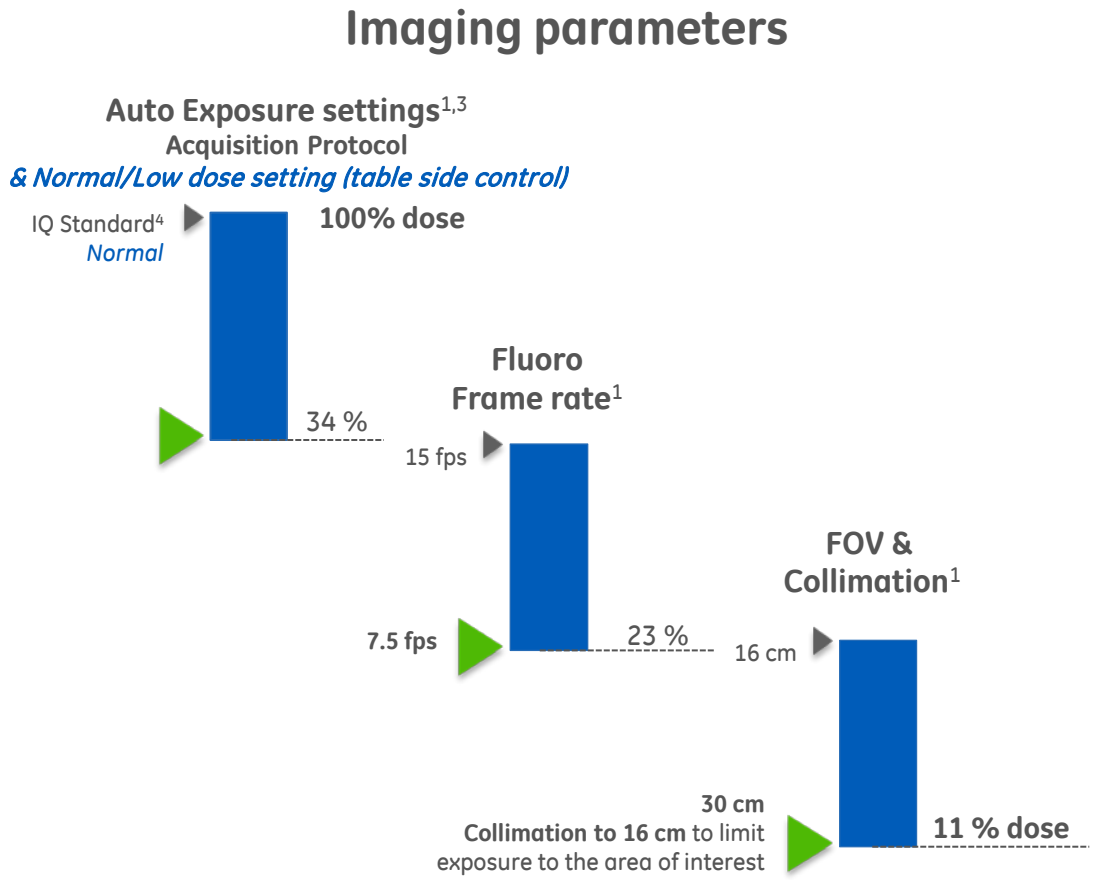
Dose management during EVAR procedures

Experience from CHU of Lille, France

Imagination at work

Imaging parameters used in the Discovery IGS 730 in Lille help the team to reduce the dose by up to 89%[1,2]



Pr. Haulon's team at CHU of Lille uses multiple strategies of dose saving, resulting in a median Dose Area Product (DAP) of only 44 Gy.cm2 (minimum 16 Gy.cm2 - maximum 147 Gy.cm2) and median fluoro time of 34 min (minimum 18 min - maximum 67 min) during the first 25 procedures of complex juxtarenal and thoracoabdominal EVAR :

