

6th July 2018

Experience feedback from a significant radiation exposure event

Spotlight on the use of the "One More" button of the General Electric Healthcare scanners

In March 2018, inappropriate use of the "One More" function of a General Electric Optima CT660 computed tomography (CT) scanner resulted in extremely significant overexposure (>1Gy) of a pregnant patient and her future child during a diagnostic CT examination.

To prevent the recurrence of this type of incident, a working group was set up by ASN with the radiology professionals. This Experience Feedback report gives you the operational recommendations of this working group, established with the assistance of IRSN.

Description of the significant radiation exposure event

A CT scan of the lumbar spine covering the T12-L2 region was prescribed for a pregnant patient (in the 3rd trimester of pregnancy) for a suspected complex vertebral fracture of vertebra L1 on a haemangioma. The examination was carried out on the centre's GE Optima CT660 scanner. Helical acquisition without injection was programmed from the middle of T11 to the bottom of L2. Acquisition was interrupted unexpectedly at L1 for an unknown reason. After the radiologist had confirmed the need to explore the L2 vertebra, the radiographer decided to use the "One More" function to cover the non-displayed L2 vertebra, thinking that this function would limit exposure of the foetus. To cover the missing 32 mm, the radiographer pressed the "One More" button 51 times. The examination led to a dose-length product (DLP) of more than 6000 mGy.cm (CTDI_{vol} per acquisition : 24.9 mGy) and overexposure of the patient's abdomen in the area of vertebrae L1 to L3, and of the pelvis of the foetus. The dosimetric reconstruction carried out by IRSN indicates absorbed doses of up to 1.6 Gy in these anatomical regions. It should be noted that no dosimetric information (cumulative DLP in particular) is visible on the acquisition screen when the "One More" function is used. This information is only available on the acquisitions configuration screen, which is not displayed when the "One More" button is pressed.

The "One More" function

The "One More" function is present on the entire range of General Electric CT scanners. It becomes available at the end of each acquisition, and allows one or more slices to be readily added to the acquisition that has just been made. The additional slice(s) is/are automatically added to the series of image of the initial acquisition, which facilitates viewing of the examination by the radiologist. The additional acquisition programmed by pressing the "One More" button reproduces all the technical parameters of the initial acquisition (except for the initial and final positions and the number of images). If the initial acquisition is helical, pressing the "One More" button without changing the default parameter settings programs a helical acquisition and the reconstruction of a **single** image following on from the last image obtained. Given the technical constraints of the helical acquisition mode (rotation or fraction of a rotation of the X-ray tube at the start and end of the spiral, known as *overranging*), the exposed length is forcibly greater than the viewed length. The "One More" acquisition is superimposed on the terminal portion of the initial acquisition, which doubles exposure to X-rays in this area over a significant width, which depends on the acquisition pitch and collimation (46 mm in the case in hand). **If the "One More" button is pressed repeatedly, the cumulative dose can reach very high values, as was the case in the radiation exposure event mentioned above.**

