

In the name of The  
Almighty

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# Nursing Care in Cardiac Catheterization Laboratory

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- ☐ ***Cardiac catheterization Definition***
- ☐ ***Contraindications to Cardiac Catheterization***
- ☐ ***Preprocedural Preparation of Patient***
- ☐ ***Intra procedural Care***
- ☐ ***Postprocedural Care***
- ☐ ***Complications***

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- Cardiac catheterization refers to all forms of direct invasive and catheter-based assessments of the heart.
  - Angiography defined as the radiographic visualization of cardiac and vascular structures, such as the Coronary arteries, Aorta and Left ventricle and etc.
  - Coronary angiography is defined as the radiographic visualization of the coronary vessels after injection of radiopaque contrast media

# The Cardiac Catheterization Laboratory

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1. hospital-based laboratories with full support services including cardiovascular surgery.
  - cardiovascular surgery
  - cardiovascular anesthesia , mechanical circulatory support services
  - vascular services, endovascular surgery/interventions
  - intensive care unit (CCU) (ICU)
  - nephrology consultative service and dialysis, neurology consultation services
  - hematologic consultative and blood bank services,
  - advanced imaging services (echocardiography, CT, MRI )
  - If offered, similar services should be available for pediatric patients.
2. hospital-based laboratories without cardiovascular surgical capability.
3. freestanding laboratories
4. mobile laboratories.

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Accordingly, the only patient groups not recommended to undergo diagnostic cardiac catheterization without cardiovascular surgery backup are those with:

- Pulmonary edema caused by ischemia
- Class 4 symptoms from severe valvular dysfunction with reduced ejection fraction,
- Complex congenital heart disease,
- Acute coronary syndromes unless percutaneous coronary intervention is possible
- Patients at risk of vascular complications unless vascular services are available.

# Cardiac Catheterization Equipment

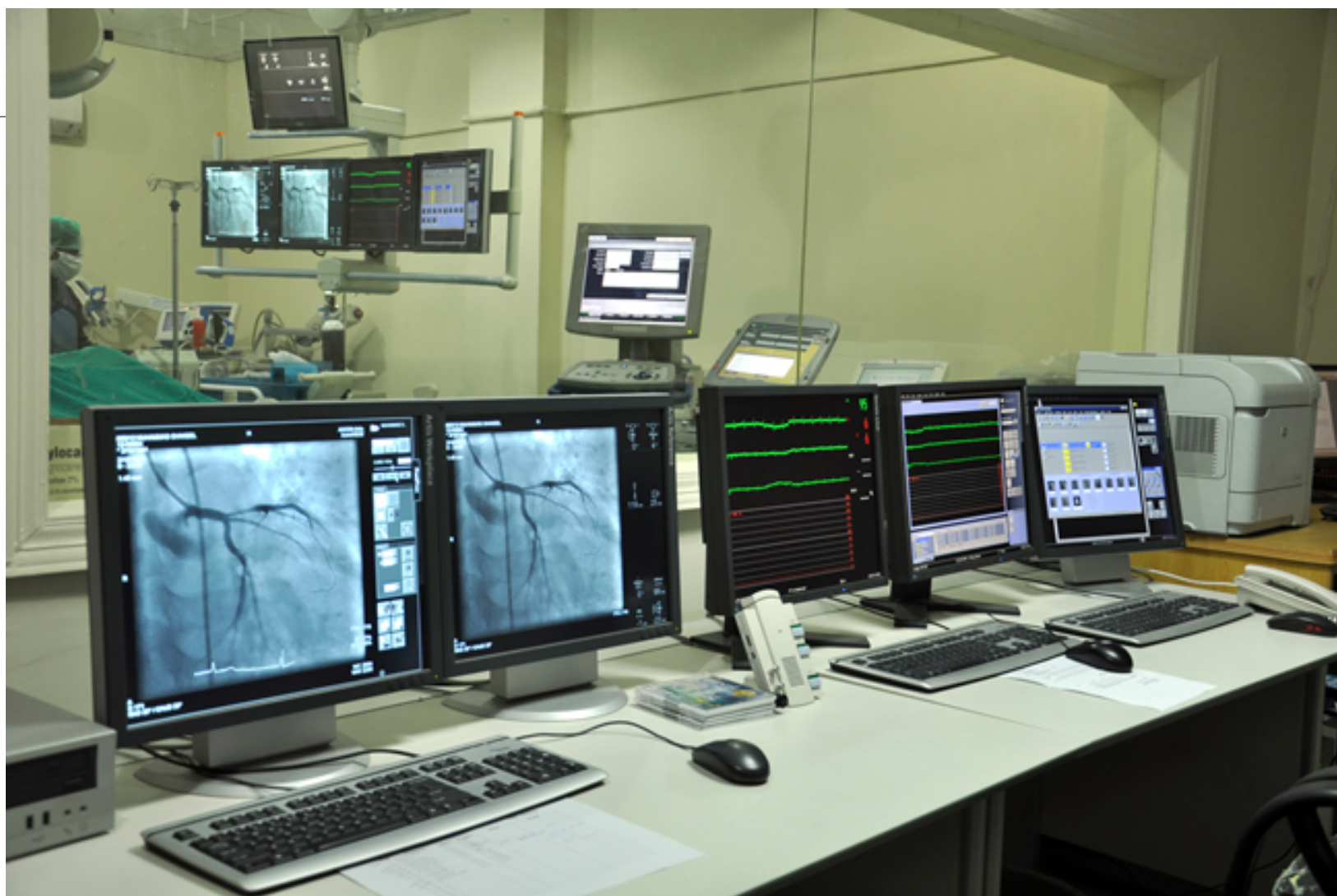
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The key elements of the cardiac catheterization laboratory :

