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Respiratory Insufficiency Scale Validity in Patients with Acute Neural Lesion

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THE AIM OF STUDY: to investigate validity of respiratory insufficiency scale (RIS) in patients with acute lesions of nervous system.

MATERIAL AND METHODS The prospective observational study included neurocritical care patients (n=179), admitted to the resuscitation and intensive care unit with independent breathing and RIS score 1 and higher. Patients were assessed according to RIS every 12 hours during the the period of RICU stay until the beginning of artificial lung ventilation or transfer to a specialized department. The RIS score did not influence the physician's decision upon intubation. The treatment was performed in accordance with national and international recommendations.

Depending on the tracheal intubation and ALV, patients were divided into 3 groups. Group I (n=65): 0% tracheal intubation and ALV; Group II (n =54): 42,6% cases of intubation and ALV; Group III (n=60): 100% patients requiring intubation and ALV.

The statistical analysis was performed using Shapiro–Wilk test, Mann–Whitney test, Kruskal–Wallis test, Chi-squared test. The ROC analysis was carried out to determine the sensitivity and specificity of the RIS scale.

RESULTS Patients with RIS score 1–2 did not require intubation and ALV. Patients with RIS 5 or more required urgent intubation and ALV. In patients with RIS score 3–4 the need for intubation and ALV was unpredictable. If RIS score 4 was sustainig during several hours, or if increased from 3 to 4, a patient required intubation and initiation of ALV.

CONCLUSION RIS helps objectify indications for intubation and ALV in patients with acute neural lesions.

Keywords: respiratory insufficiency scale; intubation; artificial lung ventilation

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ACVE — acute cerebrovascular event
ALV — artificial lung ventilation
CN — cranial nerves
CNS — central nervous system
COPDs— chronic obstructive pulmonary diseases
GOS — Glasgow Outcome Scale
PE — pulmonary embolism
RICU — resuscitation and intensive care unit
RIS — respiratory insufficiency scale
TBI — traumatic brin injury

INTRODUCTION

The absolute indications for artificial ventilation of the lungs (AVL) in patients are bradypnea less than 8 breaths per minute, tachypnea more than 35 breaths per minute, coma or the need for deep medical sedation, refractory hypoxemia (PaO_2 less than 60 mm Hg, SaO_2 less than 90%, pO_2/FiO_2 less than 200), hypercapnia $PaCO_2$ more than 55 mm Hg (in patients with COPD $PaCO_2$ more than 65 mm Hg) and $PaCO_2$ hypocapnia less than 30 mm Hg. [1–4]. Specific indications for tracheal intubation and mechanical ventilation for patients with acute lesions of the nervous system are also dysphagic disorders, weakness of the respiratory muscles, and pathological respiratory patterns [5-7]. In the practice of intensive therapy, it is often difficult to make a decision about the need to initiate mechanical ventilation, when there are no absolute indications, but there is a combination of impaired consciousness, dysphagia, and changes in the gas composition of arterial blood of varying severity. With this development of clinical events, the patient is in the so-called "gray zone" of decision making, between situations "ALV is not needed " and "ALV is necessary." In this case, the resuscitator makes a subjective decision based on his own clinical experience. The timely decision upon the start of mechanical ventilation is extremely important in neurologic resuscitation [8, 9]. This allows to prevent the development of hypoxia, which is a significant factor in secondary brain damage [10, 11]. Hypoxia should be eliminated as soon as possible. Tracheal intubation and invasive ventilation are methods of ensuring airway obstruction and maintaining adequate gas exchange in patients with damage to the central nervous system (CNS) [6, 7, 10–13]. At the same time, there are no scales in intensive care that allow an objective assessment of the patient to be made and also make a timely decision on the appropriateness of tracheal intubation and the onset of mechanical ventilation. K.A. Popugayev et al. developed a respiratory insufficiency scale (RIS), assessing the level of consciousness, the function of the bulbar group of cranial nerves and the oxygenating function of the lungs [14, 15]. Based on the obtained scoring, an objective decision is made on the need for tracheal intubation and the start of mechanical ventilation. RIS was validated in a group of neurosurgical patients with a complicated course of the early postoperative period [16]. Patients with acute vascular pathology of the brain, traumatic brain injury (TBI), polyneuropathy were not included into the study of K.A. Popugayev et al. These patients, of course, have their own characteristics of respiratory dysfunction, and RIS requires validation and study of the adequacy of its use in various neurologic resuscitation situations.

