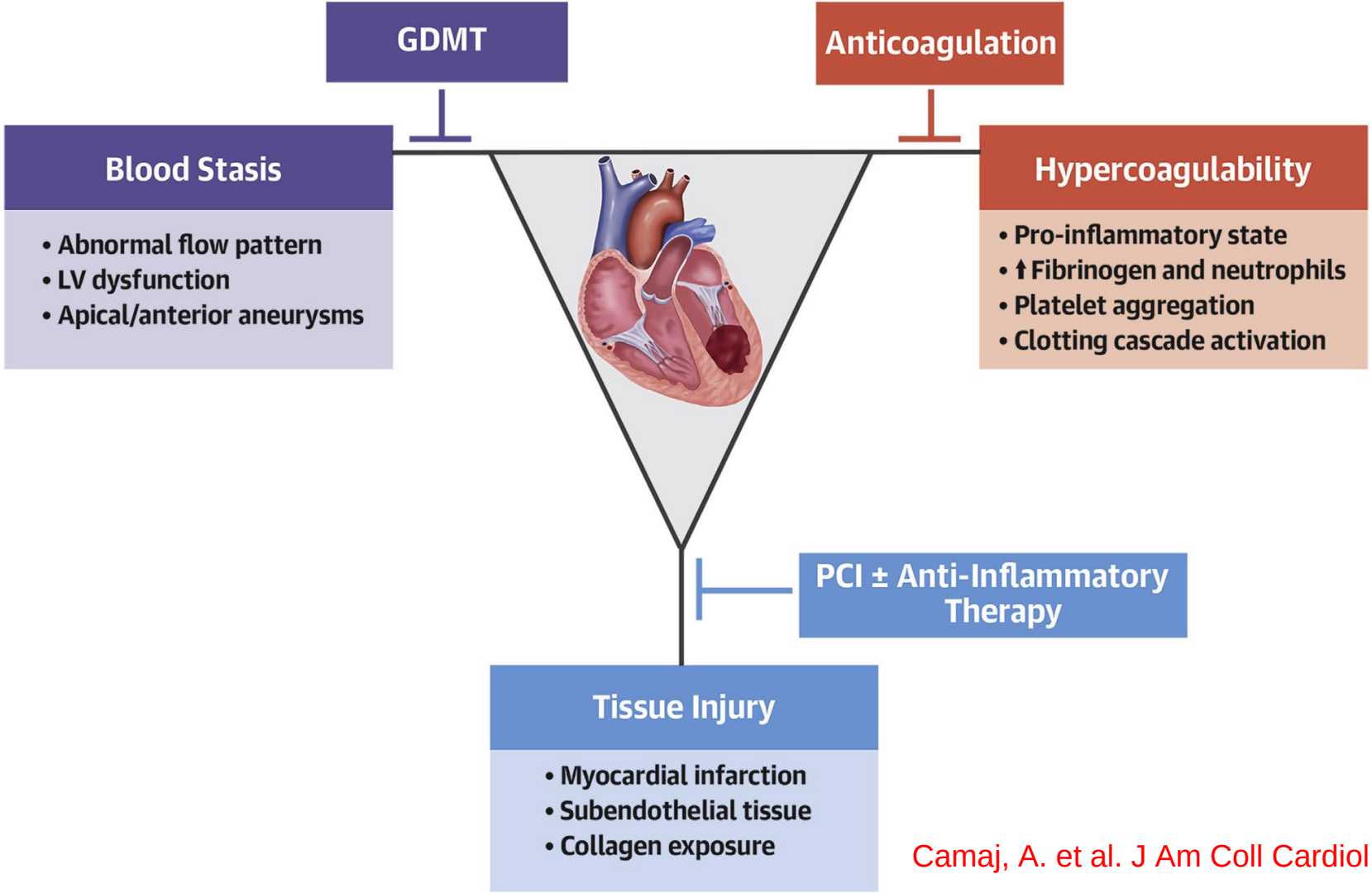
Ospedale "Sacro Cuore di Gesù"
Fatebenefratelli Benevento
U.O.C. Cardiologia/UTIC/Emodinamica
Primario: Prof. Bruno Villari

# Diagnosi e trattamento alla luce delle nuove evidenze sull'uso dei NOA nelle trombosi intraventricolari


Quirino Ciampi, MD, PhD, FESC, FEACVI
Segretario Nazionale SIECVI
Resp UOS UTIC/Echolab
PI Stressecho 2030

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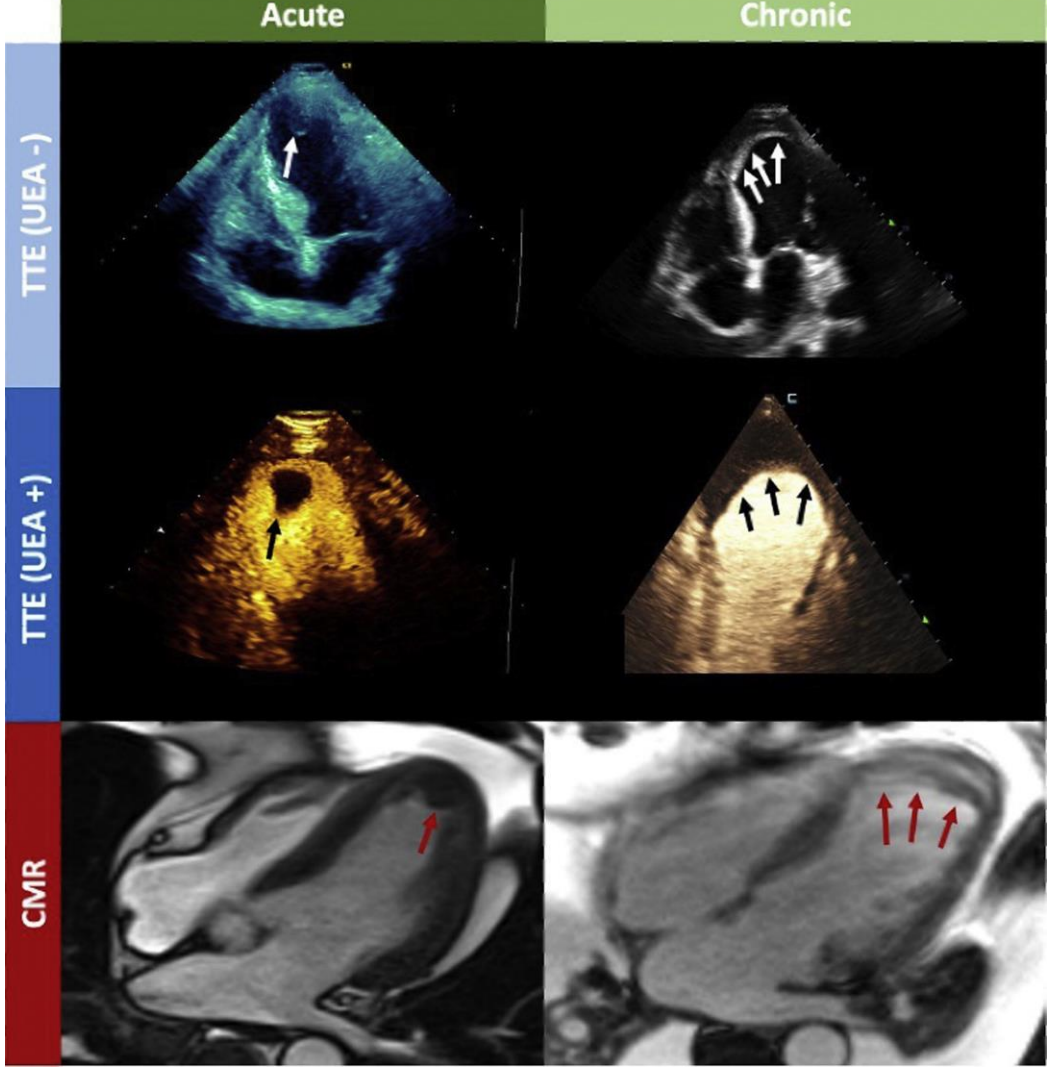


