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## **Selected Topics: Toxicology**

### **HEMODIALYSIS AND EXTRACORPOREAL REMOVAL AFTER PEDIATRIC AND ADOLESCENT POISONING REPORTED TO A STATE POISON CENTER**

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□ **Abstract—Background:** There is currently limited literature regarding the use of hemodialysis after acute pediatric and adolescent poisoning. **Objective:** We sought to characterize the use of hemodialysis (HD) and other extracorporeal removal techniques (ECR) in the treatment of acutely poisoned children and adolescents reported to a state poison control system over a 10-year period. **Methods:** After institutional review board approval, a state poison control system database was queried for all cases coded for hemodialysis and other ECR after pediatric and adolescent (0–19 years old) poisoning. We also analyzed National Poison System Data to determine national trends. **Results:** Ninety patients were reviewed after exclusions for errors in coding or incomplete documentation. HD was the principle method of ECR employed. One case of hemoperfusion and hemofiltration was reported. HD was used, on average, nine times per year. ECR was used predominantly in adolescent patients (age  $\geq$  to 12 years) (84 patients, 93%) for intentional ingestions (82 patients, 91%). Fifteen different toxins were encountered, with salicylates (29 patients) and ethylene glycol (23 patients) most commonly encountered. Ethylene glycol and methanol blood levels were not available before initiation of hemodialysis in all but one case. **Conclusions:** All salicylate-poisoned patients who underwent HD demonstrated clinical findings indicative of toxicity even in the absence of elevated levels advocated by some as indication

for HD. HD and other ECR are rarely used in the management of pediatric and adolescent poisoning. © 2013 Elsevier Inc.

□ **Keywords—poisoning; pediatric; adolescent; extracorporeal removal technique; hemodialysis**

#### **INTRODUCTION**

The kidney has the capacity to rapidly eliminate many exogenous toxins from the human body. Unfortunately, the kidney is also susceptible to direct toxicity from these substances as well as indirect toxicity arising from their clinical effects. Both parent compounds and their metabolites may impair elimination of exogenous and endogenous toxins with the potential for life-threatening toxicity. Extracorporeal removal techniques (ECR) such as hemodialysis (HD), charcoal hemoperfusion (HP), continuous veno-venous hemofiltration (HF), and hemodiafiltration (HDF), offer alternative mechanisms for removal of toxins.

Holubek et al. (2008) analyzed a total of 21,341 cases from the American Association of Poison Control Centers (AAPCC) National Poison Data System (NPDS) in which hemodialysis or other ECR techniques were employed between 1985 and 2005 (1). Lithium and ethylene glycol were the most common toxins encountered. Salicylates, methanol, theophylline, valproic acid, and

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The results of this study were previously presented in poster format at the North American Clinical Congress of Toxicology, 2011, Washington, DC.

acetaminophen were also commonly encountered (1). Unfortunately, this study did not delineate patients by age, and there is a general paucity of published literature regarding the use of ECR in the treatment of acutely poisoned children or adolescents. Therefore, we sought to characterize the use of hemodialysis and other ECR techniques in the treatment of acutely poisoned children and adolescents reported to a state poison control system over a 10-year period. Additionally, we reviewed NPDS in an attempt to determine national trends in the use of ECR for poisoned children and adolescents.

## MATERIALS AND METHODS

After Institutional Review Board review and approval, case records in a state poison control system database (Visual Dotlab [VDL], Madera, CA) were queried for all instances in which hemodialysis or other ECR technique (HP, HF, HDF) were coded in pediatric (0–11 years old) and adolescent (12–19 years old) poisoning cases between January 2000 and January 2010. Age, gender, circumstances surrounding exposure, toxin involved, available toxin blood concentrations, rationale or indication for hemodialysis, complications related to hemodialysis, and rates of hospital transfer for ECR were recorded. Available VDL free-text notes were reviewed to corroborate all data.

AAPCC data presenting the incidence of ECR use from 2000–2004 and from 2005–2009 can be found in Table 1. Before 2005, AAPCC data did not delineate use of ECR by patient age (2–11).

## RESULTS

HD or another ECR was coded in 106 pediatric and adolescent patients. Four patients were excluded, as the presumed toxin involved was unknown or not identified. Twelve additional patients were excluded because ECR was not actually performed. Ninety patients were included for review.

HD was the principle method of ECR reported in pediatric and adolescent poisoning (88 cases) (Figure 1). One case of HP and one case of HF were each reported. HD was utilized, on average, nine times per year, with no temporal trend identified suggesting increased or decreased use.

The majority of reported cases occurred in adolescent patients (84 patients, 93%) and secondary to intentional exposures (82 patients, 91%). No intentional exposures occurred in children. HD was performed in three children under the age of 6 years and two children between 6 and 12 years of age. HP was performed in one adolescent patient. HF was performed in one child between the ages of 6 and 12 years.

A total of 16 different toxins were encountered, with salicylates (29 patients) and ethylene glycol (22 patients) most frequently involved. A detailed description can be found in Table 2.

Blood levels of ethylene glycol and methanol were drawn in 16 of 22 patients and 5 of 5 patients, respectively. Ethylene glycol levels were available before initiation of HD in one case. Methanol levels were not available before initiation of HD in any cases.

ECR was employed for removal of a toxic parent compound or metabolite in 78 patients and for renal supportive therapy in 12 patients. Three cases of HD after isoniazid overdose were performed for unclear indications. Use of ECR by toxin can be found in Table 2.

No complications attributable to ECR were reported during the study period. Of note, patients required transfer to another hospital to perform ECR in 20 of 90 cases.

## DISCUSSION

We present a descriptive study of ECR use in pediatric and adolescent patients after acute poisoning. In the VDL database, HD represented the most common form of ECR utilized. One case of HP and one case of HF were reported between 2000 and 2009. For the 90 cases identified, there were no temporal trends to suggest an

**Table 1. American Association of Poison Control Centers (AAPCC) Use of Hemodialysis (HD), Hemoperfusion (HP), and Other Extracorporeal Removal (ECR) by Age and Year**

	2005			2006			2007			2008			2009		
	HD	HP	Other ECR	HD	HP	Other ECR	HD	HP	Other ECR	HD	HP	Other ECR	HD	HP	Other ECR
< 6 years	7	1	2	11	0	4	7	0	1	17	1	0	8	0	1
6–12 years	10	0	0	8	0	0	6	1	0	8	0	0	9	0	1
13–19 years	101	3	2	121	0	2	120	1	0	117	4	1	119	1	0
	2000			2001			2002			2003			2004		
HD	1207			1280			1400			1509			1726		
HP	43			45			30			27			33		
Other ECR	39			28			27			22			29		

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