

# **Acute Respiratory Toxicity in Patients with Exposure to Common Household Chemical Products: A Retrospective Study on Patients Admitted to the ICU of Poison Control Center – Ain Shams University from April 2011 to April 2012**

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**Abstract** **Background:** Poisoning with household chemical products can be attributed to their availability and easy accessibility. Poisoning by many common household products may be associated with the development of various respiratory symptoms. Accordingly, this work was conducted to study and evaluate the pattern and outcome of acute respiratory toxicity caused by common household chemical products exposure in patients who were admitted to the intensive care unit (ICU) of the Poison Control Center (PCC) Ain Shams University Hospitals.

**Method:** A hospital-based retrospective study on 149 patients with acute respiratory toxicity related to common household intoxication admitted to ICU of the PCC Ain Shams University Hospitals from April 2011 to April 2012. Data regarding age, sex, data of intoxication, type of toxic agents, clinical and investigational data on admission, management and outcome were recorded and analyzed

**Results:** Pediatric age represented 55.7% of cases and number of females slightly exceeded that of males. Poisoning was predominantly accidental. Toxic agents included cholinesterase inhibitors, hydrocarbons, corrosives, and carbon monoxide. Respiratory distress was the predominant cause for ICU admission. Complete cure was the fate of 75.2% of the cases, while mortality occurred in 16.8% of cases

**Conclusions:** Household poisoning is still responsible for a considerable number of poisoning and deaths. Preventive strategies adopted at a national level are the key measures to reduce the incidence of poisoning with household chemicals.

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## **Introduction**

Household chemicals make a heterogeneous group of products in use, chemical composition, and toxic potential. What is common for these products is that they are easily accessible to children and adults in their homes, gardens, or garages, and are often involved in suspected poisoning incidents reported to the poison control centers all over the world (Klepacet al., 2000).

Substances most commonly involved in household poisoning incidents are insecticides, organic solvents, corrosives, and carbon monoxide; all are known to cause respiratory compromise (Smith, 1999; Holland, 2007 and Palmer and Phillips, 2007).

Acute respiratory failure (ARF) and respiratory insufficiency are the most common causes of intensive care unit (ICU) admissions. Unlike many patients with diseases managed in the ICU, poisoned

patients often do not have a well-recognized clinical course or predictable complications (Kirk and Pope, 2006 and Ghoneimet al., 2013).

The aim of this work is to study and evaluate the age and sex distribution, incidence, pattern and outcome of acute respiratory toxicity caused by common household chemical products exposure

## **Methodology**

The present study was planned as hospital-based cross sectional retrospective study. The study protocol was reviewed and approved by both the ethical committee of Ain Shams Faculty of Medicine and the head of PCC. It was carried out on all patients with acute respiratory toxicity related to common household intoxication admitted to the intensive care unit (ICU) of the Poison Control Center (PCC) of Ain Shams

University Hospitals. The study is covering a period of one year starting from April 2011 to April 2012. No patients were excluded from the study.

Data were collected from the preformatted sheets used by medical staff to collect data on all poisoning cases. Confidentiality of reports was maintained by keeping the records anonymous. Data were fed into a data collection sheet and then statistically analyzed, including the following parameters: demographic data, data of intoxication, type of toxic agent, clinical and investigational data on admission, management, and outcome.

## Results

During the study period, a total of 21550 cases of intoxicated patients were presented to the PCC. 15.5% of cases (3342) were due to household chemicals of which 149 patients of both sexes were admitted to the ICU (El Masry and Tawfik, 2011).

### Demographic data

Ages for both sexes ranged from 10 months to 60 years. Chart (1) shows that child age represented (83) 55.7% of cases while adult cases represented (66) 44.3%. Regarding child age cases, toddlers (0-2 years) and preschool age (3-5 years) represented the majority of cases (46% and 37% respectively), while school age represented 17%. Sex distribution of cases was (78) 52.3% females and (71) 47.7% males. More females were involved in both child and adult cases (53.0% and 51.5% respectively).

### Data of intoxication

Most cases were related to accidental exposure (72%), while suicidal attempts represented 28% of cases. Table (1) shows that exposure was accidental for most child age cases (97.6%) and among 40.9% of adult cases.

Ingestion was the main route of exposure (85.2%), followed by dermal exposure (8.7%), and inhalation (6%).

