NURSING CARE GUIDELINES
IN PERCUTANEOUS CORONARY AND VALVULAR INTERVENTIONS
## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>Activated Clotting Time</td>
</tr>
<tr>
<td>ADP</td>
<td>Adenosine Diphosphate</td>
</tr>
<tr>
<td>AMP</td>
<td>Adenosine Monophosphate</td>
</tr>
<tr>
<td>aPTT</td>
<td>Activated Partial Thromboplastin Time</td>
</tr>
<tr>
<td>ASA</td>
<td>Acetylsalicylic Acid</td>
</tr>
<tr>
<td>BP</td>
<td>Blood Pressure</td>
</tr>
<tr>
<td>BUN</td>
<td>Blood Urea Nitrogen</td>
</tr>
<tr>
<td>CABG</td>
<td>Coronary Artery Bypass Grafting</td>
</tr>
<tr>
<td>CAD</td>
<td>Coronary Artery Disease</td>
</tr>
<tr>
<td>CK-MB</td>
<td>Creatinine Kinase-Myocardial Band</td>
</tr>
<tr>
<td>cTnI</td>
<td>Cardiac Troponin I</td>
</tr>
<tr>
<td>cTnT</td>
<td>Cardiac Troponin T</td>
</tr>
<tr>
<td>CVP</td>
<td>Central Venous Pressure</td>
</tr>
<tr>
<td>DM</td>
<td>Diabetes Mellitus</td>
</tr>
<tr>
<td>DOPPLER USG</td>
<td>Doppler Ultrasound</td>
</tr>
<tr>
<td>ECG</td>
<td>Electrocardiogram</td>
</tr>
<tr>
<td>GP IIb/IIIa</td>
<td>Glycoprotein IIb/IIIa</td>
</tr>
<tr>
<td>h</td>
<td>Hour</td>
</tr>
<tr>
<td>Hb</td>
<td>Hemoglobin</td>
</tr>
<tr>
<td>Htc</td>
<td>Hematocrites</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenous</td>
</tr>
<tr>
<td>L</td>
<td>Liter</td>
</tr>
<tr>
<td>LMWH</td>
<td>Low Molecular Weight Heparin</td>
</tr>
<tr>
<td>MAP</td>
<td>Mean Arterial Pressure</td>
</tr>
<tr>
<td>mg</td>
<td>Milligram</td>
</tr>
<tr>
<td>MI</td>
<td>Myocardial Infarction</td>
</tr>
<tr>
<td>min</td>
<td>Minute</td>
</tr>
<tr>
<td>ml</td>
<td>Milliliter</td>
</tr>
<tr>
<td>O₂</td>
<td>Oxygen</td>
</tr>
<tr>
<td>PCWP</td>
<td>Pulmonary Capillary Wedge Pressure</td>
</tr>
<tr>
<td>PTCA</td>
<td>Percutaneous Transluminal Coronary Angioplasty</td>
</tr>
<tr>
<td>PVI</td>
<td>Percutaneous Valvular Intervention</td>
</tr>
<tr>
<td>SaO₂</td>
<td>Oxygen Saturation</td>
</tr>
<tr>
<td>TxA₂</td>
<td>Thromboxane A₂</td>
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My Dear Colleagues,

Despite the passage of a very short time since the foundation of TSC the Cardiovascular Nursing and Technicianship Group has spared no effort to publish “Nursing Care Guidelines in Cardiac Failure, Acute Coronary Syndromes and Hypertension” in 2003 and “Nursing Care Guidelines in Percutaneous Coronary and Vascular Interventions” in 2004. These two publications have been well-received and distributed to all of our members. As the stocks have run out it has been necessary to republish the present new editions for the benefit of our new members and especially the nurses and the technicians. In this context I am happy to announce that our study group is working on a new guideline publication.

I do believe that the representation of these guidelines prepared with great diligence by nurses and specialist cardiologists will be of great use to our members. I would like hereby to reiterate my thanks to all of our contributing members.

I would like to take this opportunity to emphasize that the educational programs started by the Cardiovascular Nursing and Technicianship Group, their participation in other activities of TSC as well as making their presence felt in the European Cardiology Association has been recognised with great appreciation. Our association will continue to give them all the possible support.

Looking forward to many more successful cooperations and with best regards,

Prof. Dr. Çetin Erol
TSC President
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INTRODUCTION

Coronary heart diseases constitute the most important health problem affecting people of productive age.\(^1\)\(^{1-3}\)

Mortality due to cardiovascular diseases is one of the leading causes of death, in spite of all the preventive and therapeutic improvements and new methods developed in this field.\(^4\) Since cardiovascular diseases continue to be the most important cause of mortality and morbidity, there is intense research on this subject and different treatment methods are being developed. Therefore increasing number of patients are undergoing diagnostic and therapeutic interventions in the invasive cardiology laboratory.\(^1\)\(^{1-3}\) Therapeutic percutaneous coronary artery interventions (non-surgical, done via skin route) have been performed since 1980s in the world and since 1986-87 in our country with an increasing rate since 1995.\(^5\)

1. PERCUTANEOUS CORONARY INTERVENTIONS

1.1. Percutaneous Transluminal Coronary Angioplasty (PTCA): PTCA is an invasive procedure used to eliminate stenosis in the coronary arteries by insertion a catheter through the skin and moving forward through the veins. At the last stage, a balloon catheter is inserted in the coronary arterial lesion and the balloon is inflated at the level of occlusion to open the lumen.\(^3\)\(^{6-13}\)

