Circulating Biomarker Testing For Abdominal Aortic Aneurysm Incidence and Identification

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BACKGROUND

• Abdominal aortic aneurysm (AAA) continues to be a leading cause of death in the United States, necessitating adequate screening to reduce mortality.

• The United States Preventive Services Task Force (USPSTF) recommends 1-time screening for AAA with ultrasound in men aged 65 to 75 who have ever smoked.

• Despite efforts by the USPSTF to improve AAA screening at-risk populations, underutilization continues to be reported with access and racial disparity being associated. [1]

• Prior research has shown the role of circulating biomarkers in the development of major cardiovascular disorders and has been theorized that these markers can predict the risk of CVD. [2]

OBJECTIVE

• **To investigate biomarker association with AAA incidence and subsequent rupture**

METHODS

• **Study Design:** Retrospective cohort study using a multi-institutional database.

• **Population:** Hospital patients who underwent biomarker blood testing 1-year prior to identification of a new intact AAA
- Secondary outcome with patients with intact AAA matched to patients with ruptured AAA
- Matching criteria included: Age, essential hypertension, diabetes, chronic kidney disease (CKD), and chronic obstructive pulmonary disease (COPD)

• **Biomarkers Assessed** (by quartile)**:**
- **White Blood Cell Count** (per μL)
- **D-Dimer** (in mg/L FEU)
- **Cardiac Troponin** (or cTnT) (in pg/mL)
- **N-Terminal pro-B-type naturietic peptide** (or NT-proBNP) (in pg/mL)
- **C-reactive protein** (in mg/L)

•**Outcomes Assessed:**
- **Odds ratio**: comparison of incidence of intact AAA versus no AAA by quartile within 1 year of initial biomarker values
- **Comparison** of incidence of intact versus ruptured AAA within 1 year of initial biomarker values

•**Statistical Analysis:**
- **Independent t-tests** evaluated differences **between open and endovascular groups.**

RESULTS

Quartile	Biomarker	With Intact AAA	Without AAA	Odds Ratio	95% Confidence Interval
	WBC	n = 81330	n = 21148838		
1	< 4.89	10777	3257546	0.839	(0.822, 0.856)
2	4.9 - 5.89	14202	4175251	0.860	(0.845, 0.876)
3	5.9 - 7.09	21088	5432408	1.013	(0.997, 1.029)
4	7.1 >	35263	8283633	1.189	(1.172, 1.205)
	D-Dimer	n = 1653	n = 654298		
1	< 0.1699	19	27837	0.262	(0.116, 0.411)
2	0.17 - 0.2699	16	50274	0.117	(0.072, 0.192)
3	0.27 - 0.4399	82	126537	0.218	(0.174, 0.272)
4	> 0.44	1536	449650	5.975	(4.951, 7.211)
	cTnT	n = 5861	n = 1056896		
1	< 2.99	1165	288912	0.659	(0.618, 0.703)
2	3 - 4.99	34	14924	0.407	(0.219, 0.571)
3	5 - 8.99	163	44002	0.659	(0.563, 0.770)
4	> 9	4499	709058	1.620	(1.525, 1.722)
	NT-proBNP	n = 7254	n = 1227734		
1	< 33.09	661	279407	0.340	(0.314, 0.369)
2	33.1 - 67.19	901	225246	0.631	(0.589, 0.677)
3	67.2 - 129.19	1293	231516	0.933	(0.879, 0.991)
4	> 129.2	4399	491565	2.308	(2.201, 2.419)
	CRP	n = 6666	n = 2781232		
1	< 1.089	999	557372	0.703	(0.658, 0.752)
2	1.09 - 2.439	660	388152	0.678	(0.625, 0.734)
3	2.44 - 5.449	1108	554029	0.801	(0.751, 0.855)
4	> 5.45	3899	1281679	1.649	(1.570, 1.731)

Table 1: Odds ratio of intact AAA diagnosis 1-year after biomarker collection in comparison to no AAA diagnosis
- Associations with AAA incidence were observed with WBC count, D-Dimer, cTNT, NT-proBNP, and CRP
- In all biomarker categories, there was a statistically significant odds ratio between prevalence of AAA in the 4th quartile of each respective lab result.
- 1st and 2nd quartile WBC counts had lower incidence in comparison to 4th quartile
- The bottom 3 quartiles in the D-Dimer, cTnT, and CRP had significantly lower odds ratios in comparison than the 4th quartile

CONCLUSIONS

- There were significant associations with AAA incidence 1-year after collection of biomarker labs (i.e. WBC count, D-Dimer, cTnT, NT-proBNP, and CRP).
- The matched analysis revealed that patients with lower WBC counts (<11 WBC/ μL) and BNP (<129.2 pg/mL) had significiantly lower AAA rupture incidence (p=0.002 and p<0.0001, respectively) and significantly lower intact AAA incidence (p=0.03 and p<0.0001, respectively).
- Lower D-Dimer (<0.44 mg/L FEU), cTnT (<0.04 ng/mL), and CRP (<5.45 mg/L) levels correlated to significantly lower intact AAA incidence (p<0.0001, p=0.0026, and p=0.0002, respectively) during matched analysis.
- These findings further underline the possible clinical relevance of WBC count, D-Dimer, cTnT, and CRP as AAA risk indicators at least 1-year prior to identification.
- Meanwhile, WBC and NT-proBNP levels could be possible factors related to risk of rupture assessments.
- Further investigation using machine learning and other AI applications may yield further methodology in this investigation into using biomarkers as an alternative to AAA screening in hopes to increase accessibility.

REFERENCES

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