Scoring systems (pediatrics)

Kinds of scoring systems

A number of schemes and models have been developed for scoring patients in intensive care. They all strive to meet the following criteria in order to be used for:

- standardized classification of the severity of the condition;
- standardized assessment of prognosis;
- assessment of the course of the disease;
- evaluation of treatment costs and its effectiveness;
- decision support for individual patients;
- assessment of new therapeutic procedures by patient stratification;
- quality control.

In the basic division, we can distinguish two groups that differ in their approach to assessing the severity of the patient's condition:

Physiological approach

It is independent of therapy, monitors deviation and its size from physiological norms for individual parameters and correlates this dysfunction with mortality. An example is the **PRISM score** (Pediatric Risk of Mortality Score).

Therapeutic approach

It is treatment-dependent, based on the principle that the amount and intensity of treatment is proportional to the patient's instability, and thus to the risk of death. An example is the **TISS** (Therapeutic Intervention Scoring System).

- Two properties are essential for all scoring systems: **discrimination of the scoring system**, i.e. the ability to determine patient survival/non-survival, and **calibration** of the scoring system, i.e. the degree of agreement between predicted and actual mortality (sensitivity).
- The essence of model prediction of disease development and treatment outcome is a procedure in which the scoring system assigns a certain point value to the deviation of a laboratory and/or physical quantity from the normal value (physiological approach) or the need to use therapeutic procedures (therapeutic approach). The point value is then multiplied by the coefficients that were obtained by regression analysis according to the importance of the parameter in large groups of patients and directly determines, for example, the probability of the patient's death.
- It is essential to realize that **a high probability of death does not mean that the patient will actually die**. E.g. with a 50% probability of death, it can only be said that half of the patients with this risk will die, and therefore it is not possible to use the evaluation according to the scoring schemes for ethical decisions. **Prediction of death**, however, **allows an objective assessment of the patient's condition.**
- **Scoring systems can be used for disease prognosis**, in this case it almost predicts the mortality of a group of patients. **They are unsuitable for predicting individual mortality and do not say anything about the clinical course of the disease.** The second possibility is their *use as continuous scoring schemes for the daily objectification of the clinical status of an individual patient*.

The basic **breakdown of scoring schemes** is as follows:

- **disease-specific scoring systems** (eg sepsis, trauma, meningococcal infection, pulmonary involvement, state of consciousness);
- **universally applicable scores**.

Scoring systems for individual diseases

Respiratory tract

Silverman score – to determine the degree of RDS in newborns

	0 points	1 point	2 points
Movement of the chest and abdomen	current	reduced chest mobility	opposite movement of the chest and abdomen, so-called paradoxical breathing
Retraction of the epigastrium	absent	indicated	prominent
Retraction of the sternum	absent	audible with stethoscope	spacer
Alar flexion	absent	indicated by	prominent

Evaluation: Score > 3–4 b. indicates severe respiratory distress.

Downes score – for obstruction of upper RT

	0 points	1 point	2 points
Listening to breathing	normal	harsh squeaks and rumbles/weakened	silence above the lungs
Stridor	none	inspirational	mixed
Cough	none	rough	barky
Retraction	none	retracts jugulum supraclavicularly, alar flexure	dtto + subcostal and intercostal
Cyanosis	none	present at FiO_2 0.21	present at FiO_2 0.40

Evaluation':

- score ≤ 2 points: possible outpatient procedure;
- score < 5 points: care on a standard bed is sufficient;
- score 5–7 points: ICU care + i.v. line;
- score > 7 points: probability of tracheal intubation, usually 20 min. therapeutic trial and if the condition does not improve intubation.

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Modified Downes score for lower RT obstruction

	0 points	1 point	2 points
Inspirational murmurs	normal	slightly weakened	significantly attenuated/inaudible
Retraction	none	moderate	prominent
Wheezing	none	moderate	prominent
State of consciousness	normal	restlessness/depression	unconsciousness
Cyanosis	none	present at FiO_2 0.21	present at FiO_2 0.40
PaO_2 (kPa)	9.3-13.3	7.5-9.3	<7.5

Evaluation':

- score 1–3 points: inhalation/nebulization β2-mimetics and parasympatholytics;
- score 3–4 points: continuous inhalation/nebulization β2-mimetic + humidified heated O_2 + steroids, consider i.v. aminophylline;
- score 4–5 points: dtto + β2-mimetic infusion + ev. UPV;
- score > 5 UPV points.

CNS

Benes score

The GCS evaluation is most often used to '*evaluate the quantitative state of consciousness*. A simplified variant of Czech origin – the so-called Beneš score is far less used, it is not routinely recognized, but it is sometimes sufficient for simple interpretation.

