



**Università
di Brescia**

Dipartimento di Scienze Cliniche e Sperimentali

Dottorato di Ricerca in
«Intelligenza Artificiale in Medicina e Innovazione
nella Ricerca clinica e metodologica»

Coordinatore: Prof. Domenico Russo

AI for predicting cerebral embolization risk and characterizing embolic patterns during endovascular aortic arch repair

Verrengia Apollonia

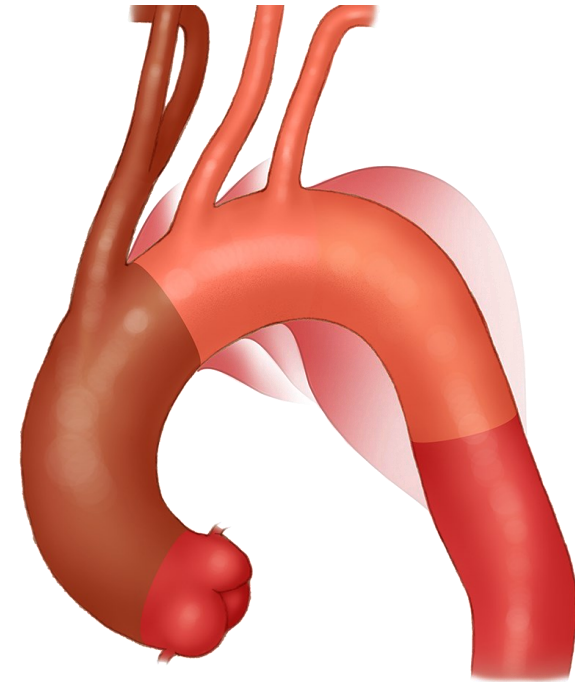
XLI

Supervisor: Prof. Luca Bertoglio

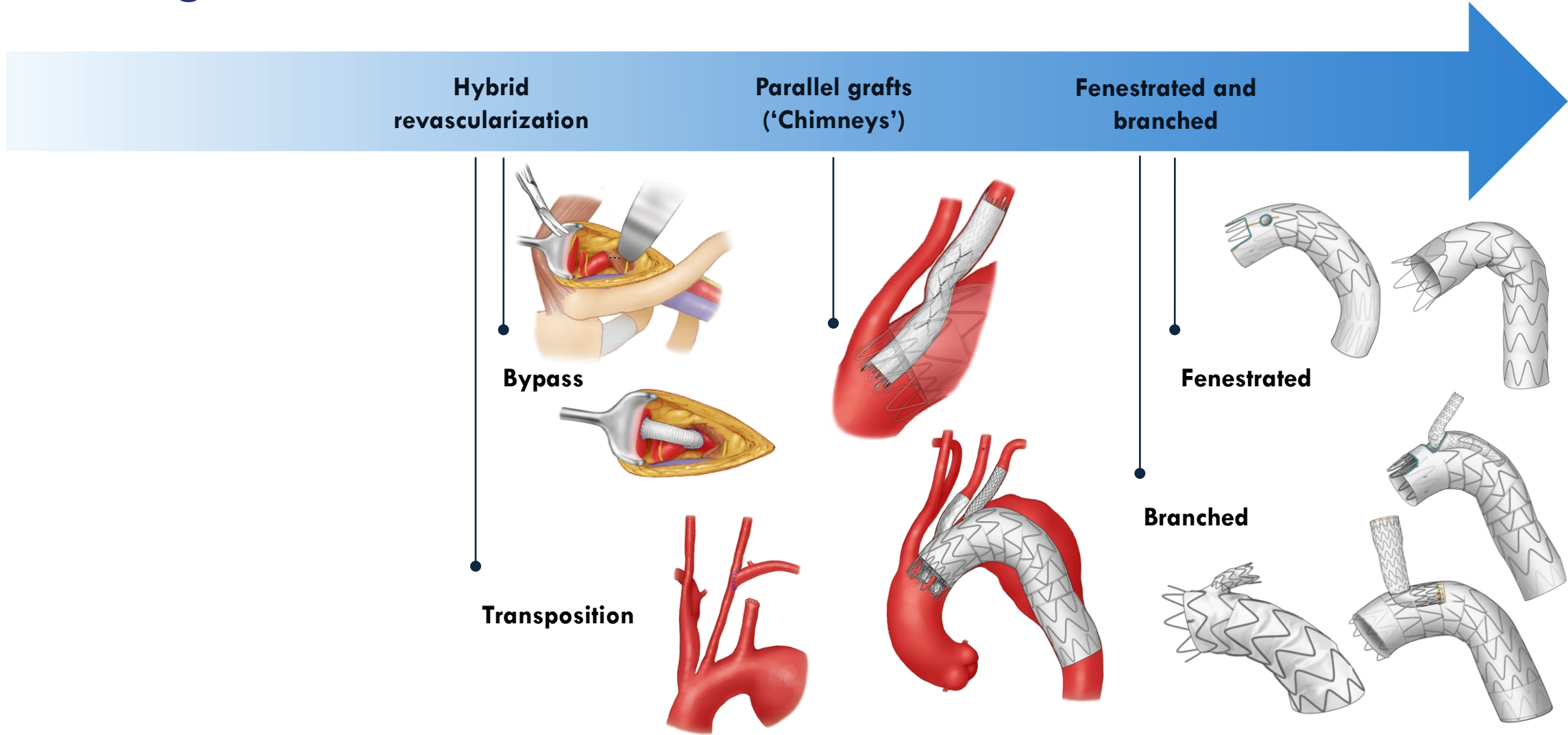
Co-Supervisor: Prof. Stefano Bonardelli

Aortic Arch Pathologies

- Aortic arch aneurysms and dissections are associated with substantial morbidity and mortality if left untreated (2-17%)
- Open aortic arch repair remains the gold standard but is highly invasive, requiring cardiopulmonary bypass and circulatory arrest, with reported mortality rates of 2–6% in elective cases and stroke rates of 2–7%.

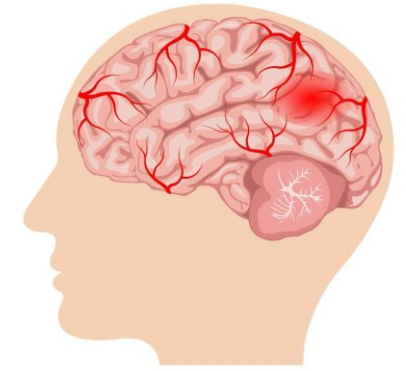


Management trend



Endovascular treatment

- HIGHER TECHNICAL SUCCESS (87-92%)
- LOWER MORTALITY (2-6%)
- SIGNIFICANT RISK OF CEREBRAL EMBOLIZATION (27-34%)



From Clinical Observation to Research Question

SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA
Azienda Ospedaliero - Universitaria di Bologna

Policlinico S. Orsola-Malpighi
Dipartimento Attività Integrate Cardio - Toraco - Vascolare

