

MASSIVE DEEP LOBE PAROTID NEOPLASMS AND PARAPHARYNGEAL SPACE-OCCUPYING LESIONS: CONTEMPORARY DIAGNOSTICS AND SURGICAL APPROACHES

Popovski V.

*Clinic for Maxillofacial Surgery, Ss Cyril and Methodius University,
Skopje, R. Macedonia*

Abstract: Regional anatomical peculiarity and the evident increasing incidence of parapharyngeal space neoplasms, have established the necessity of an adequate diagnostic approach for their verification and competent preoperative assessment. Tumours of the parapharyngeal space encompass a wide variety of benign or malignant neoplasms of different origins.

The clinical course of 26 patients with parapharyngeal space neoplasms was analysed. A standard diagnostic algorithm for parotid neoplasms was performed, followed by adequate surgical procedure with modifications. Arteriography was used only when CT or MRI suggested a glomous tumor, or possible involvement of the carotid artery, or when those tumours put the carotid artery at risk of surgical injury.

The results found from statistical evaluation revealed a higher significance of CT and MRI for tumor extension, localization and comprehension. MRI was dominant for determining tumor character and facial nerve involvement. A transparotideal approach including two modifications was confirmed as being the most effective.

When a parapharyngeal tumor is detected deep lobe parotid neoplasms are frequently to be expected. Exact preoperative planning with imaging techniques and a posterolateral parotidectomy approach with an angular mandibular osteotomy produces much better postoperative results in the surgery of deep lobe parotid tumours.

Key words: parapharyngeal neoplasms, parotid neoplasms, facial nerve, magnetic resonance, computed tomography, osteotomy, parotidectomy.

Introduction

Deep lobe neoplasms of the parotid gland are a very particular entity in cervico-facial surgery. In most large series [1, 2, 3] their incidence ranges from 2–5% of the entire group of head and neck neoplasms. A consequential number of these neoplasms have a significant parapharyngeal extension and about 45–50% of parapharyngeal tumours are accurate massive deep lobe neoplasms.

The historical interest in parapharyngeal surgery had its commencement in the 17th century, but in fact the surgical techniques of parotid neoplasm surgery have only been specified within the last five decades. A veritable explanation of the historical constraints may lie in the anatomical peculiarity of the parapharyngeal compartments with their numerous important arterial, venous and nerve structures. On the other hand the parotid gland is surgically often referred to as superficial and deep lobes, but anatomically it is referred to as a unilobular gland with numerous processes and no true superficial and deep lobes [4]. Amongst other important entities, the main challenge for surgeons was the eventful blood vessels and cranial nerve group bordering the deep parotid space in its collision with the parapharyngeal extension. The apparent gland division and variable intra-parotid branching of the facial nerve define the complexity of this field of surgery.

The expanding development of radiological techniques has certainly aided the diagnosis of parotid diseases, especially cross-sectional imaging with multi-planar reconstructions – thus allowing for better preoperative planning. While accumulating experience has moved us forward in this field, more sophisticated imaging *space* and *structural* studies will need to be undertaken [5].

Massive deep lobe neoplasms as a part of the parapharyngeal space constitute a distinctive surgical entity. Various and complex surgical procedures in head and neck surgery are still presented for these neoplasms and they continue to be a diagnostic and therapeutic challenge [1, 6, 7, 8].

Material and methods

Material from the University Clinic for Maxillofacial Surgery in Skopje was selected, where in the last eight-year period parotid neoplasms surgery was performed on 292 patients, of whom 34 were with deep lobe involvement and 26 with parapharyngeal extensions. In 4 cases parapharyngeal neoplasms were of minor salivary gland origin, while in 28 cases the parapharyngeal space was occupied by neurogenic, lymphoid or miscellaneous tumour masses. Concerning the tumour type, a wide variety of neoplasms were treated with complementary sub – typing according to the malignant group.

The 26 massive deep lobe neoplasm cases proceeding from different tissue origins formed 44.8% of the entire group of parapharyngeal tumours (Table 1).

Table 1 – Табела 1

Distribution of parapharyngeal tumors – tumor origin
Дистрибуција по појектојо на ирејираније тумори
на парафаринксој

	n	%
Deep lobe of parotid gland	26	44,8
Minor salivary glands	4	6,8
Neurogenic tissue	12	20,7
(Neurofibroma, Scwannoma, Glomus Tu, Neuroleimmoma, Paraganglioma)		
Vascular malformations	3	5,1
Miscellaneous	7	12,2
(Metastatic malignancy, mesenchymal tumors)		
Lymphomas	6	10,4

A standard diagnostic algorithm for parotid neoplasms was performed, including clinical examination, ultrasonography, CT sialography and MRI. Tumour detection through initial diagnostics has a determining asperity for the kind of tumour pathology required. Computed tomography was obligatory for parotid neoplasms and implicative of MRI. Only in cases with progressive malignancy previously detected through initial examinations was MRI directly indicated. FNAC was commonly used immediately prior to operative treatment with the intention of screening performance.

Clinical examinations were routinely made through facial inspections, virtual palpation and by scrutinizing oro-pharyngeal findings. The oro-pharyngeal findings were especially important because pharyngeal bulging was one of the crucial symptoms, with common distension of anterior pillar of the faucies. CT images were usually performed with contrast enhancement and analysed in collaboration with a radiologist concerning the determination of the relationship between the tumour and the surrounding bone and soft tissue landmarks. Doing so, the necessary parameters for further tumour analyses were established. MRI as the most sophisticated radiological method for soft tissue imaging was used

with three-dimensional reconstructions in 45 cases, using thin sections and T1 and T2 weighted protocols.

Radical surgery included total parotidectomy with facial nerve preservation and/or facial nerve reconstruction, and radical tumour excisions with adequate neck dissection. A posterolateral transparotideal or transcervical approach was mostly used, with double preparation of the facial nerve, in anticipation of its maximal preservation. In cases with necessitating facial nerve reconstruction, the procedure used was sural nerve free grafting.

Every proven parapharyngeal neoplasm was pathologically re-examined and re-evaluated according to the WHO classification revised by Simpson in 1994 [9]. For the malignant group adequate staging was engaged by means of malignancy graduation, especially for malignant tumours of salivary origin where even intermediate grades could be differentiated [10].

Results

The analysis of the entire group was based on the results gained from the statistical evaluation of data relating to the delay of symptoms prior to surgery, clinical symptoms, tumour extension, tumour comprehension, surgery performed and cumulative survival time of the patients diagnosed with malignant neoplasms (Figure 1).

