Acta Medica Academica

Journal of Department of Medical Sciences
of Academy of Sciences and Arts of Bosnia & Herzegovina

UDC 61(05) 2007 Vol. 36 No. 2 ISSN 1840-1848

Online First, www.anubih.ba/ama/

Acta Medica Academica

Contents
2007 Vol. 36, No. 2

Acta Medica Academica (ISSN 1840-1848) is an international peer-reviewed journal published two times a year.
Acta Medica Academica is printed as a continuation of the journal *Works of the Academy of Sciences and Arts of Bosnia and Herzegovina, Department of Medical Sciences*, founded in 1953.
Acta Medica Academica Online (ISSN 1840-2879) offers free access to all articles at www.anubih.ba/ama/

Print

HARFO-GRAF, Tuzla

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Printed on acid-free paper

Abstracted/Indexed in
EBSCOhost
IndexCopernicus

The Cover Picture: Petar Vidić (1938 -), "Nocturne 1", 1994, Oil on canvas 68x75 cm. Courtesy of Academy of Sciences and Arts of Bosnia and Herzegovina.

Functioning and depression in patients under cognitive-behavioral psychotherapy

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In the present study we analyzed 30 patients (20 females and 10 males) diagnosed with a severe depressive disorder, mean age 37.6 ± 9.3 years, who were under cognitive-behavioral psychotherapy. The patients were divided into three groups: one group was submitted to group therapy only (group I), the other one to individual therapy (group II), while the third group was submitted to combined individual and group psychotherapy (group III). We applied the Beck Depression Inventory (BDI) scale and Global Assessment of Functioning (GAF) scale at the beginning of treatment and at its end (namely, after 12 months), and again six months later following the one-year period of treatment. At the beginning of treatment the median values of the whole group were noted as follows: BDI 42, and GAF 50.5. After one year of psychotherapy the median values of improvement were registered as follows: in respect of BDI it was recorded as 38, while for GAF it was recorded as 22. GAF score correlated very significantly with BDI (-0.52). Six months after the last individual and group sessions were held all parameters were significantly worsened. At this stage there was a moderate correlation of GAF with BDI (-0.47). Through all the stages BDI value in group I showed a significant correlation with GAF: -0.65 before the introduction of therapy, -0.48 after psychotherapy, and -0.48 after a six-month period without therapy. Similar values were observed in group II: -0.58 before therapy, -0.36 after therapy, and -0.85 six months later, while in group III the following values were observed: -0.58 before therapy, -0.36 after therapy and -0.47 six months later. Conclusion: GAF is most strongly correlated with BDI in all stages, both in the stage of improvement or aggravation of illness and it may be applied as a useful screening test in further psychotherapeutic strategy. The combined individual and group psychotherapy increases the overall functioning rate regardless of a significantly lesser improvement of depression in comparison with the isolated group psychotherapy.

Received: 9 January 2007
Accepted: 10 September 2007

Key words: Cognitive-behavioral Psychotherapy, Scale of global assessment of functioning, Depression.

Introduction

The Global Assessment of Functioning (GAF) scale is a standard method applied in clinical assessment of the overall level of functioning of a patient, and it includes information about the axis V DSM IV (1). As such, it is widely used as a scale to assess the level of disorder in patients with psychological and psychiatric symptoms, respectively (2). It enables hospital clinicians to examine the patient's immediate functioning, but also the highest level of psychological, social and occupational functioning over a few months in the previous year, and this, in turn, greatly influences the prognostication of therapy outcome (3, 4).

GAF scores are relatively independent of socio-demographic factors (5, 6, 7, 8) so that the level of functioning assessed by the hospital clinicians does not depend on a patient's age, sex or marital status, for that matter. Several studies have proved that there is a connection between the severity of symptoms as stated by the patient and the global assessment of functioning score obtained by the hospital staff (6).

We would like to point out the fact that previous studies were largely based on the conformity of the patient's symptoms with axis V in respect of the level of overall disorder (10, 11, 12, 13, 14), and the latter includes scant information about the patient's social or occupational functioning which is independent of the assessment of the severity of the patient's symptoms by the hospital clinicians (15). Since patients usually return to the previous level of functioning after an episode of acute illness, scoring of the patient's highest level of functioning during the past year has a certain prognostic value.

However, it is surprising that there is relatively little empirical evidence about the appropriateness of GAF in this respect, and as a result, there is no confirmation regarding the validity of the prevalent use of GAF as a standard part of diagnostic procedures applied by experienced psychiatrist in hospital conditions.

In addition, there is still an outstanding question related to the kind of parameters the level of functioning correlates most strongly with, under various forms of psychotherapy treatment, and in different stages of psychotherapy.

Aims objectives

The present study was conducted to determine

- the severity of depression and the level of functioning at the beginning of cognitive-behavioral psychotherapy, a year after psychotherapy, and 6 months following the last psychotherapy session;
- the level of improvement and aggravation of the above-mentioned parameters;
- the correlation of the level of functioning with the level of depression both in the stages of improvement and aggravation.

Patients and methods

The present study included 30 patients (20 females and 10 males) who were diagnosed with a severe depressive disorder. The study was conducted over the course of 18 months. The mean age of examinees was 37.6 ± 9.3 (19-55) years. These patients were placed in three groups (each group consisted of 10 patients). One group was treated with group therapy, the other with individual therapy, while the third group was treated with a combination of group and individual psychotherapy. Cognitive-behavioral therapy (CBT) was used in the treatment of patients and it was organized in the form of group and individual sessions. The observation period lasted from June, 2004 until December, 2005. Individual sessions were performed once weekly, and the total number of sessions was 12-16. After that, we performed one ses-

sion monthly. After 5-12 individual sessions patients were included in group therapy. Groups were of the "open type" and lasted 12 months. Group therapy sessions lasted one hour, and were performed three times weekly at the beginning for one month, after that once weekly over the next two months, and after that once monthly. Each of the two groups consisted of 10 members. Selection of patients for individual or group treatment was random. We measured and compared Beck Depression Inventory (BDI) scores with Global Scale of Functioning (GAF) scores obtained at the beginning of the treatment, one year later, and 6 months after the last psychotherapy session. The correlation of BDI with GAF was also observed in the same intervals. First the parameters were set out for the whole group, but later the patients treated with cognitive-behavioral therapy were analyzed and compared independently. In the statistical analysis we used the Mann-Whitney U test, Wilcoxon test, and Spearman coefficient of correlation.

Results

Comparison of the level of depression with the level of functioning in patients treated with cognitive-behavioral psychotherapy

Scores of depression and functioning before the beginning of psychotherapy, 12 months after psychotherapy treatment, and 6 months without psychotherapy are shown in Table 1. After a 6-month period without psychotherapy values measured by Wicoxon test were significantly aggravated: for BDI p = 0.002, and for GAF p = 0.002. Correlation rates of all parameters with the scale of global functioning before psychotherapy, after 12 months of psychotherapy and in 6-months follow-up period are shown in Table 2.

BDI and GAF parameters before the beginning of group psychotherapy, 12 months after psychotherapy, and 6 months after the last session are shown in Table 3. Six months

Table 1 The values of Beck Depression Inventory (BDI), and Global Assessment of Functioning (GAF) before and after psychotherapy and 6 months after the last psychotherapy session.

Before psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	52.5	48.5-57.75	29	62
GAF	51.5	42-58	35	60
After 12 months of psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	5.5	5-8.5	3	10
GAF	70	61-79.75	60	81
The improvement				
	Median	Percentile 25-75	Min.	Max.
BDI	48.5	39.25-51.75	24	54
GAF	21	20-24.25	6	34
After 6 months without psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	12.5	9.25-14.5	8	17
GAF	62.5	58.5-72.75	55	75
The aggravation				
	Median	Percentile 25-75	Min.	Max.
BDI	5	3-7	2	12
GAF	-5.5	(-6.75)-(-3.5)	-1	-8

Table 2 Correlation of Global Assessment of Functioning (GAF) with Beck Depression Inventory (BDI) before and after psychotherapy and 6 months after the last psychotherapy session.

Before psychotherapy	
Relation	r (p=0.001)
BDI/GAF	-0.58
After 12 months of psychotherapy	
Relation	r (p=0.003)
BDI/GAF	-0.52
After 6 months without psychotherapy	
Relation	r (p=0.005)
BDI/GAF	-0.50

Comparison of the level of depression with the level of functioning in patients treated with group cognitive-behavioral psychotherapy

after psychotherapy there was an aggravation of BDI (p=0,002); the level of functioning measured by GAF was also significantly changed (p=0,002). Table 4 shows the correlation rates of GAF with BDI before and after group psychotherapy, and 6 months after the last group psychotherapy session.

Scores of depression and functioning before the beginning of individual psychotherapy, 12 months following psychotherapy treatment, and after 6 months without psychotherapy are shown in Table 5. Six months after individual psychotherapy there was an aggravation of depression measured by BDI (p=0.002); the level of functioning measured by GAF was also significantly changed (p=0.002). Table 6 shows the correlation rates of GAF with BDI before and after individual psychotherapy and 6 months after the last psychotherapy session.

Scores of depression and functioning before the beginning of combined psychotherapy treatment, 12 months later following psychotherapy treatment, and after 6 months without combined psychotherapy are shown in Table 7. After a 6-month period without combined psychotherapy parameters were significantly aggravated, (p=0.002 for BDI, and p=0.002 for GAF). Table 8 shows the correlation rates of GAF with BDI before and after combined psychotherapy and 6 months after the last psychotherapy session. The relation of importance of improvement of BDI and GAF values after 12 months in patients treated with individual, group, and combined individual and group psychotherapy in contrast to aggravation of the abovementioned values after 6 months without therapy are shown in Table 9.

Table 3 The values of Beck Depression Inventory (BDI), and Global Assessment of Functioning (GAF) before and after group psychotherapy and 6 months after the last group psychotherapy session.

Before group psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	52.5	48.5-57.75	29	62
GAF	51.5	42-58	35	60
12 Months after group psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	5.5	5-8.5	3	10
GAF	70	61-79.75	60	81
The improvement				
	Median	Percentile 25-75	Min.	Max.
BDI	48.5	39.25-51.75	24	54
GAF	21	20-24.25	6	34
After 6 months without group psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	12.5	9.25-14.5	8	17
GAF	62.5	58.5-72.75	55	75
The aggravation				
	Median	Percentile 25-75	Min.	Max.
BDI	5	3-7	2	12
GAF	-5.5	(-6.75)-(-3.5)	-1	-8

Table 4 The correlation of Global Assessment of Functioning (GAF) with Beck Depression Inventory (BDI) before and after group psychotherapy and 6 months after the last group psychotherapy session.

Before group psychotherapy	
Relation	r (p=0.049)
BDI/GAF	-0.65
After 12 months of group psychotherapy	
Relation	r (p=0.166)
BDI/GAF	-0.48
After 6 months without group psychotherapy	
Relation	r (p=0.154)
BDI/GAF	-0.48

Comparison of the level of depression with the level of functioning in patients treated with individual cognitive-behavioral psychotherapy

Table 5 The values of Beck Depression Inventory (BDI), and Global Assessment of Functioning (GAF) before and after individual psychotherapy and 6 months after the last session of individual psychotherapy.

Before individual psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	36.5	30-56.25	17	60
GAF	51	41-56.5	35	60
12 Months after individual psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	4	2-6.5	1	10
GAF	72	62.5-80	60	81
The improvement				
	Median	Percentile 25-75	Min.	Max.
BDI	33	27.25-48.25	16	56
GAF	22.5	17.75-27.25	3	41
After 6 months without individual psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	8	5.5-10	5	14
GAF	59.5	55.75-72.5	53	79
The aggravation				
	Median	Percentile 25-75	Min.	Max.
BDI	3.5	3-5	2	7
GAF	-5.5	(-10.55)-(-2.75)	-2	-25

Table 6 The correlation of Global Assessment of Functioning (GAF) with Beck Depression Inventory (BDI) before and after individual psychotherapy and 6 months after the last session of individual psychotherapy.

Before individual psychotherapy	
Relation	r (p=0.0878)
BDI/GAF	-0.58
12 Months after individual psychotherapy	
Relation	r (p=0.296)
BDI/GAF	-0.36
After 6 months without individual psychotherapy	
Relation	r (p=0.178)
BDI/GAF	-0.848

Comparison of the level of depression with the level of functioning in patients treated with combined individual cognitive-behavioral psychotherapy and group cognitive-behavioral psychotherapy

Table 7 The values of Beck Depression Inventory (BDI), and Global Assessment of Functioning (GAF) before and after the psychotherapy and 6 months after the last session of combined individual and group psychotherapy.

