

# **CT-based Analysis of the Role of Aortic Wall Calcifications in Aortic Abdominal Aneurysm (AAA) Rupture (Preliminary Univariate Results)**

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April 30th 2020

Séminaire Virtuel 2020

# I. Background

- In the US, AAA prevalence around 1.4% in those aged between 50 and 84 (1.1 million) (1). Although it is most often an asymptomatic condition, the lethality of ruptured AAAs still ranges between 80 and 95% (2).
- Main predictor of rupture risk is AAA DMax(3). Present-day model based on maximum diameter and sex only yields a 60% sensitivity (95% CI, 47%-72%) for rupture risk prediction (4). We need new parameters.
- Literature is conflictual regarding the role of aortic calcification in AAA rupture (5-13). Only a few clinical studies examined the link between aortic calcifications and AAA rupture (9, 11, 12). The goal of this project was to assess whether aortic calcification might be an independent risk factor of AAA rupture.

## II. Methods

- 83 patients treated for a ruptured AAA between January 2001 and August 2018 at the CHUM or MUHC
- Matched with 83 non-ruptured patients treated electively for a non-ruptured AAA between January 2001 and August 2018 at the CHUM or MUHC based on maximal AAA diameter (+/- 10%), age (+/-10 years), sex and contrast status of the preoperative scan
- Crossed medical archives AAA repair treatment codes with RIS-PACS mention of ruptured/non-ruptured AAA to end-up with a list of treated AAAs with imaging
- Obtained from medical archives a list of patients who died of AAA rupture without being treated (DNR and preop death) to be comprehensive

## II. Methods

- Rupture definition: mention of frank rupture, contained rupture or impending rupture in the preop CT radiology report.
- Exclusion criteria: suprarenal AAA, previous AAA treatment, known AAA cause (infection, inflammation, trauma, connective tissue dis., vasculitis, ruptured iliac AAA and preoperative CT with a slice thickness > 2 mm were excluded
- Calcification segmentation performed on ITK- Snap with a 500 HU lower threshold to make sure IV contrast on C+ scans is properly removed, AAA wall segmentation on ORS
- Upcoming machine learning analysis
- T-test for continuous vars,  $\chi^2$  for discontinuous vars, two-sided tests with a significance value of  $P < 0.05$

# III. Preliminary Results (Univariate Analysis)

	Ruptured	Non Ruptured	p-value
	[avg (st dev)]	[avg (st dev)]	
Sex (% M)	86	86	1.000
Age (years)	73.0 (8.8)	74.4 (7.9)	0.517
AAA maximal diameter (mm)	78.1 (17.1)	79.7 (15.6)	0.560
Contrast-enhanced scan (%)	76	76	1.000
Tobacco (%)	75	74	0.930
COPD (%)	33	34	0.853
Hypertension (%)	73	81	0.243
Diabetes Mellitus (%)	25	32	0.360
Coronary Artery Disease (%)	44	58	0.120
Dyslipidemia (%)	64	64	0.976
Chronic renal failure (%)	26	28	0.754
Peripheral Occlusive Artery Disease (%)	19	16	0.625
Beta-blockers (%)	48	58	0.256
Anticoagulants (%)	38	50	0.190
Antiplatelets (%)	76	77	0.927
Lipid-lowering drugs (%)	56	71	0.101
Weight (kg)	80.2 (15.3)	79.1 (18.7)	0.769
Plasma Creatinine (µmol/L)	131 (123)	110 (62)	0.230
Platelets (×10 <sup>9</sup> )	234(107)	205(86)	0.120
Calcium (mmol/L)	2.0 (0.3)	2.1 (0.2)	0.238
Phosphate (mmol/L)	1.4 (0.7)	1.1 (0.3)	0.292
Calcification Volume (mm <sup>3</sup> )	741(1237)	697(882)	0.794

# III. Upcoming Results

- Regional calcification analysis: Neck + 6 longitudinal regions of equal height

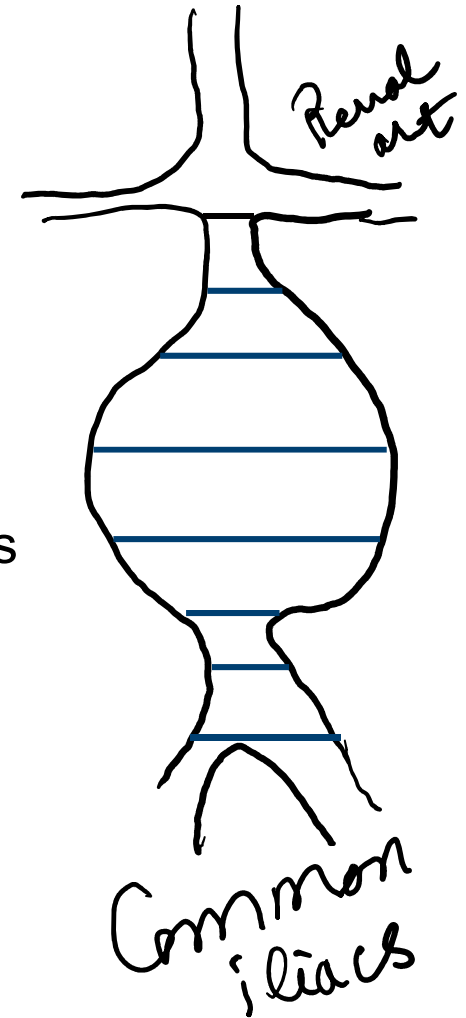
## 1) Regional variables (absolute and surface weighted):

- Calcification volume for each region
- Calcification surface for each region
- Calcification number for each region
- Calcification dispersion index:

Regional surface weighted Euler distance between calcifs

## 2) Whole AAA variables will be the same as regional

## 3) Machine learning analysis



## IV. Temporary Conclusion

For this moment, we failed to reach any statistical significance

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