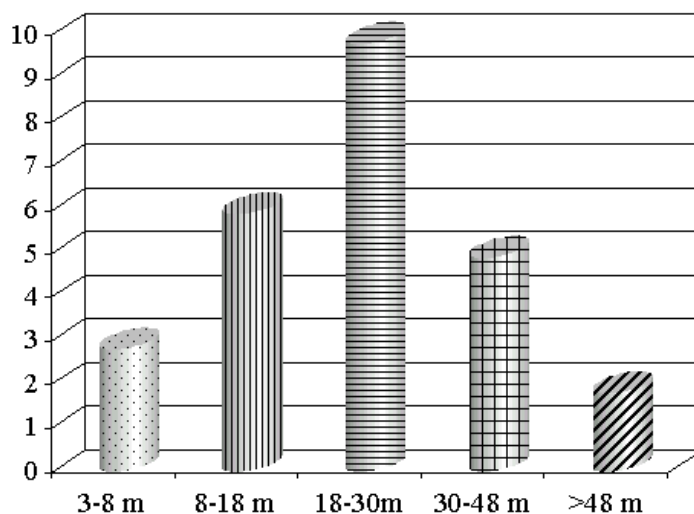


Figure 1 – Delay of symptoms prior to surgery
Слика 1 – Времетраење на симптомите пред операција

Delay of symptoms ranged from 3 to 48 months with a prevalence of from 18 to 30 months. The explanation lay in the observed distribution of pleomorphic adenomas. Regarding the grade of malignancy, high grade carcinomas always had a shorter delay of symptoms (Figure 2).

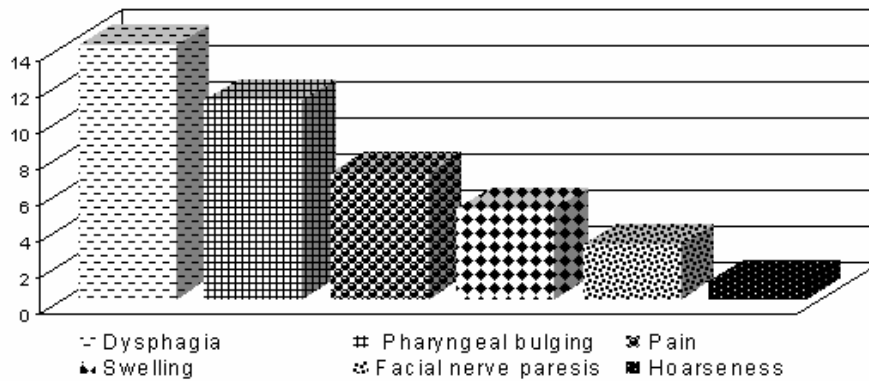


Figure 2 – Clinical symptoms-distribution

Слика 2 – Заступленост на клинички симптоми

The most expressive clinical symptom was dysphagia followed by pharyngeal bulging. A distinct number had swelling and pain, and very few had hoarseness or facial palsy. The last three symptoms were indicative of the malignant group and the degree of their presence had a role as factors influencing survival (Figure 3).

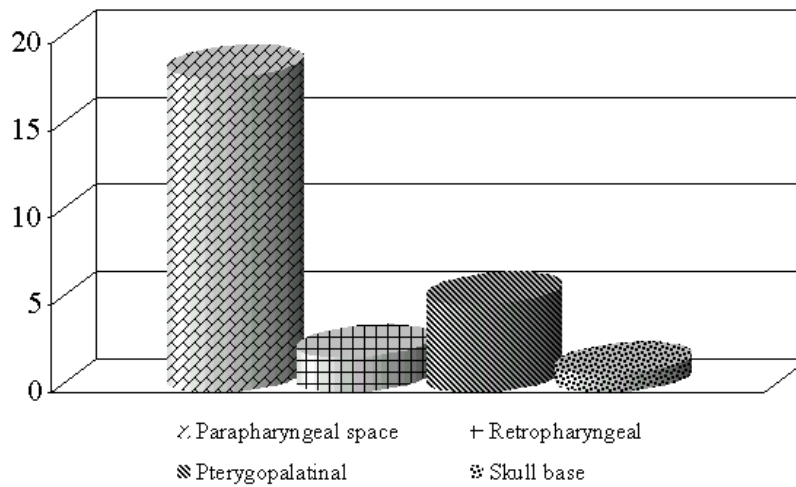


Figure 3 – Tumor extension on imaging and operative findings

Слика 3 – Екстензија на туморои на „imaging“ и ојеративни наоди

Tumour extension on accomplished imaging and operative findings was prevalent in the parapharyngeal space, but in 5 cases of massive deep lobe or malignant neoplasms, the pterygopalatal space was occupied. Only one case extension was to the skull base (Figure 4).

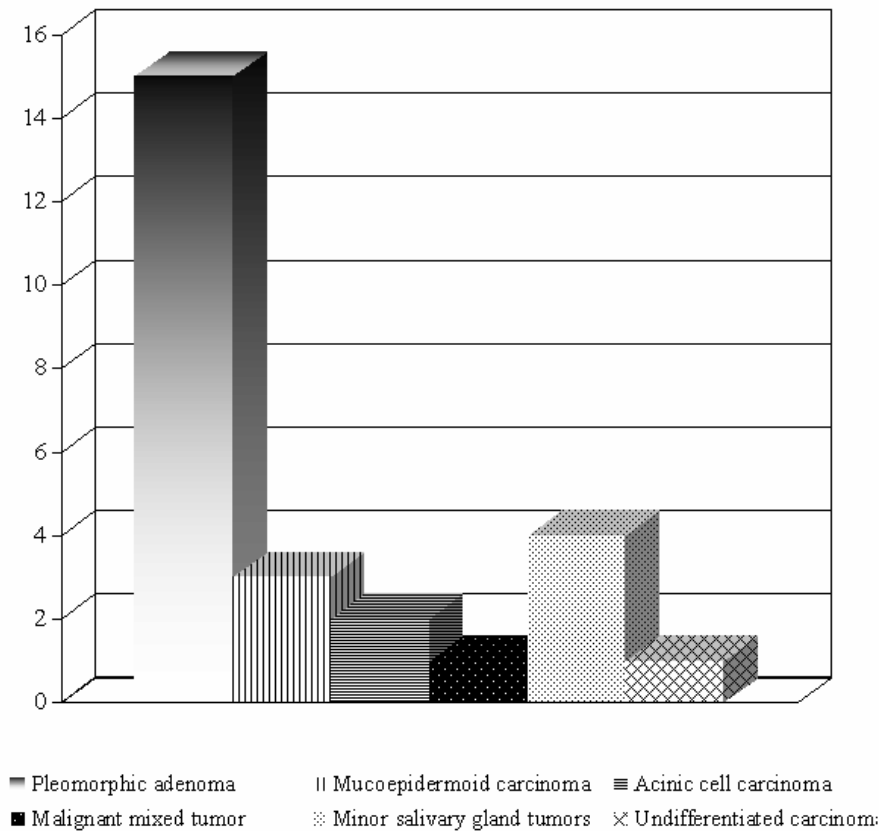


Figure 4 – Tumor comprehension
Слика 4 – Застапаност на типови на тумори

About three quarters of the massive deep lobe neoplasms in our series were benign and were represented exclusively as pleomorphic adenomas. In the malignant group, the most frequent was mucoepidermoid carcinoma as a low-grade malignancy type (Figure 5).

