Clinical/Diagnostic Problem	Investigation	Recommendation (Grade)	Dose	Comment
F01. Non-specific chest pain **(See also E01, E04, E05)**	ST elevation MI, Non-STEMI/ High Risk ACS, Non-High Risk ACS and ACPS			Diagnostic Imaging should be guided by clinical assessment, ECG and biomarkers.
F02. Minor chest trauma **(See also J30)**	CXR	Indicated only in specific circumstances [B]	☢	Suspected rib fracture, to rule out pneumothorax, hemothorax or lung contusion.
	Rib Views	Not indicated [A]	☢	CXR is not sensitive for rib fractures and therapy is pain management with or without a demonstrated fracture.
	CT	Not indicated [B]	☢☢☢	
F03. Major chest trauma **(See also J31 – J32)**	CXR	Indicated [B]	☢	To exclude pathology that threatens immediate hemodynamic stability.
	CT	Indicated [B]	☢☢☢	CT is much more sensitive than CXR for evaluation of great vessel injury, flail chest and diaphragmatic rupture.
F04. Pre-employment	CXR	Indicated only in specific circumstances [B]	☢	Individuals with positive tuberculin skin test to exclude active tuberculosis and for deep sea divers and submariners who require inspiration and expiration PA and a lateral examination to exclude apical bullae. No longer indicated for food handlers.
F05. Hospital admission	CXR	Indicated only in specific circumstances [A]	☢	Routine CXR is not indicated. Admission CXR is indicated only in patients who have acute respiratory or cardiac disease and elderly patients with chronic cardiopulmonary disease with no recent CXR available.
F06. Routine pre-operative	CXR	Indicated only in specific circumstances [A]	☢	Routine pre-operative CXR is not indicated. A pre-operative CXR is indicated only in patients who have an acute significant respiratory or cardiac disease and elderly patients with chronic cardiopulmonary disease with no recent CXR available.
F07. Routine pre-employment screening	CXR	Indicated only in specific circumstances [B]	☢	Tuberculosis screening in patients with positive Mantoux test or CXRs. Immigration screening when country of origin has endemic tuberculosis. CXR is not indicated as a routine for smokers.
	CT	Not indicated [B]	☢☢	CT is not indicated as a routine for smokers.

Clinical/Diagnostic Problem	Investigation	Recommendation (Grade)	Dose	Comment
F08. ICU patients	CXR	Indicated only in specific circumstances [A]	☢	Routine daily ICU CXR has been abandoned in most centers and replaced with on-demand CXRs even for mechanically ventilated patients.
F09. Post interventional procedures	CXR	Indicated only in specific circumstances [A]	☢	Many institutions have abandoned routine post procedural CXR in favour of on demand CXR. While there is evidence to support a low incidence of positivity in routine post procedural CXR, there is evidence that clinical judgment is not sensitive to complications of central line, N/G tube and endotracheal tubes insertion and CXR is indicated. However, pacemaker and tracheostomy probably do not require a stat post procedural CXR.
F10. Upper respiratory tract infection	CXR	Not initially indicated [B]	☢	There is no evidence that a CXR is of value in the management of upper respiratory tract infection. CXR should be reserved for patients with clinical suspicion of pneumonia, acute tracheobronchitis with other comorbid conditions and those with symptoms persisting for longer than 3 weeks.
	CT	Not indicated [B]	☢☢☢	
F11. Acute exacerbation of asthma **(For children see L48)**	CXR	Indicated only in specific circumstances [B]	☢	Diagnostic Imaging should be guided by clinical concern for complications. CXR not indicated unless there is pyrexia, leukocytosis, persistent chest pain, other features of pneumonia, suspected pneumothorax, pneumomediastinum or need for hospitalization.
	CT	Not initially indicated [C]	☢☢☢	CT should be considered only in rare circumstances where management might be altered.
F12. Acute exacerbation of COPD	CXR	Indicated only in specific circumstances [B]	☢	Diagnostic Imaging should be guided by clinical concern for complications. CXR not indicated unless there is history of CAD, CHF, findings of pyrexia, leukocytosis, persistent chest pain, other features of pneumonia, suspected pneumothorax, pneumomediastinum or need for hospitalization.
	CT	Not initially indicated [C]	☢☢☢	Should only be considered in rare circumstances where management might be altered.
F13. Pneumonia **(For children see L43 – L45)**	CXR	Indicated [C]	☢	Diagnostic Imaging should be guided by clinical findings. Initial imaging modality of choice when pneumonia is suspected. However, it should not be performed if pre-test probability is very high and a negative CXR would not preclude management.
	CT	Not initially indicated [C]	☢☢☢	Consider in cases of severe pneumonia, complicated pneumonia or possible atypical organisms. May help to diagnose pneumonia complicated with empyema and guide thoracentesis.