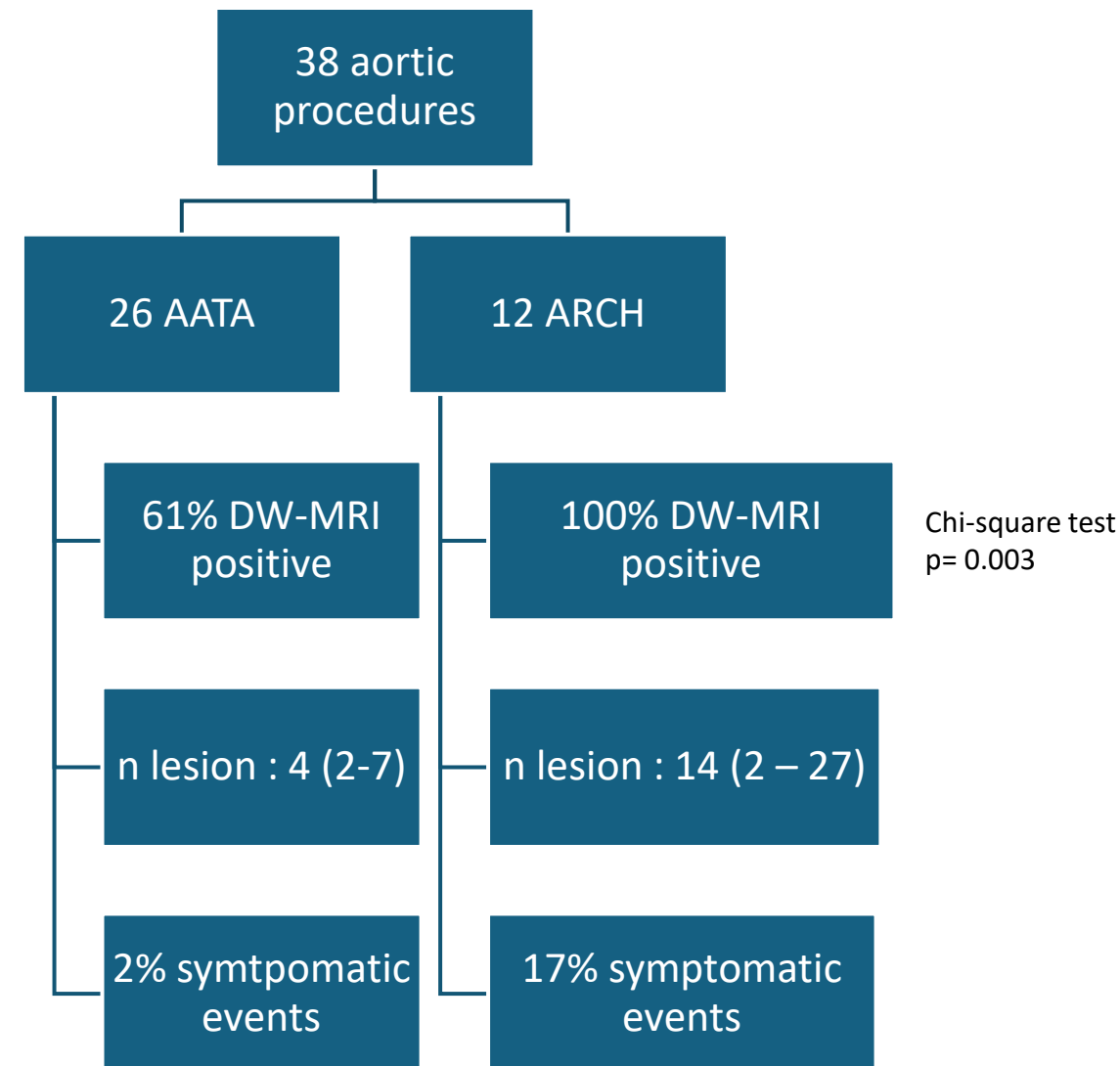


ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

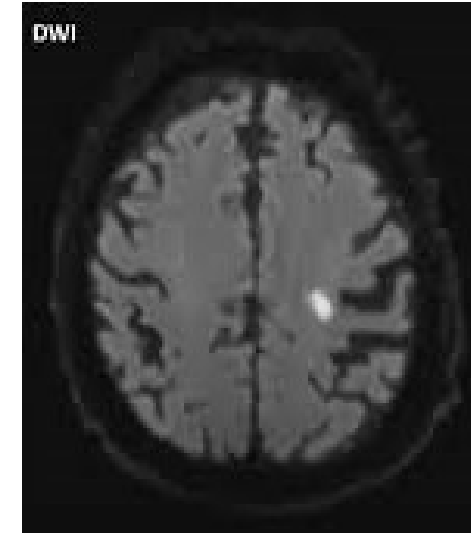
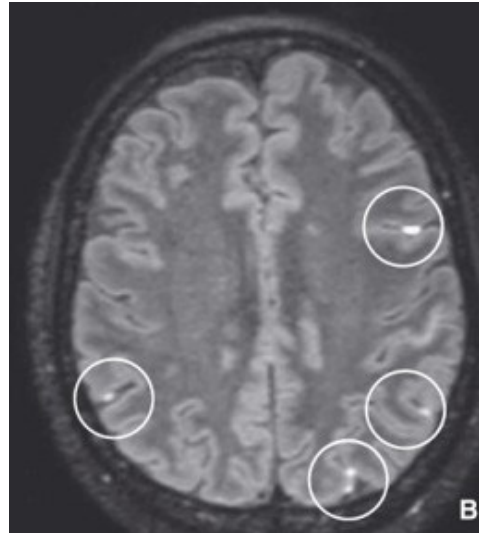
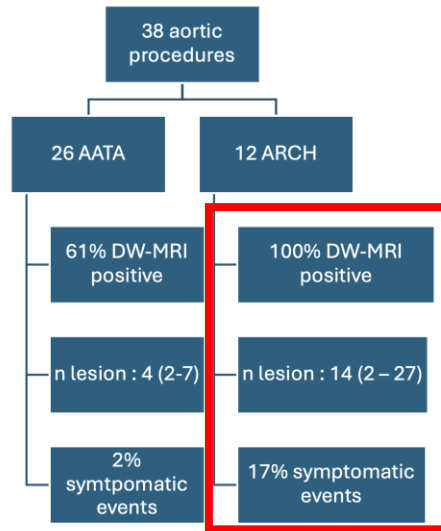
**Informazioni sul trattamento di dati personali
appartenenti a categorie particolari**

