Preoperative evaluation of lung cancer

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Nodule suspicious for lung cancer

◈ Multidisciplinary evaluation

◈ Smoking cessation counseling

◈ *Identification of patient factors*

◈ *Identification of radiologic factors*

Identification of patient factors

◈ Age

◈ Smoking history

◈ Previous cancer history

◈ Family history

◈ Occupational exposures

◈ Other lung disease (COPD, IPF)

◈ Expose to infectious disease (tuberculosis, fungus, HIV, etc)
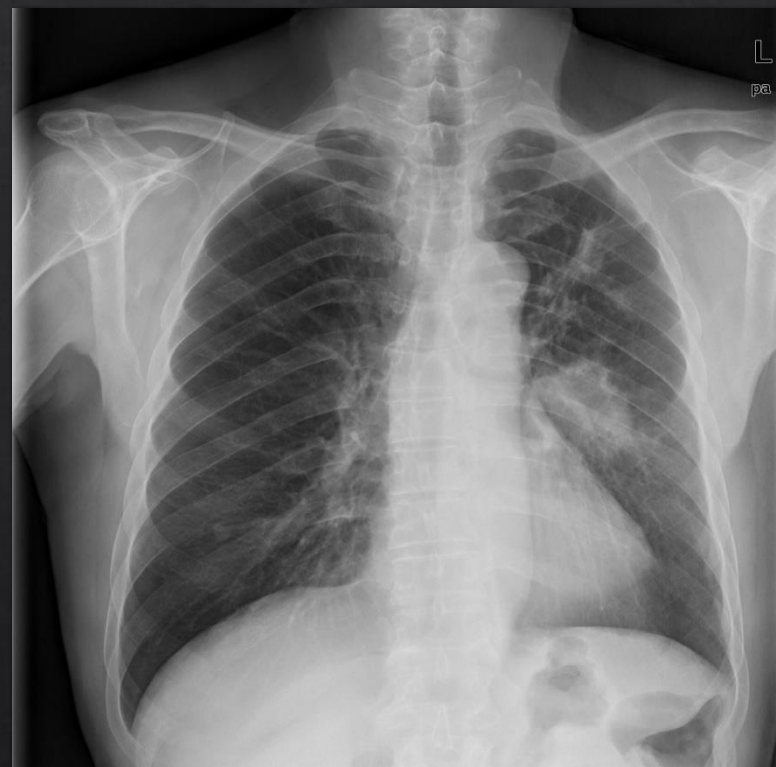
Identification of radiologic factors

◇ Size, shape, and density of the pulmonary nodule

◇ Associated parenchymal abnormality

   (eg, scarring or suspicion of inflammatory changes)

◇ PET finding

Pretreatment evaluation
- diagnosis and staging -

◈ Plain chest radiogram

◈ Chest CT

◈ **Bronchoscopy(EBUS)**

◈ **PCNA, bronchoscopic biopsy, surgical biopsy**

◈ PET CT
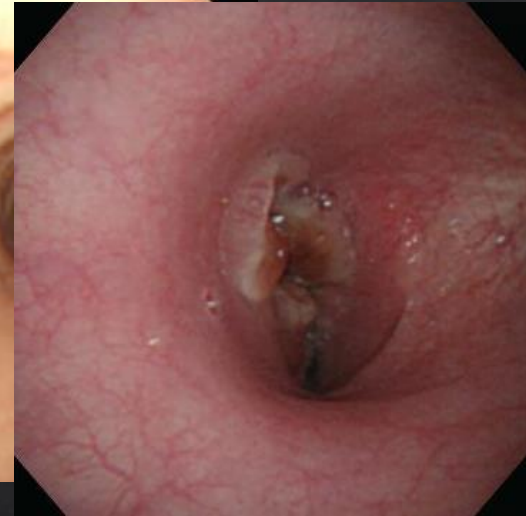
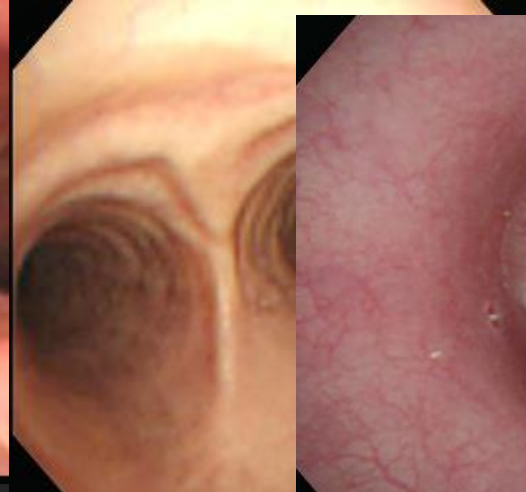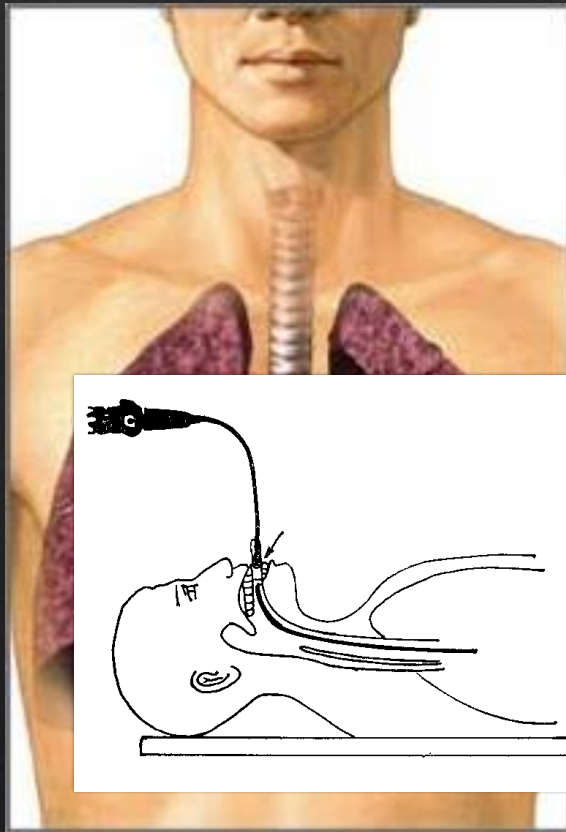◈ Brain MR, Abdomen CT, Bone scan etc.

Plain chest radiogram

Chest CT

Bronchoscopy

PCNA

Surgical biopsy

Thyroid
Cervical fascia
Incision in pre-tracheal fascia
Strap muscles divided at midline

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Scalene fat pad with nodes
Anterior scalene m.