Before individual and group psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	35	28.25-39.5	18	61
GAF	50.5	46.25-57.25	36	60
12 Months after individual and group psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	2	2-3	0	4
GAF	80	79.25-81.5	71	85
The improvement				
	Median	Percentile 25-75	Min.	Max.
BDI	33	25.25-37.5	18	57
GAF	30	20-34	19	43
After 6 months without individual and group psychotherapy				
	Median	Percentile 25-75	Min.	Max.
BDI	7	5.25-9.5	4	10
GAF	70	69-74	68	77
The aggravation				
	Median	Percentile 25-75	Min.	Max.
BDI	5	3.25-6.75	2	8
GAF	-9.5	(-11.5)- (-5)	4	-14

Table 8 The correlation between Global Assessment of Functioning (GAF) and Beck Depression Inventory (BDI), before and after the psychotherapy and 6 months after the last session of combined group and individual psychotherapy.

Before individual and group psychotherapy	
Relation	r (p=0.08)
BDI/GAF	-0.58
12 Months after individual and group psychotherapy	
Relation	r (p=0.295)
BDI/GAF	-0.36
After 6 months without individual and group psychotherapy	
Relation	r (p=0.178)
BDI/GAF	-0.47

Table 9 The significance of improvement of Beck Depression Inventory (BDI) and Global Assessment of Functioning (GAF) values measured by t-test after 12 months in patients treated with individual, group, and combined individual and group psychotherapy, and the aggravation of the BDI and GAF values after 6 months follow-up period

After 12 months of psychotherapy	
Group/individual psychotherapy	p
BDI	0.196
GAF	0.722
Group/individual and group	P
BDI	0.011
GAF	0.143
Individual/individual and group	p
BDI	0.781
GAF	0.268
After 6 months without psychotherapy	
Group/individual psychotherapy	p
BDI	0.268
GAF	0.614
Group/individual and group	p
BDI	0.807
GAF	0.128
Individual/individual and group	p
BDI	0.298
GAF	0.517

Discussion

Before the beginning of psychotherapy relatively high scores of depression were registered in all patients, whereas the improvement of all parameters was evident after 12 months of psychotherapy. After a 6-month period without psychotherapy BDI and GAF values were significantly aggravated. Prior to psychotherapy there was a significant negative correlation of all parameters with the scale of global functioning. After 12 months of psychotherapy a connection between depression and functioning was also registered. A similar observation was registered 6 months following the last psychotherapy session and this is where the only substantive connection with depression exists.

In the group of patients treated with group cognitive-behavioral psychotherapy it is evident that after 12 months of psychotherapy all parameters were significantly improved. Six months after the last psychotherapy session there was an aggravation of depression. The level of global functioning was also significantly changed. Before psychotherapy there was an important negative correlation between GAF and BDI values. After 12 months of improvement of all parameters a correlation between GAF and BDI is evident.

Changes of the BDI and GAF parameters before the first psychotherapy session, a year after therapy, and 6 months after the last session of individual psychotherapy are shown in Table 5. It is interesting to note that 6 months after the last psychotherapy session there was a significant aggravation of GAF.

At the beginning of individual psychotherapy a strong correlation between GAF and BDI was noticed. After 12 months of individual psychotherapy a very slight correlation of GAF with BDI was evident. After 6 months without individual psychotherapy there was a very significant negative correlation between GAF and BDI.

Before the beginning of combined individual and group psychotherapy there was a negative correlation between GAF and BDI. After a 12 month follow-up period there was still a slight negative correlation of GAF with BDI. A very important connection between GAF and BDI existed after the 6 month follow-up period without individual and group treatment of psychotherapy.

There was no significant difference in the improvement of parameters between patients treated with group or individual psychotherapy only, individual and individual and group psychotherapy, but there was a difference in the BDI between patients treated with individual therapy only and combined

individual and group psychotherapy. After 6 months there was no significant change of parameters in patients treated only with group, individual or with combined group and individual psychotherapy.

The data from literature indicate that low GAF scores are connected with depression, suicidal behavior and lack of confidence (10, 12, 13, 14), but also with cognitive disorders (16). It was discovered that the symptoms of cognitive deterioration, hallucination, delusion, suspicion along with an untidy physical appearance in a patient are connected with a more severe psychiatric disturbance (11).

The correlation of GAF scores and the list of social functioning were established, such as a limitation of social communication and a need for support (17, 4, 18), but also the incapability of completing work at a workplace (6). Roy-Byrne and associates (1996) established that GAF is actually focused on social and occupational functioning, but not on clinical symptoms (6).

Numerous studies have proved that the leveling of global functioning done by experienced hospital staff is actually a parameter of convalescence during the treatment and after it (19, 20, 21, 22, 23, 24, 25, 26). However, some research has been conducted into GAF scores during and after the treatment of persons with severe mental illness, observing that higher GAF scores were a moderate predictor of better work output, but also a greater likelihood of longer stay at work, which produces the possibility of higher profit (13; 27). The findings in our study show that after a year of treatment all the analyzed parameters were improved. However, it has been proved that there is a connection between the aggravation of GAF during treatment of schizophrenic patients (28).

The question arises why the correlation changes independently of the level expected with the changes of level of depression? The different correlation of functioning with these parameters after convalescence or aggravation can be explained by the observation made by Gordon et al (1988) reporting that symptoms tend to change more quickly during the treatment than functioning alone (29). In this research we found evidence of increase of functioning even with (lower levels of) disproportional depression.

Conclusion

The values of Global Assessment of Functioning (GAF) correlate with Beck Depression Inventory (BDI) values in all stages of observation throughout cognitive-behavioral psychotherapy, and they can serve as a useful screening test of either aggravation or improvement of illness. A combination of individual and group psychotherapy in relation to group psychotherapy alone increases functioning, even with a significant, low level of improvement of depression. Considering the very small sample of patients, especially the subgroups, the conclusions must be accepted with caution.

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Review of the supernumerary renal arteries by dissection method

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Received: 16 March 2007
Accepted: 22 December 2007

Introduction. A thorough knowledge of the variations of the renal artery has grown in importance with the increasing numbers of renal transplants. The literature indicates that multiple renal arteries are found in 9-76% cases. The purpose of this study was to establish the incidence and characteristics in cadavers. **Methods.** The examinations were performed on 39 cadavers dissected in the Department of Anatomy Faculty of Medicine University of Sarajevo. **Results.** The anatomical findings included the presence of multiple renal arteries in 18 (46.15) cases. Most often the hilar and lower polar arteries were found, while the upper polar artery was present in only 5.1% cases. **Conclusions.** In preparation for interventions, such as live renal donation, vascular reconstruction, renovascular hypertension, or radical nephrectomy, preoperative renal imaging is necessary and operative techniques should be considered with attention to multiple renal arteries. The recognition of multiple renal arteries is both anatomically significant and in surgical and radiological practice.

Key words: multiple renal artery, variations, renal dissection.

Introduction

The frequency of renal diseases, and the increase of the need for renal transplants, increase the need for research aimed at a better knowledge of the variations of the blood vessels in the kidneys.

The problem with transplantation is the lack of available organs, and the increasing number of patients on the waiting lists leads to increasing interest in live kidney donors. However, the presence of excessive numbers of renal arteries results in technical limitations in kidney transplantation (1).

The first anatomical findings on the renal artery, and the fact that one kidney can be provided with more than one renal artery, were shown by Eustachius on 1552, in anatomy illustrations engraved in copper. Since then, until today, the vascularisation of the kidney has been researched, with the special attention paid to variations in the arterial provisioning of this organ. The kidney can be provided with several renal arteries,

which part, enter and are located in different ways within the organ itself. They represent am important morphological fact, influencing the size and number of the vascular segments of the kidney. This has not only theoretical but also practical significance.

For the development and improvement of surgical approaches to the kidney, along with the development of diagnostic methods, we also need anatomical research in terms of the more precise definition of evaluation of the course, starting point and the division (parting) of the renal artery, and the morphological variations of the relations in its flow (2, 3, 4, 5, 6) A better knowledge of the variations in the artery vascularisation of the kidney has begun to play an important role in recent years in relation to the issue of renal transplantation (7). There is wide range of variations in the supernumerary renal arteries, which is the consequence of observation of this problem from different points of view, for different clinical purposes and due to the use of different research methods.

Also, we cannot find unified terminology for the supernumerary renal arteries (5, 6). Different terms have been used, such as: abnormal blood vessels, accessory, extra-hilar, multiple or aberrant blood vessels. All this creates a statistical gap in terms of their accurate type, number and the point of separation (parting point) (8, 9).

The knowledge of variations of the number and type of renal arteries is not only anatomical data but also represents also important clinical data, especially for surgery and radiology.

The objective of this paper is to explore through the dissection method as follows:

– Existence and localization (site) of supernumerary renal arteries,

– Types of supernumerary renal arteries using Merklin's classification (9),

– The separation point of these arteries from many arterial sources,

– Their courses and the ways of branching within the kidney itself,

– By the statistical processing of the results gained to define their frequency.

Methods

By the dissection method we processed 78 kidneys from 39 cadavers of delivered stillborns, previously fixed in 5% dissolution of formalin. The research was carried out in the Institute of Anatomy of the Medical School in Sarajevo University.

With the careful dissection of the region we accessed the blood vessels and the fat shell of the kidney. With the dissection we liberated the kidney from the fat shell and we separated the blood vessels from it towards the large blood vessels. The attention was focused on the origin and the number of the renal arteries, their relation and the separation in the hilus itself. With special care we dissected the blood vessels within the hilus of the kidney in order to notice the variations in the separation of the segmental renal arteries and their relations with the pelvis of the kidney. With the method of dissection we prepared the segmental arteries within the kidney itself and their ramification was followed up. However, this method did not provide the possibility of liberation deep inside the renal parenchyma, due to the exuberance of the blood vessels of the kidney.

All dissected preparations were photographed and documented, and we analyzed in them:

– The appearance of more than one renal artery (supernumerary renal arteries),

– Types of supernumerary renal arteries by the Merklin classification:

1. supernumerary renal arteries of the aorta origin, which can be hilar, upper and lower polar artery ,

2. supernumerary renal arteries originating from the renal artery that can be upper and lower polar artery.

3. supernumerary renal arteries that can originate from other arteries, for instance: lower phrenical artery, testicular, iliac, etc.

– The course and direction of the arteries' location and the place of entrance into the renal parenchyma.

The method of statistical analyses used in this paper is the arithmetic mean, then t- test of the differences of arithmetic mean. Statistical significance is considered important for $p < 0.05$. In our case we used Windows software statistics for biomedical research (SPSS version. 13.0).

Results

In the overall research we were led by the fact of the importance of renal transplantation, especially due to the continually increasing needs for donors of this organ in the last few years. Considering the very exuberant vascular network and the large number of variations in the vascularisation, and especially in the arterial provisioning of this organ, we examined the arterial visualization of the kidney and the potential variations on the available material.

In the preparations from the delivered still-borns we dissected the kidney, the kidney, urethra and the tree of the abdominal aorta together with the blood vessels belonging to these organs.

At the beginning of dissection we also prepared (liberated) the vena cava inferior with the accompanying veins towards the organs (Figure 1), in order to show the anatomical relationship of the arteries and the veins. After that, in order to have better insight into the positioning and separation of the segmental renal arteries within the hilus itself and further on in parenchyma of the kidney, we liberated the vena cava inferior with the accompanying veins.

39 preparations from delivered still-borns were prepared by the method of classical dissection, and the prepared organs

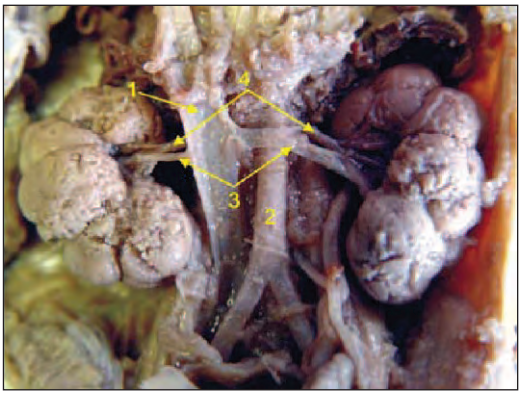

Figure 1 Review of the renal blood vessels:
1. Inferior vena cava, 2. Abdominal aorta, 3. Left and right renal vein, 4. Left and right renal artery

with the blood vessels were not taken out of the abdomen.

Of the total number, 20 preparations are male and 19 female. In all preparations the kidneys are located in the anatomic position within the abdomen.

We did not notice the lack of a kidney in any of the preparations.

For the analyses of the supernumerary renal arteries we used the classification by Merklin, of:

1. Supernumerary renal arteries originating from the aorta,

2. Supernumerary renal arteries from the kidney artery,

3. Supernumerary arteries that can come from other arterial sources.

The supernumerary renal arteries regardless of their origin, were found in 18 dissected preparations (46.15%) of 39 delivered still-borns.

In 12 preparations (30.76%) there were only the supernumerary renal arteries of aorta origin present. Five preparations (12.82%) had supernumerary renal arteries from the renal artery.