Clinical/Diagnostic Problem	Investigation	Recommendation (Grade)	Dose	Comment
F14. Pneumonia: follow-up[1]	CXR	Not initially indicated [B]	☢	A CXR is only indicated in patients with signs and symptoms suggestive of a severe pneumonia. A CXR need not be repeated before hospital discharge in patients with satisfactory clinical recovery. A follow up CXR is recommended after at least six weeks for all patients who have persistent symptoms or physical signs or who are at higher risk of underlying malignancy (especially smokers and patients > 50 years), whether or not they are admitted to hospital.
	CT	Not initially indicated [B]	☢☢☢	CT is indicated only in cases with no radiological or clinical resolution within the expected time.
F15. NEW– Immunosuppressed patient with respiratory symptoms / febrile neutropenia	CXR	Indicated [B]	☢	Initial imaging modality of choice; detects abnormalities and guides management in most cases. However, CXR may be normal in HIV and febrile neutropenic patients with pulmonary infection.
	CT	Indicated [B]	☢☢☢	Indicated when CXR is normal or equivocal in patients with high clinical suspicion for pulmonary infection. CT is accurate in the diagnosis of specific infections (PCP, fungal pneumonia, TB) and may alter patient's management. HRCT with expiratory views is indicated in patients post bone marrow transplant with suspected obliterative bronchiolitis.
F16. Pleural effusion	CXR	Indicated [C]	☢	A CXR can detect small quantities of pleural fluid (PA view: 175ml, lateral: 75ml, lateral decubitus: 10ml). More than 1cm thickness in lateral view allows safe diagnostic thoracentesis with no imaging guidance.
	CT	Indicated only in specific circumstances [B]	☢☢	CT scan may be ordered by a specialist or in consultation with a radiologist to further characterize pleural fluid and allow visualization of underlying lung and pleural pathology. CT with contrast may help in the diagnosis of suspected empyema, empyema versus lung abscess and pleural malignancy. However, CT attenuation value is not reliable for differentiating exudate from transudate.
	US	Indicated [B]	0	US is indicated to confirm the presence of pleural fluid and is superior to CT in the detection of loculations and septations. Useful to guide diagnostic and therapeutic thoracentesis (more complicated procedures such as pleural biopsy or small empyema drainage may require CT guidance).
	MRI	Not indicated [B]	0	MRI may be superior to CT in the differentiation of benign and malignant pleural disease and may help in the characterization of fluid content. However, it is not routinely used and does not replace diagnostic interventional procedures.

1 The majority of patients with community-acquired pneumonia will show radiological resolution in 4-6 weeks, but this may be prolonged in the elderly, in smokers and in those with chronic airway disease.

(continued on next page)

