Changes of Consciousness Level and Blood Pressure of Acute Stroke Patients Administering Mannitol Therapy

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Abstract

Objects: To analyze changes in consciousness level and blood pressure of acute stoke patients administering mannitol therapy.

Methods: The study was a descriptive cohort. Thirty-four respondents were applied to selecting by purposive sampling. Data were analyzed by descriptive.

Results: The results showed that there was an improvement in consciousness level (GCS). The improvement in the patient's level of consciousness occurred after more than twenty-four hours of getting mannitol therapy. While the blood pressure until the third day, there were still suffering from hypertension.

Conclusion: Improvements in consciousness level after administering mannitol therapy indicate loss of cerebral edema, improvement in cerebral blood flow (CBF) and brain perfusion pressure (CPP), and repair of damaged nerve cells.

Keywords: *Hemorrhagic stroke, Acute phase, Cerebral edema, Mannitol therapy*

Introduction

Stroke is one of the causes of brain disorders at the peak of productive age, which is the biggest threat to cause disability in human life and is the second leading cause of death after heart disease in most countries in the world[(1)]. In 2012, approximately 10% of all deaths worldwide, and about 4% of disabilities of all ages were due to strokes. The American Heart Association reports that one person has a stroke every 40 seconds and one person dies every 4 minutes in America with a prevalence of 2.8% which is expected to increase by 21.9% in 2030[(2)].

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In Southeast Asia, there are around 13 million new strokes annually, of which around 4.4 million die within 12 months[(3)]. In 2020, an estimated 7.6 million people will die from stroke[(1)]. The prevalence of stroke in Indonesia has increased from 2007 (3.8%) to 2013 (12.1%). In absolute terms, the number of Indonesians who suffer from a stroke is around 3 million. The province with the highest stroke prevalence tendency is South Sulawesi, compared to other provinces (17.9%), and Riau province is the lowest (5.2%). In the province of North Sumatra in 2013, the estimated stroke sufferer aged grater then 15 years is one thousand people[(4)].

In addition to causing a high number of deaths, the disability rate due to stroke reaches 65% and is the third cause of physical paralysis in the world with an increase of 19%[(5)]. The duration of treatment, the delay in healing, and the presence of persistent neurological sequelae will all result in decreased productivity.

A stroke consists of a series of processes starting with

the rupture of brain blood vessels causing blood to leak into the brain parenchyma tissue, the cerebrospinal fluid spaces around the brain, or a combination of both. At the onset of a stroke within a few minutes to several hours, cytotoxic edema occurs then develops into vasogenic edema due to the displacement of intravascular fluid into the interstitial space[6].

The onset of death within seven days in stroke patients was 31%[7]. The hemorrhagic stroke mortality rate was 27-52% and the majority died immediately after the onset of bleeding, but it can also cause disability. The mortality of hemorrhagic stroke patients in the first week was 11 (55%) deaths and 18 (90%) within two weeks after being hospitalized out of a total of twenty people who died at the Bahrain Royal Medical hospital in the Kingdom of Bahrain[8].

Many factors cause death in acute phase stroke patients. Based on the research and theory found, it is stated that some of the causes of death in stroke patients are cerebral edema (edema perihematomal develops shortly after intra-cerebral bleeding occurs, and peaks a few days later), pulmonary embolism, aspiration pneumonia/infection, heart defects, hydrocephalus and deep vein thrombosis[9].

One of the therapies used in patients with hemorrhagic stroke is Osmotherapy (hyperosmolar therapy) using the mannitol osmotic agent. Mannitol is an osmotic diuretic agent that has been used for decades to reduce intracranial pressure due to cerebral edema. The results of this study were supported by a research report published by Asghari et al. which concluded that the GCS value increased slowly after mannitol administration[10]. The increase occurred at 48 hours, although the increase in the level of consciousness was not significant the level of cerebral edema decreased significantly in patients with intracerebral hemorrhage. Another study conducted by Rahmah also stated that there was an increase in the GCS value after 10 minutes of mannitol therapy[11].

Drug therapy cannot be viewed in separation from the patient, the patient's illness, or other aspects of care. The delivery of medicine inpatient health care is a dynamic, inter-disciplinary and complex process that involves multiple professional competencies, theoretical knowledge, critical thinking, and comprehensive patient participation to ensure patient safety[12]. Nurses play an important role in the patient's treatment process. The role of nurses in administering drug therapy is to carry out the nursing process which consists of assessment, planning, implementation, and evaluation/monitoring[13].