The aim of the presented study was to determine the validity of RIS in patients with acute damage to the nervous system. As a consequence, the following objectives were formulated: (1) to investigate the possibilities of RIS for objectifying indications for tracheal intubation and the onset of mechanical ventilation in patients with acute pathology of the nervous system; (2) to identify clinical situations where objectification of a patient's condition with the help of RIS allows earlier to make the right decision about the necessity of tracheal intubation and the start of mechanical ventilation; (3) to identify clinical situations where RIS was not able to adequately objectify the patient's condition and make the right decision about the necessity of tracheal intubation and properly onset of mechanical ventilation.

MATERIAL AND METHODS

A prospective observational study was conducted in the period from July, 2016 to October, 2017 on the basis of the Resuscitation and Intensive Care Unit (RICU) no. 33 of the S.P. Botkin Clinical City Hospital. During the study, 1,782 patients were admitted to the Unit. Patient inclusion criteria: (1) age over 18 years; (2) acute damage to the nervous system of various origins; (3) spontaneous breathing upon admission of the patient to the RICU; (4) extubation of the patient's trachea after surgical intervention and the need for further observation in the RICU. Patient exclusion criteria: (1) age under 18; (2) the third trimester of pregnancy; (3) RIS score 0; (4) extubation of the patient's trachea within 1 hour from the time of admission to the RICU. Inclusion criteria were met in 179 patients, of which 95 were women (53.07%). The spectrum of the pathology of the nervous system was as follows: acute cerebrovascular event (ACVE) in ischemic type (n=87), ACVE in hemorrhagic type (n=33), traumatic brain injury (TBI) (n=26), central nervous system tumor (n=9), brain abscess (n=2), polyneuropathy (n=10) and trauma of the cervical spine (n=12). The median of the *APACHE*- II scale assessment was 14 ± 3. The age of patients was from 23 to 96 years (66±13). The duration of stay of patients in the RICU was from 1 to 45 days (5±2.5).

STUDY DESIGN

All patients admitted to RICU and breathed independently were assessed according RIS (Table 1).

Table 1
Respiratory insufficiency scale

Agitation and sedation - RASS Depression of consciousness	0	-1/+1	-2/+2	-3-4/+3+4	-5
Depression of consciousness (somnolency; obtundation, sopor, coma)[1]	Tranquility and alertness (normal consciousness)	Agitation/drowse (somnolency)	Agitation/mild sedation (obtundation)	Expressed agitation with agression; Moderate or deep sedation (sopor)	Unconscious (coma)
Impaired deglutition, cough and airway passage	Normal deglutition, effective cough, unimpaired airway passage	Normal deglutition, ineffective cough, unimpaired airway passage	Impaired deglutition, effective cough, unimpaired airway passage	Impaired deglutition, ineffective cough, unimpaired airway passage	Impaired deglutition, ineffective cough, impaired airway passage
pO_2/FiO_2	>300	250-300	220-250	200-220	<200

In case of patient's obesity (body mass index> 30), the total score increases by 1

The scale consists of three separate blocks and reflects the level of consciousness, bulbar functions and the oxygenating function of the lungs. The RIS was described in detail earlier [15]. Each block begins with the norm criteria: clear consciousness, preserved bulbar functions, oxygenation index (*p/f*) more than 300. In the absence of respiratory dysfunction, the patient is assessed by RIS as 0. Each block ends with an absolute indication for tracheal intubation and the start of mechanical ventilation: coma or deep sedation, lack of airway passage and oxygenation index less than 200. The patient is evaluated for each block, and the final assessment is the sum of three blocks. When the patient's body mass index is more than 30, the amount is increased by one. Intubation of the trachea and mechanical ventilation should be started immediately, if the patient gets 4 points in each separate block, which corresponds to the absolute indications, or if the total is 5 or more points. Patients having a total of 4 points, according to K.A. Popugaev et al ., form a "gray zone" of decision-making uncertainty [16].