Clinical/Diagnostic Problem	Investigation	Recommendation (Grade)	Dose	Comment
F16. Pleural effusion *(continued)*	PET/CT FDG	Indicated under specific circumstances [B]	☢☢☢☢	PET/CT could help to characterize pleural effusion in a patient with suspected or known cancer, especially mesothelioma. PET/CT could indentify metastatic pleural implants and guide biopsy.
F17. Hemoptysis: nonsmoker, low risk of malignancy, infrequent	CXR	Indicated [B]	☢	All patients presenting with hemoptysis should have a CXR.
	CT	Not indicated initially [B]	☢☢☢	CT is only indicated for patients with severe hemoptysis or other risk factors (See F18).
F18. Hemoptysis: smoker, high risk of malignancy, > 40 years or recurrent	CXR	Indicated [B]	☢	All patients presenting with hemoptysis should have a CXR. If this is normal but the hemoptysis is significant or recurrent and occurs without a concurrent chest infection, further investigation is indicated.
	CT	Indicated [B]	☢☢☢	CT should be used to investigate the majority of patients with hemoptysis. CT may detect malignancy not identified on CXR. CT (with contrast if not contraindicated) often detects the cause and site of bleeding. HRCT is indicated in the investigation of bronchiectasis. If CT is normal, fails to demonstrate the site of bleeding or demonstrates central tumor, bronchoscopy is indicated.
F19. Hemoptysis: massive (>300 ml in 24 hr)	CXR	Indicated [B]	☢	If patient is stable, CXR is indicated for initial evaluation.
	CT	Indicated [B]	☢☢☢	CT is indicated if clinically feasible and if patient is stable. CT with contrast (if not contraindicated), may show source of bleeding and be helpful especially before bronchial artery embolization. Bronchoscopy is indicated in all patients with massive hemoptysis.
F20. Chronic dyspnea of pulmonary cause or suspected interstitial / diffuse lung disease	CXR	Indicated [B]	☢	Useful as initial imaging modality and to help direct further investigations. However, normal CR does not rule out interstitial/diffuse lung disease.
	CT/HRCT	Indicated [B]	☢☢☢	HRCT (see addendum) is the imaging modality of choice in evaluation of interstitial/diffuse lung disease and provides valuable information about disease reversibility and prognosis. Additional expiratory scans often help in the differential diagnosis. Prone HRCT may be indicated when asbestosis is suspected. Because of the higher radiation dose use of HRCT should be weighed against radiation risk in young patients, particularly females.

Clinical/Diagnostic Problem	Investigation	Recommendation (Grade)	Dose	Comment
F21. Solitary pulmonary nodule (solid)	CXR	Indicated [B]	☢	Chest radiograph may be the first modality to demonstrate a SPN but is very limited in the characterization and final diagnosis.
	CT	Indicated [B]	☢☢☢	CT may demonstrate definite findings of benignity such as central calcification or fat which preclude further investigation For indeterminate solid nodules on CT, management varies depending upon risk factors for malignancy as recommended by the Fleischner Society Guidelines for Follow up and Management of Nodules (see Addendum 1).
	FDG-PET (FDG PET/CT)	Indicated [A]	☢☢☢	More sensitive than CT in the detection of malignancy in nodules larger than 8 mm. Characterization of solid nodules 8 mm and greater that are indeterminate on CT. May help in staging for these nodules proven to be malignant.
F22. Subsolid nodules (ground-glass and part-solid nodules)	CXR	Indicated [C]	☢	Chest radiograph may be the first modality to demonstrate a subsolid nodule but is very limited in the characterization and final diagnosis. Pure ground-glass nodules usually are not seen on chest radiograph.
	CT	Indicated [B]	☢☢☢	CT (especially HRCT) is much more accurate in the detection of ground-glass (GG) and part solid (PS) nodules and to demonstrate multicentric disease. No consensus in the literature yet regarding management of GG/PS nodules (Fleischner Society Guidelines for Nodules is not applied for these lesions). Interim guidelines published in 2010 suggest: Solitary lesions: • GG nodule < 5 mm: no follow up or work up is required • GG nodule 5- 10 mm: CT in 3-6 months, annually for minimal 3 years if stable. Increase in size or solid component: surgical resection. • GG nodule > 10 mm: CT in 3-6 months, surgical resection if persistent or enlarging • PS solid lesion any size: percutaneous biopsy or surgical resection. (Role of percutaneous biopsy is less clear because of sampling errors). Multiple lesions: • GG nodules < 10mm: CT in 1 year • if any GG nodule > 10mm or PS nodule: CT follow up and surgical resection (sparing resection)
	FDG-PET (FDG PET/CT)	Indicated only in specific circumstances [B]	☢☢☢	Questionable diagnostic value for pure GG nodules, especially when < 1cm. Malignant GG lesions unlikely to be positive on PET and have low risk of metastatic disease precluding PET/CT for staging. Indicated for PS lesions because of greater likelihood of invasive malignancy and for detection of metastasis and preoperative staging.