VERSIONE DEL 28/06/2024

TITOLO STUDIO: Lesioni cerebrali silenti ed eventi neurologici nei pazienti portatori di aneurismi complessi dell'aorta addominale, toracoaddominali o dell'arco aortico trattati con endoprotesi aortiche fenestrate e ramificate	
PROTOCOLLO N.:	MRI FB-EVAR
PROMOTORE	Alma Mater Studiorum - Università di Bologna
CENTRO DI SPERIMENTAZIONE	U.O. Chirurgia Vascolare - IRCCS AOU di Bologna Policlinico di S.Orsola



From Clinical Observation to Research Question



- Lesions showed a highly heterogeneous distribution pattern
- The embolic burden varied markedly among patients

Can high-risk patients be identified before treatment?

UNIBS study design – Phase I

OBSERVATIONAL, INVESTIGATOR INITIATED, MULTICENTER

Study Cohorts

Patients undergoing
endovascular aortic
arch repair

- retrospective
cohort

- prospective
cohort

Ongoing enrollment (n= 33)

Inclusion Criteria

- Patients affected by aneurysm and/or dissection of the aortic arch, whether degenerative or post-dissection, who are candidates for endovascular surgical treatment using fenestrated or branched endografts (FB- EVAR).
- Elective and/or urgent treatment
- Age ≥ 18 years
- Obtained informed consent

Exclusion Criteria

- Contraindications to MRI
- Positive medical history, confirmed by radiological documentation, of stroke/TIA/hemorrhagic events/SBI (silent brain infarcts) during previous three months
- Pregnant and/or breastfeeding patients
- Patients unable to undergo adequate follow-up
- Patients unable to complete cognitive evaluation

