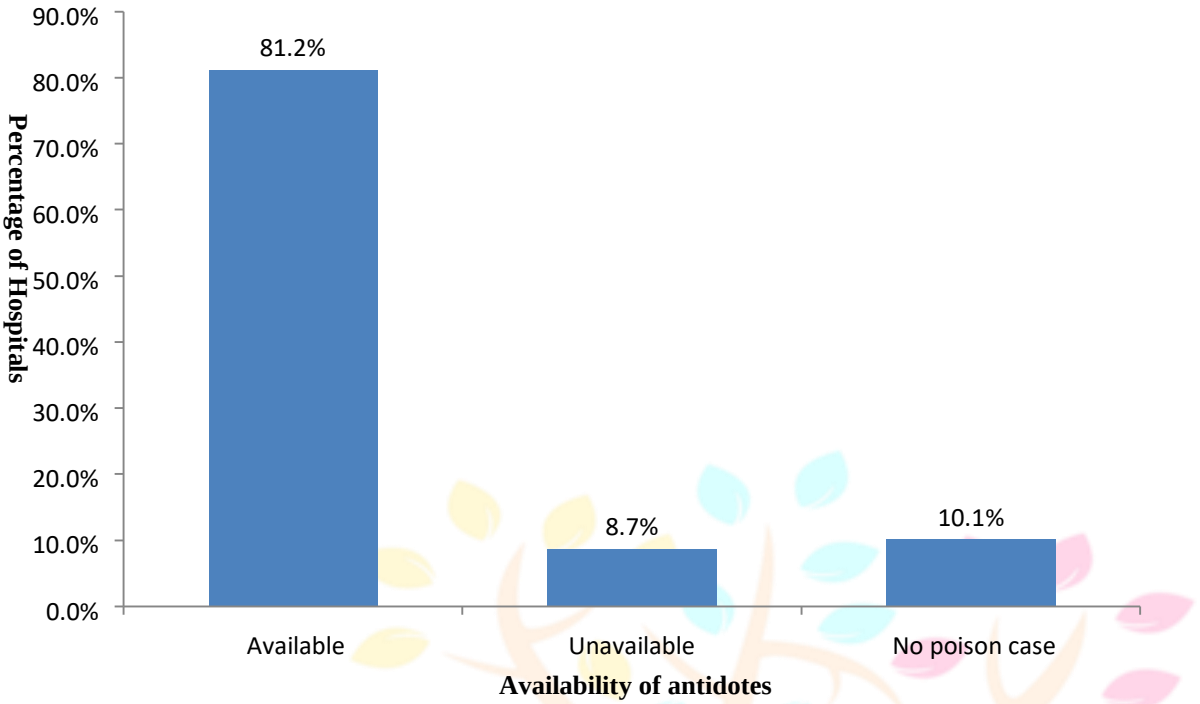

Figure 4: Availability of antidotes in different Hospitals.

Above figure shows that among the different hospitals of Kathmandu valley, 81.2% hospitals were available with at least one antidote, 10.1% hospitals were not available with any antidote while 8.7% hospitals do not treat poisoning cases.

Table no 8: Activities performed in different hospitals

Characteristics	No. of Hospitals	Percentage (%)
Primary management and refer to higher centre	37	53.6
Borrowing the unavailable antidotes from nearby hospital	32	46.4
Regular Formal stock review carried by Nurses or Pharmacists	12	17.4

Above table shows that incase of unavailability of specific antidote in the pharmacy, 53.6% hospitals carry out primary management and refer the patient to higher centre while 46.4% hospitals borrow from the nearby hospital. On the other hand, only 17.4% hospitals have regular formal stock review.

Table no 9: Availability of different brand of common antidotes with their Price and Average stock value

Antidotes	Availability (%)	Price	Average stock value
Atropine			
N-Pin	16(25)	8.13	224.81
Atropine Sulphate	41(64.1)	10.25	745.20
Atropine Jayson	6(9.4)	69.80	50
Tropine	1(1.6)	187	88
N-acetylcysteine			
Mucomelt	26(59.1)	185.79	65.15
Mucyst	14(31.8)	182.06	34.79
Mucomix	2(4.5)	200	7
Nacfil	2(4.5)	23.26	12.5
Naloxone			
Nalox	15(88.2)	141.67	37.27
Nex	2(11.8)	140.04	13
Benzylpenicillin			
Benzapen	15(93.8)	30	66.80
Alembic	1(6.3)	12.3	10

Above table shows that among the 4 available brand of Atropine, Atropine sulphate is highly available with highest stock while Tropine is least available. As compared to other brand Tropine was found to be most expensive than other i.e Rs.187. Among the different brand of N-acetylcysteine, Mucomelt is highly available with large stock while Nacfil and Mucomix have least availability and least stock of Mucomix.Mucomix is found costly Rs.200. Similarly, Nalox of Naloxone has highest availability with high stock and price Rs.141.67. Likewise Benzapen has high availability with high stock and found most costly Rs.30.

