Perioperative Assessment and Management in The Elderly

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ABSTRACT

Around half of people aged 65 years and above will undergo surgery due to various indications. Several common types of surgery in the elderly are cataract extraction, joint replacement, cholecystectomy, and revascularization procedures. Elderly patients planned for surgery are at risk of having substandard or even terrible outcome due to decreased ability to maintain or recover physiologic homeostasis during surgery. Thorough preoperative assessment is important for the elderly. Preoperative assessment should be stressed on identification of risk factors or bad predictors after the surgery. Common comorbidities in the elderly need comprehensive assessment. Special attention should be given for postoperative management in the elderly. The elderly might need longer time to recover compared to young patients, and management programs might be needed such as sub acute management, rehabilitation unit, or home-care treatment. In general the postoperative treatment consists of the use of analgesic agents, early mobilization, proper use of urine catheter, prevention and management of delirium, and use of anticoagulants.

Key words: preoperative, postoperative, elderly.

INTRODUCTION

Along with the increased life expectancy, more and more elderly people undergo surgery due to various indications. About one-third of all patients undergoing surgery is above 65 years of age. Several common types of surgery in the elderly are cataract extraction, joint replacement, cholecystectomy, and revascularization procedures.

Elderly patients planned for surgery are at risk of having substandard or even terrible outcome due to decreased ability to maintain or recover physiologic homeostasis during surgery. Furthermore, this condition will be complicated by various comorbidities such as heart disease, lung disease, diabetes mellitus, etc.

Age alone is not a good predictor for risks in surgery, and should not be the only criteria to determine which patients are eligible for surgery. Even those above 75 years old with only a few comorbidities have minimum risk of complication. Risks of surgery are mainly associated with the volume and severity of comorbid diseases. Although the functional residual capacity of each organ is decreased in the elderly along with the aging process, the more significant factor that could reduce homeostasis response is the disease process in the elderly, either acute or chronic.

Preoperative risk assessment is focused on detailed review from anamnesis and physical examination. This should also include assessment of consumed drugs, physical function, cognitive function, competency, availability of social support, and signs of depression.

An internist treating elderly patients in perioperative period has several responsibilities. First, internists are often asked by fellow surgeons to identify and to modify risk factors that might be a predisposing factor for later complication. Second, in order to reduce risk of complications they should provide optimal management for all acute and chronic medical problems throughout perioperative period. Third, whenever possible, a physician should initiate and maintain preventive strategies to minimize risk of certain complications. Last but not least, an internist should be able to understand patient’s will in serious situations and conditions. Discussions about personal values and expectations, choice of intervention, and decision making should be done within a patient-oriented comprehensive management frame plan. The planned surgical procedure should first be discussed with patient and the family, in order to obtain clear comprehension on risks and benefits of the surgery, and also to avoid the possibility of dissimilar hopes or expectations on the upcoming surgery. Other thing that should be communicated is the recovery period that might be longer compared to young patients, and management programs that might be needed such as sub acute management, rehabilitation unit, or home-care treatment. Increased physical activity and rehabilitation during postoperative recovery period could improve functional
self-activity, shorten the recovery period, and prevent re-hospitalization.

**PREOPERATIVE ASSESSMENT AND MANAGEMENT**

When performing preoperative assessment in the elderly, it is important to place the cardiovascular and respiratory function in patient’s context as a whole. The patient might experience mild cognitive disturbance which affects their memory, they give slower response, so that it might take longer time to complete the anamnesis. Clinical signs of disease might be widely different compared to young patients. Conditions such as hyperthyroidism or hypothyroidism are difficult to diagnose in the elderly. Assessment should be performed several days before surgery, so further evaluation could be done whenever needed. Interdisciplinary assessment by an interdisciplinary team will provide quite a good perioperative result and patient could be discharged.

Preoperative assessment should be aimed at identification of risk factors or bad predictors after the surgery. Common comorbidities in the elderly need comprehensive assessment.