The mean delay time among all cases was  $10.62 \pm 34.48$  hours, with minimum of 30 minutes and maximum of two days. The highest delay time was related to corrosive cases ( $30.4 \pm 78.1$  h), while the lowest was related to cholinesterase inhibitors ( $4.8 \pm 4.3$  h).

### Type of toxic agents

Chart (2) shows that 36.9% of cases were exposed to cholinesterase inhibitors followed by hydrocarbons (20.8%), corrosives (17.4%) then carbon monoxide (13.4%) while exposure to cholinesterase inhibitors combined to hydrocarbons represented 11.4% of cases.

As regards cases exposed to cholinesterase inhibitors in this study, 50.9% of cases were due to malathion exposure. Carbamate exposure accounted for 43.6%, while 5.5% of cases were exposed to unknown agents. Kerosene exposure represented the majority of hydrocarbon cases (93.5%), while thinner exposure represented only 6.5%. As regards corrosive cases, half of cases were due to potash exposure (50%) and the rest were due to exposure to chlorine (26.9%),

sulphuric acid (15.4%), or miscellaneous detergents (7.7%).

### Clinical and investigational data on admission

Respiratory distress represented the most common cause of ICU admission among all cases (34.3%), followed by pulmonary edema (31.5%), respiratory failure (27.5%), while (6.7%) only were due to pneumonia.

A statistically significant difference was observed between different toxic agents as regards causes of admission to the ICU. Pulmonary edema was the main presentation among cases exposed to cholinesterase inhibitors (60.0%). 74.2% of hydrocarbon cases were linked to respiratory distress, while none were due to pulmonary edema. Cases of combined cholinesterase inhibitors and hydrocarbon exposure were presented by respiratory distress (52.9%) and pulmonary edema (29.4%), while no cases were presented by pneumonia. Corrosive cases were presented by respiratory distress (53.8%) and pneumonia (23.1%) while pulmonary edema and respiratory failure each were only presented by 11.5% of cases. Respiratory failure was the commonest cause of ICU admission (55%) among carbon monoxide intoxication cases, while no cases were presented by pneumonia.

Duration of ICU stay ranged from a minimum of 4 hours to a maximum of one month. Table (3) shows that there was statistically significant difference between different toxic agents as regards duration of ICU stay (days) where carbon monoxide cases represented the highest mean duration of admission ( $5.8 \pm 4.6$  day). This was followed by cases with cholinesterase inhibitors, corrosive cases, combined cholinesterase inhibitors and hydrocarbon exposure. Hydrocarbon cases represented the lowest mean duration of admission ( $1.7 \pm 1.4$  day).

Regarding acid-base disturbances, 54.4% showed respiratory acidosis, followed by mixed respiratory and metabolic acidosis (30.2%) and metabolic acidosis (8.7%), while both respiratory alkalosis and normal ABG were represented by 3.4% of cases.

There was a statistically significant difference between toxic agents as regards the occurrence of respiratory acidosis (Table 4). Respiratory acidosis was the main presentation in cholinesterase inhibitors cases, hydrocarbon cases, carbon monoxide cases and combined cholinesterase inhibitors and hydrocarbon exposure (65.5%, 61.3%, 60.0% and 58.8% respectively), while represented only 15.4% of cases of corrosive cases. On the other hand, there was no significant difference between different toxic agents as regards other ABG findings; including normal ABG, metabolic acidosis, respiratory alkalosis and mixed respiratory and metabolic acidosis.

### Management data

Forty-three percent of cases (64) were in need of mechanical ventilation. Table (5) shows that there was a statistically significant difference between different toxic cases as regards the need for mechanical

ventilation (MV). Table (5) also shows that 70% of CO intoxicated cases needed MV, followed by 67.3% of cholinesterase inhibitors cases, 41.2% of combined ChEIs and hydrocarbon cases, and 19.2% of corrosive cases while only 3.2% of hydrocarbon cases needed MV.

### Outcome

Complete cure was the fate of 75.2% (112) of cases,

while 16.8% (25) of cases died and 8.1% (12) of cases showed morbidity (Chart 3).

Table (6) shows that there was a statistically significant difference among different toxic agents as regards mortality. 40% of mortality occurred among carbon monoxide cases compared to while none of combined cholinesterase inhibitors and hydrocarbon exposed cases died.

