A STUDY ON PATIENTS REQUIRING EMERGENCY HEMODIALYSIS IN HOSPITAL UNIVERSITI SAINS MALAYSIA

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LIST OF ABBREVIATIONS

USM	Universiti Sains Malaysia
HD	Hemodialysis
ED	Emergency Department
AKI	Acute Kidney Injury
RRT	Renal Replacement Therapy
ICU	Intensive Care Unit
DM	Diabetes Mellitus
HAP	Hospital Acquired Pneumonia
VAP	Ventilator Acquired Pneumonia

ABSTRAK

Objektif: Perbandingan ciri-ciri antara pesakit yang menjalani hemodialisis (HD) akut di jabatan kecemasan dengan pesakit yang menjalani HD akut selain di jabatan kecemasan (seperti di wad, unit rawatan rapi(ICU), dan HD unit(HDU)) masih banyak yang belum diketahui pada masa ini. Oleh sebab itu, kajian ini dilakukan untuk mengetahui ciri-ciri perbandingan klinikal dan bukan klinikal antara kedua-dua kumpulan tersebut dan mengetahui hasil daripada HD di jabatan kecemasan dan selain jabatan kecemasan.

Kaedah: Kajian ini merupakan kajian pemerhatian retrospektif antara pesakit yang dimasukkan ke Hospital USM, Kota Bharu, Kelantan, dan menjalani hemodialisis akut dalam tempoh 24 jam kemasukan melalui jabatan kecemasan antara Januari 2016 hingga Disember 2017.

Hasil: Seramai 177 pesakit telah dimasukkan ke dalam kajian. Analisis bivariabel mendapati sejumlah kes baharu (kali pertama HD) yang tinggi dan kes lebihan cecair di dalam badan bagi kumpulan hemodialisis akut di jabatan kecemasan berbanding kumpulan hemodialisis selain di jabatan kecemasan. Kajian ini juga mendapati kumpulan hemodialisis di jabatan kecemasan lebih memerlukan bantuan mesin pernafasan dan kadar kematian 60 hari yang tinggi berbanding HD selain di jabatan kecemasan. Regresi hierarki mendapati bahawa lokasi hemodialisis dilakukan memainkan peranan penting dalam menentukan hasil hemodialisis untuk tempoh kematian 60 hari dan jangka masa dirawat di ICU. Mereka yang menjalani hemodialisis selain di jabatan kecemasan mempunyai 0.263 (95%CI=0.096, 0.723) kali lebih rendah kadar kematian 60 hari tetapi 2.9 (95%CI=1.051, 8.258) kali lebih tinggi tempoh berada di ICU.

Kesimpulan

Terdapat perbezaan yang ketara dalam ciri pesakit dan hasil hemodialisis bagi kedua-dua kumpulan. Lokasi hemodialisis akut dilakukan mempengaruhi kadar kematian 60 hari dan tempoh berada di ICU. Walau bagaimanapun, kajian terkawal secara rawak diperlukan pada masa hadapan kerana kajian ini belum mencukupi untuk mengatakan HD di jabatan kecemasan lebih mempengaruhi pesakit-pesakit yang menjalani HD akut berbanding HD selain di jabatan kecemasan.

Kata Kunci: terapi penggantian buah pinggang, kecederaan buah pinggang akut, hemodialisis akut, kecemasan

ABSTRACT

Objective: It is currently unknown whether there are differences in patients' characteristics and hemodialysis (HD) outcomes between patients who undergo emergent HD in the emergency department (ED) and non-ED setting (i.e. ward, intensive care unit (ICU) or HD unit). Therefore, this study aims to compare the clinical and non-clinical characteristics and HD outcomes between patients who underwent emergent HD at ED ("ED group") and non-ED ("non-ED group") settings.

Methods: This is a retrospective observational study among patients admitted through the ED of a tertiary teaching hospital in Malaysia and underwent acute HD within 24 hours of admission between January 2016 till December 2017.