**Cardiovascular System**

History of cardiac disease such as coronary artery disease and congestive heart failure needs to be identified. Acute myocardial infarction within the last 6 months, active congestive heart failure, heart arrhythmia, and unstable angina are important risk factors of postoperative heart complication. Hypertension is one of the most common chronic diseases affecting the cardiovascular system. Perioperative complications due to hypertension are stroke and myocardial infarction associated with significant increase in blood pressure, and also blood pressure fluctuations. Whenever the clinical situation is possible, severe hypertension should be controlled before the patients undergo surgery. When the preoperative diastolic pressure was over 110 mmHg, the operation should be postponed. Blood pressure should be lowered gradually within several weeks using antihypertensive drugs, although the decision should be made with careful consideration on the benefit and the urgency of surgical procedure. Continuity of antihypertensive therapy from preoperative to perioperative period is essential, especially for clonidine and beta-adrenergic inhibitors.

Coronary artery disease is often found in elderly population, therefore careful screening should be performed in elderly patients for signs and symptoms of the disease, both mild and severe. Increased age-associated vascular and left ventricular rigidity are causes of higher sensitivity to changes in volume. Decreased cardiac electric conduction associated with age places elderly patients at higher risk for the incidence of drug-associated bradycardia or high-grade atrioventricular (AV) block, while history of myocardial infarct or low ejection fraction are associated with higher risk of ventricular tachycardia.

Electrocardiogram will be able to identify patients with left ventricular hypertrophy or ST segment depression. Patients with these kinds of ECG pattern, require ECG assessment during exercise, according to the type of planned surgery. Coronary angiography might be essential in patients with resting angina or unstable angina, and preoperative revascularization might be needed. Clinically detected cardiac murmur and presence of congestive heart failure need to be further evaluated using echocardiogram. The arrhythmia detected while resting or during physical exercise should be treated before surgery. If sinus rhythm could not be achieved, control of heart rate with antiagulant could be accepted. Temporary or permanent pacemaker is needed in type II or III heart block.

Indications for cardiac valve evaluation and treatment are similar with the non-surgical condition. Symptomatic aortic or mitral stenosis is associated with significant perioperative risk, severe congestive heart failure, or shock, so percutaneous valvotomy or valve surgery should be considered before the surgery is performed, while symptomatic aortic or mitral regurgitation usually causes low risk during surgery when medically treated and intensively controlled. Operative procedures on the mouth, intestine, urinary tract, biliary tract, and lungs could cause bacteremia and increase the risk of endocarditis when there is significant cardiac valve disease, therefore preoperative prophylaxis is required.

When there are no contraindications, beta adrenergic blocker agent (preferably short-acting agent) is recommended during perioperative period in all patients with high risk for acute coronary syndrome scheduled for noncardiac surgery with target resting heart rate of 60/x/minute or lower.

Heart complication due to non-cardiac surgery is very serious. A number of risk indicators have been developed for years to predict patients with risk of heart complications. As shown in Table 1, clinical predictors have been developed by the American College of Cardiology (ACC) and American Heart Association (ACC), grouped as minor, intermediate, and major predictors. Old age is categorized as minor clinical predictor, showing that risk of surgery in the elderly is increased not exclusively due to the age itself, but due to medical problems experienced by the elderly.
keeping patient in supine position for several hours. When combined with abdominal incision, this factor will cause the functional residual capacity to decrease and the airway resistance to increase. Aging and surgical procedure affect the respiratory system through hypoventilation, retention of respiratory tract secretion, hypoxemia, and lung infection. Some factors consistently related to increased risk of post-operative complications are type of incision (abdominal or thoracic), elderly group, functional status, altered cognitive function, and history of smoking. 

When performing assessment, history of lung disease such as chronic obstructive lung disease or asthma, history of smoking, and long-term use of steroid, needs to be identified. Risk factors of postoperative pneumonia are altered consciousness, cerebrovascular accident (CVA), alcohol consumption, and elective surgery. Upper abdominal and intrathoracic surgeries bring higher surgical risk.

