EINSTEIN MEDICAL CENTER

Division of Cardiovascular Diseases
Interventional Cardiology
Fellowship Program Curriculum
2021

TABLE OF CONTENTS

I. GENERAL INFORMATION

A. Background

1. Training in interventional cardiology (level 3) is now limited to formal training programs. All applicants entering interventional cardiology must have completed an Accreditation Council for Graduate Medical Education (ACGME)-accredited cardiovascular disease program or its equivalent.

2. The Residency Review Committee (RRC) of the ACGME developed a formal accreditation process effective in September of 1998 for interventional cardiology training program.

3. The ACGME also developed threshold standards of quality that all fellowship training programs must meet in order to be accredited.

4. The general program requirements for fellowship education in the subspecialties were revised 4/25/04, received ACGME approval 9/28/04 and became effective 7/1/05.

5. The American College of Cardiology (ACC) updated the requirements for optimal training in interventional cardiology, endorsing the ACGME standards for program accreditation.

   Finally, the American Board of Internal Medicine offered an added qualification examination in interventional cardiology beginning October 1999.

B. Interventional Cardiology Program at Einstein Medical Center (EMC)

1. The interventional cardiology fellowship program at Einstein Medical Center received a full accreditation from the ACGME in May 1999 for two positions starting the beginning of each academic year for the duration of one year.

2. The program is in full compliance with the basic training standards developed by the ACC Task Force 3 of the revised Core Cardiology Training in adult cardiovascular medicine (COCATS 2) and satisfies the ACGME requirements for residency education in interventional cardiology which became effective July 2002 and were revised July 1st, 2005.

3. The program's information is annually reported/updated by electronic filing with

Web Accreditation Data System (ADS), located on the ACGME website (www.acgme.org)

4. Interventional Cardiology Training will be at EMCP.

C. Lines of Responsibility for Interventional Cardiology Fellows

Fellows planning to perform interventional cardiology procedures (i.e. percutaneous transluminal coronary angioplasty, percutaneous balloon valvuloplasty, athethectomy, coronary stentings, and intracoronary diagnostic procedures) are recommended to undergo a minimum of one additional year of training following successfully completion of a cardiology fellowship. As advanced cardiology fellows they are expected to have fully completed the required level II training in diagnostic cardiac catheterization and coronary angiography prior to starting an interventional cardiology fellowship.

Fellows planning to perform coronary and other interventional procedures must also have knowledge of the indications, limitations and complications of these procedures, as well as, an in-depth understanding of the specialized equipment needs. In general, the fellow works under the direct physical supervision of an interventional cardiologist. The Director of the Cardiac Catheterization Laboratory or his/her designee assigns cases for the interventional cardiology fellows daily. In general, the schedule will be released the night prior to each intervention to allow the interventional cardiology fellow to evaluate and review the patient in advance; the interventional cardiology fellow will perform a history and physical examination on each patient, or review the H&P performed by the general Cardiology fellow. He/she also is expected to summarize the appropriate clinical concerns and outline the plans for the expected intervention. The interventional cardiology fellow is expected to discuss the case verbally with the responsible interventional attending prior to the beginning of the procedure.

Specific, technical responsibilities of each interventional cardiology fellow during each procedure will be determined by the supervising interventional cardiology attending performing the procedure. In general, the interventional cardiology fellows will perform aspects of the procedures for which they have sufficient experience. The supervising interventional cardiology attending will determine exactly which components of the procedure that can be specifically performed by the fellow. As the fellow increases his/her experience and knowledge of interventional procedures, it is expected that he/she will assume a higher level of responsibility. During the second half of the year the fellow will be the primary operator in every case, unless the attending physician chooses otherwise. At the completion of each case, the interventional cardiology fellow is responsible for documenting a note indicating the procedure, the findings and any complications of the procedure in the medical record. The responsible interventional cardiology attending physician is expected to appropriately amend the note to reflect his/her findings, in addition, the fellow is required to write post procedure orders.

The fellow is responsible for arranging removal of arterial sheaths. This responsibility may be designated to the highly trained nurses during the day or may require removal by the fellow as dictated by the circumstances. It is imperative that each fellow discuss the plan of sheath removal

with the responsible attending. The interventional cardiology attending is responsible for dictating the formal catheterization report. The fellow is expected to communicate important findings to the clinical cardiology fellows, internal medicine residents, or other members of the house staff. He/she is expected to examine the patient the day following the procedure to determine the outcome results of the procedure and determine if there are any complications.

D. Supervision of Interventional Cardiology Fellows

Supervision of interventional cardiology fellows is provided by the interventional cardiology attending physician who will be present in the cardiac catheterization laboratory throughout the procedure. Removal of the vascular sheaths and obtaining hemostasis by applying manual pressure or utilizing hemostatic devices may be performed by the interventional cardiology fellow after direct communication with the interventional cardiology attending. The same attending physician also shares with the interventional cardiology fellow in the pre and post-procedural evaluation and care of the patient. The interventional cardiology fellow is encouraged to maintain a direct dialogue with the interventional cardiology attending at each junction of the patient care and management.

E. Call Schedule

Call responsibilities include 24 hour coverage for Interventional services under the supervision of Interventional faculty. The number of hours worked per week is not to exceed 80 hours in house. The schedule will be made so that each Interventional Cardiology fellow is assured 24 hours times off during every seven day period, when averaged over a four week period.

II. TRAINING PROGRAM GOALS AND STRUCTURE

A. Educational Goals

1. The ultimate goal of the interventional cardiology training program is to prepare the trainees for the delivery of a high level clinical interventional cardiology care to their patients through the acquisition of appropriate cognitive knowledge and a high level of technical skill for performing interventional cardiology procedures.

2. ACGME Competencies. The fellowship program provides educational experience which must encompass six areas of competency related to the patient care, medical knowledge, practice based learning, interpersonal and communication skills, professionalism and system based practice.

B. Training Objectives

The fellowship training program provides educational experience according to ACGME Competency requirements and encompasses the recommended six areas of competencies. The training objectives include:

1. To understand the effectiveness and limitation of coronary interventional procedures in order to select patients and procedure types appropriately and to integrate verbal, written and electronic knowledge concerning clinical knowledge in general to individual patients. **(Patient care, procedure skills, medical knowledge, system-based practice, interpersonal and communication skills).**

1. To achieve the appropriate cognitive knowledge and technical skills needed to perform interventional cardiology procedures at the level of quality attainable through the present state of the art. **(Patient care, procedure skills, medical knowledge, system-based practice, interpersonal and communication skills).**

2. To foster an attitude of life-long learning and critical thinking skills needed to gain knowledge form experience and incorporate new developments into practice patterns. **(Patient care, procedure skills, medical knowledge, system-based practice, interpersonal and communication skills).**

3. To understand and commit to quality assessment and improvement in procedure performance. **(Patient care, procedure skills, medical knowledge, system-based practice).**

4. To supervise, back-up and serve as role model for the cardiology fellows in the cardiac catheterization laboratory. **(Patient care, procedure skills, medical knowledge, interpersonal and communication skills, professionalism).**

5. To develop the humanistic attitude, professional behavior and communication skills required of an interventional cardiologist. **(Interpersonal and communication skills, professionalism).**

6. To develop an in-depth research interest and project based on clinical observation, discussion with mentors and appropriate review of written and electronic scientific knowledge. **(Patient care, procedure skills, medical knowledge, system-based practice, interpersonal and communication skills).**

7. The senior cath fellow should strive to be primary operator as commensurate with his/her ability. The fellow should plan the study based on the specific clinical question to be answered prior to its performance. **(Patient Care,**

Procedure Skills, Medical Knowledge, Practice-Based Learning and Improvement).