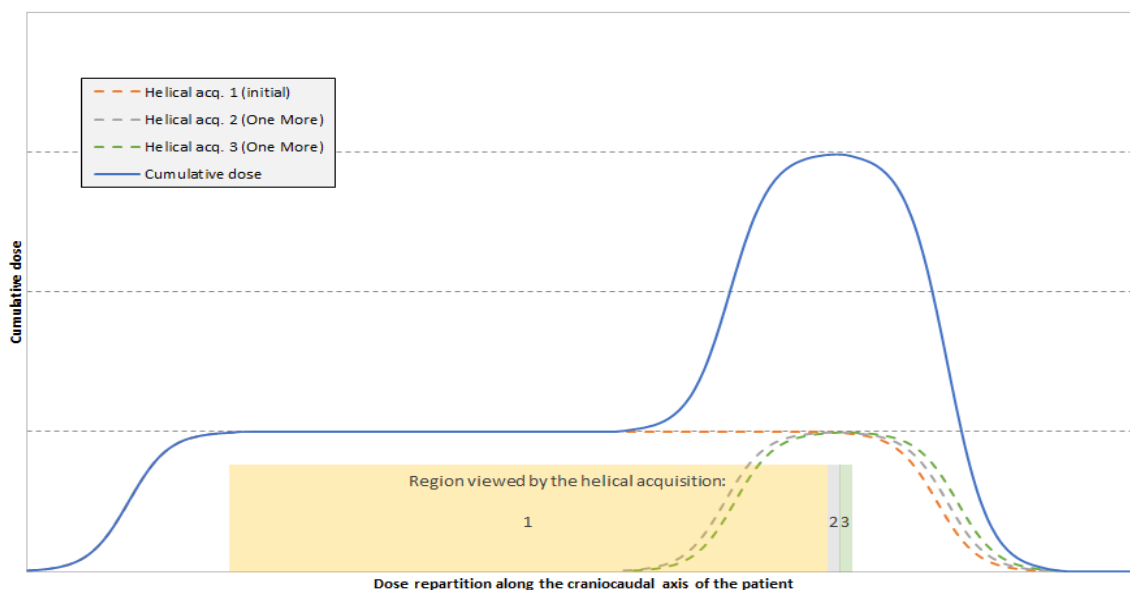


Figure : Illustration of the superpositioning of doses when the "One More" button is pressed twice in a configuration similar to that of the radiation exposure event.

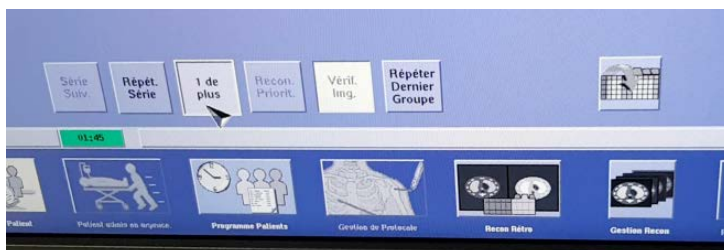
When using this option, the manufacturer recommends performing a systematic verification and modifying the number of reconstructed images in order to cover the desired viewing length in a single acquisition. This recommendation is not indicated in the user documentation however, but **seems only to be given verbally** during the initial training provided when a new CT scanner is installed. The procedure to follow is detailed at the end of this document.

First-line recommendations

- Be extremely attentive to the initial acquisition parameter settings, particularly the position of the last image viewed, using planar acquisition(s) (Scout View®) as an aid and adopting a reasonable safety margin.
- If an initial acquisition does not cover the whole of the desired area, avoid using the "One More" function. It is preferable to go back to the configuration screen and use the "Add Group" function to manually adjust the initial and final positions of the group of additional images.
- If the "one more" function is used, it is vital to set the acquisition to "pause", then go back to the configuration screen and manually change the number of images in order to cover the entire desired anatomic region in a single acquisition (see screenshots 2 to 4).
- Draw the radiographers' attention to the reading of the dosimetric indices (CTDI_{vol} and DLP) displayed on the console and provide guidance values per type of examination (diagnostic reference levels [DRL] or local reference levels if available)
- Draw up a procedure reproducing the above recommendations at least, inform the radiographer teams of the procedure and make it available at the CT scanner acquisition console.

An ASN circular letter containing corrective or preventive actions shall be published later.