Camaj, A. et al. J Am Coll Cardiol. 2022

ESC HEART FAILURE
*ESC Heart Failure* 2021; 8: 5248–5258
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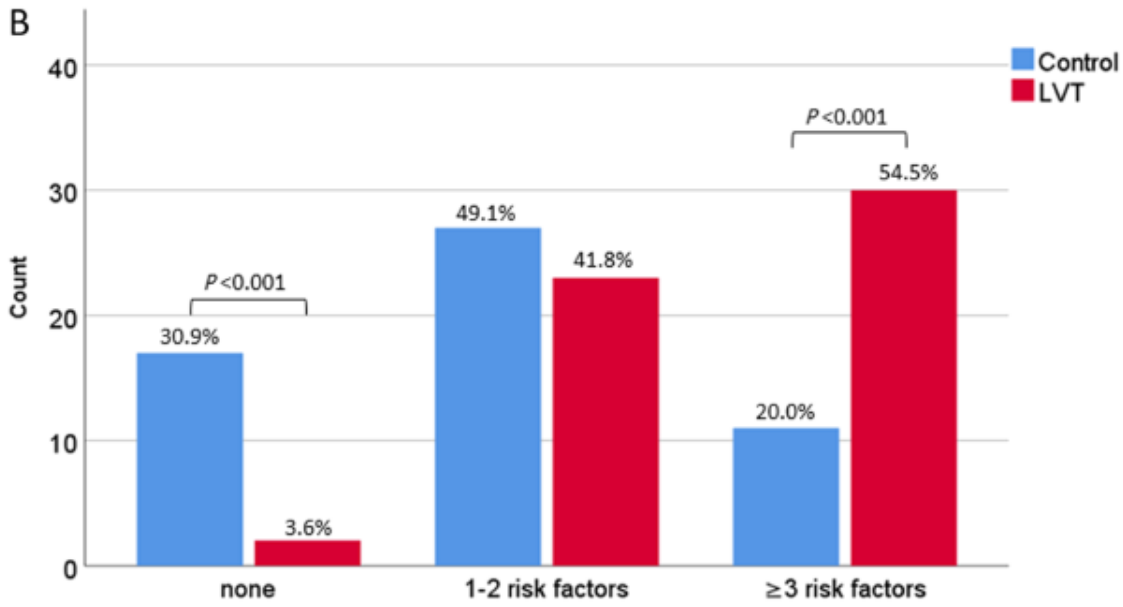
ORIGINAL ARTICLE

# Echocardiographic risk factors of left ventricular thrombus in patients with acute anterior myocardial infarction

Mengjia Chen[1,2], Dan Liu[1,2], Frank Weidemann[3], Björn Daniel Lengenfelder[1,2], Georg Ertl[1,2], Kai Hu[1,2], Stefan Frantz[1,2] and Peter Nordbeck[1,2]*

