Yale New Haven Health

Emergency Service Line

Chest Pain Center Protocol
Standard Operating Procedure

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Purpose:
Yale-New Haven Chest Pain Center is a 6-bed unit in the Emergency Department. The purpose of the Chest Pain Center (CPC) is to allow effective triage of patients with acute chest pain or angina equivalent symptoms. It allows expeditious care of patients presenting to the Emergency Department (ED) who are at moderate likelihood of having acute coronary syndrome (i.e. patients who do not have ischemic ECG changes or high-sensitivity troponins indicative of ischemia but remain moderate risk based on risk stratification).

Patients admitted to the CPC will undergo an expedited protocol in a monitored setting before undergoing a stress test. Patients with acute myocardial infarction, acute heart failure, or uncontrolled arrhythmias are not candidates for the CPC. The following serves as an outline delineating the protocol employed in the CPC:

Admission Eligibility Criteria

- Patients with chest pain considered moderate risk for acute ischemia with:
  - non-ischemic ECGs
  - high-sensitivity troponin (Hs-troponin) values and deltas in clinical scenarios that do not suggest acute myocardial injury or infarction
  - please follow / refer to Chest Pain Evaluation, Adult ED Care Signature pathway
- Patients with known coronary artery disease are eligible.
- Patients with ongoing non-ischemic chest pain (without ECG changes and without abnormal high-sensitivity troponin deltas) are also eligible.
- Patients need stable vital signs

Exclusion Criteria for Chest Pain Center

- Patients with high probability of having acute coronary syndrome:
  - New ischemic ECG changes
  - Rising Hs-troponin: new elevation >=52, on 0-hour/baseline value
    - If initial troponin is greater than or equal to 52, perform 1 and 3 hour testing as directed in the “Chest Pain Evaluation, Adult ED” Care Signature Pathway and make a clinical decision based on other chronic conditions that may be associated with an elevated Hs-Troponin which may not indicate acute MI (such as CKD, LVH, Acute heart failure, atrial fibrillation, etc.)
  - Hemodynamic instability (extreme tachycardia, hypotension, severe uncontrolled hypertension, decompensated heart failure)
- Patient who are unable to transfer independently on the imaging table. Patients need to be able to walk 4-5 steps.

- Patients on IV heparin, IV nitroglycerin, IV IIb/IIIa inhibitors.
- Patients with active asthma exacerbation or active COPD exacerbation.
- Patients with fever/febrile illness.
- Patients who are COVID + and have not yet completed the recommend isolation period. Patients must be 10-days out from the positive test *and* at least 24 hours without symptoms in order to complete a stress test.
- Uncontrolled cardiac arrhythmias (atrial or ventricular).
- Patients > 350 lbs. and PET stress testing is unavailable.
- Patients with known active C. difficile.

Special Considerations

- Patients who are oxygen dependent.
- Patients with the use of theophylline.
- Patients with uncontrolled COPD/asthma exacerbation.
  - These patients may be admitted to the Chest Pain Center, however a dobutamine stress test may warranted.
  - Dobutamine stress tests are only available on weekdays and will need to be coordinated with staff in the nuclear or echo lab.

Responsibilities of the Primary Team Prior to Transfer to the CPC

- ECG will be interpreted and documented by the ED attending.
- Appropriateness for admission will be determined by the ED attending per the inclusion and exclusion criteria.
- Patients should have a chest x-ray, bedside ED point of care echocardiogram, and at least one cardiac enzyme completed prior to being transferred to the CPC.
- Complete the following in EPIC:
  - Order Set: Choose "ED Chest Pain Observation" in the order set.
    - *This includes pre-checked admission order, diet order, troponins, lipid panel, hemoglobin A1c, COVID screening test, ECG, and stress test order.*
    - Note: patients who have a positive COVID test on file within 90 days should not be re-tested.
  - Home Medications: Review with patients their medications, dosages, and when their medications are taken. Then re-order the medications that should be administered in the CPC.
    - Please make sure that home blood pressure medications and diabetes/insulin (with sliding scale) are continued in the CPC.
    - Beta-blockers: Patients on beta-blockers should continue them while they are in the CPC. Starting new beta-blockers should be avoided as it may affect the interpretation of the stress test.
  - CPC ED Note phrase: Once the ED note is finished and the admission order to CPC has been placed, enter ".EDOBSADMITCP" into the ED note. Complete this dot phrase using F2.
  - If a patient has a cardiologist, they should be contacted to discuss plan for admission to the CPC.

