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The Effects of Administrated Dexamethasone on Neurologic Assessment in Neuro-oncology Scale in Patients with Intracranial Tumors

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Abstract

BACKGROUND: In intracranial tumors, glucocorticoids are the main therapy to treat peritumoral edema. Neurologic Assessment in Neuro-Oncology (NANO) score is an instrument that can assess neurological function objectively and practically in patients with intracranial tumors.

AIM: This study aims to determine the effect of dexamethasone administration on the NANO score of intracranial tumor patients.

METHODS: This study was a pre-experimental study with a pre and post-test design at the H. Adam Malik General Hospital in Medan from March to September 2020. The study population was intracranial tumor patients. The research subject were 37 subjects taken consecutively. Treated with dexamethasone injection, then examined the NANO score before and after receiving dexamethasone injection on days 1, 2, and 3. Statistical analysis with Friedman test.

RESULTS: Based on the demographic characteristics of the research subjects, the mean age was 53.29 ± 8.5 years. Most of the research subjects were male (54.1%) while female (45.9%). Most types of intracranial tumors were secondary tumors (59.5%) while primary tumors (40.5%). The significant effect of dexamethasone on NANO score in patients with intracranial tumors ($p < 0.001$).

CONCLUSION: There is an effect of dexamethasone on the NANO score of patients with intracranial tumors

Background

Intracranial tumors are abnormal masses of tissue in the cranium, cells grow and divide uncontrollably by mechanisms that control normal cells. Intracranial tumors or brain tumors are classified into primary brain tumors and metastatic brain tumors [1].

Brain tumors have continued to increase in incidence during the last decade in several countries [2]. The epidemiology of brain tumors covers about 85–90% of all central nervous system tumors. The mortality rate is 4.25/100,000 population/year where the mortality is higher in men [3]. One of the main causes of morbidity and mortality in brain tumor patients is the development of uncontrolled cerebral edema and causing cerebral herniation [4].

Patients with brain tumors often present with neuroemergency due to increased intracranial pressure (ICP). This is mainly due to the space-pressing effect of peritumoral edema or diffuse edema, in addition to the large mass size or ventriculomegaly due to obstruction by the mass.

In patients with brain tumors, glucocorticoids are the mainstay of treatment for peritumoral edema [5]. In three-quarters of these patients, those receiving corticosteroid therapy experienced a general change in symptoms within 48 h [6].

The recommended agent is dexamethasone [3]. Dexamethasone is preferred because of its very low mineralocorticoid activity, long half-life, and high potency [7]. Dexamethasone treats edema in tumors by decreasing the expression of Vascular Endothelial Growth Factor (VEGF) thereby improving blood brain barrier dysfunction [8].

According to a study conducted by Palombi *et al*. [9] reported the results that there was a statistically significant difference in results associated with dexamethasone administration on the improvement of glioma symptoms. According to Kural *et al.* [10], conducting a study on the effect of giving dexamethasone 16 mg for 2 days on edema volume reported the result that there was a decrease in edema volume by 1.7% compared to before dexamethasone administration.

Neurologic Assessment in Neuro-Oncology (NANO) score is an instrument that can assess neurological function objectively and practically in patients with intracranial tumors. Apart from being used to assess patient progressivity, NANO scores are also

able to predict patient survival. This suggests that the NANO score can be an alternative in assessing clinical outcome [11].

This study aims to determine the effect of dexamethasone administration on the clinical outcome of intracranial tumors according to the NANO score.

Method

This research is a pre-experimental study with a pre and post-test design. The study was conducted at RSUP H. Adam Malik Medan from March to September 2020. The study population was intracranial tumor patients. Thirty-seven subjects in this research were taken consecutively. Subject was treated by administering dexamethasone injection to intracranial tumor patients were undergoing treatment in an integrated inpatient room. Then a clinical outcome examination is carried out using a NANO score before and after receiving dexamethasone injection on days 1, 2, and 3. Statistical analysis using the Windows SPSS (Statistical Product and Science Service) version 22.0 computer program used the Friedman test.

Results and Discussion

Demographic characteristics of research subjects

Intracranial tumor patients who underwent treatment at RSUP Haji Adam Malik Medan in the period March to September 2020, there were 37 study subjects who met the inclusion and exclusion criteria so they were included in this study.

Based on the demographic characteristics of research subjects, it was found that age had a mean of 53.29 ± 8.5 years. Most of the research subjects were male, amounting to 20 subjects (54.1%), while women were 17 subjects (45.9%). Most types of intracranial tumors were secondary tumors totaling 22 subjects (59.5%) while primary tumors totaled 15 subjects (40.5%) Table 1. The mean age of the subjects in this study is relevant to a previous study conducted by Mariska *et al.* [12]. which reported that the mean age of patients with intracranial tumors was 51.36 ± 2.85 years. This is also in line with the study of Rambe *et al.* [5] who found that the mean age of intracranial tumor patients was 51.45 (11–87) years. When compared with the results of the above studies, it can be seen that the majority of tumor cases occur in the age group >40 years, then this result is in accordance with the results of other studies where the age factor does influence the incidence of intracranial tumor disease [12]. Intracranial tumors can occur at any age, but the incidence of intracranial tumors increases with age, especially in late middle age [5], [12].