Reaction to a painful stimulus	Number of points
none	0
vegetative (acceleration SF, DF)	1
overall response (decerebrate or decorticate)	2
overall response (uncoordinated movements)	3
targeted escape response	4
Response to being approached	
will honor a repeated command with latency	5
will comply with the repeated command quickly	6
speaks slowly, inappropriately, confusedly	7
is oriented, speaks adequately	8

Glasgow coma scale

The Glasgow Coma Scale (GCS) assesses the state of consciousness, objectifying a quantitative disturbance of consciousness regardless of the underlying cause. It is a commonly used scheme and has completely replaced the subjective assessment of the state of consciousness and the terms somnolence, sopor, stupor, coma. It **rates** three quantities: **verbal response, eye opening and motor response***. The minimum value is 3 points, the maximum is 15 points.* GCS **exists in two modifications** - **for infants and children**.

	Bigger kids	Babies	Points
Opening the eyes	spontaneously	spontaneously	4
	on request	on request	3
	for pain	for pain	2
	none	none	1
Verbal response	oriented	vocalizes	5
	confused	irritating cry	4
	does not fit	crying on algic stimulus	3
	incomprehensible	moaning	2
	none	none	1
Motor response	will obey the command	spontaneous momentum	6
	localizes pain	dodges to a tactile stimulus	5
	dodges the algic stimulus	dodges the algic stimulus	4
	decortication reaction (= abnormal flexion)	decortication reaction	3
	decerebration reaction (= extension)	decerebration reaction	2
	no answer	no answer	1

GCS evaluation: GCS is presented by one number from the interval 3-15, which is formed by summing the points according to the following table. The maximum number is 15 points, the minimum number is 3 points.

normal consciousness, normal orientation	15 points
change in mental state	< 12 points
severe disturbance of consciousness	< 10 points
severe disturbance of consciousness requiring neurointensive care (intubation/UPV and mostly measuring ICP)	< 8 points

Universal Scoring Systems

Multiorgan Failure Score

The risk of death is evidently dependent on the number of organs that fail or have failed. In adult medicine, this fact is known as the "rule of 3". ***Mortality when one organ system fails is 30%, with two 60%, three 90% and four or more 100%.*** In children, the prediction of mortality according to organ failure is more optimistic.

It is clear that the risk of death is not just the sum of the predicted mortality of individual organs, and therefore better expresses the situation with the simultaneous failure of several organs. *Example:* the risk of mortality with 3 organ failures is 50%, which is significantly higher than the simple sum of the risk of death with one organ failure (1%) and the other two organ failures (10%). The Multiorgan Failure Score (MOFS) can be used **to assess organ status on a daily basis and very well reflects the success of therapy**.

Definition of failure of individual organ systems		
	Parameter	**Value**
Cardiovascular system	MAP	< 40 torr (infants) < 50 torr (children)
	heart rate	< 50 or > 220/min. (infants) < 40 or > 200/min. (children)
	cardiac arrest	
	the need for continuous administration of catecholamines	
Respiratory system	tachypnea	> 90/min. (infants) > 70/min. (children)
	p0_2	< 5.3 kPa (without VCC present)
	pCO$_2$	> 8 kPa
	PFi	< 250
CNS	GCS	< 5
	pupil reaction	without photoreaction > 20 minutes
	intracranial pressure	> 20 torr
Hematopoiesis	hemoglobin	< 50 g/l
	leukocytes	< 3 000 mm^3
	platelets	< 20 000 mm^3
	DIC	
Kidneys	creatinine	> 300 µmol/l
GIT	bleeding	necessity of transfusion > 20 ml/kg/hour
Liver	total bilirubin	> 85 µmol/l
	ALT	> 2x the norm
	encephalopathy	> II. degrees

Failure of the relevant organ system is defined as the presence of at least one of the above parameters!

Probability of death by number of organ failures	
Number of organs that failed	**Mortality**
0	< 0.5%
1	1%
2	10%
3	50%
4	75%

Pediatric Risk of Mortality Score

The PRISM score is **used for critically ill newborns, infants, children and adolescents**, it is not used for the group of immature newborns and adults. It was revised in 1996 (PRISM III). The **values** included in the PRISM III score **are collected within the first 12 hours** (PRISM III – 12) **or within the first 24 hours** (PRISM III – 24). The most pathological values are recorded. **14 measured values + another 23variable parameters are included in PRISM**.

The **basic 14 values** include:

- systolic BP;
- diastolic BP;
- heart rate;
- respiratory rate;
- FiO$_2$;

- pO_2;
- pCO_2;
- Quick;
- aPTT;
- S-calcium;
- S-potassium;
- glycemia;
- bilirubin;
- bicarbonate.

Among *other variable parameters* we include TT, type of disease, pupil reaction, GCS value, child's age, value of leukocytes, platelets, urea, creatinine, SaO_2, pH, Operational Performance...

Examples of **other scoring systems** include the so-called **PIM 2** (Pediatric Index of Mortality), **PELOD Score** (Pediatric Logistic Organ Dysfunction) or **Rotterdam Score Meningococcal septic shock in children**, which predicts death in meningococcemia according to parameters of potassium, base excess, platelets and CRP value.

From a mathematical point of view, the calculations are complex, as logarithmic values of some parameters are also often applied. Therefore, for all these scoring schemes **there are online calculators**, where after entering the appropriate values, the program will calculate the score itself.

Links

Related Articles

- Apgar score

External links

Source

- HAVRÁNEK, Jiří: *Monitoring v intenzivní péči*