1.2. Percutaneous Coronary Atherectomy: Atherectomy tools provide alleviation in symptomatic patients with coronary artery disease (CAD) by two primary mechanisms;\(^1\) Decreasing the stenosis and increasing the distensibility (compliance) of the artery by partial removal of the atherosclerotic plaque,\(^2\) widening the artery at the level of plaque formation.\(^1\)\(^{4,6,10,13-16}\)

Partial removal of the plaque material by atherectomy and decreasing the resistance of the plaque by dilation renders a smoother and a more regular lumen than achieved by angioplasty.\(^1\)\(^{7}\)

1.3. Percutaneous Coronary Laser Angioplasty: Laser (light amplification by stimulated emission of radiation) is a high-energy artificial light. One of the various forms of laser beam is “excimer” laser which is used in plaque ablation in coronary arteries.\(^1\)\(^{11,10,13-16,18}\)

1.4. Placement of Percutaneous Coronary Stent: Stents are tubular metal-webs placed to maintain or increase vascular patency obtained by balloon angioplasty.\(^9\)\(^{11,12,19}\)

Coronary stents are used to achieve one of two important aims. First, to increase arterial patency achieved by balloon angioplasty and second to minimize the risk of restenosis. Recently new stents have been developed for this purpose.\(^6\)\(^{8,13,14,16,18,20,21}\)
1.5. Brachytherapy: Brachytherapy is a new and developing technique. It is performed to decrease the risk of restenosis after stent placement or balloon angioplasty.\(^{(22)}\)

2. PERCUTANEOUS VALVULAR INTERVENTIONS (PVI)

PVI is a therapeutic procedure performed by using balloons of appropriate size for the dilation of stenotic valves.\(^{(6,8,13,14,20,23-25)}\)

3. RISK FACTORS IN PERCUTANEOUS CORONARY OR VALVULAR INTERVENTIONS\(^{(26)}\)

A- Patient characteristics

- Previous history of MI (shorter the time between MI and the procedure, higher is the risk),
- Functional capacity of NYHA III or IV,
- High burden of atherosclerotic plaques,
- Having multiple risk factors,
- Very young or very old age, female gender,
- Hemodynamic instability, shock, renal insufficiency, peripheral artery disease, diabetes mellitus,
- Use of intraaortic balloon pump, previous history of coronary artery intervention, multi-vessel disease, previous history of CABG.

B- Surgeon characteristics

- Lack of knowledge, skill, experience and attention,
- Inadequate or inappropriate information given, preparation or follow-up of the patient.

C- Institutional characteristics

- Quantitative or qualitative inadequacy of equipment and tools,
- Insufficient surgical support.

Some of the risk factors may be diminished, but total risk can never be reduced to zero in any institution.

4. COMPLICATIONS IN PERCUTANEOUS CORONARY AND VALVULAR INTERVENTIONS\(^{(11,12,16,18-20,25,27,28)}\)

4.1. Major Complications

- Acute reocclusion (PTCA)
- MI (PTCA, PVI)
- Emergency Coronary Artery By-Pass Graft Operation (CABG)
- Rhythm and conduction disorders reducing cardiac output significantly (cardiac arrest etc.) (PTCA, PVI)
- Severe bleeding in the groin (PTCA, PVI)
- Accidental dissection of the valvular ring (PVI)
- Cardiac tamponade due to rupture or tear in the wall of coronary artery or heart chambers (PTCA, PVI)
- Acute heart failure (PVI)
- Death

4.2. Minor Complications

- Side branch occlusion (PTCA)
- Ventricular/atrial arrhythmias (PTCA, PVI)
- Bradycardia (PTCA, PVI)
- Left-to-right shunt (PVI)
- Hypotension (PTCA, PVI)
- Blood loss (PTCA, PVI)
- Arterial thrombus (PTCA)
- Coronary embolism (PTCA)
- Emergency recatheterization (PTCA, PVI)
- Severe blood loss requiring transfusion (PTCA, PVI)
- Ischemia in the cannulated extremity (PTCA, PVI)
- Decrease in renal functions due to contrast medium (PTCA)
- Systemic embolism (PTCA, PVI)
- Hematoma in the groin, retroperitoneal hematoma, pseudoaneurysm, A-V fistula (PTCA, PVI)
5. NURSING CARE IN PERCUTANEOUS CORONARY AND VALVULAR INTERVENTIONS

Responsibilities of the nurse involved in the care of the patient undergoing interventional therapy;
1- Prevention and early diagnosis of potential complications,
2- Education of the patient and the family,
3- Rehabilitation.

Prevention and early diagnosis of potential complications, individualized and structured care, education of the patient and his/her family, modification of risk factors and life style changes are the most important factors affecting prognosis in interventional treatment.\textsuperscript{(9,11,12,17,19)}

It is important for the nurse to follow recent advances and published literature and join nursing seminars for the improvement of her knowledge about individualized and structured patient care and education of the patient and the family.