In our study, the first assessment according to RIS was performed when a patient entered the RICU and then every 12 hours, or until the moment of critical deterioration of the patient's condition leading to tracheal intubation and the onset of mechanical ventilation. The study also included neurosurgical patients who underwent surgery, were admitted to the RICU on a ventilator, and then extubated. With the predicted need for their observation in the RICU for more than 12 hours, the patient was included in the study. The RIS assessment was performed at the moment of extubation and then carried out every 12 hours. The dynamic RIS assessment was continued throughout the patient's stay in the RICU until he was transferred to a specialized department or until the patient's trachea was intubated/reintubated and the ventilator started/resumed). Each patient had the maximum RIS score for the observation time in the RICU (RIS_{max}), and for patients who ultimately required tracheal intubation, the interval between the registration of RIS_{max} and trachea intubation (RIS_{max} interval) was calculated.

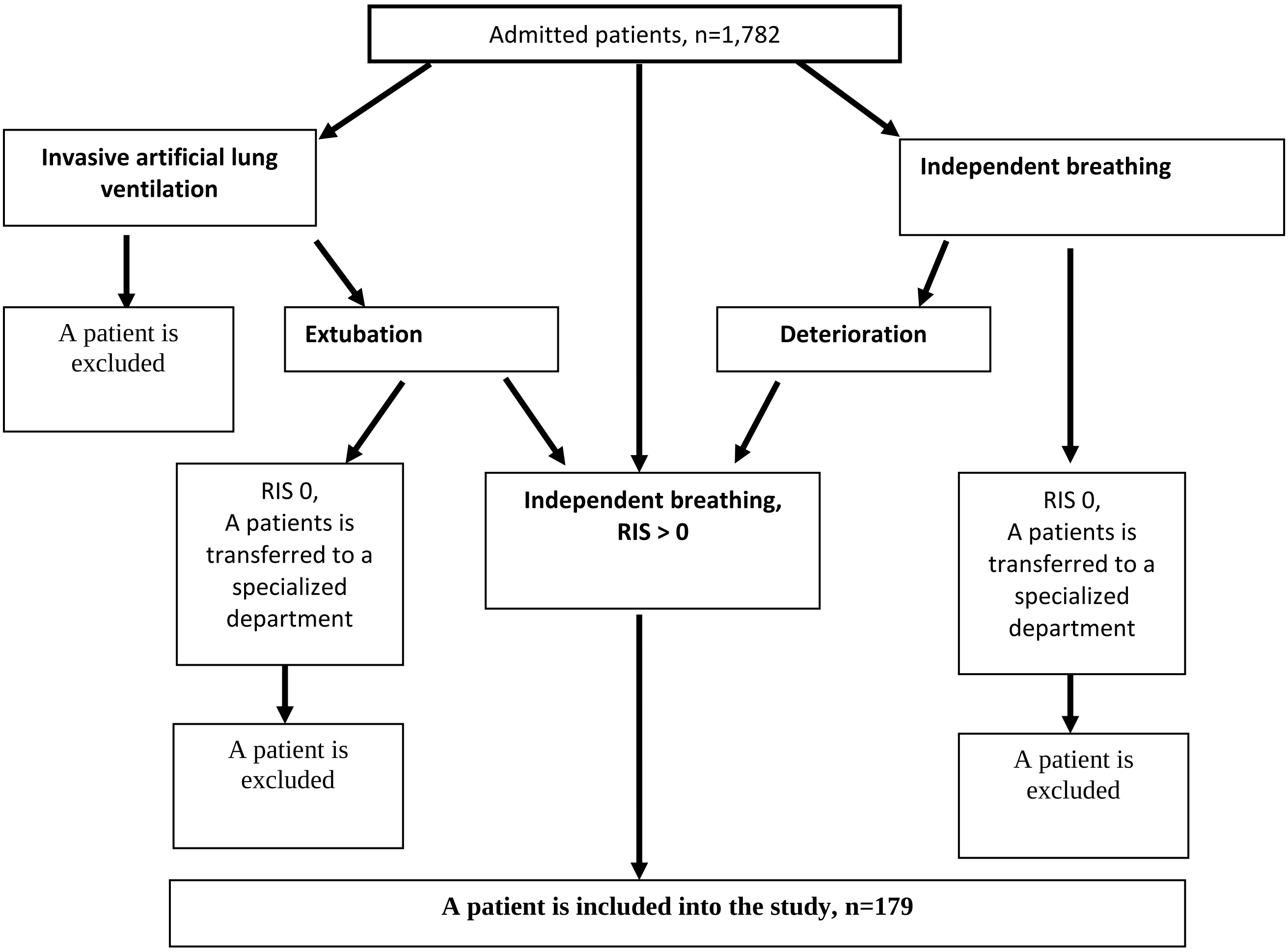

Fig. 1. The scheme of inclusion of patients into the study. Patients with independent breathing were assessed by RIS upon admission to the resuscitation and intensive care unit, and then every 12 hours. If the RIS score was more than 0, then a patient was included into the study. Patients were also included into the study after tracheal extubation, if the RIS score was higher than 0. If a patient had been on artificial respiration during the entire time spent in the department, or a patient was breathing independently without signs of respiratory failure and had a score 0 points according to RIS, then this patient was not included into the study.
Notes: ALV — artificial lung ventilation; RICU — resuscitation and intensive care unit; RIS — respiratory insufficiency scale

The patient was evaluated according to RIS by a doctor; it did not influence the decision about the need for tracheal intubation and the start of mechanical ventilation. The first point of the study was the fact of tracheal intubation and the start of mechanical ventilation. The second one was the length of stay of patients in the RICU and clinic, the development of pneumonia, sepsis and the outcome of the disease.