        - *Calling a patient's cardiologist is helpful as this can help with stress test selection or change their management.*
- Sign out:
    - Sign out must occur from ED nurse to CPC nurse.
    - Sign out must occur from the ED provider to the CPC APP.

Risk factors to consider for chest pain risk stratification:

Cardiac Risk Factors:

- Age
- Hypertension
- Diabetes mellitus
- Current cigarette smoking
- Elevated serum lipids
- Family history of premature coronary artery disease
    - < 55 in a male
    - < 65 in a female
- Known coronary artery disease
- Peripheral vascular disease
- Cerebrovascular disease
- Chronic kidney disease

HEART Score

- History
    - Slightly suspicious: 0
    - Moderately suspicious: +1
    - Highly suspicious: +2
- ECG
    - Normal: 0
    - Non-specific repolarization disturbance: +1
    - Significant ST deviation: +2
    - No ST deviation but LBBB: +1
    - No ST deviation but LVH: +1
- Age
    - <45: 0
    - 45-64: +1
    - > or = 65: +2
- Risk factors
    - No known risk factors: 0
    - 1-2 risk factors: +1
    - > or = 3 risk factors or history of atherosclerotic disease: +2
    - Risk factors:
        - Hypertension, hyperlipidemia, diabetes, obesity (BMI >30), smoking (current or smoking cessation < or = 3 months), positive family history

(parent or sibling with CVD before age 65), atherosclerotic disease, prior MI, PCI/CABG, CVA/TIA, or PAD.

- Initial troponin
  - < or equal to normal limit: 0
  - 1-3x normal limit: +1
  - > 3x normal limit: +2

Interpretation of HEART Score:

- Low Score: 0-3 points
  - Risk of MACE of 0.9 – 1.7%
- Moderate Score: 4-6 points
  - Risk of MACE of 12 – 16%
- High Score: 7-10 points
  - Risk of MACE of 50 – 65%

Evaluation Protocol in CPC:

- Upon admission, the nurse or tech should give the CPC brochure to patients as they enter the CPC.
- The CPC nurse or tech should place patients on telemetry monitor and obtain a repeat set of vitals.
- The CPC provider should evaluate the patient, review the evaluation process with the patient, and answer any relevant questions related to the stress test.
- The CPC provider or nurse should discuss dietary restrictions.
- The CPC staff should check and complete admission orders placed by the primary team.
- The CPC ED tech should obtain height (estimated) and weight (actual) of patients upon their arrival to CPC.
- Continuous cardiac telemetry monitoring and observation will occur in CPC.
- Vital signs:
  - Need to be obtained every 3 hours.
  - ED attending should be notified when a change in clinical status occurs (such as abnormal vitals, abnormal rhythms, recurrent chest pain, or new symptoms).
  - If there is a change in clinical status, a repeat ECG should be performed and made available for comparison.
- Serial biomarkers to assess for cardiac injury:
  - Follow the “Chest Pain Evaluation, Adult ED” Care Signature Pathway and apply the HEART Score to determine if a 1-hour and a 3-hour high-sensitivity troponin are warranted.
  - Interpretation of serial high sensitivity troponin assay:
  - Elevated Hs-troponin: equal or greater than 52, on 0-hour/baseline value
    - If initial troponin is greater than or equal to 52, perform 1 and 3 hour testing as directed in the “Chest Pain Evaluation, Adult ED” Care Signature Pathway and make a clinical decision based on other chronic conditions that may be associated with an elevated Hs-Troponin which may not indicate acute MI (such as CKD, LVH, Acute heart failure, atrial fibrillation, etc.)
    - Patients with elevated Hs-troponins that are stable and without a significant delta may be acceptable for admission to CPC in the appropriate clinical scenarios. Consider detailed discussion with CPC cardiology fellow

