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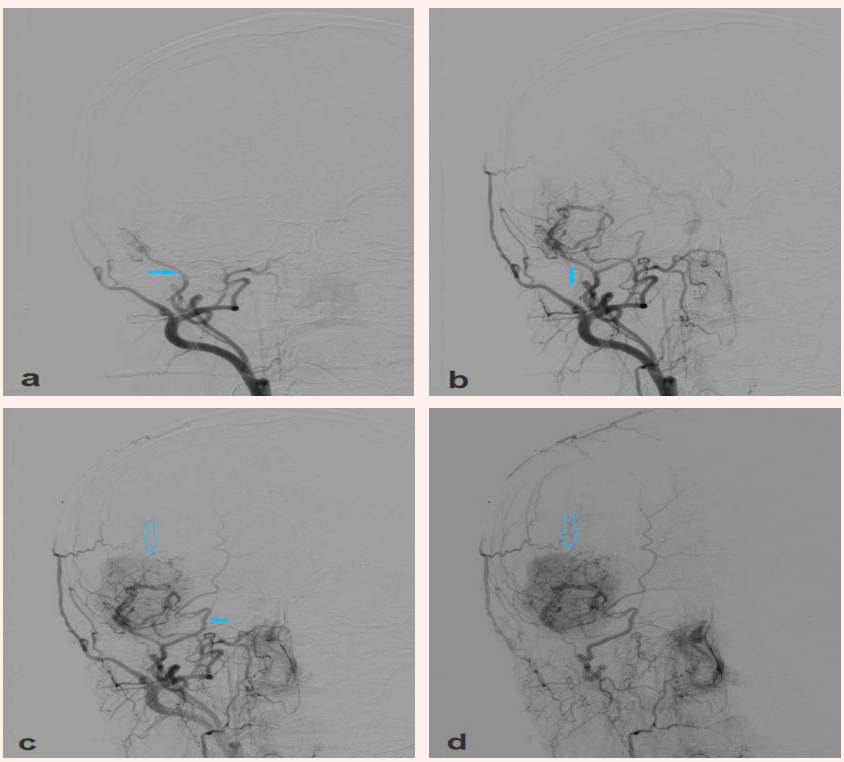

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CONTENTS ***Page***

Journal of Experimental and Clinical Medicine
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Radiation exposure of patients and staff working in angiography and interventional radiology unit

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ABSTRACT

Catheter angiography and interventional radiologic procedures are the medical applications with the highest exposure to radiation. The projection used, in other words the irradiated region of the patient, constantly changes and the change in irradiation geometry due to the movements of the image amplifier is another important factor. Irradiation can be achieved in the form of continuous (fluoroscopic) or sequential static images (filming). In these irradiations the kVp, mA and irradiation time of the system change continuously depending on the patient thickness. The aim of this study was to determine the dose of radiation the staff working in Angiography and Interventional Radiology unit and the patients undergoing intervention were exposed to and to discuss the measures to decrease the dose of radiation. In this study, the dose values of 129 patients and three physicians and two radiotechnologists working in the unit were determined. In order to evaluate the radiation doses of the employees, radiation doses were measured with Optically Stimulated Luminescence (OSL) dosimeters over a period of six months. Doses of the patients during the procedure were measured separately. Total bimonthly and annual dose amounts were determined for the physicians as chest (collar), belt and wrist with the help of OSL dosimeters. Likewise, total bimonthly and annual dose amounts of radiotechnologists were measured as breast (neck) and belt. It was found that the duration of fluoroscopy was 2-3 times higher in radiological procedures than in diagnostic angiography and therefore the patient and radiologist were exposed to more radiation. The exposure radiation dose can be significantly decreased by reducing the number of frames per second during both fluoroscopy and filming.

1. Introduction

While the sources of radiation have negative effects on living things, the benefits it provides by its diagnostic and therapeutic use in medicine cannot be denied. X-rays used in these applications are ionizing radiation. Ionizing radiation can cause significant biological damage to living organisms. These side effects vary depending on the amount and duration of radiation exposure (Tuncel, 1994). In radiological interventions, which are applied with an increasing prevalence, both patients and practitioners are exposed to a much higher dose of radiation when compared with diagnostic tests. Particularly the complexity of radiological vascular interventions increases the duration of fluoroscopy and exposure and thus the amount of radiation to which the patient and the operator are exposed.

Therefore, with regard to radiation safety, the latest EURATOM 2013/59 directive emphasizes the obligation to record and report doses according to all radiological procedures.

The responsibilities of those who direct and perform a radiological procedure are not only limited to providing the rationale and optimization of exposure to the related procedure, but they also include providing the patient with enough information about the benefits and the risks of the procedure related with the radiation that the patient will be exposed to (European Society of Radiology, 2015).

Although the dose of the practitioner is much less than the radiation received by the patient, the total dose they are exposed to during their professional life becomes very important (Miller et al., 2003). Occupational dose limits to be exposed are set by the ICRP in publication 103 (ICRP, 2007) with the following limits: The whole body effective dose limit is 20 mSv per year over a 5-year period provided that it does not exceed 50 mSv in any year. An equivalent dose of 500 mSv per year for the extremities; an average of 500 mSv for 1 cm^2 area of skin; an equivalent dose of 20 mSv a year or 100 mSv in total for five consecutive years provided that it does not exceed 50 mSv in any year have been reported (ICRP, 2012). The purpose of the recommended limits is to avoid possible harmful effects of radiation.

The aim of this study was to determine the radiation exposure of the staff working in the "angiography and interventional radiology unit" under the influence of continuous ionizing radiation and the patients undergoing interventional procedure in this unit.

2. Materials and methods

Measurements in this study were performed in Angiography and Interventional Radiology unit. Five staff (three physicians, two radiotechnologists) and 129 patients were included in the study. Cerebral and peripheral diagnostic angiography, endovascular treatment of cerebral aneurysms, AV fistulas (CCF: caroticocavernous fistula) and AVM (arteriovenous malformation), tumor embolization procedures, and biliary interventions were performed with Artis Q DSA (Siemens, Erlangen-Germany) system. Fluoroscopy was adjusted between 65-70 kV, 40-100 mA, 3.2-8 ms, and 65-75 kV, 330-450 mA, 60-80 ms nominal doses at exposure. The filming was performed at four different speeds (1, 2, 3, 4 frames / sec) depending on the body region and organ of interest. Fluoroscopy was performed at three different speeds (30, 15, 7.5 frames / sec) and normal and low image resolution options. Optimum technical parameters (kV, mA, ms) were automatically adjusted by the exposure control system in the device. While the patient was preparing for the procedure, physicians and radiotechnologists put on 0.5 mm thick lead skirt-vest-neck collar. During the filming, there was no physician or radiologic technologist in the angiography room. During the placement of the catheter and interventional procedures, while the physicians were at the bedside, the technicians stood outside the room or inside the room away from the tube. During long-term operations, lead protectors fixed to the bed and ceiling were also placed between the tube and the physician

Exposure to scattered radiation was measured by Optically Stimulated Luminescence (OSL) dosimeters in physicians and technicians. OSL dosimeters are suitable for use in many geometric figures, they have high accuracy in photon detection, and they can measure wide range of dosages. OSL dosimeters are suitable for use in any part of the body.

For six months, physicians carried three personal OSL dosimeters of chest (collar), belt and wrist dosimeter during working hours, while radiologic technologists carried two personal OSL dosimeters of chest (collar), belt dosimeter. Apart from the radiation received due to the procedures, the dose value of the OSL dosimeter of each physician includes the background value, expressed as the natural radiation of the environment. However, since we need only the dose from the examinations, the "background" value obtained for each physician was deducted from the OSL readings used in the dosimeter and the remaining value was expressed in terms of current intensity as the dose value resulting from direct operations.

These OSL dosimeters were used for the staff and the radiation equivalent dose measurement exposed during the procedure was performed. OSL dosimeters were read in two-month periods and six-months and annual equivalent dose (mSv) results were determined for the staff.

Skin and body equivalent dose measurements and irradiation times of radiation exposure during scopy and exposure were recorded separately for the patients.

3. Results

The procedures were evaluated in two groups as therapeutic and diagnostic. The lowest scopy time was on diagnostic angiography, with an average of nine minutes per procedure.

In therapeutic interventions, the treatment of vascular pathologies such as aneurysm, arteriovenous fistula and AVM had the longest scopy duration with an average of 31 minutes, while the shortest scopy duration was 12 minutes in nonvascular procedures. The average duration of scopy was 23 minutes in therapeutic interventional procedures. The longer the scopy time, the more radiation the patient is exposed to (Table 1).

According to these data, the duration of the scopy and the radiation to which the patients are exposed during this period is very high compared to diagnostic angiography in the interventional procedures.

The fact that this patient-directed radiation is in high duration and amounts indicates that the doctors at the patient's side during the scopy were exposed to high-dose scattered radiation in the interventional procedures (Table 1).

Table 1. Average total equivalent dose amounts taken by patients by type of procedure.

Procedure	Duration (sec.)	Filming		Scopy		Duration (min.)
		Skin dose (Gycm^2)	Body dose (mGy)	Skin dose (Gycm^2)	Body dose (mGy)	
Diagnostic angiography	79	119.11	507	24.07	111	9
Aneurysm, AVM, AVF, Endovascular treatment	117	191.08	1263	67.29	910	31
Embolization procedures	113	213.75	713	114.80	640	25
Nonvascular	1	2.89	19	52.07	452	12
All interventions	77	135.90	665	78.05	667	23

Depending on the procedures performed to the patient, the equivalent dose amounts that the physician and radiotechnologist are exposed to vary depending on whether they are inside or outside the room. The proximity of the doctors to the X-tube also increases the dose received. Obviously high wrist dosimeter values confirm this because the closest part of the physician's hands during the intervention (scopy) is the hands (Table 2).

Table 2. Annual equivalent dose results of physicians and radiotechnologists (mSv).

Physician	Wrist (Annual)	Collar (annual)		Belt (annual)	
		Body	Skin	Body	Skin
I	25.82	4.58	4.49	0	0
II	40.76	0.81	2.90	0.72	3.52
III	12.53	1.82	5.81	1.56	2.94
IV	-	5.85	6.17	0.36	2.72
V	-	0.47	0.44	0.18	0.18

(Numbers I, II and III refer to physicians, IV and V to radiotechnologists.)

On the other hand, it was found that if three frames were taken instead of four frames per second, the dose received by patients decreased by 15-20%, and in the case of two frames, the dose decreased by 30-40% (Table 3).

Table 3. Dose amounts of patients taken per second according to the rate of filming.