Total parotidectomy, with total preservation of the facial nerve, was the most utilized surgical procedure in this series, followed by radical tumour excisions with or without consequential neck dissection. Mandibulotomy within total parotidectomy was occasionally used (5 cases) and in three cases partial or total resection of the facial nerve was carried out (Figure 6).

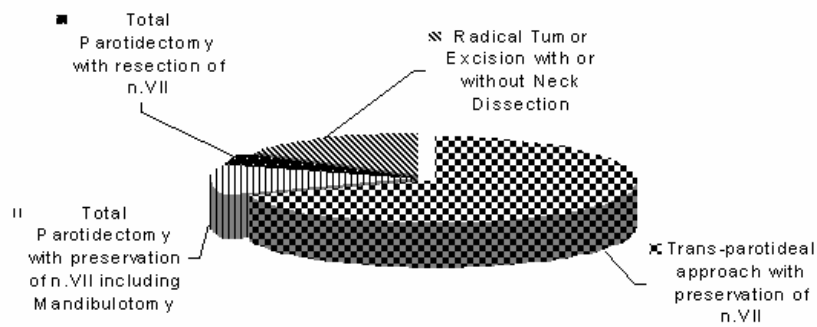


Figure 5 – Type of surgery performed

Слика 5 – Тип на изведени оперативни интервенции

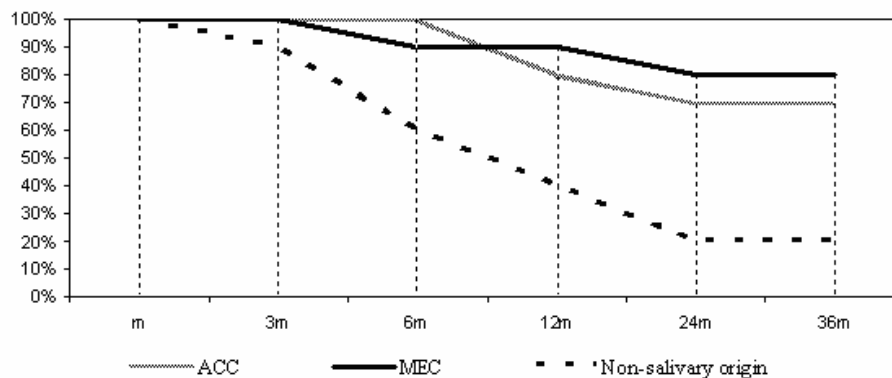


Figure 6 – Cumulative survival figure

Слика 6 – Кумулативно време на преживување

We have completed our result analysis with a cumulative survival figure for the malignant group which reveals that the poorest survival data were obtained from malignant tumours of nonsalivary origin and undifferentiated carcinomas.

Discussion

Regarding the statistical evaluation we compared the sensitivity of separate diagnostics for massive deep lobe parotid and parapharyngeal neoplasms where referring values were operative as well as histological findings. The following is what we have concluded:

An experienced surgeon can usually tell by careful bimanual palpation whether a tumour mass is in the superficial lobe or the deep lobe of the parotid gland. Other clinical symptoms indicate the malignancy of the lesion. However, the necessary preoperative assessment for such hazardous surgery can be established only by schematic analysis of the CT and MR imaging scans with maximal diagnostic significance of MRI. Sialography has no statistical significant correlation for deep lobe neoplasms.

By virtue of its superior potential for soft-tissue contrast resolution, lack of bone and dental artifacts, obviation of the need for contrast material and direct multiplanar imaging capability, MRI should be expanded and fully utilized to image deep lobe neoplasms (Figure 7 and 8).

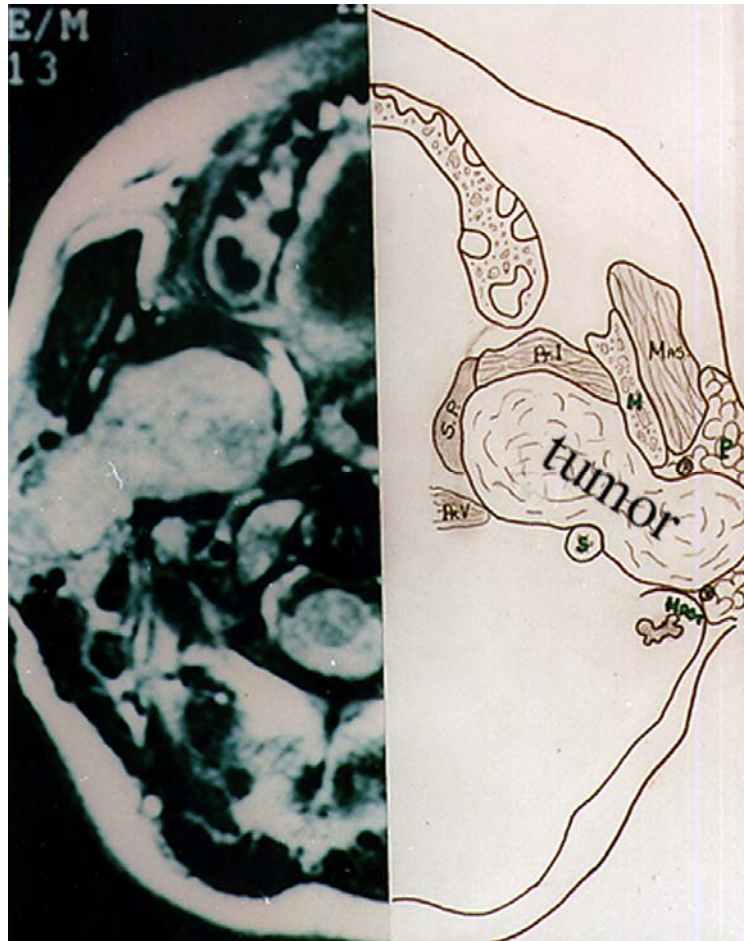


Figure 7 – MRI of deep lobe pleomorphic adenoma with dumb-bell shape
 Слика 7 – МР приказ на плеоморфен аденом во длабок паротиден лобус
 со форма на песочен часовник



Figure 8 – CT of parapharyngeal mucoidercinoma with round shape
 Слика 8 – КТ приказ на парафарингеално екстендиран мукоједермоиден
 карцином со тојчестја форма

The real advantage of MR imaging in evaluating massive deep lobe neoplasms lies in its ability to reveal the deep lobe intraparotid or parapharyngeal-extraparotid location of a tumour mass, and in lesions of small and medium size it can demonstrate the relationship of the tumour depth to the facial nerve. In larger masses identification of the nerve is more difficult or impossible but it is important to note that MR images can show the extent of nerve involvement.