UNIBS study design – Phase I

OBSERVATIONAL, INVESTIGATOR INITIATED, MULTICENTER

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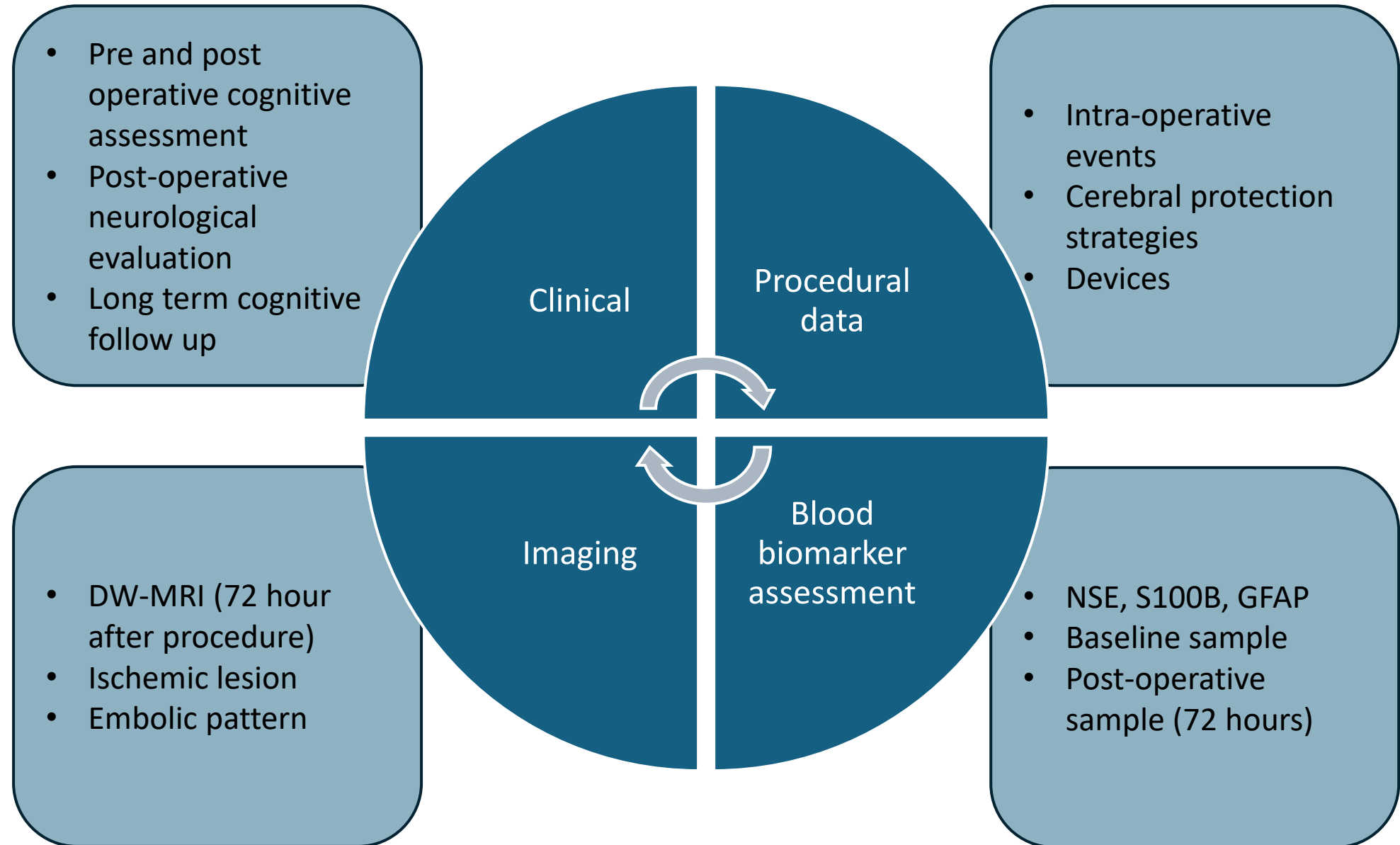
Ongoing enrollment (n= 33)

Data Collection

- Clinical
- Imaging
- Procedural Data
- Blood biomarker assessment

UNIBS study design – Phase I

DATA COLLECTION



UNIBS study design – Phase I

OBSERVATIONAL, INVESTIGATOR INITIATED, MULTICENTER

Study Cohorts

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Ongoing enrollment (n= 33)

Data Collection

- Clinical
- Imaging
- Procedural Data
- Blood biomarker assessment

Outcomes

AI-Based Risk Prediction of pattern of cerebral embolization risk

Primary study objective



To evaluate the incidence and pattern of cerebral ischemic lesions following complex endovascular arch repair using postoperative MRI.



To assess cognitive function pre- and postoperatively, identifying clinically relevant neurological impact.



To analyze serum biomarkers of neuronal injury (e.g., NSE, S100B, GFAP) at baseline and after surgery as potential indicators of cerebral damage