- Serial ECGs:
  - 12-lead ECGs are to be completed at time 0, 1-hour, and 3-hours for all patients and additionally if there are any changes in symptoms.
  - Interpretation and documentation by ED attending is required.
- Diabetic patients:
  - POC glucose should be checked and recorded every 8 hours.
- PRN orders:
  - Patients may receive Acetaminophen 650 mg every 6 hours PRN for non-cardiac chest pain (if no known contraindications – such as known allergy).
- The CPC APP will complete a modified HEART score for every patient.
- The APP will notify the CPC nurse and the ED attending of all changes in patient condition, status, or issues.
- The APP will round with the cardiology fellow covering the CPC in the morning (around 9:00 am). This can be done either by telephone or in person. The APP will continue to touch base with the fellow throughout the day/as needed to discuss patients and stress testing.
- After 5:00 pm, if there is a new CPC patient, the CPC APP should complete CPC introduction, review the evaluation process with patient, review medications, discuss diet / ensure patients orders dinner, and discuss options for stress testing. Consent for stress testing should be obtained at that time, with the caveat that the final plan will be finalized by the team in the morning.
- Patients may order dinner. The kitchen closes at 7:00 pm.
- Patient who stay overnight should be NPO from midnight – 6:00 am.
  - They can be offered a light breakfast from 6:00 am – 7:00 am consisting of either a muffin, cereal, and / or juice.
  - Patients may have sips of water during this time as well.
- All caffeinated products should be strictly avoided until after stress testing is completed.
- Fasting lipid profiles should be drawn in the morning (ideally before 6:00 am).

Re-evaluations:

- If a patient's condition changes and requires alternative evaluations, then the provider should discuss the case with the ED attending.

Stress Testing:

- Stress testing is to be performed anytime between 8:00 am –6:00 pm seven days a week. The choice of the stress test will be determined after discussing with the cardiology fellow covering the CPC.

Preparation for stress testing:

- No caffeine-containing products or beverages for 12 hours prior.
- No <u>new</u> beta-blockers.
- Light breakfast with juice is acceptable (preferably 3 hours prior to stress testing).
- During a patient's stay in CPC, the APP who first evaluates the patient in CPC will start an observation note which will be continued by the APP who completes the stress test. Only one note is required.

To expedite stress tests:

- Follow protocol for serial ECGs and protocol for interpreting high-sensitivity troponins. Utilize the "Chest Pain Evaluation, Adult ED" Care Signature Pathway.
- Start morning stress tests by 9:30 am
    - *This will require the evening APP to evaluate patients, discuss testing options, order test, and obtain consent the night prior when doable.*

Stress testing:

- The following options are available in the CPC:
    - Exercise ECG treadmill test
    - Exercise radionuclide myocardial perfusion imaging
    - Vasodilator radionuclide myocardial perfusion imaging
        - Either using SPECT in the CPC or RB-82 PET
            - PET unavailable on weekends
            - Dobutamine SPECT unavailable on weekends
    - Coronary CTA
        - Limited availability on weekends
    - Stress echocardiogram – with exercise
    - Stress echocardiogram – with dobutamine
        - Limited availability on weekends
- Type of stress test is to be determined by the Cardiology Fellow covering CPC with the CPC APP.
- The latest time radioisotope injection should occur for stress testing is 6:30 pm.
- Stress testing should be completed and resulted before 8:00 pm.
- The CPC APP should discuss with the ED attending responsible for the CPC every patients' results and then discuss dispositions.

Rest imaging:

- Some patients only require stress nuclear imaging.
- Some patients may require a second session of nuclear imaging, as resting imaging.
- In markedly obese patients, resting imaging can only be done after 24 hours. These patients may stay in the CPC overnight if this is indicated.
- Patients may not be discharged from the ED for outpatient resting imaging.

Acute resting imaging:

- Acute resting imaging should be considered in select patients with ongoing chest pain. This decision should be made in conjunction with the cardiology fellow covering CPC.
- Imaging is available until 7:00 pm every day.