A great advantage of such imaging modalities is the ability to distinguish deep lobe tumours in preoperative planning.

Teresi [11] initialized these investigations with MRI *visualization of the facial nerve* on angled axial scans using surface coils. Therefore he identified the neoplasms depth to the facial nerve and intraparotid localization when a parapharyngeal layer of fat and areolar tissue persists.

Smith [12] suggests that determining factors for deep lobe neoplasms should be the Stensens duct and predicting the course of the facial nerve by creating an arc 8.5mm from the posterior edge of the mandible.

Som, Biller and Cross [13] have pointed out that deep lobe neoplasms displace the internal carotid artery posteriorly while parapharyngeal tumours mostly do so anteriorly.

Aryoshis' [14] proposal relates to the facial nerve line FNL, the line the connecting lateral surface of the posterior belly of the digastric muscle and the lateral surface of the ascending ramus (Figure 9 and 10).

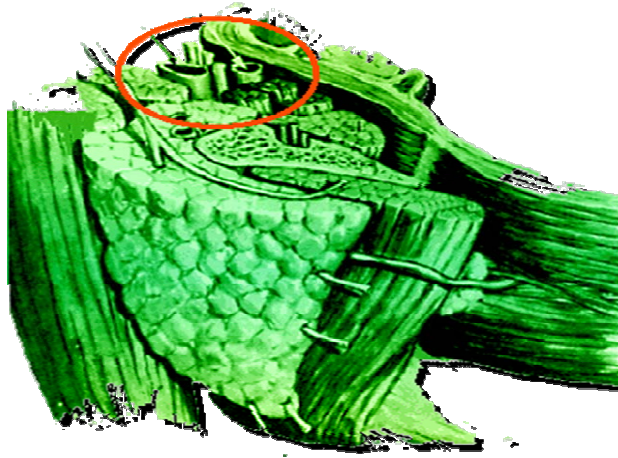


Figure 9 – 3D structural view of parapharyngeal space
 Слика 9 – Трoдимензионален њoјo-анaјњoмски aсњeкт њa њaрaфaринџeалнoј њрoсњoр

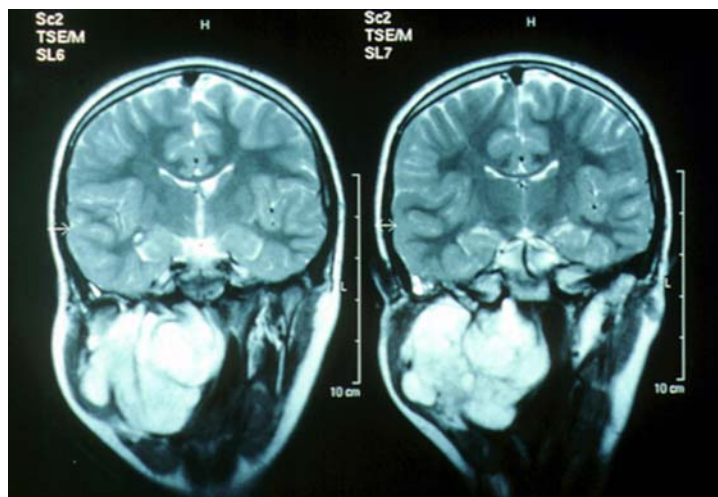


Figure 10 – Coronal MRI of malignant parapharyngeal neoplasm with extension to skull base
 Слика 10 – Кoрoнaрeн МР њрeкaз нa мaлeњнoм нa њaрaфaринџe c o eкcњeнзијa кoн бaзa нa крaниум

Our method confirmed the significance of distinguishing deep lobe tumours in preoperative planning by determining the Facial Nerve Plane (FNP) on CT scans as a cross-section of the triangle formed on the bordering osseous landmarks in the parotid region.

Such facilities in preoperative planning were an encouragement for surgical advancement to more radical and exact surgical approaches [15].

Currently, the *transoral* approach has almost been abandoned, because of the high risk of tumour spreading and of the limited vascular control (in other words inadequate exposure poses difficult technical activity).

The *transmandibular* and *retro-inframandibular* approaches are the most preferable for parapharyngeal tumours of non-glandular origin.

The most frequently utilized *transparotideal* approach is still effective for deep lobe neoplasms, but its modification as a posterolateral – cervical approach is the most conformable for the majority of these neoplasms [16].

The *skull base* approach is effective when deep lobe neoplasms extend to the infratemporal fossa, typical of the malignant group.

Finally, *salvage* procedures are, as it is well known, reserved for high-grade malignancy and recurrent neoplasms (Figure 11 and 12).

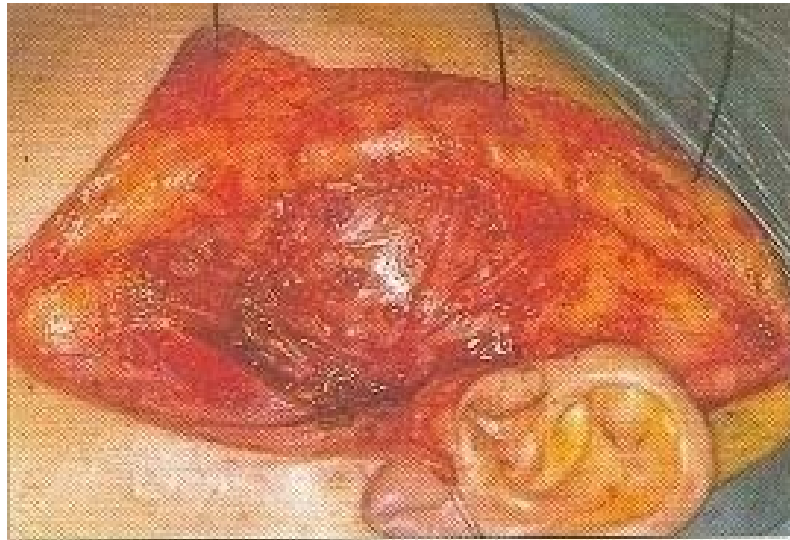
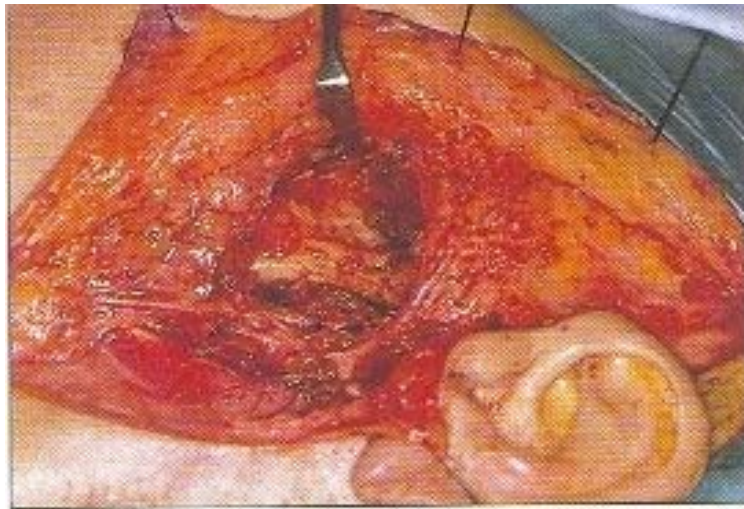