Frame rate (frame/sec)	Skin dose per second (μGym^2)	Body dose per second (mGy)
2	138	5
3	150	7
4	178	8

4. Discussion

There are a limited number of studies evaluating the exposure states of radiology workers to ionizing radiation in our country. This study is important to determine the level of radiation exposure, whether these levels are within safety limits, and protection states of patients undergoing angiographic examination and interventional treatment and also radiology staff. In this study, equivalent dose exposure of patients and staff working in radiology unit was investigated. Three physicians, two radiologic technologists and 129 patients were included in the study. Radiology staff did not remove OSL dosimeters during the procedure. Measurement results were obtained in two-month intervals. Skin and body doses of six months and annual doses were calculated.

The diagnostic and therapeutic aspects of radiation in medicine cannot be denied. However, its damage to living organisms cannot be ruled out (Ho et al., 2002). The most important factor for radiology workers is the radiation exposure emitted by X-rays. The radiation-equivalent doses of the staff and the patients who were treated in the Angiography and Interventional Radiology unit in which the study was conducted were recorded. The amount of dose to which the patients were exposed was calculated during diagnostic angiography and therapeutic procedures. It was found that the patients were most exposed to radiation during endovascular treatment of vascular pathologies.

In endovascular treatments, the high dose rate was directly proportional to the duration of the scopy. The amount of equivalent dose taken varies depending on whether the physician and radiotechnologist were in or out of the room. The proximity of the doctors to the X-tube also increases the dose received. One of the reasons why doctors take multiple doses is the presence of complex cases that are difficult to treat. More experienced physicians performing such procedures may be effective in reducing the dose taken.

The results show that the annual dose to which physicians and radiotechnologists are exposed to in the Angiography and Interventional Radiology unit is within the permissible values. Annually maximum 6 mSv body and 6.2 mSv skin dose per employee were measured. Among physicians, the annual equivalent dose of radiation exposed to the extremities was measured as 40.76 mSv. These measured doses are well below the optimum limits. The whole body effective dose limit is 20 mSv per year over a 5-year period provided that it does not exceed 50 mSv in any year. The limits are the equivalent dose of 500 mSv per year for the extremities; the average is 500 mSv per 1 cm^2 area for the skin. As a result, physicians are exposed to more radiation in interventional procedures than diagnostic angiography procedures. In interventional procedures, the duration of the scopy is effective on the

dose taken. The radiation dose to which the practitioners are exposed in the angiography room can be greatly reduced by using lead skirts under the patient table and protective lead glass separators at the tube level. On the other hand, especially in therapeutic interventions, shortening the duration of the scope as much as possible and reducing the number of frames per second, by taking into account the safety of the procedure will result in less radiation exposure to both the patient and the physician. During flouroscopy, frame rate should be selected as 10 / sec or 7.5 / sec instead of 30 / sec. As a matter of fact, in our study group, it was found that the radiation exposure decreased by 15-20% and 30-40% respectively, when the frame rate was selected as three or two instead of four per second for filming. In a similar study, it was depicted that the amount of radiation exposed decreased by about half when the "frame" rate was reduced by half (Sakai et al., 2019).

Considering the type of procedure performed by the physicians and the number of patients on whom they performed the procedure, the result of the calculations is that the most important parameters determining the amount of radiation exposed are the type of intervention and the level of simplicity/complexity of the lesion being treated. In parallel with the studies conducted, it was found in our study that the type of the procedure where the physician performing the procedure was least exposed to radiation was nonvascular (biliary) interventions (Degiorgio, 2018). However, when radiofrequency is added to the biliary procedure, the radiation dose exposed increases as the duration of the scopy increases.

In angiographic examinations and fluoroscopy-guided radiological interventions, the amount of radiation that patients and doctors are exposed to depends on factors such as fluoroscopy time and frame rate. The difficulty and complexity of the procedure, the volume of the patient and the experience of the physicians are also important in this context. In addition, the distance of the patient, physician and radiologic technologist to the X-ray tube, the use of lead protections and other variables that reduce the dose intake should be indicated.

In this study, radiation doses exposed by physicians and radiologic technologists in different procedures are presented. It was observed that the doses physicians and radiologic technologists were exposed to did not exceed the ICRP dose limits. Since radiologists and technicians are mainly exposed to radiation during fluoroscopy, reducing the frame rate during fluoroscopy and filming will reduce radiation exposure by half or even more.

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The relationship between musekna index and stroke severity in patients with acute ischemic stroke

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ABSTRACT

Acute stroke is an important cause of morbidity and mortality. Prediction tools are especially helpful in this situation in guiding for medical treatment decision. It is found that prognostic index is predictor of mortality and heart failure in patients with ischemic heart failure implanted with an ICD, the prognostic index (PI) being built according to the formula: 120 - age + mean 24 h systolic blood pressure - (creatinine * 10). However, a mean 24 h systolic blood pressure calculation is not clinically easy. Therefore, we propose a new modified prognostic index (Musekna Index). Musekna Index (MI) was calculated as "120 - age + mean arterial pressure - (creatinine * 10)". In this study, we aimed to investigate the relationship between MI and stroke severity in patients with acute ischemic stroke. This cross-sectional study included 162 patients (males, 64; females, 98; 67 ± 15 years) with acute ischemic stroke. Patients were divided into two groups based on the calculated National Institutes of Health Stroke Scale (NIHSS) score (Group 1, NIHSS score < 16; Group 2, NIHSS score ≥ 16). Demographic, clinical, and laboratory data for all patients were collected. Musekna Index (Modified Prognostic Index) was calculated as "120 - age + mean arterial pressure - (creatinine * 10)". MI index was calculated admission to the neurology care unit. Echocardiographic examinations were performed using the parasternal longitudinal axis and apical 4-chamber windows in accordance with the recommendations of the American Echocardiography Committee. There were no significant differences among the demographic parameters of patients. MI was significantly higher in Group 1 patients than in Group 2 patients (139±15.6 vs 132±13.7, p=0.028). Our results suggest that MI is associated with stroke severity on admission in patients with acute ischemic stroke.

1. Introduction

Acute stroke is an important cause of morbidity and mortality. Accurate estimation of stroke prognosis is important for several reasons. First, it may guide treatment decisions and utility clinical management. Also, it may help health care supplier communicate effectively with patients and their families and to plan the long-term living setting (Ntaios et al., 2012; Sung et al., 2014). Outcomes following a stroke event can range from full recovery, through varying degrees of disability to death (Drozdowska et al., 2019). Accurate and early prediction of survival in patients with acute

stroke is important (Kwok et al., 2013). Several factors are known to affect the short-term prognosis in acute cerebrovascular disease (CVD). There are several prediction models for acute CVD (Fullerton et al., 1988; Rodrigues and Joshi, 1991). But, these prediction models are complex and not proper for common use. Therefore, a prognostic model needs to be easily applicable in the clinical setting and does not require sophisticated calculations (Muscari et al., 2011).

This study aimed to create a simple and practical index that can be systematically and consistently applied in routine clinical practice and to investigate the relationship between Musekna Index (MI) and stroke severity in patients with acute ischemic stroke.

2. Materials and methods

Patient selection

This cross-sectional study included 162 patients (males, 64; females, 98; 67 ± 15 years, range 41- 92 years) with acute ischemic stroke (≤24 hours of symptom onset) admitted to the neurology care unit, between October 2016 and December 2018. Twenty four patients were excluded. Demographic and baseline clinical data, including neurological deficit severity assessment with NIHSS on admission to the neurology care unit were recorded. Patient clinical data, history of cardiovascular risk factors and stroke onset were determined, and neurologic examination was conducted at the time of admission. The diagnosis was made based on the neurologic examination and cranial imaging within 24 hours of symptom onset. Patients with a well-defined time of ischemic stroke symptom onset were included in the study and those with any previous history of cerebrovascular disease or transient ischemic attack, cerebral hemorrhage, documented atrial fibrillation, coronary heart disease, congestive heart failure, serious valvular heart disease, congenital heart disease, chronic obstructive pulmonary disease, chronic renal failure were excluded. Twenty four patients were excluded because of the previous history of cerebrovascular disease (n=5), documented atrial fibrillation (n=6), congestive heart failure (n=4), coronary heart disease (n=5), serious valvular heart disease (n= 4). Baseline stroke severity was assessed using the NIHSS score (Lyden, 2017).

All patients underwent immediate computed tomography after admission to the emergency department. Troponin levels were measured and electrocardiogram (ECG) was recorded after admission to the neurology care unit. Echocardiography was performed within the first 48 hours of admission to the neurology care unit. The NIHSS evaluation and echocardiographic examination were conducted by blinded investigators. The study was approved by the Ethics Committee of our hospital, and informed consent was obtained. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Definition of stroke and assesment of stroke severity

According to the updated definition of stroke in the American Heart Association/American Stroke Association guidelines, ischemic stroke is diagnosed based on the combination of symptoms and/or signs of typical neurological dysfunction and imaging evidence of central nervous system infarction. Therefore, ischemic stroke is defined as a neurological dysfunction episode caused by focal cerebral, spinal, or retinal infarction on imaging (Sacco et al., 2013).

NIHSS is a simple, valid, and reliable systematic assessment tool that measures acute stroke-related neurologic deficit (Lyden, 2017). The NIHSS score is very important to scale for clinical assessment as it enables the determination of appropriate treatment, prediction of lesion size, measurement of stroke severity, and prediction of patient outcome in patients with acute ischemic stroke. The NIHSS comprises 11 different elements evaluating specific ability. Each ability is scored between 0 and 4, where 0 corresponds to normal functioning and 4 corresponds to complete impairment. A patient's NIHSS score is calculated by adding the score for each element of the scale; 42 is the highest score possible. A higher NIHSS score corresponds to greater impairment of cerebral function in a stroke patient.

The higher the NIHSS score, the higher the impairment of a stroke patient. According to NIHSS score, there are five-stroke severity groups: NIHSS =0 (no stroke), NIHSS=1-4 (minor stroke), NIHSS=5-15 (moderate stroke), NIHSS=16-20 (moderate to severe stroke), NIHSS=21-42 (severe stroke). A baseline NIHSS score greater than 16 indicates a strong probability of patient disability and death (Lyden, 2017).

Stroke severity at admission to the neurology care unit was assessed by the NIHSS score by a neurologist (U.O). Patients were categorized into two groups; Group 1 comprised of patients with non-severe stroke (NIHSS<16; n=58), whereas Group 2 comprised of patients with severe stroke (NIHSS≥16; n=22).

