Department of Medicine

Division of Cardiology

Cardiology Rotation
Resident Manual

Sunnybrook Health Sciences Center

2012 to 2013

Program Director
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Teaching Schedule

Monday

7:30 to 8 am	Handover (CCU - C3)
8 to 9 am	Bedside Teaching Rounds (D3)
8 to 9 am	PGY 1 Core lectures. Rm (D302)
12 to 1 pm	Department of Medicine Lunch time Seminars

Tuesday

7:30 to 8:30 am	Cardiology Research rounds (E315)
12 to 1 pm	Department of Medicine Lunch time Seminars

Wednesday

7:30 to 8 am	Handover (CCU - C3)
8 to 9 am (E315)	Cardiology Non-Invasive Teaching Rounds
12 to 1 pm	Medical Grand Rounds

Thursday

7:30 to 8 am	Handover (CCU - C3)
8 to 9 am	Cardiology Core teaching (Rm D302)
12 to 12:30 pm	Cardiology Pre-Clinic Teaching session with Dr. Ahmed. (Rm D302)

Friday

7 to 8 am	PCI and CABG combined rounds (M331)
8 to 9 am	Cardiology Grand Rounds (E315)
12 to 1 pm	Department of Medicine Lunch time Seminars

** The CCU attending of the week will present an hour of “Lunch and Learn”. Date and time will be determined by the CCU attending of the week.

OVERVIEW

This is intended to give you a brief overview of the organization of the Cardiology Service and the associated educational and academic activities. A detailed discussion of the objectives for this rotation may be found in accompanying documents.

Coronary Care Unit (CCU)

- The CCU consist of a 12 bed unit
- The CCU is capable of taking critically ill cardiac patients who requires intra-aortic balloon pump, bipap support, central lines, invasive cardiac monitoring, and IV medication drip including inotropes and nitroglycerin.
- The CCU has funding for 2 invasive ventilated bed.
- The CCU team consists of a Cardiologist, Cardiology Fellow, and senior/junior non-cardiology resident(s).
- The CCU is a closed unit, and the CCU team manages all patients in the CCU.
- The CCU cardiologist is the most responsible physician (MRP) when patients are admitted to the CCU.
- All patients are admitted to the CCU are admitted under the Cardiologist in the CCU. (On rare exception, if cardiac surgery borrows a bed in CCU, the cardiac surgeon may remain as the MRP)
- The CCU team round on all patients in the CCU every day.
- The CCU team is responsible for all cardiology consults in the critical care setting including the emergency room, critical care units. These cases are reviewed with Cardiologist in the CCU. During evenings and weekend, the CCU team is also responsible for non-critical care consultation that requires urgent cardiology input.
- The Cardiologist in the CCU changes over every Friday morning at 8 am. (ie. The same cardiologist is responsible for the CCU **during the day** from Friday 8 am to the following Thursday at 5 pm)
- There is a Cardiologist on-call every night from 5 pm to 8 am the following morning. The Cardiologist on-call at night is responsible for the CCU and the cardiology consultations during those hours.
- On weekends, the CCU Cardiologist is on-call from Saturday at 9 am to the following Monday at 8 am.
- The CCU team **must speak to the cardiology ward team** when patients are transferred to the cardiology ward (D3). This will ensure proper handover and optimize patient safety.

- The CCU team is responsible for updating the patient hand over list on the intranet on a daily basis.

Cardiology Consultation team

- The cardiology consultation team consists of medical residents (usually PGY 1) who are rotating through the cardiology ward service. The supervising cardiologist is the cardiology staff on D3.
- The cardiology consultation team is not responsible for the management of cardiology patients admitted to D3 under cardiology. This is the responsible of the D3 cardiology ward team.
- The cardiology consultation team consists of a Cardiologist (D3 staff cardiologist), and 1 or more medical resident rotating through the cardiology ward service.
- The cardiology consultation teams is responsible for non-critical care cardiology consultation and follow up during working hours, Monday to Friday between 8 am to 5 pm.
- The cardiology consultation team is not available during evenings and weekend/holiday. The CCU team is responsible for all consultation during this period.
- The Cardiologist for the ward changes over every Friday morning at 8 am. (ie. The same cardiologist is responsible for the ward **during the day** from Friday 8 am to the following Thursday at 5 pm)
- The cardiology consultation team will need to negotiate with the cardiology staff (D3) staff to meet on a daily basis to review new consultations and follow ups.
- The cardiology consultation team is responsible for updating the “Cardiology Consult” list on the intranet handover system on the daily basis.
- Depending on the number of resident on the cardiology consultation team, a member of the team may be assigned to the CCU team on a weekly basis.
- If a patient seen by the cardiology consultation team becomes unable and require more acute critical care, the CCU team should be consulted.
- The CCU team may request the cardiology consultation team to see a patient in the critical care unit or emergency room. These patients are reviewed with the CCU team and **not** with the D3 cardiologist.

Specific Duties

CCU Cardiology Fellow (C1, C2 or C3)

- Supervise senior and junior resident in the CCU and report to the CCU cardiologist.
- Supervises overall care of CCU patients together with senior and junior residents in the CCU.
- Responds to requests for consultations in the emergency department, critical care units and the non-cardiology wards and delegate work to the senior and junior resident in the CCU.
- Arranges for the transfer of patients to the cardiology ward, non-cardiology ward, discharges home and transfer to outside hospital. To ensure transfer orders and transfers are written.
- Attend the various rounds and educational activities. (See schedule)

CCU Senior and Junior Resident (R2, R3 , R4, R5)

- Round and manage patients on the CCU under the supervision of the CCU cardiology staff and/or cardiology fellow.
- Round and manage patients on patients seen in consultation in the emergency room, critical care units, and wards under the supervision the CCU cardiology staff and/or cardiology fellow.
- Attend the various rounds and educational activities. (See schedule)

Cardiology consultation resident (R1, R2)

- Work under the direct supervision of the Cardiologist on the ward (D3).
- Provide cardiology consultation and follow up to non-critical care patients who require cardiology consultation (ie. Excluding emergency room and critical care patients).