The neurological diagnosis and the reasons for the deterioration of neurological status or death were confirmed by neuroimaging methods in vivo or at autopsy in case of a patient's death. The diagnosis of pneumonia and sepsis was based on *CDC* criteria [17]. Patients were managed in accordance with national and international guidelines [7–10, 12, 13, 18].

The statistical analysis was performed by the following methods: checking the normality of quantitative indicators — *Shapiro-Wilk test*, comparing groups by quantitative characteristics — non-parametric *Mann-Whitney* test and *Kruskal-Wallis test*, comparing groups based on quality criteria — *Chi-squared test* (Chi-square test). *A ROC analysis* was performed to determine the sensitivity and specificity of RIS.

The patients included in the study were divided into 3 groups: group I — patients who did not need mechanical ventilation (RIS_{max} score 1or 2); group II — some patients required mechanical ventilation, some of them did not need mechanical ventilation and were successfully transferred from the RICU (RIS_{max} 3-4); group III — all patients required mechanical ventilation (RIS_{max} 5 or more). Characteristics of patients are presented in Table 2.

T a b l e 2

Patients included in the study

			Group I	Group II	Group III	P
n			65	54	60	0.494
Male			34 (52.3%)	28 (51.8%)	22 (36.7%)	0.148
Female			31 (47.7%)	26 (48.2%)	38 (63.3%)	
Age, years			23-98 (59±10)	25-91 (63.5±13.25)	33-96 (76.5±10.6)	<<0.05
RICU stay, days			1-27 (3±1.5)	2-45 (6±2.75)	2-62 (7±4)	<0.05
Independent breathing before ALV initiation, hours			-	1-192 (28±21.25)	1-320 (56 ± 39.62)	0.233
Pathology	ACVE	Ischemic	35 (53.8%)	23 (42.6%)	29 (48.3%)	0.289
		Hemorrhagic	9 (13.8%)	10 (18.5%)	14 (23.3%)	0.601
	TBI		11 (16.3%)	10 (18.5%)	5 (8.3%)	0.304
	CNS tumor		3 (4.6%)	4 (7.4%)	2 (3.3%)	0.717
	Brain abscess		0	2 (3.7%)	0	<<0.05
	Polyneuropathy		3 (4.6%)	3 (5.5%)	4 (6.7%)	0.905
	Cervical spine trauma		4 (6.1%)	2 (3.7%)	6 (10.0%)	0.368
APACHE II (median)			5-15 (10±3)	5-19 (14±1.8)	8-22 (16±3)	<<0.05
GOS outcomes	GOS 5		31 (47.7%)	10 (18.5%)	1 (1.7%)	<<0.05
	GOS 4		30 (46.1%)	18 (33.3%)	-	0.083
	GOS 3		4 (6.1%)	7 (12.7%)	1 (1.7%)	0.105
	GOS 2		-	-	-	
	GOS 1 (lethal)		-	19 (35.2%)	58 (96.7%)	<0.05
Infectious complications		Pneumonia	2 (3.0%)	16 (29.6%)	33(55.0%)	<<0.05
		Sepsis	0	3 (5.5%)	3 (5.0%)	1
Causes of death	Brain edema, herniation		-	7 (36.8%)	31 (53.4%)	<0.05
	Brain stem ACVE		-	7 (36.8%)	20 (34.5%)	0.012
	Sepsis		-	3 (15.8%)	3 (5.2%)	1
	PE		-	2 (10.5%)	4 (6.9%)	0.667