Nursing care in percutaneous and valvular interventions are similar.\textsuperscript{(20,24)} Care is given in the context of nursing process. Nursing diagnoses are made according to medical and nursing history of the patient, physical examination, hemodynamic follow-up, analysis and interpretation of data including the results of diagnostic tests; care is planned and reassessed.\textsuperscript{(29-32)}
5.1. Nursing Diagnoses-Interventions in Percutaneous Coronary and Valvular Interventions

NURSING DIAGNOSIS - 1
ANXIETY / FEAR (33-38)

<table>
<thead>
<tr>
<th>DIAGNOSTIC CRITERIA (Symptoms and Signs)</th>
<th>CAUSE</th>
<th>AIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ↑ blood pressure (BP), pulse rate and number of breaths</td>
<td>• Having one-sided, exaggerated and negative information on interventional treatment process, outcomes and potential complications.</td>
<td>• Decreasing the patient’s anxiety/fear, • Developing effective ways of coping with stress.</td>
</tr>
<tr>
<td>• Tension, irritability, nervousness, crying</td>
<td></td>
<td></td>
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<tr>
<td>• Headache, light headedness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Palmar sweating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Attention deficit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pupillary dilation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dyspnea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Palpitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dry mouth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Frequent urination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Tingling in hands and feet</td>
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</tbody>
</table>

INTERVENTIONS

• Anxiety/fear level of the patient is assessed (posture, difficulty in falling asleep, restlessness, tension, fatigue),
• The ways the patient uses for coping with stress are identified. Causes of anxiety/fear are investigated (anxiety due to the procedure, inadequate information, getting used to the clinics, noise etc.),
• It is explained to the patient that the nurse is well aware of the anxiety/fear the patient experiences,
• Patient's participation in the process of care is provided,
• Clear and understandable words are used during the education,
• The intervention laboratory and the staff are introduced to the patient,
• Therapeutic communication techniques are used (patient is allowed to ask questions),
• Communication with other patients who had experienced PTCA/PVI is provided when needed,
• Help is provided for the patient while implementing techniques to decrease anxiety (relaxation, deep breathing, positive thinking, and promoting to express himself),
• Sedative drugs can be given the night before the procedure according to the physician’s orders.

ASSESSMENT

Expected Outcomes
• Expression of decrease in anxiety/fear by the patient,
• Use of relaxation methods effectively by the patient,
• Decrease in symptoms of psychomotor agitation
NURSING DIAGNOSIS - 2
KNOWLEDGE DEFICIT *(7,23,34,37,39)*

<table>
<thead>
<tr>
<th>DIAGNOSTIC CRITERIA (Symptoms and Signs)</th>
<th>CAUSE</th>
<th>AIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Being willing to get more information, • Asking more or less questions, • ↑ anxiety, • Restlessness</td>
<td>• Having inadequate information about the process planned to be performed.</td>
<td>• Decreasing the patient’s anxiety, • Increasing level of knowledge.</td>
</tr>
</tbody>
</table>

### INTERVENTIONS

- Definition of PTCA/PTI is done by the physician
- Pre-interventional education:
  - The patient is told that oral feeding will be ceased 8 hours before the procedure and the reasons are explained,
  - Purpose of laboratory tests, ECG and chest X-ray are explained to patient,
  - Catheterization laboratory and the staff are introduced to the patient,
  - Informed consent form and its purpose of use are explained to the patient.
  - Reason for shaving both groins is explained to the patient.
- Interventional education:
  - Site of intervention is shown to the patient.
  - Local anaesthetic agent to be used for the procedure and its effect is explained to the patient.
  - Radiocontrast medium to be used for the procedure and its effects (sensation of warmth during injection) is explained to the patient.
  - Reasons of taking and holding a deep breath and coughing according to the instructions given by the physician during the procedure are explained and exercised.
  - Reasons of burning sensation and pain felt during inflation of the balloon are explained.
- Post-interventional education:
  - Timing of removal of the cannula inserted in the groin during the procedure,
  - Importance of mobility restriction and bed rest during the cannulated period and after the removal of the cannula,
  - Application of pressure, sand bag and firm bandage to site of procedure after removal of the cannula is explained;
  - The monitoring unit where the patient will stay after the procedure is introduced;
  - All patient care activities that will be carried out are explained
- Post-discharge and homecare education:
  - The patient is told that he/she may be discharged the morning after the procedure unless there is any complication,
  - Dates and importance of visits are explained.

### ASSESSMENT

**Expected Outcomes**
- Definition of PTCA/PVI is made by the physician,
NURSING CARE GUIDELINES IN PERCUTANEOUS CORONARY AND VALVULAR INTERVENTIONS

NURSING DIAGNOSIS - 3
SAFE PREPARATION FOR PTCA / PVI\(^{[8,30,31,34,39-42]}\)

AIM

• To prepare the patient safely for PTCA/PVI.

INTERVENTIONS

• It should be checked whether the patient stopped oral intake 5-6 hours before the procedure. However, if there is a delay long-term starvation and thirst are not allowed to continue. Currently, fluid restriction is not required particularly before diagnostic procedures.
• PTCA/PVI-related procedures are completed: Whole blood count, coagulation tests, electrolytes, BUN, creatinine, blood group identification and crossmatch, chest x-ray.
• The patient signs an informed consent form,
• Groins are shaved bilaterally,
• Vital signs are checked,
• 12-lead ECG is done,
• Help is provided for the patient to carry out excretory functions,
• Dentures, accessories and nail polish are removed,
• Pulses are detected and marked,
• Intravenous access is achieved,
• A sedative drug is given according to the physician’s order,
• Medications are given according to the physician’s order,
• The patient puts on a cap and a gown and wears an identity card,
• The patient is taken to the angiography laboratory

Most common drugs used in PTCA and PVI (Table 1-Page 29)

• Antiaggregants (aspirin, clopidogrel, tirofiban etc.)
• Anticoagulants (heparin, low molecular weight heparins, especially enoxaparine)
• Intracoronary or IV nitroglycerin
### NURSING DIAGNOSIS - 4