Age alone is not an absolute indication for lung function test. Patients planned to undergo lung resection always have to perform lung function test to determine whether the remaining lung was still adequate. Procedures involving upper abdominal or thoracic incision alter respiratory function. Patients being prepared for these procedures might have to undergo lung function test, especially when they are having cough, COPD, are smoking, dyspnea, or other lung diseases. On the other hand, both orthopedic and lower abdominal procedures do not or only give minimum lung risks so that lung function test is not indicated.

When the risk for surgery is low or intermediate, as shown in Table 3, patient may proceed to the operating room. It is recommended to postpone non-cardiac surgery in the following conditions:
1. Elderly patients with poor functional capacity planned to undergo high risk surgery.
2. Patients with intermediate clinical predictors planned to undergo high risk surgery
3. Patients with major clinical predictors

### Respiratory System

Respiratory complication is more commonly found compared to cardiovascular complication in elderly patients undergoing surgery. There are important changes associated with age in the respiratory system. Some examples are decreased alveolar elasticity and increased chest wall rigidity, which are predisposing factors for atelectasis and decreased expiratory flow. Many surgical procedures involve general anesthesia and

| Table 1. Clinical Predictors of Increased Perioperative Cardiac Risk for Non-cardiac Surgery |
|---------------------------------|---------------------------------|---------------------------------|
| Minor Predictors | Intermediate Predictors | Major Predictors |
| Advanced age | Mild Angina pectoris | Unstable coronary syndrome |
| Abnormal ECG | Prior myocardial infarction | Significant dysrhythmia |
| Rhythm other than sinus | Compensated or prior heart failure | Decompensated heart failure |
| Low functional capacity | Diabetes Mellitus | Severe valvular disease |
| History of stroke | Renal insufficiency |

| Table 2. Examples of Activities to Help Stratify Patients According to their Functional Capacity |
|---------------------------------|---------------------------------|---------------------------------|
| Poor Functional Capacity (Maximum Energy Expenditure ≤ 4 METs) | Moderate/Excellent Functional Capacity (Maximum Energy Expenditure > 4 METs) |
| - Eating, dressing, using the toilet | - Climbing a flight of stairs or walking up a hill |
| - Walking indoors around the house | - Running a short distance |
| - Walking a block or two on ground level | - Scrubbing floors or moving furniture |
| - Doing light housework - dusting, washing dishes | - Playing golf, bowling, dancing |
| | - Swimming, singles tennis, skating |

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| Table 3. Risk of Cardiac Complications Associated with Specific Non-cardiac Surgeries |
|---------------------------------|---------------------------------|---------------------------------|
| High Risk (>5%) | Intermediate Risk (<5%) | Low Risk (<1%) |
| - Emergent major surgeries | - Carotid endarterectomy | - Endoscopic procedures |
| - Aortic and other major vascular surgery | - Head and neck surgery | - Superficial procedures |
| - Peripheral vascular surgery | - Intraperitoneal and intrathoracic surgery | - Cataract surgery |
| - Prolonged procedures with large fluid shifts and/or blood loss | - Orthopedic surgery | - Breast surgery |
| | - Prostate surgery |

Patients with minor or intermediate clinical predictors will then be assessed for functional status as shown in Table 2. Patients with moderate or excellent functional capacity are allowed to undergo surgery.
(pneumonia, lung edema, or lung emboli), especially after abdominal or cardiothoracic procedures. Postoperative pneumonia in the elderly is associated with 15-20% mortality rate and should be treated with aggressive respiratory therapy and the right antibiotics.