In one preparation (2.56%) we noticed both side presences of both groups of the supernumerary renal arteries. The supernumerary artery of the aorta origin was placed on the left side, and supernumerary artery

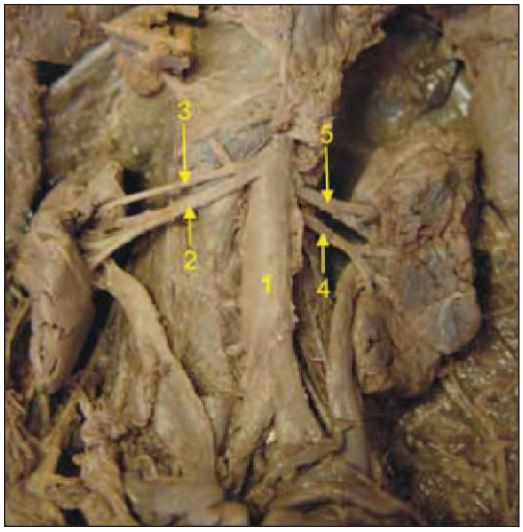

Figure 2 Both side presence of both types of the supernumerary renal arteries: 1. Abdominal aorta, 2. Right renal artery, 3. Upper polar artery from right renal artery, 4. Left renal artery, 5. Hilar artery of aorta origin from the left side

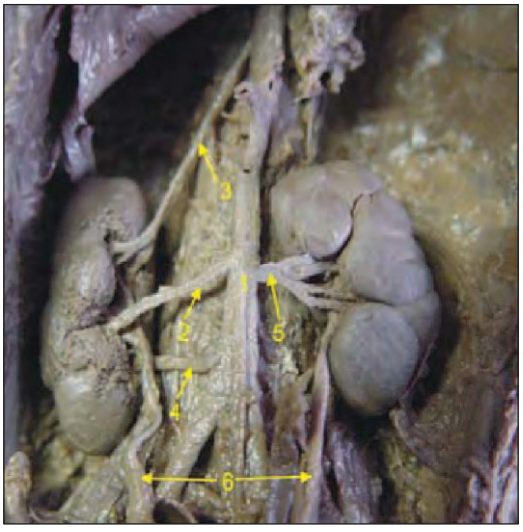

Figure 3 The right kidney provided with three renal arteries of aorta origin: 1. Abdominal aorta, 2. Right renal artery, 3. Lower polar artery of aorta origin on the right side, 4. Upper polar artery of aorta origin on the right side, 5. Left renal artery, 6. Ureters

from the renal artery on the right side (Figure 2).

In the second case we noticed that the right kidney was provided with three renal arteries of aorta origin. The upper polar supernumerary artery of aorta origin separates from the thoracic aorta, pushing its way through under the diaphragm and enters the kidney through the hilus on its upper part and provides for the upper part of the kidney.

The lower polar supernumerary renal artery of aorta origin starts from the aorta somewhere above the place of bifurcation of the abdominal aorta into two iliac arteries, flows behind the ureters and enters the hilus of the kidney in the lower part and provides for lower pole of the kidney (Figure 3)

Analysis of supernumerary renal arteries of aorta origin

Supernumerary renal arteries of aorta origin were found in 13 (33, 33%) preparations.

In ten preparations there one-sided arteries present.

The supernumerary renal arteries of aorta origin are more frequent on the right side. Nine of them were found on the right side, and five on the left side (Figure 4a and 4b.)

In three preparations (7.69%) we found the bilateral presence of supernumerary renal arteries of aorta origin (Figure 6). In one preparation the right kidney was provided with three arteries, which are described above. Also, in one preparation, the left kidney, beside the supernumerary renal artery of aorta origin had a supernumerary artery originating from the renal artery (Figure 2).

Analyzing the types of supernumerary renal arteries, using Merklin classification, we found the following results in dissection processed preparations:

– 7 (17.95%) hilar supernumerary renal arteries of aorta origin, which together with the renal artery enter the hilus of the kidney. Three arteries were found on the right side, four on the left. The bilateral presence of

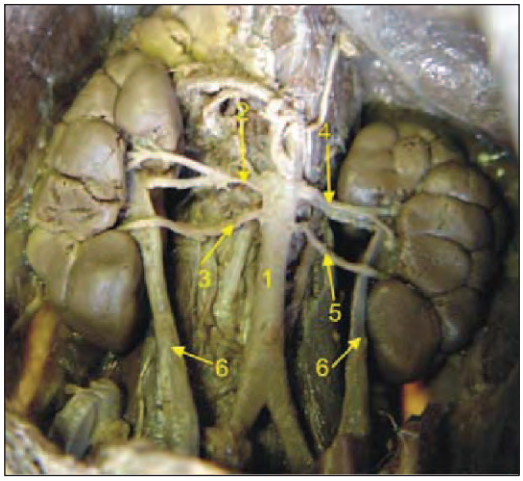

Figure 4a The both-side presence of supernumerary renal arteries of the aorta origin: 1. Abdominal aorta, 2. Right renal artery, 3. Lower polar artery of aorta origin on the right side, 4. Left renal artery, 5. Lower polar artery of aorta origin on the left side , 6. Ureters

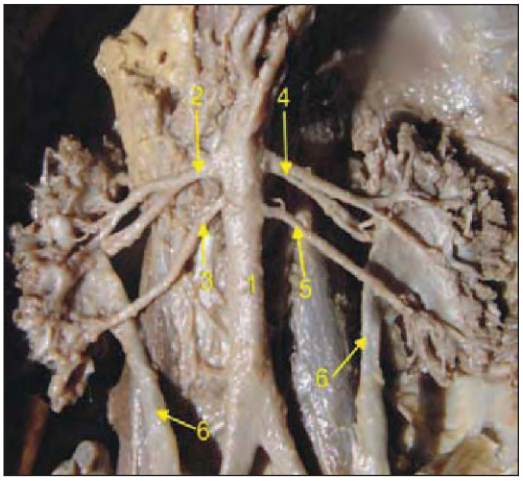

Figure 4b The bilateral presence of supernumerary renal arteries of aorta origin (the parenchyma of kidney removed): 1. Abdominal aorta, 2. Right renal artery, 3. Lower polar artery of aorta origin on the right side, 4. Left renal artery, 5. Lower polar artery of aorta origin on the left side, 6. Ureters

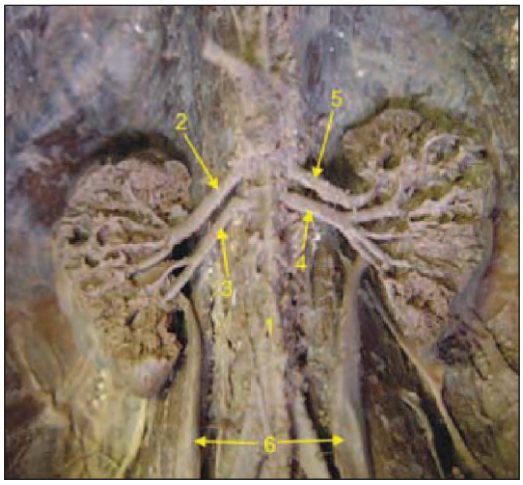

Figure 5 The bilateral presence of supernumerary renal arteries of the aorta origin (the parenchyma of kidney removed): 1. Abdominal aorta, 2. Right renal artery, 3. Lower polar artery of aorta origin on the right side, 4. Left renal artery, 5. Hilar artery of aorta origin on the left side, 6. Ureters

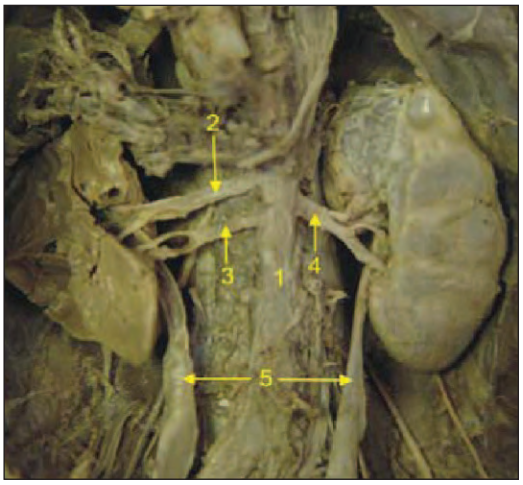

Figure 6 Right hilar supernumerary renal artery of aorta origin: 1. Abdominal aorta, 2. Right renal artery, 3. Hilar artery of aorta origin on the right side, 4. Left renal artery, 5. Ureters

this kind of supernumerary renal arteries of aorta origin was not found in the dissected preparations analyzed (Figure 6).

– In the dissection processed material, we found only 2 (5.13%) upper polar supernumerary renal arteries of aorta origin, en-

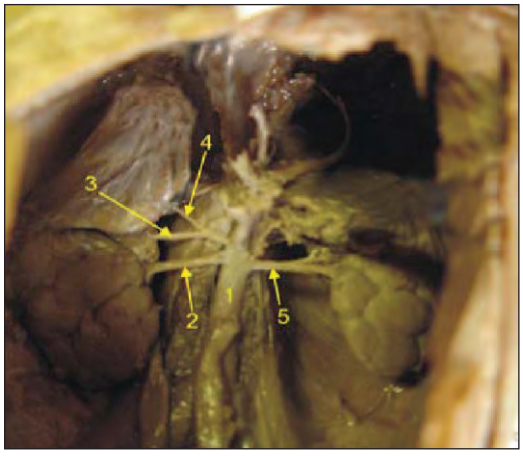

Figure 7 The right upper polar supernumerary renal artery of aorta origin: 1. Abdominal aorta, 2. Right renal artery, 3. Upper polar artery of aorta origin on the right side, 4. Inferior suprarenal artery, 5. Left renal artery

Figure 8 The left lower polar supernumerary renal artery of aorta origin (the parenchyma of kidney removed): 1. Abdominal aorta, 2. Right renal artery, 3. Left renal artery, 4. Lower polar artery of aorta origin on the left side

Table 1 Number and percentage of types of supernumerary renal arteries of aorta origin

Number of renal artery	Right kidney	(%)	Left kidney	(%)	Total	(%)
One artery	28	72	32	82	60	77
Two arteries	10	26	7	18	17	22
Hilar supernumerary renal artery	3	8	4	10	7	9
Upper supernumerary renal artery	2	5	0	0	2	2
Lower supernumerary renal artery	5	13	3	8	8	10
Three arteries	1	2	0	0	1	1
t-test	1,812					
Degree of variations	5					
Level of the significance (p)	0.05					

tering directly into the kidney parenchyma in its upper pole (Figure 7).

– We found 8 (20.51%) lower polar supernumerary renal arteries of aorta origin. Five arteries from the right side and three arteries from the left side and in two cases we found the bilateral presence of these arteries (Table1). Those arteries directly enter the renal parenchyma in its lower pole (Figure 8).

Analysis of the supernumerary renal arteries with renal artery origin

We have found in 6 (15.38%) dissected preparations a group of renal supernumerary arteries of renal artery origin, in five preparations on the right side and in one case on the left side.

Analyzing by Merklin classification the supernumerary renal arteries originating

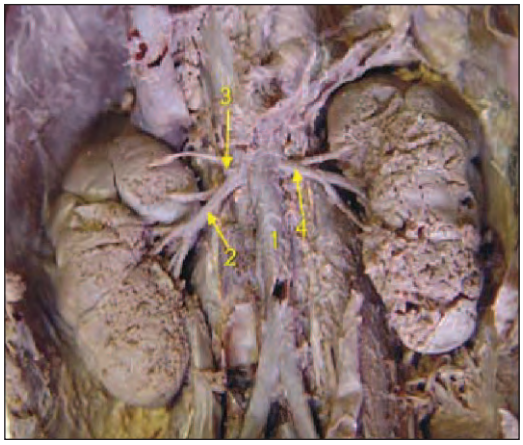

Figure 9 The upper right polar supernumerary renal artery from the renal artery: 1. Abdominal aorta, 2. Right renal artery, 3. Upper polar artery originating from the renal artery on the right side, 4. A. renalis sinistra

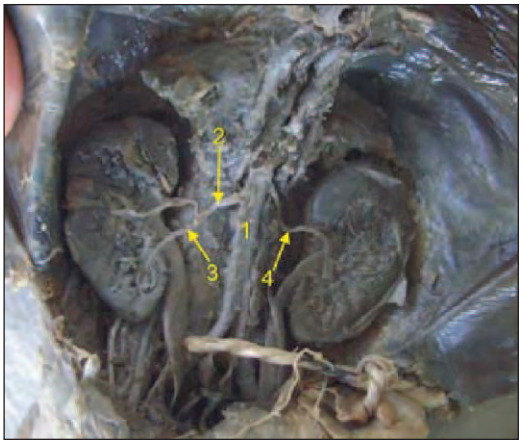

Figure 10 The lower right polar supernumerary renal artery from the renal artery: 1. Abdominal aorta, 2. Right renal artery, 3. Lower polar artery of renal artery origin from the right side, 4. Left renal artery

Table 2 Supernumerary renal arteries originating from the renal artery

Number of renal arteries	Right	(%)	Left	(%)	Total	(%)
Upper supernumerary polar artery	4	10	1	2	5	6
Lower supernumerary polar artery	1	2	0	0	1	1
t-test	2,919					
Degree of variations	1					
Level of the significance (p)	0,05					

from the renal artery, we found the existence of the upper and lower polar supernumerary renal artery (Table 2).

