RETROSPECTIVE OBSERVATIONAL CASE-CONTROL STUDY COMPARING THE EFFECTIVENESS OF ACTIVATED CHARCOAL AND RESIN HEMOPERFUSION ON TREATMENT OF ACUTE PARAQUAT POISONING

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ABSTRACT

No 60

INTRODUCTION

Paraquat ingestion is a leading cause of fatal poisoning in many parts of Asia, especially in Vietnam - almost patients were suicidal by ingestion. There are no widely accepted guidelines on treatment of patients with paraquat self-poisoning and the treatment varies from supportive care alone to various combinations…

Estimated ingestion dose of paraquat > 40 mg/kg and urine paraquat concentration (UPC) > 1 µg/mL were closely correlated with high mortality [1, 6].

Recently, early hemoperfusion (HP) showed improvement of survival for severely paraquat-poisoned patients [4, 5]. The aim of this study was to compare the effectiveness of activated charcoal hemoperfusion (ACH) and resin HP with hemodialysis (RH-HD) on clinical outcomes of acute paraquat poisoning.

OBJECTS AND METHODS

This was a retrospective observational controlled study. 62 cases of acute parquat poisoning who were admitted to Poison Control Center (PCC), Bach Mai hospital from 12/2012 to 07/2013 treated by standard treatment (all received similar pulse therapy of methylprednisolone, cyclophophamide and other detoxifications methods including gastric lavage, activated charcoal and other supportive treatments) in combination with hemoperfusion. Criteria for hemoperfusion were suicide patients by paraquat ingestion and positive with paraquat in the urine. Indication for stopping hemoperfusion was paraquat urine test was negative. Contraindication for hemoperfusion was: severe respiratory failure.

Patients were categorized into 2 groups. Group 1 (Charcoal group) included 34 patients who were treated with activated charcoal HP (when there was no resin filter at the time). Group 2 (Resin group) included 28 patients who were treated with resin HP with hemodialysis.

Death or alive patients was defined by telephone call at the time of 2 months after discharge. UPC, whole blood count, basic hemocoagulation, ure, creatinine, GOT, GPT, total bilirubin were measured before and after HP.

STUDY FACILITIES AND DATA ANALYSIS

Study facilities

Fresenius Medical Care 4008S renal dialysis machine with one time used hemoperfusion cartridge (HA230 resin hemoperfusion cartridge – Zhuhai Jafron Biomedical), Rexeed L13 filter was connected after HA230 cartridge. Blood flow rate was 180 - 200 mL/min. The anticoagulant used was enoxaparin. Prismaflex Adsorba kit 300 C (Gambro) machine with activated charcoal filter were used. Blood flow rate was 150-200 mL/min. The anticoagulant used was heparin.

Urine paraquat concentration was estimated by comparative optic analysis method.

Data analysis

Fischer Exact test was done for ratio comparison. Mann Whitney test and Sign test were done for comparison of percentage and continuous variables. P<0.05 was considered as significant.

Table 1. PATIENTS ON ADMISSION

Characteristics	Charcoal (n=34) M ±SD (min-max)	Resin (n=28) M ±SD (min-max)	p
Clinical features			
Age (years)	28,1±12,49 [14-79]	24,6±10,06 [11-48]	0,235
Male/Female	16/18 (0,89)	12/16 (0,75)	
Congestive mouth & throat	29/34	24/28	0,643
Pulse (l/ph)	89,4±16,29 [57-120]	89,7±13,56 [66-120]	0,939
BP_S (mmHg)	113,6±12,39 [90-140]	117,5±11,43 [100-150]	0,214
BP_D (mmHg)	69,4±12,48 [30-100]	72,1±9,17 [60-90]	0,339
Glasgow	15	15	
RR (l/ph)	22,1±6,32[16-35]	20,5±2,24 [18-25]	0,305
SpO2 (%)	98,4±1,39 [95-100]	97,4±1,73 [94-100]	0,051
Laboratory features			
Creatinine (µmol/l)	132,0±81,73 [31-324]	109,6±102,67 [28-600]	0,343
ALT (IU/L)	20,8±14,36 [7-57]	17,7±8,55 [10-41]	0,312
Bilirubin total (µmol/l)	12,5±10,49 [3,2-52,6]	12,8±4,58 [6,4-20,8]	0,911
Hb (g/l)	142,7±19,91 [105-182]	138,7±16,78 [110-187]	0,399
HCT (l/l)	41,7±5,29 [30-52]	40,6±4,77 [33-51]	0,391
WBC (G/l)	17,9±8,49 [4,4-34,7]	15,3±7,23 [5,8-33,2]	0,191
Platelets (T/L)	252,2±52,88 [178-387]	272,6±61,46 [149-393]	0,167
PT%	81,8±12,09 [46-106]	83,0±10,33 [48,697,5]	0,674
Fibrinogen (g/l)	2,1±0,71 [0,35-3,5]	2,1±0,43 [1,23-3,24]	0,924
pH	7,44	7,4±0,06	0,575

Comment: Two groups were similar in: ingestion time to PCC, age, male/female ratio, and other clinical symptoms and laboratory tests.

