Chapter 24

Olympus NBI® System: Our experience with Tower Model CV-190/CLV-190

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Abstract

This chapter describes practical working aspects of the Olympus Tower (CV-190/CLV-190) system that includes NBI® light filtering technology.

Keywords: NBI®, larynx, operations, problems, advantages

Introduction

Narrow Band Imaging (NBI®) technology is now being applied to study the upper aero-digestive tract. To date, it’s utility has been mainly described for early detection of two potentially devastating pathologies of the laryngeal mucosa—squamous cell carcinoma and recurrent respiratory papilloma (RRP). Here, we review our experience of using this optical technology produced by Olympus to study the human vocal fold (VF) in these and other conditions.

Equipment

We use the EVIS EXTERA III, 190 series Olympus tower (CV-190/CLV-190) as illustrated in Figure 1. This system provides improved NBI® technology, a brighter light source (300 W Xenon light), a more sensitive CCD, and 3D noise reduction in comparison to the older model (EVIS EXTERA II).

Figure 1. EVIS EXTERA III, 190 series Olympus tower (CV-190/CLV-190).
The tower is tall and has a substantial footprint. Hence a dedicated and an ergonomically designed space is a must (Figure 2).

Monitors

Recording

The system (CV-190/CLV-190) is equipped with two monitors (see Figure 1). The primary larger monitor image resolution is high definition (HD) at 1920 × 1080 pixels, which enhances viewing while conducting the NBI® study. The secondary monitor, or slave monitor, is smaller and high resolution (HR) at 1024 x 768 pixels. Recording a video or capturing a still image can be accomplished by triggering the foot pedal or by pressing the slave monitor record or still image icon. Viewing/recording the area of interest (the glottis and surrounding areas) is performed using either a flexible or a rigid scope (see below).

Audio

Do not forget to activate the microphone (audio) option. Sound recording is not automatic and requires placement of a clip-on lapel omnidirectional microphone near the patient’s mouth (typically on clothing). Having a sound track will demonstrate dysphonia severity and will help in locating pertinent video segments.

Strobe Mode

This tower also features a strobe mode allowing to conduct laryngovideostroboscopic (LVS) exam either via a flexible or a rigid scope. When the rigid scope is used, NBI® is possible only if the scope is coupled with the three chip camera Model Full HD 3CCD Camera Head CH-S 190-XZ.

Playback

Playback is viewed on the secondary HR monitor mounted on the side of the tower. Additional monitors can be connected. Annoying reduction of image quality occurs when the images are played back on the secondary screen, since this smaller monitor is of HR, not HD quality (see Figure 3).
Playback image quality also depends on the enhancements settings (A1-A8) during image recording, and in some cases when the enhancements is set up on high (A6-A8), playback image will be very washed-out (only with Stroboscopy)—a really annoying problem. This will persist, even when the playback is downloaded and viewed on the laptop instead of the tower (see Figure 3.2).

The secondary monitor is an nStream G3, which is not an Olympus product. However, Olympus informs us that at the end of 2014 the new model nStream GX monitor will permit HD upgrade. So in the near future, this new monitor will be coupled with the tower system as the standard secondary monitor and this will hopefully solve the playback degradation.
This smaller monitor also serves as an input tablet for registering the patient and storing clinical demographics. It uses a touch screen technology (Figure 4), rather cumbersome in operating, but becomes more intuitive with use. The data can optionally be entered by a keyboard.

Playback (“view icon”) gives an opportunity to display the image in a full screen view. Playback speed can also be adjusted in both forward and backward directions. Playback speed options are continuous, but are predetermined in 1/2 steps if a slow mode is chosen. Dragging the cursor to the right or left will permit skipping directly to specific locations in the video, a useful feature for identifying pertinent, revealing video segments.

As noted above, playback viewed on the slave monitor can be sub-optimal. Another drawback is the location of an icon panel that appears during playback on the slave monitor. The icon bar pops up in an awkward position at the bottom of the screen. Unfortunately, this may partially obstruct the view of the larynx on playback. In particular, the panel may block a critical view of the anterior commissure area. The icon bar is not present on the primary HD monitor with initial recording. To allow for unobstructed views on slave monitor playback, you should position the scope to obtain images of the anterior larynx well above the lower edge of the monitor screen to ensure clear views of the anterior commissure. Fortunately, the icon bar is not present on videos exported to external devices, only on the slave monitor.
Single image shots

The system also provides a single shot option to obtain selected still images of interest while conducting the NBI® study. This option is viewed on the secondary monitor and will provide higher quality images than captured from the video stream.

NBI® study storage

Once the NBI® session is completed and viewed on the slave monitor, it must be actively stored for future viewings. This is accomplished by using the touch screen prompts (“done” followed by “finish” icons). DO NOT FORGET this process, as once you log-off, all the data you just acquired will be deleted.