- One resident on the consultation may be assign to the CCU on a weekly basis.
- There may be occasion where the Consultation team may be asked to see a patient on the Critical care unit or in the emergency room at the request of the CCU team. These patients will be reviewed with the CCU team.
- Attend the various rounds and educational activities. (See schedule)

If Time Permits Resident Should

- Observe and supervise exercise test.
- Observe echocardiogram.
- Observe cardiac catheterization
- Observe percutaneous coronary intervention
- Observe Electrophysiology Study
- Observe implantation of permanent pacemaker and/or AICD

GOALS FOR RESIDENT ROTATIONS IN DIVISION OF CARDIOLOGY

- To learn how to manage an inpatient cardiology practice, including appropriate and efficient use of diagnostic tests, consultations with other services and discharge planning.
- To perform a concise and informative cardiovascular history and physical examination and to develop a therapeutic plan based upon your findings and any other available information.
- To be able to summarize your findings in a brief verbal presentation at rounds.
- To dictate a concise and informative discharge summary on cardiovascular patients under your care if not done by staff cardiologist.
- To learn the indications for implantation of a permanent pacemaker, the common types of pacemakers available for clinical use and how to set the different modes for a temporary pacemaker.
- To learn the indication for implantation of an AICD.
- To learn the indications for exercise testing and how to perform one on patients with possible ischemic heart disease.
- To understand the indications and use of echocardiography, cardiac catheterization, nuclear cardiology and ECG telemetry.
- To develop competence in basic ECG interpretations, including diagnosis of myocardial infarction, myocardial ischemia, cardiac arrhythmias and conduction diseases.
- To participate in the ward on-call schedule and learn how to care for common acute cardiovascular problems independently and when it is appropriate to consult with senior colleagues.
- To prepare and present seminars and reviews of journal articles on cardiovascular diseases.
- To develop appropriate communication skills with family members and physicians in the community.
- To obtain experience in managing cardiac emergencies including myocardial infarction, unstable angina and other serious cardiovascular disorders.

FOR SENIOR RESIDENTS ONLY

- To learn how to supervise an inpatient cardiology ward and Coronary Care Unit including the admission of appropriate patients, clinical care including treatment and timely discharge of patients, making use of home care and other similar services.
- To learn how to supervise junior and senior residents during their cardiology rotation.
- To learn how to perform cardiology consultations and to present your findings for review by a staff cardiologist.

- To become familiar with the indications and use primary PCI and thrombolytic therapy for acute myocardial infarction.
- To learn the principles of hemodynamic monitoring and its use in the CCU setting.
- To learn the indications for coronary artery angioplasty and coronary artery bypass surgery.
- To become familiar with the use of the intra-aortic balloon pump.

CARDIOLOGY ROTATION OBJECTIVES

1. Clinical Evaluations

a) Relevant Cardiovascular History
   i. Symptoms
   ii. Risk factors
   iii. Past medical history
   iv. Family history
   v. Medication history

b) Physical Examination
   i. Jugular venous pressure and wave forms
   ii. Blood pressure measurement
   iii. Arterial pulsation
   iv. Peripheral arterial pulsations and bruits
   v. Cardiac palpation
   vi. Cardiac auscultation
   vii. Peripheral examination relevant to cardiac pathology

c) Interpretation of Laboratory Results
   i. Rhythm assessment
   ii. Electrocardiogram (ECG)
   iii. Blood work
      i. Cardiac markers (CK, CK MB, Troponin)
      ii. Lipid profile
      iii. Diabetes profile
      iv. Renal profile
      v. Electrolytes profile
      vi. Hematology profile
      vii. Coagulation profile
      viii. Arterial blood gas profile
   iv. Chest X-ray
   v. CT and MRI written report
   vi. Echocardiography written report
   vii. Cardiac catheterization written report

d) Assessment and Management Plan
   i. Risk stratification
      i. Emergency treatment (i.e. Intubations, urgent cath, urgent surgery etc.)
      ii. ICU/CCU management
      iii. Ward management
      iv. Discharge
   ii. Communication of plan
      i. Patient
      ii. Colleagues
      iii. Allied health professionals

2. Non-Invasive Cardiac Testing

a) Electrocardiogram (ECG)
   i. Perform an ECG independently
   ii. Interpretation

b) Exercise Stress Test
   i. Treadmill exercise stress test
      - Indications
      - Contra-indications
      - Perform a stress test with supervision
      - Limitations
   ii. Exercise nuclear stress test
      - Indications
      - Contra-indications
      - Additional information to a treadmill stress test
      - Limitations
   iii. Pharmacological nuclear stress test
      - Indications
      - Contra-indications
      - Pharmacological mechanism (persantine, dobutamine)
      - Additional information to an exercise nuclear stress test
      - Limitations
   iv. Stress and pharmacological stress echo
      - Indications
      - Contra-indications
      - Limitations

c) Echocardiography
   i. Indications
   ii. Limitations

d) Holter Monitor
   i. Indications
   ii. Limitations

e) Ambulatory Blood Pressure Monitoring
   i. Indications
   ii. Limitations

3. Arrhythmia

a) Dizziness, Palpitation, Pre-syncope and Syncope
   i. History and physical
   ii. Differential diagnosis

iii. Investigations

b) Supraventricular Tachycardia
   i. ECG characteristics for diagnosis
   ii. Differential diagnosis
   iii. Non-invasive testing
   iv. Indications for invasive testing and therapy (electrophysiological study and ablation)
   v. Pharmacological therapies

c) Atrial fibrillation and Atrial Flutter
   i. ECG characteristics for diagnosis
   ii. Differential diagnosis
   iii. Associated medical conditions
   iv. Non-invasive testing
   v. Rate control versus rhythm control
   vi. Pharmacological therapies
   vii. Indications for invasive testing and therapy (electrophysiological study and ablation)
   viii. Risk factors associated with embolic events
   ix. Indications for anticoagulation

d) Ventricular Arrhythmias
   i. ECG characteristics for diagnosis
   ii. Differential diagnosis
   iii. Non-invasive testing
   iv. Pharmacological therapies
   v. Indications for electrophysiological study
   vi. Medical therapy versus AICD
   vii. Sudden cardiac death
      - Risk stratification
      - Therapies