Notes: ACVE – acute cerebrovascular event; ALV – artificial lung ventilation; APACHE – Acute Physiology and Chronic Health Evaluation; CNS – central nervous system; GOS – Glasgow Outcome Scale; PE – pulmonary embolism, RICU – resuscitation and intensive care unit; TBI – traumatic brain injury

RESULTS AND DISCUSSION

The distribution of patients depending on the assessment of RIS$_{max}$ is shown in Fig. 2. With an increase in the level of RIS$_{max}$ score, the outcome worsened and the risk of death was increasing. When RIS$_{max}$ was 1–2, there were no deaths, and when it was 6 or more, the death rate was 100% (Fig. 2).

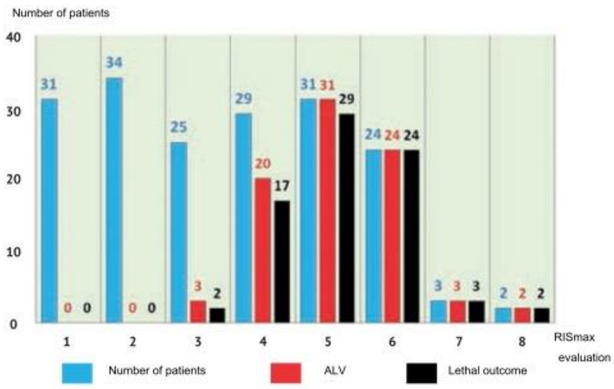

Fig. 2. The dependence of the need for ALV and death from RIS max. Patients with RIS score 3 or higher needed ALV, while the need for ALV was 100% in patients with RIS score 5 or higher. In the group of RIS max score 3–4, intubation of the trachea and ALV was required in 42.6% of cases. The higher the RIS max was, the higher the death rate was. In patients with RIS max score 6 or higher, the death was 100%.

Notes: ALV — artificial lung ventilation; RIS — respiratory insufficiency scale

The case histories of patients whose treatment required tracheal intubation and mechanical ventilation were analyzed. The time between registration of RIS score 4 and the tracheal intubation — RIS -4-interval value — correlated with the frequent development of pneumonia, sepsis, and outcome (Table 3).

Table 3

The analysis of patients with RIS max 4 by RIS interval

	n	Pneumonia	Sepsis	Duration of stay at RICU, days, median	Favourable outcome (GOS 4-5)
RIS 4 interval less than 30 min	18	7 (38.9%)	0	7	4 (22.2%)
RIS 4 interval more than 30 min	63	38 (60.3%)	5 (7.94%)	7	2 (3.1%)

Notes: RICU — resuscitation and intensive care unit; GOS — Glasgow Outcome Scale; RIS 4 interval — the time gap between the first examination according to RIS 4 and intubation with initiation of artificial lung ventilation

The assessment by RIS has high sensitivity and specificity in predicting death in a patient with acute pathology of the nervous system (Fig. 3).

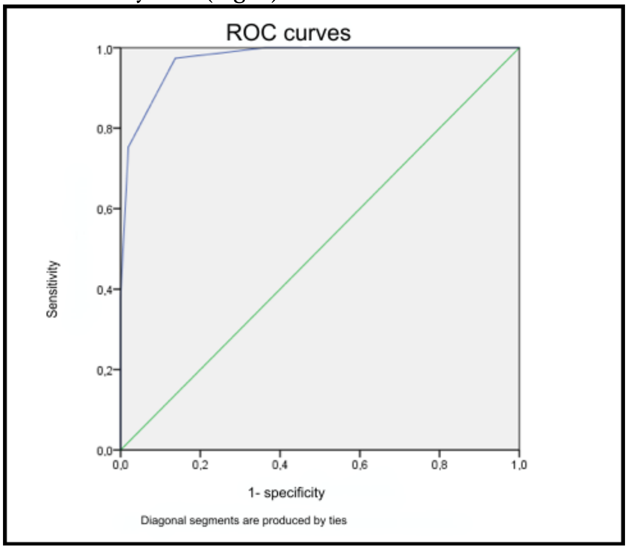

Fig. 3. The significance of RIS for predicting death. The ROC curve (Youden's index) for determining the sensitivity and specificity of RIS for predicting the lethal outcome is presented. When RIS score is 5, the sensitivity is 0.753 and the specificity is 0.98 for the prediction of death. The RIS score 4 is the lower limit, which predicts the probability of death of the patient with a sensitivity of 0.974 and a specificity of 0.863