**Table (1): Chi square statistical analysis of 149 cases with acute respiratory toxicity due to household products admitted to the ICU of the PCC from April 2011-April 2012 according to age and mode of poisoning**

		Cases				X <sup>2</sup>	P
		Child		Adult			
		N	%	N	%		
Manner of poisoning	Accidental	81	97.6%	27	40.9%	59.2	.0001*
	Suicidal	2	2.4%	39	59.1%		

N = number of cases; P = probability; p < 0.01 = significant difference = \*

**Table (2): Chi square and Fisher's exact statistical analysis of 149 cases with acute respiratory toxicity due to household products admitted to the ICU of the PCC from April 2011-April 2012 according to causes of the ICU admission and different toxic agents**

	ChEIs		Hydrocarbon		Combined ChEIs and hydrocarbon		Corrosive		Carbon monoxide		X <sup>2</sup> /fisher	P
	N	%	N	%	N	%	N	%	N	%		
Respiratory distress	2	3.6%	23	74.2%	9	52.9%	14	53.8%	3	15.0%	55.2	0.0001*
Pneumonia	0	.0%	4	12.9%	0	.0%	6	23.1%	0	.0%	16.1	0.001*
Pulmonary edema	33	60.0%	0	.0%	5	29.4%	3	11.5%	6	30.0%	39.7	0.0001*
Respiratory failure	20	36.4%	4	12.9%	3	17.6%	3	11.5%	11	55.0%	17.2	0.001*

N = number of cases; P = probability; p < 0.01 = significant difference = \*; ChEIs = Cholinesterase inhibitors

**Table (3): Kruskal-Wallis statistical analysis of 149 cases with acute respiratory toxicity due to household products admitted to the ICU of the PCC from April 2011-April 2012 according to duration of ICU stay and type of toxic agent**

Toxic agents	Duration of ICU stay (day) Mean ± SD	Test value	P
ChEIs	4.9 ± 6.4	24.72	0.0001*
Hydrocarbon	1.7 ± 1.4		
Combined ChEIs and hydrocarbon	2.3 ± 2.1		
Corrosive	4.6 ± 4.3		
Carbon monoxide	5.8 ± 4.6		

N = number of cases; P = probability; p < 0.01 = significant difference = \*; ChEIs = Cholinesterase inhibitors

**Table (4): Chi-square and Fisher's exact statistical analysis of 149 cases with acute respiratory toxicity due to household products admitted to the ICU of the PCC from April 2011-April 2012 according to acid-base disturbance in ABG pictures and type of toxic agent**

Acid-base disturbance	ChEIs		Hydrocarbon		Combined ChEIs and hydrocarbon		Corrosive		Carbon Monoxide		X <sup>2</sup> /fisher	P
	N	%	N	%	N	%	N	%	N	%		
Respiratory Acidosis	36	65.5%	19	61.3%	10	58.8%	4	15.4%	12	60.0%	19.6	.001*
Normal	11	20.0%	8	25.8%	4	23.5%	7	26.9%	4	20.0%	0.917	0.942
Metabolic Acidosis	4	7.3%	5	16.1%	1	5.9%	3	11.5%	0	.0%	4.2	0.358
Respiratory alkalosis	0	.0%	1	3.2%	0	.0%	2	7.7%	2	10.0%	6.2	0.075
Resp and met. acidosis	14	25.5%	5	16.1%	6	35.3%	14	53.8%	6	30.0%	10.6	0.031

N = number of cases; P = probability; p < 0.01 = significant difference = \*; ChEIs = Cholinesterase inhibitors

**Table (5): Chi-square statistical analysis of 149 cases with acute respiratory toxicity due to household products admitted to the ICU of the PCC from April 2011-April 2012 according to need of mechanical ventilation and type of toxic agent**