Monitoring is one of the key elements of nurses in treatment in the first 72 hours of acute stroke[14]. One of the aspects that need to be monitored is neurological status and vital signs. Neurologic status and vital signs should be observed and recorded accurately to monitor signs of neurological damage, stability, and improvement.

Methods

The study was a descriptive cohort. The study was carried out at Adam Malik and Dr. Pirngadi Hospital from January to March 2018. Thirty-four respondents were involved using purposive sampling. Inclusion criteria: 1) patients with a diagnosis of hemorrhagic stroke confirmed by clinical examination and head CT scan; 2) in the acute phase less than 72 hours; 3) receiving mannitol therapy, and 4) willing to become respondents. Exclusion criteria: 1) having a history of neurological disorders; 2) being in a chronic phase; 3) patients who died less than 72 hours (acute phase); and 4) patients who received mannitol therapy more than 3 days after a stroke attack.

The level of consciousness was examined using the Glasgow coma scale (GCS) developed in Glasgow, Scotland in 1974 by Teasdale and Jennett. The GCS is a scale that is widely used as a semi-quantitative clinical measurement of the level of consciousness based on eye open conditions, the patient's verbal and motor responses[15]. Blood pressure was measured with a GEA brand mercury sphygmomanometer and a GEA brand stethoscope that had been calibrated at the Health Facility Security Center (BPFK) with the calibration certificate number YK.02.03 / L.1 / 7895/2018.

Measurements were made by carrying out a physical examination and equipped with an observation sheet consisting of a level of consciousness assessment using the GCS, measurement of vital signs using a mercury sphygmomanometer with the GEA brand, and a stethoscope with the GEA brand. Assessment of neurological status and vital signs was performed after

10 minutes to one hour of mannitol administration. Data were analyzed by univariate. Statistical calculations used the SPSS application for windows 15.0. so that the results can be obtained in the form of frequency and presentation (proportion).

Results

Table 1. frequency distribution of Acute Stroke Respondents' Characteristics (n=34)

Characteristic	f	%
Age		
36–45 years (late adulthood)	10	29.4
46–55 years (early elderly)	17	50
56–65 years (late elderly)	7	20.6
Gender		
Male	27	79.4
Female	7	20.5
Educational		
Primary school	5	14.7
Junior high school	5	14.7
Senior high school	17	50
College	7	20.5
Profession		
Worked	24	70.5
Unworked	10	29.5
History of smoking		
Never	6	17.6
Has stopped	4	11.7
Still smoking	20	58.8
Passive smoker	4	11.7
Type of bleeding		
Intracerebral	29	85.2
Subarachnoid	5	14.7
Area of bleeding		
Basal ganglia	8	27.6
Thalamus	6	20.7
Lobar	12	41.4
Basal ganglia and thalamus Past medical history	3	10.3
Hypertension	24	70.5
Diabetes mellitus	7	20.5
Kidney failure	3	8.82

Table.1 shows that the characteristics of acute stroke patients who received mannitol therapy were 46-55 years (early elderly) 50%, the majority of respondents were male 79.4%, the majority of respondents were high school graduates 50%, the majority of respondents worked as many as 24 respondents (70.5%), the majority of the respondents' marital status was married as many as 25 respondents (73.5%), the majority of respondents were smokers 58.8%, the majority of type bleeding were intracerebral hemorrhage 85.2%, the majority bleeding area was lobar 41.4%), the majority of past medical history were hypertension 70.5%.

Table 2. Frequency of change in response level of consciousness of acute stroke patients (n=34)