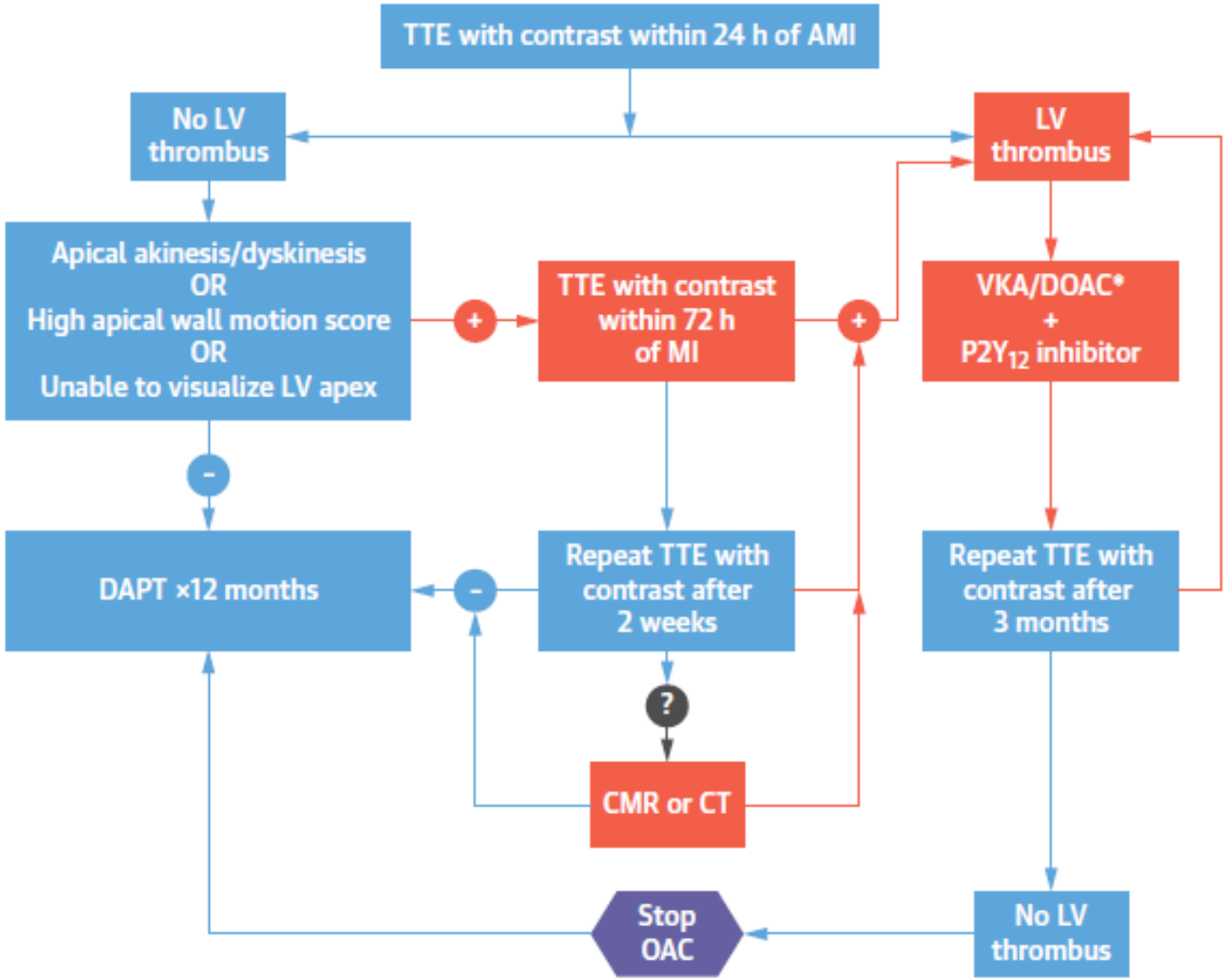
## Conclusions

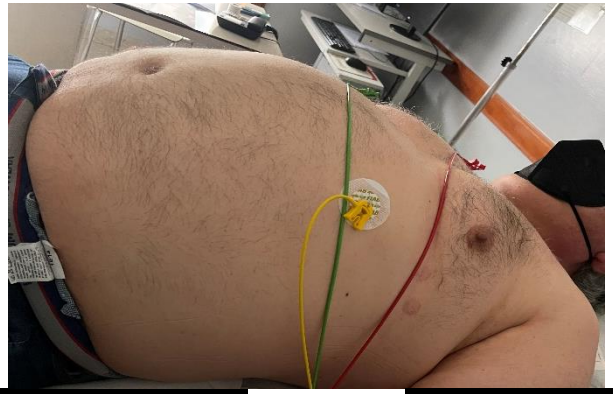
Our current data demonstrate that besides the known risk factors, including apical aneurysm, reduced left ventricular longitudinal systolic function (MAPSE) and advanced diastolic dysfunction, RV dysfunction as determined by reduced TAPSE or RV_FAC is independently associated with LVT formation in acute anterior MI patients, especially in the setting of anterior MI without the formation of an apical aneurysm. This study suggests that besides assessment of left ventricular abnormalities, assessment of concomitant RV dysfunction is of importance on risk stratification of LVT formation in patients with acute anterior MI.

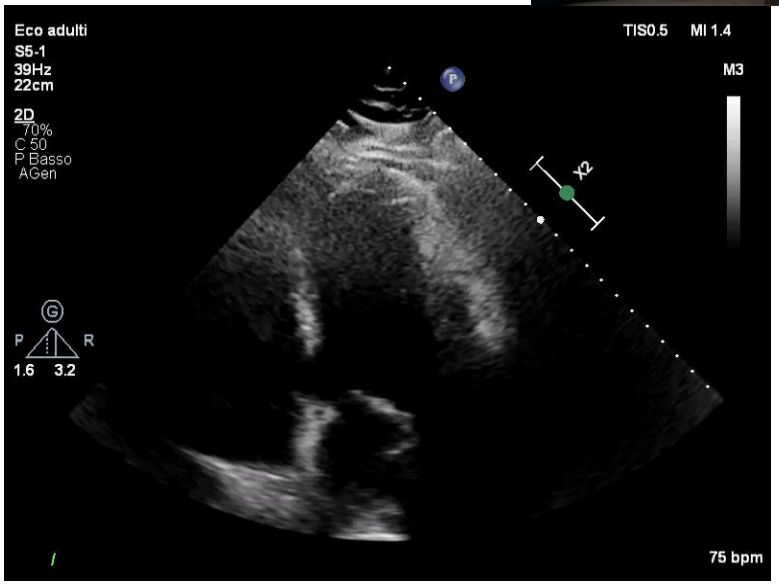


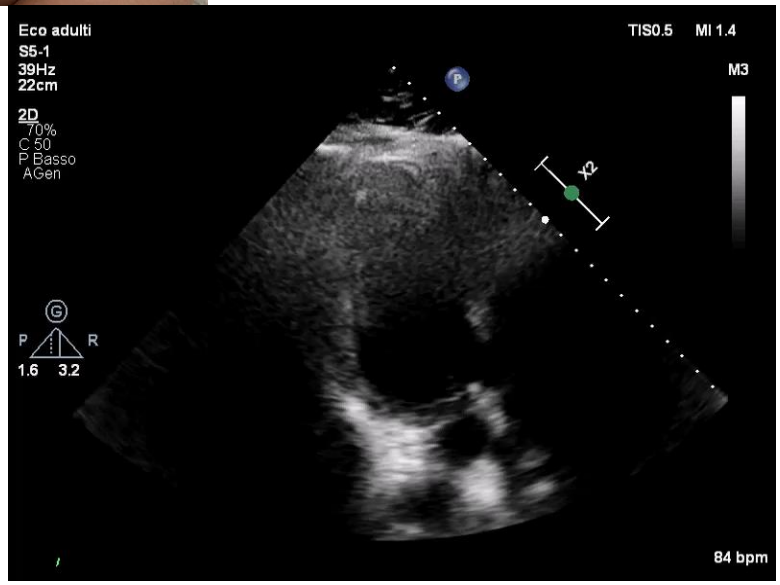

Echocardiography-detected risk factors for LVT formation

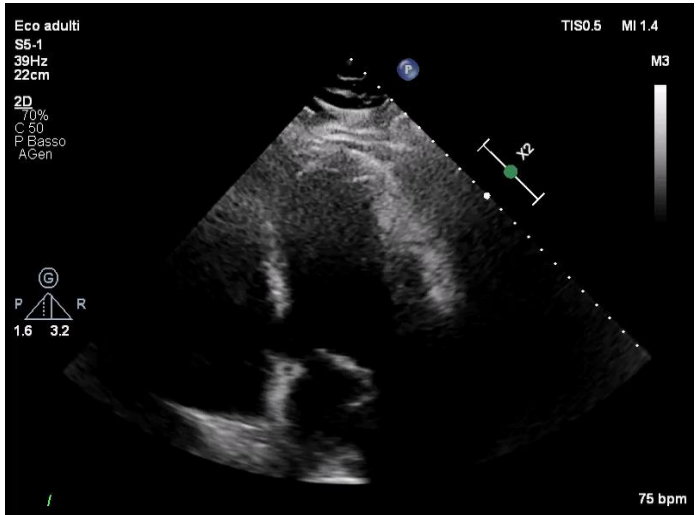
i. Apical aneurysm
ii. Reduced septal MAPSE (<7mm)
iii. Moderate to severe DD
iv. Reduced TAPSE (<17mm)
v. Reduced RV_FAC (<0.35)