- Control room
- Anesthesia cart and vital signs monitoring system,
- the imaging system
- Data-processing/archiving system,
- Data review and report station.







## Contraindications to Cardiac Catheterization

**TABLE 19.2** Relative Contraindications to Diagnostic Cardiac Catheterization

Acute gastrointestinal bleeding
Severe hypokalemia
Uncorrected digoxin toxicity
Anticoagulation with INR >1.8 or severe coagulopathy
Previous anaphylactoid reaction to contrast media
Acute stroke
Acute renal failure or severe chronic non–dialysis-dependent kidney disease
Unexplained fever or untreated active infection
Severe anemia
Recent cerebrovascular event (<1 month)
Uncooperative patient
Pregnancy

# Contraindications to Cardiac Catheterization

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Most contraindications are currently viewed as “**relative**” except **for inadequate equipment or catheterization facility.**

As outlined in the 1999 ACC/AHA coronary angiography guidelines, it is also a contraindication to perform a catheterization in patients who

- **would not want further actions to be taken**
- **whom nothing is to be gained in terms of management decisions, quality of life, or life expectancy.**



**Preprocedural Preparation of Patient**



# Preprocedural Preparation of Patient

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## 1. History

- History of present illness
- Past medical history emphasis of
  - prior cardiac and vascular events and procedures
  - Comorbidities such as DM, CKD, liver disease, hematologic diseases (e.g., heparin-induced thrombocytopenia), and infectious diseases (e.g., HIV, hepatitis)
- Medications
- Allergic reactions (to drugs, latex, or contrast material, as well as any prior problems with anesthesia)
- Physical examination (heart, lung, and vascular access status as well as the volume and neurologic status)

# Preprocedural Preparation of Patient

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## 2. Laboratory tests

- Complete blood count with platelets
- Serum electrolyte determinations
- Creatinine and estimated glomerular filtration rate (**eGFR**)
- Prothrombin time (PT) with (**INR**) is now recommended only for patients receiving warfarin or with hepatic or hematologic disease
- Partial thromboplastin time (**PTT**) for those receiving heparin
- Women of childbearing age should have a pregnancy test (**BHCG**)
- A 12-lead **ECG**

A time frame of **2 to 4 weeks of the procedure** is sufficient unless a change in clinical status has occurred.