4. Coronary Artery Disease

a) History and Physical
   i. Stable angina
   ii. Unstable angina
   iii. Acute myocardial infarction
   iv. Differentiate typical angina from atypical angina and non-cardiac chest pain
   v. Special population (e.g. elderly, women, diabetics)

b) Risk Factors
   i. Modifiable
   ii. Non-modifiable

c) Risk stratification

d) Pathophysiology

e) Non-invasive Investigations
   i. Electrocardiogram
      - Perform and interpret
   ii. Blood work

iii. Echocardiogram
- Interpret written report

iv. Exercise and pharmacological stress testing
- Indications
- Contra-indications
- ECG versus nuclear versus echocardiogram
- Recognize high risk characteristics

v. CT angiography and MRI

f) Invasive Cardiac Investigations

i. Cardiac catheterization
- Indications
- Contra-indications
- Risks
- Describe the procedure

g) Pharmacological Therapies

i. Describe the mechanism of action and benefit of each of the following medical therapies:
- Anti-platelet therapy
- Beta-Blocker therapy
- Calcium channel blocker therapy
- Nitrates therapy
- ACE inhibitor therapy
- Angiotensen receptor blocker therapy
- Cholesterol lowering therapy

h) Invasive Therapies

i. Percutaneous coronary angioplasty
- Indications
- Contra-indications
- Risks
- Benefits
- In-stent restenosis
- Stents and drug eluting stents
- Importance of anti-platelet therapy

ii. Coronary artery bypass surgery
- Indications
- Contra-indications
- Risks
- Benefits
- Arterial conduits versus venous conduits
- On-pump versus off pump

5. Acute Coronary Syndrome

a) Unstable Angina and Non ST Elevation MI

i. History and Physical
- Identify high risk characteristics

ii. Risk Factors

iii. Risk stratification

iv. Pathophysiology
- Characteristics of the vulnerable plaque(s)
- Compare with stable plaque in stable angina
- Compare to ST elevation MI
- Platelets
- Thrombus
- Coagulation cascade (i.e. factors X and II, thrombin)

v. Non-invasive Investigations
- Electrocardiogram
  - Identify ischemic changes
  - Identify high risk features
- Blood work (Benefit and limitations)
  - Creatine Kinase (CK)
  - CK MB
  - Troponin
- Exercise or pharmacological stress testing

vi. Invasive Investigations
- Cardiac Catheterization

vii. Pharmacological therapies
- Describe mechanism of action and benefit of each of the following:
  - Anti-platelet therapy
  - Beta-blocker therapy
  - Anti-thrombotic therapy (UFH, LMWH)
  - New anti-thrombotic therapy
  - Glycoprotein 2B3A receptor blockers
  - Nitrates
  - Cholesterol lowering therapy (statin versus others)
  - Calcium channel blocker therapy

viii. Invasive therapies
- Percutaneous coronary intervention
  - Indications
  - Contra-indications
  - Benefits
  - Timing of procedure
- Intra-aortic balloon pump
  - Indications
  - Contra-indications
  - Benefits
  - Risks
- Coronary bypass surgery
  - Indications
  - Contra-indications
  - Benefits

b) ST Elevation MI

i. History and Physical
    - Identify high risk characteristics
ii. Risk Factors
iii. Risk stratification
iv. Differential diagnosis of ST elevation
v. Pathophysiology
    - Characteristics of the vulnerable plaque(s)
    - Compare to non ST elevation MI
    - Platelets
    - Thrombus
    - Coagulation cascade (i.e. factors X and II, thrombin)
vi. Non-invasive Investigations
    - Electrocardiogram
        - Locate the territory of the MI
    - Blood work (Benefit and limitations)
        - Creatine Kinase (CK)
        - CK MB
        - Troponin
vii. Invasive Investigations
    - Cardiac Catheterization
viii. Pharmacological therapies
    - Indications and contra-indications for thrombolytic therapy
    - Describe mechanism of action and benefit of each of the following:
        - Anti-platelet therapy
        - Thrombolytic therapy
        - Beta-blocker therapy
        - Anti-thrombotic therapy (UFH, LMWH)
        - New anti-thrombotic therapy
        - Glycoprotein 2B3A receptor blockers
        - Nitrates
        - Cholesterol lowering therapy (statin versus others)
        - Calcium channel blocker therapy
ix. Invasive therapies
    - Primary percutaneous coronary intervention
        - Indications
        - Contra-indications
        - Risks (stroke)
        - Benefits
        - Timing of procedure
        - Compare with thrombolytic therapy alone
        - Facilitated PCI (thrombolytic therapy and/or glycoprotein 2B3A receptor blocker)
    - Rescue percutaneous coronary intervention
        - Indications
        - Contra-indications

- Timing of procedure
- Risks
- Benefits

- Intra-aortic balloon pump
  - Indications
  - Contra-indications
  - Benefits
  - Risks
- Coronary bypass surgery
  - Indications
  - Contra-indications
  - Benefits