TTE with contrast within 24 h of AMI
No LV thrombus
LV thrombus
Apical akinesis/dyskinesis
OR
High apical wall motion score
OR
Unable to visualize LV apex
+
TTE with contrast within 72 h of MI
+
VKA/DOAC*
+
P2Y12 inhibitor
-
DAPT ×12 months
-
Repeat TTE with contrast after 2 weeks
Repeat TTE with contrast after 3 months
?
CMR or CT
Stop OAC
No LV thrombus




Eco adulti
S5-1
39Hz
22cm
2D
70%
C 50
P Basso
AGen
TIS0.5 MI 1.4
M3
X2
P R
1.6 3.2
75 bpm


Eco adulti
S5-1
39Hz
22cm
2D
70%
C 50
P Basso
AGen
TIS0.5 MI 1.4
M3
X2
P R
1.6 3.2
84 bpm


Eco adulti
S5-1
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70%
C 50
P Basso
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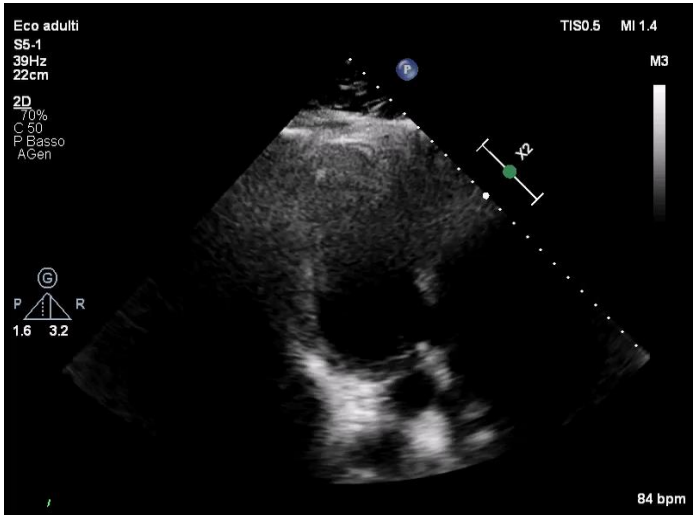
TIS0.5 MI 1.4
M3
x2
P R
1.6 3.2
75 bpm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P Basso
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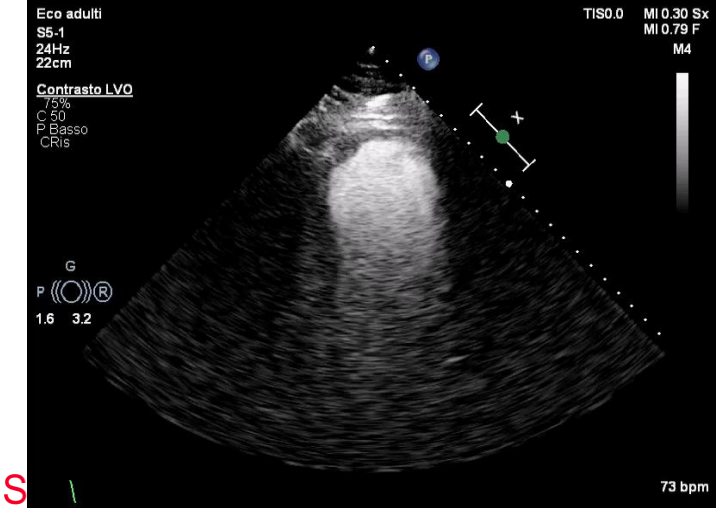
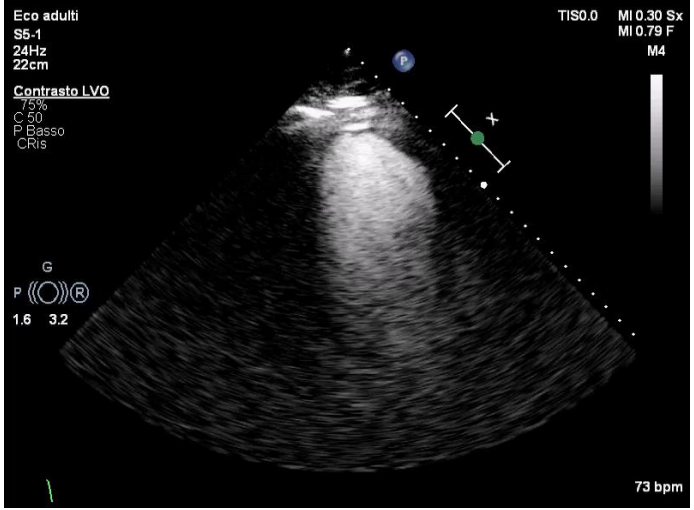
M3
x2
P R
1.6 3.2
84 bpm


Eco adulti
S5-1
24Hz
22cm
Contrasto LVO
75%
C 50
P Basso
CRis
TIS0.0 MI 0.30 Sx
MI 0.79 F
M4
x
P R
1.6 3.2
73 bpm


Eco adulti
S5-1
24Hz
22cm
Contrasto LVO
75%
C 50
P Basso
CRis
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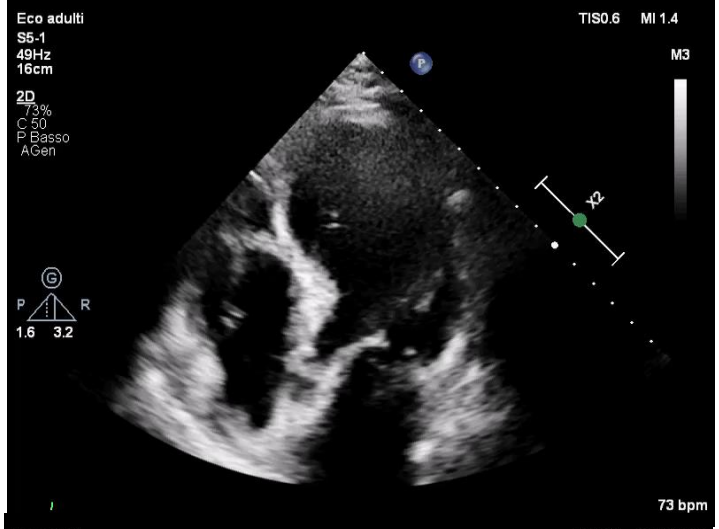
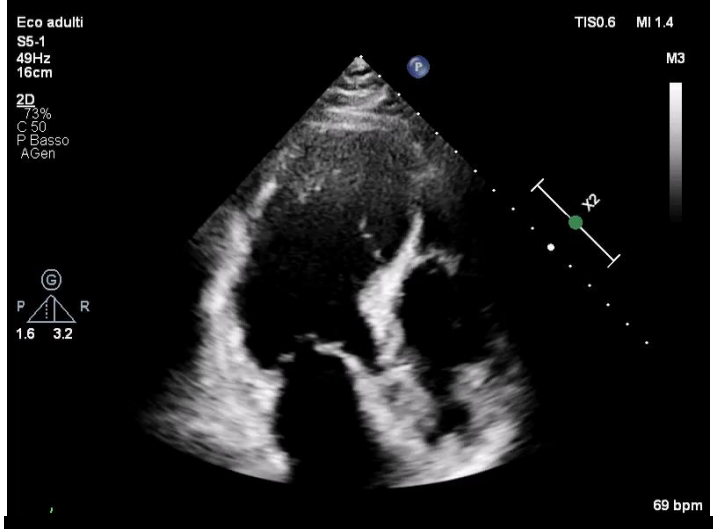
MI 0.79 F
M4
x
P R
1.6 3.2
73 bpm