# Preprocedural Preparation of Patient

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- ❖ Patient groups that may benefit from preprocedural hospitalization for preparation for diagnostic catheterization include those with
  - ❖ Severe congestive heart failure
  - ❖ Stage 4 CKD requiring additional preprocedural hydration
  - ❖ Those receiving oral anticoagulation who need to but cannot be bridged by low-molecular-weight heparin (e.g., mechanical heart valve patients)

# Preprocedural Preparation of Patient

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Patients in atrial fibrillation receiving anticoagulation need to be advised to discontinue :

- **warfarin** approximately 3 days before the procedure.
- The **INR** should be less than 1.8 for a femoral approach and less than 2.2 for a radial approach



# Preprocedural Preparation of Patient

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**Dabigatran** should be discontinued :

- 24 hours before catheterization if eGFR of 80 mL/min or greater,
- 36 hours if 50 to 79 L/min,
- 48 hours if 30 to 49 mL/ min.
- If **PCI** is likely to be performed (in addition to diagnostic catheterization), these timelines should be extended by a **factor of 2**.

# Preprocedural Preparation of Patient

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Direct Xa inhibitors (**Rivaroxaban**, **Apixaban**, or **Edoxaban**) should be discontinued :

- 24 hours before the procedure if the eGFR is 30 mL/min or higher,
- otherwise at least 36 hours.
- In case PCI is a possibility, the timeline for discontinuation is at least 48 hours

# Preprocedural Preparation of Patient

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- ❖ **Aspirin** and **other oral antiplatelet** agents are continued before the procedure.
- ❖ Patients taking **Metformin** should hold the medication the morning of the procedure and not resume until renal function is stable for at least 48 hours after the procedure.

# Preprocedural Preparation of Patient

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- ❖ All patients but especially those with diabetes and chronic kidney disease (CKD) should receive **periprocedural hydration** to reduce the risk of contrast-induced nephropathy (CIN).
- ❖ No intervention other than **fluid volume** has been shown to be effective, but the definite amount depends on baseline fluid status and cardiac function.

# Preprocedural Preparation of Patient

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- ❖ If tolerated, a total of 1 liter of normal saline should be administered from start to completion of the procedure.
- ❖ limit the amount of contrast material (as a general rule,  $<3.7$  times eGFR)

# Preprocedural Preparation of Patient

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- ❖ Patients with a history of **anaphylactoid reaction to contrast** (angioedema, flushing, pruritus, urticaria, bronchospasm, arrhythmia, shock) or **atopic conditions** are at highest risk for acute hypersensitivity reactions to contrast and should be adequately prepared to avoid this complication
- ❖ Even though this is less common with arterial than with venous contrast administration.

# Preprocedural Preparation of Patient

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- ❖ The most common premedication regimens are:
  - ❖ 60 mg of **prednisone** the night before and the morning of the procedure
  - ❖ 50 mg of prednisone 12 hours, 7 hours, and 1 hour before the procedure
  - ❖ 100 mg of **hydrocortisone** 12 hours and immediately before the procedure
  - ❖ 200 mg of hydrocortisone 2 hours before the procedure
  - ❖ **Cimetidine** (300 mg by intravenous push or by mouth),
  - ❖ **Diphenhydramine** (25 to 50 mg by IV push) may also be given just before the procedure

# Preprocedural Preparation of Patient

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- ❖ Patients with medication and food allergies might have a predisposition, but they are usually not premedicated
- ❖ No special preparation is required for those with a **shellfish allergy**
- ❖ It is important to be aware of possible **delayed hypersensitivity reactions**, presenting with fever and rash up to **48 hours after the procedure**.



# Preprocedural Preparation of Patient

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- ❖ patients fast before the procedure:
  - ❖ no **liquid**s up to **2** hours before
  - ❖ no **solid** food up to **6** hours before the procedure

# Preprocedural Preparation of Patient

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- ◆ **IV access** for hydration and drug administration
- ◆ **ECG telemetry** and **pulse oximetry**.



# Intra procedural Care

# Intraprocedural Care

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- ❖ procedural briefing should be performed include :
  - ❖ patient's name and medical record number
  - ❖ procedure to be performed
  - ❖ need and availability of necessary equipment
  - ❖ patient's allergies and pre medications
  - ❖ renal and anticoagulation status
  - ❖ antiplatelet therapy status if intervention considerate
  - ❖ signed informed consent.

# Intraprocedural Care

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- ❖ Comprehensive preprocedural **checklists** have also been used and are recommendable to maintain a uniform standard.
- ❖ If a hemodynamic catheterization is requested, this should be done before any contrast exposure, which could otherwise influence measurements given its vasoreactivity.





