Advantages of MIR Versus CT in Diagnosis of Meningiomas

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SUMMARY. Introduction, Meningiomas are slow growing tumors, with a huge substructure in dura mater, which constitute from neoplastic meningothelial cells. They are more often present in adults. Majority of meningiomas are benign and are classified in I grade according to the WHO grade. The aim of the study is to present the development of meningiomas respectively of meningiomas of the basis crani anterior during 2007-2009 year period, in UCCK and General Hospital "Aloka", in Prishtina, and the effectiveness of imaging (CT and MRI) in their diagnostics. Methods, A prospective study, where patients with meningiomas were evaluated continually according to imaging protocols and cases were verified by microscopy. All patients underwent CT scan and MRI imaging with CT–"Siemens-Emotion 6" in UCCK, and CT -"Philips-Aura" in general hospital "Aloka" and MRI 1.5T "Siemens Magnetom Symphony". Results were analyzed with a statistical program InStat 3. From statistical parameters are used, percentage, mean and standard deviation. For data testing we have used the unparametric tests; proportional t–test (Z-value) and X2–test with significant level $p< 0.05$ and $p<0.01$. Results are presented with tables, graphics and CT scan/ MRI images. Results, During this period were diagnosed 31 cases of meningiomas. Eleven cases were meningiomas of basis crani anterior, out of which 2 cases were olfactory meningiomas, 5 cases were sphenoidal and 4 cases were suprasellar meningiomas. The highest percentage of meningiomas was found at the group age 51–60 with 13 cases or (41.9%). There is a domination of female gender upon the male gender (64.5%:35.5%). CT is the main method in diagnosis of meningiomas, but MRI revealed the relations of tumor with surrounding vessels, which have the great importance during surgical interventions. Conclusions, This study documents the priority of MRI as the most applicable method of examination in the detection of the meningeomas, due to the accurate and sensitive data that it provides–100% versus CT of brain, which has an accuracy of 95%, specifity 95% and positive predictive value 91%. **Keywords: Meningiomas of basis crani anterior, CT, MRI, Prishtine, Republic of Kosova**

1. INTRODUCTION

Meningiomas are nonglial (extraaksial) tumors and contain 20-25% of all intracranial tumors, however they are most frequently occurred tumors (1,2). A part of the tumors remain undiagnosed because they show no clinical symptoms, the other part is diagnosed accidentally during CT or MRI examinations, although the major part of the tumors is diagnosed after clinical symptoms.

Generally, the tumor mass in CT and MRI examinations are shown in two different forms: as a round mass or outspread as a plate (en plaque) (3,4). Without intravenous contrast, the mass occurs as a well limited round mass, extra axial, which shift the brain to the opposite side. The tumor mass is usually homogeneous, hyperdence respectively hyperintence, contains Ca++ deposits (20-25%). Some of the tumors are completely calcificated (Meningioma psammomatous) (5). Edema is present in 60% of meningioma, which is linked to the toxic effect of tumor, with the compromise of venous drainage and the speed of tumor increase. In the examination of intravenous contrast the well vascularized tumor, in 90% of cases, is emphasized uniformly and the mass is usually homogeneous, hyperdense, and rare small hypodense zones are present (6).

Years	Meningiomas	%	Incidence 100000	Meningiomas basis crani anterior	%	Incidence 100000
2007	9	29.0	0.43	4	36.4	0.19
2008	11	35.5	0.52	2	18.2	0.10
2009	11	35.5	0.52	5	45.5	0.24
Total	31	100.0	1.47	11	100.0	0.52

Table 1 Meningiomas and Meningiomas of the basis crani anterior during the years and their incidence

Years		Meningiomas					Meningiomas of basis crani anterior				
		Total	Male		Female		Total	Male		Female	
			N	%	N	%		N	%	N	%
2007		9	2	18.2	7	35	4	1	25	3	42.9
2008		11	6	54.5	5	25	2	1	-	1	14.3
2009		11	3	27.3	8	40	5	2	-	3	42.9
Total	N	31	11	100	20	100	11	4	100	7	100
	%	100	35.5	-	64.5	-	100	36.4	-	63.6	-

Table 2 Meningiomas and Meningiomas of the basis crani anterior during the years and gender X2 test=2.61, p=0.106 ; p>0.05

Besides the intracranial mass, osseous modifications in the form of hyperostosis or erosions are evident (7-9).