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Omohyoid m.
Phrenic n. covered by pre-tracheal sheath
Subclavian v.
Transverse cervical a.
Sternocleidomastoid m.
Internal jugular v.
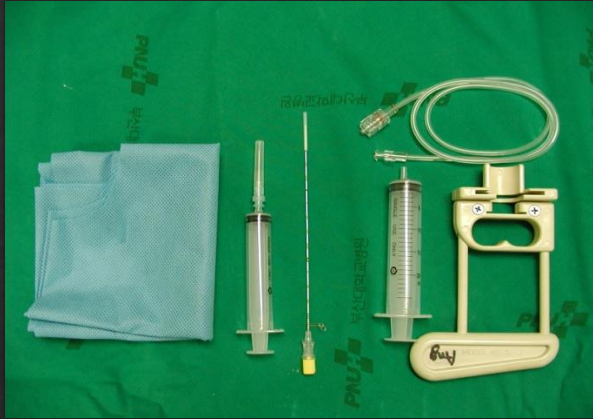
Fig. 17-1. Scalene node biopsy.
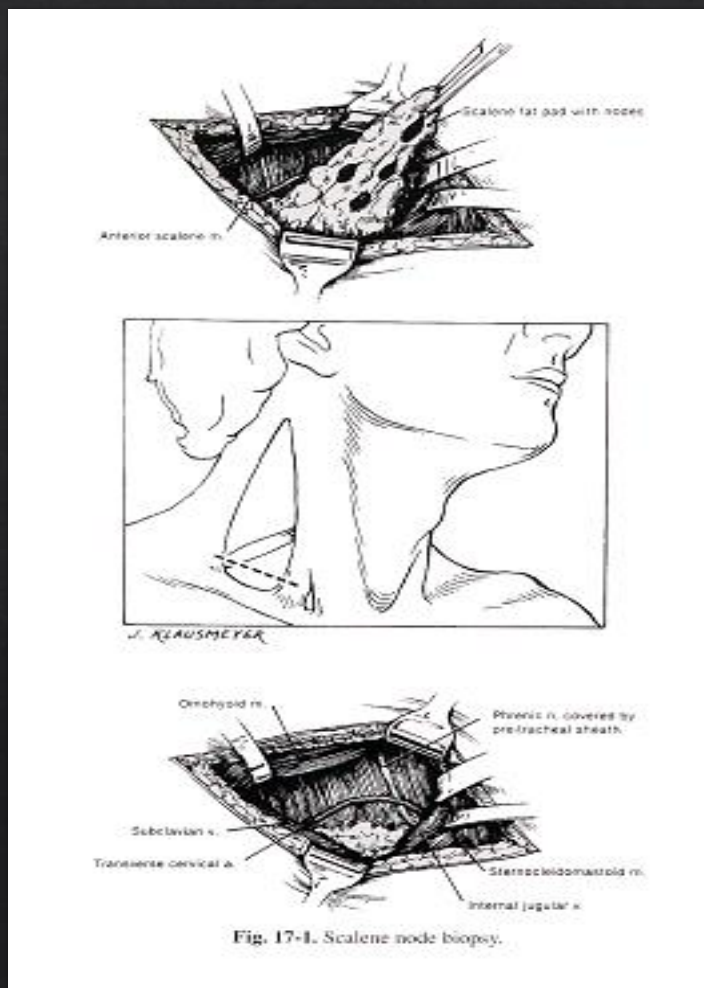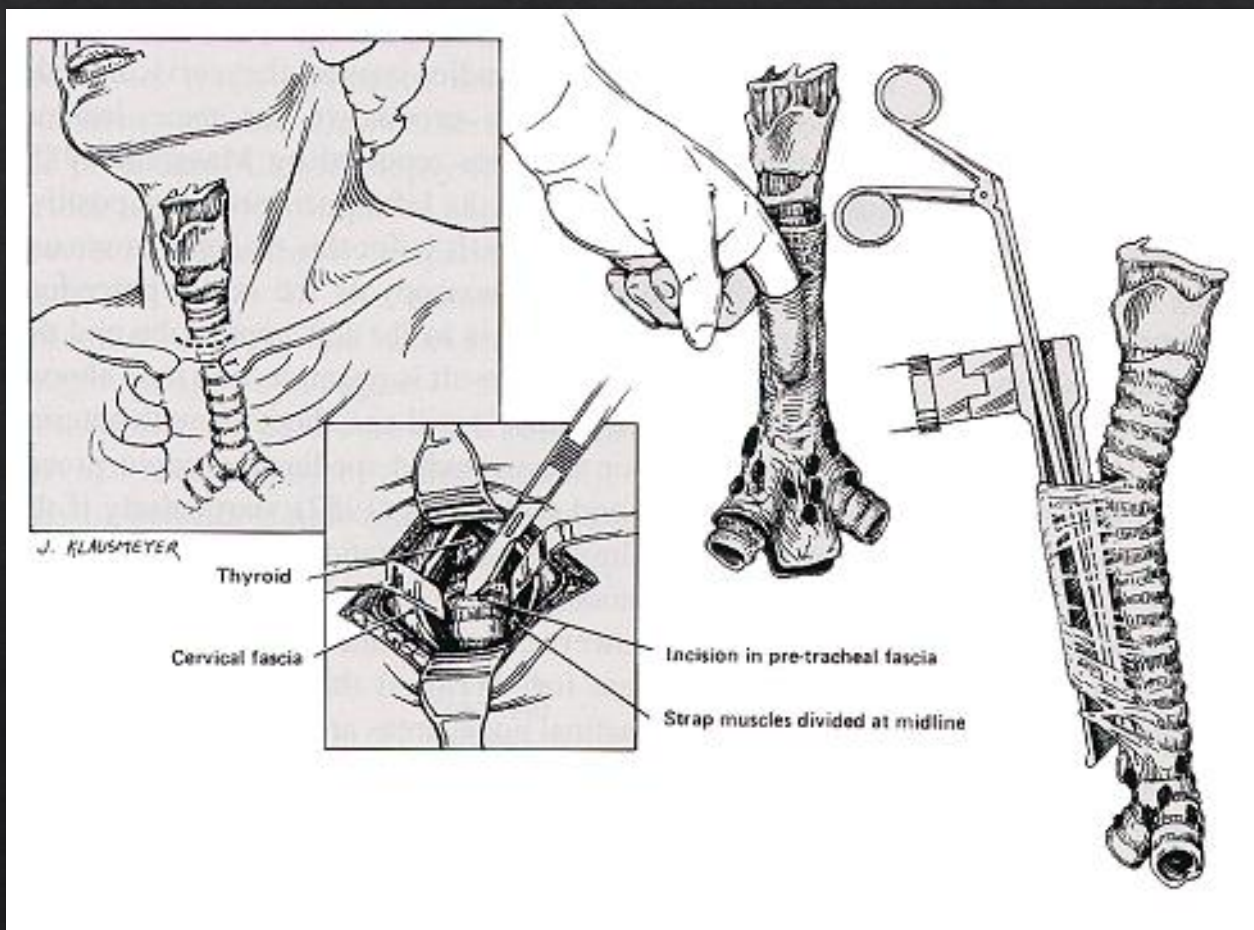
Surgical biopsy

Fig. 18-3. Four incisions for improved access and visualization.