In 5 (12.82) preparations, we found the upper polar artery of the kidney with its origin in the renal artery (Picture 9). Only in one preparation (2.56%) did we find a lower supernumerary artery of renal artery origin (Figure 10).

According to Merkin there is no hilar supernumerary renal artery originating from the renal artery, but in that case we bear in mind one pre -hilar branching of the renal artery.

Discussion

The anatomical variations of the renal artery are frequent in number, course and the place of origin. The literature data illustrate that beside the renal artery, there can be supernumerary renal arteries. These appear on average from 26-30% and they have a different starting point, course and allocation in the renal parenchyma compared to the renal artery. The fact that these arteries may be neglected during surgical procedures on the kidney or its environment is an important

morphological element, which has not only theoretical but also practical importance.

The generally accepted and precise terminology for these arteries has not been unified in the majority of the authors (8). Many call them accessory blood vessels, especially in the earlier literature. This term is not acceptable, because they occupy a certain vascular area within the kidney and there is no anastomosis, either with the branches of the main, or with branches of the segmental renal arteries (3). This fact is backed up by other authors (4) while analyzing arteriovenosus anastomoses in the human kidney and the arterial distribution within the segments of the kidneys. We can talk about the segmentation of the kidneys only when they are provided with only one renal artery.

The term aberrant arteries (8) also does not suit these renal arteries. We agree with the authors who define them as the supernumerary renal arteries, because they represent the exclusive source of provision of blood to certain parts of the kidney. They are divided into two groups according to the part of the kidney they are providing and according to their origin.

One group is the supernumerary renal arteries originating from the aorta. In this group we have three types of supernumerary renal arteries: upper polar, hilar and lower polar supernumerary artery of aorta origin.

The second group is the supernumerary renal arteries originating from the main renal artery, to which two types of supernumerary renal arteries belong: the upper and lower polar supernumerary artery.

This distinction of the supernumerary arteries is the most acceptable. The majority of the authors, recently researching this issue, agree with this distinction and they use it in their researches. The interest in supernumerary renal arteries has increased also recently due to the increase in the frequency of kidney transplantation and the need for living kidney donors (10). The development of the methods in urological surgery, as well as the development of new radiological techniques have enhanced the interest in renal artery anatomy (11). Kidney transplantation is a permanent and safe treatment for patients with chronic kidney failure. However, the presence of supernumerary renal arteries increases the complexity of the procedure of kidney transplantation (12).

The existence of supernumerary renal arteries is a challenge for the surgeons, performing the kidney transplantation, since each renal artery is a terminal blood vessel and its injury causes segmental ischemia with delayed hypertension and leads to a direct link between essential hypertension and the presence of supernumerary renal arteries, without the existence of other pathological changes (13, 14).

In the material we analyzed, we more frequently found supernumerary arteries originating from the aorta. In the dissected preparations we found 28. 2% cases. There is a high degree of concordance of our results with the values found in the literature and they are in close relation to the results of other authors in from 25% to 30% cases (15, 16, and 17).

We found 15.36% supernumerary renal arteries originating from the renal arteries in the analyses of the preparations. This group of supernumerary renal arteries has not received much attention by other authors. In the literature we only found data for types of renal supernumerary arteries originating from the renal artery.

The supernumerary renal arteries were analyzed according to their place of entrance into the kidney as: upper polar, hilar and lower polar supernumerary arteries. In cases when the kidney is provided by two arteries, along with the main renal artery, we mostly found a lower polar or hilar supernumerary renal artery of aorta origin. The supernumerary renal arteries from the aorta can be separated at any location from the Th11 vertebra to the aorta bifurcation. We found

this high starting point of supernumerary renal arteries from the aorta in one case in the dissected material with the presence of three arteries providing the right-hand kidney (18).

We found three arteries providing the kidney on average in 1-3% (5). Our results, being 0.9% in the dissected material, agree with the data from literature. Bergman points out that in the case of triple renal arteries one supernumerary artery is always hilar, and other one is either an upper or lower polar renal artery. We did not find this ratio in our material.

The hilar supernumerary artery is a kind of supernumerary renal artery coming only from the aorta. Our results show that it appears with the same frequency as the lower polar artery originating from the aorta.

Upper polar arteries are a type of supernumerary renal arteries, directly entering the renal parenchyma at its upper pole. They are one-fold. They separate from the aorta or from the renal artery. In the dissected preparations we found them in 5.1% cases, and they mostly originate from the renal artery in 12.8% cases. Before entering the renal parenchyma they often divide into smaller branches, which pass through the upper pole of the kidney.

From the surgical point of view, upper polar arteries represent a huge risk, especially from the aorta, and due to the high place of separation from it they are masked during the surgical procedure.

Since they have smaller caliber, they are often mistaken for the capsular and lumbar artery. The percentage of supernumerary renal arteries is higher in the dissection method, because the negatives are difficult to read and smaller polar arteries are neglected and they are grouped in the lumbar or capsular arteries. We only found out their origin from kidney by dissection (19).

This kind of supernumerary renal artery is less present in terms of percentages, which is also confirmed by our findings. There are more upper polar arteries compared to the lower polar arteries originating from the aorta and also there were more upper polar arteries originating from the renal artery in the dissection analyses (13,20,21). We agree with this fact completely, since the we found the most arteries of this kind in the dissection analyses originating from the renal artery.

Lower polar renal arteries are the second largest group of supernumerary renal arteries. They are present in 6% to 7% cases (2, 5, 21). This is the most numerous kind of supernumerary renal artery. Lower polar supernumerary renal arteries are found in a smaller percentage in 2.6% cases.

Our data are in accord with the data from the literature regarding the more frequent appearance of these arteries in the dissection analyses and also in kidneys during intra surgery findings. They can appear individually or together with the upper polar artery with triple arterial provision of the kidney.

Lower polar arteries are often present on both sides, whether they come from one or two different sources (18). This is also recorded in our paper.

Clinically and surgically seen, lower polar arteries are of extreme importance. In many cases, they are the direct cause of the hydronephrosis. Many cases are described, where the lower polar artery causes the constriction of the upper part of the ureter or the ureter - pelvic link. The feeding of the ureter of the transplanted kidney directly depends on the lower polar artery, and the long-term necrosis of the ureter leads to complications. Then the surgeon has to think about operative revision of the necrotic part of the ureter (13).

A lower supernumerary renal artery is alsorepresent an obstacle during other surgical procedures on the kidney. Long-term consequences occur with the accidental

ligature of these arteries (22). Although, the kidney heals spontaneously, the consequences remain the same as with the injury of segmental renal artery. It is necessary to follow up kidney function and blood pressure, since hypertension is the only long-term risk for these patients (14). The author considers the supernumerary renal arteries to be the direct cause of essential hypertension in younger patients. With the injury of the segmental renal arteries it is necessary to remove part of the parenchyma they provide with blood, because they are terminal arteries and they provoke ischemia and hypertension. The same happens with the cutting of supernumerary renal arteries, especially, with the cutting of the lower polar artery, because it provides a much larger surface than the upper polar supernumerary renal artery, so the consequences are much more prominent. The supernumerary lower polar renal artery is evident and it is easy to avoid. However, it is difficult to find it especially when it has a low starting point from the aorta or an earlier separation from the renal artery, when it is subject to injuries due to inattention.

Conclusions

From all the above-mentioned enclosed in this paper we can conclude the following:

– The kidney, in most of the cases, is vascularised by one renal artery, with the dissection method in 53.85% preparations.

– Our results confirm that there is a large number of anatomical variations in the vascularisation of the kidney. The most often incidence is the occurrence of supernumerary renal arteries.

– The most frequent are lower polar and hilar supernumerary arteries originating from the aorta.

– We more rarely found supernumerary arteries originating from the renal artery.

– This knowledge should serve as a caution in the approach to each surgical procedure on the kidney, and especially donated organs, in order not to lose precious time and the source of donation, due to the frequent impossibility of performing preoperative arteriography in the time interval of obtaining the organ from the cadaver.

– On the basis of the t-test and the probability p = 0,05 we conclude that all parameters found are at the level of significance.

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Extent of subarachnoid hemorrhage and development of hydrocephalus

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Background and objective Factors associated with the development of acute hydrocephalus following subarachnoid hemorrhage are not fully elucidated. The goal of this study was to present the relative predictive values of Hunt-Hess grade and Fischer score in determining the propensity for developing post-hemorrhage hydrocephalus and to document the frequency of acute and chronic hydrocephalus following subarachnoid hemorrhage. **Patients and methods** Our study encompassed 102 patients with anurismal subarachnoid hemorrhage. The Hunt-Hess scale was used for the initial neurological status assessment and the extent of subarachnoid hemorrhage was graded based on the Fisher scale. Assessment of hydrocephalus was made on the basis of the size of both temporal horns, the ratio of FH/ID and Evan's ratio. **Results** Thirty-two percent of patients exhibited hydrocephalus requiring CSF diversion procedure. External ventricular drainage was performed in 29 % of patients for early hydrocephalus. Seventy percent of patients with acute hydrocephalus requiring external ventricular drainage were graded as 3, 4 or 5 according to the Hunt and Hess scale on admission, in contrast to 58 percent of patients without hydrocephalus. Ninety-three percent of patients with hydrocephalus were graded as 3 and 4 according to Fisher grade on initial CT scan, in contrast to 83% of patients without hydrocephalus. **Conclusion** Even though an increased frequency of hydrocephalus was noted among patients that presented with higher Fisher and Hunt-Hess grades, none of these grades were shown to bear a statistically significant predictive value in determining the propensity for the development of hydrocephalus.

Received: 12 April 2007
Accepted: 13 August 2007

Key words: Hydrocephalus, Subarachnoid hemorrhage, Fisher scale.

Introduction

A complete therapeutic approach to the treatment of subarachnoid hemorrhage (SAH) encompasses preventing re-rupture of the aneurysm, preventing and treating vasospasm, correcting metabolic abnormalities, preventing and treating seizures and hydrocephalus (1).

One of the well-recognized complications of subarachnoid hemorrhage is a hydrocephalus, that can be explained by alterations affecting the pia mater and arachnoid membranes. Therefore increased ICP, commonly seen after SAH, is usually the result of the increased resistance to cerebrospinal fluid outflow (2), which results from an acute obstruction of arachnoid granulations, the principal site of CSF absorption by red blood cells and fibrin cloths. Late hydrocephalus is probably a consequence of CSF flow obstruction at multiple points along the CSF pathways (3). Because it is plausible that acute hydrocephalus has a negative impact on the cerebral perfusion, hydrocephalus on the admission CT scan may be a risk factor for delayed ischemia as well, even though there are recent studies that dispute this conclusion (4). An acute hydrocephalus, commonly diagnosed by computerized tomography (CT) scan, is usually treated by placing an external ventricular drainage, whilst persisting form is commonly treated by ventriculoperitoneostomy (5, 6). Factors associated with the development of acute hydrocephalus upon SAH are not fully elucidated.

The goal of this review was to present the relative predictive values of Hunt-Hess grade and Fischer score in determining the propensity for developing post-hemorrhage hydrocephalus and to document the frequency of acute and chronic (shunt-dependent) hydrocephalus following subarachnoid hemorrhage.

Patients and methods

Data were retrieved from a prospectively collected database that sequentially encompassed all patients with aneurysmal SAH admitted to the Department of Neurosurgery at the University Clinical Center Tuzla. Patients were included in the study if they had been admitted between May 2003 and April 2007 and if the initial CT scan had been performed within 4 days upon the onset of SAH. Patients with evidence of subarachnoid hemorrhage caused by a different pathology than a ruptured aneurysm and patients with a negative angiography were excluded from the study.

The Hunt-Hess scale was used for the initial neurological status assessment (7). Aneurysmal SAH was diagnosed by the presence of blood in the basal cisterns on CT or by xanthochromia of the cerebrospinal fluid in combination with an aneurysm confirmed by conventional or CT angiography. The extent of subarachnoid hemorrhage was graded based on the Fisher scale (8) (Table 1). Patients with aneurysms revealed by angiography underwent either surgical occlusion on the aneurysm neck following cisternal irrigation or endovascular aneurysm occlusion.