Data retrieval

Data video retrieval is simple and efficient. Retrieval options include searches by: patient name, medical record number, or date of NBI® study. The nature of these studies result in the recording of relatively long videos (often several minutes) containing extraneous information. The videos can be edited before storage, but this remains a somewhat cumbersome task and is not time-efficient in the midst of a busy clinical practice. Hence, unedited videos tend to be saved, which contain unnecessary and/or redundant information that deplete hard drive memory storage. Presently, we recommend keeping a separate log documenting the recorded time intervals demonstrating the findings of particular interest in a given study. In the future, a more efficient “on the go” editing process or a means of marking or tagging specific portions of a video would be helpful in retrieving valuable segments and preserving hard drive memory.

Figure 5. NBI recording with images on both primary and secondary monitor. During playback images can only be viewed on the secondary monitor.
Scopes

Two types of scopes can be used with this tower. There are a variety of flexible and rigid scopes.

Flexible Scopes

Flexible scopes use distal chip cameras to provide brilliantly lit, high-resolution views of the glottis. The technology provides wide angles of view, but also permits detailed close-up views of the laryngeal mucosa with minimal image distortion. The distal chip flexible scopes include the following models:

1. Model #ENF-VH is the “work horse” scope used for adult diagnostic studies. It has a 3.9 mm outer diameter with 3.6 mm inner diameter. The view field is 110 degrees.
2. Model # ENF-VT2 is a larger scope incorporating a biopsy channel. It has an outer diameter of 4.8 mm. The biopsy channel is 2 mm. The field of view is 90 degrees.
3. Model # ENF-V3 is the slimmer pediatric scope and has an inner and outer diameter of 2.6 mm. The field of view is 190 degrees.

Rigid Scopes

All rigid laryngoscopes are 70- or 90-degree scopes. The distal end of these 10 mm scopes are gold plated to protect them during autoclave sterilization. The large diameter provides abundant, straight fiber optic rods permitting very bright illumination of tissues for fine resolution. For NBI® option when using the rigid scope, see remarks below.

Scope operation

All scopes have two cables to connect to the recording camera processor (Olympus CV-190) and the Xenon light source (Olympus CLV-190). The camera cable has an integrated processor paddle (the paddle is labeled “up” on one side to indicate orientation for fitting into the camera processor box).

The rigid scopes are coupled to an external camera (Model #OTV-S7Pro-Hd-12E). The camera head is glossy black and somewhat bulky (see Figure 6). This head features numerically labeled buttons (camera head has three, video scope has four buttons). Each button can be programmed to perform a wide variety of functions. Most scopes are programmed with three buttons being used for white balance, NBI®, and zoom. The fourth button on the flexible scopes is often used as a “wild card” button programmed to the specific needs of the operator. Since the function of these buttons can be programmed individually in the processor under settings, actual button function may differ significantly from unit to unit. Unfortunately, the actual raised imprinted digit on each button is also in glossy black, making visual identification of each button’s number very difficult. Perhaps the next generation of scopes can have the button numbers highlighted in a contrasting color. Camera focus is automatic on flexible scopes, and is manually ring-adjusted on the rigid scopes.
White balance

White balance is needed to obtain color-true images. A pop-up icon requesting white-balance appears at the initiation of recording on the primary HD monitor. White balancing should be performed to enhance video quality and to remove the blue pop-up icon bar in the lower left corner of the screen (which will appear on downloaded videos). Anecdotally (Olympus representative direct communication), superior white balance may actually be achieved using an off-white reference (such as a typical manila folder) to perform the white balance.

Ancillary issues

Other issues are not related to Olympus technology, but are important factors affecting the ability to obtain a successful NBI® study. For example, anatomical issues can impact successful NBI® recording. A large tongue and retro-displaced larynx may make it technically challenging to see the VF with a rigid scope or difficult to pass a flexible scope around the epiglottis without stimulating the gag reflex. Physiologically, some patients are “hyper-gaggers”, making capturing quality NBI® images challenging. NBI® images are best obtained with a minimum of mucus in the larynx. Mucus accumulates progressively during the exam, especially in patients with anxiety and strong gag reflexes. Especially when using trans-nasal flexible scopes, mucus tends to gather at the scope tip distorting and obscuring the view. With either flexible or rigid scopes, mucus on the mucosa tends to block NBI® wavelength penetration, limiting the exam. Therefore, when NBI® findings might reveal important diagnostic clues, consider performing a very brief white light exam initially before progressing to NBI® or even consider performing the NBI® study before the white light imaging.
Cost vs. gains

In the United States, distal chip camera technology is gaining progressive utility. The change from indirect mirror to fiber optic scopes to distal chip scopes represents an inevitable generational technological evolution. Every technological jump comes with significant expense justified by the additional patient benefits accrued. As opposed to some other distal chip camera systems, Olympus’ distal chip technology has the added benefit of incorporating NBI® technology into all their systems. The added benefits of this technology are currently being explored in the field of laryngology. The potential of defining the utility of “optical biopsies” is presently being studied. While ultimately this imaging technique cannot replace pathological tissue biopsies, in the proper skilled hands, it may aid in patient management and lead to both earlier therapeutic interventions in suspicious lesions and the sparing of unnecessary procedures in benign appearing lesions. Patient management and outcomes can only improve with the additional information we glean from this technology.

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