Results: A total of 177 patients were included in the study. The bivariable analysis found that the ED group had a significantly higher proportion of new cases (i.e. no known history of HD), fluid overload cases, and refractory fluid overload indication as compared to the non-ED group. It was also found that the ED group had a higher proportion of those requiring mechanical ventilation and 60-day mortality. Hierarchical regression found that HD locations play a significant role in determining HD outcomes in terms of 60-days mortality and ICU stays. Those who underwent HD at non-ED have 0.263 (95%CI=0.096, 0.723) times lower odds of 60-day mortality but 2.946 (95%CI=1.051, 8.258) times higher odds of staying in ICU.

Conclusion: There were significant differences in patients' characteristics and HD outcomes between patients underwent HD in ED and non-ED settings. Emergent HD location may influence

60-day mortality and ICU stays. As the current study is insufficient to confidently justify the use of HD in ED settings as compared to the non-ED setting, a randomized controlled trial is needed.

Keywords: renal replacement therapy, acute kidney injury, acute dialysis, emergency

CHAPTER 1: INTRODUCTION

1.1 Background

Acute kidney injury is a major cause of morbidity and mortality, particularly in the hospital setting. Hemodialysis (HD) is an important procedure or supportive measure for acute kidney injury. Other method of dialysis that usually used in Malaysia's hospital is peritoneal dialysis (PD). However, due to high rate of infection and complication that rise from PD, thus many hospitals nowadays use hemodialysis as a modality for dialysis in acute or chronic setting of kidney injury.

According to 23rd report of Malaysian Dialysis and Transplant Registry (MDTR), in 2015, there were 37,183 patients receiving dialysis in Malaysia, and this was a two and a half fold increase from 15,087 in 2006. While the new intake of dialysis patients was only 3,710 in 2006, this had more than doubled to 7,597 in 2014. The equivalent incidence and prevalence of patients on dialysis were 249 and 1,220 per million population on in 2015(Goh et al., 2017). Due to high incidence and number of patients that require hemodialysis thus a study on this issue might benefit us in managing this group of patients that requiring urgent or emergency hemodialysis particularly in Emergency Department, HUSM.

The timing of early versus delay hemodialysis in managing patient with renal emergencies are still debatable. According to recent meta-analysis study it stated that there was no significant correlation between group of early HD versus delay HD in comparing with outcome of 60 days mortality (Wierstra et al., 2016). However, this study was only limited in acute kidney injury that been admitted to ICU. There was no specific data or statistics regarding acute or emergency hemodialysis that performed in Emergency Department. Thus, this study can be a landmark study for initial exposure regarding patient that requiring urgent hemodialysis in emergency department.

Later, further interventional study might be benefit in changing policies of urgent hemodialysis in ED.

1.2 Literature Review

Practice of dialysis in ED vary by institution depending on access to nephrologist and dialysis related resources (Musisca, 2014). Study on hemodialysis performed in emergency department is limited. There was an old study described the application of ED hemodialysis in treatment of patient with renal emergencies. Several factors were determined from that study that lead to hemodialysis in ED which are cardiovascular instability 33(38%), respiratory disease 22(26%), cardiac mortality 16(19%), timing 13(15%) and others 2(2%) (Sacchetti et al., 1999). However, the total number of patients used was only 36 patients and this study only focus on chronic renal emergencies patient whom on regular dialysis before.

According to study performed by Albany Medical College New York, USA regarding demographic data of patient that underwent hemodialysis in their emergency department it shows that mean patient age was 51 (range 20-86) and male are more affected (men 62% vs female 38%)(M.J. et al., 2002). Most of the patient admitted to emergency department for dialysis were presented from home 70% whereas another 26% from dialysis center (M.J. et al., 2002). Main contributors for etiologies of renal failure are hypertension (33%) and diabetes (27%). Others etiologies come from HIV (7%) and glomerulonephritis (8%). (M.J. et al., 2002).