S


Eco adulti
S5-1
49Hz
16cm
2D
73%
C 50
P Basso
AGen
TIS0.6 MI 1.4
M3
X2
P R
1.6 3.2
73 bpm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S5-1
49Hz
16cm
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73%
C 50
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AGen
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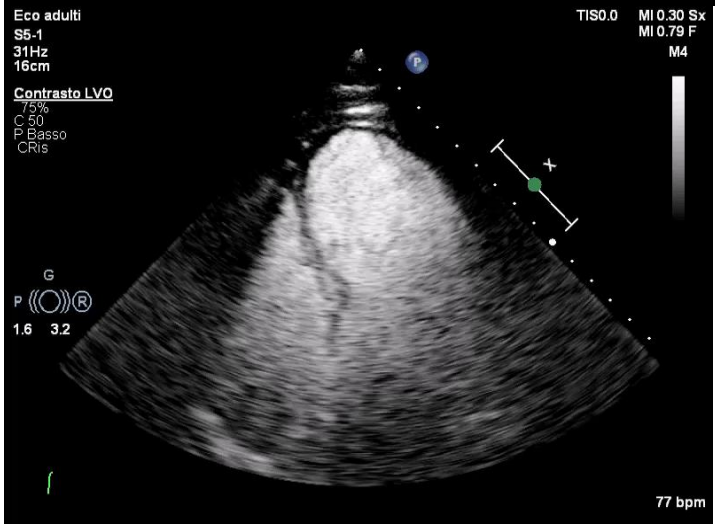
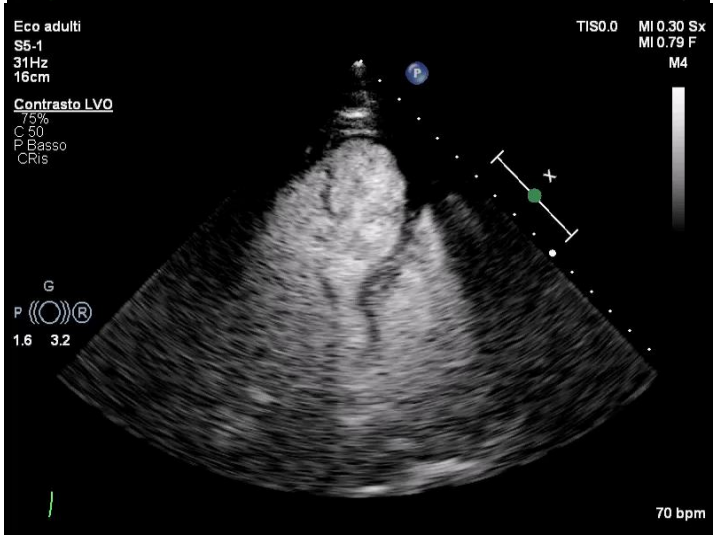
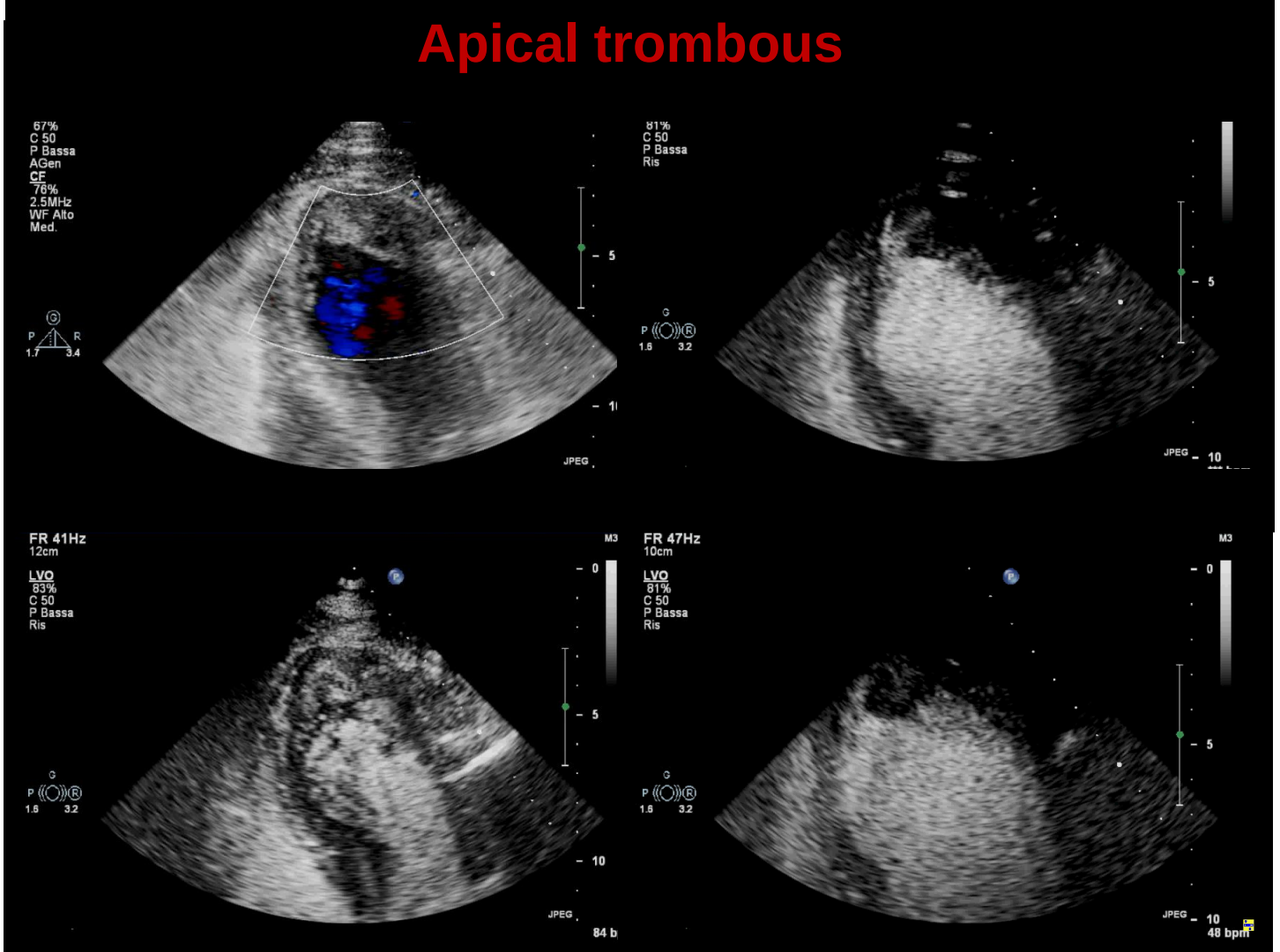
M3
X2
P R
1.6 3.2
69 bpm