**CHEST PAIN** *(17, 21, 30, 36, 37, 42, 43)*

<table>
<thead>
<tr>
<th><strong>DIAGNOSTIC CRITERIA</strong> <em>(Symptoms and Signs)</em></th>
<th><strong>CAUSE</strong></th>
<th><strong>AIM</strong></th>
</tr>
</thead>
</table>
| • The patient expresses pain,                  | • Myocardial chest pain occurs when coronary perfusion is relatively inadequate as a result of absolute or increased need of supply. Chest pain is a sign of severe ischemia. Pain starts before necrosis develops and disappears if ischemia ends or worsens if ischemia continues. | • Alleviation of pain,  
• Supporting the circulation. |
| • The patient is restless and anxious,         |           |         |
| • Pain lasts less than 20 min. in ischemic events without necrosis, |           |         |
| • ST depression or elevation, T wave changes may be seen, |           |         |
| • Detection of myocyte enzymes and some other molecules (cTnT, cTnI, myoglobin, CK-MB, CK etc.) in serum and increasing levels indicate myocyte necrosis. Enzyme levels are in parallel with extent of necrosis. |           |         |
| • Presence of hemodynamic instability signs (systolic BP <90 mmHg, mean arterial pressure <60 mmHg, heart rate >100 bpm, cardiac index <2.2 L/min/m², urine flow <30 ml/h indicates that ischemic area is large and that the risk is high. |           |         |

<table>
<thead>
<tr>
<th><strong>INTERVENTIONS</strong></th>
<th><strong>ASSESSMENT</strong></th>
</tr>
</thead>
</table>
| • Characteristics of myocardial ischemia are evaluated,  
• BP and pulse are evaluated,  
• Medications are given according to the physician’s orders (nitroglycerin, β-blockers, heparin, morphine sulfate, antiaggregants and GPIIb/IIIa receptor antagonists, dopamine, dobutamine etc.)  
• Effectiveness of treatment is monitored,  
• ECG changes accompanying pain are monitored,  
• The patient is followed-up for arrhythmia,  
• 12-lead ECG is done,  
• Oxygen is given (SaO₂ is held over 92%),  
• Urine volume is checked. | **Expected Outcomes** |
|                   | • Absence of pain,  
• Absence of Q wave in 12-lead ECG,  
• Systolic BP >90 mmHg,  
• MAP >60 mmHg,  
• Heart rate 60-100 bpm,  
• Cardiac index >2.2 L/min/m²,  
• Urine volume >30 ml/h,  
• No elevation of markers such as cardiac enzymes. |
## NURSING DIAGNOSIS - 5

### ARRHYTHMIA (5, 17, 23, 33, 36, 44, 45)

<table>
<thead>
<tr>
<th>Diagnostic Criteria (Symptoms and Signs)</th>
<th>Cause</th>
<th>Aim</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Changes in ECG,</td>
<td>• Inability to deliver sufficient O₂ to the myocardium,</td>
<td>• Preventing the development of arrhythmia,</td>
</tr>
<tr>
<td>• Consciousness disorder,</td>
<td>• Type of contrast medium given,</td>
<td>• Eliminating arrhythmia,</td>
</tr>
<tr>
<td>• Extreme increase or decrease or irregularity of pulse rate and/or decrease in amplitude,</td>
<td>• Rapid infusion or infusion of too much contrast medium,</td>
<td>• Keeping the arrhythmias that cannot be eliminated within an acceptable range.</td>
</tr>
<tr>
<td>• Pale, cold or damp skin.</td>
<td>• Electrolyte imbalance (too low or too high levels of potassium, calcium, magnesium, sodium).</td>
<td></td>
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</tbody>
</table>

### Interventions

- Vital signs are assessed,
- Level of consciousness is assessed,
- Pulse is checked (see pulse assessment, p.28),
- Skin perfusion is evaluated,
- 24-hour cardiac monitorization is provided after PTCA/PVI,
- Emergency medications should be ready for use,
- Transient (transvenous or transthoracic) pacemaker is held ready for use,
- Medical therapy (atropine, lidocaine, amiodarone, β-blockers etc.) is applied according to the physician's orders.

### Assessment

**Expected Outcomes**

- Stabilization of cardiac rhythm.

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**NURSING CARE GUIDELINES IN PERCUTANEOUS CORONARY AND VALVULAR INTERVENTIONS**
**NURSING DIAGNOSIS- 6**

**DECREASED CARDIAC OUTPUT**(17,23,24,31,33-35,37,44)

<table>
<thead>
<tr>
<th>DIAGNOSTIC CRITERIA (Symptoms and Signs)</th>
<th>CAUSE</th>
<th>AIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Tachycardia,</td>
<td></td>
<td>• Early diagnosis of symptoms and signs showing a decrease in cardiac output,</td>
</tr>
<tr>
<td>• Hypotension,</td>
<td></td>
<td>• Prevention of complications,</td>
</tr>
<tr>
<td>• Restlessness,</td>
<td></td>
<td>• Increasing cardiac output to the normal level.</td>
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<tr>
<td>• Light headedness,</td>
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<td></td>
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<tr>
<td>• Cold and damp skin,</td>
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</tr>
<tr>
<td>• ↑ PCWP,</td>
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<tr>
<td>• High-pitched fine crepitations in the pulmonary region,</td>
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<td></td>
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<tr>
<td>• Urine volume of &lt;30 ml/h,</td>
<td></td>
<td></td>
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<tr>
<td>• Increasing pulse amplitude,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Capillary filling time of &gt;3 sec.</td>
<td></td>
<td></td>
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</tbody>
</table>