# Postprocedural Care

# Postprocedural Care

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- ❖ After completion of the procedure, the patient is transferred to a **monitored bed** and the post care area.
- ❖ If only a diagnostic card ac catheterization was performed, most patients can be **discharged** within **2 to 6 hours after the procedure** unless some high-risk features are present, complications occurred, or supportive care is needed such as hydration or anticoagulation.

# Postprocedural Care

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- ❖ In **Radial access sheaths**, we use an **inflatable wristband** for hemostasis and a deflation protocol thereafter.



# Postprocedural Care

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- ❖ With **Femoral access** **manual compression** is used. often done in the **postprocedural area**. Firm pressure is applied approximately 2.5 to 5 cm (1 to 2 inches) above the skin incision point **for 10 minutes**.
- ❖ Followed by bed rest for **2 hours in case of 4F-6F sheaths** and 3 to 4 hours for sheaths greater than 6F.

# Postprocedural Care

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- ❖ **Venous sheaths** are removed either in the catheterization laboratory or in the postprocedural area and require approximately 5 to 10 minutes of firm compression.

# *complications*

**TABLE 20.1** Risks Associated with Coronary Angiography

COMPLICATION	RISK (%)
Mortality	0.11
Myocardial infarction	0.05
Cerebrovascular accident	0.07
Arrhythmias	0.38
Vascular complications	0.43
Contrast agent reaction	0.37
Hemodynamic complications	0.26
Perforation of heart chamber	0.03
Other complications	0.28
Total of major complications	1.70

*Modified from Scanlon P, Faxon D, Audet A, et al. ACC/AHA guidelines for coronary angiography. J Am Coll Cardiol 1999;33:1756.*

# complications

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- ❖ **Bleeding** remains the most common complication and reason for postprocedural hospitalization
  - ❖ Access site Bleeding
  - ❖ non-access site Bleeding
    - ❖ **Underlying comorbidity** unmasked by the anticoagulation and antiplatelet therapy (e.g., peptic ulcer disease)
    - ❖ **Complication of the procedure** (e.g., pericardial bleed)

# complications

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- ❖ Access-site bleeds can present as **minor oozing, more brisk bleeding, ecchymosis.**
- ❖ As a preventive effort, **all sheaths should be removed as soon as possible.**
- ❖ in case of anticoagulation with heparin once the **ACT is below 160 to 180 seconds** and after 2 hours in case of bivalirudin .
- ❖ Protocols for sheath removal and after care should be in place, including **distal extremity and blood pressure evaluation.**

# complications

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- ❖ major vascular complications include
  - ❖ Hematoma formation
  - ❖ Retroperitoneal bleeding
  - ❖ Pseudoaneurysm
  - ❖ Arteriovenous fistula formation
  - ❖ Occlusion requiring arterial repair or thrombectomy
  - ❖ Infection

# Complications (**Retroperitoneal hematoma**)

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- ◆ **Female gender, lower body mass index**, and higher **femoral arterial puncture site** (above the upper third of femoral head) are the main risk factors.
- ◆ **retroperitoneal hematoma** should be suspected in patients with unexplained hypotension and tachycardia, (the latter being a distinguishing feature from vagal reactions, even though bradycardia may occur as well.)

# Complications (**Retroperitoneal hematoma**)

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- ❖ most common presenting symptoms of **Retroperitoneal hematoma** :
  - ❖ hypotension (92%)
  - ❖ diaphoresis (58%)
  - ❖ groin pain (46%)
  - ❖ abdominal pain (42%)
  - ❖ back pain (23%)
  - ❖ bradycardia (31%)
  - ❖ urinary or bowel urgency
  - ❖ peritoneal signs/irritation
  - ❖ femoral neuropathy



# Complications (**Retroperitoneal hematoma**)

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- ❖ A Hb drop on **serial CBC** usually lags behind, and the interpretation may be confounded by the administration of fluid (and sometimes other blood losses) during the procedure
- ❖ **CT of the pelvis and abdomen** should be performed as clinical suspicion demands.
- ❖ Angiographic approach might be taken to visualize the vascular injury site and either aim to occlude it percutaneously or direct toward surgery.