Figure 11 – *Transparotideal approach – superficial lobe removed and tumor mass entirely below the facial nerve and behind mandibular ramus*

Слика 11 – Транспаротийден присїїай – йовришиюїї лобус оїїсїїранейї и їуморойї целосно йод фацїїалнюїї нерв и йозади рамусойї на мандибулаїїа



*Figure 12 – Facial nerve mobilized and tumor removed from parapharyngeal space
Слика 12 – Двојно прејариран и мобилизиран фаџијален нерв и тумор оћсћраней од ѓарафаринџеалниоћ просћор*

The comparable results to previous apropos findings concerning the recurrence rate after surgery of deep lobe neoplasms were a reconfirmation of the preoperative assessment and consequently performed surgical procedure. As was expected, the incidence of recurrence is higher in the malignant group, but without significant correlation to the aggressiveness of surgery [3, 4, 6]. In our opinion such acceptable results are a result of the great advancement in imaging radiology, thereby allowing the expression of surgical skill.

On the other hand, the compared results for facial nerve morbidity are quite satisfactory for such mutilating surgery. Here two cognitions are important to note. First, the incidence of facial nerve involvement varies with the histological type of the tumour, and second the incidence of facial nerve involvement is proportionally correlated to the kind of surgery selected. Partial reconstruction of facial nerve branches was conducted in three cases. Gentle mobilization together with controlled traction of the prepared facial nerve branches decreases the percentage of postoperative facial nerve morbidity [1, 7, 17].

In comparison to other results I have to emphasize that only 3.2% in our series had definitive palsy.

Conclusion

Exact preoperative planning with imaging radiology refinements is approved as a great proficiency in parapharyngeal space-occupying neoplasm

surgery. A Posterolateral transcervical approach with angular mandibular osteotomy gives much better postoperative results.

MRI should be the main choice in the majority of clinical presentations of parapharyngeal neoplasms, with compulsory application in the diagnostic evaluation of the malignant and massive deep lobe parotid neoplasms, leading correspondingly to adequate radical surgery with minimal structural and facial nerve morbidity.

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Резиме

МАСИВНИ НЕОПЛАЗМИ НА ДЛАБОК ПАРОТИДЕН ЛОБУС И ПАРФАРИНГЕАЛНИ ЕКСТЕНЗИВНИ НЕОПЛАЗМИ: СОВРЕМЕН ДИЈАГНОСТИЧКИ И ТЕРАПИСКИ ПРИСТАП

Поповски В.

*Клиника за максилофацијална хирурџија,
Универзитет „Св. Кирил и Методиј“, Скопје, Р. Македонија*

Високата специфичност на регионалните анатомски карактеристики и значително зголемената инциденца на неоплазмите што го зафаќаат парафарингеалниот простор, наметнуваат потреба од акумулација на искуства за адекватен дијагностички пристап за нивно утврдување и софистицирана предоперативна проценка. Туморите на парафарингеалниот простор опфаќаат широк дијапазон на бенигни или малигни неоплазми од различно ткивно потекло.

Направена е комплетна анализа на клиничкиот ток на серија од 26 пациенти оперативнo третирани на нашата клиника со потврдена парафарингеална неоплазма. Беше изведен рутински дијагностички алгоритам за неоплазми на паротидна жожа и парафаринкс, проследен со соодветна хируршка процедура како и адекватни модификации. Артериографија беше изведена само кога имаше суспектност за постоење на гломус тумор или ако беше евидентно зафаќање на каротидни крвни садови со ризик од нивно повредување при хируршкиот зафат. Добиените резултати од статистичката евалуација укажуваат на високо сигнификантна корелираност на „imaging“ анализите од компјутеризираната томографија (КТ) и на магнетната резонанца (МР) со утврдувањето на локализацијата и екстензијата на неоплазмата. МР беше доминантна при утврдување на карактерот на туморот и колизијата со фацијалниот нерв. Транспаротидниот пристап се потврдува како најефективен хируршки пристап, вклучувајќи и две модификации. Кога се

диференцира евнтуален парафарингеален тумор, најчесто треба да се очекува тумор од длабокиот лобус на паротидната жлезда. Преку егзактно предоперативно планирање со најновите модалитети на „imaging“ радиолошките техники и хируршкиот пристап со постеролатералната паротидектомија и ангуларната остеотомија на мандибулата, се добиваат многу подобри постоперативни резултати во оперативниот третман на овие тумори.

Клучни зборови: парафарингеални неоплазми, паротидни неоплазми, фацијален нерв, магнетна резонанца, компјутеризирана томографија, остеотомија, паротидектомија.

Corresponding Author:

Popovski Vladimir
Clinic for Maxillofacial Surgery,
Ss Cyril and Methodius University,
1000 Skopje, R. Macedonia
Phone: +389 2 3132055
Fax: +389 2 3238464

E-mail: mvep@freemail.org.mk

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парафаринксот

Figure 1. Delay of symptoms prior to surgery

Слика 1. Времетраење на симптомите пред операција

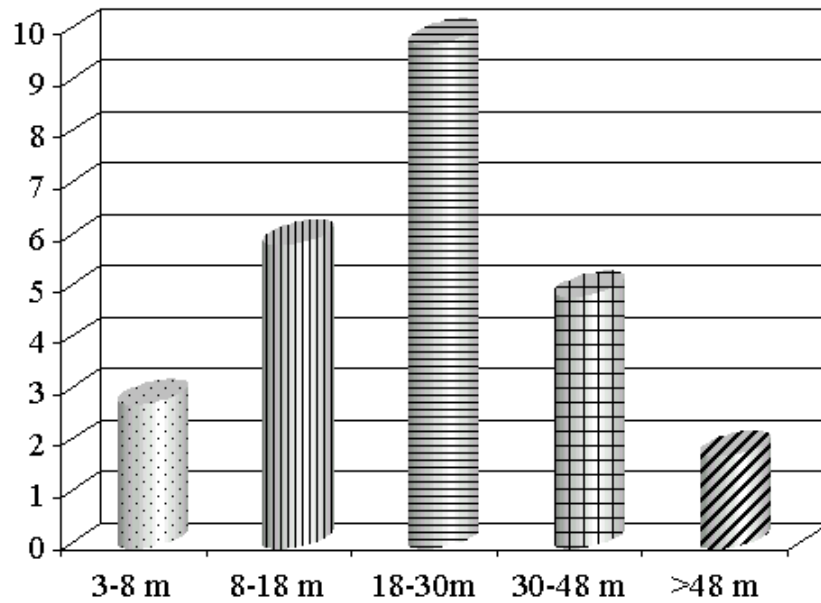


Figure 2. Clinical symptoms-distribution
Слика 2. Застапеност на клинички симптоми