Eco adulti
S5-1
31Hz
16cm
Contrasto LVO
75%
C 50
P Basso
CRis
TIS0.0 MI 0.30 Sx
MI 0.79 F
M4
X
P R
1.6 3.2
77 bpm


Eco adulti
S5-1
31Hz
16cm
Contrasto LVO
75%
C 50
P Basso
CRis
TIS0.0 MI 0.30 Sx
MI 0.79 F
M4
X
P R
1.6 3.2
70 bpm

# Apical trombous



ESC European Society of Cardiology
European Heart Journal (2018) **39**, 119–177
doi:10.1093/eurheartj/ehx393



# 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

| | | |
|---|---|---|
| Routine echocardiography to assess resting LV and RV function, detect early post-MI mechanical complications, and exclude LV thrombus is recommended in all patients.[296,297] | I | B |
| In patients with LV thrombus, anticoagulation should be administered for up to 6 months guided by repeated imaging.[341–343] | IIa | C |

ESC European Society of Cardiology
European Heart Journal (2023) **44**, 3720–3826
https://doi.org/10.1093/eurheartj/ehad191



# 2023 ESC Guidelines for the management of acute coronary syndromes

| LV thrombus | | |
|---|---|---|
| CMR imaging should be considered in patients with equivocal echocardiographic images or in cases of high clinical suspicion of LV thrombus.[577,578] | IIa | C |
| Oral anticoagulant therapy (VKA or NOAC) should be considered for 3–6 months in patients with confirmed LV thrombus.[603] | IIa | C |
| Following an acute anterior MI, a contrast echocardiogram may be considered for the detection of LV thrombus if the apex is not well visualized on echocardiography.[604] | IIb | C |

**TABLE 1** Descriptive Characteristics of Studies Comparing Vitamin K Antagonists With Direct Oral Anticoagulants in Patients With Left Ventricular Thrombus

| First Author (Ref. #) | Year | Sample Size | Study Design | Inclusion | Exclusion | Treatment Assignment | Follow-Up | LVT Resolution | Embolic Events | Bleeding |
|---|---|---|---|---|---|---|---|---|---|---|
| Abdelnabi et al[74] | 2021 | 79 | Unblinded RCT | Adults with newly diagnosed LVT by TTE | CrCl <50 mL/min, AF, DVT/PE, other indication for OAC | Warfarin: 40 (50.6)<br>Rivaroxaban: 39 (49.4) | 6 mo | Warfarin: 32 (80)<br>Rivaroxaban: 34 (87.2) | Warfarin: 6 (15)<br>Rivaroxaban: 0 (0) | Warfarin: 6 (15)<br>Rivaroxaban: 2 (5.1) |
| Lattuca et al[29] | 2020 | 159 | Retrospective observational | All patients with reported LVT | RV and/or atrial thrombus | VKA: 77 (48.4)<br>DOAC: 36 (22.6)<br>LMWH: 37 (23.3)<br>UFH: 7 (4.4)<br>APT: 2 (1.2) | 632 d (IQR: 187-1,126 d) | 121 (76.1) | 35 (22.2) | BARC ≥2: 27 (17)<br>BARC ≥3: 21 (13.2) |
| Daher et al[62] | 2020 | 59 | Retrospective observational | All patients with TTE-confirmed LVT | N/A | VKA: 42 (71.2)<br>DOAC: 17 (28.8) | N/A | VKA: 30 (71.4)<br>DOAC: 12 (70.6) | VKA: 4 (9.5)<br>DOAC: 2 (11.8) | N/A |
| Guddeti et al[63] | 2020 | 99 | Retrospective observational | All patients with diagnosed LVT | N/A | VKA: 80 (81)<br>DOAC: 19 (19) | 1 y | VKA: 65 (81)<br>DOAC: 15 (80) | VKA: 2 (2)<br>DOAC: 0 (0) | VKA: 4 (5)<br>DOAC: 1 (5.3)<br>($P = 0.96$) |
| Iqbal et al[64] | 2020 | 84 | Retrospective observational | All patients with LVT, treated with DOAC or VKA | N/A | VKA: 62 (73.8)<br>DOAC: 22 (26.2) | 3 ± 1.4 y | VKA: 42 (76)<br>DOAC: 13 (65) | VKA: 4 (4)<br>DOAC: 0 (0) | VKA: 6 (10)<br>DOAC: 0 (0)<br>$P = 0.13$ |
| Jones et al[65] | 2020 | 101 | Retrospective observational | LVT post AMI | Patients without AMI or recent MI | VKA: 60 (59.4)<br>DOAC: 41 (40.6) | 1 y | VKA: 39 (64.4)<br>DOAC: 34 (82)<br>$P = 0.0018$ | VKA: 3 (5)<br>DOAC: 1 (2.4)<br>$P = 0.388$ | BARC 2<br>VKA: 4 (6.7)<br>DOAC: 0 (0)<br>$P = 0.03$ |
| Robinson et al[66] | 2020 | 514 | Retrospective observational | All patients with TTE-diagnosed LVT | N/A | VKA: 300 (58.4)<br>DOAC: 185 (36) | 351 d (IQR 51-866 d) | VKA: 131 (43.7)<br>DOAC: 56 (30.3) | VKA: 14 (4.7)<br>DOAC: 17 (9.2) | VKA: 19 (6.3)<br>DOAC: 8 (4.3) |
| Bass et al[67] | 2021 | 949 | Retrospective observational | ICD-9/10 criteria for LVT | N/A | VKA: 769 (81)<br>DOAC: 180 (19) | 90 d | N/A | VKA: 254 (33)<br>DOAC: 55 (30.6)<br>$P = 0.53$ | VKA: 80 (10.9)<br>DOAC: 14 (7.8)<br>$P = 0.40$ |
| Ali et al[68] | 2020 | 110 | Retrospective observational | All patients with confirmed LV thrombus | N/A | VKA: 60 (63)<br>DOAC: 32 (33)<br>LMWH: 4 (3) | 1 y | VKA: 37 (61.7)<br>DOAC: 18 (56.3) | VKA: 16 (26.6)<br>DOAC: 2 (6) | N/A |