6. Congestive Heart Failure

a) Definition of Congestive Heart Failure
b) Definition of Cardiogenic Shock
c) Classification of Congestive Heart Failure
d) Pathophysiology
   i. Systolic failure
      - Left ventricular dysfunction
      - Ischemia
   ii. Diastolic failure
   iii. High output failure
   iv. Valvular disease
      - Aortic valve disease
      - Mitral valve disease
   v. Congenital heart disease
e) History and Physical
   i. Symptoms
      - Respiratory
      - Cardiac
      - Gastro-intestinal
      - Secondary causes (e.g. infection, high output states etc.)
   ii. Past Medical History
      - Associated systemic illness
      - Toxins (e.g. chemotherapy, radiation, alcohol etc.)
      - Infection
   iii. Physical
      - Pulse
      - Blood pressure
      - Chest auscultation
      - Jugular venous pressure
      - Cardiac palpation
      - Cardiac ausculatation
      - Abdominal findings
      - Peripheral findings

f) Non-Invasive Investigations
g) Invasive Investigations
h) Pharmacological Therapies
i) Invasive Therapies

RESPONSIBILITIES OF THE RESIDENT-IN-CHARGE

OF THE CORONARY CARE UNIT

1. PATIENT ADMISSION & DISCHARGE

The resident will decide which patients are candidates for admission to the CCU upon consultation with the appropriate CCU staff cardiologist of that particular week. Admissions to the CCU are admitted under the CCU cardiologist. The on-call cardiologist for that day should also be documented in the chart to ensure a follow up cardiologist is available in the event the patient need cardiology follows up. After 5:00 pm, the cardiologist-on-call should be notified of the admission regardless of the time.

If patient is admitted to the cardiology ward (D3), the patient should be admitted under the cardiologist on the ward. The on-call cardiologist for that day should also be documented in the chart to ensure a follow up cardiologist is available in the event the patient need cardiology follows up. After 5:00 pm, the cardiologist-on-call should be notified of the admission regardless of the time.

Whenever possible, the discharge of the patient from the CCU should be with the knowledge of the attending cardiologist. The ward resident/intern under whose care the patient in to be transferred should be informed verbally about the status of the patient. Just prior to the patient being transferred to a ward within the hospital, the transfer note outlining the patient's course during his stay in the CCU should be written in the chart as a final progress note. Transfer orders must be written before the patient leaves the CCU and include the order to notify the ward intern or resident immediately upon the arrival of the patient from the CCU.

The patient's family physician and cardiologist should be informed of the patient's admission. If patient's cardiologist works at Sunnybrook, a message should be left with the patient's cardiologist at the time of admission.

2. RESIDENT MORNING HANDOVER

During weekdays this CCU resident on call is responsible for handover at 0730 in the morning to the CCU team and the cardiology ward team in the D3 conference room. There are a few exceptions due to educational events. (See schedule)

On weekends, handover takes place at 0900 in the CCU.

3. CORONARY CARE UNIT ROUNDS

The CCU resident is expected to conduct formal CCU rounds with the CCU cardiologist in the morning. The nurse looking after each patient will also make rounds with the CCU team. Rounds should be performed with the cardiologist-on-call Saturday and Sunday.

4. DIVISIONAL ROUNDS

The residents should attend educational rounds in the Division of Cardiology. A schedule of rounds is included in this manual.

5. ECG READING

All electrocardiograms done on patients in the Coronary Care Unit must be interpreted during the day by the CCU team. The interpretation should be written in the daily progress note of the individual patient.

6. CONSULTATION SERVICE FOR EMERGECY DEPARTMENT

The resident in the CCU is responsible for providing cardiology consultation to the Emergency Department. Requests for consultations must be answered promptly and decisions made about patient disposition in a timely fashion. Patients who are candidates for primary PCI or thrombolytic therapy must be seen as quickly as possible and "fast-tracked" to the CCU in order to minimize delays in the initiation of treatment. The current policy at Sunnybrook for STEMI is 24/7 primary PCI. If there are unexpected delay for primary PCI, staff cardiologist should be contacted and alternative method of revascularizton considered.

7. INVASIVE PROCEDURES

Invasive procedures, including pericardiocentesis, arterial lines and Swan-Ganz catheterization, temporary transvenous pacing and cardioversion must be supervised initially by a staff cardiologist. All these procedures require prior notification of the attending CCU cardiologist. The resident must demonstrate proficiency in the technique and ability to deal with the potential complications before he can expect to have permission to attempt unsupervised procedures. Informed consent should be obtained from the patient or an appropriate family member. The patient's attending staff cardiologist should be notified of any major invasive tests or if serious complications develop.

8. SUPERVISORY & TEACHING RESPONSIBILTIES

The cardiology fellows are responsible for the supervision and teaching of the junior and senior residents as well as any undergraduate students assigned to the CCU.

9. RESEARCH

Residents are expected to be familiar with, and to participate in, ongoing clinical research protocols in the CCU.

GENERAL CCU POLICY

1. A complete history and physical examination should be on the chart at the time of admission. Progress notes must be written daily and at more frequent intervals according to the patient's status.

2. Standard orders for CCU admission should be utilized. These act as a guide to routine care and are frequently reviewed and updated. **Please use discretion in the application of standard orders to individual patients.** Verbal orders must be written in the doctor's order sheet and signed as soon as possible. These should be kept to a minimum. The senior resident must carry a functioning bellboy at all times. Any changes, particularly deterioration of a patient's condition, should be conveyed to the attending staff immediately.

3. When the patient is admitted to the CCU, all pertinent medical information should be obtained and reviewed. If the patient is referred from another hospital, the resident should request that all information accompany the patient at the time of transfer. The resident should discuss individual patient management with the CTU cardiologist. A therapeutic plan should be undertaken to cover a 24-hour period. Consent for post-mortem examination should be sought on all patients who die in the Unit.