Consciousness level	Administering mannitol therapy																							
	1		2		3		4		5		6		7		8		9		10		11		12	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Composmentis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	9	7	21	8	23
Somnolent	11	32	11	32	11	32	11	32	12	35	17	50	19	56	20	59	21	62	19	56	15	44	14	41
Soporocomatus	23	68	23	68	23	68	23	68	22	65	17	50	15	44	14	41	13	38	12	35	12	35	12	35
Coma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table.2 shows that the consciousness level of acute stroke patients who received mannitol therapy at the first, second, third, and fourth administration was that 32.4% had a somnolent level of consciousness GCS13 to 14 and 67.6% had a level of consciousness soporocomatus GCS 8 to 12. On the second day, namely the fifth administration, the consciousness level of acute stroke patients who received mannitol therapy was 35.3% had a somnolent level of consciousness GCS 13 to 14 and 64.7% had a soporocomatus level of consciousness GCS 8 to 12. At the sixth administration, 50% had a somnolent level of consciousness GCS 13 to 14, and 50% had soporocomatous consciousness GCS 8 to 12. At the seventh administration, the level consciousness of acute stroke patients who received mannitol therapy was 55.9% with somnolent GCS 13 to 14) and 44.1% had a soporocomatous level of consciousness GCS 8 to 12. At the eighth administration, the consciousness level of acute stroke patients who received mannitol therapy was 58.8% with somnolent GCS 13 to 14 and 41.2% had a soporocomatous level of consciousness GCS 8 to 12. At the ninth administration, 61.8% of acute stroke patients who received mannitol therapy had somnolent GCS 13 to 14 and 38.2% had a soporocomatous level of consciousness GCS 8 to 12). At the tenth administration, there were 8.9% with composmentis level of consciousness, 55.9% were somnolent GCS 13 to 14, and 35.3%) had a soporocomatous level of consciousness GCS 8 to 12. At the eleventh administration, there were 20.6% with composmentis level of consciousness, 44.1% were samnolenic GCS 13 to 14 and 35.3% had a soporocomatous level of consciousness GCS 8 to 12. In the twelfth administration, there were 23.5% with a composmentis level of consciousness, 41.1% were somnolent GCS 13 to 14 and 35.3% had moderate levels of consciousness GCS 8 to 12.

Table 3. Frequency of change in response to a blood pressure of acute stroke patients (n=34)

Blood pressure	Administering mannitol therapy																							
	1		2		3		4		5		6		7		8		9		10		11		12	
	f	%	f	%	F	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Normal	0	0	0	0	0	0	1	3	2	5,9	2	6	2	6	2	6	4	12	8	24	10	29	11	32
High normal	1	3	1	3	1	3	2	5,9	2	5,9	3	9	5	15	9	27	9	27	8	24	9	27	8	24
Grade 1	11	32	11	32	12	35	10	29	14	41	17	50	16	47	15	44	15	44	15	44	14	41	14	41
Grade 2	10	29	10	29	11	32	13	38	8	24	7	21	8	24	7	21	6	18	3	9	1	3	1	3
Grade 3	12	35	12	35	10	29	8	24	8	24	5	15	3	9	1	3	0	0	0	0	0	0	0	0

Table 3. shows that the blood pressure of acute stroke patients who received mannitol therapy who experienced hypertension up to the administration of the twelfth mannitol still had hypertension patients. Normal blood pressure can only be achieved after acute stroke patients received mannitol in the fourth that there was one patient (2.9%). On the first day of administration of mannitol, the majority of patients had grade 1 hypertension and grade 2 hypertension, and on the second and third days of mannitol administration, the majority of patients had grade 1 hypertension.

Discussions

The study indicated that the age of the occurrence of hemorrhagic stroke was early elderly (46 to 55 years) 61%. The results of this study are in line with research conducted by Sunjaya et al. found that the age range for stroke was the 45-59 age group 48.6%. Another study in 28 hospitals in Indonesia showed that the mean age of stroke was 58.8 ± 13.3 years, with an age range of 18-95 years[16]. Age less than 45 years was 12.5% and more than 65 years was 35.8%[1]. The study was found that the majority of respondents were male 79.41%. Another study conducted by Safri also found that the number of male respondents was more than female 73.3%[17]. An epidemiological study showed results similar to this study. It was found that 75% of male patients had a stroke compared with 25% of female patients[18].

This study was found that 50% of respondents had senior high school. The level of education affects the ability to understand and follow directions to be healthy, if a person is illiterate written information about healthy behavior and healthy resources becomes worthless[19]. The results of this study indicated that 70.58% of respondents are working. Suiraoka said that high workloads, heavy life pressures, or other things without realizing it can cause long-term effects on physical and mental health, one of which is stress. Stress accounts for 20% of the causes of stroke because stress can increase cholesterol levels in the blood which can clog arteries so that you are at risk of having a stroke[20].

