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Reasons Underlying the Consent to Endovascular Treatment, Displayed by Patients Diagnosed with Asymptomatic Internal Carotid Artery Stenosis

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Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
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Background: Endovascular treatment of internal carotid artery stenosis (ICAS) has gained popularity in recent years. Offering CAS, which is a controversial treatment in asymptomatic disease, may provoke patient distrust of the diagnosis and intervention benefit.

The aim of this study was to prove that asymptomatic ICAS patients tend to show an emotional attitude to their illness, and therefore their decisions regarding carotid artery stenting are externally motivated and assessed emotionally.

Material/Methods: This study was conducted by a questionnaire consisting of 18 half-open questions (obtained from 25 consecutive patients) in categories of self-image, attitude to illness, and decision-making regarding CAS. Descriptive analysis was performed.

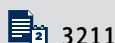
Results: Reaction: "Nothing to worry about – every illness can be cured" evidenced the rational attitude to the disease. Attitude towards oneself after receiving the unexpected information about the disease did not change. Most patients pursued a second opinion before the intervention.

Most patients showed internal motivation (78.7%). Rational assessment of the decision on CAS relied on consulting and insights into the disease and the intervention-related risk compared to risk of "doing nothing"

Conclusions: In decision-making about CAS by asymptomatic patients, the emotional attitude to disease and negative expectations pertaining to postoperative health lead to an internally-motivated and rationally assessed decision. At least 2 conversations with the patient should be scheduled. The primary purpose of the second visit should be dissipating any doubts and repeating the arguments for the intervention. Patients should be provided with an appropriate amount of information to reduce their fear of neurological complications and mental disturbances. Conversation should be concentrated on life-quality improvement instead of controversies about the intervention.

MeSH Keywords: **Adaptation, Psychological • Carotid Artery Diseases • Emotions**

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Background

In endovascular interventions, one of the most frequent indications for interventional treatment in the case of an asymptomatic disease is internal carotid artery stenosis (ICAS). ICAS involves a risk of cerebral stroke estimated to be 35–50% over a period of 5 years if the blood vessel lumen narrowing is 70–99% [1]. Interventional treatment involves a risk of death or developing serious neurological complications and cognitive function disorders, such as puncture site hemorrhage, acute thrombus formation in the treated artery, symptoms of cerebral hyperemia, and intracranial hemorrhage. The medical pressure to apply endovascular treatment is justified by a relative decrease in the imminent risk of life-threatening outcomes. In the case of an advanced illness, the risk connected with the natural outcomes exceeds the risk involved in intervention [2,3], because the likelihood of death, cardiac infarction, and cerebral stroke in the post-operative period is 2–9% [4]. Indication for interventional treatment (despite estimating the risk of postoperative complications) is relatively formalized, which means that each patient diagnosed with significant carotid artery stenosis is advised to undergo surgery or stenting [5]. Moreover, a physician may be held liable for ignoring a case of hemodynamically significant carotid artery stenosis.

From the patient's perspective, giving consent to intervention is far from being a simple and unambiguous issue. This decision is considerably easier when the disease is accompanied by symptoms, because then the patient perceives a direct relationship: "no intervention = symptoms of cerebral ischemia (aphasia, vision disorders, transient ischemic attacks) = death". But when the disease does not produce any symptoms, it is difficult for the patient to trust the physician's diagnosis or believe it is necessary for the patient to immediately decide about having surgery. The binding formula for a conversation between a physician and an ICAS patient is that the physician presents the benefits of the intervention on the condition that no complications develop during the CAS. The patient is provided briefly with selected statistical data adapted for their particular risk group. Following the data presentation, the patient is expected to consent to the intervention. No account is taken for the psychological aspects of this situation, which are extremely difficult for the patient, ignoring patient feelings connected with absolutely unexpected and shockingly negative news [6–10]. The physician tacitly assumes that the professional diagnosis (following the formula: "diagnosing a serious illness = mortal risk connected with abandoning the treatment = smaller risk of intervention = the prospect of disease-free life") is received and interpreted by the patient in exactly the same way. Thus the physician assumes that it is enough to communicate the information to the patients (without assessing their psychological condition), to grant them an equal status in the therapeutic process where they have an adequate

level of knowledge regarding the illness, and are more than ready to immediately make a rational decision on intervention.