4. The resident should be acquainted with the use of all technical equipment in the CCU, i.e. defibrillators, monitors, external pacemaker equipment for vascular access, cardiac output computers, etc.

5. To book temporary pacemakers and pericardiocentesis the resident should contact the head nurse in the Catheterization Laboratory or the nurse on call for that unit. Cardiac catheterization should be booked through the Cath Triage Coordinator's office. A Cath Referral Form **must** be filled and handed over to the Coordinator.

6. The resident is responsible for obtaining consent forms for invasive and surgical procedures including cardioversion, pacemakers, arterial lines, central lines and Swan-Ganz catheters. The patient with a temporary transvenous pacemaker should have the pacing and sensing thresholds assessed daily.

7. Hemodynamic data should be recorded at least every four hours when patients are being hemodynamically monitored. More frequent recording of hemodynamic parameters may be necessary, depending on the number and type of interventions employed.

8. Frequent communication with the family members of a patient in the Coronary Care Unit is mandatory. A family member, preferably the next of kin, must be informed of the patient's condition on admission to the Unit and any sudden deterioration while in hospital.

9. It is important that, following work or teaching rounds, orders are written promptly so that they can be carried out early in the day. Patients should be transferred early in the day whenever possible and the receiving resident notified of such transfer.

10. The charge nurse should be notified of patients requiring chest x-rays during the morning rounds. 2D echocardiograms can be scheduled as portable studies if necessary.

11. Policies for the CCU are created by the Coronary Care Unit Committee. The Chairman of this committee is the Unit Director. Any questions regarding policy in the Unit should be discussed with the Unit Director.

GUIDELINES FOR THE ROUTINE CARE

OF THE MYOCARDIAL INFARCTION PATIENT

Primary PCI

- The policy for primary PCI continues to change.
- All patients presenting with STEMI should be considered for primary PCI 24/7 as the primary modality for revascularization.
- If primary PCI is delayed, (ie. Door to balloon over 60 minutes) then thrombolytic therapy should be considered if not contra-indicated.

Thrombolytic Therapy

- Thrombolytic therapy is given for acute myocardial infarction when primary PCI is not available.
- Unless contraindicated, thrombolytic therapy is usually given to patients presenting within the first 12 hours after the onset of symptoms.
- Protocols for thrombolytic therapy are in the CCU and Emergency Departments.

Relief of Chest Pain

- The treatment of chest pain with MI in the acute setting is generally with morphine and oxygen. Sublingual nitroglycerin may be used if there is some doubt as to whether a myocardial infarction has occurred or if the patient is experiencing unstable angina. (Sublingual nitroglycerin may cause marked hypotension with an inferior wall myocardial infarction.
- IV nitroglycerin may be used for prolonged chest pain that does not respond to repeated doses of morphine. BP needs to be monitored carefully and alternate diagnoses such as pericarditis should be considered.

Intravenous Beta-blocker Therapy

- IV beta-blocker therapy (e.g. Metoprolol 5 mg + 5 mg + 5 mg over 15-30 minutes should be considered unless contraindications exist (e.g., CHF, heart block, asthma, hypotension). Please consult staff cardiologist upon admission regarding use of these agents.

Prophylaxis Against Left Ventricular Thrombi

- Anteroseptal myocardial infarction is frequently associated with the development of LV thrombi. Unless contraindicated, patients with an anteroseptal infarct should be considered for 3 to 6 months of anticoagulation.

- If signs of pericarditis develop during prophylactic heparin therapy, then heparin should be discontinued and anti-inflammatory (NSAID) could be considered.

Myocardial Infarction and Ventricular Arrhythmias

- Frequent ventricular premature beats, couplets or isolated short bursts of ventricular tachycardia are not usually treated with anti-arrhythmic therapy particularly if they occur within the first 24 hours after the onset of symptoms.

- Beta-blockers are generally effective in reducing incidence of sudden death post-MI.

- **Amiodarone** is often the drug of choice in such patients if life-threatening ventricular arrhythmias are a concern.

Myocardial Infarction and Congestive Heart Failure

- CHF occurs commonly in the first few days and can be treated with prn doses of intravenous or po **furosemide**.

- **ACE-inhibitor** and/or **Angiotensin receptor blocker** therapy is generally prescribed especially in the setting of LV dysfunction.

- Once CHF is under better control, **beta-blocker** has been shown to reduce mortality and improve NYHA class.

- **Spironolactone** should be considered after patient is optimally treated with ACE-I/ARB, beta-blocker and diuretic. But renal function and potassium need to be followed closely.

Routine Post-MI Prophylaxis

- **Enteric-coated ASA** 81 to 325 mg should be started routinely in MI patients on admission and continued as prophylaxis indefinitely.

- **Beta-blockers** are used post myocardial infarction to prevent cardiac death and preserve cardiac function unless otherwise contra-indicated.

- **ACE-inhibitor** therapy and/or **ARB** are beneficial not only in LV dysfunction with heart failure, but also reduce major adverse cardiac event in patients with coronary artery disease.

- **Clopidogrel** in combination with ECASA should be considered for 1 year for routine secondary prevention. It is mandatory in patients who undergo PCI (see below). Be aware of alternatives to Clopidogrel including **Ticlopidine, Prasugrel, and Ticagrelor**.

- **Stain** therapy must be considered in all patients with coronary artery disease. Generally high dose statin is recommended. At a minimum, the LDL and Total cholesterol/HDL targets needs to be met, less and 2.0 and less than 4.0 respectively.

- **Calcium Channel Blockers** are generally not first line therapy for patients post MI. If a calcium channel blocker is needed post MI, avoid diltiazem and nifidepine in patients with congestive heart failure and/or LV dysfunction. Amlopidipine is a safer choice.