쐐기절제술

PET-CT

Brain MR and abdominal CT
for distant metastasis

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NCCN Guidelines Version 2.2018
Non-Small Cell Lung Cancer
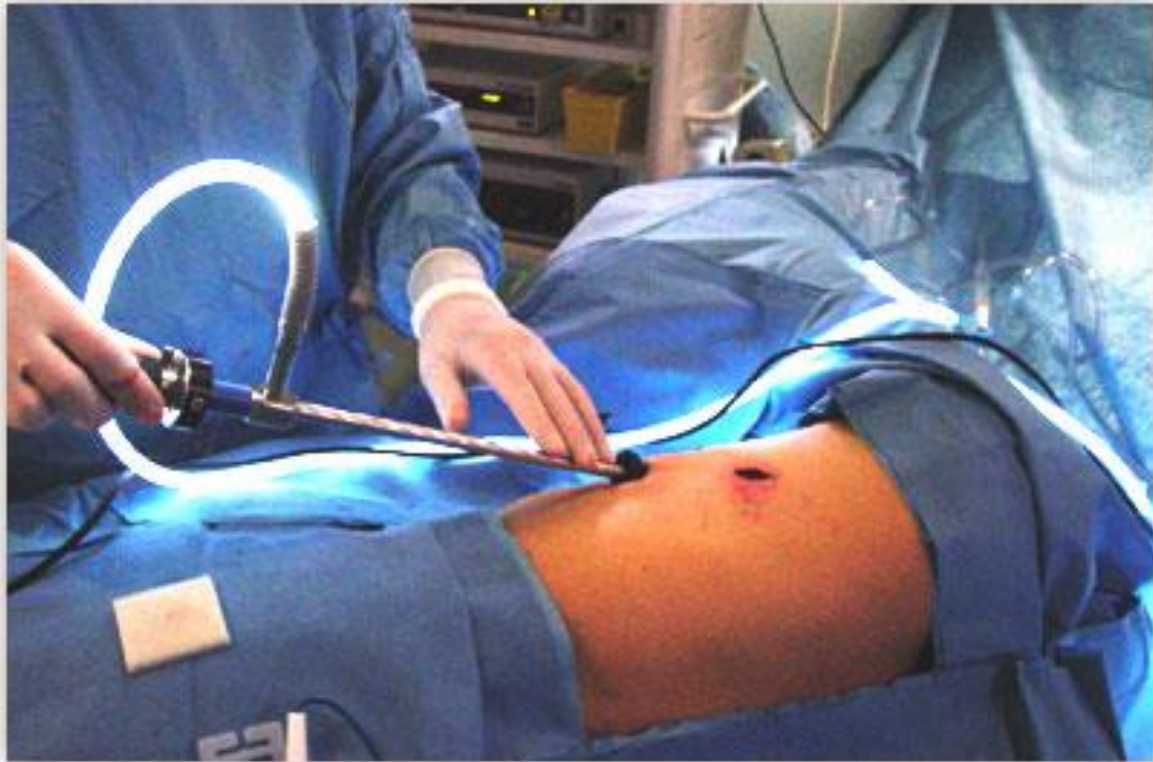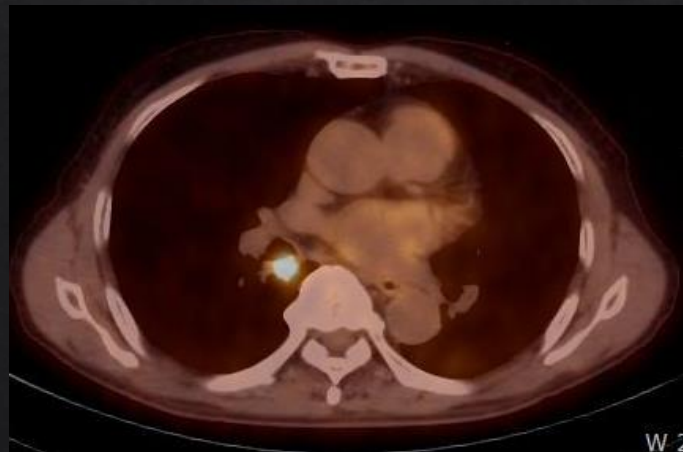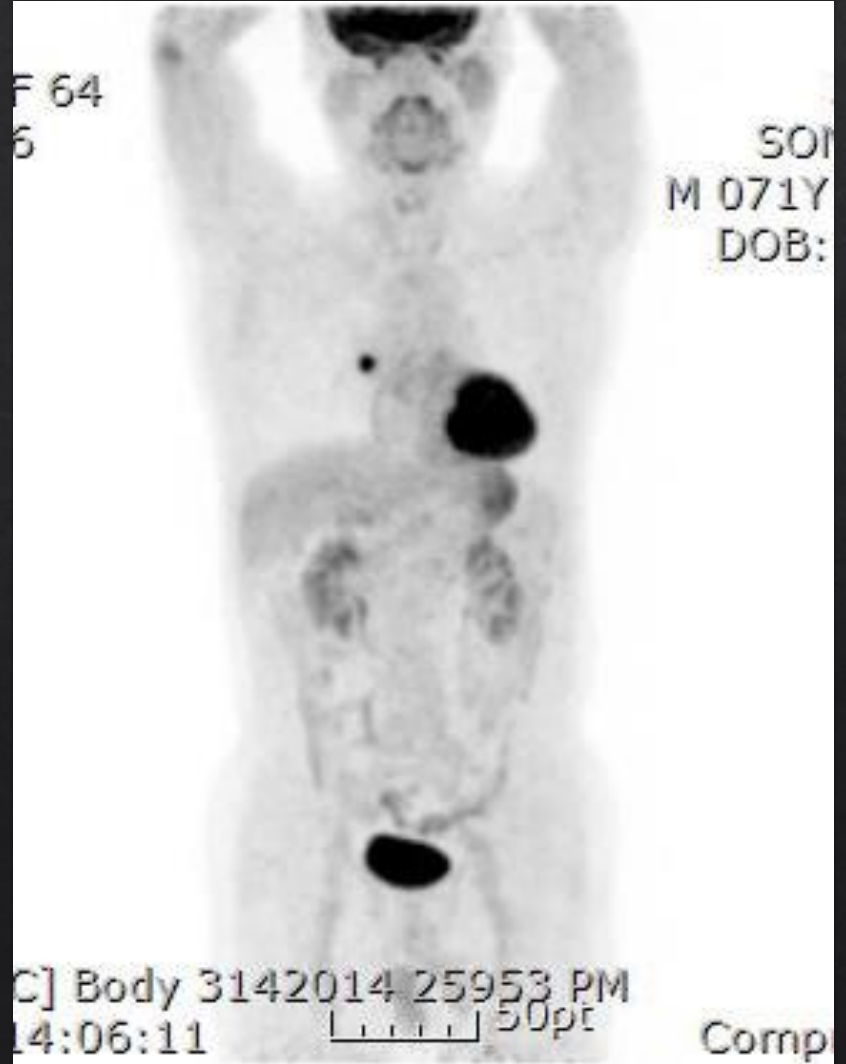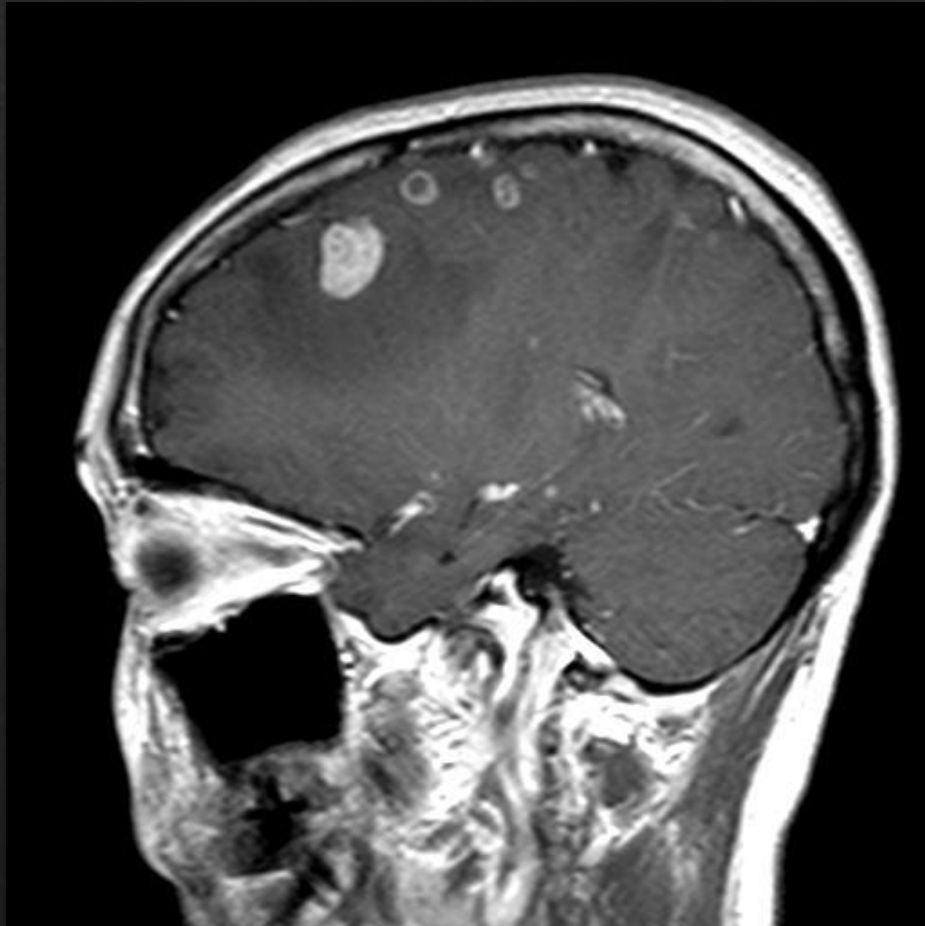
NCCN Guidelines Index
Table of Contents
Discussion