Detailed procedures for the use of the "One More" button



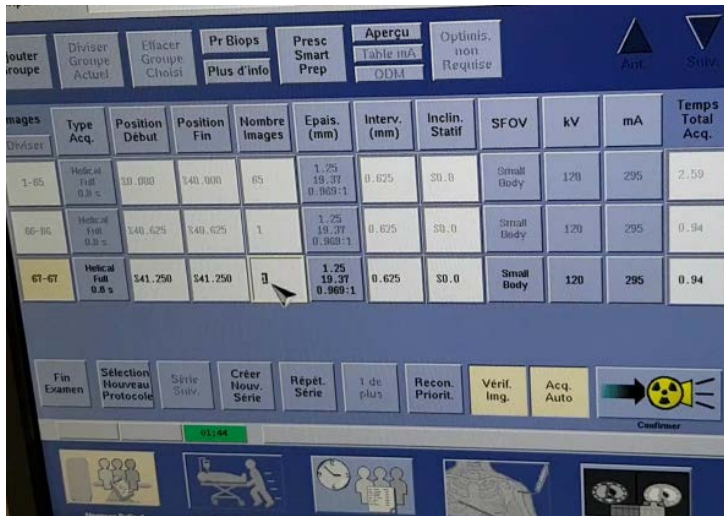
Screen 1: Press the "One More" button



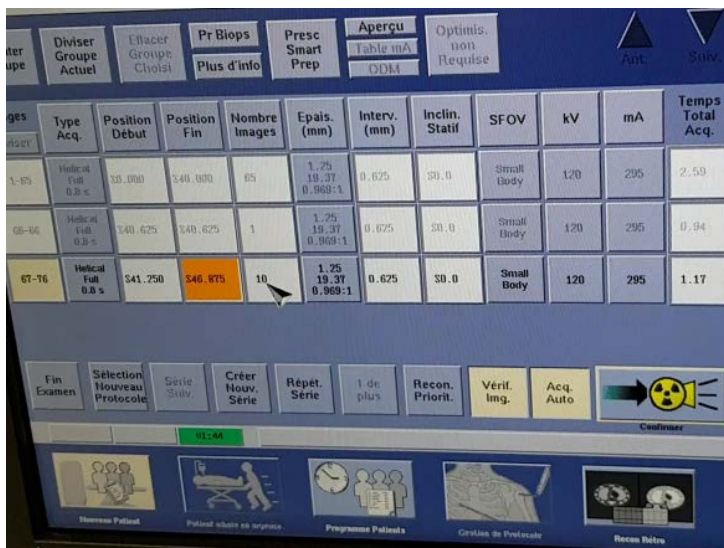
Screen 2: Press the "Pause/Suspend" button



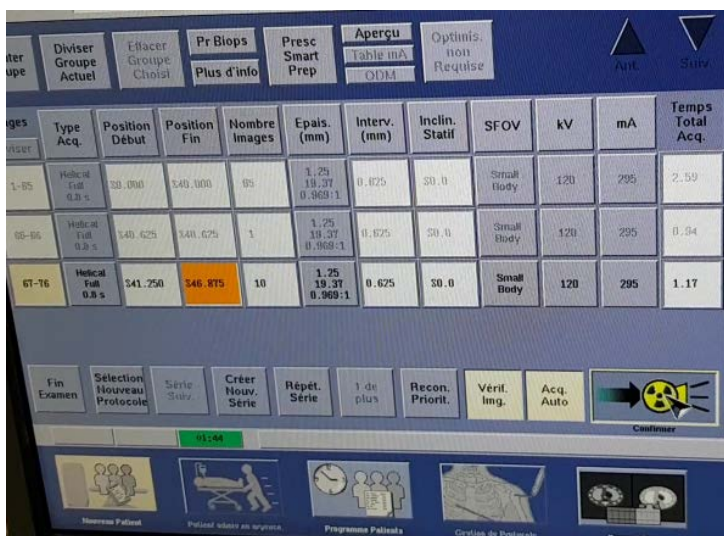
Screen 3: Press the button to return to the acquisitions configuration screen



Screen 4: Manual modification of the number of images. Entry of the number of images necessary to cover the region to be viewed. Use Scout View® as an aid to image positioning



Screen 5: The system automatically changes the position of the last image viewed. Verification of the number of images and change it if necessary.



Screen 6: Press the "Confirm" button

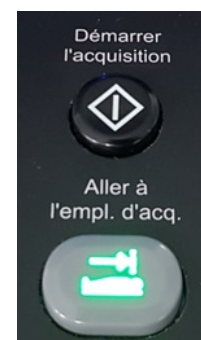


Table movement authorisation and start of acquisition