The usual complaints were related to infection (18%), dyspnea (17%), vascular access (16%), chest pain or dysrhythmia (15%) and gastrointestinal complaints (12%).(M.J. et al., 2002)

Two hundred and eighteen patients (62%) were admitted (ICU 11%, telemetry 22%), 19 (5%) refused admission and 2 expired in the ED. The average hospital length of stay was 7.8 days (range 1-59), with 29% hospitalized more than 1 week, compared to 6.54 days for non-HD patients (M.J. et al., 2002)

The incidence hemodialysis is associated with high rate of in hospital mortality (16.8%). The highest associated risk factors that lead to in hospital mortality in this group are presence of cardiopulmonary resuscitation of (aHR: 31.47; 95% CI: 5.766– 171.814), use of inotropes (aHR: 11.846; 95% CI: 3.650–38.440), infections such as pneumonia (aHR: 6.408; 95% CI: 2.007–20.454), and ventilator use (aHR: 7.561; 95% CI: 2.142–26.686). Other causes that leads to in hospital mortality are arrhythmia (aHR: 3.253; 95% CI: 2.179–4.856), hematologic malignancy (aHR: 2.088; 95% CI: 1.041–4.189), pneumonia (aHR: 3.302; 95% CI: 2.033– 5.364), and postbleeding (aHR: 2.569; 95% CI: 1.680–3.928). (Bae et al., 2015)

1.3 Problem Statement and Study Justification

1. Hemodialysis in ED HUSM is a new modality since opening of Trauma Building in 2015. There was no other ED in Malaysia that has a hemodialysis machine operated in ED. Hence, there was no study being conducted for the evaluation and demographic data done for hemodialysis in ED.

2. Studies or published journals about hemodialysis in ED are limited in our country. It's necessary and timely to start the basic data recruitment, from demographic and background information, to the patterns of case presentation, the diagnosis made in ED, indication for

urgent dialysis, to the outcome and complications etc. Hopefully from the study that we have conducted, we can be better and more experienced in managing renal emergencies patient at the best level in terms of resources, equipment, staff and manpower skills, and other areas of interest

1.4 Benefit of the Study

1. An objective method of data collection for assessment and review of the hemodialysis performed in ED, HUSM with special reference to its demand, clinical practice, performance, outcome of patients and mortality.

2. More organized and systematic data information about indication for hemodialysis in ED, diagnosis made in ED for renal emergencies cases, types of intervention (intubation/need of Non-invasive ventilator/access block for hemodialysis) to the extent of outcome, complications, and in-ICU/hospital outcome in terms of length of stay. This can provide a thorough and valuable evidence to improve the necessary tasks in managing renal emergencies cases.

1.5 Research Questions

1. What is the overview of patient's demographics?
2. What are the outcomes of patient requiring hemodialysis between group in ED and in HDU/Ward?

1.6 Research Objectives

General objective:

