Web System Support to Decision Making in Surgery

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Web system support to decision making in spinal surgery is discussed. The system provides optimal tactics for surgery.

Principles and methods of spinal surgery and methods of postsurgical rehabilitation of spinal patients have been reported in the literature [1-3]. However, spinal surgery is not always successful. Therefore, methods of spinal surgery require improvements.

Mathematical models can be used to evaluate postsurgical complications [4]. The model discussed in this work is:

$$ P_c = P_{mpc} \cdot P_{cpc} \cdot P_{ac} \cdot P_{se}, $$

where $P_c$ is the numerical value of complication probability; $P_{mpc}$ is the probability of the main process complications; $P_{cpc}$ is the probability of concomitant pathology complications; $P_{ac}$ is the probability of anatomical complications; $P_{se}$ is the probability of surgical error. There are no ideal patients (ideal anatomy) or ideal surgeons, so $P_c$ components differ from zero. On the other hand, the probability of surgical error increases in case of the main process or concomitant pathology complications, anatomical complications, etc. according to the theory of probability [4]. The probability of surgical error is:

$$ P(O) = \sum_{j=1}^{k} P(A_j)P(O | A_j), $$

where $O$ is surgical error; $A_j$ is complications or pathology.

Although model (1) is not completely adequate, it is useful in practice.

Any surgical intervention is associated with risk. This risk cannot be zeroed, but its probability can be reduced. Risk management is an important component of patient preparation for surgery. Risk management includes mathematical simulation.

The risk factor $R$ is the multiplicative convolution of complication probability $P_c$ with health defect of the patient $M$:

$$ R = P_c \cdot M, $$

where $R$ is risk degree; $M$ is probability of health threat for the patient.

Patient health quality depends on working ability (working disability).

Risk management should be an integral component of preparation for surgery. Risk management has specific strategy and tactics. Risk management should comply with the modern state of science.

The following activity is possible: avoidance of risk factors; modification of surgical tactics; modification of rehabilitation methods.

The risk factors should be avoided. There are two approaches to risk prevention: broad and narrow.

The narrow approach implies specific measures. The broad approach implies modification of patient therapy tactics.

Interaction between risk factors is shown in Fig. 1 [8]. Surgical tactics are selected on the basis of four components:

1) efficacy of surgical intervention;
2) postoperative complications;
3) efficacy of therapy;
4) negative consequences of surgery denial.

The surgeon determines surgical tactics and risk level. Risk level is determined in categories 2 and 3. The risk level decreases from category 1 to category 4.

Optimal risk level provides optimal surgical result in the given patient. A decision-making model for the surgeon is shown in Fig. 2.

Modern computers provide effective simulation of surgical tactics. This allows optimal surgical tactics to be selected.
Prognosis of pathology development predicts complications in given treatment tactics.

Medical prognosis is based on regression models [6]. Correlation, discriminant, factorial, and cluster analysis is also used [5]. The Bayes method, Markovian networks, and other probabilistic methods are also used [6]. Neural networks are particularly promising [6]. Statistical prognosis models are rarely used in medical practice. This is due to the complexity of such models.

![Diagram 1](image1.png)

**Fig. 1.** Interaction between risk factors.

![Diagram 2](image2.png)

**Fig. 2.** Decision-making model for surgeon.