Camaj, A. et al. J Am Coll Cardiol. 2022

RESEARCH ARTICLE

# Meta-analysis comparing direct oral anticoagulants versus vitamin K antagonists in patients with left ventricular thrombus

Kazuhiko Kido[1☯*], Yasir Abdul Ghaffar[2☯], James C. Lee[3], Christopher Bianco[2], Mikiko Shimizu[4], Tsuyoshi Shiga[5], Masayuki Hashiguchi[6]

| Study or Subgroup | DOAC Events | DOAC Total | Warfarin Events | Warfarin Total | Weight | Odds Ratio M-H, Random, 95% CI |
|---|---|---|---|---|---|---|
| Ali 2020 | 2 | 32 | 16 | 60 | 12.1% | 0.18 [0.04, 0.86] |
| Bass 2019 | 55 | 180 | 254 | 769 | 33.7% | 0.89 [0.63, 1.27] |
| Daher 2020 | 2 | 17 | 4 | 42 | 9.8% | 1.27 [0.21, 7.66] |
| Guddeti 2020 | 0 | 19 | 2 | 80 | 4.0% | 0.81 [0.04, 17.46] |
| Iqbal 2020 | 0 | 22 | 2 | 62 | 4.0% | 0.54 [0.02, 11.64] |
| Jones 2020 | 1 | 41 | 3 | 60 | 6.6% | 0.47 [0.05, 4.73] |
| Robinson 2020 | 17 | 121 | 14 | 236 | 25.2% | 2.59 [1.23, 5.46] |
| Willeford 2020 | 0 | 22 | 8 | 129 | 4.5% | 0.32 [0.02, 5.70] |
| **Total (95% CI)** | | **454** | | **1438** | **100.0%** | **0.89 [0.46, 1.71]** |
| Total events | 77 | | 303 | | | |

Heterogeneity: Tau² = 0.30; Chi² = 12.67, df = 7 (P = 0.08); I² = 45%

Test for overall effect: Z = 0.35 (P = 0.73)

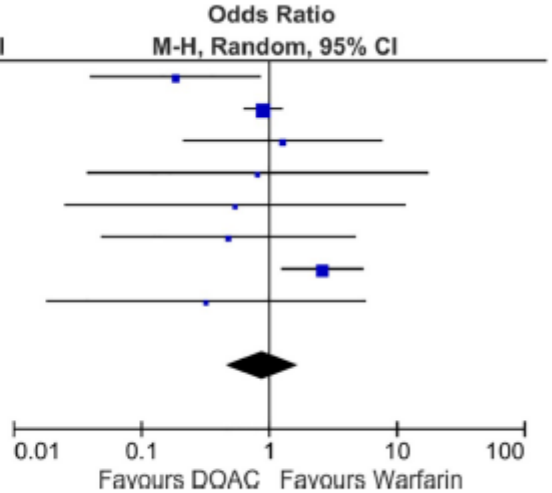



**Fig 2. Forest plot of stroke of systemic embolism event rate in patients with left ventricular thrombus receiving DOACs versus VKA.**

## Conclusions

In this meta-analysis of published observational LVT anticoagulation full-text study data, there were no differences in stroke or systemic embolism and left ventricular thrombus resolution between direct oral anticoagulant and warfarin therapy. DOAC use was associated with significantly less bleeding compared to warfarin. Prospective, randomized clinical trials are needed

Circulation

AHA SCIENTIFIC STATEMENT

# Management of Patients at Risk for and With Left Ventricular Thrombus: A Scientific Statement From the American Heart Association

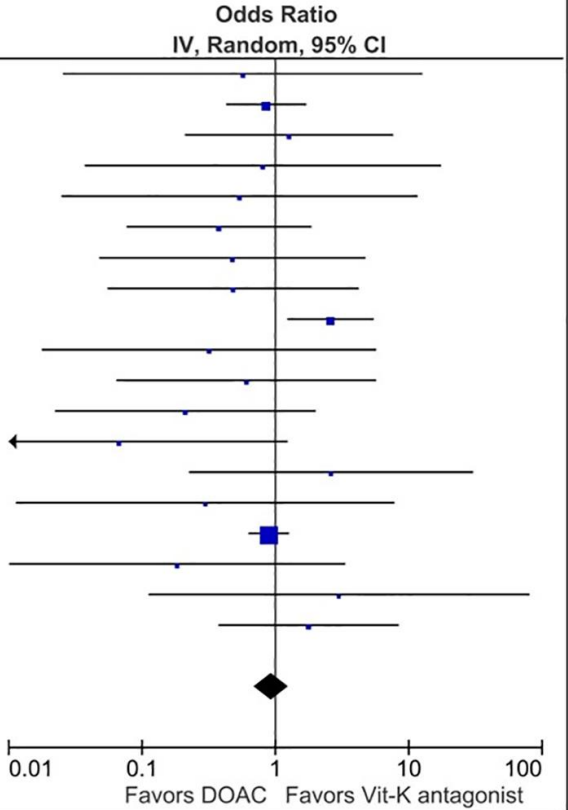
Glenn N. Levine, MD, FAHA, Chair; John W. McEvoy, MB, BCh, BAO, MEHP, MHS, PhD, Vice Chair; James C. Fang, MD; Chinwe Ibeh, MD; Cian P. McCarthy, MB, BCh, BAO; Arunima Misra, MD; Zubair I. Shah, MD; Chetan Shenoy, MBBS, MS; Sarah A. Spinler, PharmD, FAHA; Srikanth Vallurupalli, MD; Gregory Y.H. Lip, MD; on behalf of the American Heart Association Council on Clinical Cardiology; Council on Cardiovascular and Stroke Nursing; and Stroke Council