8. Concentrate on the fine points of angiography such as customizing catheter selection and angiographic angles of the image intensifier to the patients specific anatomy and clinical questions. **(Patient Care, Procedure Skills, Medical Knowledge, Practice-Based Learning and Improvement).**

9. Concentrate on the fine points of hemodynamics measurement such as the evaluation of intracardiac shunts in congenital heart disease, use of pharmacologic provocation in obstructive cardiomyopathy and pulmonary hypertension, valvular stenosis in the low output state and the differentiation of the findings of pericardial tamponade, pericardial constriction and cardiac restriction. **(Patient Care, Procedure Skills, Medical Knowledge, Practice-Based Learning and Improvement).**

III . EDUCATIONAL PROGRAM

A. Training Program curriculum

1. Duration and Scope of Education

   - The interventional cardiology training program is accredited for 12 continuous months of clinical training- COCATS Level 3 – which must be carried out during one continuous year of fellowship dedicated exclusively to cardiac interventional training and predominantly focused on diagnostic and interventional cardiac procedures.

2. All applicants entering interventional cardiology will have completed a cardiovascular disease fellowship accredited by the ACCME. Preceptorship and on-the-job training are no longer recognized as viable methods of training.

3. The subspecialty educational program in interventional cardiology will function as an integral component of the accredited subspecialty fellowship in cardiovascular diseases.

4. Participation is a minimum of 250 interventional procedures is required by the ACGME. The ACC recommends this experience level as a threshold value and advises against exceeding 600 procedures per year.

B. Faculty

The cadre of faculty in the interventional cardiology program at Albert Einstein Medical Center consists of the following fulltime attending physicians:

Program Director: Christian Witzke, MD

Key Clinical Faculty: Sahil Banka, MD

Other Faculty: N/A

C. Facilities and Resources

1. Einstein Medical Center's cardiac catheterization laboratory is equipped with four fully functional state-of-art rooms with X-ray generator units from Phillips Company capable of producing high quality digital radiographic images, for coronary and peripheral diagnostic and interventional procedures. Two rooms were recently upgraded to accommodate high quality peripheral vascular procedures. The third room was recently upgraded to a hybrid room to accommodate cardiac procedures, structural heart procedures, peripheral arterial procedures, complex endovascular procedures, and combined cardiac interventional and cardiac surgical procedures.

2. The GE hemodynamic monitoring system provides high quality physiologic monitoring and recording with large storage capabilities.

3. The McKesson CIS unit for storage, review and reporting is available not only for the diagnostic cardiac catheterization and interventional cases but also for other invasive and non-invasive cardiology and radiologic studies performed in the Division of Cardiovascular Diseases.

4. Other resources and support services:

.

    a. The following ancillary support services are available at EMC:

        1. Clinical inpatient and ambulatory services

        2. Echocardiography and stress testing

        3. Cardiac radionuclide Laboratory including new Cardiac CTA, MRI, and MRA studies

        4. Active cardiac surgery program

5. Cardiac surgical intensive care unit
6. Clinical electrophysiology
7. Cardiovascular critical care unit
8. Vascular and interventional radiology
9. Vascular Surgery
10. Anesthesia
11. Hematology
12. Respiratory Therapy to support evaluation of complex hemodynamic abnormalities of the heart and lungs.

5. EMC Catheterization Laboratory is very richly supplied with a variety of FDA approved equipments and devices for the performance of diagnostic and interventional cardiac catheterization procedures and peripheral diagnostic and interventional procedures including:

    A. A wide array of diagnostic catheters and interventional guide catheters

    B. A wide array of guidewires, balloons and stents for coronary intervention

    C. Atherectomy and chronic total occlusion devices

    D. Coronary physiologic measurement technologies for coronary flow reserve and fractional flow reserve determinations

    E. Intravascular ultrasound (IVUS)- Boston Scientific and Volcano Systems

    F. Intracardiac ultrasound (ICE)

    G. Thrombectomy devices- (Rotational, Orbital, Directional, and Spectranetics Laser)

    H. Distal and proximal protection devices

    I. Retrieval devices

    J. Intra-aortic balloon pumps

    K. Percutaneous left ventricular support devices including Impella and Tandem Heart devices

    L. Endomyocardial biopsy systems

    M. A wide array of diagnostic and interventional equipment and devices for peripheral vascular disease management

    N. A wide array of devices for the invasive management of structural heart disease including septal occlusion devices, coiling devices and valvuloplasty equipment

D. EDUCATIONAL CONTENT

1. The following are the components of our interventional cardiology fellowship program, the areas where the fellows are given the opportunity of acquiring the required cognitive knowledge and technical skills:

   a. Clinical experience through in-patient activities,

      (1) Pre and Post procedure patient evaluation and management.
      (2) Active involvement in the critical manipulation of the procedure.

   b. Out-patient follow-up program.

   c. Clinical conferences.

   d. Didactic formal lectures.

E. PRINCIPLE TEACHING METHODS:

1. The overall activities of the fellows are organized and overseen by the Program Director.

2. The key clinical faculty, together with the Program Director, are responsible for planning, implementation, monitoring and evaluation of the fellows clinical and research training.

3. All clinical faculty members, will participate in prescribed faculty development programs designed to enhance the effectiveness of their teaching.

F. FELLOWS ASSIGNMENTS AND RESPONSIBILITIES

1. Fellows will participate in all cardiac interventional procedures at EMC. In each case the fellows must:

   a. Participate in pre-procedural evaluation of the patient and pre-procedural planning, including the indications for the procedure and the selection of the appropriate procedure and instruments.

   b. Perform the critical technical manipulations of the procedure under direct supervision of an attending physician.

   c. Demonstrate substantial involvement in post-procedure care.

1. The specific responsibilities of the fellows in each area include:

    a. Post-procedure care:

        1. Review the available medical data/medical chart and obtain confirmatory History and physical examination with special attention given to the factors known to increase the risk of the procedure, including vascular disease, renal failure, diabetes mellitus, history of contrast reaction, congestive heart failure, anemia, active infection and conditions known to increase the risk of bleeding.

        2. Obtain information related to any prior cardiac catheterization studies, interventional percutaneous or surgical invasive procedures and finally any non-invasive cardiovascular studies (stress tests, echocardiography and other modalities).

        3. Obtain informed consent.

        4. Assess appropriateness of the procedure and to plan procedural strategies.

        5. Write a pre-procedure note that should include indications for the procedure, risk of the procedure and alternative to the procedure.

    b. In-Lab Performance:

        1. Performance of the procedure by the trainee should be always under the direct supervision of a program faculty member. Personal performance of the trainee of the case's critical manipulation is the ultimate goal, however, the nature of the trainee's participation in a given case will vary depending on the procedure's complexity and the trainee's experience.

        2. A program's training strategy should provide that the trainee's responsibility and involvement in the case's technical manipulations progressively increase as experience is gained. The trainee should also be involved in procedure reporting and the process of insuring quality.