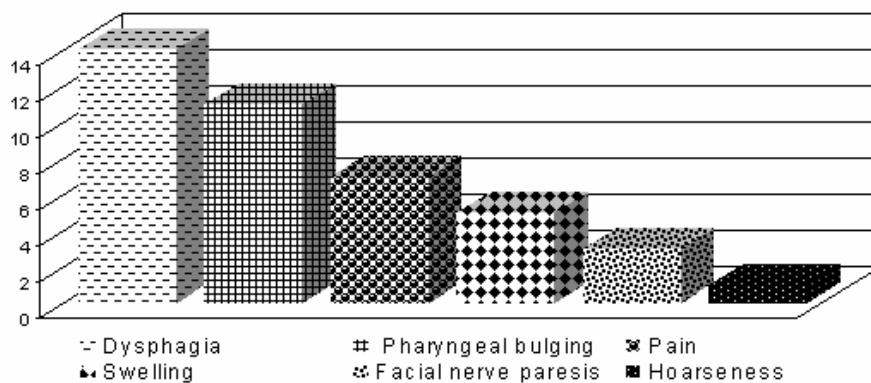


Figure 3. Tumor extension on imaging and operative findings
Слика 3. Екстензија на туморот на имиџинг и оперативни наоди

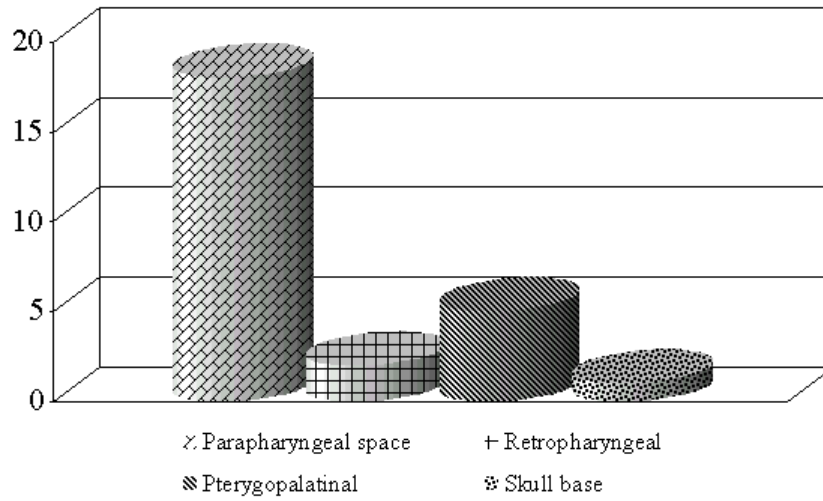


Figure 4. Tumor comprehension

Слика 4. Застапеност на типови на тумори

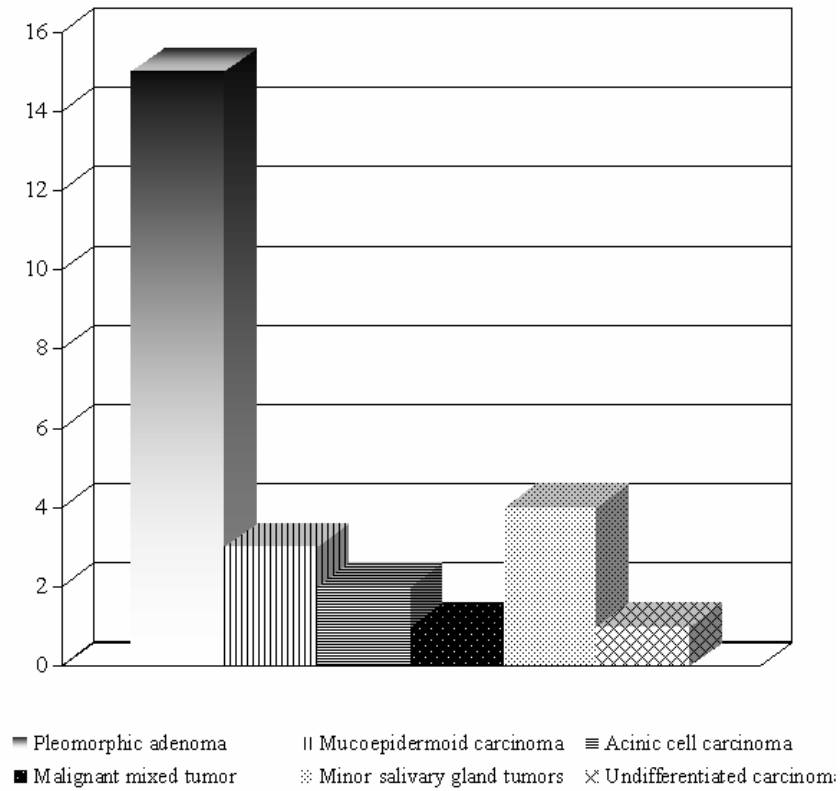


Figure 5. Type of surgery performed
Слика 5. Тип на изведени оперативни интервенции

