Embedded Self Organizing Systems (Vol 9. No 3. 2022) (pp.70-72)

Embedded Selforganizing Systems

Special Issue Topic: "International Symposium on Computer Science and Educational Technology"

Prognosis of Complications at Surgical Treatment of Benign Parotid Tumors

Elmira Iriskulova
Scientific department
EMU University
Tashkent, Uzbekistan
ORCID 0000-0001-9306-0106

Kodirova Ziyodakhon
EMU University
Tashkent, Uzbekistan
ziyoshkadirova@gmail.com

Juraboev Sardor
EMU University
Tashkent, Uzbekistan
emu.jurabaev@gmail.com

***Abstract*— The development of clinical medicine to a certain extent depends on the level of prognosis of surgical patients. In prognosis, the method of regression analysis is widely used. Prognostic scales help to assess the risk of complications in patients after surgery, which allows the use of relatively more effective diagnostic and therapeutic measures. The aim of the study was to develop the integral mathematical characteristics of the prognosis of the outcome at surgical treatment of benign parotid tumors, adequately describing the pathological process. When constructing a mathematical prognostic model, its parameters were subject to the requirement of their efficiency above P>95% according to the t-criterion. The purpose of the mathematical modeling was to statistically adequately link the complications of surgical treatment of parotid tumors with clinical and diagnostic data. The developed mathematical model made it possible, on the basis of significant clinical and diagnostic data in patients, to identify prognostic factors for the development of paresis of the mimic muscles of the face in the surgical treatment of benign parotid tumors. Based on the studied correlation analysis, the significant (p<0.05) clinical prognostic factors for the development of paresis of the mimic muscles of the face after the operation of partial superficial parotidectomy were revealed: gender, patient's age, cytological result, sonoelastographic strain-ratio value, computer tomography or magnetic resonance imaging of tumor size. Also, the prognostic factors for the development of paresis of the mimic muscles of the face during the parotidectomy and the extracapsular dissection of the lower pole of the parotid gland were determined. In the result the certificate of the official registration of the computer program was received. The possibility of prognosis of the complications of surgical treatment in patients with parotid tumors has also been developed in order to reasonably carry out more effective therapeutic and rehabilitation measures.**

Keywords*— *surgery, tumor, parotid, salivary gland, complication, benign.

I. INTRODUCTION

The progressive development of clinical medicine to a certain extent depends on the level of diagnosis, treatment and prognosis of patients. There is a need to use of prognostic scales in medicine [6,7]. In constructing of prognostic scales, the method of least squares is widely used, which is the basic method of regression analysis. The least squares method has been comprehensively studied and has several theoretical justifications. Prognostic scales help to assess the risks of complications for groups of patients with similar conditions, and on their basis to take more effective diagnostic and therapeutic measures.

Surgical treatment of benign parotid tumors is the main method of treatment and prevention of cancer of this localization. But due to the complex anatomical and topographic localization of the parotid gland, surgical treatment is associated with the occurrence of certain complications [1,2,3,4,5,8,9].

II. PATIENTS AND METHODS

The clinical material of 99 operated patients with a diagnosis of benign parotid tumor was used. To enter the initial information into the computer, for the purpose of its subsequent statistical processing, a special coding card of the examination of patients was developed, which included 42 clinical indicators related to the outcome and clinical course of the disease.

In our study, extracapsular dissection was performed in 28 (28.3%) of the studied patients.

Partial superficial parotidectomy was the most frequently performed operation and was performed in 64 (64.6%) cases.

Parotidectomy with facial nerve preservation was used in 7 (7.1%) patients.

Regression analysis was used to identify patterns. The mathematical model was constructed using the least squares method in a linear form.

When constructing a mathematical model for predicting of complications after surgery, the least squares method parameters were effective and not lower than the level of $p<0.05$ according to the t-criterion.

In the result of the calculations, a mathematical model was obtained for predicting of complications at extracapsular dissection, partial superficial parotidectomy and parotidectomy. Calculations were performed using the statistical software package "STATISTICA-10".

III. RESULTS

As a result of the calculations, a mathematical model was obtained for predicting complications during partial superficial parotidectomy (1), extracapsular dissection (2), and parotidectomy (3).

Model for predicting complications in partial superficial parotidectomy:

$$(1) = -1.568 + 0.078 \times Z(1) + 0.002 \times X(1) - 0.034 \times Y(1) + 0.309 \times X(10) + 0.389 \times\times X(11) - 0.519 \times X(12) + 0.085 \times X(13)$$

TABLE I. PREDICTING COMPLICATIONS IN PARTIAL SUPERFICIAL PAROTIDECTOMY

Equation data	Clinical and diagnostic data
Z1	Gender
X1	Age
Y1	Cytological answer before surgery
X10	Elastography index Strain-ratio
X11	CT (MRI) size of tumor (height, mm)
X12	CT (MRI) size of tumor (width, mm)
X13	CT (MRI) size of tumor (anterior-posterior, mm)

Table I shows the prognostic factors for the development of paresis of the mimic muscles of the face during partial superficial parotidectomy. Thus, the female gender and older age of the patient caused a pronounced degree of paresis; a cytological result with the presence of cellular atypia, a high elasticity index (more than 4.1) and a large tumor size led to an increase in the resection volume of the operation, which increased the likelihood of damage to the branches of the facial nerve.