# Complications (**pseudoaneurysms**)

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- ❖ **Ultrasound** is the test of choice with concern for vascular complications more local to the access site, such as **pseudoaneurysms**.
- ❖ They are classically seen with a
  - ❖ **low or lateral femoral artery puncture**
  - ❖ **excessive anticoagulation at the time of sheath removal**
  - ❖ **inadequate compression of the puncture (access) site.**

# Complications (**pseudoaneurysms**)

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- ❖ The typical presentation of **pseudoaneurysms** is
  - ❖ groin tenderness
  - ❖ palpable pulsatile mass
  - ❖ systolic bruit

# Complications (**pseudoaneurysms**)

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- ❖ **Sizes less than 2** cm represent a low likelihood of rupture and may be followed clinically with serial ultrasound to document spontaneous thrombosis
- ❖ **Larger than 2** cm in size, ultrasound-guided manual compression with or without thrombin or collagen injection is the treatment of choice. Covered stent placement or surgery are rarely required.

# Complications (AV fistulas)

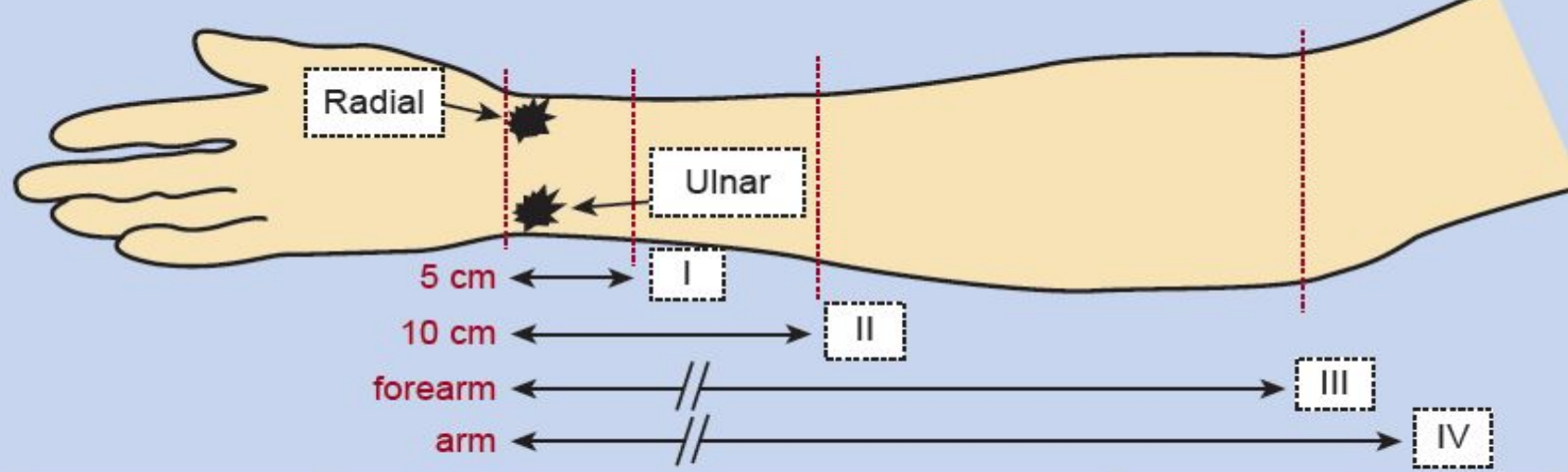
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- ❖ Arteriovenous (AV) fistulas have been reported to occur at an incidence of 0.25% to 1%.
- ❖ more common with low femoral accesses
- ❖ Pain ,swelling, and bruit are signs and symptoms
- ❖ ultrasound is diagnostic
- ❖ Intervention is required only if significant shunting occurs (stent graft or vascular surgery).

# Complications (**radial artery** )

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- ❖ After **radial artery catheterization**, vascular complication and access related bleeding can be more subtle, and unnoticed and untreated hematoma can progress to the point of forearm compartment syndrome.
- ❖ **Pain** and **paresthesia** should serve as warning signs, and protocols for easy recognition and management have been developed.