Manufacturer of common antidote

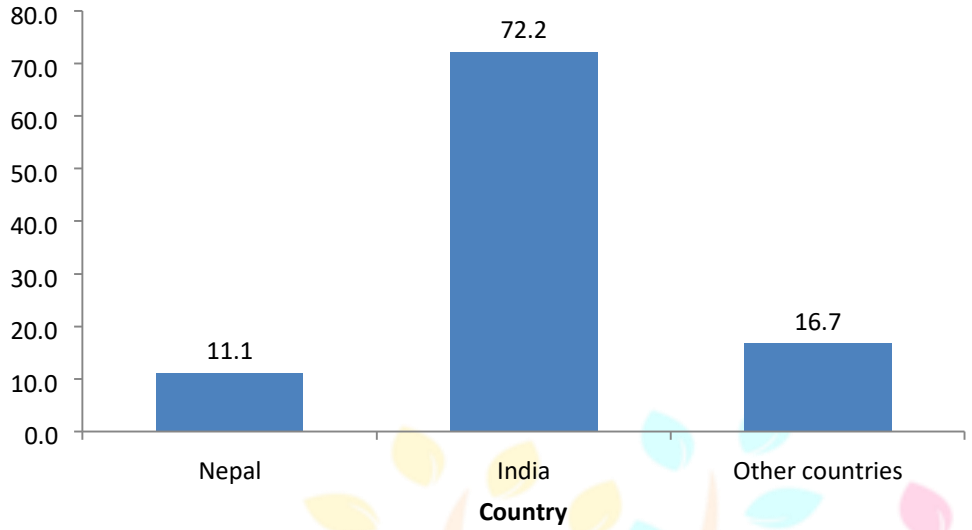

Figure no 5: Manufacturer of common antidotes.

Above figure represent that out of 10 common antidotes 72.2% antidotes were from Indian manufacturer and 16.7% antidotes were from other countries manufacturer while only 11.1% antidotes were manufactured in our country.

Discussion

Acute poisoning with various substance is common everywhere. The earlier the initial resuscitations, gastric decontamination and use of specific antidotes the better the outcome .But unfortunately no specific antidotes for all poisoning are neither available nor proper treatment protocol. Very few studies have been undertaken on this topic in different country.

This study was carried out in 69 hospitals of Kathmandu Valley. Study showed that among the different hospitals of Kathmandu valley the most frequently encountered poisoning case was observed to be Organophosphate poisoning (93.1%), while thyronom toxicity was found rare (5.2%). Whereas other mostly observed poisoning cases were Paracetamol (84.5%) and zinc phosphide (56.9%). The result deviates from another study in which Organophosphate (42%), drugs (25%), and zinc phosphide (6.5%) were found (P 2005). It shows that poisoning cases are increasing day by day in which Organophosphate poisoning is the highest so that strict rules and regulations should be formulated regarding the use of insecticides.

The study showed that poisoning cases had been frequently occurring.8.6% cases encountered greater than ten times in a month and 6.9% poisoning case was encountered once in a month. It shows that poisoning cases are unpredictable emergency cases that may encounter at any interval of time so stocking of all antidotes is of great importance.

According to research neither hospital in Kathmandu valley had adequate availability of all antidotes. The maximum available antidotes were found to be Atropine (82.6%), Charcoal (72.5%) and N-acetylcysteine (62.3%) while the other antidotes were below 30% with Antivenom (2.9%) to be least. Similar result were observed in the study of Massachusetts Hospitals which also has only 2 out of 82 hospitals (2.4%) carried all 16 antidotes, there were 100% availability of Naloxone and Charcoal, greater than 90% N-acetylcysteine, Flumazenil, 82.9% cyanide, 52.4% Ethanol 46.3% Dimercaprol, less than 30% of hospitals had supplies of Pralidoxime chloride and antivenom. (Woolf and Chrisanthus 1997) The National Essential Medicine list has included most of the selected antidotes like charcoal, Atropine, Naloxone, Pralidoxime, Acetylcysteine, Deferoxamine, Dimercaprol, Sodium nitrate and Fomepizol which must be available adequately all the time but the study has found insufficient availability of most of the antidotes while do not availability few antidotes.