Special note on Clopidogrel and ECASA with stents

- The majority of patients presenting with acute coronary syndrome will have a diagnostic angiogram performed prior to discharge. If PCI is appropriate, these patients will also have PCI with stent(s) with either a bare metal stent (BMS) or a drug eluting stent (DES).

- Patients with a **BMS must be on Clopidogrel for a minimum of 4 weeks** along with ECASA indefinitely.

- Patients with a **DES must be on Clopidogrel for a minimum of 1 year** along with ECASA indefinitely.

Sunnybrook
SCHULICH HEART CENTRE

INTERNAL CODE STEMI ALGORITHM

ED CCL calls STEMI hotline **(416-480-4621)**
Gilbert CICU tl activates "**CODE STEMI**"[1] **(EXT. 5555)**
IF INTUBATED
interventionalist to consult critical care medicine as needed
ED CCL NOTIFies patient flow **(ext. 4315)** / shift manager **(pgr. 1400)**

WEEKDAYS DAYTIME (07:30 to 17:00)
Gilbert CICU TL calls cath lab TL **(Ext. 7744)**
patient goes directly to cath lab if cath lab ready
otherwise remains in Ed
CATH LAB RN NOTIFIES ED CCL at ext 88093
WHEN SPECIFIC LAB IS READY
ED ARRANGES PORTER FOR TRANSPORT
ED RN AND PORTER TRANSPORT PATIENT TO
IDENTIFIED CATH LAB

AFTER HOURS (17:01 to 07:29), WEEKENDS, & HOLIDAYS
patient remains in ed until cath lab is ready
GILBERT CICU TL INFORMS ED CCL ext 88093
WHEN ALL CODE STEMI TEAM MEMBERS
HAVE RESPONDED
CATH LAB RN NOTIFIES ED CCL at ext 99093
WHEN SPECIFIC LAB IS READY
ED ARRANGES PORTER FOR TRANSPORT
ED RN AND PORTER TRANSPORT PATIENT TO
IDENTIFIED CATH LAB

post-cath lab procedure

intubated (outside CICU Criteria) – CVICU
IF INTUBATED DURING PROCEDURE
interventionalist to consult critical care medicine
CATH LAB NOTIFIES patient flow **(ext. 4315)** /
shift manager **(pgr. 1400)**
CATH LAB TO PROVIDE CALL BACK NUMBER to
patient flow / shift manager
PATIENT FLOW / SHIFT MANAGER NOTIFIES
CATH LAB OF ASSIGNED BED

Intubated (within CICU Criteria/NON-intubated – GILBERT CICU
CATH LAB NOTIFIES GILBERT CICU
GILBERT CICU NOTIFIES patient flow **(ext. 4315)** / shift manager **(pgr. 1400)**

if no bed
PATIENT FLOW / shift manager NOTIFIES CATH LAB
rapid decant of patient from cvicu/Gilbert CICU to admit post-cath lab procedure patient

rapid decant of CVICU patient
CRITICAL CARE MEDICINE IDENTIFIES
APPROPRIATE PATIENT FOR TRANSFER TO D3
or overflow to B3 (to a maximum of 8 patients)
IF NO D3 BED AVAILABLE – CRITICAL CARE
MEDICINE IDENTIFIES APPROPRIATE PATIENT
FOR TRANSFER TO GILBERT CICU
CRITICAL CARE MEDICINE CALLS GILBERT
CICU RESIDENT TO DISCUSS TRANSFER
IF ACCEPTED TO GILBERT CICU, TRANSFER
ORDERS can BE WRITTEN ON ARRIVAL TO
GILBERT CICU

rapid decant of GILBERT CICU patient
GILBERT CICU RESIDENT IDENTIFIES
APPROPRIATE PATIENT FOR TRANSFER to D3
or overflow to B3 (to a maximum of 8 patients)
immediate transfer of patient
TRANSFER ORDERS CAN BE WRITTEN ON
ARRIVAL to the ward BY GILBERT CICU
RESIDENT

BED still unavailable for ventilated patient
PATIENT FLOW / SHIFT MANAGER NOTIFIES Cath lab
CATH LAB notifies criTIcall **(1-800-668-4357)** to arrange transfer
PATIENT remains IN CATH LAB until bed arranged by criticall

[1]Includes on-call Cath Lab RNs (4), Interventionalist, Fellow, Gilbert CICU Resident on-call, Patient Flow, Gilbert CICU RN-In-Charge, Cath Lab RN first call, and Telecommunications Manager - Updated March 2012

1. **Admission Criteria to the Gilbert CICU**

Preamble

The purpose of the CICU admission criteria is to appropriately identify high-risk cardiac patients who will benefit from specialized cardiac care provided in the Gilbert CICU and to appropriately identify a subset of patients who will be best cared for in the Critical Care Unit (CVICU/CRCU), while minimizing predictable transfers of care between the services. The Gilbert CICU will have Ten (10) level 2 beds (non vented) and Two (2) level 3 beds (vented) along with 4-telemetry step down beds. The attending cardiologist will be the most responsible physician for all Gilbert unit patients. L**evel 3 (vented) patients** will be managed with consultative support from the DCCM when needed. The Gilbert CICU will be able to provide renal replacement with routine hemodialysis or SLED as is currently performed in the Coronary Care Unit (CCU).