Model for predicting complications during extracapsular dissection:

$$(2) = -0.596 + 0.004 \times X(1) + 0.045 \times Z(1) + 0.168 \times Y(3) - 0.011 \times X(2) - 0.004 \times X(5) + 0.062 \times Z(4)$$

TABLE II. PREDICTING COMPLICATIONS DURING EXTRACAPSULAR DISSECTION

Equation data	Clinical and diagnostic data
X1	Age
Z1	Gender
Y3	Elastotype
X2	Duration of disease
X5	Vertical size of the tumor (height, mm)
Z4	Ultrasound borders of the tumor (regular, irregular)

Table II shows prognostic factors for the development of paresis of the mimic muscles of the face during extracapsular dissection of the lower pole of the parotid gland. As a result, the female gender, the older age of the patient, the long duration of the presence of the tumor determined the pronounced degree of paresis. Elastotype corresponding to a malignant tumor, a large vertical size of the tumor, irregular borders on ultrasound increased the likelihood of damage to the branches of the facial nerve, due to the increased area of the operation.

Model for predicting complications in parotidectomy:

$$A(3) = -0.217 + 0.010 \times X(1) + 0.241 \times X(2) + 0.166 \times X(3) + 0.135 \times X(2) + 0.025 \times X(4) - 0.017 \times X(5)$$

$$B(3) = 0.401 + 0.077 \times Y(2) + 0.018 \times X(1) - 0.215 \times X(2) + 0.377 \times X(3) + 0.041 \times Z(2) + 0.033 \times X(5)$$

$$(3) = \frac{A(3) + B(3)}{2}$$

TABLE III. PREDICTING COMPLICATIONS IN PAROTIDECTOMY

Equation data	Clinical and diagnostic data
X1	Age
X2	Duration of disease (years)
X3	Number of previous operations
Z2	Histological result
X4	Horizontal size of the tumor (mm)
X5	Vertical size of the tumor (mm)
Y2	Ultrasound structure of the tumor
Z5	Color Doppler Mapping (hypervascularity, hypovascularity, avascularity)

In Table III, as prognostic factors for the development of a pronounced degree of paresis of the mimic muscles of the face during parotidectomy, in addition to the older age of the patient, the long duration of the disease and size of the tumor, the following are indicated: an increased frequency of previous operations, the presence of a malignant tumor according to the results of histology, a structure on ultrasound, hypervascularity on Color Doppler Mapping.

The decision rule looked like this (4):

If the (1) or (2) or (3) is 0.25 - complications will not occur;

0,26 – 0,75 insignificant complications;

0,76 – 1,25 moderate complications;

1,26 and more - significant complications will occur.

IV. CONCLUSION

The prediction error using the mathematical model of predicting of complications at the surgical treatment of patients with benign parotid tumors did not exceed 2%, which indicated its prognostic effectiveness. According to this on the basis of equations (1), (2), (3), (4) it was the basis for the development of a software tool "Predicting of complications at surgical treatment in patients with benign parotid tumor".

REFERENCES

[1] Achour I. et al. Surgery of pleomorphic adenoma of the parotid gland //Revue de stomatologie, de chirurgie maxillo-faciale et de chirurgie orale. – 2015. – T. 116. – №. 3. – C. 129-131.

[2] Ahmedli N., Myssiorek D. Parotidectomy incisions //Operative Techniques in Otolaryngology-Head and Neck Surgery. – 2018. – T. 29. – №. 3. – C. 135-138.

[3] Ciuman R. R. et al. Outcome, general, and symptom-specific quality of life after various types of parotid resection //The Laryngoscope. – 2012. – T. 122. – №. 6. – C. 1254-1261.

[4] Cristofaro M. G. et al. Pleomorphic adenoma of the parotid: extracapsular dissection compared with superficial parotidectomy—a 10-year retrospective cohort study //The scientific world journal. – 2014. – T. 2014.

[5] Croonenborghs T. M. et al. A multicentre retrospective clinico-histopathological review of 250 patients after parotidectomy //International journal of oral and maxillofacial surgery. – 2020. – T. 49. – №. 2. – C. 149-156.

[6] Dantigny, Raphaëlle, et al. "Knowledge and use of prognostic scales by oncologists and palliative care physicians in adult patients with advanced cancer: A national survey (ONCOPRONO study)." *Cancer medicine* 11.3 (2022): 826-837.

[7] Dehingia K., Sarmah H. K., Jeelani M. B. A Brief Review On Cancer Research And Its Treatment Through Mathematical Modelling //Annals of Cancer Research and Therapy. – 2021. – T. 29. – №. 1. – C. 34-40.

[8] Ruohoalho, Johanna, et al. "Complications after surgery for benign parotid gland neoplasms: a prospective cohort study." *Head & neck* 39.1 (2017): 170-176.

[9] Zbären P. et al. Pleomorphic adenoma of the parotid: formal parotidectomy or limited surgery? //The American Journal of Surgery. – 2013. – T. 205. – №. 1. – C. 109-118.