Figure no 1 showed that the highest poisoning was found to be Organophosphate (93.1%) and Paracetamol (84.5%) while the availability of antidotes were found inadequate i.e. (79.5%, 71.4%, 92% Atropine), (59.2%, 57.1%, 76.9% N-acetyl cysteine) in Kathmandu, Bhaktapur, Lalitpur respectively which is not satisfactory being the central region of the country. 20.7% Methanol poisoning was observed however only 7.6% Fomepizol was found in Lalitpur and 4% in Kathmandu. Likewise another dangerous poisoning i.e. Benzodiazepine which was found to be 19.0% but no availability of antidote in Bhaktapur, Lalitpur and only 4% in Kathmandu. It shows that there is no sufficient availability of all the antidotes in any hospital of Kathmandu valley. While Lalitpur has highest availability though Kathmandu being capital city. Many patients from outside the valley are referred to the central hospitals in the belief of effective treatment; such unavailability of antidotes in central region indicates maximum mortality.

Table no 2 showed that teaching hospitals have 100% availability of Atropine and Nacetylcysteine, 80% Pralidoxime, Benzylpenicillin and Charcoal while 60% Naloxone and 20% flumazenil. No availability of Ethanol, Fomepizol and Antivenom. While non-teaching hospitals have less availability than teaching

hospitals but availability of all antidotes, around 70% availability of Atropine and charcoal, 59.3% N-acetylcysteine while below 32% availability of remaining antidotes. The result deviates from the result of study on Massachusetts Hospital in America that shows the availability of all the antidotes with 100% availability of Atropine, Naloxone, Charcoal, and Flumazenil in both teaching and nonteaching hospitals. Teaching hospital has 97% N-acetylcysteine, 71% ethanol, 19% antivenom while nonteaching hospital has 96% N-acetylcysteine, 48% ethanol and 24% antivenom (Woolf and Chrisanthus 1997). The result showed that there are not sufficient availability of all the antidotes in both Teaching and non-teaching Hospitals and had unequal availability as well. Teaching hospital being the most preferred hospital even had no availability of certain antidotes which is likely to cause risk in life of many patients and highest mortality rate.

Table no 3 showed that government hospitals had highest availability of most of the antidotes than non-government Hospitals. While both government and non-government hospitals have no stock of Flumazenil and Fomepizol respectively. There were 100% availability of Atropine, Charcoal and 77.8% N-acetylcysteine while other antidotes were found below 45%. Whereas Non-government hospitals have only 80% availability of Atropine and around 60% N-acetylcysteine and charcoal while other antidotes were found below 35%. Being government hospital there is maximum flow of patients which required sufficient availability of all those antidotes but the availability was not satisfactory.

Table 4 showed that among the different bed size hospitals, only large no of bed size Hospitals i.e. >500 have 100% availability of 3 antidotes i.e. Atropine, Pralidoxime and N-acetylcysteine and 75% Naloxone and Charcoal, 50% Benzylpenicillin and Ethanol, only one hospital with 25% Antivenom and Flumazenil and no stock of Fomepizol. While medium size hospital with bed size 100-500 has less availability of almost all antidotes than large size hospital and small hospitals have least availability with no stock of Ethanol, Fomepizol and Antivenom. The study carried out in British Columbia Hospital also have similar result like our study i.e. only one hospital with Bed size>500 and 100-500 have 100% availability of Sodium bicarbonate. While 90%, 81%, 45% N-acetylcysteine, 70%, 59%, 37%Ethanol, 90%, 63%, 24% Naloxone, 50%, 52%, 8% Atropine, in large (>500), medium (100-500) and small (<100) size Hospitals respectively. (Sean K. Gorman and Roy A. Purssell 2003) The result showed that antidotes availability is

directly depended upon the bed sizes of hospital. Smaller hospital tend to see fewer poisoning cases so stocking the expensive and not frequently used antidotes that expire frequently may constitute large portion of the pharmaceutical budget.

Table no 5 and 6 showed that most of the antidotes were stocked with greater adequacy in Government Hospitals than Nongovernment Hospitals. Lalitpur was found highly stocked with most of the antidotes among Kathmandu and Bhaktapur. Nonteaching hospitals were stocked with all the antidotes though not in sufficient quantity while teaching hospitals were not stocked with all the antidotes. Among the different sizes of hospitals found in Kathmandu valley, hospitals with bed size> 500 were found to have maximum stock of most of the antidote. There should be equal stocking of all antidotes uniformly in all hospitals irrespective of category.