PATHOLOGIC DIAGNOSIS OF NSCLC   INITIAL EVALUATION   CLINICAL STAGE

NSCLC →

- Pathology review[a]
- H&P (include performance status + weight loss)[b]
- CT chest and upper abdomen with contrast, including adrenals
- CBC, platelets
- Chemistry profile
- Smoking cessation advice, counseling, and pharmacotherapy
  ▸ Use the 5 A's Framework: Ask, Advise, Assess, Assist, Arrange http://www.ahrq.gov/clinic/tobacco/5steps.htm
- Integrate palliative care[c] (See NCCN Guidelines for Palliative Care)

Stage IA, peripheral[d] (T1abc, N0) → See Pretreatment Evaluation (NSCL-2)

Stage IB, peripheral[d] (T2a, N0);
Stage I, central[d] (T1abc-T2a, N0);
Stage II (T1abc-T2ab, N1; T2b, N0);
Stage IIB (T3, N0)[e]; Stage IIIA (T3, N1) → See Pretreatment Evaluation (NSCL-2)

Stage IIB[f] (T3 invasion, N0);
Stage IIIA[f] (T4 extension, N0-1; T3, N1; T4, N0-1) → See Pretreatment Evaluation (NSCL-4)

Stage IIIA[f] (T1-2, N2); Stage IIIB (T3, N2) → See Pretreatment Evaluation (NSCL-7)

Separate pulmonary nodule(s) (Stage IIB, IIIA, IV) → See Pretreatment Evaluation (NSCL-7)

Multiple lung cancers → See Treatment (NSCL-9)

Stage IIIB[f] (T1-2, N3); Stage IIIC (T3, N3) → See Pretreatment Evaluation (NSCL-11)

Stage IIIB[f] (T4, N2); Stage IIIC (T4, N3) → See Pretreatment Evaluation (NSCL-12)

Stage IVA (M1a)[c] (pleural or pericardial effusion) → See Pretreatment Evaluation (NSCL-12)

Stage IVA (M1b)[c]
Limited sites and definitive therapy for thoracic disease feasible → See Pretreatment Evaluation (NSCL-13)

Stage IVB (M1c)[c] disseminated metastases → See Systemic Therapy (NSCL-17)