Addendum: Highly experience COCATS Level 3 trainees may collaborate in a diagnostic cardiac catheterization procedure with COCATS Level 1 or 2 trainees under the direct supervision of a program faculty member. In these circumstances, both level trainees may claim

credit for participation in the diagnostic procedure by the junior fellow and for the interventional procedure by the interventional cardiology fellow.

c. Post-Procedural Management:

1. The trainee is required to be actively involved in post-procedural management of the patient in the Lab at the conclusion of the case and on the in-patient unit afterward. These duties include:

    a. Post-procedural note.

    b. Monitoring and following the patient's condition while in the Lab post-procedure.

    c. To be available to respond to, and to participate in management of any adverse reactions or complications that may arise.

    d. A post-procedural follow-up note should be completed before hospital discharge, preferably within a reasonable time after the procedure.

d. Core Procedure Capability:

1. A comprehensive training program should offer a core experience in the following interventional techniques.

    a. Core skills include conventional balloon angioplasty, coronary stents, coronary atherectomy, primary angioplasty for acute myocardial infarction, intra-vascular ultrasound, intra-aortic balloon counterpulsation and other mechanical circulatory supports.

    b. Optional skills include cardiac valvuloplasty, endomyocardial biopsy, Doppler coronary flow measurement and transcatheter closure of structural cardiac defects.

2. Trainees should be experienced in the full range of arterial vascular access techniques. These should include transfemoral approaches, transradial and brachial access.

3. Coronary interventional experience should include the full range of coronary interventional activity. Thus, a trainee should have experience treating the full range of coronary

lesion morphologic subsets. This includes type A, B and C lesions; total occlusions; heavily calcified lesions; saphenous vein graft lesions; and lesions accessed via arterial bypass grafts.

3. Clinical Conferences

a. The ACGME and the ACC (COCATS 2) mandate that the interventional cardiology training program should conduct a regularly scheduled clinical interventional cardiology conferences-ideally weekly-to:

(1) Review and critique both diagnostic and interventional cases with respect to case selection, procedure conduct and outcome, including the review and the discussion of all adverse outcomes that occur within the training program.

(2) Present and discuss the cognitive interventional cardiology curriculum subject matter basic to interventional cardiology-see also the formal didactic lectures.

b. Additionally, the present cardiology training program should operate a joint cardiology/cardiac surgery clinical conferences at which a broad spectrum of clinical issues are discussed. Many topics will be relevant to interventional cardiology.

c. The faculty and trainees should have "active participation in these conferences.

d. At Einstein Medical Center, the following clinical conferences are made available to the trainees in interventional cardiology program:

(1) Weekly interventional cardiology conferences are held on Thursday from 7:15 to 8 am. The cases that have undergone diagnostic and interventional procedures during the previous week will be presented and analytically reviewed with respect to case selection, their technical aspects, selection of procedure strategies and outcome, including all adverse outcomes occurring during or immediately after the procedure.

(2) Weekly hemodynamic/cath conferences every Thursday from 8:00 to 9:00 AM,. This format begins with a case presentation, including a brief review of the history and the physical examination as well as non-invasive findings and concludes with a brief review of the literature on the subject matter related to the case. Indication for the procedure, complications and

management strategies will be covered. Each conference is assigned at the beginning of the year. Each conference is overseen by an attending interventionalist.

(3) Formal Didactic Lectures.

a. A lecture series (10 lectures or more) by the program faculty members will be provided primarily as part of the core curriculum lecture series during the months of July and August, as well as at the time of hemodynamic allocation of attending physician days on the first Mondays of the months, covering important topics in anatomy, physiology, vascular biology and pathology, hemostasis, pathophysiology, pharmacology, radiology imaging and radiation safety, intra-coronary imaging and coronary physiology, interventional device design and performance and finally, clinical management strategies. See the attached appendix for dates and subjects.

b. Attendance to the above conferences will be mandatory and conference time, except for absolute emergencies, will be protected. Interventional cardiology trainees are also required to attend at least 50% of the following general cardiology conferences.

(4) Monthly cardiology/cardiothoracic surgical morbidity & mortality conferences held every third Wednesday of each month from 8:00 AM to 9:00 AM.

(5) Cardiology Grand Rounds weekly on Wednesday from 8:00 AM to 9:00 AM except for the third Wednesday of each month when cardiology/cardiothoracic M&M will be conducted.

(6) Journal club on Tuesday from 8 AM to 9 AM and occasionally Wednesday from 12 to 1pm.

4. Ambulatory Follow-up Program:

    a. Goals

        1. This experience must provide an opportunity for the fellows to observe and learn the natural history of the disease and to evaluate the short and mid-term results of the interventional procedures.

    b. Requirements

        1. This continuity care experience includes the attendance in ambulatory outpatient facilities ½ day each week where between four to eight patients are seen.

        2. Fellows will have the opportunity to obtain patient history and to perform physical examination, review the information and the findings with the attending physician and finally to discuss management plans.

        3. This experience can be accomplished in either:

            (a) A special dedicated outpatient cardiology clinic, half day per week directed and supervised by a member of the interventional cardiology staff where patients who had coronary interventions are seen by the cardiology fellow involved in the case for an early follow-up and check-ups.

            (b) The private office of one of the full time interventional cardiologists located on the third floor of the Moss Rehab Building where their private patients are seen.

5. Research

    a. As part of an academic environment, fellows are encouraged to participate in research activities of the department, as an additional tool to enhance the fellow's medical knowledge and to further their learning process.

IV. TRAINEE EVALUATION

A. Responsibilities for trainee evaluation resides with the Program Director who in collaboration with the other program faculty assesses and rates the trainees didactic and hands on training.

B. During training the Program Director should meet with the trainee periodically to provide a structured elusive feedback on his/her progress. This should include identification of deficiencies and shortcomings and formulation of a plan for remediation.

C. The trainee is responsible for the maintenance of detailed records in the form of a logbook that contains clinical information for each patient studied and/or treated in the Laboratory. Documentation must include a patient identifier, the procedure performed, assisting physicians and procedure outcomes including any encountered complications.

D. The training program has a database system that records the trainee's caseload experience.

E. The Program Director will use this system to validate the trainee's experience to certifying boards and credentialing bodies.

F. The overall evaluation should include assessment of the trainee's cognitive knowledge, technical skill and clinical and procedural judgment as well as the trainee's interpersonal relationship. To fulfill the requirements of the ACGME competencies, a detailed evaluation form is used for the interventional cardiology trainees at Einstein Medical Center, allowing the evaluation of each trainee in the following areas:

1. Patient care and Procedural Skills

2. Medical knowledge

3. Practice based learning and improvement

4. Interpersonal and communication skills

5. Professionalism

6. System based learning

7. Clinical skills

G. In addition the program utilizes focused observation and evaluation of procedures and conference presentations.

H. For each trainee, an evaluation form is completed every month by the Program Director and other active members of the invasive attending physicians. The content of

each evaluation is discussed with the trainee and the record is then maintained in the program file.