Table 1: Demographic characteristics of research subjects

Variable	Mean	N	%
Age (mean ± standard deviation)	53.29 ± 8.5		
Gender			
Male		20	54.1
Female		17	45.9
Types of tumors			
Primary		15	40.5
Secondary		22	59.5

The sex characteristics of the subjects of this study are relevant to previous studies conducted by the research of Rambe *et al*. [5] and Mariska *et al*. [12] which showed that there were more brain tumor sufferers in men than women. According to Mckinney [13] reported that men are more often diagnosed with intracranial tumors than women, with a ratio of 1.5: 1. Intracranial tumors can occur in both men and women, however, both primary and metastatic intracranial tumors are more common in men than in women [12], [13].

In this study, it was found that the most characteristic types of intracranial tumors were metastatic tumors, namely 25 patients (67.6%). This is in accordance with the results of the study by Mariska *et al*. [13] which found that 16 patients (53.3%) had metastatic brain tumors. However, it is different from the results of the study by Rambe *et al*. [5], which found that 56 subjects (74.7%) had primary brain tumors and 19 (25.3%) secondary brain tumors. Brain metastases are the most common intracranial tumors. The incidence of brain metastases over time increases with the sophistication of detection of malignancies and the development of cancer management. Metastatic brain tumors occupy the most frequent intracranial tumors, surpassing primary tumors [14].

The Effect of Dexamethasone Administration on the NANO Score of Intracranial Tumor Patients Based on the data normality test, it shows that the NANO scores of the research subjects before giving dexamethasone, giving dexamethasone on days 1, 2, and 3 are not normally distributed so it requires a non-parametric analysis test, namely, the Friedman test. Based on the Friedman test, it was found that there was a significant effect of dexamethasone on the NANO score of patients with intracranial tumors ($p < 0.001$). Then proceed with post hoc analysis using the Wilcoxon test and it was found that there was a significant difference in the mean NANO score between before giving dexametasone with the 1st, 2nd and 3rd day administration, 1st day to 2nd and 3rd day, while the NANO score on day 2 and 3, there was no significant difference in mean Table 2. The results of this study are relevant to previous studies conducted by Palombi *et al*. [9] reporting that there were statistically significant differences in results associated with dexamethasone administration on the improvement of glioma symptoms.

Table 2: The effects of administrated dexamethasone on neurologic assessment in neuro-oncology scale in patients with intracranial tumors

NANO score	Median (minimum-maximum)	p
Before dexamethasone administration	7 (2–18)	0.000
Day 1 Injection	6 (2–16)	
Day 2 Injection	5 (2–16)	
Day 3 Injection	5 (2–15)	

*Friedman test. Wilcoxon post hoc values: before vs. day 1 P = 0.01; before vs. day, 2 P < 0.001; before vs. day 3 P < 0.001; day 1 vs. day 2 P = 0.002; day 1 vs. day 3 P = 0.002; day 2 vs. day 3 P = 0.632.

According to Kural *et al*. [10], conducting a study on the effect of giving dexamethasone 16 mg for 2 days on edema volume reported the result that there was a decrease in edema volume by 1.7% compared to before dexamethasone administration.

Corticosteroids have been widely used in tumor therapy and are useful in brain tumor patients with significant peritumoral edema accompanied by a neurological deficit [15]. Three-quarters of patients receiving corticosteroid therapy experience a general change in symptoms within 48 h [6]. Corticosteoid administration is very effective in reducing cerebral edema and improving symptoms caused by cerebral edema, the effects of which can be seen within 24–72 h. The recommended agent is dexamethasone with an intravenous bolus dose of 10 mg followed by a maintenance dose of 16–20 mg/day intravenously then tappering off 2–16 mg (in divided doses) depending on the clinic.

According to Nayak *et al*. [16] reported the use of the NANO score as a clinical outcome parameter for patients with intracranial tumors who had an inter observer agreement value> 90% and kappa values ranging from 0.35 to 0.83. According to research conducted by Ung *et al*. [17] reported that the initial NANO score had a correlation with the survival of glioma patients at 3.6, and 12 months ($p > 0.001$). The NANO score is a specific scale in oncology cases and can be used to assess glioma patients. According to Lee *et al*. [18], the NANO score is a more detailed and objective scale in assessing neurological function and can also be used to predict the prognosis of glioma patients. Lee *et al*. [18] divided the cut-off Nano score 0–7 and 8–23 and looked at survival and found that patients with a Nano score 0-7 had a higher survival rate than those with a score of 8–23 (25.2 vs. 12.4 months; $p = 0.023$).

Conclusion

Corticosteroids have been widely used in tumor therapy and are useful in brain tumor patients with significant peritumoral edema and neurological deficits. In this study, there was a significant effect of dexametasone on the NANO score of patients with intracranial tumors.

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