Table no 7 showed that comparing the selling price of antidotes among the hospitals of Kathmandu, Lalitpur and Bhaktapur there was observed least variation on the price of most of the antidotes. The result shows that somehow availability of antidotes is little bit affected by the price of the antidotes like Fomepizol and Flumazenil that have the expensive price that constitute larger portion of the pharmaceutical budget. While atropine has low cost so majority of all type of hospital is available with Atropine.

Figure 4 showed that among the different hospitals of Kathmandu valley, 81.2% hospitals were available with the antidotes, 10.1% hospitals were unavailable with any antidote and 8.7% hospitals did not deal with poisoning cases. This showed that the patient visiting such hospitals where there were no availability of any antidote and don't take any poison case are at great risk of mortality as little delay in availability of treatment can be fatal.

Table no 8 showed that 53.6% hospitals refer the patient to higher centers while 46.4% hospitals borrow the specific antidotes if not available in the hospital. Similar result was obtained in Queensland Hospital where there was 24.5% hospitals that refer to higher centers while38.3% formal borrowing agreement with other health care centre.(A.A. Moghadamnia and Abdollahi 2002)

World Health Organization (WHO) Guidelines for Poison Control Centers recommend that all antidotes needed immediately (within 30 min) should be stocked at all hospitals.There are many antidotes like Fomepizol, Flumazenil, and Antivenomwhich have been found very less available while no stock in some of the large hospitals. Similarly,Dimercaprol and Deferoxamine and Sodium nitrate have not found in all hospitals of Kathmandu valley. But these are the antidotes which should be available within 2 hrs.of poisoning according to WHO recommended time frame. So, it is impossible for availability of such antidotes for immediate treatment. Thus referring and borrowing cannot be effective for solving the problem.

Also our study identified that only 17.4% hospitals have regular formal stock review by Nurses and Pharmacists which was similar to the study found in Queensland with only 27.7% regular formal stock review. (A.A. Moghadamnia and Abdollahi 2002)It shows that due to no official guidelines in Nepal, the pharmacists are unaware about which antidotes need to be stocked. They may conclude that rarely used antidotes is not worth stocking and can be borrowed from nearby healthcare centers if required so formal stock review are also not carried on. So it is very necessary to aware the healthcare professionals about stocking of all the antidotes and reviewing them frequently.

Table no 9 analysed the availability of various brands of selected antidotes in Kathmandu Valley and it was found that among the various brand of Atropine, Atropine sulphate was available in large amount i.e. 64.1% with large stock of 745.20 while Tropine found least 1.6% with average stock of 88.Tropine was found most costly with the price of Rs 187 and N-Pin Rs. 8.13 found cheap. However, Atropine sulphate was found in large stock which must be due to easy availability than N-pin and have minimum Price Rs.10.25. Similar result was obtained for remaining antidotes with different brand like N-acetylcysteine, Naloxone, and Benzylpenicillin. The study shows that availability of specific antidote has direct correlation with manufacturing company that can provide consistently large quantity of stock with reasonable price.

Figure no 5 showed that out of 10 selected antidotes 72.2% antidotes were from Indian manufacturer and 16.7% antidotes were from other countries manufacturer while only 11.1% antidotes were manufactured in Nepal. It showed that central region of the country has to be depended on foreign countries and neighboring

country like India so availability of antidotes are uncertain. Therefore government has to encourage and make capable domestic company to manufacture required antidotes.

Conclusion

Antidotes are the emergency lifesaving medicines whose delay in availability can be fatal. So, it is an essential emergency need of each hospital irrespective of their category. But this study concluded that there is no uniform availability of all the antidotes among the various hospitals whether it may be between large or small size hospital, Government or Nongovernment hospital, Teaching or Non- teaching Hospitals. Even the large size hospitals, teaching and government hospitals have no adequate availability and stock of most of the antidotes. Hospitals of Kathmandu valley being central hospitals where uniform and adequate availability of antidotes were expected but the result concluded it to be very poor. Among the common antidotes mostly available brand were from foreign manufacturer i.e. 88.9%, this concluded that the country has not seen to be self- reliant in producing essential antidotes though it has become major producer of essential medicines. It has been found that majority of hospitals i.e. 53.6% borrow the unavailable antidote from other healthcare centers and some have referring activity i.e. 46.4%, but these alternatives may be ineffective for all the cases that require immediate availability which may cause delay in treatment. Majority of hospitals i.e. 17.4% have no activity of performing formal stock review by the health care professionals which concludes that our healthcare professionals are unaware about the stocking requirements.

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