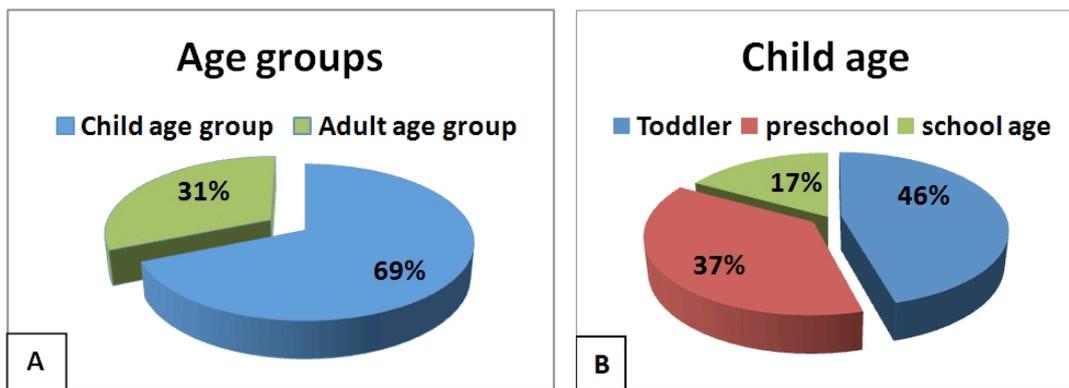
Mechanical ventilation	ChEIs		Hydrocarbon		Combined ChEIs and hydrocarbon		Corrosive		Carbon monoxide		X <sup>2</sup>	P
	N	%	N	%	N	%	N	%	N	%		
Yes	37	67.3%	1	3.2%	7	41.2%	5	19.2%	14	70.0%	45.2	.0001*
No	18	32.7%	30	96.8%	10	58.8%	21	80.8%	6	30.0%		

N= number of cases; P= probability; p<0.01 = significant difference =\*; ChEIs =Cholinesterase inhibitors

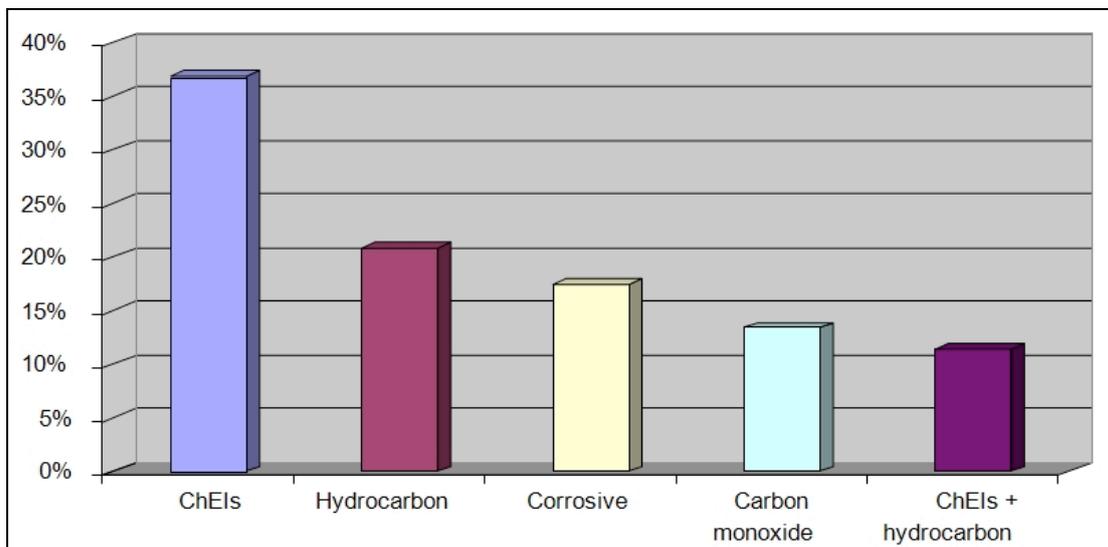
**Table (6): Fisher’s Exact statistical analysis of 149 cases with acute respiratory toxicity due to household products admitted to the ICU of the PCC from April 2011-April 2012 according to type of toxic agent and outcome**

		ChEIs		Corrosive		Hydrocarbon		Carbon monoxide		ChEIs + hydrocarbon		Fisher’s Exact	P
		N	%	N	%	N	%	N	%	N	%		
Mortality	Yes	12	21.8	3	11.5	2	6.5	8	40	0	0	13.8	0.005*
	No	43	78.2	23	88.5	29	93.5	12	60	17	100		
Morbidity	Yes	5	9.1	1	3.8	0	.0	5	25	1	5.9	9.21	00.028*
	No	50	90.9	25	96.2	31	100	15	75	16	94.1		
Cure	Yes	38	69.1	22	84.6	29	93.5	7	35	16	94.1	26.89	.0001*
	No	17	30.9	4	15.4	2	6.5	13	65	1	5.9		