To study the pattern of patients requiring acute hemodialysis in HUSM

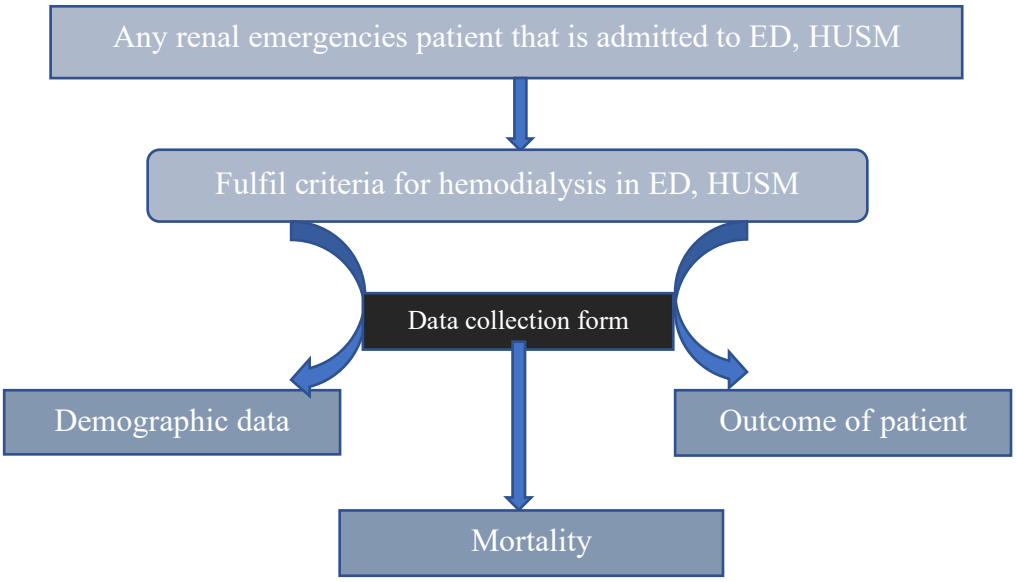
Specific objective:

1. To determine the profile and clinical characteristic of patient that require hemodialysis in ED, HUSM within 24 hours of admission

2. To compare outcome of acute hemodialysis (HD related complication – catheter related sepsis[CRBSI]/length of hospital stay/length of ICU stay/requiring mechanical ventilation/nosocomial infection) between the group of acute hemodialysis that performed in emergency department and acute hemodialysis that performed in ward/HDU/ICU

CHAPTER 2: STUDY PROTOCOL

2.1 Conceptual Framework



2.2 Research Design

This is a 2 years retrospective cohort study conducted on Jan 2016- Dec 2017 which includes all the patients that fulfil the inclusion and exclusion criteria for hemodialysis in Emergency Department, Hospital Universiti Sains Malaysia.

2.3 Study Area

Emergency Department, Hospital Universiti Sains Malaysia

2.4 Study Population

Population sample	Population
Reference population	All hemodialysis patient that come to emergency department in Kota Bharu
Source population	All hemodialysis patient that come to Emergency department, HUSM
Sampling frame	Jan 2016 till Dec 2017

2.5 Subject Criteria

Inclusion Criteria

1. Medical cases that lead to acute hemodialysis in Emergency department or ward/HDU/ICU, HUSM
2. Those attending hospital requiring acute hemodialysis within 24 hours of admission through Emergency Department, HUSM
3. Adult patient

Exclusion Criteria

1. Those already received outside hemodialysis prior to arrival in ED, HUSM
2. Patient on peritoneal dialysis

2.6 Sampling Method and Subject Recruitment

Convenient sampling method will be applied in this study.

2.7 Operational definition

Hemodialysis is a medical procedure to remove fluid and waste products from the blood and to correct electrolyte imbalances. This is accomplished using a machine and a dialyzer, also referred to as an "artificial kidney."

Hemodialysis is used to treat both acute (temporary) and chronic (permanent) kidney injury.

Acute Hemodialysis or emergency hemodialysis is defined as hemodialysis that performed in Hospital USM within 24 hours of admission through emergency department.

Mortality is death that occur in hospital admission at 60 days after acute hemodialysis.

Severe hyperkalemia is defined as potassium level of >6mmol/L from the lab result or evidence of electrocardiograph (ecg) changes such as tall tented t wave, prolonged pr interval, sine wave.

Severe metabolic acidosis is defined as pH <7.2 from the blood gases analysis.

Catheter related blood stream infection (CRBSI) is defined as the presence of bacteremia originating from an intravenous catheter.

Nosocomial infection which is now called the healthcare associated infection (HAI) is refer to any systemic or localized conditions that result from the reaction by an infectious agent or toxin.

Fluid overload is define as patient whom presented with breathlessness and bilateral pedal edema and which requiring emergent HD after failed medical therapy.