When RIS score is 5, the sensitivity is 0.753 and the specificity is 0.98 for the prediction of death. The RIS score 4 is the lower limit, which predicts the probability of death of the patient with a sensitivity of 0.974 and a specificity of 0.863. Indicators of sensitivity and specificity of RIS are presented in Table 4.

Table 4

Sensitivity and specificity of RIS

Valid if greater or equal (RIS score)	Sensitivity	Specificity
1	1.000	0.000
2	1.000	0.304
3	1.000	0.637
4	0.974	0.863
5	0.753	0.980
6	0.377	1.000
7	0.065	1000
8	0.026	1.000

The dynamics of the change in the assessment of RIS in groups is shown in Fig. 4. The data for 6 is presented, as during this time either a deterioration of the condition, tracheal intubation and transfer of the patient to a ventilator occurred, or the patient's condition improved and he was transferred from the RICU.

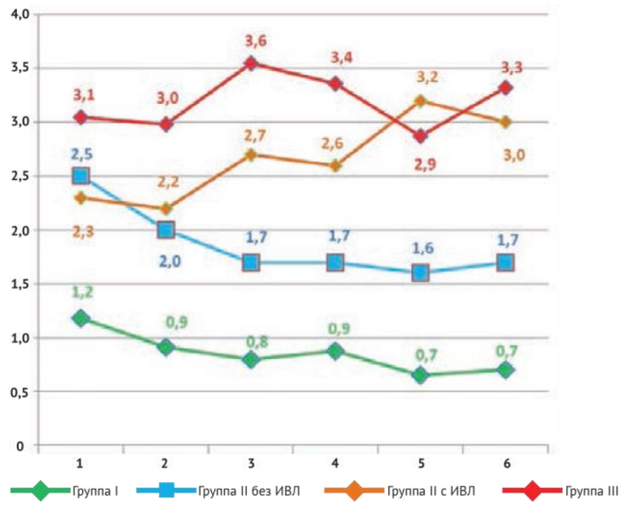

Fig. 4. The dynamics of changes in the assessment of RIS in groups of patients I, II and III during the first 6 days. In Group I, there was a downward trend in the rate of RIS. In Group II, patients who did not need ALV had the same tendency to decrease in the rate of RIS in the dynamics as in Group I. Patients in Group II who required ALV showed a tendency to an increase in RIS score over time. Group III had a high RIS rate for the entire time preceding initiation of ALV, which was 100% necessary

Notes: ALV — artificial lung ventilation; RIS — respiratory insufficiency scale

To determine the differences between patients of group II who needed mechanical ventilation and those who did not need mechanical ventilation, a comparative analysis was conducted (Table 5).

T a b l e 5

Various of comparison of The treatments (with or without the ALV the ALV) in Patients with II of Group is of the RIS $_{max}$ score 3-4

			Patients of Group II without ALV	Patients of Group II with ALV	p
n			31	23	0.276
Male			16 (51.6%)	12 (52.2%)	0.967
Female			15 (48.4%)	11 (47.8%)	
Age, years			30-91 (66±12.75)	25-91 (63±11.25)	0.606
RICU stay, days			2-35 (5±1.5)	2-45 (7±4)	0.066
Independent breathing, hours			-	1-192 (28±21.5)	
Pathology	ACVE	Ischemic	14 (45.2%)	9 (39.1%)	0.297
		Hemorrhagic	5 (16.1%)	5 (21.7%)	1
	TBI		**9 (29.0%)**	**1 (4.3%)**	**0.011**
	CNS tumor		2 (6.5%)	2 (8.7%)	1
	Brain abscesss		**0**	**2 (8.7%)**	<<0.05
	Polyneuropathy		**0**	**3 (13.0%)**	<<0.05
	Cervical spine trauma		1 (3.2%)	1 (4.3%)	1
APACHE II, median			8-17 (14±0.75)	5-19 (13±3)	0.171
GOS oucomes	GOS 5		**9 (29.0%)**	**1 (4.4%)**	**0.011**
	GOS 4		**15 (48.4%)**	**3 (13.0%)**	**0.005**
	GOS 3		7 (22.6%)	-	<<0.05
	GOS 2		-	-	
	GOS 1 (lethal outcome)		-	19 (82.6%)	<<0.05
Infectious complications	Pneumonia		**2 (6.5%)**	**14 (60.9%)**	**0.003**
	Sepsis		**0**	**3 (13.0%)**	<<0.05
Causes of death	Brain edema, herniation		-	7 (36.9%)	<<0.05
	Brain stem circulation disorder		-	7 (36.9%)	<<0.05
	Sepsis		-	3 (15.8%)	<<0.05
	PE		-	2 (10.5%)	<<0.05
RIS	Block I (consciousness)		2	2	0.41
	Block II (bulbar)		1	1	0.97
	BlockIII (lungs lesion)		1	2	0.054
	Obesity		8 (25.8%)	3 (13.0%)	0.132
RIS max score, мода			**3**	**4**	**<<0.05**
Average score RIS av			**1.9**	**2.6**	**<<0.05**