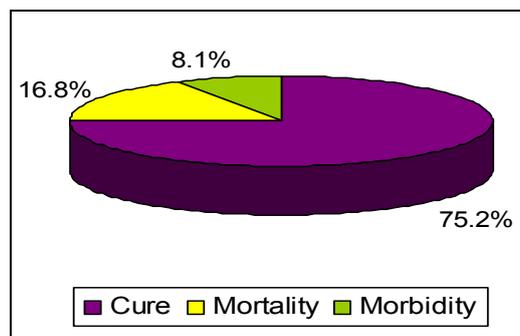
N= number of cases; P= probability; p<0.01 = significant difference =\*; ChEIs =Cholinesterase inhibitors



**Chart (1):** distribution of age groups among 149 cases with acute respiratory toxicity due to household products admitted to the ICU of the PCC from April 2011-April 2012. A) Child and adult age among all cases; B) Toddlers, preschool age, and school age among child age cases.



**Chart (2):** showing distribution of different toxic agents among 149 cases with acute respiratory toxicity due to household products admitted to the ICU of the PCC from April 2011-April 2012 (ChEIs= Cholinesterase inhibitors).



**Chart (3): Description of the different outcomes among 149 cases with acute respiratory toxicity due to household products admitted to the ICU of the PCC Hospitals from April 2011–April 2012.**

## Discussion

Poisoning due to household chemical products is considered a serious problem nowadays. Respiratory compromise is one of the most common factors contributing to death from poisoning resulting from airway obstruction, loss of airway-protective reflexes, direct pulmonary damage, pulmonary edema, toxin-induced metabolic acidosis and respiratory depression (Meyer et al., 2007).

Despite the increasing incidents of household products poisoning all over the world and the resultant serious injury and death due to exposures to these products annually, little work has been published in the area of household chemical poisoning (Balme et al., 2012 and Cantrell et al., 2013).

This clinical study aimed at describing the pattern of common household products poisoning that led to admission to the intensive care unit (ICU) due to acute respiratory problems. This was achieved by analysis of retrospectively collected data of 149 patients admitted to ICU of the Poison Control Center (PCC) of Ain Shams University Hospitals in the period from April 2011 to April 2012.

This study showed that the pediatric age group was more susceptible to exposure to household chemicals compared to adults. Accidental poisoning outnumbered suicidal attempts (represented 27.5% of cases) and was recorded among most of children cases (97.6%) compared to adult cases (40.9%).

Previous studies from Pakistan and USA by Manzar et al., (2010) and Bronstein et al. (2011) respectively also showed a high prevalence of unintentional intoxication with non-pharmaceutical products in children. This is secondary to the explorative behavior of children, their tendency to place objects in the mouth and access to unsecured substances (Meyer et al., 2007).

A female predominance among both pediatric and adult cases was noted; a finding similarly recorded in Brazil by Fook et al. (2013). This can be attributed to the fact that females are the major users of household cleaning products and indoor pesticides and consequently may be exposed to these products accidentally, due to inappropriate storage, food contamination, or incorrect product use (Habib et al., 2006 and Presgrave et al., 2008).

The relative frequency of suicide with the household products (28% of cases) may be related to the impulsive behavior of suicidal patients who chose their poison on the basis of availability either in or near to their home (Eddleston et al., 2006).

Route of exposure was mainly oral ingestion (85.2%), followed by dermal exposure (8.7%), while inhalation represented only (6%) of cases. This agreed with Al-Shehri, (2004) who related this to the fact that common household chemicals are usually in liquid forms.

The mean delay time among all cases in the current study was relatively long (10.62 h.), which may be a contributing factor for clinical severity; an association reported by Chowell et al., (2006).

The highest mean delay time was observed among cases of corrosive cases. Similar delayed presentation among corrosive cases was observed by Ekpe and Ette (2012). This can be explained by the fact that devastating complications can occur even with low-grade probably underestimated corrosive injuries (Lupa et al, 2009). This is in comparison to the lowest mean delay time noted in cholinesterase inhibitors cases where respiratory symptoms usually require immediate intervention (Eddleston, 2008).

Cholinesterase inhibitors cases represented 36.9% of cases and were mainly due to malathion and carbamate. These results may be explained by the ready availability of agricultural pesticides which became a common household product in many rural areas of the developing world in the last decades (Meyer et al., 2007).