Table 1 The Fisher scale of the extent of subarachnoid hemorrhage on CT

Group	Hemorrhage on CT
1	No hemorrhage evident
2	Diffuse or vertical layer of subarachoid hemorrhage < 1 mm thick
3	Localized clot and/or vertical layer of subarachnoid hemorrhage ≥ 1 mm thick
4	Intracerebral or intreaventricular clot, with or without a diffuse subarachnoid hemorrhage

Assessment of hydrocephalus was made on the basis of computed tomographic studies obtained from the day of admission to

48 months after SAH, 25 months (SD ±13 months) on average. Criteria indicating the occurrence of hydrocephalus were the size of both temporal horns (TH) ≥ 2 mm in width, the ratio FH/ID > 0.5 (where FH is the largest width of the frontal horns) and Evan's ratio > 30% (ratio of FH to maximal biparietal diameter). Patients with documented hydrocephalus were treated either by external ventricular drainage or by ventriculoperitoneostomy. The Glasgow Outcome Scale was used in documenting the degree of functional impairment upon completing the treatment.

Results

Associations among various factors and the occurrence of hydrocephalus after aneurysmal subarachnoid hemorrhage were evaluated retrospectively in 102 patients admitted to the Department of Neurosurgery of the University Clinical Center Tuzla for aneurismal subarachnoid hemorrhage, in the period between May 2003 and April 2007.

The mean age at presentation was 54.7 years, ranging from 30 to 87 years. Female to male ratio was 2.2:1 (Figure 1).

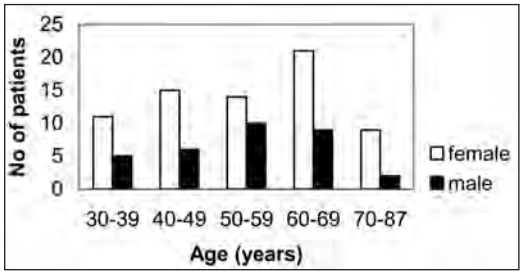

Figure 1 The distribution of patients according to age and gender

Table 2 depicts the interval between the onset of hemorrhage and admission. Ninety-one percent of patients were admitted within 72 hours of hemorrhage. Sixty seven percent of patients were graded as having Hunt-Hess grade 1, 2 or 3 at admission. In accordance, two-thirds of patients were in satisfactory neurological condition, including those admitted 72 hours upon the onset of hemorrhage or later.

In the group of patients admitted on the very day that the hemorrhage commenced, 64 % exhibited a favorable neurological status, whilst 70% of patients admitted between the first and third post-hemorrhage day exhibited a good neurological status. Among patients admitted 72 hours post-hemorrhage 67 % exhibited a favorable neurological status. A head CT scan at admission revealed a subarachnoid hemorrhage in 98% of patients (Table 2). The subarachnoid hemorrhage was diffuse in 66.6% of patients, of which 7.8 % had a thin (under 1mm) and 58.8 % had a thick (more than 1 mm) layer of hemorrhage. Intracerebral or intraventricular hematomas were present in 31.4 % of patients. There were twice as much female subjects as male patients and the influence of this selection bias on the results cannot be denied. Out of 102 patients with verified aneurysm, 100 patients were operated on by aneurysm neck occlusion following cisternal irrigation and 2 patients underwent aneurysm embolization.

Thirty-two percent of patients exhibited hydrocephalus requiring CSF diversion procedure (Table 3). External ventricular drainage was performed in 29 % of patients for early hydrocephalus. A permanent CSF diversion was required 14 % of patients. An average intracranial pressure value was 20.9 cm H_2O, as measured during the external ventricular drainage, ranging from 15-32 cm H_20. Three patients without prior external ventricular drainage developed hydrocephalus requiring a VP shunt.

Seventy percent of patients with acute hydrocephalus requiring external ventricular drainage were graded as 3, 4 or 5 according to the Hunt and Hess scale on admission, in contrast to 58 percent of patients without hydrocephalus. Ninety-three percent of pa-

Table 2 Hunt-Hess and Fisher grades on admission according to days after hemorrhage

*Hunt-Hess Scale (grades)	Day 0 No (%)	Day 1-3 No (%)	Day > 3 No (%)	Total No (%)
I	13 (22)	6 (17.6)	3 (33.3)	22 (21.5)
II	10 (16.9)	7 (20.5)	1 (11.1)	18 (17.6)
III	15 (25.4)	11 (32.3)	2 (22.2)	28 (27.4)
IV	18 (30.5)	8 (23.5)	3 (33.3)	29 (28.4)
V	3 (5.1)	2 (5.8)	–	5 (4.9)
°Fisher Scale (grades)				
I	2 (3.4)	–	–	2 (1.9)
II	6 (10.2)	1 (2.9)	1 (11.1)	8 (7.8)
III	29 (49.2)	25 (73.5)	6 (66.6)	60 (58.8)
IV	22 (33.9)	8 (23.5)	2 (22.2.)	32 (31.4)
Total	59 (57.8)	34 (33.3)	9 (8.8)	102 (100.0)

*T=3.175, P=0.0131; °T=1.907, P=0.1051

Table 3 Treatment modalities for early and late hydrocephalus

Treatment modality	Cases (N; %*)
External ventricular drainage	30 (29)
Ventriculoperitoneostomy	14 (14)

*Percent of 102 patients.

tients with hydrocephalus were graded as 3 and 4 according to Fisher grade on initial CT scan, in contrast to 83% of patients without hydrocephalus (Table 4).

The analysis of the extent of the subarachnoid hemorrhage, based on a head CT, revealed a good correlation between the outcome (as graded by GOS) and the amount of subarachnoid blood on CT. Patients that presented with diffuse hemorrhage on the initial CT scan exhibited a favorable outcome twice as often as compared to those that presented with intraventricular and intracerebral hemorrhage (Table 5). Distribution of blood on the initial CT scan was

Table 4 Predictive value of Hunt-Hess and Fisher grade for hydrocephalus

[1]Hunt-Hess Scale (grades)	Patients without hydrocephalus No (%)	Patients with hydrocephalus No (%)	Total No (%)
I and II	31 (43)	9 (30)	40 (39)
III, IV and V	41 (67)	21 (70)	62 (61)
[2]Fisher Scale (grades)			
I and II	8 (11)	2 (7)	10 (10)
III and IV	64 (89)	28 (93)	92 (90)
Total	72 (100.0)	30 (100.0)	100 (100.0)

[1]T=2.689, P = 0.115; [2]T = 0.680, P = 0.5665

Table 5 Outcome as graded by GOS in relation to extent of hemorrhage

Fisher Scale (grades)	Good recovery No (%)	Moderate disability No (%)	Severe disability No (%)	Vegetative state No (%)	Lethal outcome No (%)	Total No (%)
I	2 (100.0)	–	–	–	–	2 (100.0)
II	8 (100.0)	–	–	–	–	8 (100.0)
III	33 (56.9)	8 (13.8)	9 (15.5)	–	8 (13.8)	58 (100.0)
IV	10 (29.4)	6 (17.6)	6 (17.6)	3 (8.8)	9 (29.4)	34 (100.0)
Total	53 (51.9)	14 (13.7)	15 (14.7)	3 (2.9)	17 (16.6)	102 (100.0)

Chi-square = 4.479; $p < 0.005$

one of the factors influencing the outcome in patients with SAH.

Conclusion and discussion

In spite of substantial progress in the treatment of intracranial aneurysms and subarachnoid hemorrhage over the past few decades, the severe disability rate continues to peak at 50 % level in SAH survivors, while 66 % of patients with successfully occluded aneurysms never achieve their original life quality (9, 10). Patients who survive an aneurysm rupture run the risk of a secondary rupture and repeated, even more prominent bleeding, or of developing angiospasm, hydrocephalus, seizures or metabolic disturbances (4).

CSF flow disturbance early after SAH is the principle cause of early hydrocephalus and is most likely caused by villi arachnoidales or ventricular obstruction by a blood clot. Late hydrocephalus is in fact a communicating form and usually develops days or weeks after SAH (3). The clinical significance of post SAH hydrocephalus remains poorly defined, with the recognized fact that hydrocephalus can cause cerebral perfusion pressure disorder, thus determining clinical status. Increased intracranial pressure upon SAH and intraventricular hemorrhage is usually caused by increased liquor flow resistance.

According to De Oliveira et al. (11) the Hunt and Hess grade, Fisher grade, acute hydrocephalus, intraventricular hemorrhage and angiographic vasospasm all pose significant risk factors for shunt dependency. Clipping of a ruptured aneurysm may be associated with a lower risk for developing shunt dependency, possibly by clot removal. This might influence the long-term outcome and surgical decision making (11).

Katano et al. (12) showed the difference in two different programmable valve shunt systems and mentioned their complications and revision rates, but they did not demonstrate limitations in the clinical efficacy of shunting for hydrocephalus. Temporary or permanent cerebrospinal fluid diversion is recommended in symptomatic patients and may improve clinical status in this group of patients (13). Ventriculostomy has been generally recommended for patients with acute hydrocephalus and diminished level of consciousness after SAH (14, 15, 16), although it was believed to increase the risk of rebleeding, until recent studies disputed this finding (17).

The predisposing factors leading to hydrocephalus after subarachnoid hemorrhage are not fully elucidated. This study assessed the predictive value of various factors for the development of this condition**.** Almost

one third of patients in our study developed hydrocephalus severe enough to require CSF diversion procedure**.** Even though an increased frequency of hydrocephalus was noted among patients that presented with higher Fisher and Hunt-Hess grades, none of these grades were shown to bear a statistically significant predictive value in determining the propensity for the development of hydrocephalus. The analysis of the extent of subarachnoid hemorrhage, based on a head CT, revealed a good correlation between the outcome (as graded by GOS) and the amount of subarachnoid blood on CT.

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Bone levels in patients with osteoporosis and periodontal disease

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Received: 28 June 2007
Accepted: 29 November 2007

The constantly present dilemmas concerning the existence /non-existence of a relationship between bone density and periodontal disease gave us the idea to do this research. Our study covered 128 female patients in post menopause who were, on the basis of their densitometry findings, divided into three groups (healthy, with osteopenia, with osteoporosis). All the patients under research were clinically examined and dental X-rayed (orthopantomogram). Results were processed statistically and compared to the relevant reference data. On the basis of the obtained results we came to the conclusion that there is a relationship between periodontal disease and systemic osteoporosis.

Key words: Osteoporosis, Osteopenia, Periodontal disease.

Introduction

Periodontal disease belongs to the group of diseases with more that one cause, as a disease of multifactorial etiology. The disease is caused by local etiological factors, causing immunological reaction and interaction with both systemic and genetic components in the organism. Although bacteria are the major cause of the disease, the immuno-inflammatory reaction of the host is responsible for the majority of destructive changes of periodontal tissue. Loss of alveolar bone is the most critical factor in the pathogenesis of periodontal disease. The loss of the bone in fact marks the irreversibility of the pathological process (1). Resorption of the alveolar bone is explained by various mechanisms. Their common denominator is the activation of osteoclasts demineralising the bone and degrading non collagenous matrix (2).

Osteoporosis is a metabolic bone disease with typical reduction of bone tissue quantity per volume unit of anatomic bone, these

bones are mechanically less valuable and the possibility of fracture with insignificant trauma is increased (3, 4). Loss of bone mass in osteoporosis occurs because the activity of osteoclasts is either increased or extended so that resorption is large. It is also possible that it appears because of the weaker or shorter activity of osteoclasts which results in insufficient filling of resorbed surfaces. Recent research shows that both processes take place at the same time. It is nowadays considered that osteoporosis is not just one disease, but a heterogeneous disorder with a number of causes (5). The disease is primarily developed in women and is especially observable in post menopause.

In last ten years a large amount of research was done on the influence of systemic bone mass loss in osteoporosis on the periodontal disease appearance. Krall thinks that alveolar bone loss in patients with lower bone mineral density can be faster and less resistant to therapy than in patients with normal bone density (6). Jeffcoat came to the conclusion that a quarter of postmenopausal women has faster bone mass loss (5-8% a year) and is at higher risk of mass and alveolar bone loss and periodontal disease (7).

The goal of the research was to study the connection between systemic bone mass loss and periodontal disease in postmenopausal women.

Material and methods

Our studycomprised 128 female patients (age 50-60 years) who were in natural post menopause. On the basis of densitometry results obtained by means of bone mass measurement using dual energy x-ray absorptiometry (DXA) from two points on the skeleton - between the first and fourth lumbar vertebra and part of the femur neck which shows the total spinal mineral content, including data on both trabecular and compact bone, as well as bone mass in the area of the hip bones, and fracture risk assessment (8). The patients were divided into three groups (healthy, with osteopenia, with osteoporosis) where the examined group included patients with osteopenia and osteoporoses and the control group included healthy patients. All the patients under research went through a clinical evaluation (measurement of periodontal pocket depth for each tooth from two sides – medial and distal). They were dental x rayed (orthopantomogram). On the basis of the orthopantomogram analysis the mandible bones resorption type was determined (9). The horizontal type of alveolar bone resorption is the line on the resorptive bone surface, which together with the vertical tooth axis, forms the right angle - suprabony pocket. The vertical type of the alveolar bone resorption is the line on the resorptive bone surface, which together with the vertical tooth axis, forms the acute angle - infrabony pocket. The combined type of the alveolar bone resorption can be seen on the orthopantomogram as a combination of the horizontal and vertical resorption type (suprabony and infrabony pockets).