Notes: ACVE — acute cerebrovascular event; ALV — artificial lung ventilation; APACHE — Acute Physiology and Chronic Health Evaluation; CNS — central nervous system; GOS — Glasgow Outcome Scale; PE — pulmonary embolism, RICU — resuscitation and intensive care unit; RIS_{max} — the maximum score during the RICU stay; RIS av — the average RIS score during the stay; TBI — traumatic brain injury

In the present study, for the first time, the characteristics of the use and validity of RIS were studied in patients with acute neurological and neurosurgical pathology. Patients with RIS $_{max}$ 1–2 points (group I) did not need mechanical ventilation, patients with RIS $_{max}$ score 5 or more, all required mechanical ventilation (group III), and in the group of patients with RIS $_{max}$ score 3-4 points (group II), only some of them needed mechanical ventilation. Unlike the study of K.A. Popugaev et al ., when the “gray zone” included only patients with score 4 [16], in the presented study, patients with score 3–4 were in the “gray zone”. Thus, it can be assumed that, unlike planned neurosurgical patients with a complicated early postoperative period, on the basis of the analysis of which RIS was created, in emergency patients admitted to hospital with acutely developed cerebral event there are additional factors that are not taken into account by RIS, but resulting in respiratory dysfunction.

The age of patients was statistically significantly different in all three groups (Table 2). In group I, patients were significantly younger than in group III. The revealed tendency coincides with the literature data that the age of patients is an independent predictor of the need for mechanical ventilation in a patient [19-21]. In all groups, the most common pathology was a stroke. At the same time, the ischemic type of stroke was more often developed in patients of group I, and hemorrhagic type of stroke was found in patients of group III. It is generally accepted that the condition of patients with hemorrhagic stroke is heavier than with ischemic one [22, 23]. Our data indicate that patients with hemorrhagic stroke should be intubated already at the first signs of a change in consciousness, disturbed blood gas composition, and dysphagia, that is, RIS score 3-4.

The duration of stay in the RICU was maximum in patients of group II. Group I patients stabilized fairly quickly, they were transferred from RICUs, and patients in Group III had severe primary damage to the nervous system, and, as a result, the relatively rapid death due to cerebral edema, impaired cerebral blood circulation and cerebral herniation. Thus, adequate management of patients with score3-4 is an extremely important task, since the greatest number of potentially manageable complications develops precisely in such observations.

The problem of infectious complications is extremely important for patients with acute pathology of the nervous system. On the one hand, they occupy leading positions in the structure of mortality, and on the other hand, infectious complications are potentially preventable [24]. Sepsis due to pneumonia was the direct cause of death in 15.8% of group II observations. Pneumonia in most of the observations of this group was aspiration, since the duration of spontaneous breathing before intubation of the trachea in our study was 2.6 hours. Patients breathed independently, their airways were not protected, which probably caused aspiration and further deterioration [25, 26]. Timely separation of the respiratory tract and the digestive tract with tracheal intubation would prevent aspiration [27, 28]. The introduction of RIS into routine clinical practice will certainly reduce the likelihood of aspiration and improve outcomes in patients with acute pathology of the nervous system.

