

MEETING ABSTRACT

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# Artificial Intelligence, System Analysis and Simulation Modeling in Precise Prediction of 5-Year Survival of Esophageal Cancer Patients after Complete Esophagogastrectomies

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## Background/Introduction

Modern TNM-classification is based only on cancer characteristics and does not take into account at all the features of extremely complex alive supersystem - the patient's organism.

## Aims/Objectives

We examined factors in terms of precise prediction of 5-year survival (5YS) of esophageal cancer (EC) patients (ECP) (T1-4N0-2M0) after complete (R0) esophagogastrectomies (EG).

## Method

We analyzed data of 491 consecutive ECP (age =  $56.2 \pm 8.8$  years; tumor size =  $6.3 \pm 3.4$  cm) radically operated and monitored in 1975-2015 (m = 359, f = 132; EG Garlock = 280, EG Lewis = 211, combined EG with resection of pancreas, liver, diaphragm, aorta, VCS, colon transversum, lung, trachea, pericardium, splenectomy = 147; adenocarcinoma = 279, squamous = 202, mix = 10; T1 = 90, T2 = 112, T3 = 166, T4 = 123; N0 = 227, N1 = 69, N2 = 195; G1 = 136, G2 = 123, G3 = 232; early EC = 71, invasive = 420; only surgery = 377, adjuvant chemoimmunoradiotherapy-AT = 114: 5-FU + thymalin/taktivin+radiotherapy 45-50 Gy). Multivariate Cox modeling, clustering, SEPATH, Monte Carlo, bootstrap and neural networks computing were used to determine any significant dependence.

## Results

Overall life span was  $1776.1 \pm 2223.2$  days and cumulative 5-year survival (5YS) reached 47.1%, 10 years - 40.3%, 20 years - 30%. 147 ECP lived more than 5 years, 79 - 10 years. 223 ECP died because of EC. Cox modeling displayed ( $\text{Chi}^2 = 293.38$ ,  $\text{df} = 18$ ,  $p = 0.000$ ) that 5YS of ECP significantly depended on: phase transition (PT) N0-N12 in terms of synergetics, cell ratio factors (CRF) (ratio between cancer cells and blood cells subpopulations), T, G, age, AT, localization, blood cells, prothrombin index, coagulation time, residual nitrogen ( $p = 0.000-0.014$ ). Neural networks, genetic algorithm selection and bootstrap simulation revealed relationships between 5YS and PT N0-N12 (rank = 1), T, AT, G, prothrombin index, glucose, blood cells, localization, PT early-invasive EC, CRF. Correct prediction of 5YS was 100% by neural networks computing.

## Discussion/Conclusion

5YS of ECP after radical procedures significantly depended on: 1) PT "early-invasive cancer"; 2) PT N0-N12; 3) CRF; 4) blood cell circuit; 5) biochemical factors; 6) hemostasis system; 7) adjuvant chemotherapy; 8) tumor localization.

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