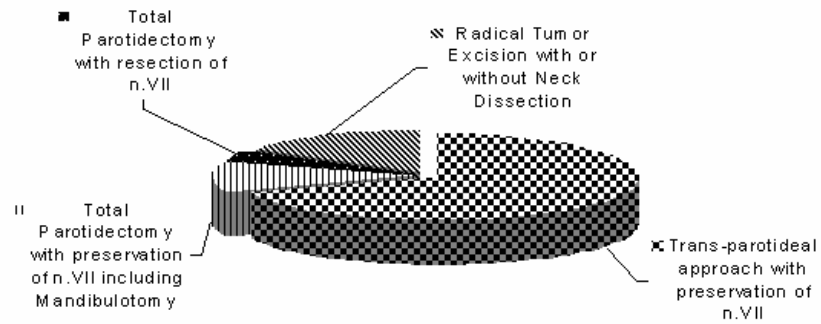


Figure 6. Cumulative survival figure

Слика 6. Кумулативно време на преживување

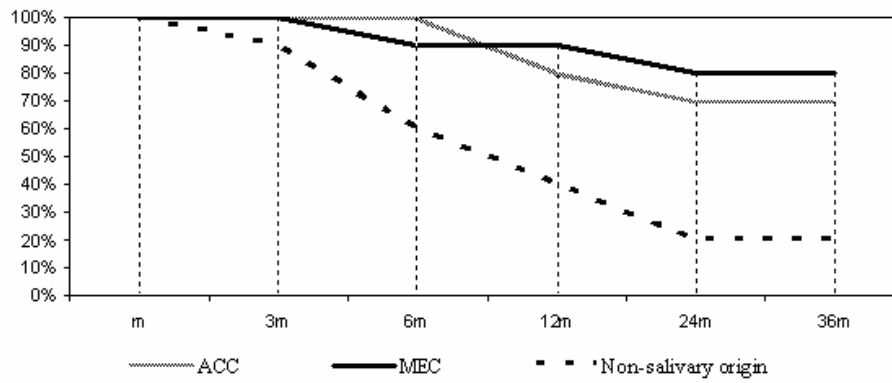


Figure 7. MRI of deep lobe pleomorphic adenoma with dumb-bell shape

Слика 7. МР приказ ма плеоморфен аденом во длабок паротиден лобус со форма на песочен часовник

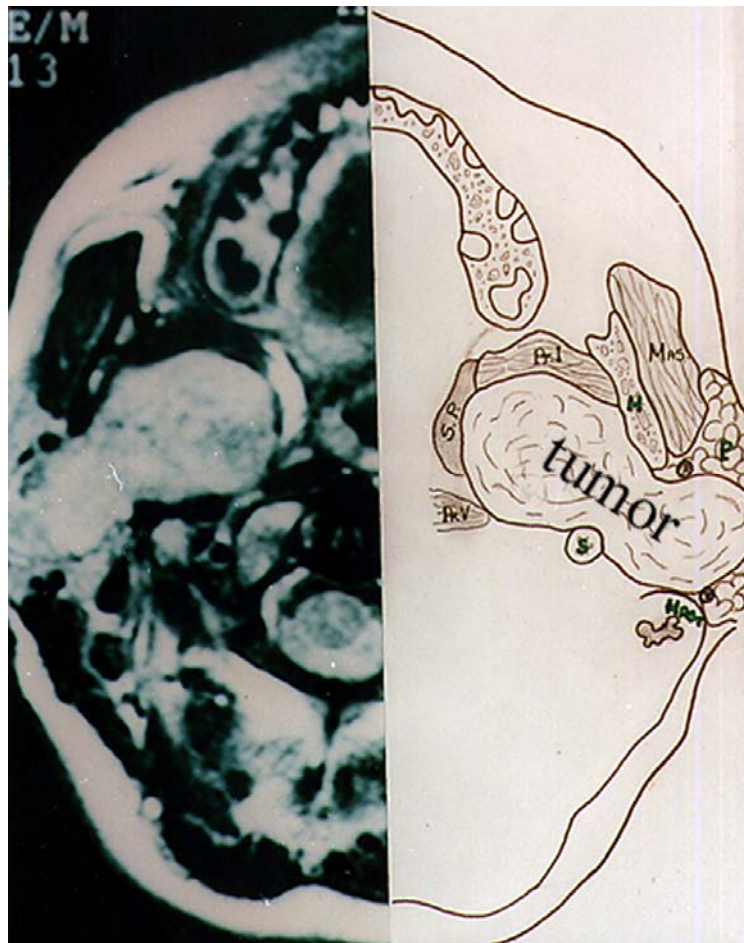


Figure 8. CT of parapharyngeal mucoepidermoid carcinoma with round shape

Слика 8. КТ приказ на парафарингеално екстендиран мукопедермоиден карцином со топчеста форма



Figure 9 – 3D structural view of parapharyngeal space
Слика 9 – Тродимензионален шoйo-анaшoмски aсшeкш на
шaрaфaршншeалншoш шрoсшoр

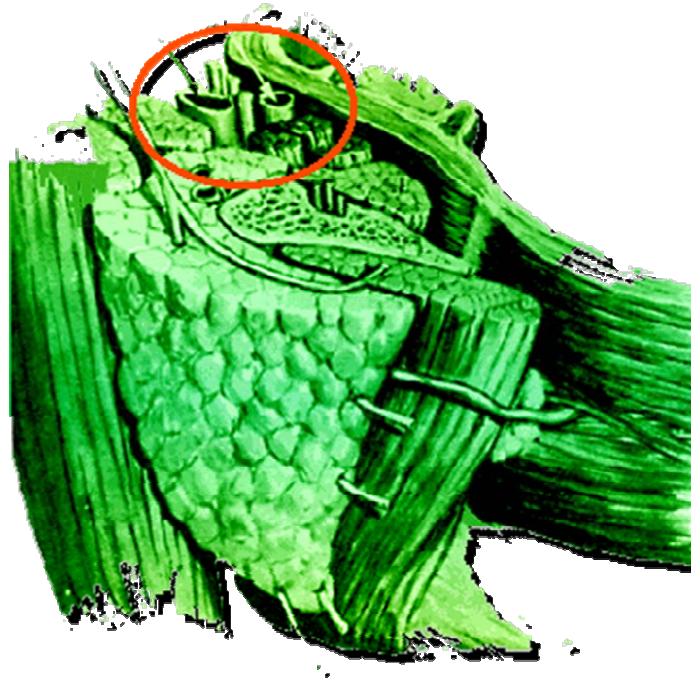


Figure 10 – Coronal MRI of malignant parapharyngeal neoplasm with extension to skull base

Слика 10 – Коронарен МР приказ на малигном на парафаронкс со екстензија кон база на краниум

