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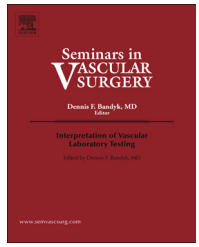

Appearance of the Nellix endoprosthesis on postoperative imaging: implications for patient and device surveillance

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ABSTRACT

The Nellix stent graft has novel features that influence interpretation of imaging follow-up, in particular, the use of endobags that seal the aneurysm sac. The polymer within the endobags contains a small amount of contrast medium, which causes a predictable temporal change in appearances. Understanding of these features allows correct image evaluation.

In this article, we review the appearance of Nellix on computed tomography, ultrasound, magnetic resonance imaging, and plain radiography. We describe the special considerations that are important to consider when reviewing imaging, including endobag position and seal, endobag configuration, endobag and polymer maturation, and endobag gas. Detection of complications is discussed, with suggestion of a follow-up protocol based on the authors' experience.

1. Introduction

As the Nellix endovascular aneurysm sealing (EVAS) system (Endologix, Irvine, CA) is a novel solution for endovascular aneurysm treatment, there are consequently unique imaging appearances. These appearances have a predictable temporal change. In this article, we will describe the typical imaging features after Nellix EVAS, across a variety of modalities, focusing on the novel imaging findings and their characteristic evolution during follow-up.

2. Normal EVAS appearances

2.1. *Computed tomography imaging*

The computed tomography (CT) scan is the most common modality for initial postoperative imaging after EVAS. Similar to conventional endovascular aneurysm repair (EVAR), review should focus on stent position, stent patency, visceral and iliac artery patency, aneurysm size, and the exclusion of endoleak. However, the presence of endobags is a unique consideration that has a bearing on image interpretation. Our local CT protocol includes unenhanced and arterial phase series, although a portal venous phase can also add important information specific to EVAS with Nellix.

When reviewing CT images, there should be careful attention to the window level and range. Due to the greater density of the cobalt-chromium stent, artefact can artificially narrow the lumen of the stents or mask intraluminal thrombus (Fig. 1). This is important, due to the fact that the lumen of the stents is only 10 mm compared to larger diameters for standard EVAR. The stent position and endobag configuration can be assessed easily, with the typical crossing of the stents within the aneurysm sac and classic "yin-yang" appearance of the individual endobags (Fig. 2).

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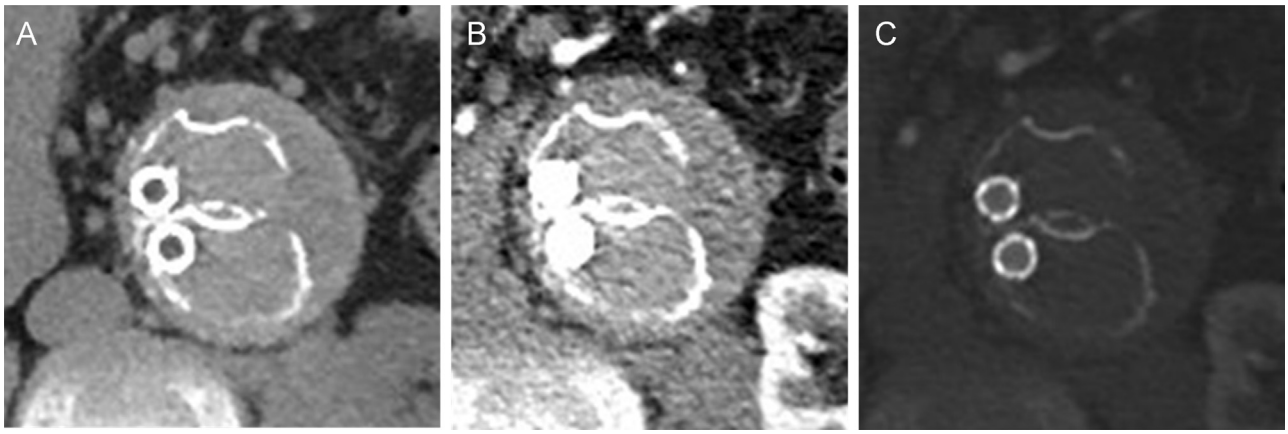

Fig. 1 – Axial computed tomography images showing artefact from the cobalt-chromium stents. (A) Unenhanced, (B) arterial phase, and (C) arterial phase with adjustment of window level and width.