Section F: Thoracic

Clinical/Diagnostic Problem	Investigation	Recommendation (Grade)	Dose	Comment
F23. Pulmonary metastases	CXR	Indicated [A]	☢	Clinical first line of investigation for most malignancies.
	CT	Indicated only in specific circumstances [A]	☢☢	Recommended for primary cancers that frequently metasta-size to the thorax and / or those with a satisfactory response to surgical metastatectomy e.g. sarcomas, melanoma, colon, testicle.
	PET/CT FDG	Indicated only in specific circumstances [B]	☢☢☢☢	PET/CT may assist with whole body staging and may identify lung metastases when greater than 8 mm. FDG PET/CT allows assessment of operability of solitary pulmonary metastasis by excluding/identifying extra-pulmonary metastases.
F24. Suspected mediastinal lesion on CXR	CT	Indicated [C]	☢☢☢	CT is very sensitive in the detection of mediastinal lesions and provides information to help in the differential diagnosis. CT may guide percutaneous biopsy. Optionally gated for paracardiac lesions.
	MR	Not initially indicated [C]	0	MRI accurately differentiates solid and cystic lesions and is superior to CT in the detection of invasion of mediastinal structures. Optionally gated if paracardiac.
	US	Indicated only in specific circumstances [C]	0	May be warranted depending on suspicion of paracardiac lesion.
	PET/CT FDG	Indicated only in specific circumstances [B]	☢☢☢☢	FDG PET/CT should be performed only after CT scan is performed. Can identify biopsy site, identify extra-thoracic disease easier to biopsy, may prevent futile biopsy in a non FDG-avid lesion, identify a benign lesion (i.e. thymic hyperplasia), provides staging when a malignant chest lesion is confirmed.
F25. Suspected lymphadenopathy[2]	CXR	Indicated [C]	☢	Limited sensitivity in detection of mediastinal and hilar adenopathy.
	CT	Indicated [C]	☢☢☢	CT is very sensitive in the detection of mediastinal and hilar adenopathy and provides information that may help in the diagnosis (i.e. calcification, necrosis, nodal enhancement and parenchymal abnormality). CT may guide percutaneous biopsy depending on clinical concern.
	PET/CT FDG	Indicated [A]	☢☢☢☢	PET/CT can identify biopsy site, identify extra-thoracic disease easier to biopsy, may prevent futile biopsy of non FDG-avid lymph nodes, and can help in staging when a malignant lymph node is confirmed. It does not replace biopsy.

2 Suspected on CXR or clinical examination. Diagnostic imaging should be guided by clinical findings and biomarkers. No literature to guide management of incidental lymphadenopathy detected on chest CT.

Clinical/Diagnostic Problem	Investigation	Recommendation (Grade)	Dose	Comment
F26. Elevated diaphragm on CXR	CXR	Indicated [B]	☢	Decubitus CXR may increase accuracy in detection of effusion as the cause of apparent elevation of the diaphragm.
	CT	Indicated [B]	☢☢☢	To rule out mediastinal lesion involving phrenic nerve when CXR is negative. When CXR demonstrates mediastinal abnormality, CT is indicated for further characterization (see "suspected mediastinal lesion on CXR).
	Ultrasound	Indicated only in specific circumstances [A]	0	U/S can detect and evaluate pleural effusion and diaphragmatic motion in real time. May be more sensitive than fluoroscopy.
	Fluoroscopy	Indicated only in specific circumstances	☢☢	Fluoroscopy "sniff " test is accurate for evaluation of diaphragmatic motion in real time and to detect paralysis and paradoxical movement.

Addendum:

HRCT definition:
Inspiratory CT scan with 1 to 2mm thick slices. Imaging modality of choice for evaluation of interstitial/diffuse lung disease and small airways disease, including COPD.

Fleischner Society Guideline

Recommendations for Follow-up and Management of Nodules Smaller than 8mm Detected Incidentally at Nonscreening CT

Nodule Size (mm)[1]	Low-Risk Patient[2]	High-Risk Patient[3]
≤ 4	No follow-up needed[4]	Follow-up CT at 12 months; if unchanged, no further follow-up
> 4–6	Follow-up CT at 12 months; if unchanged, no further follow-up[5]	Initial follow-up CT at 6–12 months then at 18–24 months if no change
> 6–8	Initial follow-up CT at 6–12 months then at 18–24 months if no change	Initial follow-up CT at 3–6 months then at 9–12 months and 24 months if no change
> 8	Follow-up CT at around 3, 9 and 24 monthsdynamic contrast-enhanced CT, PET, and/or biopsy	Same as for low-risk patient

1 Average length and width
2 Minimal or absent history of smoking and of other known risk factors
3 History of smoking or other known risk factors
4 The risk of malignancy in this category (<1%) is substantially less than that in a baseline CT scan of an asymptomatic smoker
5 Nonsolid (ground-glass) or partly solid nodules may require longer follow-up to exclude indolent adenocarcinoma