Heart and lung examination could detect active heart failure or heart murmur, especially aortic stenosis, the most common valve problem in the elderly. Presence of S3 heart sound, increased jugular venous pressure, bradycardia, tachycardia, ectopic beats, are markers of potential risk factors. Examination of lower extremities might reveal abnormal peripheral pulse or presence of edema might indicate heart and circulation problems. Weakened breath sounds might indicate COPD, while ronchi and bronchial spasm might indicate presence of pulmonary disease or heart failure.

Some parameters below could be used as significant predictors of respiratory complication:5

- **PCO₂ > 45 mmHg**
- **FEV₁ < 2 liters (especially < 1 liter)**
- **Predicted maximum ventilation volume < 50%**

Further examination should be done to find diseases or problems that could not be found through anamnesis and physical examination or to confirm suspected diagnosis from the anamnesis and physical examination. Among the routine laboratory examinations are:

- Fasting blood glucose level (looking for diabetes mellitus)
- Complete peripheral blood count (presence of infection or anemia)
- Electrolyte (indicates risk of arrhythmia)
- Creatinine (used to calculate creatinine clearance to look for renal disorders)
- Thorax X-ray (screening for lung disease)
- ECG (detection of ischemia or arrhythmia)

Presence of thromboembolic problems such as deep vein thrombosis in the medical history, both in upper or lower extremities, or lung embolism are risk factors of postoperative thromboemboli incidence. This complications could occur in orthopedic knee, hip, and femoral surgery, or intraabdominal oncology procedures. Elderly patients undergoing orthopedic hip or knee replacement surgery and also urologic and gynecologic procedures, are at higher risk of postoperative deep vein thrombosis. For patients with low to intermediate surgical risk, low dosage of subcutaneous heparin or external pneumatic compression could be given right after surgery, so that the patient could be discharged. For high risk procedures, administration of low-molecular weight heparin or warfarin should be considered to avoid postoperative deep vein thrombosis.

In patients consuming long term warfarin with target INR 2-3, the dosage schedule should be postponed to return INR back to normal value less than 1.5 before the surgery. If the target INR was previously maintained to be above 3, then warfarin needs to be discontinued for longer period of time. INR should be measured one day before the surgery to ensure that the INR value has reached the acceptable range. When the INR value is still to high (>1.8), low dose subcutaneous vitamin K (1 mg) could be administered. If the INR value is less than 2, administration of other antithrombotic prophylaxis agent needs to be considered. Elective surgery should be postponed for 1 month after the incidence of deep vein thrombosis. If this is not possible, intravenous heparin should be administered before and after the surgical procedure when INR is less than 2. Administration of intravenous heparin should be discontinued 6 hours before the surgery, and could be re-administered not less than 12 hours after the surgery, depends on the type of surgical procedure and the outcome. Patients with DVT receiving warfarin for 2-3 months do not need to receive heparin before the surgery, except when there are other risks. Heparin should be administered postoperatively until the INR is above 2. This recommendation should also be combined with mechanical prophylaxis (gradient compression stockings intermittent pneumatic compression). Elective surgery should be avoided within 1 month after incidence of arterial embolism.

**Kidney and Metabolism**

The kidneys play a part in drug metabolism, fluid and electrolyte balance. Therefore it is extremely important to assess renal and metabolic function preoperatively, so that the condition could be maintained during perioperative period. The reduced number of glomerulus and renal blood flow as the age advances contributes in decreased creatinine clearance. Since muscle mass also decreases along with age, serum creatinine concentration might remain normal and could not be used to estimate renal function. Therefore creatinine clearance needs to be calculated using Cockcroft-gault formula:6

\[
Ccr (\text{ml/minute}) = \left\{ \frac{[140-\text{age}] \times \text{BW}}{72 \times \text{serum creatinine level}} \right\}
\]

(This formula is for men, in women the result is multiplied by 0.85)

Using this equation, dosage of drugs metabolized in the kidney need to be adjusted.