Cerebral infarct volume measurements

A neurologist calculated the "cerebral infarct volume" in each patient by using Analyze 12.0, a software package for biomedical image analysis (Biomedical Imaging Resource, New York, NY, USA). The area of interest were segmented using the Region Grow in the Volume Edit module, with manual elimination of artifacts when essential. The total infarct volume was calculated as mL.

Musekna index (Modified prognostic index)

Antonini et al. found that prognostic index was predictor of mortality and heart failure in patients with ischemic heart failure implanted with an ICD (Antonini

et al., 2015). The prognostic index (PI) was calculated according to the formula: 120 - age + mean 24 h systolic blood pressure - (creatinine * 10). However, a mean 24 h systolic blood pressure calculation is not clinically easy. Also, in a recent analysis of the Medical Research Council Mild Hypertension Trial, sphygmomanometric PP was a predictor of cardiovascular events and MAP was a better predictor of acute stroke than PP (Millar et al., 1999). A study of 24-hour BP monitoring also ensured evidence that PP is the important predictor of cardiovascular events; MAP is the major independent predictor of acute cerebrovascular events (Verdecchia et al., 2001; Zheng et al., 2008). Therefore, we propose a new modified prognostic index (MI) in patients with acute ischemic stroke. MI was calculated as "120 - age + mean arterial pressure - (creatinine * 10)"

Statistical analysis

Statistical analysis was conducted with the SPSS statistical package (Version 12.0; SPSS Inc., Chicago, IL,USA). All baseline parameters were analyzed. Continuous variables are expressed as mean±SD, and categorical variables are expressed as percentages. Intra-observer variability was calculated as the absolute difference between the two measurements as a percentage of their mean. Student t-test and Chi-square test were used for comparison of data as appropriate. p values <0.05 were considered statistically significant. The Pearson's or Spearman's correlation was used for assessing correlations between variables. Multivariate analyses were performed.

3. Results

Baseline characteristics

The baseline characteristics of patients are summarized in (Table 1). Clinical characteristics of groups were similar with respect to gender, hypertension, diabetes, smoking (p>0.05). Age, systolic blood pressure (BP), diastolic BP, mean arterial pressure, heart rate, dyslipidemia, infarct volume, troponin, glucose, HbA1c, creatinine, LDL cholesterol levels in Group 2 patients were significantly higher than Group 1 patients (p<0.05). MI was significantly higher in Group 1 patients than Group 2 patients (p<0.05).

Echocardiographic findings

Echocardiographic parameters are summarized in Table 2. LV wall thickness and E/e' values were significantly higher in Group 2 patients than in Group 1 patients (p < 0.05). LVEF was significantly higher in Group 1 patients having lower NIHSS scores than in Group 2 patients having higher NIHSS scores.

Electrocardiographic findings

Group 2 patients showed significantly longer QTc, QTd, QTcd than Group 1 patients (Table 2). Correlation analysis performed to investigate the relationship between NIHSS score and clinical parameters showed a negative correlation among the NIHSS score and MI and LVEF. Also, there was a positive correlation between the NIHSS score and age, heart rate and E/e' (Table 3). Logistic regression analysis was performed

Table 1. Clinical characteristics of patients.

Variables	Group 1 (NIHSS score<16) n=97	Group 2 (NIHSS score≥16) n=41	p Value
Age (years)	64.8 ± 13.9	71.5±16.9	0.038
Gender (F/M), n	56 / 41	26 / 15	0.671
Hypertension, n %	45 (46 %)	23 (56%)	0.070
SBP (mmHg)	141.9±16.7	158.6±17.3	0.039
DBP (mmHg)	74.2±9.4	88.1±13.5	0.042
MAP (mmHG)	94.7±10.1	105.3±13.4	0.029
Heart Rate (bpm)	91.8±13.5	117±13.4	0.024
Musekna Index	139±15.6	132±13.7	0.028
Diabetes Mellitus, n %	28 (28%)	13 (32%)	0.075
Smoking, n %	13 (14%)	7 (18%)	0.083
Dyslipidemia, n %	13 (14%)	15 (38%)	0.040
Infarct volume (mL)	17 mL ± 2.5	46 mL ± 4.5	0.032
Troponin (ng/L)	7.432	16.953	0.034
HbA1c (%)	6.78±1.32	8.68±1.92	0.023
Glucose (mg/dl)	139.7±35.8	197.2±47.8	0.037
Creatinine (mg/dL)	1.3±0.5	2.1±0.7	0.025
LDL cholesterol (mg/dL)	106.1±25.6	134.2±38.9	0.007
HDL cholesterol (mg/dL)	40.5±11.4	38.2±9.3	0.547

*F:Female, † M:Male, ‡ SBP: Systolic Blood Pressure, § DBP: Diastolic Blood Pressure, ‖ MAP: Mean Arterial Pressure, ¶ LDL: Low Density Lipoprotein, ** HDL: High Density Lipoprotein.

Table 2. Echocardiographic and electrocardiographic parameters of patients.

Variables	Group 1 (NIHSS score<16) n=97	Group 2 (NIHSS score≥16) n=41	p Value
LV septal thickness, mm	11.1±1.7	12.9±1.9	0.032
LVDd (mm)	50.4±5.7	54.4±6.4	0.413
LV posterior Wall thickness, mm	10.6±1.3	12.1±1.7	0.027
LVDs (mm)	41.3±4.6	43.7±4.9	0.325
LVEDV (mL)	87.0±15.1	94.6±23.9	0.219
LVESV (mL)	42.3±11.7	45.2±13.8	0.426
LAD (mm)	39.7±5.2	43.1±5.2	0.572
RAD (mm)	31.3±3.7	34.9±3.4	0.492
RVDd (mm)	29.3±2.7	31.4 ± 2.5	0.371
LVEF (%)	58.6±6.3	52.7±7.1	0.027
E/e'	8.4±3.2	11.5 ±3.4	0.030
QTc (ms)	463±47.7	536±62.3	0.040
QTd (ms)	56.1±4.6	89.2±4.8	0.033
QTcd (ms)	60.7±3.4	89.5±4.3	0.044

NIHSS: National Institutes of Health Stroke Scale, † LV: Left Ventricle, ‡ LVDd: Left ventricular diastolic diameter, § LVDs: Left ventricular systolic diameter, ‖ LVEDV: Left ventricular end-diastolic volume, ¶ LVESV: Left ventricular end-systolic volume, ** LAD: Left atrial diameter, †† RAD: Right atrial diameter, ‡‡ RVDd: Right ventricular diastolic diameter, §§ LVEF: Left ventricular ejection fraction, ||| QTc: corrected QT interval, ¶¶ QTcd: QTc dispersion, *** QTd: QT dispersion.

to identify the potential predictors for stroke severity. Results of the multivariate analysis revealed MI, age, LV EF, and heart rate powerful predictor of severe ischemic stroke (Table 4).

Table 3. Correlation between NIHSS score and clinical parameters in patients with acute ischemic stroke.

Parameters	Pearson's correlation coefficient (r value)	p Value
Musekna Index	-0.656	0.023
LVEF	-0.432	0.032
E/e'	0.312	0.041
Age	0.480	0.039
Heart rate	0.380	0.03

* NIHSS: National Institutes of Health Stroke Scale, † LVEF: Left ventricular ejection fraction.

Table 4. Multivariate logistic regression analysis between NIHSS score and clinical parameters in patients with acute ischemic stroke.

Parameters	OR	95 % CI	p Value
Parameters	OR	95 % CI	p Value
Musekna Index	0.562	0.483-0.840	0.017
LVEF	0.725	0.687-0.785	0.029
Age	1.324	1.053-1.435	0.036
Heart rate	1.090	0.867-1.191	0.527

NIHSS: National Institutes of Health Stroke Scale, † LVEF: Left ventricular ejection fraction.

4. Discussion

Acute stroke is characterized by severe autonomic dysfunction, including alterations in the autonomic reflex pathways, central autonomic neuroanatomical sites, and hormonal factors. Stroke-related sympathetic activation is high in patients with higher NIHSS score. Irrespective of prior cardiovascular status, an acute stage of stroke importantly influences systemic BP, heart rate, LV function, and biochemical parameters (Ripoll et al., 2018).

Predicting morbidity and mortality in the acute cerebrovascular disease remains a challenge in clinical practice and continues to encourage researchers to develop new and more accurate prognostic tools (Racosta et al., 2014). Several studies have developed simplified prognostic model systems. However, there has been no published simple prognostic scoring for early period acute ischemic stroke mortality. The Guy's score and Fiorellis' prediction model were developed to predict two and four month outcome (Allen, 1984; Fiorelli et al., 1995). Gompertz's G-score (simplified Guy's score) and Fullerton's prognostic index were used to predict the mortality at six months (Fullerton et al., 1988; Gompertz et al., 1994). Wade et al. developed his prognostic scoring system for prediction of outcome over a 2-year period (Wade et al., 1984). All the prognostic scoring systems are complex and do not lend themselves to bedside use.

We have developed a new prognostic scoring system (MI) for patients with acute ischemic stroke during the early hospitalisation period. MI is built with three easily measured clinical predictors on which data were routinely available for all acute stroke patients. In this study, we found that MI was significantly lower in patients who have a severe stroke. MAP is a function of left ventricular contractility, heart rate, and systemic arterial resistance and aortic elasticity (Benetos et al., 1997). In this study, elevated MAP level was independently associated with acute ischemic stroke severity, which was similar to other clinical studies (Mazza et al., 2001; Verdecchia et al., 2001). Soliman et al. found that stroke disability was higher in a patient with advanced age. Mortality associated with stroke increases with age (Soliman et al., 2018). Mathisen et al. found that long-term mortality was associated with elevated values of creatinine at the time of the acute stroke (Mathisen et al., 2016). In the present study, we found that admission creatinine values were significantly higher in severe stroke patients. Mostofsky et al. suggesting that clinical risk factors for cardiovascular diseases including age, diabetes mellitus, hypertension may indicate vascular pathogenesis resulting from reduced renal clearance. Renal function predicts survival in patients with acute ischemic stroke (Mostofsky et al., 2009).

The effect of ischemic stroke severity on the LV function is not very well known, and only a few studies are investigating this relationship (Milionis et al., 2013; Kim et al., 2016). Sung et al. found that severe acute ischemic stroke patients had lower LVEF (Sung et al., 2019). In our study, we found that LVEF was significantly higher in patients with lower NIHSS scores than in those with higher NIHSS scores. Also, infarct volume was significantly higher in Group 2 patients than Group 1 patients.

Previous studies have reported that a relationship between acute cerebrovascular disease and QT (Lederman et al., 2014; Lederman et al., 2019). Lazar et al. found that a positive relationship between baseline QTd and NIHSS and modified ranking scores (Lazar et al., 2008). In our study, we found that QT parameters were significantly higher in Group 2 patients than Group 1 patients.