**CAUSE**

• Decrease in circulating volume,
• Blood loss,
• Cardiac tamponade,
• Arrhythmia,
• Myocardial ischemic dysfunction or necrosis (myocardial infarction),
• Valvular tear or rupture causing heart failure,
• Increase in pulmonary arterial pressure and pulmonary vascular resistance due to right-left shunt through the septa,

**INTERVENTIONS**

- Hemodynamic status of the patient is closely monitored; changes are recorded until vital signs are stabilized,
- Monitorization continues until improvement in the following parameters are provided: BP, PCWP, CVP, cardiac output and oxygen saturation,
- 12-lead ECG is done and evaluated,
- If chest pain is present 2-4 ml/h O₂ is given and the physician is informed,
- Cardiac enzymes and other markers are monitored according to the physician's order,
- Hourly and daily fluid intake and output are monitored,
- Urine volume of than less than <30 ml/h is reported to the physician,
- Oral feeding of the patient is restricted (possible surgery),
- Necessary medications according to the physician's order (nitrates, calcium antagonists, beta blockers, heparin, diuretics, inotropic agents etc.),
- The patient is assessed for symptoms such as disorientation, confusion, fatigue, increasing restlessness.

**ASSESSMENT**

**Expected Outcomes**

- Obtaining adequate cardiac output; warm and dry skin,
- Normal BP,
- Pulse rate of 60-100 bpm,
- Absence of crepitations,
- Normal PCWP,
- Urine volume of more than 30 ml/h.
NURSING CARE GUIDELINES IN PERCUTANEOUS CORONARY AND VALVULAR INTERVENTIONS

NURSING DIAGNOSIS - 7
DECREASE IN PERIPHERAL TISSUE PERFUSION\(^{(24,28,30,33,35,37,39,45,46)}\)

<table>
<thead>
<tr>
<th>DIAGNOSTIC CRITERIA (Symptoms and Signs)</th>
<th>CAUSE</th>
<th>AIM</th>
</tr>
</thead>
</table>
| • Decrease or absence of pulse amplitude in the affected extremity,  
  • Capillary filling time of >3 sec. in the affected extremity,  
  • Pallor, mottling and cyanosis developing at the distal region of the affected extremity,  
  • Decrease in voluntary movements and senses. | • Mechanical obstruction in the arterial or venous cannula,  
  • Arterial vasospasm,  
  • Thrombus formation,  
  • Embolization,  
  • Immobility,  
  • Bleeding or hematoma. | • Providing adequate peripheral tissue perfusion. |

<table>
<thead>
<tr>
<th>INTERVENTIONS</th>
<th>ASSESSMENT</th>
</tr>
</thead>
</table>
| 1- Before Cannula Removal  
  • Presence and quality of the pulse are assessed and recorded,  
  • Unpalpable pulses are checked by Doppler ultrasound according to the physician's order and the pulse location is marked.  
  • Colour and temperature of all four extremities are assessed and recorded,  
  • All extremities are assessed for pain, numbness, loss of sensation, motor and sensory functions and the findings are recorded,  
  • Bed rest is provided,  
  • The cannulated extremity is held straight with the aid of knee and leg immobilizers,  
  • The patient is not allowed to be in a seated position (head of the bed should not be elevated more than 30 degrees),  
  • Assistance is provided for feeding and excretory functions of the bedridden patient  
  2- After Cannula Removal  
  • Presence and quality of pulses at the distal of the extremity with an arterial cannula are evaluated (radial and ulnar pulses in brachial interventions, arteria dorsalis pedis and a. tibialis posterior pulses in femoral interventions),  
  • Site of intervention is assessed for swelling and hematoma formation,  
  • Development of pseudoaneurysm and arteriovenous fistula is assessed (a pulsatile mass, systolic inguinal pain, systolic murmur),  
  • The patient is prepared for surgical intervention when needed (peripheral arterial embolectomy etc.). | Expected Outcomes  
  • Palpable pulses,  
  • Disappearance of ischemic pain,  
  • Presence of senses, warm and pink skin at the extremity. |
NURSING DIAGNOSIS - 8
RISK OF THROMBOEMBOLISM(6,8,31,34,39,47,48)

<table>
<thead>
<tr>
<th>DIAGNOSTIC CRITERIA (Symptoms and Signs)</th>
<th>CAUSE</th>
<th>AIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>In thromboembolic events in the extremities; • Pain, edema in the extremity, • Unusual warmth and/or Homans’ sign, • Decrease in pulse amplitude • Coldness and pallor at the extremities. In cerebral, coronary and pulmonary thromboembolic events; • Decrease in level of consciousness, changes in sensory and motor functions, • Sudden onset chest pain, • Dyspnea and irritability, • Significant decrease in SaO₂</td>
<td>• Decrease in peripheral perfusion.</td>
<td>• Prevention of thromboembolism, • Early diagnosis of signs and symptoms of thromboembolism, • Prevention of complications.</td>
</tr>
</tbody>
</table>

INTERVENTIONS

For interventions involving the extremities;
• The extremity is checked for pallor, numbness, color change, bleeding and hematoma,
  - Once every 15 minutes the first hour,
  - Once every 30 minutes for the next two hours,
  - Once every 60 minutes for the next 4 hours,
  - Once every 4 hours until the patient is stabilized.
• Bed-rest is provided in a supine position,
• Heparin is infused according to the physician’s order.
In cerebral thromboembolic events;
• Bed rest, neurological consultation and anticoagulant treatment according to the physician’s order, if needed.
In pulmonary embolic events;
• Deep breath exercises every hour in suitable patients,
• Avoidance of Valsalva manoeuvre,
• Anticoagulant and fibrinolytic treatment according to the physician’s order.
In coronary thromboembolic events;
• Antiplatelet, anticoagulant, fibrinolytic treatment according to the physician’s order.