Management strategies have also been developed to optimize perioperative blood glucose control.7 In well-controlled diabetic patients, there is no particular
recommended intervention before the patients undergo surgery. Blood glucose is monitored perioperatively, and hyperglycemia is treated using short-acting insulin. Serious complications in diabetic patients are mainly due to hypoglycemia; therefore, the aim of perioperative diabetic control is to maintain blood glucose concentration between 150 and 200 mg/dL. Glucose infusion is recommended at 5 grams of glucose/hour. Patients consuming oral hypoglycemic agents should not take the drug on the day of surgery, and hyperglycemia could be corrected using short-acting insulin until the patient could consume the oral agents. For patients using once-daily insulin injection, the dose of insulin in the morning before surgery depends on the time of surgery.

Neuropsychiatry

Neuropsychiatric assessment is done to determine whether there are cognitive disorder, depression, Parkinson’s disease, or focal weakness. Presence of cognitive disorder will increase the risk of perioperative delirium and longer hospital stay in the elderly. Intravascular volume status should be optimized preoperatively.

Medications

Thorough assessment on consumed medications by an elderly should be done before the surgery. Aspirin, clopidogrel, nonsteroids, and other antiplatelet drugs increase the risk of perioperative bleeding, and if not necessary should be discontinued for 7-10 days. Drugs with anticholinergic effects should also be discontinued, because they can increase the risk of perioperative delirium. The use of chronic benzodiazepine agents should be taken into account, and should be tapered off to minimize the risk of withdrawal effect when the patient should fast during perioperative period. When it is not essential to manage excessive fluid volume or symptoms of lung edema in patients with congestive heart failure, discontinuation of diuretic agents for 24-48 hours before the surgery should be considered. Patients consuming antiepileptic, cardiovascular, and antihypertensive agents usually have to take the drugs in the morning before the surgery using as little water as possible. An abrupt discontinuation of beta adrenergic inhibitors and clonidine is associated with significant cardiovascular complication. Oral hypoglycemic agents usually should not be taken the night before surgery to minimize the risk of perioperative hypoglycemia. Diabetic patients receiving intermediate-acting insulin therapy usually receive half their regular dosage in the morning before the surgery, and intravenous 5% dextrose is given. Plasma glucose level above 250 mg/dL after the surgery could be managed with subcutaneous insulin, or if the patient is in unstable hemodynamic state (could cause altered absorption of subcutaneous insulin) short-acting insulin infusion is given. Adrenal suppression due to chronic use of steroid should be treated with steroid, usually 100 mg of hydrocortisone every 6 hours, starting from the night before the surgery and then the dose is reduced until it reaches maintenance dose in 3-5 days in relation to the postoperative condition.

Functional Status

Preoperative assessment requires the history of illness (anamnesis) together with the assessment of functional status. Whenever needed, ask the patient to walk and climb the stairs during preoperative assessment, so that the physiological status could be measured before surgery. It is also recommended to stop smoking at least 8 weeks before the surgery. Chest physiotherapy 24 hours before surgery provides physical benefit and could facilitate instruction to be able to breathe deeply and cough after the surgery. Patients with active lung infection should be postponed for surgery and should first receive medical treatment.

Evaluation of functional status determines the status and ability of patient to mobilize and to do daily activities by him/herself. Musculoskeletal problems due to arthritis, Parkinson’s disease, or stroke might be associated with mobility problems, reduced functional status, and other factors delaying the recovery.

Nutritional status needs to be evaluated to reveal eating and swallowing problems, gastrointestinal disorders, and involuntary loss of weight. Body mass index of 22 kg/m2 or less is an indication of inadequate nutritional status and might require further monitoring. Degree of frailty and deconditioning when the patient enters the examination room should also be observed.

It is suggested to prepare physical condition, such as daily walking for 2-3 weeks before elective surgery and followed by early ambulation after the surgery. Patients with severe lung disease or poor physical condition should be made familiar with the proper use of spirometry before the surgery, in order to minimize risks of lung atelectasis and its complications. Giving up smoking at least 8 weeks before the surgery might give some benefit.