V. SPECIFIC PROGRAM CONTENT

A. Clinical Experience

1. Special Clinical Experiences. Fellows must have formal instruction clinical experience, and must demonstrate competence in the prevention, evaluation and management of both inpatients and outpatients with the following disorders:

a. chronic ischemic heart disease;

b. acute ischemic syndromes;

c. valvular and structural heart disease;

d. bleeding disorders or complications associated with percutaneous intervention or drugs including but not limited to:

(1) bleeding after thrombolytic usage;

(2) direct or indirect thrombin inhibitor usage;

(3) glycoprotein IIb/IIIa inhibitor usage; and;

(4) thienopyridine or other antiplatelet usage.

e. use and limitations of intra-aortic balloon counterpulsation (IABP) and other hemodynamic support devices (as available);

f. consultation and informed consent;

g. care of patients in the cardiac care unit, emergency department, or other intensive care settings;

h. care of the patient before and after interventional procedures;

i. outpatient follow-up of patients treated with drugs, interventions, devices, or surgery;

j. use of anti-arrhythmic drugs, including knowledge of pharmacokinetics and pharmacodynamics related to acute ischemic events occurring during and after interventional cardiac procedures;

k. use of thrombolytic and antithrombolytic, antiplatelet, and antithrombinagents; and

1. use of vasoactive agents for epieardial and microvascular spasm,

B. Technical and Other Skills

1. Fellows must have formal instruction, clinical experience, and must demonstrate competence in the performance ofthe following:

a. coronary arteriograms;

b. ventriculography;

c. hemodynamic measurements;

d. intravascular ultrasound;

e. Doppler flow, intracoronary pressure measurement and monitoring, and coronary flow reserve;

f. coronary interventions (Each fellow must perform a minimum of 250 coronary interventions, a single coronary intervention being defined as all coronary interventions performed during one hospitalization.);

(1) Femoral and brachial/radial cannulation of normal and abnormally located coronary ostia; and

(2) Application and usage of balloon angioplasty, stents, and other commonly used interventional devices.

g. Management of mechanical complications of percutaneous intervention, including but not limited to:

(1) coronary dissection;

(2) thrombosis;

(3) spasm;

(4) perforation;

(5) "slow flow/no reflow";

(6) cardiogenic shock;

(7) left main trunk dissection;

(8) cardiac tamponade including pericardiocentesis;

(9) peripheral vessel occlusion, and retained components; and

(10) pseudoaneurysm.

C. Formal Instruction

The training program will provide formal instruction for the fellows to acquire knowledge of the following, content areas:

1. The role of platelets and the clotting cascade in response to vascular injury;

2. pathophysiology of restenosis;

3. the role and limitations of established and emerging therapy for treatment of restenosis;

4. physiology of coronary flow and detection of flow-limiting conditions;

5. detailed coronary anatomy;

6. radiation physics, biology, and safety related to the use of x-ray imaging equipment;

7. the role of randomized clinical trials and registry exp eriences in clinical decision-making;

8. the clinical importance of complete versus incomplete revascularization in a wide variety of clinical and anatomic situations;

9. strengths and limitations, both short- and long-term, of percutaneous versus surgical and medical therapy for a wide variety of clinical and anatomic situations related to cardiovascular disease;

10. strengths and limitations, both short- and long-term of differing percutaneous approaches for a wide variety of anatornic situations-related to cardiovascular disease;

11. the role of emergency coronary bypass surgery in the management of complications of percutaneous intervention;

12. strengths and weaknesses of mechanical versus lytic approach for patients with acute myocardial infarction;

13. the use of pharmacologic agents appropriate in the postintervention management of patients;

14. strengths and limitations of both noninvasive and invasive coronary evaluation during the recovery phase after acute myocardial infarction;

15. understanding the clinical utility and limitations of the treatment of valvular and structural heart disease; and

16. the assessment of plaque composition and response to intervention.

VI. FORMAL DIDATIC LECTURES FOR INTERVENTIONAL CARDIOLOGY PROGRAM JULY 2021– JUNE 2022

CORE CURRICULUM LECTURE SERIES 2021-2022

Addendum

EINSTEIN MEDICAL CENTER
DIVISION OF CARDIOVASCULAR DISEASES
INSTITUTIONAL CURRICULUM CONFERENCE (ICC) SERIES

Institutional Curriculum Meeting Dates 2021-2022- DO Not have updated schedule yet

All conferences will be held on Wednesdays @ 7AM
Braemer Education Center
Gouley Auditorium

July 18, 2018	The Opioid Epidemic in Philadelphia
August 51, 2018	Standards of Care for LGBT Patients
September 19, 2018	Einstein's Report Card on Safety and Quality: Slip-Ups & Kudos
October 17, 2018	What?! How?! What now?! (or, Lets Get Woke!)
November 21, 2018	Dealing with Disruptive Patients: A Trauma-Informed Approach
December 19, 2014	House staff Forum
January , 2019	TBD
February , 2019	TBD
March , 2019	TBD
April , 2019	TBD
May , 2019	TBD
June , 2019	TBD

APPENDIX I
RECOMMENDED PRE-MEDICATIONS FOR ALLERGY TO CONTRAST MEDIA

1. Steroids (Prednisone 40 mg Q 6 Hrs x 3)

2. Antihistamines (Diphenhydramine-Benadryl 25 mg Q6 Hrs x 3)

3. H_2 blockers - optional - (Tagamet 300 mg, Zantac 150 mg, Axid 150 mg or Pepcid 20 mg, two doses 6-12 Hrs apart.

   Example

   On the day prior to catheterization:

   1. Prednisone 40 mg
      Benadryl 25 mg - P.O. at 6:00 PM

   2. Prednisone 40 mg
      Benadryl 25 mg - P.O. at 12:00 AM
      Tagamet 300 mg

   On the day of catheterization:

   3. Prednisone 40 mg
      Benadryl 25 mg - P.O. at 6:00 AM
      Tagamet 300 mg

In emergency cases, the coverage can be provided by the intravenous administration of 100 mg Hydrocortisone, 25 mg Benadryl and 150 mg Zantac, followed by the infusion of 100 mg Hydrocortisone in 250 ms D5W to run in the next 4 hours.

APPENDIX II
GUIDELINES FOR DIABETIC MANAGEMENT DURING AND AFTER CARDIAC CATHETERIZATION

TYPE OF DIABETIC TREATMENT	PARAMETER	TIME OF PROCEDURE 8 AM TO 12 NOON	12 NOON TO 4 PM
ALL	Food	NPO	Liquid Breakfast (100 cal)
	Fluids	IV's at 80-100 cc/hr when NPO and immediately post-procedure until Oral intake is assured	
INSULIN DEPENDENT	Insulin	1/2 - 2/3 usual intermediate Insulin (NPH, Lente) No regular insulin	Same as AM Usual regular insulin
	Post-procedure	Check accu-chek blood sugar on return or pre-lunch and cover with regular insulin	Check accu-chek blood sugar pre-dinner and cover with regular insulin
DIET-CONTROLLED	Post-procedure	Check sugar on return if over 300 mg% cover with regular insulin	Same as AM
SHORT-ACTING ORAL	Medication	Omit AM dose	Give AM dose; omit noon dose
	Post-procedure	Resume usual doses or oral Agent. Check sugar on return if over 300 mg% may need insulin coverage	Same as AM
LONG-ACTING ORAL	Medication	Check sugar on return and pre-dinner; if over 100 mg% coverage with regular insulin	Check sugar on return and/or pre-dinner. If over 100 mg% cover with regular insulin

APPENDIX III
CARDIAC CATHETERIZATION IN RENAL FAILURE

I. CHRONIC RENAL FAILURE:

A. Adequate hydration:

1. Intravenous NSS or ½ NSS at 75-100 ml/for 6 hrs prior to the procedure to be continued during the procedure. Use caution in patients with -poor cardiac function and impending CHF.