ASSESSMENT

Expected Outcomes
• Absence of pain, edema and numbness in the extremities,
• Return of normal skin temperature and color,
• Normal mental status,
• Normal sensory and motor functions,
• Disappearance of chest pain and dyspnea,
• SaO₂ in the normal range.
## NURSING DIAGNOSIS - 9

### BLEEDING\(^{(6,17,23,34,37,39,42,43,45,49,50)}\)

<table>
<thead>
<tr>
<th>DIAGNOSTIC CRITERIA (Symptoms and Signs)</th>
<th>CAUSE</th>
<th>AIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>• External bleeding,</td>
<td>• Hemorrhagic diathesis due to treatment or patient characteristics,</td>
<td>• Prevention of bleeding,</td>
</tr>
<tr>
<td>• Internal bleeding (into anatomical spaces or within tissues)</td>
<td>• Use of wide cannula,</td>
<td>• Stopping the bleeding,</td>
</tr>
<tr>
<td>• Swelling due to bleeding (hematoma formation)</td>
<td>• Inadequate pressure applied on the site of intervention.</td>
<td>• Elimination of complications of bleeding.</td>
</tr>
</tbody>
</table>

### INTERVENTIONS

- Site of intervention is followed for bleeding (blood on bandage, pain, swelling, hematoma),
- Symptoms and signs of retroperitoneal bleeding are monitored (side pain, decrease in amplitude of extremity pulses, decrease in Htc and Hb levels),
- After the procedure vital signs are monitored until they are stabilized (BP and pulse may be indicators of bleeding),
- Prothrombin time, partial thromboplastin time, activated coagulation time (ACT) and platelet levels are monitored.

**If there is significant bleeding:**
- Vital signs are monitored every 15 minutes until bleeding is controlled,
- Circulation of the extremities is checked,
- Amount of blood on the bandage is evaluated and recorded,
- If hematoma is present, it is marked on the skin starting from the outer borders.

**Before Cannula Removal:**
- The limb is held straight in a resting position,
- The head of the bed is elevated with an angle of less than 30 degrees,
- A suitable position for feeding, excretory functions and necessary position changes are provided,
- Frequent movements of the limb on which the intervention is done are avoided,
- The patient is taught to apply pressure on the site of intervention during coughing, sneezing and head elevation with a pillow,
- The patient is told to inform the nurse when he/she feels temperature rise, dampness or swelling at the site of intervention,
- Antiplatelet drugs are ceased according to the physician's order

**If there is serious bleeding:**
- The physician is informed,
- Infusion of anticoagulants (heparin, low molecular weight heparin), antiaggregants (GPIIb/IIIA receptor blockers) and fibrinolytic agents is ceased after consulting the physician,
- Bandage at the bleeding site is changed; manual or mechanical pressure is applied,
- The cannula is removed by the physician if necessary,
- Fluid infusion is started according to the physician’s order.

**Following Cannula Removal:**
- Pressure is applied for 30 minutes according to the clinical protocol,
- Bed rest in supine position is provided according to the clinical protocol,
- Sudden movements are avoided until wound closure and clot formation is complete,
- Mobilization of the patient is started according to the clinical protocol.
NURSING DIAGNOSIS - 10

FLUID VOLUME DEFICIT *(8,17,28,31,34,38)*

<table>
<thead>
<tr>
<th>DIAGNOSTIC CRITERIA (Symptoms and Signs)</th>
<th>CAUSE</th>
<th>AIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bleeding at the site of intervention,</td>
<td>• Bleeding,</td>
<td>• Obtaining and maintaining fluid balance,</td>
</tr>
<tr>
<td>• Pulse rate &gt;100 bpm,</td>
<td>• Diuresis, nausea and vomiting due to contrast medium use,</td>
<td>• Providing excretion of contrast medium.</td>
</tr>
<tr>
<td>• Systolic BP &lt;90 mmHg,</td>
<td>• Restriction of oral intake,</td>
<td></td>
</tr>
<tr>
<td>• Diastolic BP &lt;50 mmHg.</td>
<td>• Treatment with vasodilator agents.</td>
<td></td>
</tr>
</tbody>
</table>

CAUSE

• Bleeding,
• Diuresis, nausea and vomiting due to contrast medium use,
• Restriction of oral intake,
• Treatment with vasodilator agents.

INTERVENTIONS

• Vital signs are evaluated;
  - Once every 15 minutes the first hour,
  - Once every 30 minutes for the next two hours,
  - Once every 60 minutes until removal of the cannula,
  - Once every 4 hours after removal of the cannula.
• Site of intervention is assessed for bleeding, swelling, color change with the frequencies stated above and the findings are recorded,
• The patient is encouraged for oral fluid intake,
• IV infusion is made according to the physician’s order,
• Blood transfusion is made according to the physician’s order,
• Fluid intake and output are monitored,
• The patient is assessed for orthostatic hypotension that may develop during getting up from the bed;
  a- BP and pulse are checked in supine and seated positions,
  b- If a systolic blood pressure decrease of at least 10 mmHg and a pulse rate increase of at least 20/min are detected, the patient is laid in a supine position and IV infusion is increased according to the physician’s order.