However, clinical experience and psychological observations [11–15] show that this approach makes a double error. Firstly, a physician usually lacks proper skills to conduct conversations of this kind. The level of physicians' communicative and psychological competences is far from good, which may be attributed, inter alia, to the fact that those skills are not adequately developed and reinforced in the course of medical studies. Moreover, usually working under time pressure, the physician communicates the information too fast and selectively, not allowing the patient to ask questions, and tending to cut them off rather than explaining anything to the patient. The physician tends to monologue and use specialized medical jargon, assuming that the patient fully understands the information. Furthermore, the physician may misinterpret the patient's body language [16,17]. For instance, a physician may think that the patient's nodding means comprehension, whereas it may mean the patient's total astonishment and helplessness.

Secondly, the process of making a decision as important as undergoing surgery is rarely based on the same premises as a professional decision on qualifying a patient for carotid artery stenting (CAS) made by a physician. An immediate consent to intervention is an effect of experiencing very intense emotions rather than a conscious choice based on insights and referring to medical arguments. This is due to the fact that in a difficult communication situation like diagnosis, the patient unexpectedly experiences a cognitive dissonance connected with stress and intense negative emotions, which lead to "freezing" their logical thinking and disturbs the process of communication with the physician [17,18]. Most probably, the patient no longer comprehends the meaning of the communication, as he or she concentrates on their own problem – coping with the dissonance, the experienced conflicting feelings, and own emotions. Patients may lose control of their behavior and body language, and the patients' questions, if they manage to formulate them, may differ from those expected by the physician. No questions and no interest shown in the illness and its treatment may be misinterpreted by the physician as reluctance to acquire knowledge about one's health status [19].

The described situation should be considered as exceptionally difficult psychologically for both parties, but more difficult for the patient, who, under time pressure and in response to the physician's communication, is expected to make a choice between 2 comparably negative solutions: do nothing or undergo CAS.

The aim of this study was to verify the hypothesis that asymptomatic ICAS patients tend to show an emotional attitude to their illness, and therefore their decisions regarding carotid artery stenting are externally motivated and assessed emotionally.

Material and Methods

The study involved all patients admitted to the Department of Vascular Surgery within a 3-month period to undergo interventional (carotid artery stenting) treatment of asymptomatic ICAS. CAS is not the only procedure offered by the department. Our department performs about 340 carotid interventions (CAS and CEA) each year (approximately 250 for asymptomatic disease including 90 CAS). The study excluded patients with concomitant asymptomatic abdominal aortic aneurysms (AAA) and patients who did not consent to participate in the research survey. Twenty-seven persons were included, diagnosed with concomitant risk factors such as hypertension (86%), diabetes (37%), tobacco smoking (51%), or ischemic heart disease (63%).

The study was carried out by means of a specially constructed questionnaire consisting of 18 half-open questions. The questions regarded 3 psychological and 1 psychosocial category: (1) self-image; (2) attitude to one's illness; (3) reasons for making the decision about the interventional treatment; and (4) the attitudes of people in the patient's social environment toward the patient and the illness. In accordance with the research objective, this text will discuss the part of the survey results that pertains to the relationship between the attitude to one's illness and the underlying reasons for making the decision about the interventional treatment.

The analysis involved the survey results obtained from 25 patients (9 women and 16 men) who had been qualified for the interventional treatment due to asymptomatic ICAS. Two surveys were rejected due to incomplete answers.

Results

The analysis of the results revealed no differences between responses given by men and women. Patient age was not a differentiating variable, and the average age was 66.8 years. However, it was assumed that in the case of this differentiating variable it was not possible to exclude its influence on some of the patients' responses [20,21]. The results of the survey regarding the 2 specified psychological categories are presented below. Wherever the results do not sum up to 25 (the number of the survey participants), there was a possibility to choose any number of answers.

Attitude to one's illness

This psychological category was assessed on the basis of the answers to 3 questions referring to: (1) the first remembered reaction to news about the illness; (2) the feelings experienced when thinking about one's illness; and (3) any change (or not)

Table 1. First reaction to the news of one's illness.

Response category	Number of answers
Nothing to worry about, every illness can be cured	9
Who else should I consult about it?	8
It's a mistake	5
It's impossible, it doesn't hurt me, does it?	4
It's terrible, what's going to happen to me now?	1
Total	27

Table 2. Comparison of feelings experienced when thinking about one's illness.

Kind of feeling	Number of answers
Anxiety, fear, concern	10
Nothing special	8
Horror	7
Sadness	4
Total	29

in attitude towards oneself as a result of the illness. The survey results are presented below in the specified sequence.