- Stress tests are interpreted in the YNHH Nuclear Cardiology Laboratory by board-certified nuclear cardiologists.
- Results will generally be communicated to the CPC APP.
- The stress test results should be discussed with the ED attending covering CPC. The ED attending may contact the nuclear cardiology fellow or attending any time to discuss the stress testing.

Cocaine use:

- Patients with recent cocaine use can be admitted to the CPC. Those with active sympathomimetic manifestations (tachycardia, hypertensive) need to be medically managed first and cannot be stressed due to concern for coronary spasm.
- For the rest, the current recommendation is to treat patients with an observation period and stress test based on the risk profile. The rate of CAD in these patients is similar to that of the CPC population. A pharmacologic stress test may be completed in these patients after the proper observation period is completed and after myocardial infarction is ruled out.
    - Urine test not required
    - Recommend more than 24 hours since cocaine use before regadenoson and more than 48 hours for exercise

COPD patients:

- Patients with moderate-severe COPD can be admitted to the CPC.
- If patient is unable to exercise, dobutamine stress testing can be considered.
- Patients with active wheezing need to be managed from a pulmonary standpoint prior to completing any stress testing.

CPC Overnight

- There can be 6-patients in the CPC overnight with an additional 2 over-flow patients in the ED.
- Any over-flow patient will be under the care of the area nurse but the CPC nurse can review CPC brochure and evaluation process with the patients.

Weekend Stress Testing – inpatients

- On weekends, 2-3 discharge dependent inpatient stress tests can be completed in the Chest Pain Center each day.
- The nuclear tech and ED tech covering CPC will work with the cardiology fellow covering the CPC to complete the inpatient stress tests.
- On weekends, the number of stress tests should not exceed a total of six (this includes both CPC and inpatient tests).
- The inpatients will only be stressed after all the eligible CPC patients have been stressed.
- The inpatients will remain under the care of the inpatient team and will be treated in the same fashion as the Main Stress Lab.
- The CPC APP and ED staff will not be responsible for taking care of the inpatients except in code situations.
- The inpatients will be transported from the floor generally 15 minutes before starting their stress test.
- When CPC patients are held over in the main ED, they take priority over the inpatient weekend patients.
- If the inpatient requires emergent treatment (i.e. code, acute dyspnea), then the ED team will take care of this patient. The documentation will then be entered as a separate note in EPIC.

Disposition Options in CPC

- Hospitalization:
    - Patients with abnormal high-sensitivity troponin that are consistent with acute injury or ischemia.
        - The ED Chest Pain Clinical Pathway should be followed.
    - Patients with abnormal resting imaging.
    - Patients with ECG changes, change in clinical status during observation.
    - Patients with markedly abnormal stress test (at the discretion of the ED attending and consulting cardiology attending). These patients will undergo timely evaluations with the consulting cardiology team and possibly undergo further testing per discretion of the treating cardiologist. The patient will also receive cardio-protective medications and cardiac risk factor modifications.
- **Patients with abnormal stress tests and moderate- or high-risk features should receive a cardiology consult at the discretion of the ED CPC attending. The ED attending can reach out to the imaging attending on call directly to discuss stress results to determine high-risk versus low-risk features.**
- High risk features that will benefit from formal consult include:
    - New reversible perfusion defects consistent with ischemia.
    - High risk exercise treadmill ischemic ECG changes
    - Moderate or greater stenosis noted on Coronary CTA
    - New cardiomyopathy
    - New or significant arrhythmias.
- If a patient has an abnormal stress test and follow up cannot be ensured, patients can be admitted for further work up.
- The CPC APP (during daytime between 8:00 am – 8:00 pm) is responsible for booking patients and calling either the primary provider or cardiologist when warranted.