1.1 General Admission Criteria

- Acute ST elevation myocardial infarction (STEMI).
- High risk acute coronary syndrome
- Cardiogenic shock
- Unstable brady or tachy arrhythmias
- Acute decompensated congestive heart failure related to ischemia or arrhythmia as the inciting cause
- Cardiac Tamponade
- Type B aortic dissection
- Valvular heart disease with hemodynamic instability
- Infective endocarditis with hemodynamic instability
- Post endovascular image guided procedures
    - i. Percutaneous coronary intervention
    - ii. EP directed procedures
    - iii. Transcutaenous aortic valve intervention/Mitral clip
    - iv. Percutaneous peripheral endovascular and selected endovascular aortic interventions
- Selected cases of level 2 postoperative cardiac or vascular (such as carotid endarterectomy) surgical patients.

1.2 Invasive Mechanical Ventilation Criteria

a. Patients who require mechanical ventilation as a direct consequence from their primary cardiac condition. (See General Admission Criteria)
b. Patients already admitted to the Gilbert CICU who deteriorate to require mechanical ventilation.
c. Anticipated short-term need for mechanical ventilation (72-96 hours)

1.21 Exclusion Criteria for Gilbert CICU patients (who otherwise meet admission criteria of Gilbert CICU)

a. Out of hospital cardiac arrest (including STEMI patients), requiring hypothermia therapy
b. Continuous renal replacement (ie CVVHD)
c. Multi-organ failure with respiratory failure
d. In-hospital code blue
e. Level 3 post operative open cardiac/vascular surgical patients
f. Anticipated prolonged and complex mechanical ventilation (beyond 72-96 hours)
g. Patients with troponin elevation or underlying cardiac disease (coronary artery disease or left ventricular function) with clear secondary cause of decompensation requiring mechanical ventilation (pneumonia or sepsis)
h. Out-of hospital transfers of ventilated patients that will likely require surgical intervention due to aortic dissections, or acute valvular dysfunction due to endocarditis or other causes.
i. In hospital patients (including those already receiving level 2 care in the Gilbert ICU) that are likely to require surgical intervention due to aortic dissections, or acute valvular dysfunction due to endocarditis or other causes. These patients should be cared for in CVICU whenever possible.

2. Scope of Care within the Gilbert CICU

- Invasive mechanical ventilation (Maximum of two level 3 beds)
- Non-invasive ventilation support with CPAP/BIPAP
- Insertion of transvenous pacemaker wire at the bedside with fluoroscopy
- Insertion of intra aortic balloon pump at the bedside with fluoroscopy
- Pericardiocentesis at the bedside with both ultrasound and fluoroscopy
- Central venous and/or invasive arterial pressure monitoring
- Management of transvenous, transcutaneous, and epicardial pacemaker
- Management of intra aortic balloon pump
- Intravenous inotropic support

3. Role of Critical Care Medicine in the Gilbert CICU

The Department of Critical Care Medicine will assume the same role in the CICU that the Division of Cardiology has in the CVICU. Specifically, DCCM will provide elective consultation to address specific questions and provide specific procedures beyond the scope of practice of the cardiologists providing routine critical care services in the CICU. The rapid response team will not see patients in the CICU and will not perform routine ICU follow up in patients after discharge from the CICU.

4. Lack of Available Gilbert CICU Beds

In the event of a patient meeting CICU admission criteria but insufficient beds available in Gilbert CICU but Level 3 beds available elsewhere, patient will be admitted to the DCCM with cardiology consulting. During the first year, if no critical

care beds are available in the hospital, these patients will remain in the emergency department under DCCM. This policy will be reviewed at the end of the first year. −

5. Transfer to CVICU

- If the patient remains on mechanical ventilation beyond 72-96 hours with anticipated complex and prolonged mechanical ventilation course, a joint discussion between Cardiology and Critical Care regarding the appropriate location for care should occur.

6. Emergency Room Consultation for Vented Patients

- The overall goal is to minimize dual consultation. Cardiology will be consulted on patients that meet Gilbert Unit admission criteria. The appropriateness of consultations and frequency of joint requests for consultations will be regularly reviewed as part of Quality Assurance. In the event of consultations to both services, a joint decision between Cardiology and Critical Care, with the aid of the admission criteria, will be used to decide the appropriate location for care (ie. Gilbert CICU, CVICU or CRCU).

7. Airway And Ventilator Coverage

- The cardiology team has the primary responsibility to manage airway and mechanical ventilation along with assistance from the respiratory therapist assigned to the Gilbert CICU.
- The cardiology team is responsible for **emergency** airway issues with assistance from anesthesia and/or CODE BLUE Team.
- For **non-emergent** tracheostomy and/or ventilation issues, the primary cardiology team will have consultation with the appropriate services (Critical Care, Anesthesia, Respirology, General Surgery etc.).

MAC approved June 9, 2009

Appendix -
Referral of Patients from Emergency Department

The Appendix is a table for those Clinical Presentations which have created uncertainty in the past at Sunnybrook Health Sciences Centre with respect to the most appropriate service for consultation and admission.

Future modifications of the Appendix will be managed by mutual consent of the involved departments/divisions/services, with notification provided to the Vice President, Medical Professional Practice, who in turn will be responsible for communicating the most current version of the Appendix to all hospital stakeholders and to the Medical Advisory Committee at its next scheduled meeting.