Acute delirium syndrome is found in 10-15% of elderly patients undergoing general surgery, 30% of cardiac surgery, and up to 50% of hip fracture repair surgery. Presence of dementia, extremely advanced age, and history of previous deterioration in cognitive function are risk factors of perioperative delirium.
Preoperative Index to Predict Postoperative Complication

Cardiac risk index (CRI) from Goldman is a predictor of heart outcome after the surgery. Nine independent factors assessing the degree of hemodynamic stress in vital organ systems and cardiac risks include:

- Third heart sound 11
- Increased jugular venous pressure 11
- Myocardial infarct within the last 6 months 10
- ECG shows more than 5 PVC (premature ventricular contracture) 7
- ECG- PAC (premature atrial contraction) or rhythm other than sinus 7
- Age above 70 years old 5
- Emergency procedure 4
- Intrathoracic, intraabdominal, or aortic surgery 3
- Poor general condition, metabolic condition, or long-term bed rest 3

Table 4. The Nine Factors Above are used to Classify a Patient Into 4 Risk Categories

<table>
<thead>
<tr>
<th>Class</th>
<th>Point</th>
<th>Life-threatening complication (%)</th>
<th>Death (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>0-5</td>
<td>0.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Class II</td>
<td>6-12</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Class III</td>
<td>13-25</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Class IV</td>
<td>&gt; 26</td>
<td>22</td>
<td>56</td>
</tr>
</tbody>
</table>

An elderly patient over 70 years of age undergoing intraabdominal, intrathoracic, or aortic procedure, and has the first 5 factors will have the total point of 13, and this condition places him in the highest risk category.

POSTOPERATIVE MANAGEMENT FOR SPECIFIC MEDICAL CONDITION

In general, the postoperative management includes the use of medications to reduce pain, to increase mobility, the use of right urine catheter, prevention and treatment of delirium, and the use of anticoagulants.

Cardiovascular Problem

During postoperative period there should be close observation on the presence of myocardial ischemia, infarction, arrhythmia, and deep vein thrombosis. Anginal pain might be masked by the use of narcotic agents or difficult to be expressed by the patient during recovery period. Changes of ST segment in the ECG after the surgery could lead to myocardial ischemia. When there is no previous history of coronary artery disease, observation is limited in patients who show signs or symptoms of cardiovascular dysfunction, while ECG should be performed in patients undergoing high or intermediate risk surgery before and immediately after the procedure, and daily for 2 first days afterwards.

When blood pressure increases after the surgery, non-cardiovascular causes need to be evaluated, such as pain or full bladder. If the high blood pressure is associated with essential hypertension, some medications could be used, such as beta-blocker, calcium channel blocker, ACE inhibitor, and drugs that could inhibit the alpha and beta receptors.

Postoperative arrhythmia is often caused by correctable non-cardiac problems, such as infection, hypotension, metabolic disturbance (hypokalemia, hypomagnesemia), and hypoxia. The use of arrhythmie prophylactic agents other than beta adrenergic inhibitor has not been established. Heart arrhythmia is often found and may trigger myocardial ischemia and heart failure. Elderly patients are at risk of having postoperative supraventricular tachycardia, especially with the history of supraventricular dysrhythmia, asthma, heart failure, before the surgery. In this condition, efforts should be made to return the rhythm to normal sinus by administration of adenosine infusion, beta-blocker, or calcium channel blocker agents.

Postoperative heart failure could be triggered by excessive fluid administration, heart ischemia, or newly found rhythm disorder. Therefore optimum ventricular filling pressure should be guaranteed, based on clinical assessment of patient’s volume status through physical examination and standard laboratory workup.

Special care should be placed to the first 3 days after surgery, when myocardial infarct is most likely to occur. Notice that ischemia in this age group might not show any symptoms (silent), and might not be associated with the occurrence of Q wave in the ECG.