Table 2. HEMOPERFUSION & ITS EFFECTS

Characteristics	Charcoal (n=34) M ±SD (min-max)	Resin (n=28) M ±SD (min-max)	p
Ingestion to PPC (hrs)	8,5±6,72 [1-29]	7,1±8,79 [2-48]	0,475
Times of HP	1,3±0,68 [1-4]	2,5±1,29 [1-5]	0,001
Average time of HP (hrs)	4,4±1,16 [2-7]	4,3±0,67 [3,5-6]	0,637
Duration between two times of HPs (hrs)	19±7,52 [8-26]	11,4±6,79 [3-23,5]	0,039
UPC before HP (µg/mL)	59,3±44,92 [1-100]	82,5±32,74 [0,01-100]	0,075
UPC after HP (µg/mL)	19,9±27,48 [0-100]	14,7±26,78 [0-100]	0,546
Rate of UPC decretion after HP (%)	79,9±21,95 [49-100]	87,1±17,26 [50-100]	0,294
Creatinine before HP	132,0±81,73 [31-324]	109,6±102,67 [28-600]	0,343
Creatinine after HP	111,4±59,91 [37-237]	81,0±34,17 [35-165]	0,029

Comment: *Before first HP, UPC in resin group seemed to be higher than charcoal one.* After the first HP with the same duration: UPC decretion and the rate of UPC decretion after HP was not different between two groups; *creatinine was lower in resin than charcoal group showed the effectiveness of RH-HD method for renal function support. Duration time between the first and the second procedure of hemoperfusion in resin was shorter than charcoal group.*

Table 3. OUTCOME & SIDE EFFECT

Characteristics	Charcoal (n=34) M ±SD (min-max)	Resin (n=28) M ±SD (min-max)	p
Mortality (%)	25/31 (80,6%)	12/25 (48%)	0,011
Platelets after first HP (G/L)	111,1±39,70 [31,1-214]	188,4±76,14 [77-332]	0,0001
Rate of platelets decretion after first HP (%)	53,6±14,37 [13-78]	31,9±20,53 [3-66]	0,0001

Note: There was 3 missing patients in both two groups (charcoal and resin) because of there was not information about last results (death or alive). ***Some of patients with estimated ingestion dose of paraquat > 40 mg/kg and some had UPC > 1 µg/mL, even > 100 µg/mL were rescued***

Comment: *Mortality in resin group was lower than charcoal group significantly. After the first HP with the same duration: Platelets count was lower in charcoal than resin group, and the rate of platelets decretion in charcoal group was more than resin one.*

DISCUSSION

Results showed one course of RH-HD and ACH method had the same effect in decretion of UPC, but the outcome on mortality after 2 months of treatment seemed to be better in RH-HD group, this might be due to: more time of RH-HD procedure than ACH during treatment; effectiveness of RH-HD method in renal function support; RH-HD could rapidly decrease UPC (table 2) and so on... The following table (Table 4) show RH-HD was a method that had lowest mortality.

Studies	n	Method	Time from ingestion-admission	UPC before first HP (µg/mL)	UPC after first HP (µg/mL)	Times of HP	Mortality
V. Đ. Thang 2012 [2]	27	ACH	~ 5	385	60	3,4±2,1 [1-9]	17/27 (62,9%)
Pham Due 2013 [1]	19	RH-HD	8,6 ± 9,4	165,5±353,22	30,2	2,53 [1-5]	15/19 (78,9%)
Yanxia Gao 2015 [8]	458	ACH					57,4%
Yanxia Gao 2015 [8]	226	ACH-CVVH					58,4%
Hsu CW 2012 [6]	207	ACH	Varies			2	142/207 68,6%
This study	62			37,9±37,78 [0,01-100]	12,6±19,39 [0,2-50]	1,9±1,17 [1-5]	31/56 (55,3%)
Charcoal	31	ACH	11,8±6,39 [4,5-28,3]	59,3±44,92 [1-100]	1,8±2,75 [0-5]	1,3±0,68 [1-4]	25/31 (80,6%)
Resin	**25**	**RH-HD**	**12,4±9,93 [1,75-54]**	**82,5±32,74 [0,01-100]**	**16,2±27,8 [0-50]**	**2,5±1,29 [1-5]**	**12/25 (48%)**

Advantages of RH-HD were cheaper prices, renal dialysis machine are available in many local hospitals so RH-HD method can be performed rapidly and easily for sooner treatment of any acute paraquat poisoning patients. One course of RH-HD clearly had lower fall in platelets count than ACH method was a meaningful point.

CONCLUSION S & RECOMMENDATIONS

Initial results of the study showed more times of RH-HD was significantly associated with decretion in mortality of acute paraquat poisoing with fewer side effects in comparinson with ACH method.

Resin hemoperfusion with hemodialysis should be sooner carried out for acute paraquat poisnoing patient (even in local hospital because of its advantages and feasibilities) in order to increase its effectiveness by continuously performing every course of the technique.

LIMITATIONS & REFERENCES

This was a retrospective study, and just the fisrt HP between two group was compared, therefore, some bias could not be avoided.

Blood paraquat concentration was not measured before and after HP, urine paraquat concentration was just estimated by comparative optic analysis method were limitations.

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