2. Lasix (100-200 mg I.V.) at the end of cardiac catheterization

3. Monitor urine output for 48 hours after procedure.

4. Monitor BUN/Creatinine for 3 days.

II. DIALYSIS PATIENTS

A. Since these patients do not have renal function, therefore nephrotoxicity is not a problem. However, these patients cannot excrete contrast material and may be more prone to fluid overload, heart failure, cardiac arrhythmias and uremic bleeding abnormalities. The following precautions should be undertaken:

1. Angiography to be performed ideally after dialysis or interdialytic days.

2. Alert the dialysis personnel because the patient may need ultrafiltration dialysis immediately after procedure because of overhydration from the dye.

3. Check the -patients after the procedure, carefully for evidence of heart failure and excessive bleeding from cutdown or puncture site.

APPENDIX IV
HEMOSTASIS AFTER SHEATH REMOVAL

A. At the present time, the AngioSeal hemostatic device is routinely used for hemostasis in all patients undergoing diagnostic and interventional procedure, unless there is a contraindication for their placement.
Sheath Removal Technique Using no Hemstatic Device:

1. Aspirate the sheath and flush to clear the thrombi (in the Lab).

2. Obtain an ACT.

3. The patient is then transferred to the holding area on a stretcher for sheath removal.

4. If ACT is abnormal, Heparin effect may be reversed by the administration of Protamine Sulfate (10-25 mg intravenously as a bolus) prior to sheath removal.

ACT >250	20-25 mg
200-250	15-20 mg
180-200	10-15 mg
160-180	0-10 mg

Repeat ACT after 5 minutes and administer additional Protamine if necessary.

Protamine reactions include the following:
Shaking
Flushing
Chills
Back, Chest or Flank Pain
Vasomotor Collapse

Caution should be use in giving Protamine to patient receiving NPH insulin.

5. Remove the sheath when ACT is □ 150 seconds.

6. Have sandbag, sterile 4x4's, gloves, Atropine and band-aid at bedside.

7. Place left hand fingers over the femoral artery entry site (approximately 1" higherthan the actual skin puncture site) and apply firm pressure while gently removing the sheath from the leg.

8. Release the pressure partially during the removal process to avoid crushing the sheath or stripping the clot into the distal artery. Allow a small spurt of blood. This purges the distal site of retained thrombi.

APPENDIX IV (Con't)
HEMOSTASIS AFTER SHEATH REMOVAL

9. Hold manual pressure firmly without site observation for 15-20 minutes, enough to maintain hemostasis and at the same time allow good distal arterial flow.

10. Patients with hypertension or aortic insufficiency, obese patients, elderly, female, patients with advanced peripheral vascular disease, those who have undergone prior and multiple complicated punctures and finally patients with coagulopathy or those taking anticoagulants or antiplatelets are at high risk for groin hematoma and arterial complications. A longer pressure application (20-30 minutes) may be required for complete hemostasis.

11. Release pressure gently at the completion of designated time and inspect the area for 1-2 minutes for hematoma or bleeding.

12. If hemostasis is not completely obtained, resume pressure for additional 5 minutes until hemostasis is achieved.

13. After hemostasis is obtained, clean the area with an antiseptic solution and apply sterile tape of clear porous dressing.

14. Large pressure dressings or sandbags are not used routinely.

15. Large opaque occlusive dressing over the puncture site is not recommended.

16. In obese patients or those with large thighs, more than 500 ml of blood can be lost before the patient or nurse identifies the problem.

17. Keep the patient at complete bed rest with the affected leg straight for six hours.

18. Increase activity after six hours, to bed rest with bathroom privileges until the following morning.

19. Mechanical devices (ex. Femo-stop) can be employed to assist in puncture-site hemostasis. These devices are effective, but must be applied carefully by a trained individual and must be monitored frequently for misalignment, bleeding or excessive pressure with limb ischemia. See instruction package.

APPENDIX V
OUTLINE FOR PRELIMINARY POST-PROCEDURE NOTE

1. List of procedures performed and location of arterial and venous access sites
2. Equipment used for angioplasty
3. Operators (attending angiographer, fellow)
4. Complications
5. Results
    A. Hemodynamics
    B. Left Ventriculography
    C. Coronary Cine
    D. Angioplasty; site, initial and final stenosis severity
6. Method of hemostasis
7. Complete report to follow
8. State your name and beeper number.

APPENDIX VI
GUIDELINES FOR CARDIAC CATHETERIZATION CONFERENCE

A. Thursday (8:00-9:00 AM) Conference

1. Thursday conferences will be designated a Diagnostic Catheterization Conference.

2. It will be run by the clinical cardiology fellow during his/her rotation through the cardiac catheterization laboratory, interventional cardiology fellow, and (invasive) attending physician.

3. The fellow is responsible for presenting the case; including the pertinent - history, physical examination, laboratory data, EKG, and non-invasive studies, (including stress test or echocardiogram).

4. The cine film will then be shown, and will be read by another first year fellow.

5. The discussion of therapeutic options will.be performed by the second and third year fellows.

6. The discussion should then be summarized.

7. A brief (10 minute) review of the literature, involving recent articles or textbooks will be.made.

8. One or two cases are usually appropriate for the conference.

9. A central theme should be discussed.

10. At the conclusion of the conference several accepted teaching points should be stressed.

B. Thursday Conference

Thursday's conference will be designated an Interventional Cardiac Catheterization Conference.

1. The senior interventional fellows will be responsible for the presentation in a rotating manner.

2. The fellow presents the case; including the pertinent history, physical, laboratory data, EKG, and noninvasive studies (stress tests and echo).

3. The cine films will be read by a first year fellow.

4. Discussion of the case, involving therapeutic decisions, will be made by the second and third year fellows.

5. The case will be summarized, and then a brief review (10 minutes) of the literature or textbooks will be made.

6. At the conclusion of the case, generally accepted points will be emphasized.

7. A central theme or topic should be discussed.

C. Selected Topics for Cath Conference Include;

1. Indications and contraindications of cardiac catheterization.

2. Complications of cardiac catheterization.

3. Angiographic techniques.

4. All aspects of valvular disease. . .

5. All aspects of congenital cardiac anomalies.

6. All aspects of congenital heart disease.

7. Aortic disease.

8. Pericardial disease.

9. Cardiomyopathy.

10. Endomyocardial biopsy.

11. Intravascuiar ultrasound.

12. Doppler flow wire analysis.

13. Coronary angioplasty.

14. Directional coronary atherectomy.

15. Rotational coronary atherectomy
16. Intracoronary stenting.
17. Laser techniques
18. Balloon valvuloplasty.
19. Cardiac tamponade.
20. Coronary arterial anomalies.
21. Treatment of acute myocardial infarction.
22. Primary angioplasty.
23. Comparison-of therapeutic techniques.
24. Difficult clinical decision making.
25. Difficult diagnostic testing.
26. Left main coronary artery disease.
27. Three vessel coronary artery disease.
28. Unstable angina.
29. Intracoronary thrombus.
30. Treatment of left internal mammary arteries.
31. Treatment of saphenous vein grafts.
32. treatment of multivessel disease.
33. extraction atherectomy.
34. Restenosis.

APPENDIX VII
BIBLIOGRAPHY

Principles of Radiographic Imaging and Radiation Safety

1. Melvin P. Judkins Cardiac Imaging Symposium. Society for Cardiac Angiography and Interventions.
2. Moore, J. *Imaging Principles of Cardiac Angiography*. Aspen Publishers, Rockville, MD, 1990.
3. Grossman W and Baim DS. *Cardiac Catheterization, Angiography and Intervention*. Fourth Edition. Lea and Febiger, Philadelphia, 1991.
4. Johnson LW, Moore RJ, Balter, S. Review of Radiation Safety in the Cardiac Catheterization Laboratory, Cath and Cardiovasc Diag 25:186-194, 1992.