Hypertension, hyperlipidemia and diabetes mellitus are important risk factors for atherosclerotic cerebrovascular disease (Wu et al., 2010). We found that blood pressure at admission is significantly higher in severe ischemic stroke patients. Li et al. suggested that the NIHSS score on admission in the H-type hypertension group was significantly higher than that in the control group (Li et al., 2018). However, Bonardo et al. found that, large infarct volume was not

associated with high blood pressure at admission in young patients with acute ischemic stroke (Bonardo et al., 2018). In our study, we found that LDL cholesterol was significantly higher in patients with higher NIHSS scores than in those with lower NIHSS scores.

In this study, we found that troponin levels were significantly higher in severe ischemic stroke patients. Chang et al. showed that cardiac biomarkers are related with acute large vessel occlusion in patients with ischemic stroke (Chang et al., 2019). Hendrix et al. found that diabetes mellitus history is an important predictor of stroke severity (Hendrix et al., 2019). Lindsberg and Roine observed that increasing blood glucose level is common in the early phase of acute stroke (Lindsberg and Roine, 2004) . In our study blood glucose and HbA1c levels were significantly higher in severe stroke patients on admission. Although up to one-third of severe acute ischemic stroke patients have diagnosed diabetes, probably a major proportion of patients have stres induced hyperglycemia mediated partly by the release of cortisol and norepinephrine (Lindsberg and Roine, 2004). Bogdanovic et al. found that acute hyperglycemia in asymptomatic diabetic patients have significant negative effects on LV function (Bogdanovic et al., 2019). In our study, we found that E/é value was significantly higher in severe stroke patients. Ryu et al. suggested that E/e' ratios were associated with arterial occlusion in AF-related acute ischemic stroke and may play an important role in identifying patients at high risk of severe stroke (Ryu et al., 2018).

In conclusion, we have developed the MI a simple score for assessing ischemic stroke severity and prognosis based on signs and symptoms noted upon admission. The modified prognostic index score is not intended to replace any of the currently used prognostic scoring systems. Our purpose is providing physicians not trained in the use of more sophisticated scales with a readily available clinical parameters to be used for clinical purposes. It is also intended to be used when clinical, laboratory, or neuroimaging data needed for other scores, are not fully available. However, it would be preferable for our prognostic index to be tested in the other independent samples and in prospective studies.

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Ethical approval: The study was approved by the Ethics Committee of our hospital. The study was conducted in accordance with the principles of the Declaration of Helsinki.
Informed consent: Informed consent was obtained from all individual participants included in the study.

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The long term renal and bladder function outcomes of patients with posterior urethral valve

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ABSTRACT

We aimed to evaluate the preoperative and postoperative renal and bladder functions of patients operated for posterior urethral valve (PUV). Thirty five patients operated for PUV between 2006 and 2016 (mean 94 days, range 4 days-12 years). Seven patients had prenatal diagnosis. Preoperative and postoperative serum creatinine, Dimercaptosuccinic acid (DMSA), Voiding cystourethrography (VCUG), recurrent urinary tract infection, additional surgical procedures and urodynamic study results were evaluated. No vesicoureteral reflux (VUR) was demonstrated in four patients. No VCUG is obtained in two patients. Most of the bilateral VUR cases were grade IV or more. Thirteen patients had significant neuropathic bladder findings on VCUG and 21 had dilatation of posterior urethra. There were no preoperative DMSA scintigraphy in nine patients. Twenty two patients had a history of recurrent urinary tract infection. Nine of them had high grade reflux and seven of them had worsening of DMSA function with scars at postoperative follow-up. Preoperative/postoperative creatinine levels were 0.94mg/dL (0.14-4.63) / 0.39 mg/dL (0.11-2.3) respectivel. Five patients are on CIC (3 had Mitrofanoff conduit). Two patients underwent augmentation+Mitrofanoff and one patient had Mitrofanoff procedures. One underwent bilateral ureterostomy and one unilateral ureterostomy (undiversion at five years). Three received percutaneous vesicostomy procedure and one diverged to permanent vesicostomy. Seven has ESRD and two patients are on continous peritoneal dialysis. Postoperative UTI encountered in 22. Forty-two sessions of subureteric injection (17 right, 14 left, 11 bilateral) were performed. Urodynamic study conducted in 27 patients; 14 diagnosed as neuropathic bladder and 9 had DSD. Low bladder capacity and compliance was encountered in 17. Posterior urethral valve is the most important infravesical urinary obstruction that causes deterioration of renal function and permanent damage in boys in terms of long-term outcomes. Life long follow-up is obligate to protect from renal failure.

1. Introduction

Posterior urethral valve (PUV) is the most common cause of lower urinary tract obstruction (LUTO) in male children. PUV has a broad clinical spectrum from mild to severe obstruction resulting in variable dysfunction of urinary tract such as renal dysplasia, urinary incontinance, neuoropathic bladder etc. (Hennus et al., 2012; Long et al., 2018). End stage renal disease (ESRD) is inevitable in 25-50% of cases despite early intervention (Holmdahl et al., 2005; Heikkila et al., 2011; Jonksisz et al., 2017). This finding suggests that the deterioration of renal function has already

occured during intrauterine life (Smith-Harrison et al., 2015). Obstruction in urinary system leads to increased intravesical pressure and detrusor hypertrophy and may result in reflux nephropathy and renal dysfunction (Nasir et al., 2011; Bhadoo et al., 2014). The initial approach is decompression of bladder via urethral cathaterization and endoscopic valve ablation is the gold standart surgical treatment modality. In some cases, temporary vesicostomy may be preferred depending on the condition of the patient (Krahn et al., 1993).

In this study, we retrospectively evaluated preoperative and postoperative creatinin levels, renal functions (dimercaptosuccinic acid (DMSA) results), vesicoureteral reflux, recurrent urinary tract infections, additional surgical interventions and urodynamic study results.

2. Materials and methods

We performed retrospective analysis of patients presenting with PUV diagnosis from 2008 to 2016. All patient underwent endoscopic PUV incision. Patients excluded from study whose cystoscopic evaluation were normal. Thirty five patients operated (mean 94 days, range 4 days-12 years). All of them was type I PUV. Seven patients had a prenatal diagnosis. Preoperative and postoperative DMSA, voiding cystourethrography (VCUG), creatinine and history of urinary tract infection (UTI) and additional surgical procedures were evaluated.

3. Results

Seven patients had been diagnosed by standard prenatal ultrasound examination with dilated bladder and posterior urethra (key hole sign) (Fig. 1). Prenatal USG also revealed various degree of upper urinary dilatation and oligohydraminos. Vesicoureteral reflux (VUR) was not demonstrated with VCUG in four patients. Other patients have various degrees and laterality of VUR (Fig. 2). Bilateral cases tended to have high grade reflux (grade IV or more). Thirteen patients had neuropathic bladder findings on VCUG; irregular bladder wall (trabeculation), loss of normal shape of bladder etc. Twenty one had posterior urethral dilatation namely key hole sign on US (Fig. 3).

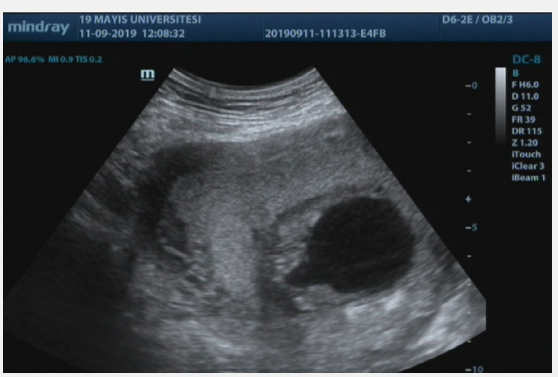

Fig. 1. Prenatal USG with dilated posterior urethra (Key hole sign).

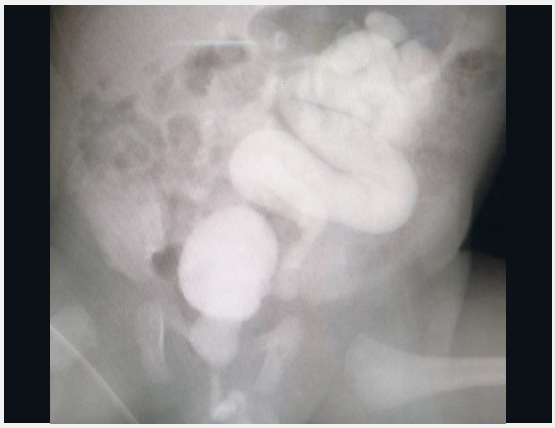

Fig. 2. Left grade V vesicoureteral reflux.

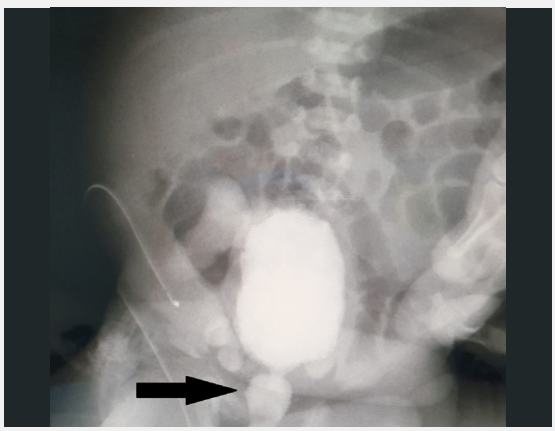

Fig. 3. Key hole sign.

Preoperative mean creatinine levels were 0.94 mg/dL (0.14-6.63) and postoperative mean creatinine levels were 0.39 mg/dL (0.11-2.3). Creatinine levels decreased under 1 mg/dL in 23 patients and decreased to 1-1.3 mg/dL in 10 patients in two days after valve ablation. Eight of them tend to drop below 1 mg/dl over months.

Preoperative and postoperative vesicoureteral reflux numbers were showed at tables 1 and 2. VUR grades were variable but most of them tend to be high

Table 1. Preoperative VUR grade and side.

Preop. VUR	Right	Left
Grade V	11	14
Grade IV	2	4
Grade III	2	4
Grade I-II	7	2
No VUR	7	5
Bilateral VUR	13	13

grades (grade IV and V). In longterm follow-up, high degrees of VUR persisted and lower degrees tend to increase on follow up.

Table 2. Preoperative VUR grade and side.