- Discharge Home:
    - Patients with normal stress test.
    - Patients with abnormal stress test, but low risk features such as:
        - Hypertensive blood pressure response that resolves
        - Coronary calcifications without stenosis on CTA or ischemia on stress imaging.
            - Consider initiation of statin.
        - Low risk perfusion defects
    - Patients with abnormal stress test and low risk features should follow up with their outpatient cardiologist.
        - It is appropriate to curb side the nuclear cardiology attending to discuss the abnormal findings and discuss the significance of these findings for further guidance.
    - Consider placing a formal referral to cardiology for follow up or placing a referral to the Cardiology Preventative Clinic for patients that do not have a cardiologist.
    - Note: Not all patients with an abnormal stress test require a cardiology consultation but should have a documented treatment plan.

- Transfer back to the ED:

- After discussion with the ED attending, if a patient is thought to have an alternative / non-cardiac diagnosis OR is thought to have a life threatening arrhythmia, pulmonary embolism, aortic dissection, pericarditis, pneumothorax, fever, etc., patient can be transferred back to the ED.

- Discharged from CPC:
  - Cardiology team will inform the CPC APP of the stress test results.
  - The discharging provider should:
    - Discuss the results and diagnoses with the patient.
    - Counsel the patient on their risk factors and discuss risk factor management.
    - Discuss with patients the results of their lipid profile and hemoglobin A1c if completed.
    - Document the stress test result in the CPC Observation Note.
    - The ED attending should also evaluate patient at the time of discharge and add the attestation to the CPC Observation Note started by the CPC APP by entering "EDOBSATTEST".
    - Notify the patient's primary care provider (PCP) of any pertinent results and any results that may require follow up.
      - The CPC APP may notify a patient's PCP by direct message via EPIC, when available to do so.
      - If the APP is unable to communicate with the primary care provider, a follow-up request may be placed.
  - Discharge paperwork for CPC patients:
    - The CPC APP will place a discharge order.
    - The APP will complete the discharge paper work by doing the following:
      Attach and fill out the appropriate discharge paper work using one of following documents in attachments in Epic:
      - ***"CPC ADENSPECT":*** for patients who completed Adenosine SPECT stress test.
      - ***"CPC CTA COR"***: for patients who completed a CTA Coronary.
      - ***"CPC ETT":*** for patients who completed an Exercise Tolerance Test.
      - ***"CPC EXSPECT":*** for patients who completed an Exercise SPECT stress test.
      - ***"CPC PET":*** for patients who completed a PET stress test.
      - ***"CPC REGASPECT":*** for patients who completed a Regadenoson SPECT stress test.
      - ***"CPC STRESSECHO":*** for patients who completed a Stress Echocardiogram.

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CPC CQ1 Process:

- The CPC database is queried on a weekly basis to monitor the efficiency of the Chest Pain Center. In addition, any concerning cases as well as inappropriate admissions are reviewed by the CPC

Medical Director and the CPC Lead APP. Faculty may receive feedback on their patients as cases come up.

Research Studies in the CPC:

- Research studies may be occurring in the Chest Pain Center. Please assess patient's eligibility in any of the ongoing studies. You can page the study coordinator or Dr. Basmah Safdar (basmah.safdar@yale.edu) if you have any questions.

Role of the CPC Providers:

Role of the APP

- An APP covering CPC will be scheduled to work 8:00 am – 8:00 pm seven days a week.
- They will work closely with the nuclear cardiology team and the ED attending to determine management of plans for the CPC patients.
- The APP will have an active ACLS certification.
- The roles of the APP include the following:
  - Assume care of patients in the CPC at 8:00 am.
  - Discuss patients with CPC RN and CPC ED tech.
  - Review charts of CPC patients (including vitals, lab / imaging results, ECGs, history, previous cardiac testing, patient histories, allergies, and medications).
  - Round on patients for assessments/re-assessments and risk stratification. Review plans discussed from the APP the day before and proceed as indicated.
  - Round with the cardiology fellow covering for CPC and discuss plans and type of testing for each patient.
  - Conduct the stress tests in the CPC.
  - Admit and discharge patients per designated protocol.
  - Complete the observation note including a Modified HEART Score.
  - Notify the ED attending of any change in condition or any need for alternative diagnostic work-up.
  - Notify the ED attending before discharging a patient.
  - Be proactive in the afternoon/evening hours, by evaluating patients in the CPC who will be stressed the following day. Review the plan with patient and obtain written consent for stress testing when able to do so.
  - Notify the nuclear cardiology attending and the ED attending in case of an adverse event during the stress test.
  - Goal to facilitate morning discharges:
    - Stress testing can be started after reviewing cases with the cardiology fellow and once the nuclear technician is available to begin as well. Ideal goal is start to start stress testing around 9:00 – 9:30 am.
    - Try to order / schedule stress echocardiograms early as there are limited slots.
    - Stress tests will be read as they are performed.