2.8 Sample size calculation

- For first specific objective: no sample size calculation needed since it is descriptive study

- For second specific objective: To compare outcome (HD related complication – catheter related sepsis[CRBSI/length of hospital stay/length of ICU stay/requiring mechanical ventilation/nosocomial infection) between the group of acute
- hemodialysis in emergency department and acute hemodialysis in ward/ICU. Sample size needed from this objective is 112 based on the available data from the literature review. This sample size calculation is based on the available data using 2 proportion estimation Power and Sample size (PS) software

Variable	P0	P1	m	n (per group)	n (+10%)
Mortality 60 days	0.55	0.35	1	96	105
Length of hospital stay	0.65	0.45	1	96	105
Length of ICU stay	0.22	0.4	1	102	112
Nosocomial infection	0.28	0.5	1	76	83
Mechanical ventilator	0.57	0.35	1	79	87

Notes

P0 = literature review(Chao et al., 2012) (D'Agata et al., 2000), exposure with outcome

P1 = expert opinion, non-exposure with disease

m = ratio between 2 groups

n = sample size

2.9 Ethical Consideration

During the study, all data involving the samples will be held confidential and will be only accessible to the investigator and team. The investigator has declared no conflict of interest with regard to the study. Patient's safety and rights will not be jeopardized and will always be prioritized over the study. After completion of study, all data will be disposed

2.10 Data Collection Method

Data will be collected from the patient's folders who were underwent acute hemodialysis in HUSM from Jan 2016- Dec 2017 using the data collection form in Appendix 1. It will be performed by the investigator herself. There is no need to obtain a consent from patient for each of the folder as this is a retrospective study. A general consent will be obtained with from the Director of Health Campus of USM to obtain the data from those folders.

2.11 Data Entry & Analysis

Variables

2.11.1 Independent variables

a Patient's demography

- Gender, age, race

b. presentation in ED

- SOB, fluid overload, hypertensive emergency, hyperkalemia

c. Clinical diagnosis

- acute on CKD, APO, Fluid overload, severe hyperkalemia

2.11.2 Dependent variables

In Hospital Outcome

- length of ICU stay, length of hospital stay, duration of mechanical ventilation (if intubated), mortality 60 days, catheter related infection

2.11.3 Data Entry

Data will be entered and analyzed using Statistical Package for Social Science (SPSS) for windows, version 22.0.

2.11.4 Statistical Analysis

For 1st objective, the data will be presented in table form in which the numerical data in mean (SD) whereas the categorical data in frequency (%).

For 2nd objective, depending on the variables; independent t test will be applied for the numerical data and chi square will be used for the categorical data.

2.11.5 Dummy Tables

Table 1: Demographic factors contributing to patient outcome (n=) (simple logistic regression)

Variables	Crude OR , n (%)	p-value
Demographic		
Age ,mean ± SD		
Gender		
Male		
Female		
Race		
Malay		
Chinese		
Indian		
Others		
ED Presentation		
Shortness of breath		
Weakness		
Chest pain		
High potassium		
Other		
ED Diagnosis		
Congestive heart failure		
Hyperkalemia		
Fluid excess without shortness of breath		
Missed Hemodialysis		
Acute kidney injury		
Indication for hemodialysis		
Cardiovascular instability		
Respiratory Distress		
Severe hyperkalemia		
Acute kidney injury		
Severe metabolic acidosis		

Table 2: Comparison of hemodialysis in between patient receiving hemodialysis in ED and non ED (ward/ICU/HDU)

Variable	Mean (SD)		Mean diff. (95% CI)	t-statistic (df)	P-value
	ED (n=)	Non ED (n=)			
Mortality 60 days					
Sepsis -CRBSI					
Mechanical ventilator					
Length of hospital stay					
Length of ICU stay					
Nosocomial infection					

2.12 Flow Chart