




Assessing Radiation Exposure to Patients During Recanalization of Chronic Venous Obstruction



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Literature review

Author	Year	Groups	Imaging System	Number Of procedures	DAP (Gy.cm ²)	CAK (mGy)	Pelvic ESD (mSv)	E (mSv)
Chait	2019	Iliofemoral venous stenting	Mobile C-arm	40	-	1.88 (48.54)	-	0.221
Barbati	2019	Iliofemoral venous stenting and IVC reconstruction with bilateral lesions	Mobile C-arm	78	74.6 [*] (IQR 29.5-189.2)	393.5 [*] (IQR 178-955)	1.66 [*] (IQR 0.27-2.59)	17.4 [*] (IQR 8.7-33.12)
Lim	2020	DVT thrombolysis (lower extremity)	Fixed C-arm (endovascular operating room)	29	9.2 (0.2-176.0)	-	-	-
		DVT thrombolysis (upper extremity)	91	2.0 [*] (0.1-11.7)	-	-	-	
		unilateral chronic iliofemoral venous stenting	56	32.4 [*] (0.1-289.6)	-	-	-	
		IVC reconstruction	39	60.8 [*] (2.5-269.1)	-	-	-	
Baccellieri	2021	Iliofemoral venous stenting without Cone-Beam computed tomography (CBCT)	Fixed C-arm (endovascular operating room)	15	24.0 [*] (IQR 19.3-35)	69.8 [*] (IQR 19.3-35)	-	-
		Iliofemoral venous stenting with CBCT	10	70.5 [*] (IQR 56.9-97.3)	244.6 [*] (IQR 190.3-323.7)	-	-	

Modarri B et al. Editor's Choice - European Society for Vascular Surgery (ESVS) 2023 Clinical Practice Guidelines on Radiation Safety. Eur J Vasc Endovasc Surg.

Radiation effects

- Deterministic effects:** predictable dose-dependent effect and occurs only beyond a threshold (2 Gy skin erythema, 5 Gy skin nekrosis, ...)
- Stochastic effects:** without a threshold dose (long-term effects of radiation like cancers)

Measuring the radiation quantity

	Fluoroscopy time (FT)	Cumulative air kerma (CAK)	Dose area product (DAP)	Effective dose (ED)
Description	Amount of time the X-ray is activated	The energy extracted from an x-ray beam per unit mass of air	Absorbed dose multiplied by the area irradiated	Sum of the equivalent whole body dose
Unit of measurement	Minutes	Gray (Gy)	Gy x cm ²	Sievert (Sv)
Availability	Provided by fluoroscopy unit	Provided by fluoroscopy unit	Provided by fluoroscopy unit	Dosimeter


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Indirect parameters


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Direct parameter

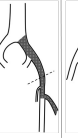
CVO classification


Type 1


Type 2


Type 3


Type 4a


Type 4b


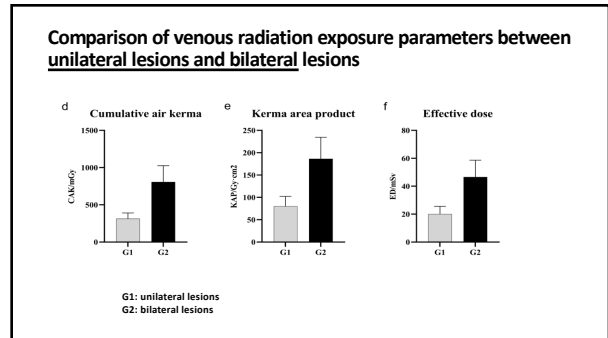
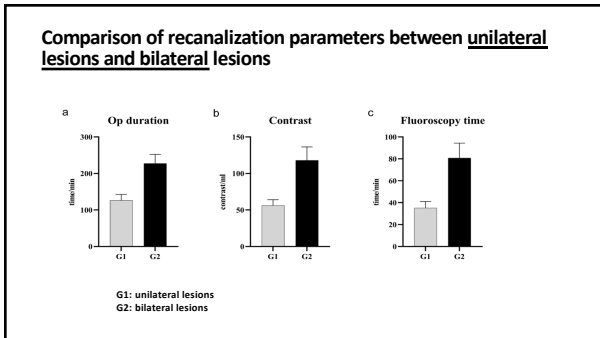
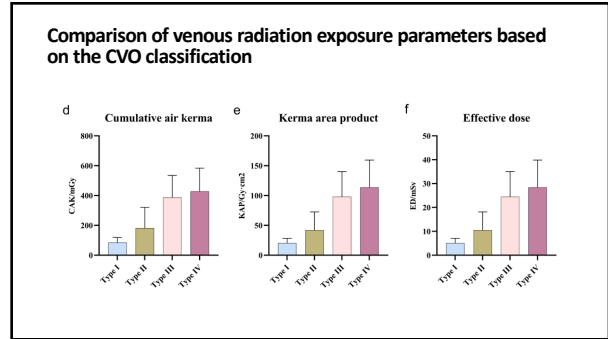
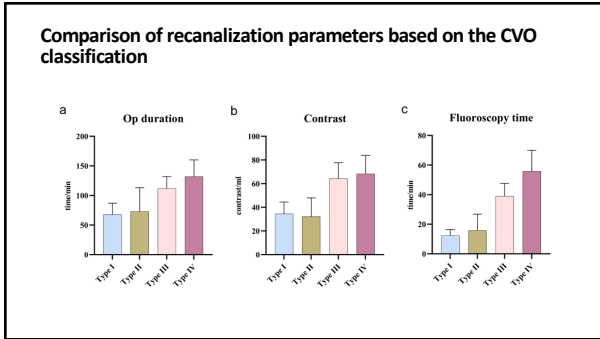
Type 5


Jalaie H et al. Prognostic Value of a Classification System for Iliofemoral Stenting in Patients with Chronic Venous Obstruction. Eur J Vasc Endovasc Surg. 2024

Study methods and design

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    graph TD
      A[Single center retrospective analysis of prospective gathered data (N=191)] --> B[Group A (Unilateral lesions n=143)]
      A --> C[Group B (Bilateral lesions with IVC reconstruction n=48)]
      B --> D[Analysis with Group A (Unilateral lesions) based on CVO classification system Type I vs Type II vs Type III vs Type IV]
      C --> E[Comparison Between Groups Unilateral lesions (Group A) vs Bilateral lesions (Group B)]
      D --> E
      E --> F[Main comparison parameters: OP duration, Contrast use, Fluoroscopy time (FT), Cumulative air kerma (CAK), Kerma area product (KAP), Effective dose (ED)]
      F --> G[Analysis of factors affecting the outcomes (e.g. BMI, CVO classification system)]
    
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Correlation of BMI and CVO classification with radiation exposure indicators

variables	r	p
OP duration	0.176	0.015
contrast	0.184	0.012
CAK	0.358	<0.001
KAP	0.478	<0.001
FT	0.201	0.006

Correlation between BMI and variables

variables	r	p
OP duration	0.586	<0.001
contrast	0.329	<0.001
CAK	0.427	<0.001
KAP	0.462	<0.001
FT	0.598	<0.001

Correlation between CVO classification and variables

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Summary

- Venous recanalization rarely causes deterministic radiation effects
- Radiation dose is highly related to CVO classification
- Higher classification seems to result in higher contrast use, FT, cAK, KAP, ED values, and bilateral lesions radiation amount are significant higher than unilateral lesions
- Use of IVUS to reduce the radiation amount

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Thank you very much



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