Additionally, the relatively higher incidence of malathion poisoning compared to carbamate in the current study can be attributed to the inability of carbamates to penetrate the CNS (with subsequent less central respiratory depression), as well as the spontaneous reactivating of acetylcholinesterase enzyme making the duration of symptoms and severity of carbamate poisoning generally less than malathion (Tracqui et al., 2001).

Hydrocarbons were the second common toxic agents (20.8%) of which kerosene exposure represented the majority, while thinner exposure represented only 6.5% of cases. The higher incidence

of kerosene poisoning in the present study is similarly observed in India and Malaysia by Singh et al. (2012) and Sulastri et al. (2012) who attributed this to its extensive usage as a fuel and light source in the developing world in contrast to thinner which usually has limited household use as a solvent and paint-remover. Kerosene is also more related to respiratory problems as it belongs to the aliphatic group of hydrocarbons which are easily aspirated following ingestion (Singh et al., 2009).

Corrosives cases represented (17.4%) of cases. Potash was the most common caustic substance followed by acids (chlorine and sulphuric acid). Similar findings were reported by Arici et al. (2012). Similarly, Johnson and Brigger (2012) reported that ingestion of alkali was more prevalent than that of acid Injury. In the present study, which focuses on the severe cases, the higher incidence of potash cases may be explained by the fact that even lower concentrations of alkali can produce extensive injury, tend to injure the upper airway and cause laryngeal edema and airway compromise (Lupa et al, 2009).

The low prevalence of carbon monoxide poisoning cases (13.4%) in the present study is explained by the fact that the earliest and severest manifestations of carbon monoxide poisoning are more pronounced in oxygen-dependent organs (the brain and the heart) while respiratory symptoms (the main concern of our study) are more common in patients having a previous respiratory compromise (Kao and Nanagas, 2004 and Sideras, 2008).

Combined ChEIs and hydrocarbons poisoning in the present study, is represented by low percentage of cases (11.4%) and this can be explained according to Fishel and Andre (2002) and Sadaka et al., (2011) who noted that such exposure usually occurs through skin during treatment of lice and dermal exposure has relatively low incidence of severe poisoning compared to systemic poisoning.

Respiratory distress was the most common cause of ICU admission among all cases.

This can be explained according to Deorari (2005) who stated that respiratory distress is the primary manifestation for many pulmonary conditions including acute respiratory distress syndrome (ARDS), pneumonia, aspiration, asphyxia and acidosis. A low incidence of pneumonia as a cause of ICU admission was also noted. This may be attributed to the fact that the indication of ICU admission in pneumonia is limited to the development of respiratory failure requiring intubation and mechanical ventilation (Marrie and Shariatzadeh, 2007).

In the present study, it was observed that there was statistically significant difference between different toxic agents as regards causes of admission to the ICU. Pulmonary edema was the main presentation among ChEIs cases. This can be attributed to the increase in pulmonary capillary permeability (high-permeability edema) due to hypoxia, respiratory

failure, and parasympathetic discharge that is related to the anticholinesterase activity of the toxicant (Hoffman, 2006).

A predominance of respiratory distress as the primary causes of ICU admission in hydrocarbon cases was noted in the current study and similarly observed by Abdel Raouf (2012). This can be explained by the fact that respiratory distress is usually the first presentation following ingestion and subsequent aspiration of hydrocarbon due to the resultant hypoxia with minimal findings on chest radiograph (Levine, 2013).

A relatively high incidence of cases presented with respiratory distress following combined ChEIs and hydrocarbon exposure on admission was noted and agreed with Eddleston et al. (2004) who found that hydrocarbon aspiration may complicate ingestion of liquid concentrates of organophosphate pesticides with occurrence of respiratory distress before the development of pulmonary edema.

Corrosive cases showed a high incidence of respiratory distress followed by pneumonia as an indication of ICU admission. This can be explained by the fact that respiratory distress is usually indicative of associated laryngeal edema and pneumonitis with impaired gas exchange due to direct inhalation or aspiration of vomitus containing the corrosive (McGuigan, 1999).

Respiratory failure was the commonest cause of ICU admission among carbon monoxide intoxication cases, which coincides with C-MAC (2008). CO-associated respiratory failure occurs due to several mechanisms including replacing oxy-hemoglobin by carboxy-hemoglobin and binding of carbon monoxide to intracellular carriers of oxygen that cause tissue asphyxia, in addition to acute lung injury due to direct toxic effects on the alveolar membrane, aspiration pneumonia following loss of consciousness, and finally weakness of the respiratory muscles (Tomaszewski, 2006 and Weaver, 2009).

