Artificial Intelligence Technologies to Assist Prediction of type 1A Endoleak Following Standard EVAR

Jean-Nicol ALBERTINI, MD, PhD
Stephan HAULON, MD,PhD

Conflict of interest

JN Albertini: Co-founder & Chief Medical Officer

PrediSurge

S Haulon: Principal Investigator EndoVx Consortium

EndoVx
Reinvent endovascular aortic surgery

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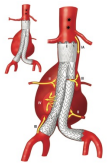
Background

- Endoleaks affect 30% of patients after EVAR
- Type I endoleak is associated with the highest risk of rupture (7.5% at 2 years) and require secondary endovascular or oper repair



Management of Endoleaks After Elective Infrarenal Aortic Endovascular Aneurysm Repair
A Review
JAMA Surgery · September 2023 · Volume 158, Number 9

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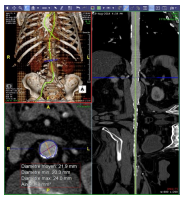
Limitations of current sizing and planning for EVAR

- **No tool** for preoperative evaluation of **device behavior**
- Device selection & **prediction of complications rely on operator experience** and clinical judgement



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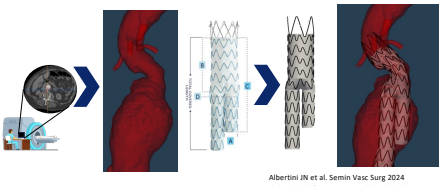
Digital twin technology for EVAR



Albertini JN et al. Semin Vasc Surg 2024
doi: 10.1053/j.semvascsurg.2024.07.002

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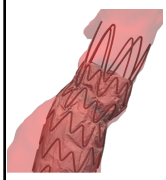
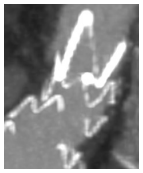
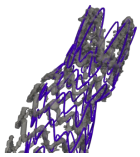
Validation of EVAR digital twin







Derycke et al. Comput Methods Program Biomed 2024
doi: 10.1016/j.cmpb.2023.107993

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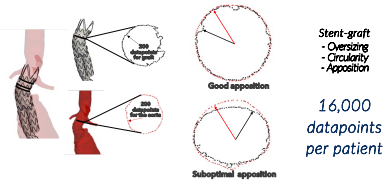
Post-processing of stent-graft and aorta digital twins



Stent-graft
- *Oversizing*
- *Circularity*
- *Apposition*

16,000 datapoints per patient

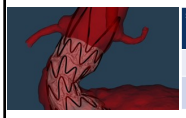
Generation of machine learning based type 1A endoleak risk index (ERI)

Training set (EnduSim 1 study)

- *Retrospective multicenter cohort*
- *90 patients*
- *EVAR – Endurant® (Medtronic, Dublin, Ireland)*
- *Type 1A endoleak (early and late) 23 cases Control 27 cases*
- *Analysis of digital twin parameters using machine learning algorithms*
- *Generation of type 1A endoleak risk index*

Endoleak Risk Index (ERI)

A synthetic AI-based index



Simulated device reference	Simulated landing zone	PlanOp® Aortic Output: Risk of type IA Endoleak
ETBF 2316 C 166	Lower edge Right Renal	High risk
ETBF 2516 C 166	Lower edge Right Renal	Low risk

EnduSim 2

Validation study

- *Multicenter European trial*
- *Ongoing enrolment 32 patients (target 200)*
  - *16 type 1A endoleaks*
  - *16 controls*
- *Assessment blinded to endoleak status, ERI algorithm based on EnduSim 1 data*

Preliminary results:

Sensitivity 96 %

Specificity 81 %

Conclusion

- *AI-powered digital twin coupled with conventional planning may be used in clinical practice to evaluate the risk of type 1A endoleak*
- *The technology provides a tool for assessment of stent-graft deployment prior to the procedure*
- *Various clinical scenario (device diameter and proximal landing zone) may be tested for the same patient with potential to enhance preoperative strategy*
- *Preliminary results of external validation shows good sensitivity for predicting type 1A endoleaks*