In MRI, meningioma is well differentiated from the brain tissues, where there is a small amount of cerebrospinal liquor between them. In T1, they represent isodense or hyperdense compared to brain cortex.(10-12) MRI is important in detecting small meningiomas that have the same density as the brain cortex, and the flat plaque, too. In some cases, tumor mass shows emphasis and thickness of dura (dural tail), the presence of this image serves for a secure diagnose of meningiomas (13-17). Some authors interpret dural tail as a reaction of dura; some others interpret it as an extension of tumor.

2. AIM

The aim of the study is to present the development of meningiomas respectively of meningiomas of the basis crani anterior during 2007-2009 year period, in UCCK and General Hospital "Aloka", in Prishtina, and the effectiveness of imaging (CT and MRI) in early diagnosis, in order to prevent recidivism and malignization of present tumor.

3. METHODS

We studied 31 consecutive patients, respectively 11 patients, who were referred for diagnostic evaluation and treatment in Department of Radiology, Clinic of Neurosurgery of University Clinical Centre of Kosova (UCCK) and General hospital "Aloka" in Prishtina, in a period between 2007-2009. This is a prospective study, where patients with meningiomas were evaluated continually according to imaging protocols and cases were verified by microscopy. All patients underwent CT scan and MRI imaging with CT– "Siemens-Emotion 6" in UCCK, CT -"Philips-Aura" in general hospital "Aloka" and MRI 1.5T "Siemens Magnetom Symphony" (Sequences SagT1, AxT1, AxT2 FSE/TSE, AxFLAIR FSE/TSE, AxDWI / ADC / Bo, Cor T2 FSE/TSE). Results were analyzed with a statistical program InStat 3. From statistical parameters we used: percentage, mean and standard deviation. For data testing we have used the non-parametric tests; proportional t–test (Z-value) and X^2–test with significant level p< 0.05 and p<0.01. Results are presented with tables, graphics and CT scan/ MRI images

4. RESULTS

The highest number of meningiomas was registered in 2008 and 2009 with 11 cases (35.5%) each, however the smallest number was recorded during year 2007 with 9 cases (29%).

The increased rate of morbidity was recorded during years 2008 and 2009, with 052/100000 inhabitants, the reduced rate was evident during year 2007 with 043/100000 inhabitants.

During the period 2007-2009, from the total number of menin-

Age-group	Gender				Total	
	Male		Female			
	N	%	N	%	N	%
<20	-	-	-	-	-	-
21- 30	1	-	-	-	1	3.2
31- 40	2	18.2	1	5	3	9.7
41- 50	1	9.1	4	20	5	16.1
51- 60	4	36.4	9	45	13	41.9
61- 70	3	27.3	5	25	8	25.8
70 +	-	-	1	-	1	3.2
Total	11	100	20	100	31	100
Mean ± SD	51.5 ± 10.2		56.5 ± 5.0		54.7 ± 4.0	
t-test, p-value	t = 1.843, p=0.0756					
X2-test, p-value	X^2-testi=2.61, p=0.106					

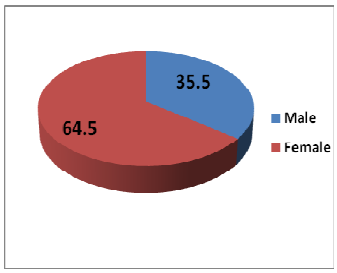
Table 3 Meningiomas according to age and gender

Meningiomas according to localization							
M. olfactory		M. sphenoidale		M. suprasellare		Total	
N	%	N	%	N	%	N	%
2	18.2	5	45.5	4	36.4	11	100

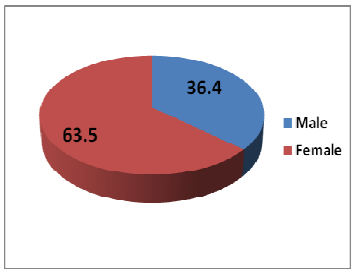
Table 4 Classification of meningiomas according to localization

	Sensitivity	Specificity	Positive Predictive Value
CT	95%	90.40%	91%
MRI	100%	100%	100%

Table 5 Evidences for sensitivity and specificity of brain MRI in comparison with CT for diagnosis of meningiomas



Graph 1 Meningiomas according to gender



Graph 1a Meningiomas of basis crani anterior according to gender

giomas localized basis crani anterior, the largest number was detected during year 2009 with 5 cases (45.5%), the smallest number during year 2008 with 2 cases (18.2%).

The increased incidence was recorded during year 2006 with 0.24:100000 inhabitants, the reduced rate was evident during year 2008 with 0.10:100000 inhabitants (Table 1).