RIS has a prognostic value. In group I, there were no deaths, and 93.9% of patients had a favorable outcome. The opposite situation was in group III, where death occurred in 96.66% of patients. At RIS-5, the sensitivity and specificity of the prediction of death are 0.753 and 0.98, respectively, and RIS-4 is the lower limi where the probability of death of a patient with a sensitivity of 0.974 and specificity of 0.863 can be predicted. Thus, RIS-5 is an independent put on a ventilator.

The dynamics of RIS has an extremely important predictive value (Fig. 4). Group I was characterized by a decrease in the RIS score, whereas in group III it remained stable or increased. In group II, the assessment of RIS decreased in those patients who eventually did not require mechanical ventilation and were transferred from the RICU, and in those patients who needed mechanical ventilation, the RIS score was 3–4 or more. Thus, a dynamic assessment, primarily of a patient with score 3-4, is extremely important, as it may indicate a depletion of compensatory reserves and the need for tracheal intubation and the onset of mechanical ventilation. It is possible that the continuing level of RIS score 3-4 over several hours in patients of the "gray zone" (group II) should be an indication for the protection of the respiratory tract and transfer of the patient to mechanical ventilation.

Group II deserves a detailed analysis, since it is a "gray zone" for making a decision about tracheal intubation and the start of mechanical ventilation. Group II was divided into two subgroups depending on tracheal intubation and mechanical ventilation (Table 5). Patients did not differ in gender, age and severity of the condition upon admission to the RICU, as assessed by the *APACHE*- II scale . Patients who needed mechanical ventilation often had a hemorrhagic stroke and less frequently ischemic stroke. In the treatment of all patients with polyneuropathy, mechanical ventilation was required, and they developed a fatal outcome, despite the fact that when the patient was admitted the condition was not extremely serious. The cause of death was sepsis on the background of aspiration pneumonia and sputum evacuation disorders. The literature also suggests the extremely high importance of proper airway management for a favorable outcome [8, 19, 29]. Thus, the introduction of RIS assessment in routine practice of patients with polyneuropathy can improve outcomes, as RIS is a unique tool for objectification the state of neurologic patients.

The frequency of pneumonia and sepsis was statistically significantly higher in the subgroup of patients in group II who required mechanical ventilation. Reducing the time to make a decision about tracheal intubation and the onset of mechanical ventilation (RIS-4 – interval) to 30 min leads to a statistically significant decrease in the incidence of pneumonia, sepsis and improved outcomes.

Patients of group II, where tracheal intubation was not required, were more likely to have obesity compared with those patients who required mechanical ventilation. However, among those patients who required mechanical ventilation, no one survived if they had obesity. Thus, we obtained multidirectional data on the effect of obesity on the patient's respiratory function. According to the literature, obesity aggravates respiratory dysfunction [30, 31]. In our opinion, according to the assessment of the RIS, proposed in the original version, an increase in the total score when the patient has a body mass index of more than 1 is correct.

RIS consists of three blocks which assess consciousness, the function of the bulbar group of the CN and the oxygenating function of the lungs. It can be assumed that each of these components has a different contribution to the development of respiratory dysfunction in a patient. The analysis of subgroups of group II showed that patients who required mechanical ventilation had a significantly higher score in the block assessing the oxygenating function of the lungs. It can be assumed that the delay in tracheal intubation leads to aspiration, pneumonia and deterioration of gas exchange.

Based on the data presented, it can be assumed that the adequate use of RIS in neurologic resuscitation practice will improve outcomes.

FINDINGS

1. The study confirms the results obtained by K.A. Popugayev data that the use of the respiratory insufficiency score (RIS) allows to objectify the indications for the beginning of artificial lung ventilation (ALV). The use of RIS is expedient in all groups of patients with acute lesions of the nervous system.

2. Unlike the data obtained by K.A. Popugayev, that the "gray zone" includes patients with RIS score 4 poins, the study made it possible to expand the "gray zone" and include patients with a score 3 and 4.

3. In case of acute damage to the nervous system, the patient may spontaneously breathe at RIS 1–2 and must be intubated immediately if, according to the assessment, in each separate block of the scale has 4 points or 5 points or more.

4. S RIS score 3-4 in patients with acutely developed polyneuropathy and hemorrhagic stroke is an indication for immediate tracheal intubation and the onset of mechanical ventilation, if within a few hours of adequate intensive therapy there is no decrease in the level of RIS assessment or its further increase.

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