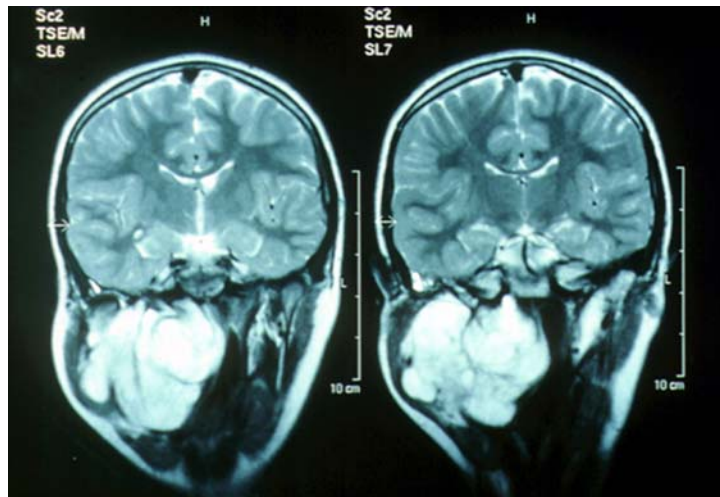
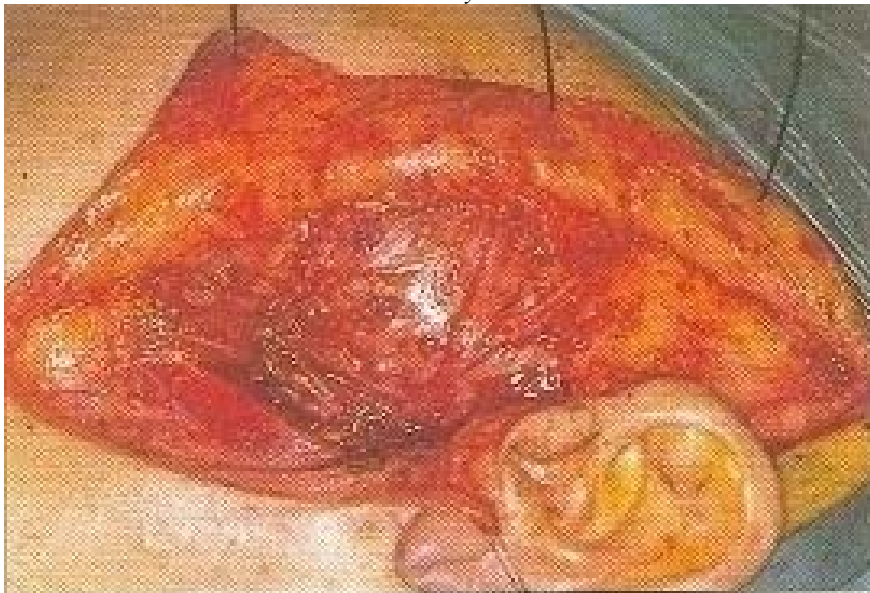
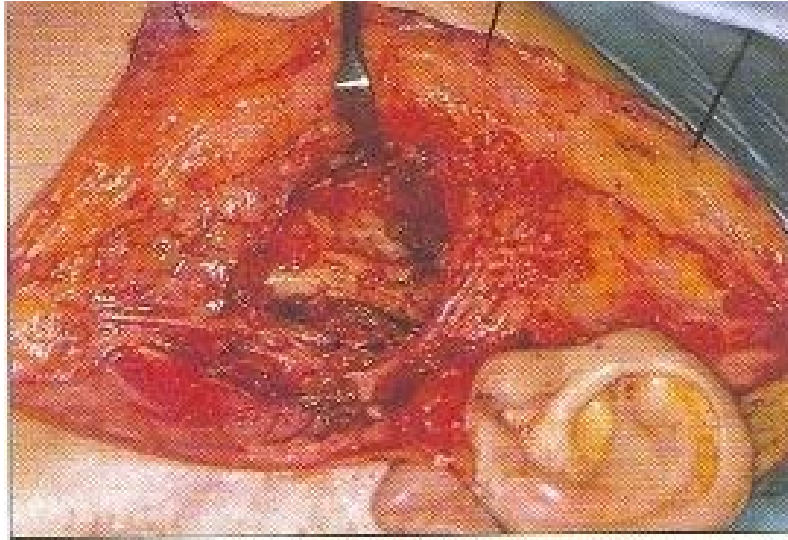


Figure 11 – Transparotideal approach-superficial lobe removed and tumor mass entirely below the facial nerve and behind mandibular ramus

Слика 11 – Транспаротиден йрисійай-йовршиної лобус ойсіраней і йшуморій во целосій исїод фаціјалної нерв и йозади рамусої на мандибула



*Figure 12 – Facial nerve mobilized and tumor removed from parapharyngeal space
Слика 12 – Двојно прејариран и мобилизиран фаџијален нерв и тумороић
ојсџиранетј од парафарингеален јросџор*



Резиме:

МАСИВНИ НЕОПЛАЗМИ НА ДЛАБОК ПАРОТИДЕН ЛОБУС И ПАРФАРИНГЕАЛНИ ЕКСТЕНЗИВНИ НЕОПЛАЗМИ: СОВРЕМЕН ДИЈАГНОСТИЧКИ И ТЕРАПИСКИ ПРИСТАП

В. Поповски

*Клиника за максилофаџијална хирурџија, Универзијетј “Св. Кирил и
Метјодиј”, Скопје, Р. Македонија*

Високата специфичност на регионалните анатомски карактеристики и значително зголемената инциденца на неоплазмите што го зафаќаат парафарингеалниот простор, наметнуваат потреба од акумулација на искуства за адекватен дијагностички пристап за нивно утврдување и софистицирана предоперативна проценка. Туморите на парафарингеалниот простор опфаќаат широк дијапазон на бенигни или малигни неоплазми од различно ткивно потекло.

Направена е комплетна анализа на клиничкиот ток на серија од 26 пациенти оперативно третираны на нашата клиника со потврдена парафарингеална неоплазма. Беше изведуван рутински дијагностички алгоритам за неоплазми на паротидна жожа и парафаринкс, проследен со соодветна хируршка процедура како и адекватни модификации. Артериографија беше изведувана само кога имаше суспектност за постоење

на гломус тумор или ако беше евидентно зафаќање на каротидни крвни садови со ризик од нивно повредување при хируршкиот зафат. Добиените резултати од статистичката евалуација укажуваат на високо сигнификантна корелираност на имиџинг анализите од компјутеризираната томографија (КТ) и магнетната резонанција (МР) со утврдувањето на локализацијата и екстензијата на неоплазмата. МР беше доминантна при утврдување на карактерот на туморот и колизијата со фацијалниот нерв. Транспаротидниот пристап се потврдува како најефективен хируршки пристап, вклучувајќи и две модификации. Кога се диференцира евнтуален парафарингеален тумор, најчесто треба да се очекува тумор од длабокиот лобус на паротидната жлезда. Преку екзактно предоперативно планирање со најновите модалитети на имиџинг радиолошките техники и хируршки пристап со постеролатерална паротидектомија и ангуларна остеотомија на мандибулата, се добиваат многу подобри постоперативни резултати во оперативниот третман на овие тумори.

Клучни зборови: Парафарингеални неоплазми, паротидни неоплазми, фацијален нерв, магнетна резонанца, компјутеризирана томографија, остеотомија, паротидектомија.

Авџорска нотификација: Напоменуваме дека значаен дел од трудот беше презентираан во одбрани орални презентации на 18-тиот Европски конгрес за Краниомаксифацијална хирургија во Барселона, Шпанија, во септември 2006 година.

Corresponding author:
Popovski Vladimir
Clinic for Maxillofacial Surgery,
Ss Cyril and Methodius University,
1000 Skopje,
R. Macedonia
Phone: +389 2 3132055
Fax: +389 2 3238464
e-mail: mvep@freemail.org.mk