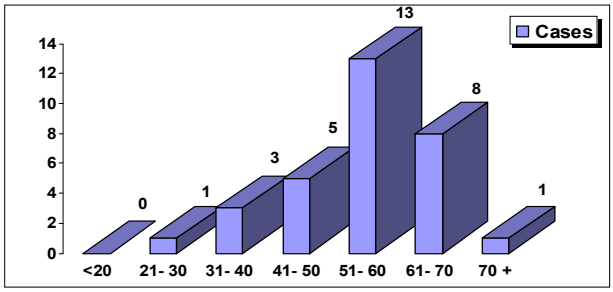
According to the gender, there is a domination of female gender, but with no significant difference X^2 test=2.61, p=0.106 so p>0.05.

From the total number of meningiomas (n=31) detected in our two clinics during 2007-2009 year period, female patients dominate with 20 cases (64.5%), in correlation with male gender, 11 cases (35.5%).

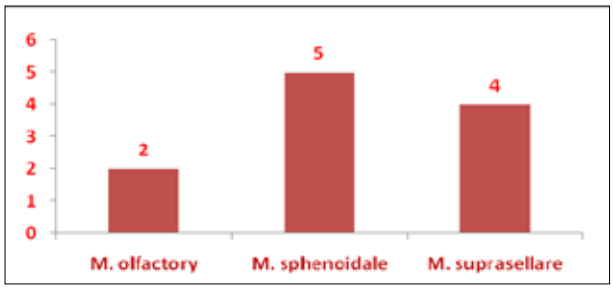
From the total number of meningiomas (n=11) localized in anterior basis crani, detected in our two clinics during 2007-2009 year period, female patients dominate with 7 cases (63.6%), in correlation with male gender, 4 cases (36.4%) (Table 2 & Graph 1 and 1a).

Meningiomas frequently attacked the patients 51-60 years old, in 13 cases or 41.9%, and 61-70 years old patients, 8 cases or 25.8%, however the younger patients were less attacked. The mean age for patients was 54.7 yr. (SD ± 4.0 yr). The mean age for male patients was 51.5 yr. (SD ± 10.2 yr.), and for female patients was 56.5 yr. (SD± 5.0 yr.). The calculation with the t-test shows no significant difference in patients with regards to gender (T = 1.843, p>0.05), (Table 3 and Graph 2).

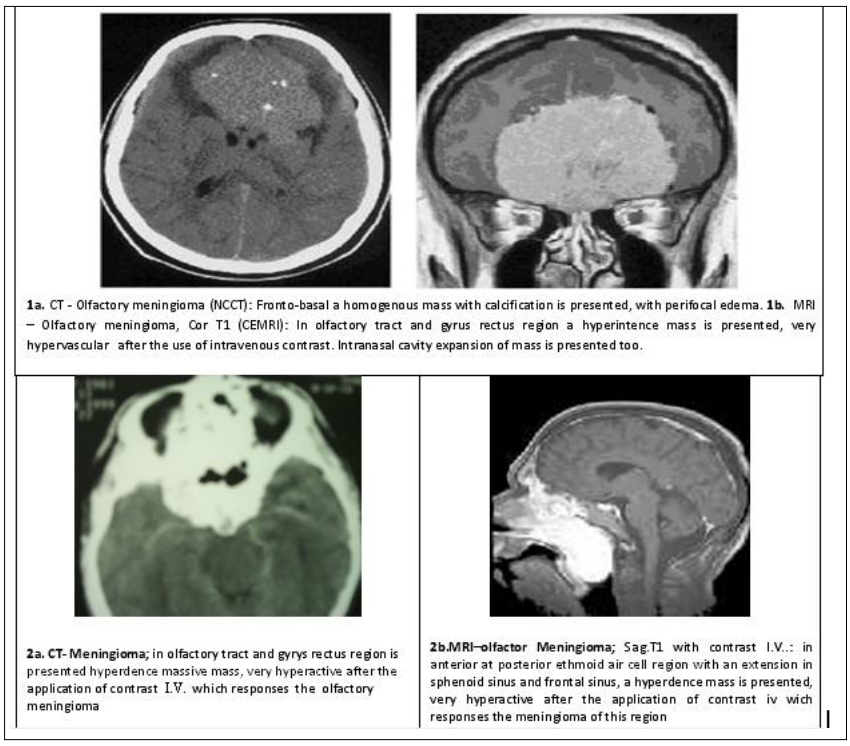
From the total number of meningiomas (n=31), detected during this period, only 11 are localized in bassis crani anterior, 45.5% of that was sphenoidal, 36.4% was suprasellar and 18.2% was olfactory (Table 4 and Graph 3). With CT and MRI we are enable to have the correct histological diagnosis of basis crani meningiomas in most of cases and to predict the patient outcomes. In about 20-30% of meningiomas recidives occurred after surgical excision of tumor. In differential diagnosis was included glioma, schvanoma, metastasis, hemangioma etc. MRI is the most applicable method of examination in the detection of the meningeomas, due to the accurate and sensitive provided dates–100% versus CT of brain, which has an accuracy of 95%, specifity 95% and positive predictive value 91%, (Table 5).