As there is a small amount of iodinated contrast medium within the polymer, CT performed at an early stage post-EVAS shows the endobag contents to be relatively high attenuation (Fig. 2A). Over time, the bag contents become low attenuation, with an increase in attenuation of the bag periphery; this is due to migration of the contrast medium within the polymer toward the plastic of the endobag [1]. Important facets in the interpretation of this are discussed in a later section.

2.2. *Ultrasound*

As with standard EVAR surveillance, ultrasound (US) post-EVAS is advantageous due to its lack of ionizing radiation. US can visualize aneurysm size, assess limb patency, and evaluate endoleak. Disadvantages are similar to those found with all ultrasound-based imaging, with difficulties due to raised body habitus or overlying bowel gas, and the requirement for skilled operators. The cobalt-chromium stents are easily visible on US, and the addition of Doppler US allows evaluation of flow within the individual stents, and can also detect endoleak. Due to its high water content, the polymer within the endobags is hypoechoic and of fluid echogenicity; this allows for excellent sound transmission for evaluation of flow within the stents, and for the presence of posterior endoleaks. The endobag is seen as a thin hyperechoic rim surrounding the anechoic polymer (Fig. 3). Due to the way in which the polymer is injected into the endobags, gas can be introduced. In the first few days after EVAS, this gas can cause difficulty with US, which is discussed in more detail later. This issue has largely resolved within 1 week of implantation.

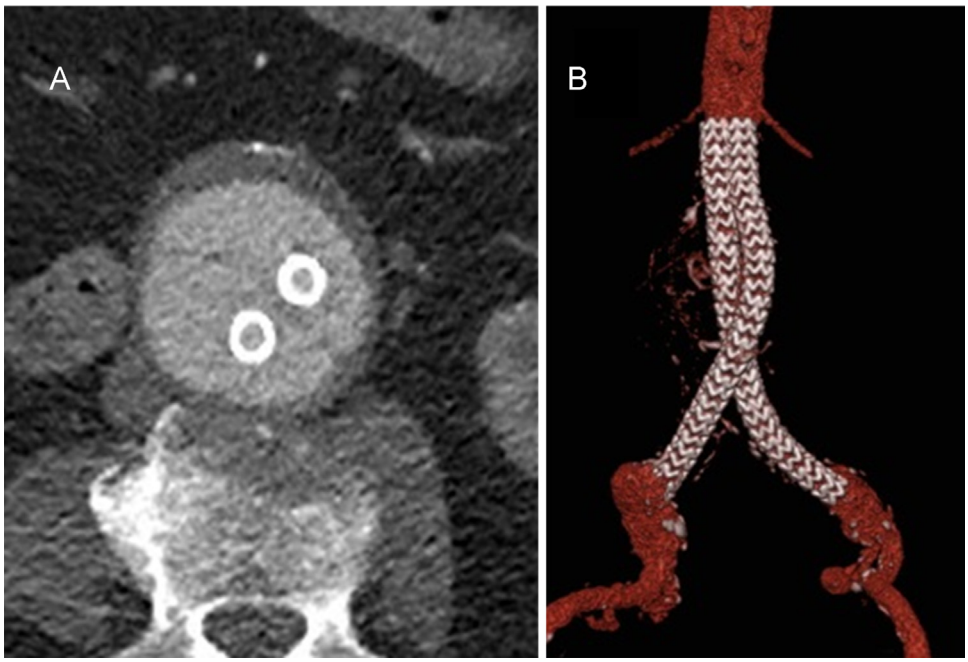

Fig. 2 – (A) Axial computed tomography (CT) showing classic "yin-yang" appearance of the stents within the endobags. (b) Volume rendered CT showing characteristic crossing stents within the aneurysm.