**Table 6** Prerequisite general competencies of the IE trainee

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| • Know the basic principles of echocardiography, physics, artifacts, and best practices for image optimization for both 2D and 3D echocardiography |
| • Know the use of 2D and 3D and Doppler echocardiography to evaluate native and prosthetic valve disease, basic adult congenital heart disease (including atrial and ventricular septal defects), and imaging of LAA |
| • Know the standard views included in a comprehensive TEE for SHD assessment[11] |
| • Skill to independently perform comprehensive diagnostic or perioperative 2D, 3D, and Doppler TEE[12,13] |
| • Skill to independently perform 3D transesophageal echocardiographic image acquisition, cropping, and postprocessing[14] |
| • Skill to identify the potential complications of and how to manage them[12] |
| • Skill to effectively communicate detailed information on cardiac anatomy periprocedurally and intraprocedurally in addition to collaborating in interdisciplinary cardiovascular care teams |

percutaneous LAA closure or posterior and mid to superior location for percutaneous mitral edge-to-edge repair.[16]

***Visualization of Septal Tenting.*** For transseptal puncture, interventionalists use a needle concealed inside a catheter advanced transvenously into the right atrium. The catheter is positioned at the desired location on the right atrial aspect of the septum, visualized using echocardiography. The catheter is then advanced to stretch the IAS toward the left atrium to create septal tenting. Expertise in recognizing the proper location and the extent of septal tenting, as well as proficiency in visualizing the subsequent steps of transseptal puncture, is required.

***Recognition of Transseptal Puncture Complications.*** A trainee should gain proficiency in monitoring for and recognizing procedural complications, including hemorrhagic pericardial effusion and puncturing of surrounding structures such as the aorta.

## Mitral Procedures

The current ACC/AHA guideline for the management of patients with valvular heart disease[20] gives mitral TEER repair a class IIa level of recommendation for patients at high surgical risk with primary mitral regurgitation (MR) and patients with secondary MR who fulfill the COAPT (Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients With Functional Mitral Regurgitation) trial criteria.[21] This procedure has become an essential treatment option for patients with both primary and secondary MR but with different indications for each classification of disease as well as different anatomic criteria for device suitability. Thus, the medical knowledge essential to the determination of appropriateness of TEER therapy is to know the morphologic differences that define the major classification of mitral valve pathology into primary and secondary disease. This also requires an understanding of the Carpentier classification of leaflet mobility, which falls into these major classifications.[22] Primary disease includes Carpentier type I (i.e., perforation or cleft or indentations of a leaflet), type II (i.e., excessive motion of the margin of a leaflet segment above the annular plane), and type IIIa (i.e., both diastolic and systolic restriction of leaflet mobility as with rheumatic disease). Secondary disease includes Carpentier type I (i.e., annular dilatation, also known as atrial functional MR) and type IIIb (i.e., systolic restriction of leaflet motion, also known as ventricular functional MR).

The appropriateness of various devices for specific patients may depend on both disease classification as well as leaflet morphology. In addition to quantification of disease severity, TEE is the imaging modality of choice for determining anatomic suitability for TEER device implantation[20] as well as procedural guidance.[23-25] As with other SHD, 3D TEE is useful for defining complex mitral anatomy[26-28] as well as MR severity[29,30] and is particularly useful for the procedural planning of both surgical and transcatheter devices.[13,31] For TEER device therapy, preprocedural cardiac computed tomography (CCT) is not required.[32] However, for therapies involving direct or indirect annular repair, or transcatheter valve replacement, preprocedural imaging with CCT is essential.[33] The interventional echocardiographer should thus understand the correlation between cardiac computed tomographic and echocardiographic assessment of device approach (i.e., transapical or transseptal) and anchoring (i.e., coronary sinus, annulus, ventricle, or atrium), mitral annular size, left atrial and ventricular size and

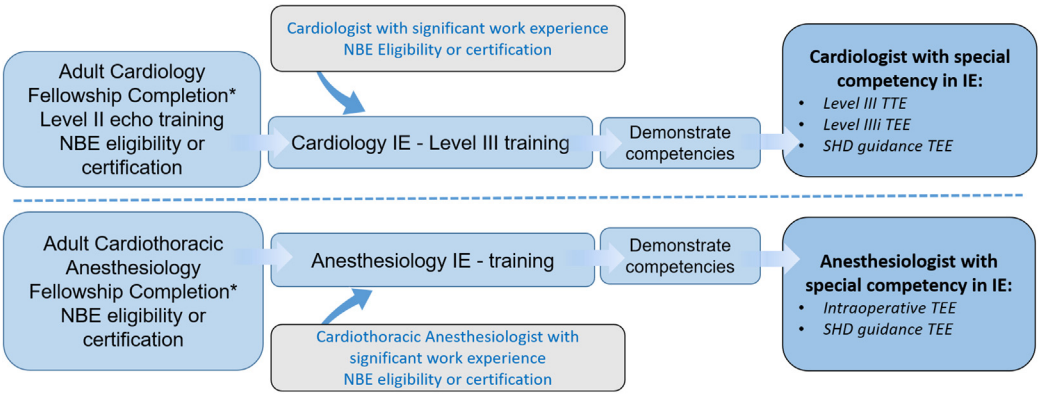


**Figure 4** Training pathways to achieve level III IE competency.