Diagnostic Cardiac Catheterization

1. Melvin P. Judkins Cardiac Imaging Symposium. Society for Cardiac Angiography and Interventions.
2. Moore, J. *Imaging Principles of Cardiac Angiography*. Aspen Publishers, Rockville, MD, 1990.
3. Grossman W and Baim BS. *Cardiac Catheterization, Angiography and Intervention*. Fourth Edition. Lea and Febiger, Philadelphia, 1991.
4. Kern, MJ. *The Cardiac Catheterization Handbook.* 1991 Mosby Year Book, St. Louis.
5. King S and Douglas K. *Coronary Arteriography and Angioplasty*. 1985. McGraw Hill Book Company, New York.
6. Pepine C, Hill J and Lambert C. *Diagnostic and Therapeutic Cardiac Catheterization*. Williams and Wilkins, Baltimore, 1989.
7. Zimmerman HA, editor. *Intravascular Catheterization*. 1966, Charles C. Thomas, Springfield, Illinois.

Hemodynamics

1. Criley J and Ross R. *Cardiovascular Physiology*. 1971 Tampa Tracings. Tarpon Springs.
2. Grossman W. *Cardiac Catheterization and Angiography*. 1985 Lea and Febiger. Philadelphia.
3. Kern, MJ. *The Cardiac Catheterization handbook.* Mosby Year Book. St. Louis, 1991.
4. Yang S, Bentivoglio L., Maranho V and Goldberg H. *From Cardiac Catheterization Data to Hemodynamic Parameters*. F.A. Davis Company, Philadelphia, 1978.

Cardiac Catheterization Laboratory Pharmacology Contrast

1. Kern MJ. Selection of radiocontrast medial in cardiac catheterization: Comparative physiology and clinical effects of onoionic monomeric and ionic dimeric formulations. Am Heart J 1991;122:195.

2. Piao Ze, Murdock DK, Hwang MH et al. Hemodynamic effects of contrast media during coronary angiography: A comparison of three nonionic agents to Hypaque-76. Cathet Cardiovasc Diagn 1988;14:53.
3. Grollman Jr JH, Liu CK, Astone RA, Lurie MD. Thromboembolic complications in coronary angiography associated with the use of nonionic contract medium. Cathet Cardiovasc Diagn 1998;14:159.
4. Murdock DK, Johnson SA, Loeb HS, Scanlon PJ. Ventricular fibrillation during coronary angiography: reduced incidence in man with contrast media lacking calcium binding additives. Cathet Cardiovasc Diagn 1985;11:153.
5. Dawson P. Chemotoxicity of contrast media and clinical adverse effects: a review. Invest Radiol 1985;20:S84.
6. Davidson CJ, Mark DB, Pieper KS, et al. Thrombotic and cardiovascular complications related to nonionic contrast media during cardiac catheterization: analysis of 8,517 patients. Am J Cardiol 1990;65:1481.
7. Porter GA. Contrast-associated nephropathy. Am J. Cardiology 1989;64:22E.

Anticoagulants

1. Hirsh J, Dalen JE, Deykin D, Poller L. Heparin: mechanism of action, pharmacokinetics, dosing considerations, monitoring, efficacy, and safety. Chest 1992;102:337S.
2. Hirsh J. Heparin. N Engl J Med 1991;324:1565.
3. Cruinkshank MK, Levine MN, Hirsh J, et al. A standard heparin nomogram for the management of heparin therapy. Arch Intern Med 1991;151:333.
4. Morabia A. Heparin doses and major bleeding. Lancet 1986;1:1278.
5. King DJ, Kelton JG. Heparin-associated thrombocytopenia. Ann Intern Med 1984;100:535.
6. Levine MN, Goldhaber SZ, Califf RM, et al. Hemorrhagic complications of anticoagulant therapy. Chest 1992;102:364S.
7. Cairns JA, Hirsh J, Lewis HD, et al. Antithrombotic agents in coronary artery disease. Chest 1992; 102:456S.

Atrophine

1. Das G. Therapeutic review. Cardiac effects of atropine in man: an update. Int J Clin Pharmacol Ther Toxicol 1989;27:473.
2. Kanto J, Klotz U. Pharmacokinetic implications for the clinical use of atropine, scopolamine and glycopyrrolate. Acta Anesthesiol Scand 1988;32:69.
3. Paraskos JA. Cardiovascular pharmacology. III: Atropine, calcium, calcium blockers, and beta-blockers. Circulation 1986; 74:IV86.
4. Schweitzer P, Mark H. The effect of atropine on cardiac arrhythmias and conduction. Part 2. Am Heart J 1980; 100:255.
5. Schweitzer P, Mark H. The effect of atropine on cardiac arrhythmias and conduction, Part 2. Am Heart J 1980; 100:255.

Beta Blockers

1. Held PH, Yusuf S. Effects of beta-blockers and calcium channel blockers in acute myocardial infarction. Eur Heart J 1993; 14 Suppl F:18.
2. Leren P. Ischaemic heart disease: how well are the risk profiles modulated by current beta blockers? Cardiology 1993;82 Suppl 3:8.
3. Burris JF. Beta-blockers, dyslipidemia, and coronary artery disease. A reassessment. Arch Intern Med 1993 27:153:2085.
4. Frohlich ED. Vasodilatory beta-blockers: systemic and regional hemodynamic effects. Am Heart J 1991; 121:1012.
5. Becker RC, Gore JM. Adjunctive use of beta-adrenergic blockers, calcium antagonists and other therapies in coronary thrombolysis. Am J Cardiol 1991 25:67:25A.
6. Frishman WH. Beta-adrenergic blockers. Med Clin North Am 1988;72:37.
7. Frishman WH, Murthy S, Strom JA. Ultra-short-acting beta-adrenergic blockers. Med Clin North Am 1988;72:359.
8. Frishman WH. Beta-adrenergic receptor blockers. Adverse effects and drug interactions. Hypertension 1988;11:II21.

Calcium Channel Blockers

1. Luft FC, Haller H. Calcium channel blockers in current medical practice: an update for 1993. Clin Exp Hypertens 1993;15:1263.
2. Triggle DJ. Calcium-channel antagonists: mechanisms of action, vascular selectivities, and clinical relevance. Cleve Clin J Med 1992;59:617.
3. Ferrari R, Visioli O. Calcium channel blockers and ischaemic heart disease: theoretical expectations and clinical experience. Eur Heart J. 1991;12 Suppl F:18.
4. Schlanz KD, Myre SA, Bottorff MD. Pharmacokinetic interactions with calcium channel antagonists (Part II). Clin Pharmacokinet 1991; 21:448.
5. Schlanz KD, Myre SA, Bottorff MB. Pharmacokinetic interactions with calcium channel antagonists (Part I). Clin Pharmacokinet 1991;21:344.
6. Kim KE. Comparative clinical pharmacology of calcium channel blockers. Am Fam Physician 1991;43:583.