Oxygen supplementation and chest physiotherapy should be continued postoperatively until at least 5 days after the surgery, since this period of time has the highest possibility for nocturnal hypoxia and the onset of pneumonia. When there are no contraindications, start mobilization as early as possible, range of motion exercise for the joints, etc.

Lung Problems and Thromboembolism

Early mobilization, deep breathing exercise is an important factor that should be done to minimize the risk of postoperative atelectasis and pneumonia. Vein thrombosis and lung emboli are serious complications in elderly patients undergoing surgery. Because these two conditions are associated with significant morbidity, prophylaxis becomes really important. Prophylaxis could
be given as low-dose of unfractionated heparin (UFH), low molecular weight heparin (LMWH), or intermittent pneumatic compression device. Elderly patients undergoing femoral fracture or knee replacement surgery could be treated with LMWH or adjusted-dose warfarin (target INR 2.5, range 2-3). Dose adjustment should be done for LMWH when the renal function is predicted to be compromised below 30 mL/minute. Prophylactic therapy is given for 4-6 weeks after hip or knee replacement.

Renal Failure
Postoperative renal failure is a serious complication associated with high mortality. Preoperative disturbance in renal function is often found in elderly and is an important risk factor of the occurrence of renal failure. Kidney is an organ that is prone to be damaged when there is decreased cardiac output, and also toxic effects of anesthetic drugs or other drugs metabolized by the kidney. Early onsets of acute renal failure are oliguria, isostenuria, and elevated serum creatinine.

Evaluation should be made on acute renal failure, whether it is due to disturbance in renal blood flow or due to acute tubular necrosis. In renal failure caused by renal blood flow disturbance, urine sodium level is usually lower than 40 mEq/L and ratio between urine and serum creatinine level is above 10. This condition should be managed by optimizing intravascular volume and cardiac output. On the other hand, when the cause of acute renal failure is acute tubular necrosis, urine examination will reveal granular or epithelial cells, urine sodium concentration above 40 mE/L, ratio between urine and plasma creatinine level below 10. In such condition, identification and elimination of nephrotoxic agents, and also maintenance of euvolemic body fluid, is essential. In a male elderly, obstructive nephropathy could be the cause of acute renal failure. Bed rest, prostate hypertrophy, and anticholinergic agents could trigger urine retention and acute renal failure. In such condition, urine catheter should be attached, followed by monitoring of fluid balance. Note that attachment of urine catheter could be a predisposing factor for urinary tract infection along with its complications. Therefore, the catheter should only be used for a short period of time, and should be detached in the following morning after surgery. Use of urine catheter for more than 48 hours should be avoided, except if urine retention could not be treated with other methods.

Fluid and Nutrition Management
Adequate hydration in the elderly could be disturbed due to decreased thirst sensation and decreased renal ability to produce concentrated urine. This ability to maintain volume homeostasis is further compromised during perioperative period due to hormonal response to the trauma of tissue damage. Antidiuretic hormone released during stress will cause fluid retention, a condition that needs attention when giving intravenous fluid postoperatively in order to avoid fluid excess.

Delirium and Decreased Cognitive Function
Decreased cognitive function has been reported postoperatively in various surgical procedures. A study found that 26% of patients above 60 years of age who underwent intraabdominal or orthopedic surgery showed significant decrease in cognitive function, 1 week after the surgery. Risk factors of decreased cognitive function are older age, use of higher dose of anesthetic agent, and infection and respiratory complications postoperatively. Decreased cognitive function could also be found due to brain infarction after cardiac surgery. Two symptoms most commonly found are delirium and decreased postoperative cognitive function.

Pain in the elderly is often not properly treated. Patient should be regularly asked for the severity of pain using analog scale (such as visual analog scale) and analgetic drugs should be given routinely, not only when needed.

Early postoperative mobilization is essential to reduce the risk of complication. When early mobilization is not possible during the recovery process, range of motion exercise could be done, and also by keeping straight posture.
REFERENCES