GRADE	I	II	III	IV	V
INCIDENCE	≤5%	<3%	<2%	≤0.1%	<0.01%
DEFINITION	Local hematoma, superficial	Hematoma with moderate muscular infiltration	Forearm hematoma and muscular infiltration, below the elbow	Hematoma and muscular infiltration extending above the elbow	Ischemic threat (compartment syndrome)
TREATMENT	Analgesia Additional bracelet Local ice	Analgesia Additional bracelet Local ice	Analgesia Additional bracelet Local ice Inflated BP cuff	Analgesia Additional bracelet, Local ice Inflated BP cuff	Consider surgery
NOTES		Inform physician	Inform physician	Inform physician	STAT call to physician
REMARKS	<ul style="list-style-type: none"> <li>- Control blood pressure (BP) (importance of pain management)</li> <li>- Consider interruption of any anticoagulation and/or antiplatelet infusion</li> <li>- Follow forearm and arm diameters to evaluate requirement for additional bracelet and/or BP cuff inflation</li> <li>- Additional bracelet(s) can be placed alongside artery anatomy</li> <li>- Ice cubes in a plastic bag or washcloth are placed on the hematoma</li> <li>- Finger O<sub>2</sub> saturation can be monitored during inflated blood pressure cuff</li> <li>- To inflate blood pressure cuff, select a pressure of 20 mm Hg &lt; systolic pressure and deflate every 15 minutes</li> <li>- After bracelet removal, use "Velpeau bandage" around forearm/arm for a few hours to maintain mild positive pressure</li> </ul>				

# Complications (**radial artery**)

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- ❖ Adequate hemostasis is important, but it is also critical to maintain **patency of the radial artery**, especially at sheath removal and shortly thereafter.
- ❖ **Compression of the ipsilateral ulnar artery** limited to this acute phase has sufficed to reduce radial artery occlusion. **Additional administration of vasodilators and adequate anticoagulation** are important interventions.
- ❖ Otherwise, radial artery occlusion rates can be as high as 15% acutely and 3% to 5% chronically.



# complications

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- ❖ The differential diagnostic considerations for **hypotension**
- ❖ Vasovagal reactions
- ❖ Severe (retroperitoneal) bleeds
- ❖ Contrast reaction

# Complications (Contrast reaction)

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- ❖ **Hives** are less common with low-osmolar contrast agents and intra-arterial administration
- ❖ **anaphylactoid reactions** are very rare
  - ❖ IV corticosteroid and diphenhydramine are the main agents. Epinephrine is reserved for severe reactions, such as **anaphylactic shock**.
- ❖ Patients with severe allergic reactions and anaphylaxis should be observed at least overnight.

# complications

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- ❖ Any patient with **chest pain** should have a **12-lead ECG**, and those with significant changes, especially ST-segment elevation and after coronary angiography, should be taken back to the **catheterization laboratory**.

# complications

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- ❖ In patients with **chest pain**
  - ❖ Dissection should be ruled out
  - ❖ Embolization especially if the aortic valve was crossed
  - ❖ If a right-heart catheterization was performed,
    - ❖ pulmonary embolism
    - ❖ pulmonary infarction,
    - ❖ pulmonary artery or right ventricular (RV) perforation

# complications

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- ❖ The most common complications of right-heart catheterization, however, are **minor, non sustained atrial or ventricular arrhythmias.**

# complications

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- ❖ Risk of neurologic complications is 0.03% to 0.2%.
- ❖ Those with **severe aortic atherosclerosis** and **aortic stenosis** are at higher embolic risk.

# complications

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- ◆ **Neurologic deficits** can be noted at the time of or within a few hours after the procedure, and it is not clear whether the mechanisms differ by time of presentation.

# complications

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- ❖ known risk factors for stroke:
  - ❖ The length of the procedure
  - ❖ volume of contrast material
  - ❖ urgent indications
  - ❖ use of intra-aortic balloon pumps (IABPs)
  - ❖ diabetes mellitus
  - ❖ Hypertension
  - ❖ previous stroke
  - ❖ renal failure.



A purple rectangular tag with a hole on the left side is the central focus. It is surrounded by three white daisies with yellow centers. A light-colored string is looped around the tag and one of the daisies in the background. The entire scene is set against a rustic, textured wooden background.

Thank  
you!