Antiarrhythmic Agents

1. Man RY. Symposium: pharmacology of class I anti-arrhythmic agents. Introduction: electrophysiological, biochemical and clinical considerations. Clin Invest Med 1991;14:444.
2. Leibowitz D. Sotalol: a novel beta-blocker with class III anti-arrhythmic activity. J Clin Pharmacol 1993;33:508.
3. Woolsey RL, Funck-Brenatno C. Overview of the clinical pharmacology of antiarrhythmic drugs. Am J Cardiol 1988;61:61A.
4. Zipes DP. A consideration of antiarrhythmic therapy. Circulation 1985;72:949.
5. Vaughan Williams EM. A classification of antiarrhythmic actions reassessed after a decade of new drugs. J Clin Pharmacol 1984;24:129.

6. Brown JE, Shand DG. Therapeutic drug monitoring of antiarrhythmic agents. Clin Pharmacokinet 1982;7:125.
7. Holt DE, Tucker GT, Jackson PR, McKenna WJ. Amiodarone pharmacokinetics. Br. J. Clin Pract 1986;40:109.
8. Mason JW. Amiodarone. N Engl J Med 1987;316:415.
9. Pelleg A. Mechanisms of action and therapeutic potential of adenosine and its analogues in the treatment of cardiac arrhythmias. Coron Artery Dis 1993;4:109.
10. Chronister C. Clinical management of supraventricular tachycardia with adenosine. Am J Crit Care 1993;2:41.
11. Adenosine for acute cardiac arrhythmias. Drug Ther Bull 1993 21: 31:49.
12. Rakin AC, Brooks R, Ruskin JN, McGovern BA. Adenosine and the treatment of supraventricular tachycardia. Am J. Med 1992;92:655.

Catecholamine

1. Orlowski JP. Pediatric cardiopulmonary resuscitation. Emerg Med Clin North Am 1983;1:3.
2. Zaritsky A, Chernow B. Use of catecholamine in pediatrics. J Pediatr 1984;105:341.
3. Rude RE. Pharmacologic support in cardiogenic shock. Adv Shock Res 1983;10:35.
4. Chernow B, Rainey TG, Lake CR. Endogenous and exogenous catecholamine in critical care medicine. Crit Care Med 1982;10:409.
5. Francis GS, Sharma B, Hodges. Comparative hemodynamic effects on dopamine and dobutamine in patients with acute cardiogenic circulatory collapse. Am Heart J 1982;103:995.
6. Majerus TC, Dasta JF, Bauman JL, et al. Dobutamine: ten years later. Pharmacotherapy 1989;9:245.
7. Ruffolo RR Jr. The pharmacology of dobutamine. An J Med Sci 1987;294:244.

Nitrates

1. Fung HL. Clinical pharmacology of organic nitrates. Am J Cardiol 1993;72:9C.
2. Parker JO. Nitrates and angina pectoris. Am J Cardiol 1993;72:3C.
3. Jugdutt BI. Role of nitrates after acute myocardial infarction. Am J Cardiol 1992;70:82B.
4. Abrams J. Mechanisms of action of the organic nitrates in the treatment of myocardial ischemia. Am J Cardiol 1992;70:30B.
5. Loscalzo J. Antiplatelet and antithrombotic effects of organic nitrates. Am J Cardiol 1992;70:18B.
6. Stamler JS, Loscalzo J. The antiplatelet effects of organic nitrates and related nitrous compounds in vitro and in vivo and their relevance to cardiovascular disorders. J Am Coll Cardiol 1991;18:159.

Aspirin

1. Hirsh J, Dalen JE, Fuster V, et al. Aspirin and other platelet-active drugs. The relationship between dose, effectiveness, and side effects. Chest 1992;102:327S.
2. Harker LA, Fuster V. Pharmacology of platelet inhibitors. J Am Coll Cardiol 1986;8:21B.

3. Lewis HD, David JW, Archibald DG, et al. Protective effects of aspirin against acute myocardial infarction and death in men with unstable angina. Results of a Veterans Administration Cooperative Study. N Engl J Med 1983;309:396.
4. Pederson AK, Fitzgerald GA. Dose-related kinetics of aspirin: N Engl J Med 1984;311:1206.

Thrombolysis

1. Cairns JA, Fuster V, Kennedy JW. Coronary thrombolysis. Chest 192;104:482S.
2. Topol EJ. Thrombolytic intervention, in Topol, EJ. *Textbook of Interventional Cardiology*. W. B. Saunders, Philadelphia 1990.
3. Sleight P. Thrombolysis: state of the art. Eur Heart J 1993;14 Suppl G:41.
4. Johnstone D, Roy L. Nonhemorrhagic complications of coronary thrombolysis. Can J Cardiol 1993;9:511.
5. Anderson HV, Willerson JT. Thrombolysis in acute myocardial infarction. N Engl J Med 1993;329:703.
6. Gersh BJ, Anderson JL. Thrombolysis and myocardial salvage. Results of clinical trials and the animal paradigm -- paradoxic or predictable? Circulation 1993;88:296.
7. Eisenberg PR. Role of heparin in coronary thrombolysis. Chest 1992;101:131S.
8. Rapaport E. Thrombolysis, anticoagulation, and reocclusion. Am J Cardiol 1991;68:17E.
9. Tognoni G, Fresco C, Franzosi MG, Maggioni AP. Thrombolysis in acute myocardial infarction. Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto. Chest 1991;99:121S.
10. Fareed J, Walenga JM, Leya F, Bacher P, et al. Some objective considerations for the use of heparins and recombinant hirudin in percutaneous transluminal coronary angioplasty. Semin Thromb Hemost 1991 Oct;17(4):455-70.
11. Johnson PH. Hirudin: clinical potential of a thrombin inhibitor. Annu Rev Med 1994;45:165-77.
12. Topol EJ, Fuster V, Harrington RA, Califf RM, et al. Recombinant hirudin for unstable angina pectoris. A multicenter, randomized angiographic trial. Circulation 1994 Apr;89(4):1557-66.
13. Rote We, Mu DX, Bates ER, Nedelman MA, Lucchesi BR. Prevention of rethrombosis after coronary thrombolysis in a chronic canine model. II. Adjunctive therapy with r-hirudin. J Cardiovasc Pharmacol 1994 Feb;23(2);203-11.
14. White H. Hirudin and Hirulog. Aust N Z J Med 1993 Dec; 23(6):769-70.
15. Van den Bos AA, Deckers JW, Heyndrickx GR, Laarman GJ, et al. Safety and efficacy of recombinant hirudin (CGP 39 393) versus heparin in patients with stable angina undergoing coronary angioplasty. Circulation 1993 Nov;88(5 Pt 1):2058-66.
16. Zoldhelyi P, Webster MW, Fuster V, Grill DE, et al. Recombinant hirudin in patients with chronic, stable coronary artery disease. Safety, half-life, and effect on coagulation parameters. Circulation 1993 Nov;88(5 Pt 1):2015-22.
17. Sitko GR, Ramjit DR, Stabilito II, Lehman D, et al. Conjunctive enhancement of enzymatic thrombolysis and prevention of thrombotic reocclusion with the selective factor Xa inhibitor, tick anticoagulant peptide. Comparison to hirudin and heparin in a canine model of acute coronary artery thrombosis. circulation 1992 Feb;95(2):805-15.

18. Herrman JP, Serruys PW. Thrombin and antithrombotic therapy in interventional cardiology. Tex Heart Inst J 1994;21(2):138-47.