Postop. VUR According to last VCUG	Right	Left
Grade V	13	12
Grade IV	5	4
Grade III	12	7
Grade I-II	8	7
No VUR	7	5
Bilateral VUR	8	8

Twenty two patients had a history of recurrent urinary tract infection. Nine of them had high grade reflux and seven of them had worsening of DMSA function with scars on postoperative follow-up. Nearly half of the patients had less than 40% DRF on preoperative DMSA scanning and renal hypo-dysplasia (Table 3). Number of patients with <10% renal function increased two fold on follow up (Table 4).

Table 3. Preoperative DMSA results.

Preop. DMSA	Right	Left
%40 >	13	9
%20-40	6	10
%10-20	4	5
%10<	3	2

Table 4. Postoperative DMSA results.

Postop. DMSA	Right	Left
%40 >	11	8
%20-40	9	12
%10-20	9	8
%10<	6	7

Fig. 4. Posterior view. Right renal hypoplasia.

Fig. 4. shows right renal function is 9% in a three month-old baby in his/her first DMSA scan. This hypoplasia may have occured in the prenatal period because of high intravesical pressure with severe VUR. Left kidney may be preserved by 'pop-off' mechanism. Figs. 5 and 6 show that renal scarring has increased within the three years following valve ablation with reccurent UTI's.

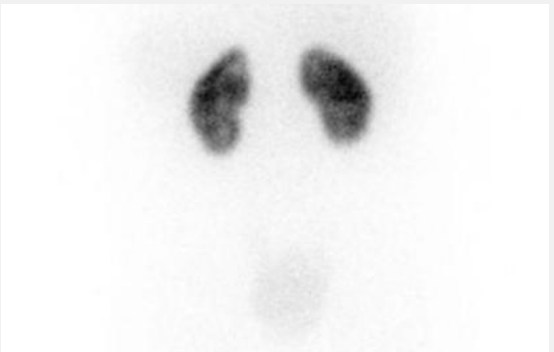

Fig. 5. Posterior view. Left renal scars alone.

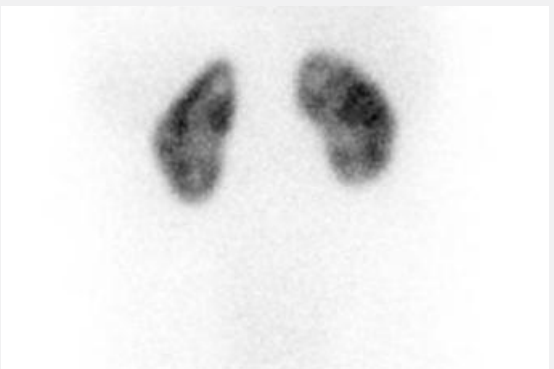

Fig. 6. Posterior view. Bilateral scars after three years.

Secondary surgical interventions

Six patients are on clear intermittent catheterization (CIC) (3 through Mitrofanoff conduit). Two received augmentation / Mitrofanoff and one Mitrofanoff procedures. One underwent bilateral ureterostomy. Unilateral ureterostomy was performed in one patient (undiversion at 5 year-old). Three percutaneous vesicostomy procedures were performed and one diverged to permanent vesicostomy. Seven has ESRD and two are on continous peritoneal dialysis.

Urodynamic study was conducted on 27 patients; 14 diagnosed as neuropathic bladder and nine had detrusor sphincter dyssynergy. Seventeen patients had low bladder capacity and compliance.

Thirty one sessions of subureteric injection (17 right, 14 left, 11 bilateral) were performed for various degrees of VUR. The success rates were higher for grade III or less degrees of VUR than neuropathic bladders. In five patients, VUR resolved totally (3 right,

1 left and 1 bilateral VUR). Six patients' VUR grade were decreased but not resolved (all grade III to V). Secondary injections were performed in seven patients and third injections were performed in two patients.

4. Discussion

Pathophysiological changes in the bladder and decreasing renal function in children with PUV seem to occur despite early diagnosis and valve ablation. Even after successfull valve ablation, some degree of renal and bladder dysfunction will develop in most of the patients (Jonkisz et al., 2017). This morbidity is caused by ocurrence of urinary obstruction at a critical time in organogenesis and may have enormous and lifelong effect on the function of kidney, ureter and bladder. The exact etiology is unknown (Borzi et al., 1992; Berte et al., 2018). Antenatal diagnosis depends on maternal ultrasound which shows that dilatation of bladder and posterior urethra (key hole sign), thickening bladder wall, upper urinary tract dilatation and oligohydramnios (Sweeney et al., 1981). After birth, urinary ultrasound, VCUG are performed for initial evaluation of PUV and renal scintigraphy is indicated for the evaluation of renal function and degree of renal impairment. On VCUG, the diagnosis of PUV depends on; thickened bladder wall, dilation of posterior urethra (key hole sign). Scintigraphic radionuclide studies are useful in estimation of the renal differential function (DRF), drainage and focal parenchymal defects (Gordon et al., 2003). Mercaptoacetly triglycine (MAG3) or diethletriaminepentaacetic acid (DTPA) are used as dynamic study. DMSA is used as static study. DMSA is more sensitive for DRF and parenchymal defects than other radionuclides and accepted as gold standart method for evaluating renal parenchymal scarring (Binghamn et al., 1978; Farnsworth et al., 1991). Pereira et al. considered that presence of one or more renal scars on DMSA had poor prognosis when compared with normal DMSA (Pereira et al., 2003). Narasimhan et al. also said that patients with dilated ureters on ultrasound and poor drainage on DTPA are at highest risk of renal scarring (Narasimhan et al., 2006). These results are similar to our patient's group outcomes about renal scarring and end stage renal failure.

The surgical procedure of choice is endoscopic valve ablation. Valve is incised at 5,7 and 12 o'clock position (Bhatnagar et al., 2000; Joseph et al., 2000; Puri et al., 2002). In case of unavailable instrumentation, persisting or increased urinary tract dilation or high creatinine levels after incision some urinary diversion should be suggested. Diversion options are vesicostomy, ureterocutaneostomy, pyelostomy and nephrostomy (Krahn et al., 1993, Liard et al., 2000, Hosseini et al., 2015). The main problem is high bladder storage pressures in PUV patients. After ablation of valve, secondary bladder management should continue as medically (Abraham et al., 2009).

When necessary, secondary surgical procedures including bladder augmentation / Mitrofanoff (for urinary incontinance), subureteric material enjection (for VUR) or botox enjection (for reducing intravesical pressure) should be reserved in PUV patients during follow up. Severe recurrent urinary tract infection and pyelonephritis are common in patients with PUV. High bladder storage pressure, elevated post voiding residual urine volumes, stasis of urine and severe VUR are the main cause of UTI (Smith et al., 1996; Kim et al., 1997; Fine et al., 2011). Bladder drainage is essential to decrease storage pressures and residual urine to protect from severe pyelonephritis and renal scarring (Taskinen et al., 2012). Double voiding (for mild residual urine less than 50 ml), clean intermittent catheterization (CIC) or over night catheter drainage are options for urinary drainage (Koff et al., 2002; Holmdahl et al., 2003; Fumo et al., 2006). Existence of VUR is not associated with end stage renal disease but need for multiple surgeries for management of VUR. Unilateral VUR may act as 'pop-off' mechanism to decrease bladder storage pressure and having protective effect on renal function (Bilgutay et al., 2016).

Predicting long-term results of PUV patients is challenging. In severe cases, multiple surgical interventions may be necessary In long-term follow-up and almost half of them may losts their renal functions and develop renal failure and are candidates of renal transplantation. On the other side, in mild cases, valve ablation may suffice and may have subtle symptoms and signs later in their lives (Kari et al., 2013).

Factors associated with renal scarring is not clear and many prognostic factors have been reported such as creatinine levels, nadir cretinine, beta-2 microglobulin level, fetal N-acetyl-beta-D-glucoseaminidase (NAG) level, presence of bladder dysfunction, VUR (degree and laterality) with reccurent UTI and pyelonephritis (Thomas et al., 2007; Abdenanadher et al., 2015; Lipitz et al., 2016; Spaggiari et al., 2017).

In our series, seven patients has ESRD (creatinine levels over 2 mg/dl) and four patients are suffering from renal failure. Fourteen patients have neuropathic bladder diagnosed by urodynamic studies. More than twenty patients have reccurent UTI or severe pyelonephritis with decreased renal function. Our results are similar to literature considering the long-term renal functional outcomes of PUV (Hennus et al., 2012; Tourchi et al., 2014; Jesus et al., 2015; Hebenstreit et al., 2018; Long et al., 2018; Canning, 2019). Six patients have performed clean intermittent catheterization with half of them have mitrafanoff conduit.

In conclusion, PUV is the most common infravesical urinary obstruction that causes deterioration of renal functions and permanent damage in boys. PUV ablation is not enough for preservation of renal and bladder functions. In most of the patients, life long follow-up is needed to protect from renal failure.

Conflict of interest

The author declares that there is no conflict of interest.

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Case Report

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A rare cause of fever in the emergency department

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ABSTRACT

Fever is one of the most frequent reasons for application to emergency service. Inflammatory diseases may vary from short-termed and self-limiting to serious conditions that may cause hospitalization at intensive care unit or death. Malaria is a disease with high mortality. We have aimed to submit a malaria case who has applied to emergency due to high fever and conscious change. A 52 years old male patient was brought to emergency by his relatives due to fever, headache, cold-shivering, conscious change at the periods with high fever. It was learnt that the patient had returned to Turkey 10 days ago from Africa where he had lived for the last six months. Systemic examination was normal and no organomegaly or icterus was observed in the patient. In thick smearing preparation, malaria forms were observed and in the thin smearing preparation, more than one ring-form gametocytes were observed and thus Plasmodium falciparum diagnosis was considered. Atovaquone/Proguanil 1x1 gr (3 days) treatment was started for the patient and he was hospitalized in the infections service. For the patients applied to emergency with high fever, travelling history should be investigated, malaria should be considered and early treatment should be started.

1. Introduction

Fever is one of the most frequent reasons for application to emergency service. Inflammatory diseases may vary from short-termed and self-limiting to serious conditions that may cause hospitalization at intensive care unit or death (Knott et al., 2004). Malaria is a disease with high mortality that should be considered among the infection emergencies in the patients applied with fever and travelled to abroad (Malaria report, 2015). Malaria is a parasitic disease causing an illness in approximately 250-500 millions of people annually in tropical countries and causing the death of approximately more than 1 million people per year (Fairhurst et al., 2010). Malaria parasites causing infections in humans are Plasimodium vivax, ovale, falciparum and malaria. Among these four species, the most severe clinical pictures and deaths are seen in the malaria caused by Plasmodium falciparum (Fairhurst et al., 2010). In our country, malaria cases caused by Plasmodium vivax are frequently seen, Plasmodium falciparum malaria is more common the people having a traveling history to abroad (Çelikbaş et al., 2006). We have aimed to submit a malaria case who has applied to emergency due to high fever and altered consciousness and traveled overseas.

2. Case

A 52 years old male patient had brought to emergency service by his relatives due to fever, headache, cold-shivering, altered conscious at the periods with high fever. The patient had no previous illnesses and it was specified that his complaints had started five days ago and increased gradually. It was learnt that the patient had returned to Turkey 10 days ago from Africa where he had lived for the last six months.

The general status of the patient was moderate, conscious but prone to sleep, partially cooperated and oriented. Blood pressure was 150/90 mm Hg, heart rate (HR) was 110/min, temperature was 39° C and respiration rate was 26/min. Systemic examination was normal and no organomegaly or icterus was observed in the patient. Neurological examination of the patient was evaluated as normal. In the laboratory examinations, hemoglobin was observed as 12.2 g/dL; hematocrit 35.6; thrombocyte 23.000 /mm^3; C-reactive protein (CRP) as 195 mg/L; total bilirubin 2.23 mg/dL; direct bilirubin 1.48 mg/dL; aspartate amino-transferase (AST) 69 IU/L; alanine amino-transferase (ALT) 34.6 IU/L; lactate dehydrogenase (LDH) 607 IU/L; glucose 146 mg/dL; blood urea nitrogen (BUN) 34.5 mg/dL; creatinine 0.64 mg/dL; total protein 4.8 mg/dL; albumin 2.80 mg/dL. Urinary examination of the patient was normal.

No pathology was observed in computerized brain tomography (CBT) and diffusion magnetic resonance (MRI) imaging technique in the patient. Due to the failure to explain the clinic of the laboratory results and radiologic images of the patient and the history of travel to a risky area; the pre-diagnosis of malaria was considered for the patient. Blood samples were prepared from the patient via thick drop and thin smearing technique. These samples were stained in the parasitology laboratory according to the Giemsa staining procedure and then they were examined under a light microscope. In thick smearing preparation, malaria forms were observed and in the thin smearing preparation, more than one ring-form gametocytes were observed and thus Plasimodium falciparum diagnosis was considered (Fig. 1).

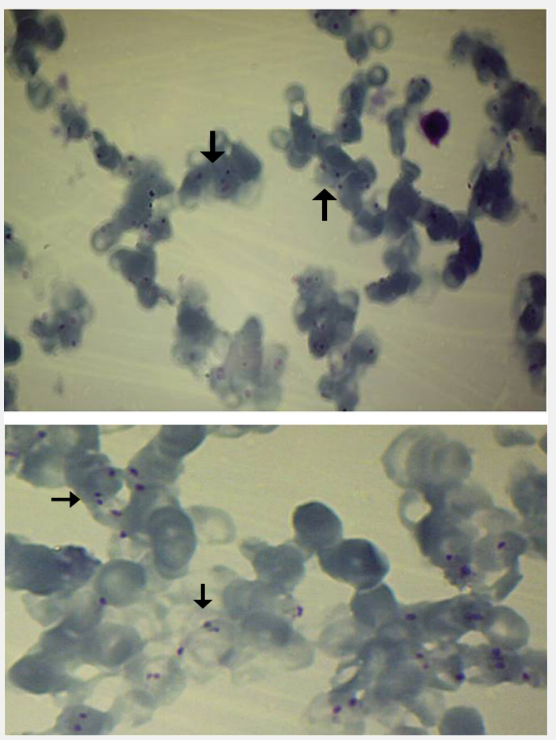

Fig. 1. More than one ring-form Plasmodium falciparum trophozoites in the erythrocyte.

Atovaquone/Proguanil 1x1 gr (3 days) treatment was started for the patient and he was hospitalized in the infections service. Fever of the patient was regressed on the third hospitalization day, his conscious was returned to normal and he was mobilized. At the end of the third day, doxycycline treatment was started. The patient was discharged on the 10th day with recommendations after his treatment was completed.

3. Discussion

Malaria is prevalently seen in tropical and subtropical areas and it causes illness in approximately 250-500 millions of people in a year and also causes the death of more than 1 million people per year (Fairhurst et al., 2010). Today travelling to various regions in the world due to tourism and employment is frequent and malaria is one of the inflammatory diseases especially seen after travelling to sub-Saharan Africa and tropical areas (Bozkurt et al., 2013). When the travel histories of our patient are inspected, it was learnt that he had spent his last six months in Gabon, Africa. The patient had specified that while he was working in Gabon, some of his friends had inflammatory diseases with similar complaints. According to the data of World Malaria Report 2015, Gabon is an endemic region for falciparum malaria (Ülçay et al., 2014). The malaria parasites causing infections in humans are P. vivax, P. ovale, P. falciparum, P. malaria and P. falciparum causes the most serious clinic (Celikbaş et al., 2006). Although P.vivax is most frequently seen in our country and in the world, P. falciparum can also be seen in the people who have travelled to the endemic regions (Celikbaş et al., 2006).Like other malaria types, Falciparum malaria starts with headache, asthenia, cold, shivering and sweating. In falciparum malaria, periodical fever is seen once every 72 hours and mostly it progresses with irregular intermittent fever (Parlak et al., 2013). In case early and correct treatment is not applied in this malaria type, mortality may occur besides various complications thus early diagnosis is of great importance. Thus malaria diagnosis should be considered for the patients who have applied to emergency with fever complaint, the

travelling history of the patient should be investigated for early diagnosis and required examinations should be done. In our case, fever, headache and conscious change are present and fever is observed at irregular periods. The patient had applied to various doctors within the last five days due to fever but diagnosis could not be made because malaria is eluded.

In malaria, physical examination findings such as the symptoms are non-specific and most frequently splenomegaly and hepatomegaly are seen. In the laboratory findings, elevated anemia, thrombocytopenia, liver function tests disorders, bilirubin and lactic dehydrogenase enzyme may be seen (World malaria report, 2015). In our case, hepatosplenomegaly is not present and thrombocytopenia (23000/mm^3), elevated bilirubin (total bilirubin 2.23 mg/dL, direct bilirubin 1.48 mg/dL), elevated LDH (607 IU/L) are specified.

Malaria diagnosis can be done via various methods and thin smearing and thick drop blood preparations are one of the diagnosis methods that are very simple and responding very quickly. In P. falciparum malaria, only young trophozoite, more than one ring-form and banana-type gametocyte forms are seen in peripheral blood (Moody, 2002). In our case, diagnos is was made by observing more than one ring-form and gametocytes in one erythrocyte. Atovaquone/Proguanil 1x1gr treatment for three days and then doxycycline treatment for 7 days is given upon contacting to the infectious diseases branch of the Directorate of Health. During the treatment, fever of the patient has regressed on the 3rd day, his consciousness was restored and he was mobilized. After a total of 10-day treatment, the patient was discharged by recommending a polyclinic follow-up.

Malaria is an important disease that responds well to the treatment and that may progress mortally when no treatment is applied and early diagnosis and early treatment are very important. For the patients applied to emergency with high fever, travelling history should be investigated, malaria should be considered and early treatment should be started.

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Peroneal palsy as a complication of developmental hip dysplasia surgery

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ABSTRACT

Nerve injuries are rare complications of surgical management of developmental dysplasia of the hip (DDH). Over-stretching can cause injuries of femoral, sciatic and peroneal nerves. In this report, we present a 6-year-old girl with Tönnis type IV bilateral DDH whose postoperative period was complicated with foot drop due to the breakage of the spica cast. Open reduction and Pemberton pericapsular osteotomies, high femoral osteotomies for derotation and shortening had been performed on both hips of the patient. Patient had been kept in a spica cast for six weeks. At the 6th week follow up visit it was observed that spica cast was broken at the knee. When the cast was removed foot drop was noted on left foot. Electromyoneurography (EMNG) revealed total axonal degeneration of the peroneal nerve at the level of the fibular head. The conservative therapy for 18 months failed to result in any improvement in common peroneal nerve function. Therefore, peroneal nerve decompression, neurolysis and posterior tibial tendon transfer had been performed. At the 4th year follow up visit the patient had active dorsiflexion of the ankle, no need for AFO and the foot was plantigrade and painless. We presented this case report in order to inform the orthopedic surgeons performing DDH surgeries about a possible complication of the spica cast and to emphasis the necessity of good care of the spica cast.

1. Introduction

Nerve injuries are rare complications of surgical management of developmental dysplasia of the hip (DDH). Femoral, sciatic and peroneal nerve injuries have been reported in the previous articles (Pemberton, 1965; Hellinger and Schmidt, 1982; Salter et al., 1984; Kessler et al., 2001; Lalonde et al., 2002; Serin et al., 2004; Pekmezci and Yazici, 2007). These injuries were most commonly caused by over-stretching of the nerves during reduction of the hip. A case of irreversible peroneal nerve injury which had been caused by intrapelvic hematoma have been reported (Hellinger and Schmidt, 1982). Peroneal nerve lesions results in foot drop.

Peroneal nerve lesions are frequently caused by compression of the peroneal nerve or direct trauma to the peroneal nerve at the level of fibular head where it is superficial (Lippin et al., 1993; Watemberg et al., 2000). Dorsiflexion deficit of the foot results in foot drop which can also be caused by lumbar plexus lesions and lower lumbar radiculopathy.

In this case report we presented a case of peroneal nerve lesion and foot drop which was a complication of DDH surgery.

2. Case

Our case was a 6-year-old girl with Tönnis type 4 bilateral DDH. Patient did not have any concomitant pathology, history of trauma or familial disease. Open reduction and Pemberton pericapsular osteotomies for both of the hips, high femoral osteotomies for derotation and shortening had been performed on both femurs of the patient. No immediate intra-operative or postoperative complications had been noticed. At 6th week follow up visit, it was noted that the spica cast was broken at the left knee. Foot drop of the left foot had been noticed after the removal of the spica cast. There was extension deficit in all toes and extension and eversion deficits of the ankle. Sensory deficit was present at the anterolateral leg and at dorsal part of the foot and toes. Tinnel's test was positive at the level of the fibular head. Electromyoneurography (EMNG) revealed a total axonal degeneration of the peroneal nerve at the level of the fibular head. An ankle-foot orthotic (AFO) had been prescribed and patient had been treated with high dose cobalamine. During the three month follow up period no recovery had been noted and peroneal nerve decompression surgery was advised but the parents refused surgery. At 18th month follow up visit EMNG revealed no change in peroneal nerve function (Fig. 1A, B). Parents accepted the surgery at the 18th month. Peroneal nerve decompression at the level of the fibular head, neurolysis and posterior tibial tendon transfer had been performed (Fig. 2A, B, C). It was observed during the operation that the peroneal nerve was stuck and tenuous at the fibular neck. Long leg cast was applied and had been kept for 6 weeks; then a patellar tendon bearing cast was applied and patient was mobilized for the next 6 weeks. After the removal of the cast active dorsiflexion of the ankle was achieved but EMNG revealed no recovery of the peroneal nerve function. An AFO was prescribed for the following three months. At the postoperative 4th year follow up the patient had active dorsiflexion of the ankle and the foot was plantigrade and painless (Fig. 3A, B). Patient is still being followed up.

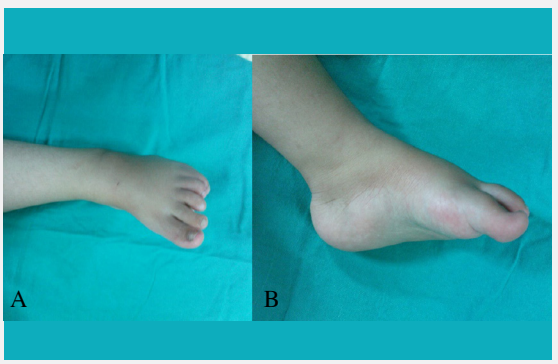

Fig. 1. A, B Preoperative photograph of foot, lack of dorsiflexion.

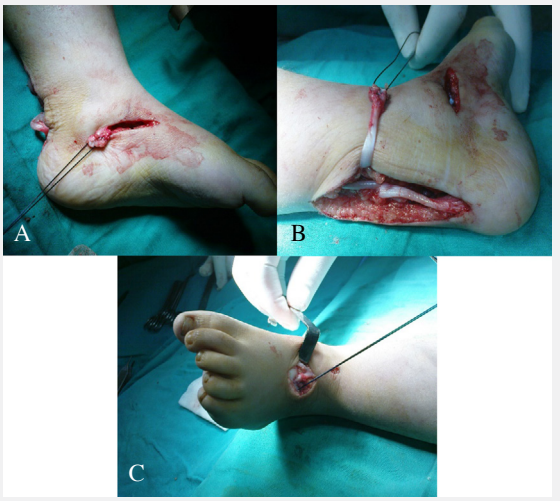

Fig. 2. A,B,C Transfer of the tibialis posterior tendon to the lateral cuneiform.

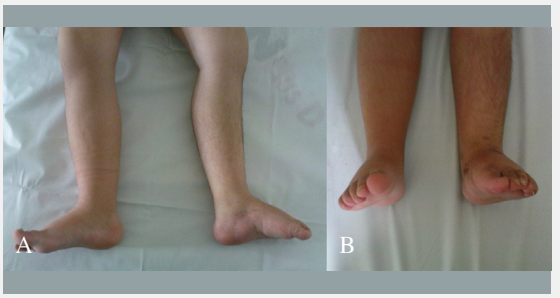

Fig. 3. A,B Post-operative 4th month photograph of plantigrade foot.

3. Discussion

Peroneal nerve arises from the trunk of the sciatic nerve in the popliteal fossa and passes over the lateral head of the gastrocnemius muscle. Peroneal nerve is just beneath the skin at the level of the fibular head and neck where it is susceptible to trauma (Lippin et al., 1993; Watemberg et al., 2000). Hypermobility of the fibular head results in continuous mechanical injury to the peroneal nerve (Mc Crory et al., 2002). Peroneal nerve has a small number of nerve fibers and a small amount of endoneurium and perineurium. These attributes along with its vulnerable location around the fibular head makes it susceptible to direct trauma and stretching (Lippin et al., 1993; Evans et al., 1994). Most common causes of peroneal nerve injury at the level of fibular head are iatrogenic trauma during surgical procedures, knee dislocations, casting, orthoses and penetrating injuries. Other causes are exostoses hematomas, ganglion cysts, compression of the fracture calluses, tumors of the fibular head, lipomas and hemangiomas (Evans et al., 1994; Wilkinson and Birch, 1995; Toğrol et al., 2000; Tomaino et al., 2000; Garozzo et al., 2002; Pichler et al., 2009; Halm and Schepers, 2012).

Peroneal femoral and sciatic nerve injuries after surgical management of DDH had been reported previously (Pemberton, 1965; Hellinger and Schmidt, 1982; Salter et al., 1984; Pekmezci and Yazici, 2007). Forceful reduction may result in nerve injuries. Hellinger and Schmidt reported a case of peroneal nerve injury caused by intrapelvic hematoma after pericapsular osteotomy (Hellinger and Schmidt, 1982). We presented the case of a 6-year old girl with a peroneal nerve injury which was caused by compression of the peroneal nerve by the break of the spica cast at the left knee.

A three month of high dose cobalamin treatment and AFO use is suggested in treatment of the peroneal nerve palsy (Mc Crory et al., 2002). A posterior tibial tendon transfer is suggested in late diagnosed cases (Mont et al., 1996). Posterior tibial tendon transfer in cases with surgical nerve repair is reported to improve outcomes (Bekler et al., 2007). We treated our patient with high dose cobalamin and an AFO for the first three months and suggested peroneal nerve decompression surgery at the end of the third month. Parents refused the surgery so we had to keep treating the patient medically until the parents gave the permission for the surgery for a total of 18 months which resulted in no improvement in peroneal nerve function. At the end we performed peroneal nerve decompression neurolysis and posterior tibial tendon transfer on the patient.

Orthopedic surgeons who perform DHD surgery can see peroneal nerve lesions as a complication of the surgical procedure. Bony prominences like the knee should be well padded during the application of the spica cast and the greatest care must be given to the spica cast. Posterior tibial tendon transfer is an effective procedure in treatment of foot drop due to long term peroneal nerve palsy.

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Ethical Approval: All procedures performed on the patient were in accordance to the ethical standards of the institution research committee.
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Case Report

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Meningeal hemangiopericytoma

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ABSTRACT

Meningeal hemangiopericytomas are rare malign mesenchymal tumors accounting for less than 0.4% of all intracranial tumors. They are accepted as an aggressive form of solitary fibrous tumors and classified as World Health Organization grade II or III lesions. The clinical behavior of these tumors is highly aggressive and they are prone to local recurrence and extracranial metastasis. In clinical practice, pre-operative diagnosis of meningeal hemangiopericytomas plays a key role in treatment selection and surgical planning. However, their radiological imaging features can be almost indistinguishable from those of meningiomas. Here, we aimed to present a 46-year-old male with anaplastic hemangiopericytoma and to emphasize the distinctive radiological features specific to hemangiopericytoma.

1. Introduction

Meningeal hemangiopericytomas (HPC) are rare malign mesenchymal tumors accounting for less than 0.4% of all intracranial tumors. They mostly occur in younger adults with a mean presentation age of 38-42 years. Approximately 10% of all HPCs occurs in children and show a slight male preference (Smith et al., 2014). While HPC is widely thought to develop from pericytes surrounding capillaries, the exact origin of the tumor remains controversial. Currently, it is accepted as an aggressive form of solitary fibrous tumors and classified as World Health Organization (WHO) grade II or III lesions. The WHO grade III encompasses the anaplastic HPCs (Giannini et al., 2007). HPCs usually present with headache, seizures, visual impairment and motor weakness. And in imaging studies, they appear as a locally aggressive, bulky dural mass. However, HPCs are very similar in terms of radiological features to meningiomas, which are much more common than they are. Therefore, HPCs are often indistinguishable from meningiomas in imaging studies and have a high rate of misdiagnosis (Bouvier et al., 2012; Liu et al., 2013; Smith et al., 2014). Here, we aimed to present a 46-year-old male with anaplastic HPS and to emphasize the distinctive radiological features specific to HPS.

2. Case

A 46-year-old male patient presented with headache that had been present for the last six months and had increased significantly in the last two weeks. He also reported weakness and numbness in his right arm for the past few months. Neurological examination revealed loss of strength in the patient's right arm compared to the left. Head computed tomography (CT) revealed a bulky mass in the right temporal lobe which caused erosion at the adjacent skull (Fig. 1). On brain magnetic resonance imaging (MRI), the lesion appeared as a lobulated extra-axial mass measuring 54 x 32 x 53 mm (AP x T x CC). It was a heterogeneous lesion with central necrotic areas and perilesional edema. Due to the mass effect of the lesion, the adjacent cortical sulci as well as the lateral ventricle were effaced and the midline structures were pushed towards the contralateral side (Fig. 2). The mass was hypointense in T1-weighted, T2-weighted and FLAIR images. Diffusion-weighted images and ADC mapping showed intermediate restriction of diffusion within the mass (Fig. 3). An intense heterogeneous enhancement following gadolinium administration was recorded. The mass showed a relatively narrow base of dural attachment and dural tail sign (Fig. 4). Digital subtraction angiography (DSA) demonstrated the arterial supply from the external carotid artery and rich vascularization within the mass. In addition, a characteristic "fluffy" stain was noted within the lesion (Fig. 5).

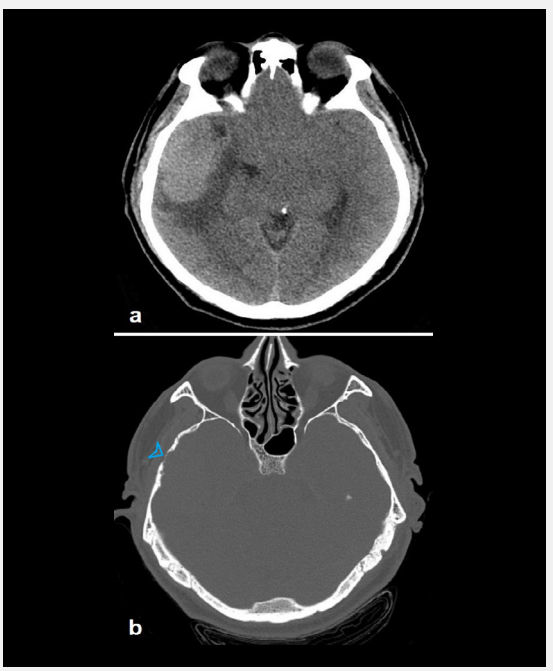

Fig. 1. Axial computed tomography sections through parenchyme (a) and bone (b) windows show a large mass located in the right temporal lobe causing erosion at the adjacent skull (arrowhead).