Statistical analysis comprised basic statistical data: arithmetical means, standard arithmetical mean error and standard deviations, as well as the following statistical analysis tests: Post-hoc analysis (Bonferroni test), Hi-test quadrangle and T-tests for independent samples.

Results

It is evident that 69 patients (90.8%) have periodontal bone resorption and only 7 patients (9.2%) do not have periodontal bone resorption (Figure 1).

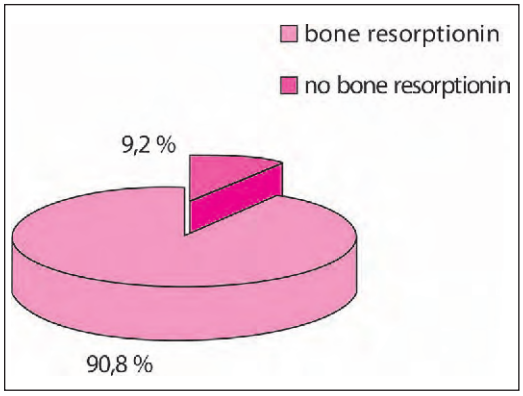

Figure 1 Percentual presentation of mandible bone periodontal resorption for the whole sample

Table 1 Interrelation of periodontal pocket depth with groups of patients

Groups	M	SD	N
Healthy Patients	3.51	0.68	24
Patients with osteopenia	3.46	0.77	26
Patients with osteoporosis	4.14	0.83	26
Total	3.71	0.82	76

M - Arithmetical mean, SD - Standard deviation
The Levens test of variance equality: F (2.74) = 0.10, p = 0.90

Table 2 Group comparison using Bonferroni test

Groups	M_{diff}	S_e	Sig.	95% Confidentiality Interval	
				Lower	Upper
Healthy Patients	0.04	0.22	1.000	-0.49	0.58
Patients with osteopenia	-0.64	0.22	0.014	-1.17	-0.10
Patients with osteoporosis	-0.68	0.23	0.006	-1.20	-0.16

Post-hoc analysis (Bonferroni test) showed that the average values of pocket depth in healthy patients (M = 3.51) are statistically significantly lower (at 98% significancy level) than the average values of pocket depth in patients with osteoporosis (M = 4.14). We determined, by the same analysis, that the average values of pocket depth in patients with osteopenia (M = 3.46) are statistically significantly lower (at 98% significancy level) than the average values of pocket depth in patients with osteoporosis (M = 4.14). The average values of periodontal pocket depth in healthy patients and patients with osteopenia are not statistically significantly different. (p = 1.00).

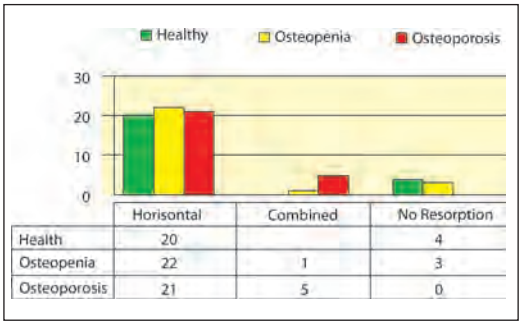

Figure 2 Frequency of various types of periodontal resorption according to groups of patients based on orthopantomogram

In all three groups of patients horizontal alveolar bone resorption is obvious.

The combined type of resorption is detected in 5 patients with osteoporosis, in only 1 patient with osteopenia and it is not detected in healthy patients.

Table 3 Relationship between presence of combined type of periodontal alveolar bone resorption and groups

			Groups			Total
			Healthy Patients	Patients with osteopenia	Patients with osteoporosis	
Presence of Combined Type of Bone Resorption	Yes	Frequency	0	1	5	6
		% between groups	0.0%	16.7%	83.3%	100.0%
	No	Frequency	24	25	21	70
		% between groups	34.3%	35.7%	30.0%	100.0%
Total		Frequency	24	26	26	76
		% between groups	31.6%	34.2%	34.2%	100.0%

The Hi-test quadrangle indicates the relationship between the combined type of bone resorption and osteoporosis (i.e. groups). The presence of the combined type of bone resorption is more frequent (at 97% significancy level) in patients with osteoporosis (f = 5) in comparison to healthy ones (f = 0) and to the patients with osteopenia (f = 1).

Table 4 Interrelation of the depth of periodontal pocket (measured clinically and via X rays) in relation to the presence of bone resorption

	Presence of Alveolar Bone Resorption	N	M	SD	S_e
Depth of Pocket Measured Clinically	Yes	69	3.05	0.66	0.08
	No	7	2.14	0.13	0.05
Depth of Pocket Measured via X rays	Yes	69	3.85	0.72	0.09
	No	7	2.32	0.15	0.06

M - Arithmetical mean, SD - Standard deviation,
S_e - Standard arithmetical mean error

The Levens test of variance equality proved to be statistically significant in both cases of pocket depth measurement, indicating that variances of average pocket depth values are statistically significantly different in relation to the presence of bone resorption.

Table 5 Interrelation of periodontal pocket depth with combined type of alveolar bone resorption

	Combined type of alveolar bone resorption	N	M	SD	S_e
A. Depth of Pocket Measured Clinically	Yes	6	4.22	0.73	0.29
	No	70	2.86	0.56	0.07
B. Depth of Pocket Measured via X rays	Yes	6	5.32	0.83	0.34
	No	70	3.57	0.66	0.08

M - Arithmetical mean, SD - Standard deviation,
S_e - Standard arithmetical mean error
A. The Levens test of variance equality:
F (1.74) = 0.42, p = 0.52.
B. The Levens test of variance equality:
F (1.74) = 0.53, p = 0.47.

Leven's test of the variance equality did not prove to be statistically significant in either case of pocket depth measuring, indicating that variances of the average depth pocket values are not statistically significantly different in relation to the presence of combined alveolar bone resorption type.

Table 6 T-tests for independent samples

t-test						
T	df	Sig.	M_{diff}	S_e	95% Confidentiality Interval	
					Lower	Upper
5.542	74	0.000	1.36	0.24	0.87	1.85
6.120	74	0.000	1.75	0.29	1.18	2.32

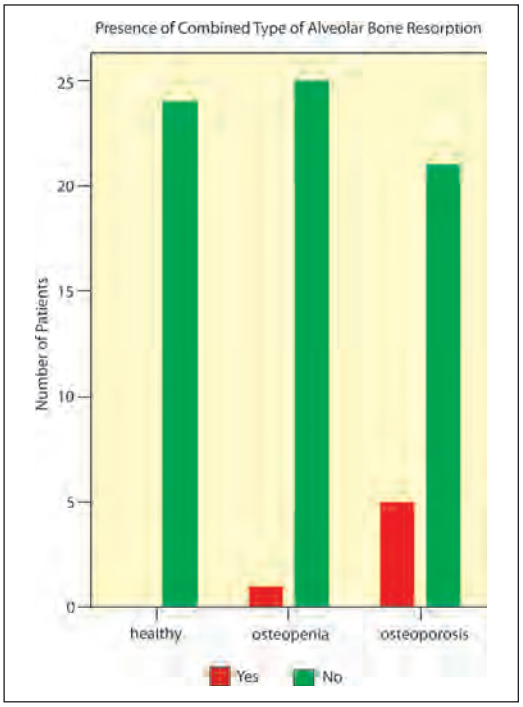

Figure 3 Presence of combined type of alveolar bone periodontal resorption in relation to groups

A. The T-test established that the average value of the pocket depth measured clinically in the case of the presence of combined resorption of the alveolar bone (M = 5.32) is statistically considerably higher (at 99% significancy level) in

comparison to cases in which the combined type of bone resorption was not recorded. (M = 2.86).

B. The T-test established that the average value of the pocket depth measured by X rays in the case of the presence of the combined resorption of alveolar bone (M = 4.22) is statistically considerably higher (at 99% significancy level) in comparison to the cases in which the combined type of bone resorption was not recorded. (M = 3.57).

The combined type of alveolar bone resorption is more frequent in patients with osteoporosis in comparison to both healthy ones and those with osteopenia.

Discussion

Tezal et al., Pilgrae et al. and Chohayeb connect skeleton bone mass density BMD with alveolar bone loss and also with evident clinical connection loss and they conclude that there is a connection between postmenopausal osteoporosis and periodontal status (10, 11, 12) which is equivalent to our results showing that the average pocket depth value is statistically significantly different in relation to skeleton BMD (Table 1 and 2). We can compare our results (Table 3) with the results arrived at by Hildebolt, Shen et al. and Von Wowen et al. and agree that BMD does change with age and that the change is accompanied by alveolar bone changes.(13, 14, 15). Geurs et al. studied the connection between systemic bone loss (measured by DXA) and periodontal disease (measured by periodontal pocket depth). They concluded that the patients with osteoporosis have greater epithelial connective tissue loss than the patients without osteoporosis, i.e. that the greatest epithelial connective tissue loss is in patients with both periodontal disease and osteoporosis. Our results correspond to the results of Geurs et al. who consider that this indicates that osteoporosis or lower values of skeleton BMD should be considered as a risk factor for the development of periodontal disease (16). In their study, Wactawski-Wende, discovered a significant connection between periodontal connective tissue loss, as an indicator for periodontitis, and skeleton osteoporosis measured by DXA, especially in postmenopausal women (17). These results correspond to the results of our research (Figure 3) and also with the results of Klemetti et al. (18) who studied the postmenopausal women with significantly deep periodontal pockets and detected greater BMD loss in relation to the patients with shallow periodontal pocket or no periodontal pockets. On the basis of their research they concluded that there is a relation between BMD and periodontal disease.

Conclusion

Based on the results obtained we can conclude that there is a relation between alveolar bone resorption at postmenopausal women and systemic osteoporosis.

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Effects of Rapid Maxillary Expansion on Nocturnal Enuresis: A Literature Review

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Received: 20 September 2007
Accepted: 27 December 2007

Rapid maxillary expansion (RME) is a dentofacial orthopedic treatment procedure which has been routinely used to correct transversal maxillary skeletal and/or dental constriction. Application of RME not only expands the constricted maxilla but also results in an increase in nasopharyngeal airway dimensions, improvement in nasal respiration in patients with abnormal breathing patterns, and better blood oxygen saturation. It is known that adenotonsillectomy significantly reduces nocturnal enuresis in patients having upper airway obstruction and/or breathing problems. Some authors have shown that RME was also effective on reducing or ceasing nocturnal enuresis (bed-wetting) in patients with maxillary constriction. The results of these uncontrolled clinical trials showed that the success rate of the treatment varied from 47 percent to 100 percent The purpose of this article is to review the etiology and pathophysiology of nocturnal enuresis and the studies investigating the effects of RME on nocturnal enuresis in growing children.

Key words: Rapid maxillary expansion, Nocturnal enuresis, Nasal breathing.

Introduction

"Nocturnal" means pertaining to or occurring at night and "Enuresis" is a voluntary or involuntary discharge of urine. The term nocturnal enuresis (NE) is defined as involuntary loss of urine during sleep more than two nights per month after the ages of 5-6 years (1-5), since normal urine flow and bladder control generally occurs before 5 years of age (6, 7). Some clinicians (8, 9) have also added voluntary urination to this definition. NE has been divided into primary and secondary forms according to onset and course of bedwetting. In primary nocturnal enuresis, the child never has a dry period for over 6 months, while the child with secondary nocturnal enuresis can be dry for at least six months (2, 7, 10).

Prevalence of Nocturnal Enuresis

It is difficult to estimate the prevalence of NE because of the variations in its definition and in social standards, but it has been known that prevalence of bedwetting in boys is more common than in girls (8). It is generally accepted that 15 to 20 percent of children by the age of 5 years wet their beds during sleep at night (4, 6, 8, 9). A spontaneous recovery (self-limiting) occurs after this age because bladder control improves with increasing age, and thus the prevalence of children with NE decreases about 15 percent per year (2, 6, 9). The incidence of enuretic children at 8 years reduces approximately 50 percent relative to five years, and this incidence is only 2-3 percent at 12 years of age and 1-2 percent at 15 years (4, 8). Although spontaneous recovery occurs in the juvenile and adolescent periods, 1 to 2 percent of adults still continue to wet their beds (4, 6, 11).

Etiology of Nocturnal Enuresis

Despite extensive research on NE over the past few decades, many questions still remain unanswered regarding its exact pathophysiology (7, 11). Several theories have been proposed to explain the etiology of NE (2, 4, 6, 7, 11). They can be summarized as follows:

1. Genetic factors,
2. Nocturnal polyuria resulting from low antidiuretic hormone (ADH) secretion at night,
3. Reduced nocturnal functional bladder capacity,
4. Delayed maturation of the central nervous system,
5. Stress factors,
6. Sleep disorders and upper airway obstruction,
7. Psychological factors,
8. Organic causes (allergy, infections, and lesions of urinary system).