ASSESSMENT

Expected Outcomes

• During PTCA/PVI
  - Presence of normal vital signs
  - Absence of bleeding
### NURSING DIAGNOSIS - 11
### ALLERGIC REACTION\(^{(15,20,25,42,45)}\)

<table>
<thead>
<tr>
<th>Diagnostic Criteria (Symptoms and Signs)</th>
<th>Cause</th>
<th>Aim</th>
</tr>
</thead>
</table>

### Interventions
- Allergy against contrast medium is investigated,
- The patient is told to give information in case of:
  - Pruritus, feeling of warmth
  - Nausea and vomiting, malaise
  - Dyspnea
- Vital signs are closely monitored,
- Antihistamines/corticosteroids/pressor amines are given according to the physician's orders when needed,
- Life supporting measures are taken if the reaction is severe,
- Psychological support is provided for the patient.

### Assessment
#### Expected Outcomes
- No signs of allergic reactions are observed in the patient.
## NURSING DIAGNOSIS - 12

### RESTRICTION OF MOVEMENTS FOR MEDICAL PURPOSES<sup>7,25,33,37,38,43</sup>

<table>
<thead>
<tr>
<th>DIAGNOSTIC CRITERIA (Symptoms and Signs)</th>
<th>CAUSE</th>
<th>AIM</th>
</tr>
</thead>
</table>
|                                         | • Activity restriction necessary for the intervention,  
• Limited movement at the site of intervention. | • Ensuring activity restriction. |

### INTERVENTIONS

- Reasons of activity restriction are explained to the patient,
- Training for activity restriction is given;
  - Bed rest for 12-24 hours,
  - Immobilization of the extremity on which the procedure is performed,
  - Head elevation of less than 30 degrees for a period of 12-24 hours,
  - Applying manual pressure during bowel movements, coughing, sneezing and supporting the head with a pillow,
- Log-rolling technique is used to position or to move the patient,
- The body is supported by pillows while being positioned,
- Materials (water, tissue paper) the patient may need are kept somewhere within the reach of the patient
- After 12-24 hours the patient is gradually mobilized following the steps stated below:
  - Sitting on the bed (holding both sides of the bed for support),
  - Sitting on the edge of the bed (legs swinging from the bed),
  - Sitting on a chair,
  - Walking.

### ASSESSMENT

**Expected Outcomes**

- Providing activity restriction suitable for the patient.
5.2. Patient/Family Education Before Discharge\textsuperscript{(20,21,25,31,35,36,38,39,42-46)}

After discharge the patient is planned to be able to take care of the site of intervention, to recognize symptoms and signs of complications and to develop behaviour aiming to reduce risk factors.

A. Giving General Information

• Information on the procedure to be performed and on the results is given,
• Level of information given during the training before PTCA/PVI is checked and missing issues or misunderstood subjects are identified and the education is repeated when necessary,
• One of the family members should be ready for assisting the patient during hospital discharge.

B. Symptoms and Signs that Should be Reported

Symptoms and signs of emergency situations, information on possible complications are overviewed and the patient is told to admit to a health care facility if one of these conditions is present.

The patient is told to inform the nurse in the presence of the following conditions;

• Continuing chest pain (pain not alleviating despite use of nitroglycerine 3 times with intervals of 15 minutes and lasting more than 15 minutes),
• Irregularity of pulse, light headedness,
• Weight gain of 1-2 kg/day or 3-5 kg/week,
• Lack of energy and fatigue,
• Shortness of breath with minimal physical effort,
• Changes at the site of intervention (except slight ecchymosis and firmness)
  - Recent bleeding at the site of cannula insertion,
  - A recently forming and growing swelling,
  - Redness, swelling, discharge or feeling of warmth at the extremity on which the procedure is performed,
  - Insensitivity, numbness

C. Special Considerations

The patient is told that;

• He/she would better have assistance when going home after hospital discharge,
• He/she can remove the gauze pad at the site of insertion one day later,
• He/she can take a bath without rubbing the site of intervention (if the permission to take a bath is given)
• Tight clothes should be not worn until the sensitivity at the site of intervention diminishes,
• Protective bandage can be used if the underwear touches the site of intervention.
D. Mobility

• Avoidance of intense activity for the first week (swimming, running, biking, dancing, climbing up the stairs etc.),
• Protection of the site of cannula insertion from trauma.

The patient is told:

• Not to carry, push or pull heavy objects for the first 2-3 days,
• Not to drive for at least one week,
• To avoid ascending the stairs for the first 2 days (if obligatory, the leg contralateral to the limb on which the procedure is performed is advanced first placing it on the step above and than the other leg is advanced up to the same step,
• To avoid sexual activity for 2-3 days following the intervention,
• To avoid constipation and straining and to inform the physician/nurse about these symptoms,
• When to start working (usually one week later).

E. Medical treatment

The following explanations are made:
• Name of the medication and why it is used,
• How many mgs of drug each tablet or capsule contains,
• How many times a day and how the medications will be used,
• How and where the medications should be kept,
• Most common side effects and the importance of reporting them to the physician/nurse when they occur,
• Importance of regular use and avoidance of missing doses,
• Importance of not ceasing the medication without consulting the physician.

F. Modification of risk factors

Saves more lives than all therapeutic interventions. See Guidelines for Prevention and Treatment of Coronary Heart Diseases 2002 and Nursing Care Guidelines for Heart Failure - Acute Coronary Syndromes - Hypertension 2003 for more details.