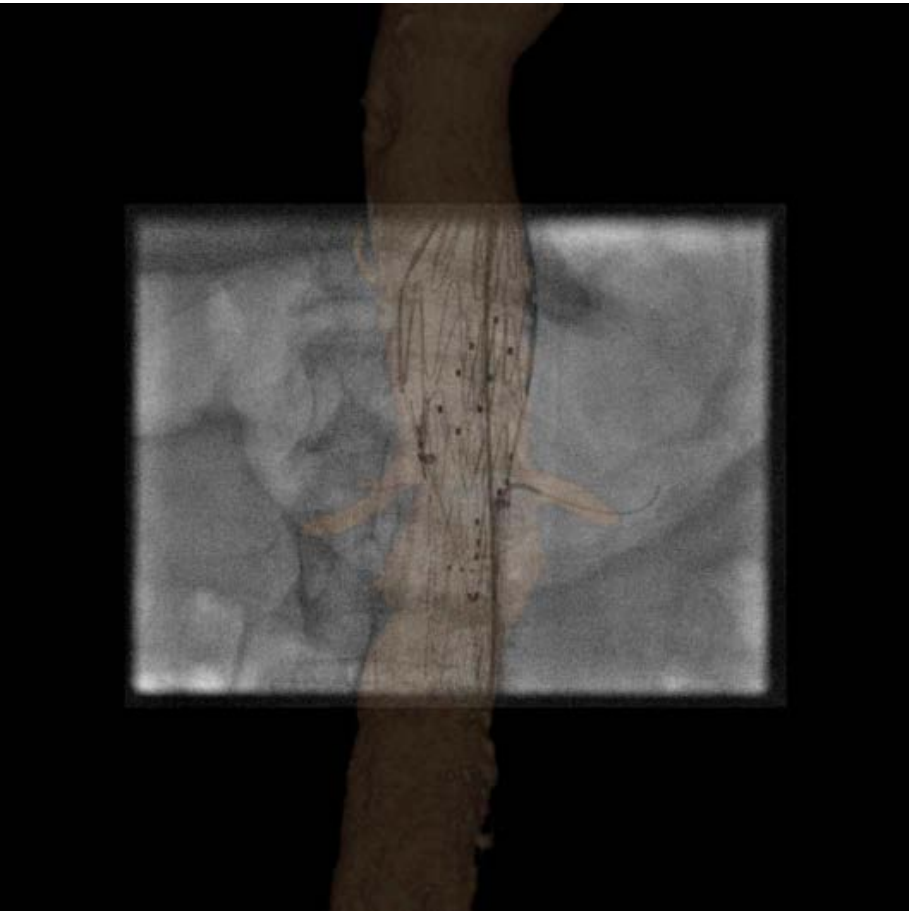
- Median Dose Area Product (DAP) of only 44 Gy.cm² (minimum 16 Gy.cm2 - maximum 147 Gy.cm²)
- Median fluoro time of 34 min (minimum 18 min - maximum 67 min).

Median DAP of 233 to 697 Gy.cm2 (5 to 15 times higher than in Lille) and median fluoro times of 35 min to 83 min are reported in the literature for this type of procedures [a,b,c]

Bibliography.
a. D.L. Miller et al. Radiation Doses in Interventional Radiology Procedures: The RAD-IR Study. Part I: Overall Measures of Dose. J Vasc Interv Radiol 2003; 14:711–727
b. G. Panuccio at al. Comparison of indirect radiation dose estimates with directly measured radiation dose for patients and operators during complex endovascular procedures. J Vasc Surg 2011;53:885-94.
c. P. Howells et al., Risk of Radiation Exposure during Endovascular Aortic Repair. Eur J Vasc Endovasc Surg 2012; 43 : 393-397

1 Approximated Dose per IEC 60601-2-43 (20 cm PMMA phantom)
2 Compared to the default settings of the aorta and aorta arch protocols of the Discovery IGS 730 with 16 cm FOV
3 Only valid when the maximum fluoro entrance dose is not reached
4 Default settings of the aorta and aorta arch protocols of the Discovery IGS 730
In clinical use, the results of dose reduction techniques will vary depending on the clinical task, patient size, anatomical location and clinical practice.

Use of Innova Vision with pre-op CT overlay without need to acquire cone–beam CT is key according to the site experience



Fusion imaging

Pr. Haulon gets 3D vascular map from the pre-operative CT without need to perform an intra-operative 3D acquisition (which generates 4.2 to 24 Gy.cm2 of DAP according to phantom studies [a, b, c] and 37 Gy.cm2 according to a study on patients[d]). If used, intra-operative 3D acquisition (cone beam CT) would represent an additional dose of 10% to 85% of the median total exam DAP measured in Lille.

Centering of the anatomy and optimization of the C-arm angulation is done without shooting x-ray by leveraging the capacity of the 3D mask to follow the table and gantry movements.

Fluoroscopy

When clinically relevant, Pr. Haulon performs fluoroscopy rather than DSA runs. This applies, for example, to the roadmap imaging used during endograft legs positioning on the iliac arteries where the mask is acquired in fluoroscopy.

Bibliography.
a. Suzuki S. et al., Effective Dose during Abdominal Three-dimensional Imaging a Flat-Panel Detector Angiography System. Radiology 2009; 250 (2) : 545–550
b. Sangroh K. et al., Radiation dose from 3D Rotational X-ray imaging: organ and effective dose with conversion factors. Radiation Protection Dosimetry 2012; 150 (1) : 50 – 54
c. Suzuki S. et al., Evaluation of Effective Dose During Abdominal Three Dimensional Imaging for Three Flat-Panel-Detector Angiography Systems. Cardiovasc Intervent Radiol 2011; 34:376–382
d. Nordon I.M. et al., Validation of DynaCT in the Morphological Assessment of Abdominal Aortic Aneurysm for Endovascular Repair. J Endovasc Ther (2010)17:183–189
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