Graph 2 Meningiomas according to age



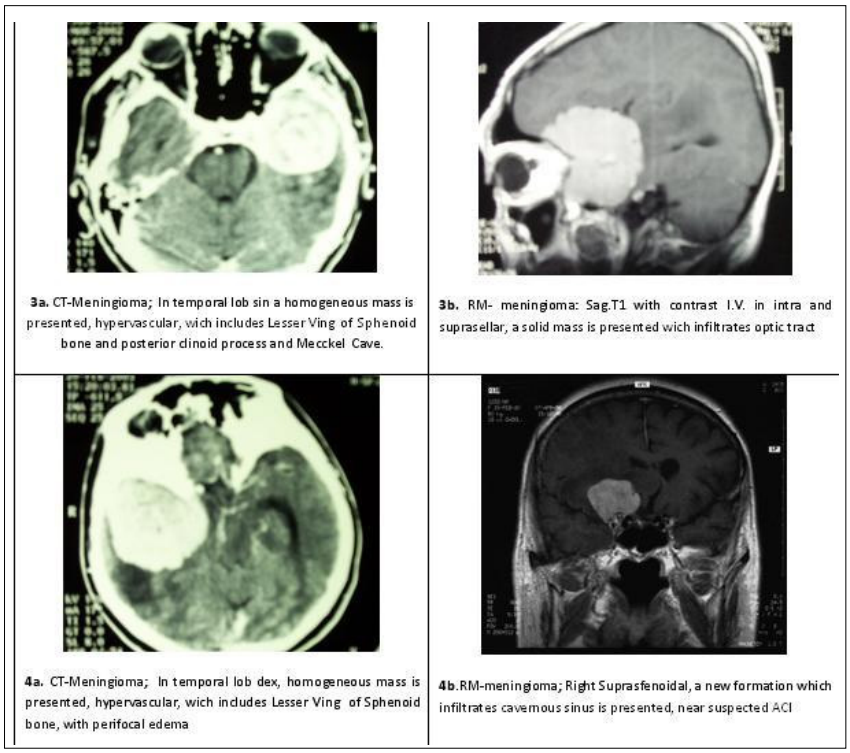
Graph 3 Classification of meningiomas according to localization