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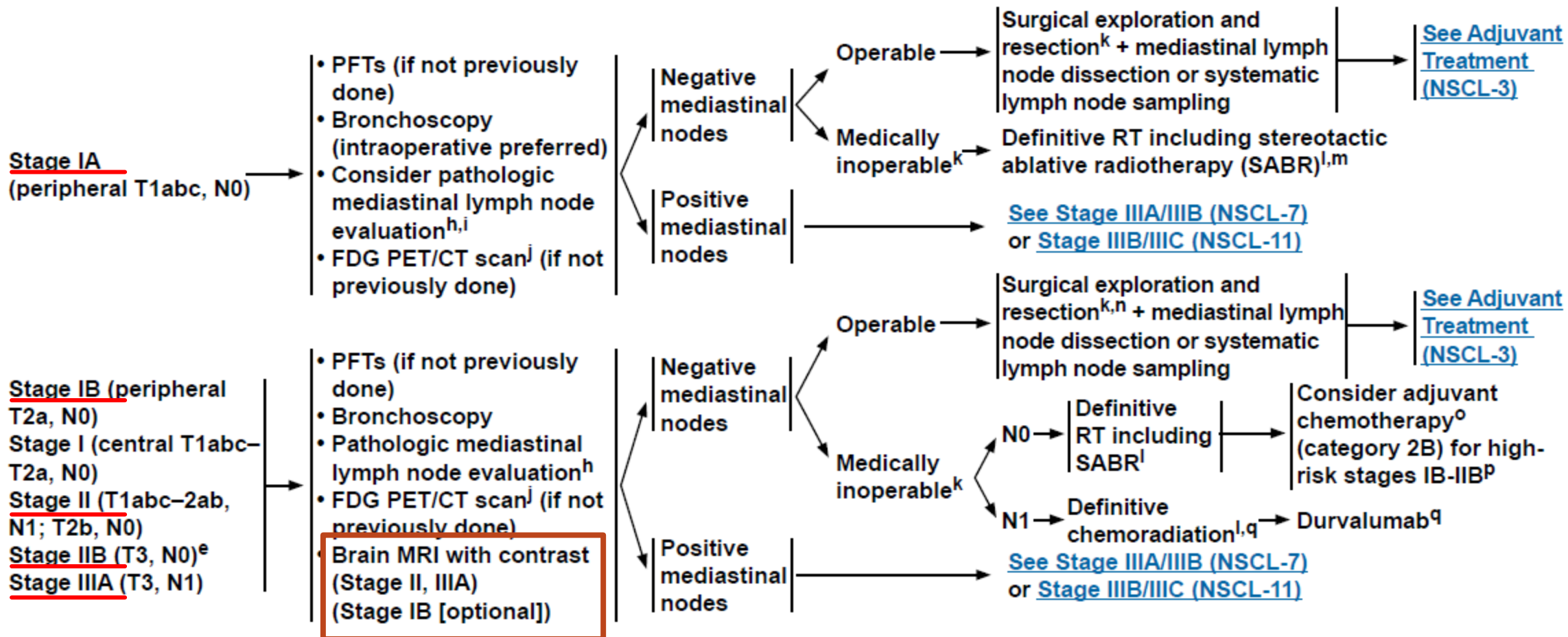
CLINICAL ASSESSMENT

PRETREATMENT EVALUATION

CLINICAL EVALUATION

Superior sulcus tumor ⟶ **See Treatment (NSCL-5)**

Chest wall ⟶ **See Treatment (NSCL-6)**

Proximal airway or mediastinum ⟶ **See Treatment (NSCL-6)**

Stage IIB (T3 invasion, N0)
Stage IIIA (T4 extension, N0-1; T3, N1; T4, N0-1)

⟶

• PFTs (if not previously done)
• Bronchoscopy
• Pathologic mediastinal lymph node evaluation[h]
• Brain MRI with contrast
• MRI with contrast of spine + thoracic inlet for superior sulcus lesions abutting the spine or subclavian vessels
• FDG PET/CT scan[j] (if not previously done)

Stage IIIA (T4, N0-1) ⟶ **See Treatment (NSCL-6)**

Unresectable disease ⟶ **See Treatment (NSCL-6)**

Metastatic disease ⟶ **See Treatment for Metastasis limited sites (NSCL-13) or distant disease (NSCL-16)**

CLINICAL ASSESSMENT

PRETREATMENT EVALUATION

MEDIASTINAL BIOPSY FINDINGS AND RESECTABILITY

Stage IIIA (T1-2, N2)
Stage IIIB (T3, N2)

• PFTs (if not previously done)
• Bronchoscopy
• Pathologic mediastinal lymph node evaluation[h]
• FDG PET/CT scan[j] (if not previously done)
• Brain MRI with contrast

N2, N3 nodes negative → **See Treatment T1-3, N0-1 (NSCL-8)**

N2 nodes positive, M0 → **See Treatment (NSCL-8)**

N3 nodes positive, M0 → **See Stage IIIB (NSCL-11)**

Metastatic disease → **See Treatment for Metastasis limited sites (NSCL-13) or distant disease (NSCL-16)**

Separate pulmonary nodule(s)
(Stage IIB, IIIA, IV)

• PFTs (if not previously done)
• Bronchoscopy
• Pathologic mediastinal lymph node evaluation[h]
• Brain MRI with contrast
• FDG PET/CT scan[j] (if not previously done)

Separate pulmonary nodule(s), same lobe (T3, N0-1) or ipsilateral non-primary lobe (T4, N0-1) → **See Treatment (NSCL-9)**

Stage IVA (N0, M1a): Contralateral lung (solitary nodule) → **See Treatment (NSCL-9)**

Extrathoracic metastatic disease → **See Treatment for Metastasis limited sites (NSCL-13) or distant disease (NSCL-16)**

Pretreatment evaluation
– patient condition-

◈ **Preoperative routine lab**

  ◇ CBC, ESR, LRFT, electrolyte, ABO type

  ◇ HBV, HCV, HIV, VDRL

  ◇ Tumor marker (CEA, CA19-9, cyfra21-1, NSE, SCC etc)

◈ *Pulmonary Function Test, Lung perfusion scan*

◈ *Cardiac evaluation*

  ◇ Myocardial perfusion, Treadmil test, CAG

  ◇ Echocardiography

Predictive postoperative FEV1

1. **Lung perfusion scintigraphy**

   The percentage of function attributed to the lung not being resected was multiplied by the preoperative measured value of lung function to achieve a predicted postoperative value for lung function