Antiplatelet Therapy

1. Collaborative overview of randomized trials of antiplatelet therapy -- II: Maintenance of vascular graft or arterial patency by antiplatelet therapy. Antiplatelet Trialists' Collaboration. BMJ 1994 Jan 15;308(6922):159-69.
2. FitzGerald GA, Shipp E. Antiplatelet and anticoagulant drugs in coronary vascular disease. Ann Epidemiol 1992 Jul;2(4):529-42.
3. Franklin SM, Faxon DP. Pharmacologic prevention of restenosis after coronary angioplasty: review of the randomized clinical trials. Coron Artery Dis 1993 Mar;4(3):232-42.
4. Topol EJ, Plow EF. Clinical trials of platelet receptor inhibitors. Thromb Haemost 1993 Jul 1:70(1):94-8.
5. Weitz J, Hirsh J. New anticoagulant strategies. J Lab Clin Med 1993 Oct;122(4):364-73.
6. Flores-Runk P, Raasch RH. Ticlopidine and antiplatelet therapy. Ann Pharmacother 1993 Sep;27(9):1090-8.
7. Herrman JP, Hermans WR, Vos J, Serruys PW. Pharmacological approaches to the prevention of restenosis following angioplasty. The search for the Holy Grail? (Part I). Drugs 1993 Jul;46(1)18-52.
8. Chesebro JH, Badimon L, Fuster V. Importance of antithrombin therapy during coronary angioplasty. J Am Coll Cardiol 191 May;17(6 Suppl B):96B-100B.
9. Badimon L, Chesebro JH, Badimon JJ. Thrombus formation on ruptured atherosclerotic plaques and rethrombosis on evolving thrombi. Circulation 1992 Dec;86(6 Supl);III74-85.
10. Chesebro JH, Webster MW, Zoldelyi P, Roche PC, et al. Antithrombotic therapy and progression of coronary artery disease. Antiplatelet versus antithrombins. Circulation 1992 ec;86(6 Suppl):III100-10.
11. Cairns JA, Hirsh J, Lewis HD Jr, Resnekov L, Theroux P. Antithrombotic agents in coronary artery disease. Chest 1992 Oct; 102(4 Suppl):456S-418S.
12. Loscalzo J. Antiplatelet and antithrombotic effects of organic nitrates. Am J Cardiol 1992 Sep 24;70(8):18B-22B.
13. Becker RC. Seminars in thrombosis, thrombolysis and vascular biology. 3. Platelet activity in cardiovascular disease. Cardiology 1991;79)1):49-63.
14. Becker RC. Thrombin antagonists and antiplatelet agents. Am J Cardiol 1992 Jan 3;69(2):39A-51A.
15. Theroux P. Antiplatelet and antithrombotic therapy in unstable angina. Am J Cardiol 1991 Sep 3;68(7):92B-98B.
16. Kerins DM, FitzGerald GA. The current role of platelet-active drugs in ischaemic heart disease. Drugs 1991 May;41(5)665-71.
17. Hermans Wr, Rensing BJ, Strauss BH, Serruys PW. Prevention of restenosis after percutaneous transluminal coronary angioplasty: the search for a magic bullet. Am Heart J 1991 Jul; 122(1 Pt 1):171-87.
18. Ellis SG, Bates ER, Schaible T, Weisman HF, et al. Prospects for the use of antagonists to the platelet glycoprotein IIb/IIIa receptor to prevent post-angioplasty restenosis and thrombosis. J am Coll Cardiol 1991 May;17(6 Suppl B):89B-95B.

19. Willerson JT, Golino P, McNatt J, Eidt j, et al. Role of new antiplatelet agents adjunctive therapies in thrombolysis. Am J Cardiol 1991 Jan 25;67(3):12A-18A.
20. Karas SP, Santoian EC, Gravanis MB. Restenosis following coronary angioplasty. Clin Cardiol 1991 Oct;14(10):791-801.
21. Stamler JS, Loscalzo J. The antiplatelet effects of organic nitrates and related nitroso compounds in vitro and in vivo and their relevance to cardiovascular disorders. J Am Coll Cardiol 1991 Nov 15;18(6):1529-36.

Interventional Curriculum

1. Melvin P. Judkins Cardiac Imaging Symposium. Society for Cardiac Angiography and Interventions.
2. Moore J. *Imaging Principles of Cardiac Angiography*. Aspen Publishers, Rockville, MD. 1990.
3. Grossman W and Baim DS. *Cardiac Catheterization, Angiography and Intervention*. Fourth Edition. Lea and Febiger. Philadelphia. 1991.
4. Johnson LW, Moore RJ, Balter S. Review of Radiation Safety in the Cardiac Catheterization Laboratory. Cath and Cardiovasc Diag 25:186-194. 1992.
5. Wagner LK, Eifel PJ, Geise RA. Potential Biological Effects Following High XRay Dose Interventional Procedures. Journ Vasc and Interventional Radiology 5:71-84, 1994.

Laboratory Techniques

1. Topol E. *Textbook of Interventional Cardiology.* W.B. Saunders Company, Philadelphia. 1990.
2. Grossman W and Baim DS. *Cardiac Catheterization, Angiography and Intervention*. Fourth Edition. Lea and Febiger. Philadelphia. 1991.
3. Kern MJ. *The Cardiac Catheterization Handbook. Mosby Year Book.* St. Louis. 1991.
4. King S and Douglas J. *Coronary Arteriography and Angioplasty*. McGraw Hill Book Company, New York. 1985.
5. Pepine C, Hill J and Lambert C. *Diagnostic and Therapeutic Cardiac Catheterization*. Williams and Wilkins, Baltimore. 1989.
6. Vliestra R and Holmes D. (Editors) *Coronary Balloon Angioplasty*. Blackwell Scientific Publications, Oxford, England. 1994.
7. White C and Ramee S. (Editors) *Interventional Cardiology: Clinical Application and New Technologies*. Raven Press, New York. 1991.
8. Freed M and Grines C. (Editors) *Manual of Interventional Cardiology*. Physicians Press, Birmingham, Michigan. 1992.

Intravascular Ultrasound

1. Tobis J and Yock P. (Editors) *Intravascular Ultrasound Imaging*. Churchill Livingstone, New York. 1992.
2. Hodgson J McB and Sheehan H. (Editors) *Atlas of Intravascular Ultrasound*. Raven Press, New York. 1994.

Thrombus Formation

1. Cairns JA, Fuster V, Kennedy JW./ Coronary thrombolysis. Chest 1992;104:482S.
2. Topol EJ. Thrombolytic intervention, in Topol, EJ. *Textbook of Interventional cardiology*. W.B. Saunders, Philadelphia 1990.
3. Sleight P. Thrombolysis: state of the art. Eur Heart H 1993;14 Suppl G:41.
4. Johnstone D, Roy L. Nonhemorrhagic complications of coronary thrombolysis. Can J Cardiol 1993;9:511.
5. Anderson HV, Willerson HT. Thrombolysis in acute myocardial infarction. N Engl J Med 1993;329:703.
6. Gersh BJ, Anderson JL. Thrombolysis and myocardial salvage. Results of clinical trials and the animal paradigm -- paradoxic or predictable? Circulation 1993;88:296.
7. Eisenberg PR. Role of heparin in coronary thrombolysis. Chest 1992;101:131S.
8. Rapaport E. Thrombolysis, anticoagulation, and reocclusion. Am J Cardiol 1991;68:17E.
9. Tognoni G, Fresco C, Franzosi MG, Maggioni AP. Thrombolysis in acute myocardial infarction. Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto. Chest 1991;99:121S.