Images 1a, 1b, 2a, 2b CT and MRI images of meningiomas of basis crani anterior

5. DISCUSSION

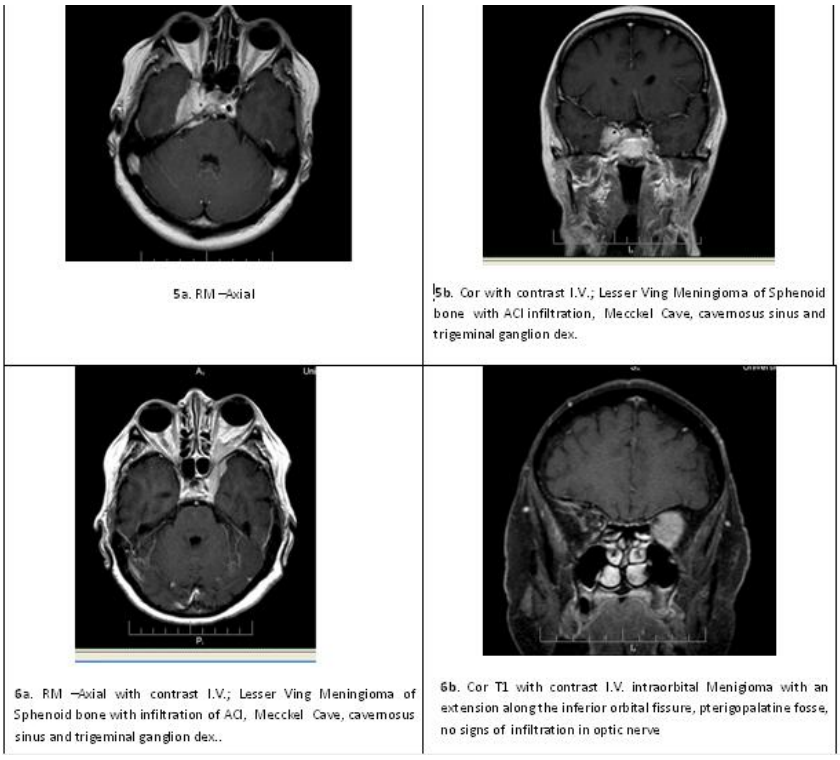
Meningiomas in CT and MRI



Images 3a, 3b, 4a, 4b CT and MRI images of meningiomas of basis crani anterior

are presented as extra-acsial mass, usually homogeneous, hyperdence respectively hyperintence and may be calcificated (20/25%) (18,19). Contrast i.v. has a crucial role in accurate diagnosis of MRI, because meningiomas are very hypervascular and are amplified by the contrast. Despite the fact that menigiomas are primarily diagnosed with CT (this only has priority in detection of calcifications) (19), for practical purposes the basis menigiomas in anterior crani are divided in: olfactory m., sphenoidal m., suprasellar m., where from the total number (31 cases) of meningiomas diagnosed in UCCK and in the general hospital "Aloka" in Pristina, only 11 cases are those located in basis crani anterior, most of them had sphenoidal localization with 45.5% and a few of them olfactory with 9.1% which is consistent with data from literature.

In our investigation, from the total number of meningiomas, the largest number of cases was recorded in 2008 and 2009 with 11 cases (35.5%) and higher incidence of 0.52:100000 inhabitants, while for the meningiomas of basis crani anterior, the largest number of cases was recorded in 2007 and 2009 with 4 cases (40%) and higher incidence of 0.19:100000 inhabitants. In UCCK and general hospital "Aloka" in Pristina, the incidence of meningiomas during 2007-2009 was 1.4 in 100,000 inhabitants, while in the studies made in different countries of the world incidence varies (in Nordic countries: Denmark, Finland, Norway and Sweden, the incidence of meningiomas was 1.9 to 4.5 in 100,000 inhabitants, where the incidence for men was 1.4–1.9 in 100,000 and 2.6–4.5 in 100,000 for females, while the ratio F: M was 3.5:1 (20) In Finland, in 2001, the incidence was 2.9 in 100,000 for males and 13.0 in 100,000 for females. In the U.S., in 2006, the incidence for men was 1.8 and for women was 4.2 in 100,000–2006 (21) The most attacked age group was 51-60 with 13 cases or 41.9%, while the young age group was rarely attacked. The average age of patients was 54.7 years (SD ± 4.0 years). The average age of male patients was 51.5 years (SD ± 10.2 years), while the female patients was 56.5 years (SD ± 5.0 years). There is significant statistical difference between the average age of patients by gender (t = 1843, p> 0.05).



Images 5a, 5b, 6a, 6b CT and MRI images of meningiomas of basis crani anterior

From the total number of meningeomas (n = 31), during the 2007-2009 time period, dominate the females upon males, were the ratio is 64.5%: 35.5%, but there is no significant difference test X2=2.61, p=106 then p> 0:05. Enhancement of the ratio F: M in the

35-59 age group is explained in ratio with hormones as a main cause in the growth of tumors percentage in women in this age group, that consists with our data, (22).

6. CONCLUSIONS

The incidence of meningiomas in Kosovo is lower compared with other states.

The most attacked age groups by meningeomas were older age groups, with a significant difference compared with the young age groups (t=1.843, p>0.05).

There is a domination of female gender upon the male gender, but with no significant difference (X^2 testi=2.61, p=0.106, p>0.05).

This study documents the advantages of MRI as the most applicable method of examination in the detection of the meningeomas, due to the accurate and sensitive datas that it provides–100% versus CT of brain, which has an accuracy of 95%, specifity 95% and positive predictive value 91%.

Competing interests: Authors declare that they have no competing interests

Author's contribution: SK created of manuscript skeleton, SM has crate the main research, IA established the classification of tables and figures, HY has made images , SD has participated in design study, NS participated in comparisons between our study and others, HH participated in the design of the study and HF drafted manuscript and participate in additional correction and design

All authors have read and approved the final manuscript

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