   Example)
   RUL lung cancer
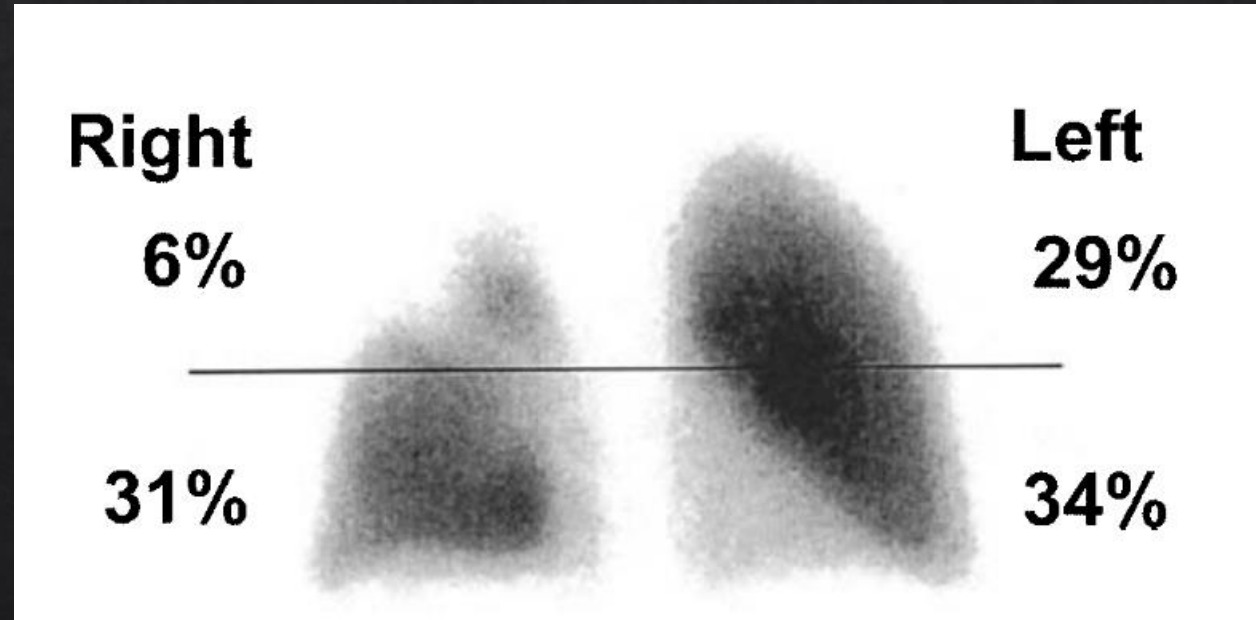
Predictive postoperative FEV1

2. The calculation of postoperative lung function using simple equations rather than physiologic tests was originally introduced in 1975: an equal value was assigned to each of the **19 lung segments** in order to determine the amount of functioning lung remaining after resection.

3. More recent techniques for calculating predicted postoperative spirometric values use the number of **functioning segments** as the denominator and the number of functioning segments

$$\text{Postoperative function} = \text{Preoperative function} \times \frac{\text{Functioning segments remaining following resection}}{\text{Functioning segments present prior to resection}}$$

Predictive postoperative FEV1

4. The use of **quantitative computed tomography (CT)** in estimating relative lung function as a means for calculating predicted postoperative function has been shown to be similar to **lung perfusion scintigraphy** and segmental percentage loss in the accuracy of predicting postoperative function.

General Thoracic Surgery, 7th edition

Section V chapter 20
Assessment of the Thoracic Surgical Patient

Algorithm for pulmonary preoperative assessment of patients requiring lung resection
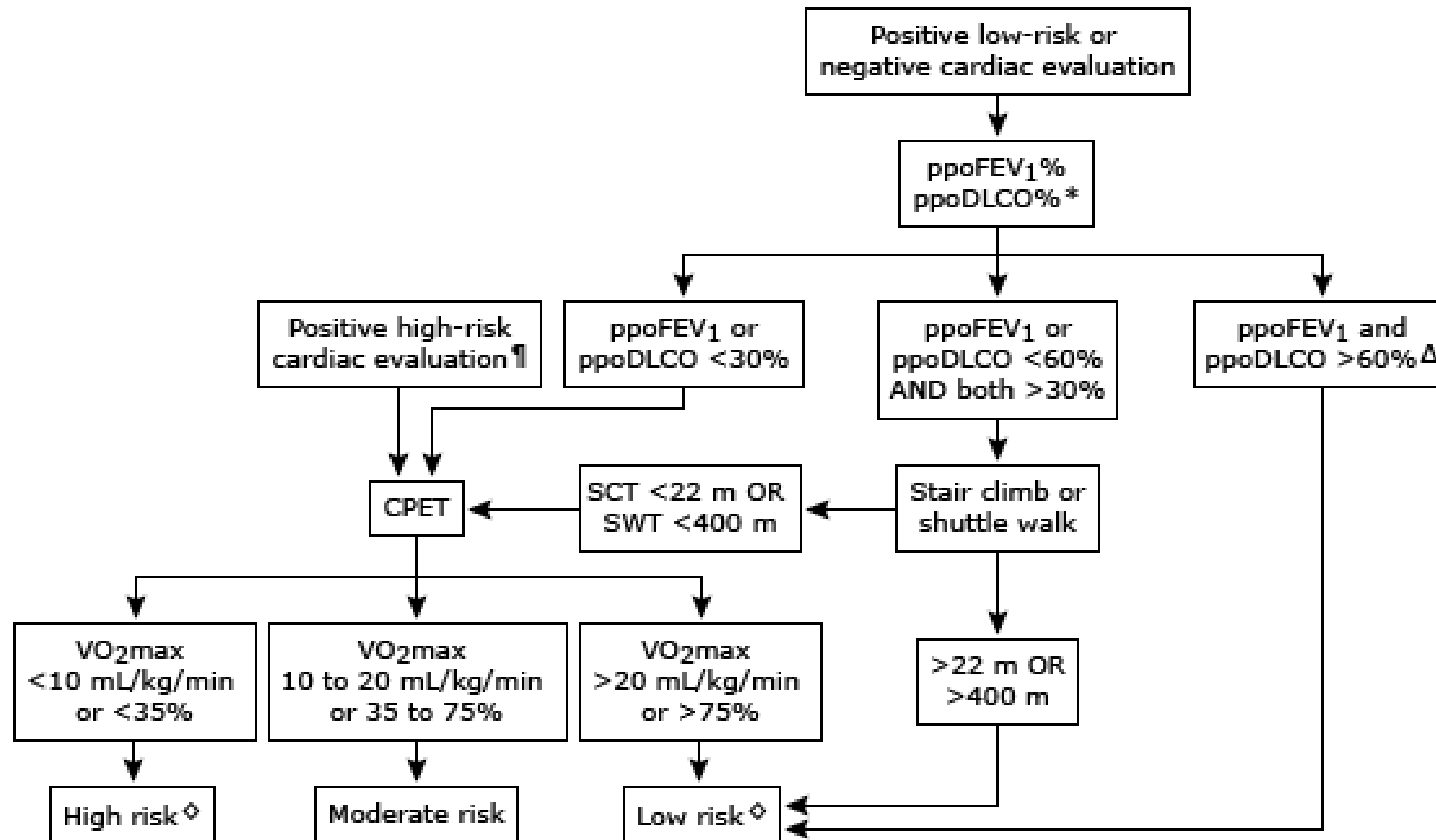
Physiologic evaluation resection algorithm.
Actual risks affected by parameters defined here and:

Risk group

1. **Low risk** : The expected risk of **mortality is below 1%.** Major anatomic resections can be safely performed in this group

2. **Moderate risk**: Morbidity and mortality rates may vary according to the values of split lung functions, exercise tolerance and extent of resection. **Risks and benefits of the operation should be thoroughly discussed with the patient.**

3. **High risk:** The risk of **mortality** after standard major anatomic resections may **be higher than 10%.** Considerable risk of severe cardiopulmonary morbidity and residual functional loss is expected. Patients should be counseled about **alternative surgical (minor resections or minimally invasive surgery) or nonsurgical options.**

Cardiac evaluation

Physiologic reasons for especially high risk of cardiac complications

1. Significant atelectasis, decreased lung compliance, and decreased diffusing capacity after thoracic surgery may lead to hypoxia, hypercarbia, or increased work of breathing, which all decrease **myocardial oxygen** supply and increase myocardial oxygen demand. This **mismatch** may precipitate ischemia, which in turn can lead to arrhythmias, congestive heart failure, or even MI.

2. Postoperative patients develop a **hypercoagulable** state that may exacerbate fixed coronary stenoses, contribute to new coronary plaque rupture, or place strain on the heart through the development of pulmonary emboli.

3. After major lung resections, the decrease in the pulmonary vascular bed results in **increased preload**, which can worsen congestive heart failure.

◈ Which patients warrant *non invasive cardiac stress testing* (tread mill test, stress echocardiography, or a nuclear stress test)?

◈ Which patients should proceed directly to *coronary angiography?*

◈ Who should have *no testing* at all?

Clinical Predictors of Increased Perioperative Cardiovascular Risk (Myocardial Infarction, Heart F̲a̲i̲l̲u̲r̲e̲, ̲D̲e̲a̲t̲h̲)

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Se

Intermediate
Mild angina pectoris (Canadian class I or II)
Previous MI by history or pathologic Q waves
Compensated or prior heart failure
Diabetes mellitus (particularly insulin-dependent)
Renal insufficiency

Minor
Advanced age
Abnormal ECG (left ventricular hypertrophy, left bundle-branch block, ST-T abnormalities)
Rhythm other than sinus (e.g., atrial fibrillation)
Low functional capacity (e.g., inability to climb one flight of stairs with a bag of groceries)
History of stroke
Uncontrolled systemic hypertension

Table 4 Surgical risk[a] estimate (modified from Boersma et al.[6])

Low-risk <1%	Intermediate-risk 1–5%	High-risk >5%
• Breast	• Abdominal	• Aortic and major vascular surgery
• Dental	• Carotid	• Peripheral vascular surgery
• Endocrine	• Peripheral arterial angioplasty	
• Eye	• Endovascular aneurysm repair	
• Gynaecology	• Head and neck surgery	
• Reconstructive	• Neurological/ orthopaedic—major (hip and spine surgery)	
• Orthopaedic—minor (knee surgery)	• Pulmonary renal/ liver transplant	
• Urologic—minor	• Urologic—major	

[a]Risk of MI and cardiac death within 30 days after surgery.

Table 13   Clinical risk factors

Angina pectoris

Prior MI[a]

Heart failure

Stroke/transient ischaemic attack

Renal dysfunction (serum creatinine >170 μmol/L or 2 mg/dL or a
    creatinine clearance of <60 mL/min)

Diabetes mellitus requiring insulin therapy

Functional activities (■는 심폐 기능 강화 활동이며 이보다 낮은 강도의 활동은 안전하게 시행 가능합니다.)

METs	활동	METs	활동
☐ 2.0	시속 1.5km로 걷기	☐ 6.0	시속 7.3km의 조깅, 복식 테니스(많이 뛰는) 시속 16km의 자전거
☐ 2.5	계단 내려가기, 개 산책시키기	☐ 6.5	하이킹
☐ 2.8	시속 4km 걷기, 골프, 볼링, 낚시	☐ 7.0	조정, 격렬한 춤동작
☐ 3.5	시속 5km 걷기	☐ 8.0	시속 8km의 조깅, 시속 20km의 자전거
☐ 4.0	계단오르기, 보통 속도의 춤, 수중에어로빅 탁구, 시속 15km의 자전거	☐ 10.0	시속 9.6km의 조깅, 시속 24km의 자전거 단식 테니스, 스쿼시, 라켓볼
☐ 4.5	느린 수영, 골프, 배드민턴(레저)	☐ 13.5	시속 11.2km의 조깅
☐ 5.0	시속 6.4km로 걷기, 빠른 춤동작, 복식 테니스 성생활	☐ 14.0	스피닝

Summary of pre-operative cardiac risk evaluation and perioperative management

Step 6 — Cardiac risk factors (table 13)

≤ 2 → Statin therapy and a titrated low-dose beta-blocker regimen are recommended prior to surgery. In patients with systolic LV dysfunction ACE-inhibitors are recommended prior to surgery.

≥ 3

Step 7 — Consider non-invasive testing. Non-invasive testing can also be considered prior to any surgical procedure for patient counselling, change of perioperative management in relation to type of surgery and anaesthesia technique.

Interpretation of non-invasive stress test results

No/mild/moderate stress-induced ischaemia → Proceed with the planned surgical procedure, it is recommended to initiate statin therapy and a titrated low dose beta-blocker regimen.

Extensive stress-induced ischaemia → An individualized perioperative management is recommended considering the potential benefit of the proposed surgical procedure compared with the predicted adverse outcome, and the effect of medical therapy and/or coronary revascularization.

Balloon angioplasty: Surgery can be performed > 2 weeks after intervention with continuation of aspirin treatment.

Bare-metal stent: Surgery can be performed > 6 weeks after intervention. Dual anti-platelet therapy should be continued for at least 6 weeks, preferable up to 3 months.

Drug-eluting stent: Surgery can be performed within 12 months after intervention, during this period dual anti-platelet therapy is recommended

CABG

If applicable, discuss the continuation of chronic aspirin therapy. Discontinuation of aspirin therapy should be considered only in those patients in which haemostasis is difficult to control during surgery.