Role of the ED Techs:

- The CPC ED technicians will be scheduled to work 7:00 am – 7:00 pm seven days a week. They will continue their previous role that should include (but is not limited to) assistance with preparing patients

for the stress tests, monitoring hemodynamics during stress tests, drawing labs, and performing electrocardiograms.
- The ED techs will have an active BLS certification.

Role of the ED Nurses:

- The CPC ED nurse will be scheduled to work 24 hours a day seven days a week. They will work closely with the ED and CPC staff as well as the nuclear cardiology staff in taking care of patients who are admitted as observation patients. In addition to clinical care, the nurse will be responsible for maintaining continuity of care for the patients. Upon admission, the patient should be given a brief overview of the expected protocol. The nurse should provide the CPC brochure to the patient. This can be done by either the CPC APP or the CPC nurse.
- Patients will have orders placed for continuation of their home medications as well as for regular monitoring and tests. The nurse should follow these protocols and discuss any changes in patient conditions or vitals with either the CPC APP or the ED attending.
- The nurse should ensure a patient's diet order is placed (Cardiac Diet) and ensure patients are provided a breakfast after completing morning stress tests and ensure patients order lunch and dinner when appropriate to do so. The nurse should also ensure a patient is NPO after midnight when staying overnight.
- The nurse should ensure a patient does not consume any caffeine until after completing stress testing.
- The nurse will bring any changes in patient status (hemodynamics, recurrent chest pain) to the attention of the CPC APP or ED attending and obtain ECGs and lab testing when indicated.
- ACLS protocol will be followed for any acute decompensation or change in clinical status.
- The nurse will have an active ACLS certification.
- For overflow patients, the overnight ED nurse will evaluate any patients held over in the main ED and will then call the CPC nurse to notify them and ensure they are aware of the patient.

Role of Nuclear Cardiology:

- The nuclear cardiology service will consist of a fellow and an attending. Their schedule will be posted on Amion and will also be printed and posted in the CPC monthly.
- The nuclear cardiology team will be available to discuss testing options and to help determine the optimal study for individual patients.
- In addition, they will be responsible for supervising the stress tests and any adverse events encountered during the stress tests.
- The nuclear cardiology fellow will typically be available until 5:00 pm on weekdays. The nuclear cardiology attending will be available in the evenings on weekdays and on weekends to discuss matters further if needed.
- The role of the nuclear cardiology fellow covering CPC is NOT a cardiology consult. The cardiology fellow is only involved to help determine the most appropriate stress test. If the fellow decides additional tests are needed for a patient (i.e. d-dimer, formal echocardiogram, or a CT) or decides not to proceed with a stress test, then they will write a formal consult note or obtain a formal consult that will then be staffed with the cardiology attending.

Role of the ED Attending Physicians:

- The ED attending will be responsible for the CPC.
- The ED attending will oversee the patients 24 hours a day seven days a week.
- The ED attending will sign out to the B-side attending throughout each shift.
- They will participate in formal sign outs in the morning, afternoon, and evenings. They will also supervise any changes in management plans. The ED attending is responsible for documenting serial ECGs, as well as start and end observation status.
- The ECGs can be electronically signed or entered using the "procedure tab" in ED notes.
- If the attending feels the need to obtain a formal cardiology consult, it should ideally be completed prior to sending the patient to the CPC.
- If a patient has an abnormal stress test, the ED attending should discuss the patient and the results with the CPC APP and then determine the need for further consultation with cardiology and also final disposition.

Reviewed and approved by:

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