Clinical Presentation	**Qualified As Follows**	**Consult Service = Admission Service, unless indicated (**) admission service is different from consult service**
Abdominal Pain, undifferentiated	Needing admission for investigations	Internal Medicine
Aortic Dissection	Type A	Cardiac Surgery
	Type B	Cardiology, with consult to Vascular Surgery
Bowel Obstruction	All, except if complication listed as “Oncology Problem”	General Surgery
Chest Pain	Acute STEMI High risk Acute Coronary Syndrome with either: • Elevated troponin • Dynamic ECG change • Acute CHF • Hemodynamic instability	Cardiology
	Borderline or negative troponin without: • ECG changes • Ongoing chest pain • Hemodynamic instability Elevated troponin: • Without ACS or MI (i.e. Renal Failure, Pulmonary Embolus, etc.) Patients who are not candidate for invasive cardiac investigations or interventions.	Internal Medicine
Congestive Heart Failure	Associated with either: • ACS or acute MI • Ventricular arrhythmias • Congenital heart disease • Endocarditis	Cardiology
	All others Patients who are not candidate for invasive cardiac investigations or interventions.	Internal Medicine

Clinical Presentation	Qualified As Follows	Consult Service = Admission Service, unless indicated (**) admission service is different from consult service
Arrhythmia	Complex arrhythmias • Ventricular tachycardia • AICD discharge (appropriate or inappropriate) • Unstable tachyarrthymias with hemodynamic compromise (SVT or VT) • Bradyarrhythmias requiring temporary pacing Syncope with demonstrated cardiac rhythm etiology	Cardiology
Arrhythmia	Uncomplicated arrhythmias (atrial fibrillation, SVT, and bradyarrhythmias) Bradyarrhythmias secondary to other causes (hypothyroidism, hyperkalemia, renal insufficiency, digoxin toxicity etc.)	Internal Medicine
COPD/Asthma	Unstable Patient requiring ongoing invasive mechanical ventilation or ongoing non-invasive (BiPAP) ventilatory support.	Critical care
	All others	Internal Medicine
Deep Venous Thrombosis	If patient can be treated as an outpatient	Thromboembolism Service (TES)
	If clinically non-massive, but patient requires admission	**Internal Medicine
	If clinically massive, e.g. patient unable to walk.	**Internal Medicine admit Consult to TES
	If clinically non-massive and patient is post-operative or patient is from Oncology	**Operative service or Oncology admission Consult to TES
Dialysis Patient Under review 2003 guidelines apply	All medical problems All access problems	Nephrology
Diverticulitis	All patients	General Surgery
Dysvascular Limb	Patient presents within 3 months of re-vascularization by Sunnybrook Vascular Surgery and requires amputation.	Vascular Surgery
	Limb amenable for revascularization	Vascular Surgery
	Limb not amenable for revascularization:	
	• If medically stable	Orthopaedic Surgery
	• If patient or surgery team declines surgery as an option	Internal Medicine
	• If medically unstable (hemodynamic or respiratory instability) and surgery not an option	Critical Care
GI Bleed	If persistent hemodynamic instability	Gastroenterology with consultation as necessary to General Surgery
	All others	Internal Medicine
Inability to Ambulate or Inability to Use arms	If fracture identified including stable fracture (e.g. pubic ramus fracture) and medically stable (no hemodynamic or respiratory	Orthopaedic Surgery

Clinical Presentation	Qualified As Follows	Consult Service = Admission Service, unless indicated (**) admission service is different from consult service
	instability)	
Inability to Ambulate or Inability to Use arms	If fracture identified and medically unstable (hemodynamic or respiratory instability) or If no fracture identified	Internal Medicine
Inability to Ambulate or Inability to Use arms	If fracture identified and medically unstable (hemodynamic or respiratory instability).	Critical Care
Intracranial Bleed	All patients initially	Neurosurgery consult
	• If operable lesion	**Neurosurgery admission
	• If non-operable lesion	**Internal Medicine or **Critical Care admission
Oncology Problem (including complications of therapy)	All oncology patients based upon recent relationship with Sunnybrook oncologist	Gynaecologic, Medical, Radiation or Surgical Oncology
Pancreatitis	Gallstone related	General Surgery
	All others	Internal Medicine
Pulmonary Embolus	If patient can be treated as an outpatient	Thromboembolism Service (TES) consult
	If clinically massive (e.g. hypotension, overt right heart failure)	**Critical Care admission Consult TES
	If clinically non-massive	**Internal Medicine admission Consult TES
	If clinically non-massive and patient is post-operative or patient is from Oncology	**Operative service or Oncology admission Consult TES
Pyelonephritis and Urosepsis	In setting of obstruction requiring urgent surgical intervention	Urology
	All others	Internal Medicine
Spine Injuries under review 2003 guidelines apply	All spine injuries requiring surgical opinion	Integrated Spine Service on Call
Stroke/high risk TIA	Potential candidates for tPA or stroke studies.	Neurology
	All others	Internal Medicine
Trauma	Trauma Team Activation Patient – The TTL has the authority to decide which of the following 4 services the trauma patient will be admitted to:	General (trauma) surgery, Neurosurgery, Orthopaedic surgery, Plastic surgery.

Appendix – Chest Pain
Old vs. New Referral Guidelines

Clinical Presentation	Qualified As Follows	Service
OLD GUIDELINE		
Chest Pain	Acute STEMI High risk Acute Coronary Syndrome with either: • Elevated troponin • Dynamic ECG change • Acute CHF • Hemodynamic instability	Cardiology
	Borderline or negative troponin without: • ECG changes • Ongoing chest pain • Hemodynamic instability Elevated troponin: • Without ACS or MI (i.e. Renal Failure, Pulmonary Embolus, etc.) Patients who are not candidate for invasive cardiac investigations or interventions.	Internal Medicine
NEW GUIDELINE		
Chest Pain	1. Acute STEMI 2. High risk Acute Coronary Syndrome as the PRIMARY DIAGNOSIS with ANY of the following features: • History strongly suggests ACS and patient will likely require cardiac intervention • Elevated troponin • Dynamic ECG change • Acute CHF • Hemodynamic instability • Ongoing chest pain in the ER	Cardiology
	1. Negative troponin without ANY of the following features: • ECG changes • Ongoing chest pain • Hemodynamic instability 2. Elevated troponin without ACS as the PRIMARY diagnosis (sepsis, etc.) 3. Patients who are not candidates for invasive cardiac investigations or interventions based on known wishes or significant comorbidities.	Internal Medicine