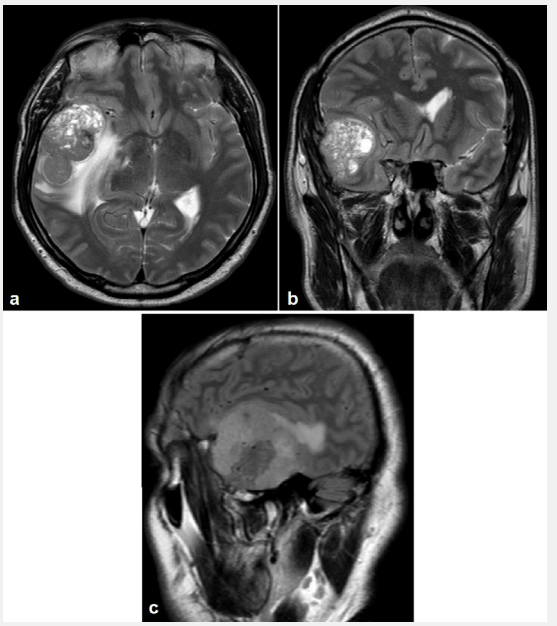

Fig. 2. Axial (a), coronal (b) and sagittal (c) T2-weighted brain magnetic resonance images show a lobulated, extra-axial, heterogeneous mass with central necrotic areas and perilesional edema in the right temporal lobe. Due to the mass effect of the lesion, the adjacent cortical sulci as well as the right lateral ventricle are effaced and the midline structures are pushed towards the contralateral side.

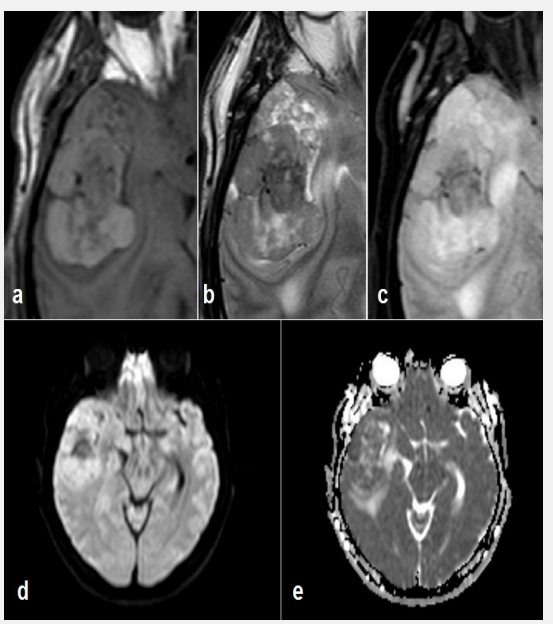

Fig. 3. The mass is isointense in T1-weighted (a), T2-weighted (b) and FLAIR (c) images. Diffusion-weighted image (d) and ADC mapping (e) show intermediate restriction of diffusion within the mass.

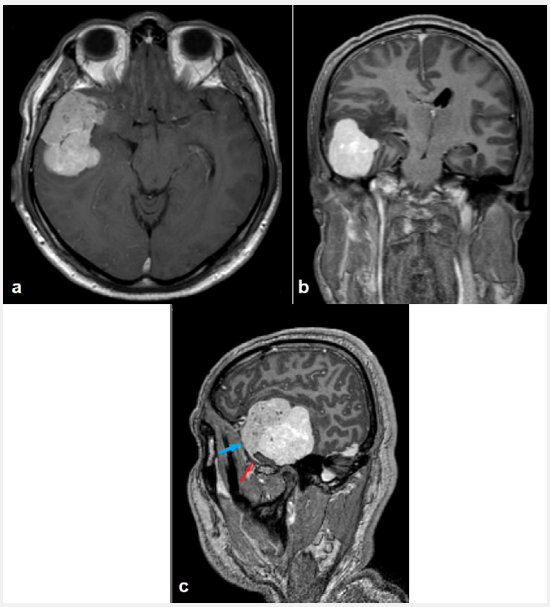

Fig. 4. Post-contrast axial (a), coronal (b) and sagittal (c) T1-weighted images show an intense heterogeneous enhancement of the mass. Note the mass shows a relatively narrow base of dural attachment (blue arrow) and dural tail sign (red arrow).

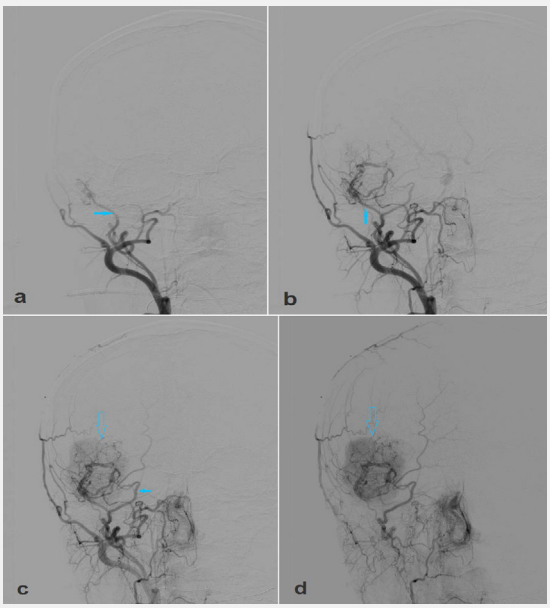

Fig. 5. Consecutive digital subtraction angiography images demonstrate the arterial supply from the deep temporal artery branches of the right maxillary artery (solid arrows). Note the rich vascularization and fluffy stain within the mass (oper arrows).

Based on the imaging findings, the lesion was diagnosed as meningeal hemangiopericytoma. A comprehensive imaging study was then performed to exclude a possible metastasis and no metastatic focus was detected. Following the pre-operative catheter embolization, en bloc resection of the mass was performed. On pathological evaluation, the tumor exhibited high mitotic activity with spindle character occasionally showing a storiform pattern. Immunohistochemical preparations for CD34 were focally positive (Fig. 6). Pathological examination confirmed the pre-operative diagnosis and the lesion was categorized as WHO grade III HPC. Adjuvant radiotherapy was planned to prevent recurrence.

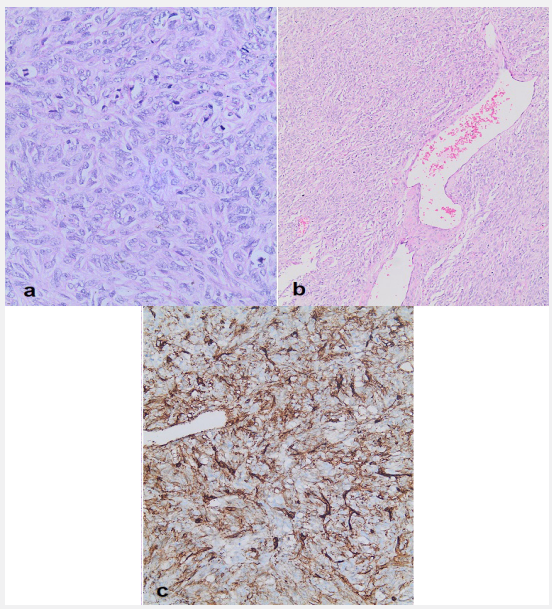

Fig. 6. (a) (H&E 100x) The tumor exhibits high mitotic activity with spindle character occasionally showing a storiform pattern. (b) (H&E 100x) In some places, fine vascular structures in the form of antlers were recorded. (c) (IHC 200x) There are patchy areas of CD 34 positivity in tumor cells.

3. Discussion

While HPC is considered a mesenchymal tumor, it exhibits different clinical behaviors, histological classification and immunohistochemical features compared to other primary mesenchymal tumors such as meningioma. Therefore, according to the WHO classification of central nervous system tumors, HPC is categorized as "mesenchymal, non-meningothelial tumors". HPC is much more aggressive and has a high recurrence rate compared to meningioma (Giannini et al., 2007). In clinical practice, pre-operative diagnosis of HPCs plays a key role in treatment selection and surgical planning. However, pre-operative diagnosis of HPC is not always easy. In most cases, the mass exhibits very similar imaging features to the meningioma, making it extremely difficult for the radiologist to make differential diagnosis (Liu et al., 2013; Smith et al., 2014).

We presented a patient with HPC showing a narrow dural attachment, contour lobulation and skull erosion, suggestive of a HPC rather than a meningioma which is characterized by a broad dural attachment, regular contours and hyperostosis at the adjacent skull. HPCs almost always present as a large and locally aggressive dural mass causing skull destruction and frequently extending through the skull vault. However, meningiomas are characterized by overgrowth of the adjoining bone, which is called "hyperostosis" (Bouvier et al., 2012; Smith et al., 2014). Further, the mass lesion we currently present depicted a "fluffy" stain in DSA unlike a meningioma that typically exhibits a "sunburst" stain (Liu et al., 2013). Other findings that excluded the diagnosis of meningioma in our case were extensive perilesional edema and intratumoral necrosis including old bleeding foci and cystic sites. Intratumoral necrosis and peritumoral edema are striking findings supporting HPC, especially the anaplastic form, as we have now presented (Giannini et al., 2007; Bouvier et al., 2012; Liu et al., 2013; Smith et al., 2014).

In addition to imaging features, there are some clinical clues that can help distinguish HPC and meningiomas. First, the average age of presentation of HPCs (mean, 38-42) is lower than that of meningiomas which mostly manifest themselves at the early fifties. Second, the interval between initial symptoms and the diagnosis of HPC (mean, 4 months) is significantly shorter than that of meningiomas which is 1-2 years on average. Third, the clinical behavior of HPCs is more aggressive than that of meningiomas. And different from meningiomas, HPCs have a strong tendency to local recurrence and extracranial metastasis (Liu et al., 2013; Abdollahi et al., 2016).

The presentation symptoms of our case were headache and weakness in the right arm. According to the previously reported cases, the presentation of the tumor depends on the location of the lesion, but the symptoms usually include headache, seizures, visual impairment and motor weakness. Headache is reported to be the most common symptom in patients with HPC (Liu et al., 2013; Abdollahi et al., 2016; Tatarlı et al., 2016). The treatment of HPC consists of surgical resection and post-operative adjuvant radiotherapy. Since they are highly vascular tumors pre-operative embolization is highly recommended in these cases (Keser et al., 2014; Smith et al., 2014; Tatarlı et al., 2016).

Meningeal HPCs are rare malign mesenchymal tumors of which at times the radiological imaging features can be almost indistinguishable from those of meningiomas. Knowledge of the distinctive imaging features as well as characteristic clinical clues can help distinguish HPS and meningioma.

Informed consent: Informed consent for publication was obtained from the patient.

Conflict of Interest: The authors declare that they have no conflict of interest.

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