As a rule (Table 1), a reaction like: "Nothing to worry about, every illness can be cured" is the evidence of the rational attitude to the disease, approaching it as a practical problem that can be overcome with some help from the physicians. The other reactions are emotional – expressing disbelief and shock, or even denying the diagnosis.

Out of the list of feelings connected with the illness, the patients indicated mainly the negative ones (Table 2), most often anxiety, fear, concern, and horror, even though the 8 "nothing special" responses are evidence of a calm, balanced approach to one's illness.

When it comes to attitude towards oneself in connection with unexpected information on the illness, none of the patients felt it changed for better or worse. Most patients (15) admitted that the illness upset their attitude to themselves, while the other patients (10) reported no changes in that respect.

Reasons for the decision on undergoing CAS

This psychological category was surveyed on the basis of the responses regarding: (1) sources of knowledge about the

Table 3. Sources of knowledge on the CAS.

Source	Number of answers
Physician who diagnosed the disease	19
Another physician	20
Spouse	9
Patients who underwent the operation	3
Searching for information on one's own in the internet	0
Total	51

Table 4. Comparison of feelings connected with post-operative health status.

Response category	Number of answers
Being a burden to others	21
Suffering, pain	15
Mental health disorders	14
Infirmity resulting from illness	12
I'm not afraid of anything particular	7
Recurrence of illness	5
Postoperative complications	3
Death	3
Total	80

intervention; (2) motives for undergoing the operation; (3) feelings connected with the post-operative health status; and (4) assessing the correctness of their decision.

The vast majority of patients pursued a second opinion and consulted another specialist with regard to the illness and its treatment. Some of them consulted their spouses and talked to persons who had undergone this kind of treatment. However, none of the patients used the internet to search for information on the disease (Table 3).

What the patients feared most was being a burden to their families; followed by pain and suffering, then mental disturbances and infirmity resulting from the illness. Less numerous responses pertained to recurrence of illness, postoperative complications and death, which is a proof of lack of concern in that respect (Table 4).

Most patients showed internal motivation (78.7%), which could be due to the knowledge and the “dose of optimism” resulting from consulting other physicians [22–24] (Figure 1). It should be noted that the internal motives included: fear of

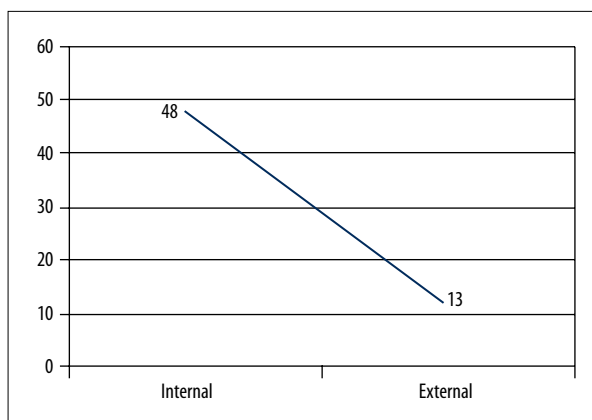


Figure 1. Dominating motivations.



Figure 2. Assessment of the decision on undergoing CAS.

death, fear of health deterioration, a belief that intervention is a chance for a longer life, and a belief that CAS involves a smaller risk than not being operated on at all (the last 2 categories were the most frequent). The external motives included the responses showing that the patients had been persuaded by the attending physician and an independent specialist doctor.

The rational assessment of the decision on undergoing CAS (“neither good nor bad, but necessary”) may usually be treated as an effect of consulting and insights into the disease and the risk involved in CAS compared to the risk of “doing nothing” (Figure 2). None of the patients assessed their decision as bad or very bad, which is hardly possible once the decision was made, as this act itself significantly reduces an unpleasant emotional stress resulting from the intense cognitive dissonance.

Discussion

The presented results show an optimistic view of the ICAS patients as highly motivated to overcome their illness [22,24], despite the emotional attitude and the negative feelings related

to postoperative health status. A very important feature here is seeking a second opinion of a consultant, or contacting persons who have undergone this sort of intervention. This means that patients verify the information received from the physician diagnosing the disease. However, as expected, patients predominantly show an emotional attitude to an asymptomatic disease. This is evidenced by the acts of denying, disbelief, and shock being the first reactions to the unexpected news of an illness requiring a quick intervention. This is also evidenced by the negative feelings (mainly anxiety, fear, concern, and horror) related to thinking about the illness, and also the wavering attitude toward oneself. The decision to undergo CAS is made on the basis of intense emotions reinforced with fears related to postoperative health status. Contrary to our assumptions, the decision is usually internally motivated and rationally assessed as “necessary”.

The probable course of the process is as follows: 1) experiencing an intense cognitive dissonance related to the fierce negative emotions and the stress condition, because the news of the serious illness is sudden and unexpected; 2) initiating defensive mechanisms (ie, self-calming rationalization and projection), transferring the responsibility for one’s own health status to the physician(s), thus helping to regulate the unpleasant emotions; 3) a change in the attitude towards oneself due to the need to assimilate the obtained information on the illness and to adapt to the new situation; 4) searching for additional information on the disease, treatment possibilities, and effects, as well as the possible consequences of avoiding CAS; 5) making an internally motivated and rationally evaluated decision on consenting to the intervention; and 6) the final elimination or mitigation of the cognitive dissonance and the related stress condition.

This change in attitude may mean that the disease was approached as an obstacle that can be overcome, which would be a proof of high confidence in physicians as well as persuasiveness of their arguments. The change in the approach may also mean that the patients make a dramatic calculation: which is “better” – to consciously burden their families with an infirm and suffering, mentally disturbed person that they may become following an imminent cerebral stroke; or to face similar consequences, yet less probable in the case of interventional treatment of the condition [25]. No matter which of the interpretations is correct, it must be recognized that such reactions serve the adaptive function – the patient is trying to adapt to the illness as a stressful situation that dramatically deteriorates quality of life [6–8,26,27]. Then the coping process is initiated in response to the news of illness, which depends mainly on the individual assessment of the hazard level. If patients decide that taking an appropriate action will eliminate the hazard, they will tend to approach the stressful situation rationally (ie, in a task-oriented manner). Otherwise,

coping with this situation will consist of minimizing the adverse effect of the negative emotions [6,7,13].

Therefore, a physician prepared to face the patient’s emotional reaction to the unexpected news of an asymptomatic illness should contribute significantly to the transformation of the emotional approach to a rational one [10,28,29]. This purpose is served by providing clinical and practical information that may contribute to decreasing the impact of emotional factors in the patient. In the case of ICAS patients, the conversation should therefore concentrate on the aspects that arouse the most intense emotions – stroke, paralysis, paresis, and mental disorders – since they are identified first and foremost with infirmity requiring long-term care [25,26,30]. In the context of existing controversies over CAS and CEA with the data biased by speciality and comorbidities, the choice of the procedure should be left to medical professionals. Informed patients with detailed knowledge would be very concerned about CAS and certainly would question the “if you don’t do this, something bad is going to happen” presentation. To block such questions (which can increase alarmingly negative emotions), the strategy of discussion with the patient is focused on the presentation of the benefits of giving consent for the intervention (removal of uncertainty and anxiety about health, improve the quality of life, and relieve relatives). In addition, practitioners may refer to relevant statistics and examples of patients whose state of health after the surgery clearly improved.

This form of conversation, outlined on the basis of the conducted research, creates an opportunity to move quickly from emotional premises to a rational decision, which effectively reduces both cognitive dissonance and related stress.

It is advisable that the conversation should also address issues connected with the patient’s cognitive functioning, since carotid artery postoperative complications involve not only pareses or paralyzes, but also impairment of cognitive capacities resulting from microembolism occurring during open surgical and endovascular operations. The relevant literature does not provide a cohesive opinion on this issue, and depending on the selected research group and assessment methodology, it shows improvement, impairment, or no effect of CAS and CEA (carotid endarterectomy) on cognitive functions [31–35]. So far, the data gathered in our Department have shown worse results in the Benton Visual Retention Test, assessed at 3 months after CAS and CEA (based on our own preliminary research).

Finally, it should be noted that the research results presented herein were conducted before publishing the research results of CREST and ICSS [36,37]. The controversies resulting from them are the climax of the discussion held by the representatives of medical specialities dealing with treatment of carotid artery stenosis, and they concern issues connected with safety of CAS

and CEA. The patients consulted by neurologists, angiologists, and interventional radiologists will be persuaded to undergo CAS due to the method availability to these specialists, but the information on an increased cerebral stroke risk may be withheld [37]. Vascular surgeons, in turn, although they are skilled in performing the surgery using both methods, tend to present the cerebral stroke risk involved in CAS, failing to mention the risk of damage to cranial nerves and cardiac infarction during CEA treatment [36,37]. Furthermore, since the U.S. FDA (Food and Drug Administration) recognized CAS and CEA as equivalent treatment methods in 2011, the confusion regarding the information communicated to the patients has increased [38]. No less important seems to be the fact that according to the present system of financing medical procedures, CAS operators receive substantial profits [39]. In this confusing situation it is hard to expect that even the rational patients who are eager to verify the obtained information will cope successfully with the situation of a serious illness. Therefore, it may be expected that being confronted with contradicting and incoherent indications regarding selection of the intervention method, presented by physicians of related specialties, will further increase the cognitive dissonance and stress connected with the diagnosis of an asymptomatic illness and the need for interventional treatment.

Conclusions

The completed research has led to the following conclusions:

In the process of making a decision on submitting to a carotid artery stenting by asymptomatic patients, at some point a

certain change takes place, because generally the emotional attitude to one's illness and negative expectations pertaining to the postoperative health status lead to taking an internally motivated and rationally assessed decision.

Therefore, following the diagnosis, it is advisable to schedule at least 2 conversations with the patient. After receiving the first news about having the disease, the patient should be given some time to cope with emotions resulting from the experienced cognitive dissonance and related stress, and the doctor should make another appointment with the patient. The primary purpose of the second visit should be to dissipate any doubts and repeating (if necessary) the arguments for undergoing CAS. It is advisable that the second conversation take place in the presence of the patient's close family member or friend who is open to the doctor's rational arguments. The patient should be told that the CAS treatment is a good (but not the only) choice, and also needs to be informed of the risk involved in refusing the treatment. This particularly concerns elderly people with numerous concomitant conditions. Moreover, the patients should be provided with an appropriate amount of information on their illness and consequences of its interventional treatment in order to reduce their fear of neurological complications and mental disturbances. The conversation should be concentrated on improvement in life quality as a result of treating the condition and eliminating the associated risks.

Conflict of interests

Authors declare no conflict of interest.

References:

- Young B, Moore WS, Robertson JT et al: An analysis of perioperative surgical mortality and morbidity in the asymptomatic carotid atherosclerosis study. ACAS Investigators. *Asymptomatic Carotid Arteriosclerosis Study. Stroke*, 1996; 27(12): 2216-24
- Saw J: Carotid Artery Stenting for Stroke Prevention. *Can J Cardiol*, 2014; 30: 22-34
- NICE: National Institute Of Clinical Excellence. Carotid artery stent placement for asymptomatic extracranial carotid stenosis. Available at: <http://www.nice.org.uk/nicemedia/live/13026/54241/54241.pdf>
- Liapis CD, Bell PRF, Sir, Mikhailidis D et al: ESVS Guidelines. Invasive Treatment for Carotid Stenosis: Indications, Techniques. *Eur J Vasc Endovasc Surg*, 2009; 37(4 Suppl): 1-19
- Redgrave JN, Rothwell PM: Asymptomatic carotid stenosis: what to do. *Curr Opin Neurol*, 2007; 20: 58-64
- Lazarus RS, Folkman S: Stress, Appraisal, and Coping. New York: Springer, 1984
- Lazarus RS: Emotion and adaptation. New York: Oxford University Press, 1991
- Hobfoll SE: Stress, Culture, and Community. The Psychology and Philosophy of Stress. Kluwer Academic/Plenum Publishers, 1998
- Dulmen AM, van, Bensing JM: Health promoting effects of the physician-patient encounter. *Psychology, Health & Medicine*, 2002; 7(3): 289-99
- Stewart MA: Effective physician-patient communication and health outcomes: a review. *Can Med Assoc J*, 1995; 152: 1423-33
- Carver CS, Scheier MF, Weintraub JK: Assessing coping strategies: A theoretically based approach. *J Pers Soc Psychol*, 1989; 56: 267-83
- Heszen-Niejodek I: Polish research of doctor-patient communication. In: Mol SSL, Mol, Bensing JM (ed.). *Doctor-patient communication and the quality of care*, 1993. Utrecht: Nivel
- Heszen-Niejodek I: The level of patients' anxiety and their illness behavior. In: Rodrigues-Marin J (ed.), *Health psychology and quality of life research*, 1995. Alicante: The University of Alicante
- Bensing JM, Verhaak PFM: Communication in medical encounters. In: Kaptein A, Weinman J (eds.), *Health psychology*. Oxford: BBS Blackwell, 2004: 267-87
- Laine C, Davidoff F, Lewis CE et al: Important elements of outpatient care: a comparison of patients' and physicians' opinions. *Ann Intern Med*, 1996; 125: 640-45
- Hamilton Ch: *Communicating for results*. Belmont: Thomson Wadsworth, 2008
- Bensing JM, Verheul W, van Dulmen AM: Patient anxiety in the medical encounter: a study of verbal and nonverbal communication in general practice. *Health Education*, 2008; 108(5): 373-83
- Festinger L: *A Theory of Cognitive Dissonance*. Stanford University Press, 1957
- Pawlun M, Dzieciuchowicz Ł, Brzuzgo K et al: Wiedza chorych o planowanym leczeniu operacyjnym. *Pol Prz Chir*, 2006; 78(9): 1000-12 [in Polish]
- Heatheron TF, Hebl MR, Hull JG, Kleck RE (eds.): *The Social Psychology of Stigma*. New York: Guilford Press, 2000

21. Hyer LA, Sohnle S: Trauma Among Older People: Issues and Treatment. London: Routledge, 2001
22. Seligman MEP: Learned Optimism: How to Change Your Mind and Your Life. New York, NY: Pocket Books, 1991
23. Seligman MEP: Authentic Happiness: Using the New Positive Psychology to Realize Your Potential for Lasting Fulfillment. New York: Free Press, 2000
24. Fournier M, Ridder D de, Bensing JM: How optimism contributes to the adaptation of chronic illness: a prospective study into the enduring effects of optimism on adaptation moderated by the controllability of chronic illness. *Personality and Individual Differences*, 2002; 33(7): 1163-83
25. Tutaj A, Nowak B, Nowak J: Wczesne powikłania neurologiczne po operacjach udrożnienia tętnic szyjnych. *Neurol Neurochir Pol*, 2005; 39(2): 120-24 [in Polish]
26. Karla L, Evans A, Perez I et al: Training careers of stroke patients: randomized controlled trial. *British Med J*, 2004; 328(448): 1099
27. Mattlin J, Wethington E, Kessler RC: Situational determinants of coping and coping effectiveness. *J Health Soc Behav*, 1990; 31(1): 103-22
28. Bensing JM: Doctor-patient communication and the quality of care: the role of affective behaviour. *Ars Medici: Zeitschrift für Praktische Medizin*, 1995; 17: 1188-98
29. Myerscough PR, Ford M: Talking with Patients. Keys to Good Communication. Oxford University Press, 1996
30. Weert JCM van, Dulmen AM van, Bensing JM: What factors affect caregiver communication in psychogeriatric care? In: A.M. Visser. Alzheimer's disease: new research. New York: Nova Science Publishers, 2008; 87-117
31. Lin MS, Chiu MJ, Wu YW et al: Neurocognitive improvement after carotid artery stenting in patients with chronic internal carotid artery occlusion and cerebral ischemia. *Stroke*, 2011; 42(10): 2850-54
32. Huang KL, Ho MY, Chang CH et al: Eur Impact of Silent Ischemic Lesions on Cognition following Carotid Artery Stenting *Neuro*, 2011; 66(6): 351-58
33. Turk AS, Chaudry I, Houghton VM et al: Effect of carotid artery stenting on cognitive function in patients with carotid artery stenosis: preliminary results. *Am J Neuroradiol*, 2008; 29(2): 265-68
34. Gossetti B, Gattuso R, Irace L et al: Embolism to the brain during carotid stenting and surgery. *Acta Chir Belg*. 2007; 107(2): 151-54
35. Grunwald IQ, Supprian T, Politi M et al: Cognitive changes after carotid artery stenting. *Neuroradiology*, 2006; 48(5): 319-23
36. Carotid Stenting Trialists' Collaboration1, Bonati LH, Dobson J et al: Short-term outcome after stenting versus endarterectomy for symptomatic carotid stenosis: a preplanned meta-analysis of individual patient data. *Lancet*, 2010; 376(9746): 1062-73
37. Brott TG, Hobson RW II, Howard G et al: CREST Investigators. Stenting versus Endarterectomy for Treatment of Carotid-Artery Stenosis. *N Engl J Med*, 2010; 363(1): 11-23
38. <http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm254430.htm>
39. Moore WS: Carotid Endarterectomy versus Carotid Angioplasty Cui Bono, *Eur J Vasc Endovasc Surg*, 2010; 39(Suppl.1): S44-48