Surgery

Stepwise approach to perioperative cardiac assessment for CAD
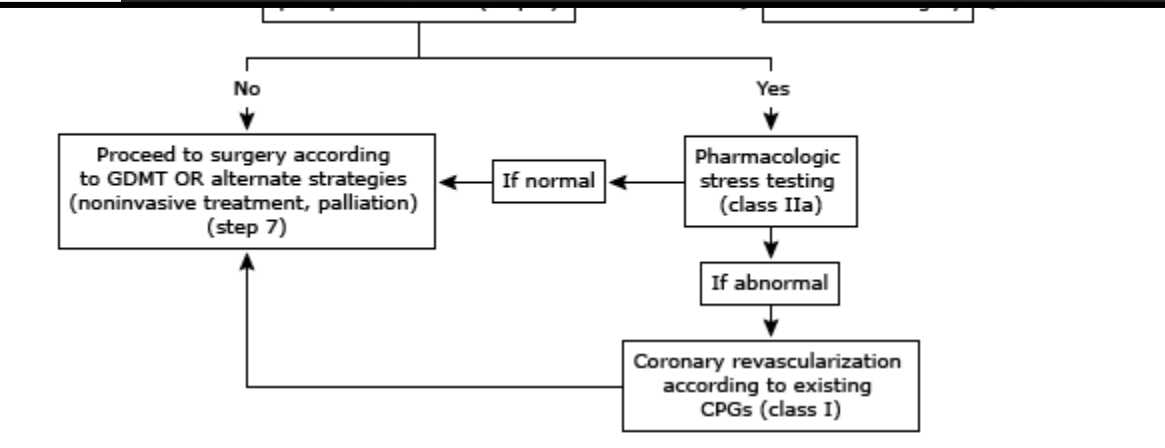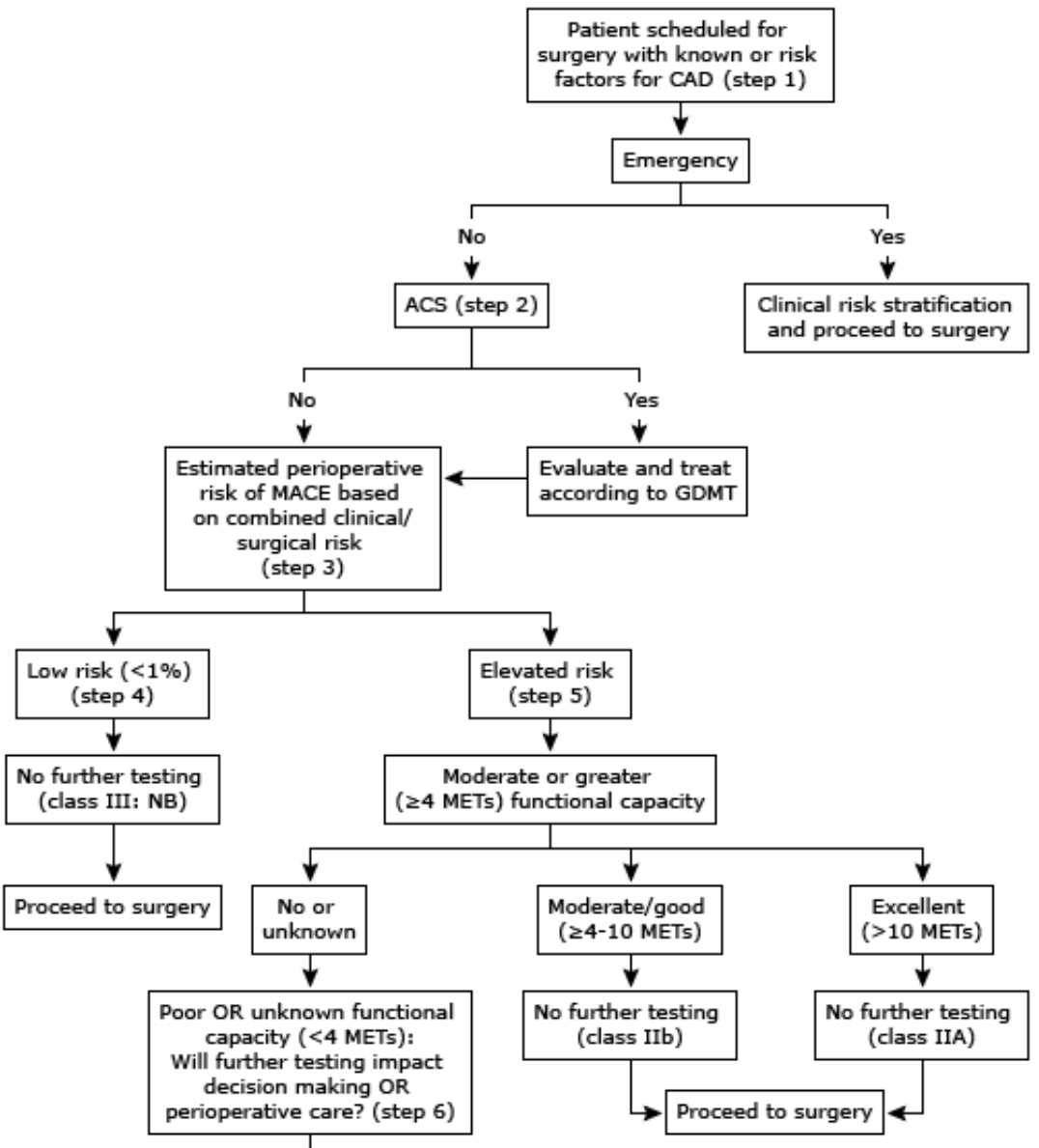
ACS: acute coronary syndrome; CABG: coronary artery bypass graft surgery; CAD: coronary artery disease; CPG: clinical practice guideline; DASI: Duke Activity Status Index; GDMT: guideline-directed therapy; HF: heart failure; MACE: major adverse cardiac event; MET: metabolic equivalent; NB: no benefit; NSQIP: National Surgical Quality Improvement Program; PCI: percutaneous coronary intervention; RCRI: Revised Cardiac Risk Index; STEMI: ST elevation myocardial infarction; UA/NSTEMI: unstable angina/non-ST elevation myocardial infarction; VHD: valvular heart disease.

Decision making for operability and extent of resection

폐암 적정성 평가 항목

지표4. 치료 전 정밀 검사 시행률 – 포함기준

검 사 항 목	평가대상
폐기능 검사(PFTs)	폐암 수술 혹은 근치적 방사선치료 대상환자 (NSCLC-stage I-III, and SCLC-LD stage)
흉부CT(상복부, 부신 포함), 혹은 흉부CT 와 복부 CT	폐암으로 처음 진단받은 모든 환자
PET-CT or PET	비소세포폐암 Stage IB~III기 환자