The mean duration of ICU stay of all cases in this study was 4.01 days. This is in contrast to data stated in a study performed in Spain by Burillo Putze et al., (2008) who found that the majority of acutely intoxicated cases are discharged from the emergency department after less than 12- 24 hours. However, there was statistically significant difference between different toxic agents as regards duration of ICU stay where carbon monoxide cases represented the highest mean duration of stay. This was similarly reported by Henry et al., (2006) who linked the prolonged duration of ICU stay in carbon monoxide cases to the severity of morbidity due to anoxic brain injury, myocardial injury, and development of respiratory failure, seizures, and coma. On the other hand, hydrocarbon cases represented the lowest mean duration of stay as hydrocarbon poisoning usually subsides after 24-48 hours and few cases require mechanical ventilation (Singh et al., 2009).

In the current study, more than half of cases (54.4%) showed respiratory acidosis. This coincides with Kollef and Isakow (2011) who reported that acute respiratory acidosis result from many disorders that acutely interfere with any component of the ventilatory mechanism such as the central or peripheral nervous system, neuromuscular junction, respiratory muscles, chest wall, pleura, upper airway, or lungs. Interference leads to hypoventilation with increased partial pressure of arterial carbon dioxide (PaCO<sub>2</sub>).

Mixed respiratory and metabolic acidosis also represented relatively high percentage (30.2%). This can be explained according to Stewart, (2013) by the fact that mixed acidosis is related to respiratory problems associated with severe prolonged hypoventilation causing hypercapnia (respiratory acidosis) in addition to severe prolonged hypoxia that leads to metabolic acidosis.

Respiratory alkalosis is particularly common among the critically ill, especially with severe hypoxemia (as a major stimulus of alveolar ventilation); however it can be effectively corrected by mechanical ventilation (Madias and Adrogué, 2000). This may explain the low percentage of respiratory alkalosis in the present study which may be missed as mechanical ventilation was employed in management.

There was statistically significant difference between different toxic agents in the arterial blood gases pictures. The main presentation in ChEIs cases was respiratory acidosis, followed by combined respiratory and metabolic acidosis. Similar results were detected by Eddleston et al. (2006) and Byrd, (2013) who attributed the occurrence of acute respiratory acidosis with ChEIs to the abrupt failure of ventilation as a result of combination of paralysis of the diaphragm and intercostal muscles, depression of the brain respiratory center, bronchospasm, and excessive bronchial secretions.

As regard the hydrocarbon cases, the main presentation was respiratory acidosis. Singh et al., (2009) and Rodricks et al. (2003) related the increased association of respiratory acidosis with hydrocarbon poisoning to the occurrence of pneumonitis, and pulmonary edema in addition to central respiratory depression and finally respiratory failure following exposure.

Similarly, respiratory acidosis was also the commonest acid base disturbances in the combined ChEIs and hydrocarbon cases.

Analysis of the acid base results noted among the corrosive cases in this study revealed that mixed respiratory and metabolic acidosis were the commonest disorder. Respiratory acidosis related to aspiration of the corrosive substance was due to bronchoconstriction, chemical pneumonitis, inhalation bronchopneumonia, Mandelson syndrome and pulmonary edema with subsequent hypoventilation. While the associated metabolic acidosis is generated by elevated

lactate from necrotic tissue or hemodynamic compromise due to hypovolemia following hemorrhage, vomiting and third-space sequestration (Turan et al., 2000 and Raghu et al., 2012).

Respiratory acidosis was also the commonest acid base disturbances among carbon monoxide cases. These results agreed with those reported by Tomaszewski (2006) and Byrd (2013), who related the occurrence of respiratory acidosis late in the process of CO poisoning to the development of severe pulmonary disease as pulmonary edema, pneumonia, weakness of the respiratory muscles and respiratory arrest.

The major indication of mechanical ventilation is respiratory failure, the end results of any severe lung disease (Kumar and Clark, 2005). In the present study, mechanical ventilation was needed in 43% of cases. However the leading indications for mechanical ventilation were carbon monoxide poisoning, followed by cholinesterase inhibitors and combined ChEIs and hydrocarbons: all sharing the possibility of severe respiratory compromise where mechanical ventilation is indicated. This is in contrast to the management in hydrocarbon poisoning which is principally conservative and mechanical ventilation is only required in few cases with inadequate oxygenation, severe respiratory distress or decreased level of consciousness (Singh et al., 2009).