Pathophysiology of Nocturnal Enuresis

Three main pathophysiological factors that may interact with each other have been suggested to explain the occurrence of NE (11):

1. Nocturnal polyuria (lack of ADH release)
2. Reduced nocturnal functional bladder capacity
3. Impaired arousal response to bladder fullness during sleep

When these factors are taken into consideration, it will be seen that orthodontists have no chance to interfere in the treatment process of the first two factors. Treatment of NE resulting from the first two factors is carried out by child urologists and /or pediatricians.

It has been shown, however, that children with upper airway obstruction and sleep disorder are more susceptible to NE (12-15). In a recent study, Cinar et al. (13) investigated the relationship between nocturnal enuresis (NE) and upper airway obstruction in a pediatric population, and observed that 35 percent of the cases with upper airway obstruction had NE. In the light of their findings, the authors concluded that upper airway obstruction might be a potential etiological factor in NE. It was also shown that surgical relief of upper airway obstruction by tonsillectomy, adenoidectomy or both greatly reduced NE in 76 percent of cases (12-15). Although otolaryngologists have obtained sufficient nasal airflow by these approaches, there are still some difficulties in children with severe maxillary width deficiency and a deep palatal vault. In these patients, nasal airflow can be achieved and/or increased by means of rapid maxillary expansion (RME), and orthodontists can contribute to the treatment of NE by this approach.

Rapid Maxillary Expansion (RME)

Rapid maxillary expansion (RME) has been used as a routine clinical procedure in orthodontics, with its main purpose to expand the maxilla in young patients who had transversal maxillary constriction and a deep palatal vault. RME has also a positive effect on breathing pattern, conductive hearing loss and nocturnal enuresis in some growing children. This treatment procedure is carried out with an appliance with an expansion screw welded to the bands on the first premolars and first molars (Figure 1). The expansion screw was periodically activated per day, and the resulting force (0.9–4.5 kg) causes the mid palatal suture to open and the maxillary bones to diverge from each other. Vertical opening of the suture is triangular, with the greatest width at the nasal floor (16).

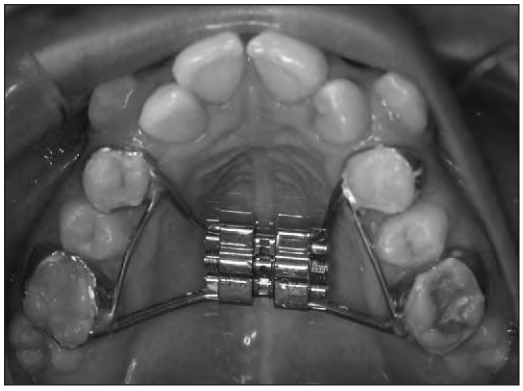

Figure 1. RME appliance cemented to teeth

Studies Regarding the Effects of RME on NE

There are a few studies investigating the effects of RME on NE in literature (17-21). In these studies, it has been shown that nocturnal enuresis was greatly reduced or completely ceased within a few months of maxillary expansion. The relevant data are summarized in Table 1.

The first relevant study was published in 1970 by Freeman (17). In this article, cessation of NE was an unexpected finding, because the observer was trying to assess the effect of RME on the basal metabolism of mentally retarded children aged 9 to 14 year olds. Freeman (17) related this beneficial effect to improved lymph circulation and the increased antidiuretic function of the pituitary gland due to RME. Another important clinical study on this topic was performed by Timms (18), which was published 20 years later than Freeman's study. In this retrospective study, Timms evaluated ten cases aged between 6.5 and 15.5 years old. Timms (18) reported that NE ceased within 1 to 4 months of maxillary expansion in all 10 cases. Kurol et al (19) published a prospective study in 1998, which was carried out on 10 children, aged between 8 and 13 years old, who had not responded to conventional medical treatment for bed-wetting. The authors observed that 4 of 10 cases became completely dry, 3 of them showed considerable reduction in bedwetting nights per week, and the remainder did not respond to the treatment. They also reported that 2 of the 3 non-responders showed better sleeping, improved school performance, and felt more alert in the daytime. The last study was performed by Usumez et al (20) in 2003 on eight subjects. These authors observed that the rate of improvement in bedwetting was 74.2 percent at end of the eight-month observation period. However, none of the children they observed became completely dry at end of this period. Recently, Schütz-Fransson and Kurol (21) conducted a clinical study to assess the effects of the treatment in children who had long-standing resistance to medical therapy and to evaluate the long-term success rate after 10 years. These clinicians reported that positive effects of RME were observed in 11 of 23 patients within 1 month of treatment: six were completely dry and five had notable improvements, the results

Table 1 The studies investigating the effects of RME on NE.

Study	Year	Treated cases	Evaluation method	Reduce of NE after RME
Freeman[17]	1970	-	Subjective	YES
Timms[18]	1989	10	Subjective	YES
Kurol et al[19]	1998	10	Subjective	YES
Usumez et al[20]	2003	8	Subjective	YES
Schütz-Fransson and Kurol[21]	2008	23	Subjective	YES

were stable at the 10-year follow-up, and no adverse reactions were noted.

Discussion

NE can cause significant frustration for parents and affected children. This problem can also be stressful for parents and other family members. The fact that NE may be a negative potential factor on the self-esteem and attitudes of children (2) is the most important issue that must be taken into consideration.

General behavioral and medical treatment of NE generally includes proper counseling, reward systems such as star charts, a regular voiding habit during the daytime, fluid restriction at night, voiding before retiring, waking the child at night for voiding, drug prescription such as desmopressin which has a profound antidiuretic activity, and enuresis alarms (2, 3, 5, 7, 9, 11, 22).

Nocturnal enuresis is significantly more common in patients with upper airway obstruction and sleep disorders (12, 13), and many of these children are deep sleepers, and have a lower arousal response to stimulus than age-matched controls (11).

Literature review regarding RME has revealed that this treatment approach causes an increase in nasal cavity width and volume (23-25), a lowering of the palatal vault (26), a straightening of the nasal septum (26), a reduction in nasal resistance (27), and an improvement in nasal respiration.

There is a small number of studies in literature, in which the medical effects and benefits of RME on NE were evaluated (23, 28, 29). Timms (24, 28) in 1974 and 1987 and Gray (29, 30) in 1975 and 1987 showed that RME caused a significant increase in nasal respiration, resulting in a reduction in respiratory diseases and improvement in hearing and speech. These authors also stated that RME has positive effects on improving social relationships, increasing self-confidence and improving the behavioral and psychological standing of children. It is generally accepted that social, behavioral and psychological factors play an important role in the etiology of NE (4, 6). It was clearly shown by some clinicians (31, 32) that RME was a useful approach in children with abnormal breathing and sleep patterns. Cistulli et al (31) applied RME to 10 children with maxillary constriction and obstructive sleep apnea (OSA), and marked improvements were observed in 9 of them. Pirelli et al. (32) evaluated the effects of RME in 31 children with maxillary constriction, nasal breathing, and obstructive sleep apnea syndrome. They found that RME not only proved normal anterior rhinometric values, but also reduced the mean apnea-hypopnea index from 12.2 events to lower than 1 event per hour during a four-month follow-up period after maxillary expansion. Guilleminault and Li (33) reported that maxillomandibular expansion increased the lowest blood oxygen saturation in patients having transversal maxillary and mandibular constriction.

Basha et al. (12) and Cinar et al. (13) revealed that adenotonsillar and tonsillar sur-

gery cured or at least markedly improved NE in most cases with upper airway obstruction and obstructive sleep apnea. Weider and Hauri (15) and Weider et al. (14) also reported that removal of upper airway obstruction by surgical intervention led to complete recovery of NE in approximately 75 percent of the treated cases with upper airway obstruction. These surgical approaches have significant potential to resolve breathing and sleep problems most effectively. It has been shown that blood oxygen saturation of children with OSA and adenotonsilllar hypertrophy markedly increased after adenotonsillectomy operation (34, 35). These authors have also reported that breathing and sleep problems reduced remarkably after the surgery.

Robertson (36) evaluated the effect of mandibular advancement by means of a functional orthopedic appliance on nocturnal enuresis of a child who did not respond to medical therapy. Although it is not related with RME, this treatment approach also increases the oropharyngeal size and regulates the breathing pattern. The bedwetting days of the patient reduced from every night to 1-2 nights a week after the first month of the therapy. Complete dryness was achieved at the end of 20-month treatment.

The recovery rate of NE after RME was reported as 47 percent or more in literature (18-21). According to these studies, RME shows its healing effect on NE by the following mechanisms:

1. RME causes an increase in nasal and nasopharyngeal airway dimensions, resulting in improvement in breathing and blood oxygen saturation (18-21).

2. RME results in improvement in nasal breathing and reduction in apnoic episodes which relate to RME improved lymphatic circulation and increased the antidiuretic function of the pituitary gland (17).

3. Improved breathing capacity and better oxygen saturation after RME might have a beneficial effect on sleep and it may cause the children to wake up more easily because of bladder fullness (19, 21).

4. Better blood oxygen saturation may have a positive effect on neuromuscular coordination and control of bladder sphincter during sleep (18, 21).

5. RME may also have a placebo effect. Referral to orthodontic clinics for treatment and coming to orthodontists several times may positively affect the psychology of children (19, 20). In addition, the placement of a rigid orthodontic appliance to the palate may affect and irritate the tongue, and this event may alter the degree of arousal response and wakefulness during sleep (19, 20).

Conclusions

It has been stated by several authors that RME had a positive effect on reducing and/or ceasing NE in 70 percent of the children. It should be noticed, however, that only one hypothesis such as the increase in nasopharyngeal airway was assessed in RME studies, and that the observed effects were subjectively quantified. In order to reveal and to explain the efficiency of RME on NE, further studies assessing polysomnographic records, blood oxygen saturation, respiratory changes, and placebo factors during and after RME must be conducted.

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The Editorial Board of Acta Medica Academica (AMA) wishes to acknowledge and thank the reviewers who volunteer their time and expertise to read and evaluate the submission for AMA. The following individuals provided such expert assistance to AMA in 2007:

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Momir Macanović
(1938-2007)

The news of the death of dr. Momir Macanović deeply moved many who had the honour to know this quiet intellectual, a dedicated and extremely capable research physician. Nephrology has lost a supreme expert and scientist, his many pupils, co-workers and friends have lost a great teacher, an inspirational role model and faithful friend, his family has lost a husband and father, and his many patients around the world have lost a doctor whom they remember with gratitude, not only for his expert help, but also the care expressed by his human qualities.

Momir Macanović was born on 2nd January 1938 in Sarajevo, where he attended elementary school, high school, the medical faculty, post-graduate studies and specialized in internal medicine. He took his doctorate in London, where he was a student from 1970 to 1973 as a post-graduate at the *Royal Postgraduate Medical School (Hammersmith Hospital, Renal Unit)*. On his return to Sarajevo, he worked at the medical faculty as an assistant, docent and professor of internal medicine, and from 1985 to 1988 he was the dean of that faculty. The exceptional good intentions of two persons need to be emphasized for the success of his professional and scientific career – that is, prof. dr Enisa Bašagić, the then head of the nephrology department, and prof. dr Ante Lovrinčević, a radiologist at the medical faculty in Sarajevo. Dr. Macanović held two more functions in the health service of the Republic of Bosnia and Herzegovina: he was president of the Committee (minister) for health from 1987 to 1991, and director of the Institute for Nephrology from 1990 to 1992.

Dr. Macanović lived for ten years before the war in London and Paris, conducting immunological research with the famous scientists P. J. Lachman and Prof. G. Richet. The research projects he worked on with his co-workers in Sarajevo were financed by the *National Institute of Health (Bethesda) INSERM U 64 (Hospital Tenon, Paris) and the Commission of the European Communities (Joint Research Centre)*. Whether alone or with co-workers, he published more than a hundred publications in international journals and monographs. He was one of the few Yugoslav researchers who had his research published in The Lancet. It was no particular surprise when this prestigious medical journal published his articles written together with English scientists but his particular success was the research paper that came to that journal from Sarajevo. Other well-known journals which also published papers by dr. Macanović and

his co-workers were: *British Medical Journal, Clinical Experimental Immunology, Journal of Immunology, Kidney International* and the well-known Zagreb journal *Periodicum Biologorum* which was at that time edited by Nikša Alegretti.

Dr. Macanović as a humanist physician did not believe that the war in Bosnia and Herzegovina would last or that it would prevent him publishing his work. Each day he would go to his clinic, despite the snipers threatening from both sides of the Miljacka. However, once when he was crossing the bridge to get to work he was wounded, and he decided to leave his native city. This great expert could not stay in Belgrade and Novi Sad. It is not easy without a home or furniture at the wrong time, even if he could find regular work in the new setting. So his friends advised him to seek refuge abroad. An additional difficulty was the order forbidding refugees finding employed in Serbia.