Secondary study objective

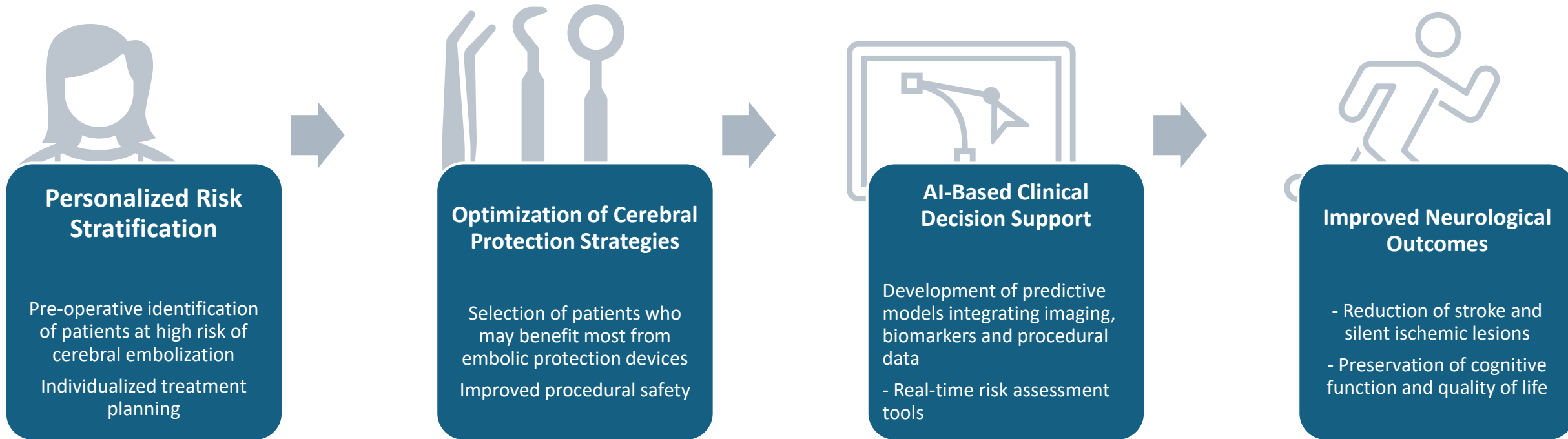


To identify clinical, procedural, and imaging-based predictors of embolic events.



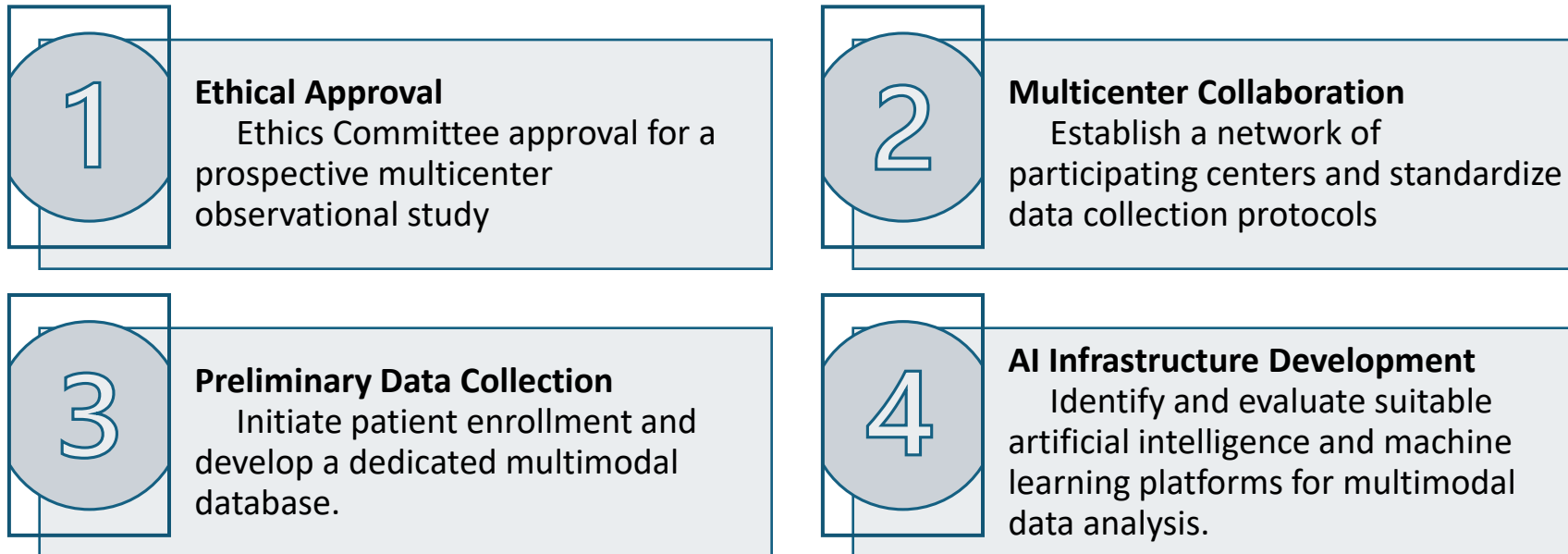
To explore the role of artificial intelligence in integrating multimodal data to predict risk and stratify patient outcomes

Future clinical implications



UNIBS study design

Future directions..





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