Diet: Low-cholesterol diet according to the physician's recommendations; weight loss is recommended if necessary,

Physical activity: Importance of compliance with the physician's recommendations on physical activity is explained,

Smoking: Importance of quitting smoking is emphasized,

Alcohol consumption: Avoidance of excessive consumption is recommended. Patient-specific limits are determined by the physician,
G. Importance of regular visits for maintenance of well-being is explained to the patient and the family.

- For continuity of the education, written materials (booklet, brochure etc.) on patient care are provided for the patient and the family,
- Names and phone numbers of the physician and the nurse to be called up when needed are given to the patient.

6. PULSE ASSESSMENT\(^{49,51}\)

- Presence,
- Amplitude (fullness),
- Rate,
- Rhythm of the pulse are assessed.

Presence of pulse is assessed in all arteries from head to toe bilaterally

- Carotid arteries (assessed without pressing)
- Radial arteries
- Femoral arteries
- Popliteal arteries
- Aa. dorsalis pedis
- Aa. tibialis posterior are especially important. Doppler USG can be used if these arteries cannot be palpated.

**Pulse Amplitude**

Pulse amplitude may give a rough and quick idea on blood pressure and cardiac output.

- Pulse amplitude is scored from 0 to 4.
  - 0 = The pulse is not palpable
  - +1 = The pulse is weak or thready
  - +2 = The pulse is normal
  - +3 = The pulse is bounding
  - +4 = The pulse is hyperkinetic and visible to the eye without palpation,
- Pulse rate and rhythm are compared bilaterally at the same time.
### Table 1: Agents Commonly Used in PTCA and PVI\(^{20,24,30,31,40,44,52-57}\)

<table>
<thead>
<tr>
<th>Category</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calcium antagonists</strong></td>
<td>• They inhibit calcium entry to myocytes and smooth muscle cells. Some of them may decrease myocardial contractility and rate of conduct. They dilate coronary arteries and arterioles.</td>
</tr>
<tr>
<td><strong>Beta blockers</strong></td>
<td>• They decrease heart rate, cardiac contractility and oxygen requirement.</td>
</tr>
<tr>
<td><strong>Nitroglycerin</strong></td>
<td>• They are generally useful for coronary syndromes with chest pain except myocardial infarction. They decrease ventricular filling pressure and systemic vascular resistance and increase collateral flow.</td>
</tr>
<tr>
<td><strong>Positive inotropic agents</strong></td>
<td>• They are used for conditions where myocardial contractility is decreased. Digoxin, dopamine and dobutamine are the most frequently used agents. Dopamine and dobutamine are more often used for severe hemodynamic failure such as cardiogenic shock.</td>
</tr>
<tr>
<td><strong>Diuretics</strong></td>
<td>• They are used to alleviate congestive symptoms. Furosemide, a loop diuretic, is the treatment of choice. Loop diuretics inhibit sodium and chloride reabsorption at the ascending proximal part of Henle’s loop.</td>
</tr>
<tr>
<td><strong>Atropine</strong></td>
<td>• It is an anticholinergic agent that inhibits acetylcholine at the parasympathetic neuromuscular junction. It increases heart rate by decreasing parasympathetic inhibition on sinus node and atrioventricular node.</td>
</tr>
<tr>
<td><strong>Lidocaine hydrochloride</strong></td>
<td>• It belongs to Class Ib antiarrhythmic agents used for ventricular extrasystols that cause symptomatic and hemodynamic impairment. It acts by shortening action potential duration.</td>
</tr>
<tr>
<td><strong>Antiaggregant agents</strong></td>
<td>• Inhibits cyclooxygenase, an enzyme involved in the synthesis of thromboxane A2 which causes aggregation of platelets. Consequently, tendency of platelets to adhere to each other and to vessel walls and to aggregate is decreased. Daily dose is 75-325 mg. Acute treatment dose is 150-300 mg/day and chronic treatment dose is 80-100 mg/day.</td>
</tr>
<tr>
<td>-Aspirin</td>
<td>• Inhibits platelet aggregation and release of platelet derived factors. Inhibits binding of fibrinogen to platelet membrane via ADP. Ticlopidine prevents ADP-induced platelet aggregation. Antiaggregant activity is increased when used concurrently with aspirin. This combined use markedly increased the safety of PTCA and coronary stent placement and extensively decreased early occlusions.</td>
</tr>
<tr>
<td>-Ticlopidine</td>
<td>• Acts like ticlopidine, has less side effects and is generally used for the same indications.</td>
</tr>
<tr>
<td>-Clopidogrel</td>
<td>• Prevents thrombus formation at the site of PTCA by speeding up the synthesis of antithrombin III-thrombin complex. Inactivates thrombin and prevents the conversion of fibrinogen to fibrin. Duration of its effect is 4 hours and the activity is monitored by aPTT.</td>
</tr>
<tr>
<td><strong>Anticoagulant therapy</strong></td>
<td>• They are derived from standard heparin. They have a lower molecular weight and are given every 12 hours. There is no need for aPTT control. Some of these agents –enoxaparine– are shown to be superior to standard heparin in acute coronary syndromes.</td>
</tr>
<tr>
<td>-Standard heparin</td>
<td>• They are used for high-risk coronary artery interventions in non-ST segment elevation myocardial infarction. They prevent binding of platelets to each other via fibrinogen bridges by blocking GP IIb/IIIa receptors. Reduction of heparin doses should be considered when they are used with heparin or LMWH.</td>
</tr>
</tbody>
</table>
7. REFERENCES


41) Black JM, Matassarin-Jacobs E. Medical-Surgical Nursing. 4th Edition. Philadelphia: