There is a continuous increase in the proportion of elderly patients undergoing surgical procedures. This review will concentrate on selected topics related to elderly care that represent current unresolved and relevant issues for the care of the elderly surgical patient including: aging related organ dysfunction, perioperative risk assessment of geriatrics patient, preoperative optimization and pharmacological support of elderly patient. Additionally, age as a clear risk factor for postoperative cognitive dysfunction is also discussed.

Key words: elderly patients, surgery, risk assessment, cognitive dysfunction

INTRODUCTION

More than sixty years ago, Welch and colleagues published alarming data that perioperative mortality was 20.7% for patients older than 70 years undergoing a major abdominal surgery procedure1. Greater vulnerability to surgical stress and increased incidence of perioperative organ dysfunction in geriatric patients is primarily a consequence of the reduced functional organic reserve and the presence of significant comorbidity. The incidence of serious adverse events in the perioperative period was significantly higher among elderly patients. In many studies, older age is a significant predictor of perioperative morbidity and mortality2,3. On the other hand, some studies have shown no significant increase of perioperative mortality in geriatric patients, while the overall morbidity associated with the entire postoperative course was only slightly elevated4,5. Regardless of these findings, recently it was accepted practice that a large number of surgical procedures, including those with clear potential clinical benefit, were postponed or canceled due to increased age of the patients. But, denial of any therapeutic procedures including surgery for unjustified or insufficiently justified reasons also poses the risk to the patient.

However, in the last two decades, the perioperative risk has been reduced due to progress in the field of surgical techniques and anesthesia safety. These developments have allowed expansion of different surgical interventions among elderly patients. Today, surgical procedures in elderly patients are part of the daily routine practice of both: surgeons and anesthesiologists.

ORGAN DYSFUNCTION ASSOCIATED WITH AGING

In general, there are three groups of changes in morphology and function of the organs and systems that are associated with aging. The first group includes changes of autonomic functions and cellular homeostasis, such as temperature, pH and volume of blood and extracellular fluids. These functions are not significantly affected with aging. Reduction of organic mass belongs to another group of changes related to aging. Regarding this, it is known that the weight of the brain, liver and kidney decrease with aging. The most significant changes that have a great influence on perioperative course and mortality of geriatric patients are in the third group, and they are related to the reduction of organic functional reserve6.
clinical symptoms, but many functional respiratory parameters, such as vital capacity, lung compliance, and maximal voluntary ventilation were significantly reduced in geriatric patients and must be taken into account in the preoperative evaluation.

Kidneys and urinary tract

Progressive loss of cortical nephrons is a dominant morphological change of the kidney in the elderly. These morphological changes result in nearly 50% reduction in the efficiency of renal homeostasis. In addition, resistance to the effects of antidiuretic hormone in elderly patients reduces the efficiency of the kidneys, and lead to decreased ability of preservation or elimination of salt and water, which also reduces elimination of anesthetics and other medications that are used in the perioperative course. Urinary canalicular system is also affected by aging. Urolithiasis is common in older men, while the problem of urinary incontinence is present in older women. All this increases the risk of urinary infection and hydronephrosis.

Cardiovascular system

The aging process is associated with morphological changes on the heart and blood vessels. Changes in the heart include: reduction of the total number of cardiomyocytes, reduction of the intermyocyte binding matrix and increase of the left ventricular wall thickness. Described morphological changes generate various functional disorders such as: reduction of cardiac contractility, reduced coronary blood flow, prolongation of action potential and a reduced β-adrenergic response compared with the increase of sympathetic activity. The increased stiffness of the aortic wall contributes to structural changes in the heart muscle and the mechanism of relaxation is weakened. This all leads to systolic hypertension, a phenomenon that is a characteristic of the elderly population. Systolic hypertension, which is due to morphological changes in the wall of the aorta, increases subsequent systolic load of left ventricular afterload, and leads to hypertrophy and thickening of its wall.

Taking into consideration that the heart is very well adapted to the aforementioned structural and functional changes, the values of some parameters, such as: frequency of heart rate and cardiac index in the elderly do not differ significantly in relation to young people at rest and during ordinary life activities. But during exercise or exposure to surgical stress, older persons cannot compensate the decrease in cardiac output by increasing the frequency of heart, which is otherwise the usual physiological compensatory mechanism in younger people, given the already mentioned reduction in beta receptor sensitivity.

Hepatic function

Aging reduces the overall weight of the liver, even up to 45%. This reduction of volume leads to reduced hepatic blood flow, and overall functional capacity of the liver. Reduced catalytic activity of liver enzyme systems is responsible for prolonged activity of anesthetics due to decreased degradation of metabolic products, and degradation of some drugs. Synthetic liver function is also weak, and also decreases the synthesis of albumin and coagulation factors.

Central nervous system

The specific cause that leads to decreased function of the central nervous system during aging is not fully understood. The causes are probably hiding in hormonal imbalance, changes in the cerebral blood supply and neural damages mediated by oxidative stress. Brain atrophy is the most common CNS morphological change associated with aging and the extensiveness of these changes correlated with the extent of cognitive deficit. From the anesthesia perspective the most important changes associated with aging are related to the functioning cholinergic and adrenergic autonomic nervous system. Changes in the

<table>
<thead>
<tr>
<th>Classification</th>
<th>Preoperative status and comorbidity present</th>
<th>Expected mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA 1</td>
<td>A normal healthy patient</td>
<td>0.06-0.08</td>
</tr>
<tr>
<td>ASA 2</td>
<td>A patient with mild systemic disease</td>
<td>0.27-0.4</td>
</tr>
<tr>
<td>ASA 3</td>
<td>A patient with severe systemic disease</td>
<td>1.8-4.3</td>
</tr>
<tr>
<td>ASA 4</td>
<td>A patient with severe systemic disease that is a constant to life</td>
<td>7.8-23</td>
</tr>
<tr>
<td>ASA 5</td>
<td>A moribund patient who is not expected to survive without the operation</td>
<td>&gt;50</td>
</tr>
<tr>
<td>ASA 6</td>
<td>A declared brain-dead patient whose organs are being removed for donor purposes</td>
<td>----</td>
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</tbody>
</table>

Preoperative assessment of patient status by the American Society of Anesthesiologists scores. The table also presents the assessment of postsurgical mortality based on the correlation of ASA status and surgical mortality in two large samples of 69388 and 34145 patients.
Preoperative preparation of geriatric patients

The actual assessment of perioperative risk in geriatric patients is sometimes a really difficult task, due to the fact that the aging process varies significantly between individuals, as well as the ability of each individual elderly patient to overcome surgical stress and anesthesia as painlessly as it is possible.

PERIOPERATIVE RISK ASSESSMENT OF GERIATRIC PATIENT

Two primary goals of preoperative evaluation of geriatric patients are related to the understanding of organic functional reserve and the identification of coexisting pathologic process. It is also important to assess whether older patients independently perform everyday mental and physical activity. In fact, it was noted that older patients who give information about a high level of preoperative physical and mental activity, have more organic functional reserve, which may represent a predictor of successful postoperative outcome\(^1\). Preoperatively, it is necessary to identify and adequately treat the diseases that can disrupt the normal functioning of vital organ systems, such as coronary disease, acute renal function impairment, chronic obstructive lung disease or diabetes. In this way it is possible, in most cases, to avoid the adverse events and fatal outcome after surgical procedures for elderly patients. For example: perioperative use of beta blockers significantly reduces incidence of perioperative cardiac complications including myocardial infarction in geriatric patients with preoperative determined high risk, (the case with elderly patients with associated coronary artery disease)\(^2\).

The presence of multiple comorbidities in geriatric patients requires a comprehensive understanding of medical history and thorough clinical examination. Although most physicians believe that medical history taken by older people has only limited value, primarily due to the presence of sensory and cognitive deficits in these patients, the information obtained can still be very useful. In the elderly, family and friend support may also be helpful as well, and that kind of information should be provided. In geriatric patients who are in poor physical condition, with evident cognitive deficit and lack of social support, it is necessary for preoperative evaluation to include other members of the geriatrics team, such as social workers and psychologists. It is known that elderly people take many different medications. In the preoperative period, it is necessary to take into consideration interactions between different medications, and also the influence of aging on the reduction of functional reserve of the liver and kidneys, and the implications of the metabolism and degradation of drugs that we use in the perioperative course. These patients often have abnormalities of laboratory tests. Changes in the electrocardiogram and chest radiograph are relatively common. For these reasons, laboratory tests, ECG, X-rays and other elements of the preoperative evaluation should be as recent as possible and repeated, depending on the condition of the actual patient.

The actual assessment of perioperative risk in geriatric patients is sometimes a really difficult task, due to the fact that the aging process varies significantly between individuals, as well as the ability of each individual elderly patient to overcome surgical stress and anesthesia as painlessly as it is possible. The using of different scales and scoring systems can estimate the operational risk of geriatric patients, but it was shown that in this case all these stratification methods have certain limitations. The most commonly used scale for assessing the status and perioperative risk of patients according to American Society of Anesthesiologists is popularly known as the ASA classification (American Society of Anesthesiologists physical status of the system) (Table 1). If it is an urgent surgical procedure the patient’s preoperative status is defined by adding the letter E (emergency) after the classification. For example, patients who are preparing for emergency surgery and suffer from moderate systemic disturbance preoperatively are assigned ASA 2E status. Patients of ASA 5 status usually require urgent surgical intervention so they belong to 5E status mandatory. In contrast, in the ASA group 6, which was recently introduced, there is no possibility of adding guidelines E, because organ explanation is performed urgently in donors with confirmed brain death. The disadvantages of these classifications are reflected primarily in the absence of objective criteria, but also the fact that the system is not sufficiently sensitive, taking into account that the largest proportion of patients are in categories II and III, without defining specific subgroups within these broad groups\(^3\-\(^6\)\).

The other two scoring systems which are routinely used to assess perioperative risk are also used as predictors of morbidity and mortality in critically ill patients. These are: APACHE (Acute Physiology and Chronic Health Evaluation) and POSSUM (Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity) scoring systems. Apache score seems more appropriate for risk assessment of critically ill patients, but its usefulness in scoring surgical patients is limited. On the other hand POSSUM score is more applicable to surgical patients, although for calculating the score it is necessary to enter operational variables, so there is no possibility of its use in preoperative evaluation of total risk\(^20\-\(^22\). Of the other scoring systems for evaluation of Cardiac risk for non cardiac surgery a modification of the Goldman scale of risk\(^23\) can be used and the revised cardiac risk index that was adopted by Lee and associates in 1999.\(^24\) (Table 2).

On the other hand, there are indices designed precisely to assess the perioperative risk and mortality risk of hospitalized elderly patients. The so-called functional axle scoring system was introduced in 1998 by Inouye and co-workers and was constructed by using three independent risk factors for prediction of 90-day and one-year mortality. These factors include: reduction of regular daily activities, mini-mental test score more than 20 and score on the geriatric depressive scale greater than 7\(^25\). Later, Walter and colleagues pointed out six independent risk factors that can predict one-year mortality of geriatric patients. These are: male gender, number of usual daily activities that cannot be done without the help of another person, congestive heart failure, cancer, serum creatinine >3.0 mg /dl and decrease of serum albumin\(^26\).
TABLE 2
LEE’S REVISED CARDIAL RISK INDEX. COMPLICATIONS INCLUDING: MYOCARDIAL INFARCTION, PULMONARY EMBOLISM, VENTRICULAR FIBRILATION, CARDIAC ARREST AND COMPLETE HEART BLOCK

Criteria

Points

High Risk Surgery 1 Point
Coronary Artery Disease 1 Point
Congestive Heart Failure 1 Point
Cerebrovascular disease 1 Point
Diabetes Mellitus on Insulin 1 Point
Serum Creatinine >2 mg/dl 1 Point

1. Emergency surgery
2. Cardiac procedures
3. Aortic or other major vascular procedures
4. Peripheral vaskular procedures
5. Prolonged surgery anticipated > 2 hours, anticipated large fluid shift or blood loss

Scoring & Interpretation

Points 0: Class I Very Low (0.4% complications)

Points 1: Class II Low (0.9% complications)

Points 2: Class III Moderate (6.6% complications)

Points 3: Class IV High (>11% complications)
PREOPERATIVE OPTIMIZATION OF ELDERLY PATIENT

Optimization of respiratory function

With age the functional reserve of the respiratory system progressively decreases. Deficiency of conditioning function of the respiratory system must be taken into consideration when optimizing the patient’s general condition immediately before surgery. In smokers, it is recommended to stop smoking, but only if you stop smoking for at least two weeks before surgery. In geriatric patients who are preparing for surgery, and who suffer from chronic obstructive lung disease, it is necessary to apply adequate preoperative antibiotic prophylaxis and bronchodilatory therapy including preoperative corticosteroids and amniphylline. In order to prevent early postoperative respiratory complications, it is necessary preoperatively to stimulate and educate older patients about the necessity of breathing and coughing, and obese patients encouraged in the direction of optimal weight loss.

Nutritional supplements

The data shows that elderly people are generally underweight. Older people, indeed, sometimes seem slow and overweight, mainly because of the increase of adipose tissue during aging, but in spite of this physical appearance, the majority of older people is undernourished or even malnourished. Of course, malnutrition is an additional problem for successful perioperative management of geriatric patients, so preoperative optimization of nutritional status in geriatric patients can result in clinical benefit. If it is not contraindicated, enteral nutrition is recommended for the elderly, due to the fact that the morphological integrity and function of the gastrointestinal tract, is not significantly changed with aging. Slow enteral supplementation has advantages compared to parenteral nutrition, because the tolerance of the intake of sugar and liquid is reduced in older people. The data shows that very underweight elderly people can have the greatest benefit from preoperative nutritional support, and that the ideal period for optimization is two weeks.

Preoperative cardiovascular support

The loss of elasticity of the heart and blood vessels primarily in the aorta leads to ventricular hypertrophy. Morphologically, the aging of the heart muscle leads to proliferation of connective tissue and fat accumulation instead of autonomous and muscle tissues, leading to atrial arrhythmias, sick sinus syndrome, and atriorentricular block. On the other hand, reduced β-adrenergic response prevents reflex acceleration of heart rate as a compensatory response to the decrease in cardiac output and volume depletion, which is otherwise uncommon in the elderly. Taking into account the overall cardiac risk in geriatric patients, sometimes it is reasonable to delay the surgical procedure, due to additional angiographic examination, stent or a pacemaker implantation, and even to do cardiac surgical procedures. Preoperative optimization of cardiovascular system is necessary in patients of younger age, and especially in older patients. For patients with reduced coronary reserve it is necessary to include coronary vasodilators. Correction of heart failure, and preoperative arterial hypertension: using beta blockers, ACE inhibitors, diuretics and other medicaments is absolutely wanted and indicated. There is strong evidence that preoperative use of beta blockers reduces the incidence of postoperative cardiovascular complications. Patients should be referred to and encouraged to take their antihypertensive treatment without interruption until the morning before surgery. Patients with valvular damage require antibiotic prophylaxis of bacterial endocarditis. Patients with a stent require adequate antiplatelet and anticoagulant prophylaxis. If oral intake of these medications during the perioperative course is not possible, it is time to begin alternative parenteral therapy.

PREOPERATIVE PHARMACOLOGICAL SUPPORT

There is no justification to recommend interruption of a patient previously prescribed therapy unless the application of a medication may adversely affect the overall perioperative outcome. The geriatric patient is not an exception to this rule. But there are some specifics in the way of taking certain drugs in the immediate postoperative period. For example, if it is not necessary, patients should be advised to stop taking anticholinergic medicaments, since they precipitate in the elderly and may lead to the occurrence of psychomotor agitation and delirium in the postoperative period. They should avoid abrupt cessation of taking sedatives, because sudden stoppage of benzodiazepines can lead to a withdrawal syndrome. Aspirin and clopidogrel significantly prolong bleeding time and their suspension or continuation of therapy should be decided in each case separately taking into account the relationship between the risk of perioperative bleeding and therapeutic benefits.

POSTOPERATIVE COGNITIVE DEFICITS

Postoperative cognitive dysfunction (POCD) is usually defined as a deterioration of memory and concentration in the period after surgery and may be detected by neuropsychological tests (Mini mental test score). Until recently, this phenomenon is often related to the phenomenon of Cardiac Surgery and cardiopulmonary by-pass, but research in recent decades has directed attention to the elderly as a single most influential factor for the development POCD. The risk for prolonged postoperative cognitive deficit is about 10% in people older than 60 years, but the possibility of serious cognitive deficits can multiply in a very old person. It is expected that the POCD will occur in every third patient aged 80 years undergoing major surgery. Since the age is the most significant predictor of prolonged POCD, it is necessary for preoperative evaluation of the risk/benefit to take into account the possibility of POCD that can dramatically reduce the quality of life of elderly patients despite a successful surgical procedure. It is therefore preferably to test preoperative cognitive fu-
tion of older patients as a specific method of screening for the development POCD. Thus preoperative Mini-Mental score <28 double increase the risk of POCD compared to values 29-30. In the light of these facts, it is necessary to assess whether older patients should undergo an operation (if the indications are not absolute), if they will be disabled after the surgery and not able to take care of themselves.

CONCLUSION

The number of elderly patients who are undergoing surgery for various reasons is growing from year to year. Aging reduces the organic functional reserve and comorbidity significantly increases. Adequate preoperative assessment of geriatric patients is crucial for a successful postoperative process. In this sense, during the preoperative preparation it is necessary to determine the presence of coexisting diseases and other risk factors, and then take all actions to optimize the patient’s general condition. The modern concept in the surgical treatment of geriatric patients is "no one is too old for surgery intervention" and the successful outcome of surgical intervention may be achieved in older patients taking into account all the specifics of the aging process and its implications on perioperative course.

SUMMARY

PREOPERATIVNA PRIPREMA GERIJATRIJSKIH BOLESNIKA

Postoji stalan porast broja bolesnika starijeg životnog doba koji se podvrgavaju hirurškim intervencijama. U članaku je prikazano nekoliko odabranih aspekata vezanih za preoperativnu pripremu bolesnika starijeg životnog doba: organska disfunkcija u vezi sa starenjem, procena perioperativnog rizika gerijatrijskih bolesnika, preoperativna optimizacija i farmakološka podrška kod starijih bolesnika. Takođe, budući da je starije životno doba značajan faktor rizika za razvoj postoperativnih kognitivnih deficita, u članaku je razmatran i ovaj problem.

Ključne reči: gerijatrijski bolesnici, hirurške intervencije, procena perioperativnog rizika, postoperativna kognitivna disfunkcija

REFERENCES