Dr. Macanović was helped by an English colleague, who offered him the position of Senior Research Associate at Cambridge. In England Dr. Macanović began his struggle to survive, he took the exams he needed to work as a nephrologist in Britain. First he worked in Dorchester, and then went to the United Arab Emirates. However, in February 2007 illness forced him to return to London, to his sons, where he died two months later. His body was cremated on 2nd May 2007 in England.

All the troubles encountered by a refugee at an advanced age, in a foreign country, did not put a stop to the professional and research work of this exceptional and dedicated scientist. Dr. Macanović continued to publish his research and pass on his enormous clinical experience in nephrology and immunology. In that period he published ten professional papers in journals. Several chapters in various monographs (of which the one on the system of complements in kidney diseases should be emphasized in particular and the book *Manual of Nephrology: Drug Therapy and Therapeutic Protocols in Renal Diseases)*. This book (ISBN-13:9781581125160), published in 2004, contains protocols and instructions founded on clinical evidence, and when there is none, other available evidence is used or personal experience.

Rajko Igić

Faruk Konjhodžić
(1936-2007)

Academic Faruk Konjhodžić died on 19 July 2007 in Sarajevo. He was a respected professor at the Faculty of Medicine in Sarajevo and for many years the secretary of the medical science section of the ANUBiH (the Academy of Arts and Sciences of Bosnia and Herzegovina).

With his death, the scientific world in Bosnia and Herzegovina lost one of its main architects of contemporary neurosurgery and the long term director of the University Clinical Centre in Sarajevo.

The work of Academic Faruk Konjhodžić, as the long-term manager of the neurosurgery clinic was well thought out and systematic, both in the way he selected and trained his staff and in the provision of modern diagnostic and research equipment. This approach made the rapid and modern development possible of the University Clinical Centre in Sarajevo. The enthusiasm and the professional, educational and scientific work of Academic Faruk Konjhodžić influenced not only the colleagues with whom he worked for many years, but had wider importance for the work of other clinics and institutions, in the sense of increased activity in the field of modern medicine. His work bore fruit as the neurosurgery clinic of the University Clinical Centre in Sarajevo produced significant professional and scientific results through its work.

Furthermore, frequent contacts with experts from many countries, where he gained his experience, continued to speak of his continuing interest in gaining even more experience, which Academic Faruk Konjhodžić wrote about in his many scientific papers. These papers are a reflection of his work and experience gained, and were presented to the world public, which appreciated and respected him as a top expert in the field of neurosurgery.

Unusually for the field of surgery, Academic Faruk Konjhodžić was a fruitful author of discussions and scientific topics which dealt not just with the narrow field of neurosurgery, but also much wider areas, and he paid particular attention to research work. Precise in terms of methodology, he spoke of working methods in researching problems with clinical patients, where he passed on his rich experience to others, opening up problem areas which clinicians had to verify through scientific and research methods, so establishing the correct balance in the work of neurosurgery but also in other disciplines. The scientific and professional public noted

the value of his discussions and thought, but also the experience of an experienced clinician, resulting in a large number of editions of some of his books.

In the medical science section of the ANUBiH he showed understanding and encouraged others in the work of individual committees and holding specific public meetings, and his work as a writer in the *Rječnik medicinskih naziva (Dictionary of Medical Terminology)* was seen as a major contribution, not only interpreting an abundance of terms, but also in an original way showing his broad knowledge of general and specialized medicine. By organizing classes and offering assistance in the foundation of emergency medicine, naturally by passing on the experience he had gained, he made a major contribution to students and doctors in this important sector, which daily requires not only quick intervention, but increasingly new insights from that segment of medicine.

Academic Faruk Konjhodžić showed to all those interested the events in our country, by dealing with the consequences of the war in his own particular way, especially the very important subject of the problem of tumors, which is also a very current problem in other countries in the world. Many visits as a guest to several clinics in this country and abroad and the high recognition of the Medical Faculty in Pittsburg, of an honorary PhD, clearly show recognition of his quality as a neurosurgeon and scientist.

His breadth is also seen in his interest in other areas of medicine, through encouragement of the work of the medical science section of the ANUBiH. The Academy of Arts and Sciences of Bosnia and Herzegovina owes Academic Faruk Konjhodžić, expert, scientist and educator, a great debt of gratitude.

Ladislav Ožegović

Instructions to Authors

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Manuscripts should be written according to the rules stated in "Uniform Requirements for Manuscripts Submitted to Biomedical Journals". The full document is available from www.icmje.org.

Language. Manuscripts must be written in clear, concise, grammatical English. Authors from non-English speaking countries are requested to have their text translated by a professional, or thoroughly checked by a native speaker with experience in writing scientific manuscripts in English. Revision of the language is the responsibility of the author. All manuscripts should be spellchecked using a Microsoft Word or Dorland's spellchecker before they are submitted. Spelling should be US English or British English, but not a mixture. Manuscripts may be rejected on the grounds of poor English.

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- for reviews – up to 24 pages (maximum count 43200 characters),
- for original research or clinical reports – up to 20 pages (max. 36000 characters),
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Organization of the text. The text of observational and experimental articles is usually (but not necessarily) divided into sections with the following headings: Introduction, Methods, Results, and Discussion. This so-called "IMRAD" structure is not simply an arbitrary publication format, but rather a direct reflection of the process of scientific discovery. Long articles may need subheadings within some sections (especially the Results and Discussion sections) to clarify their content. Other types of articles, such as case reports, reviews, and editorials, are likely to need other formats.

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3. Authors' names and institutional affiliations (full first name followed by family name, separated by a coma from the next name; using Arabic numerals in superscript format relate names and institutions).
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5. Corresponding authors. The name, mailing address, telephone and fax numbers, and e-mail address of the author responsible for correspondence about the manuscript. The name and address of the author to whom requests for reprints should be addressed (if different from the corresponding author), or a statement that reprints will not be available from the authors.
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9. The number of figures and tables.

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An abstract in English (up to 250 words each) should follow the title page. The abstracts should have titles (in English and in Bosnian/Serbian/Croatian), without authors' names and institutional affiliations. Its structure should be similar to that of the text. For original articles, the abstract should provide the context or background for the study; it should state the study's purposes, basic procedures (selection of study subjects or laboratory animals, observational and analytical methods), main findings, and principal conclusions. It should emphasize new and important aspects of the study or observations.

Following the abstract, authors provide, and identify as such, 3 to 5 key words or short phrases that capture the main topics of the article. Terms from the Medical Subject Headings (MeSH) list of Index Medicus should be used; if MeSH terms are not available, natural language terms may be used. MeSH terms are available from: www.nlm.nih.gov/mesh/.

Introduction. Provide a context or background for the study. State the specific purpose or research objective of, or hypothesis tested by, the study or observation. Give only strictly pertinent references and do not include data or conclusions from the work being reported.

Methods. The Methods section should include: *Selection and Description of Participants, Technical information (*describe the methods, apparatus, and procedures in sufficient detail to allow other workers to reproduce the results; give references to established methods, including statistical methods; identify precisely all drugs and chemicals used, including generic names, doses, and routes of administration), *and Statistics.*

Results. Present your results in logical sequence in the text, tables, and illustrations, giving the main or most important findings first. Restrict tables and figures to those needed to explain the argument of the paper and to assess its support. Use graphs as an alternative to tables with many entries; do not

duplicate data in graphs and tables. The text must contain a clear designation as to where the tables and illustrations are to be placed relative to the text. Do not duplicate data by presenting it in both a table and a figure.

Discussion. Emphasize the new and important aspects of the study and the conclusions that follow from them. Do not repeat in detail data or other material given in the Introduction or the Results section. For experimental studies it is useful to begin the discussion by summarizing briefly the main findings, then explore possible mechanisms or explanations for these findings, compare and contrast the results with other relevant studies, state the limitations of the study, and explore the implications of the findings for future research and for clinical practice.

Conclusion. Link the conclusions with the goals of the study but avoid unqualified statements and conclusions not adequately supported by the data. In particular, authors should avoid making statements on economic benefits and costs unless their manuscript includes the appropriate economic data and analyses. Avoid claiming priority and alluding to work that has not been completed. State new hypotheses when warranted, but clearly label them as such.

Acknowledge anyone who contributed towards the study by making substantial contributions to conception, design, acquisition of data, or analysis and interpretation of data, or who was involved in drafting the manuscript or revising it critically for important intellectual content, but who does not meet the criteria for authorship. List the source(s) of funding for the study, for each author, and for the manuscript preparation in the acknowledgements section.

References (separate page). Small numbers of references to key original papers will often serve as well as more exhaustive lists. Avoid using abstracts as references. References to papers accepted but not yet published should be designated as "in press" or "forthcoming"; authors should obtain written permission to cite such papers as well as verification that they have been accepted for publication. Information from manuscripts submitted but not accepted should be cited in the text as "unpublished observations" with written permission from the source. Avoid citing a "personal communication" unless it provides essential information. For scientific articles, authors should obtain written permission and confirmation of accuracy from the source of a personal communication.

References should be numbered consecutively in the order in which they are first mentioned in the text. Identify references in text, tables, and legends by Arabic numerals in parentheses at the end of a sentence. Use the same number in the reference list. References cited only in tables or figure legends should be numbered in accordance with the sequence established by the first identification in the text of the particular table or figure.

The titles of journals should be abbreviated according to the style used in Index Medicus. Consult the list of Journals Indexed for MEDLINE, published annually as a separate publication by the National Library of Medicine (available from: www.nlm.nih.gov/tsd/serials/lij.html).

Sample References

Articles in Journals

Standard journal article (List the first six authors followed by et al.):

Halpern SD, Ubel PA, Caplan AL. Solid-organ transplantation in HIV-infected patients. N Engl J Med. 2002;347(4):284-7.

More than six authors:

Rose ME, Huerbin MB, Melick J, Marion DW, Palmer AM, Schiding JK, et al. Regulation of interstitial excitatory amino acid concentrations after cortical contusion injury. Brain Res. 2002;935(1-2):40-6.

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Diabetes Prevention Program Research Group. Hypertension, insulin, and proinsulin in participants with impaired glucose tolerance. Hypertension. 2002;40(5):679-86.

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Geraud G, Spierings EL, Keywood C. Tolerability and safety of frovatriptan with short- and long-term use for treatment of migraine and in comparison with sumatriptan. Headache. 2002;42(Suppl 2): S93-9.

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Letters or abstracts:
Tor M, Turker H. International approaches to the prescription of long-term oxygen therapy [letter]. Eur Respir J. 2002;20(1):242. ; Lofwall MR, Strain EC, Brooner RK, Kindbom KA, Bigelow GE. Characteristics of older methadone maintenance (MM) patients [abstract]. Drug Alcohol Depend. 2002;66 Suppl 1:S105.

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Personal author(s):
Murray PR, Rosenthal KS, Kobayashi GS, Pfaller MA. Medical microbiology. 4th ed. St. Louis: Mosby; 2002.

Editor(s), compiler(s) as author:
Gilstrap LC 3rd, Cunningham FG, VanDorsten JP, editors. Operative obstetrics. 2nd ed. New York: McGraw-Hill; 2002.

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Royal Adelaide Hospital; University of Adelaide, Department of Clinical Nursing. Compendium of nursing research and practice development, 1999-2000. Adelaide (Australia): Adelaide University; 2001.

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Meltzer PS, Kallioniemi A, Trent JM. Chromosome alterations in human solid tumors. In: Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York: McGraw-Hill; 2002. p. 93-113.

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Christensen S, Oppacher F. An analysis of Koza's computational effort statistic for genetic programming. In: Foster JA, Lutton E, Miller J, Ryan C, Tettamanzi AG, editors. Genetic programming. EuroGP 2002: Proceedings of the 5th European Conference on Genetic Programming; 2002 Apr 3-5; Kinsdale, Ireland. Berlin: Springer; 2002. p. 182-91.

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Abood S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role. Am J Nurs [serial on the Internet]. 2002 Jun [cited 2002 Aug 12];102(6):[about 3 p.]. Available from: http://www.nursingworld.org/AJN/2002/june/Wawatch.htm

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Cancer-Pain.org [homepage on the Internet]. New York: Association of Cancer Online Resources, Inc.; c2000-01 [updated 2002 May 16; cited 2002 Jul 9]. Available from: http://www.cancer-pain.org/.

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American Medical Association [homepage on the Internet]. Chicago: The Association; c1995-2002 [updated 2001 Aug 23; cited 2002 Aug 12]. AMA Office of Group Practice Liaison; [about 2 screens]. Available from: http://www.ama-assn.org/ama/pub/category/1736.html

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Who's Certified [database on the Internet]. Evanston (IL): The American Board of Medical Specialists. c2000 – [cited 2001 Mar 8]. Available from: http://www.abms.org/newsearch.asp

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ISSN 1840-1848