The study was found that the majority of patients were active smokers 58.82%. The study is supported by William et al. states that the number of stroke sufferers who have a smoking habit is 53.8% more than the number of stroke patients who do not have a smoking habit 23%[5]. The arterial walls damaged by cigarette smoke will be the site of accumulation of fat, platelet cells, cholesterol, and thickening of the smooth muscle layer of the artery walls (atherothrombotic). Atherothrombotic causes the diameter of the arterial cavity to narrow and usually causes fragility of the arterial walls, this is what causes stroke[21]. This study indicated that most of the 85.2% of respondents experienced intracerebral hemorrhage. The location of bleeding experienced by most patients was the lobe (41.4%). A study conducted by Misbach also revealed that from 28 hospitals in Indonesia the percentage of locations for hemorrhagic strokes was 4.2% subarachnoid hemorrhage (PSA), 18.5% intra-cerebral hemorrhage (PIS) with a division of 8.8% lobar hemorrhage, basal ganglia hemorrhage 7.1%, brain stem hemorrhage 1.7%, and cerebellar bleeding 0.9%[1]. The study conducted by Musa (2017) states that the location of the hematoma is an independent predictor of mortality during acute care, Almutawa, Shahda & Albalooshi also reveal that independent risk factors Significant mortality during treatment was hematoma location, hematoma volume, and intraventricular hemorrhage[8].

The study showed that the majority of patients had a history of hypertension with 70.58% of respondents. The results of epidemiological studies also show that hypertension is found in 50-70% of stroke patients. Someone who has hypertension has 3-4 times the risk of having a stroke compared to people who do not have hypertension[18].

According to Wagner et al. said that the GCS value of hemorrhagic stroke patients was more in the moderate and bad category when compared to the GCS value in non-hemorrhagic stroke patients, which was around 55% when admitted to hospital[22]. In line with research conducted by Baidya, Tiwari, and Usman which revealed that acute phase hemorrhagic stroke patients will experience decreased consciousness. Of the 50 study subjects, 25 patients (50%) had decreased consciousness with GCS 9-12, 5 patients (10%) had a GCS score of 13-15, a GCS score of 4-8 was 18 patients (36%), and GCS score 3 in 2 patients (4%)[23].

The results of this study were supported by a research report published by Asghari et al., which concluded that the GCS value increased slowly after mannitol administration. The increase occurred at 48

hours, although the increase in the level of consciousness was not significant the level of cerebral edema decreased significantly in patients with intracerebral hemorrhage[10]. Another study that is in line is a study conducted by Jaya, Widodo and Ganda which states that administering 20% mannitol at the start of admission to the fifth day (120 hours) shows an increase in the value of GCS in moderate head injury patients. The mean GCS value of the patient before was 11.24 and after (assessment V) was 13.72. The dynamics of GCS at the beginning and end of the assessment showed an improvement in the degree of consciousness began to occur on the second day after the administration of mannitol therapy[24].

The study was found that there was an increase in blood pressure in acute stroke patients. On the first day, most of the patients had grade 3 hypertension, until the third day most patients still had grade 1 hypertension. In line with the research conducted by Al-Ghifari and Andina which also obtained the most blood pressure results experienced by acute stroke sufferers is hypertension grade 3 with 41.3%[25]. Likewise, the study conducted by Al-Ghifari and Andina found that the blood pressure of acute stroke patients was very high in the first 48 hours, namely experiencing grade 3 hypertension (systolic ≥180 mmHg and diastolic ≥110 mmHg) 44.1%[25].

Recent research conducted by Ekayanti, Bachtiar, Mawuntu and Pertiwi revealed that changes in blood pressure in acute phase strokes can be influenced by circadian rhythms. The circadian rhythm is an endogenous physiological rhythm with a duration of about 24 hours found in living things. Circadian rhythms not only regulate endogenous sleep and wake cycles but also influence behavior and nearly every physiological function. In humans, circadian rhythms are mainly controlled by the suprachiasmatic nucleus (SCN) which is located in front of the hypothalamus. The suprachiasmatic nucleus regulates molecular and cellular functions which in turn affect blood pressure, pulse, respiration, body temperature, sleep time, and another body metabolism[26].

Conclusions

There was a change in neurological status, namely an increase in the level of consciousness of acute stroke patients at 24 hours after receiving mannitol therapy. There were changes in vital signs, namely an improvement in blood pressure in acute stroke patients receiving mannitol therapy.

Conflict of Interest: Nil

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