In our study the fate of the majority of cases was complete cure (75.2%), while mortality and morbidity occurred in 16.8% and 8.1% respectively. An association was also found between carbon monoxide and mortality. Carbon monoxide poisoning is considered to be one of the leading causes of death and injury worldwide (Smollin and Olson, 2010). Effects of severe poisoning may be life-threatening, including cardiac arrhythmias, myocardial ischemia, cardiac arrest, hypotension, respiratory arrest, non-cardiogenic pulmonary edema, seizures, and coma.

This can be explained according to Kirk and Pope (2006) who stated that although most critically ill poisoned patients have acute reversible conditions requiring supportive care measures, poisoning may produce both anticipated and unanticipated complications that can prolong ICU care and decrease survival such as pulmonary compromise, global cerebral anoxia and aspiration pneumonia.

## Conclusion and recommendations

Poisoning due to household chemicals is a significant health problem increasing the burden on the health care system due to the resultant morbidity and mortality. This can be reduced by introduction of safer ingredients in household chemical products, better enforcement of childproof containers, educational measures aimed at improving poison awareness, and advertising telephone numbers of poison control centers. Labels of household products must also provide concise, accurate first aid instructions in easy-to-understand language.

Attention should also be drawn towards the establishment of regional poison treatment centers to decrease delay time with properly trained physicians committed to clinical toxicology for proper diagnosis and treatment. It will be important to provide continuing medical education for the primary care physician for proper supportive management prior to the referral to poison control centers.

While the results of the present study showed a pilot insight about the patterns of the patients admitted ICU of the Poison Control Center, a more detailed multicenter study is recommended taking into consideration a prolonged duration which would include more number of patients with follow up data and laboratory confirmation of exposure.

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## المخلص العربي

## التسمم الحاد للجهاز التنفسي في المرضى المتعرضين للمنتجات الكيميائية المنزلية الشائعة: دراسة استرجاعية للمرضى الذين ادخلوا العناية المركزة بمركز علاج التسمم بمستشفيات جامعة عين شمس خلال الفترة من ابريل 2011 إلى ابريل 2012

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**الخلفية:** يمكن أن يعود التسمم بالمنتجات الكيميائية المنزلية إلى توافرها وسهولة الحصول عليها وقد يصاحب التسمم من قبل العديد من المنتجات المنزلية الشائعة حدوث أعراض تنفسية مختلفة، ووفقاً لذلك أجرى هذا العمل لدراسة وتقييم نمط ونتائج التسمم الحاد للجهاز التنفسي التي يسببها التعرض للمنتجات الكيماوية المنزلية الشائعة في المرضى الذين تم حجزهم في وحدة العناية المركزة بمركز علاج التسمم بمستشفيات جامعة عين شمس.

**المنهج:** دراسة استرجاعية مستندة على المستشفى تشمل 149 من المرضى الذين يعانون من تسمم الجهاز التنفسي الحاد بعد التعرض للمواد المنزلية الشائعة (خلال الفترة من ابريل 2011 إلى ابريل 2012) و الذين ادخلوا العناية المركزة بمركز علاج التسمم بمستشفيات جامعة عين شمس، و قد تم جمع و تحليل البيانات الخاصة بالعمر والجنس وبيانات التسمم ونوع المادة السامة والبيانات السريرية والفحوص المعملية وبيانات العلاج والنتائج.

**النتائج:** كانت فئة الأطفال تمثل 55.7% من الحالات، وتجاوز عدد الإناث عدد الذكور بقليل و كان التسمم في غالبية الحالات هيباً وقد شملت المواد السامة مثبطات الكولين والهيدروكربونات و المواد الأكلة و أول أكسيد الكربون. كان ضيق التنفس السبب الرئيسي للدخول بوحدة العناية المركزة و كان الشفاء التام مصير 75.2% من الحالات في حين وقعت وفيات في 16.8% من الحالات.

**الاستنتاجات:** لا تزال المنتجات الكيميائية المنزلية مسؤولة عن عدد كبير من حالات التسمم والوفيات. وتعد الاستراتيجيات الوقائية المعتمدة على المستوى الوطني هي التدابير الرئيسية للحد من حالات التسمم بالمواد الكيماوية المنزلية.

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