## LV thrombus Figure 4A: Stroke/Systemic thromboembolism

| Study or Subgroup | DOAC Events | DOAC Total | Vit-K antagonist Events | Vit-K antagonist Total | Weight | Odds Ratio IV, Random, 95% CI | Year |
|---|---|---|---|---|---|---|---|
| Jaidka 2018 | 0 | 12 | 2 | 37 | 0.9% | 0.57 [0.03, 12.66] | 2018 |
| Yunis 2020 | 13 | 64 | 46 | 200 | 15.7% | 0.85 [0.43, 1.71] | 2020 |
| Daher 2020 | 2 | 17 | 4 | 42 | 2.6% | 1.27 [0.21, 7.66] | 2020 |
| Guddeti 2020 | 0 | 19 | 2 | 80 | 0.9% | 0.81 [0.04, 17.46] | 2020 |
| Iqbal 2020 | 0 | 22 | 2 | 62 | 0.9% | 0.54 [0.02, 11.64] | 2020 |
| Ali 2020 | 2 | 32 | 9 | 60 | 3.2% | 0.38 [0.08, 1.87] | 2020 |
| Jones 2020 | 1 | 41 | 3 | 60 | 1.6% | 0.47 [0.05, 4.73] | 2020 |
| Minciunescu 2020 | 1 | 57 | 5 | 140 | 1.8% | 0.48 [0.06, 4.22] | 2020 |
| Robinson 2020 | 17 | 121 | 14 | 236 | 13.8% | 2.59 [1.23, 5.46] | 2020 |
| Willeford 2021 | 0 | 22 | 8 | 129 | 1.0% | 0.32 [0.02, 5.70] | 2021 |
| Xu 2021 | 1 | 25 | 4 | 62 | 1.7% | 0.60 [0.06, 5.69] | 2021 |
| Zhang 2021 | 1 | 33 | 4 | 31 | 1.7% | 0.21 [0.02, 2.00] | 2021 |
| Abdelnabi 2021 | 0 | 39 | 6 | 40 | 1.0% | 0.07 [0.00, 1.24] | 2021 |
| Albabtain 2021 | 2 | 28 | 1 | 35 | 1.4% | 2.62 [0.22, 30.43] | 2021 |
| Alcalai 2021 | 0 | 18 | 1 | 17 | 0.8% | 0.30 [0.01, 7.81] | 2021 |
| Bass 2021 | 55 | 180 | 254 | 769 | 46.1% | 0.89 [0.63, 1.27] | 2021 |
| Cochran 2021 | 0 | 14 | 9 | 59 | 1.0% | 0.18 [0.01, 3.34] | 2021 |
| Isa 2021 | 1 | 14 | 0 | 13 | 0.8% | 3.00 [0.11, 80.39] | 2021 |
| Mihm 2021 | 3 | 33 | 4 | 75 | 3.4% | 1.77 [0.37, 8.42] | 2021 |
| **Total (95% CI)** | | **791** | | **2147** | **100.0%** | **0.94 [0.70, 1.25]** | |
| Total events | 99 | | 378 | | | | |

Heterogeneity: Tau² = 0.02; Chi² = 18.60, df = 18 (P = 0.42); I² = 3%

Test for overall effect: Z = 0.45 (P = 0.65)



LVT

Oral anticoagulation

Median Follow up 12 months

Warfarin

NOAC

Systemic embolism

Thrombus resolution

Bleeding

11.2%

74.4%

8.9%

Systemic embolism

Thrombus resolution

Bleeding

9.7%

69.6%

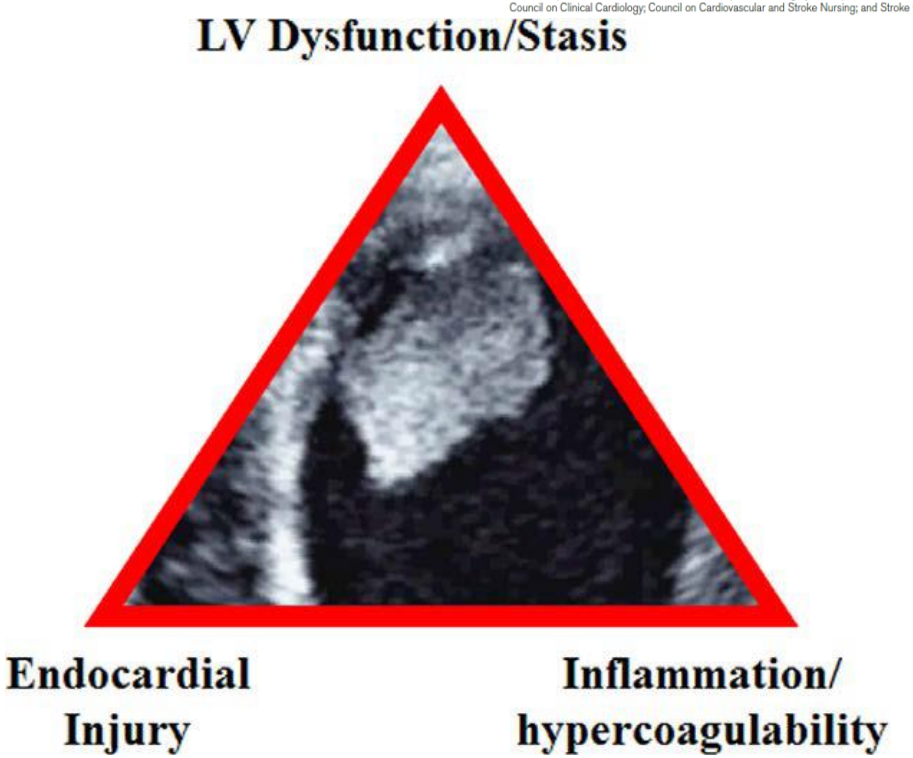
9.3%

Circulation

AHA SCIENTIFIC STATEMENT

# Management of Patients at Risk for and With Left Ventricular Thrombus: A Scientific Statement From the American Heart Association

Glenn N. Levine, MD, FAHA, Chair; John W. McEvoy, MB, BCh, BAO, MEHP, MHS, PhD, Vice Chair; James C. Fang, MD; Chinwe Ibeh, MD; Cian P. McCarthy, MB, BCh, BAO; Arunima Misra, MD; Zubair I. Shah, MD; Chetan Shenoy, MBBS, MS; Sarah A. Spinler, PharmD, FAHA; Srikanth Vallurupalli, MD; Gregory Y.H. Lip, MD; on behalf of the American Heart Association Council on Clinical Cardiology; Council on Cardiovascular and Stroke Nursing; and Stroke Council




| DCM | Risk factors associated with LV thrombus formation |
|---|---|
| Takotsubo syndrome | LV dysfunction with LVEF ≤30% and/or apical ballooning[5,70,71] |
| Left ventricular noncompaction | History of stroke or TIA[2] and/or LV dysfunction[6,72,73] |
| Peripartum cardiomyopathy* | Bromocriptine administration and/or LVEF ≤35%[7,8,36,74,75] |
| Hypertrophic cardiomyopathy | Apical aneurysm[31,76,77] |
| Chemotherapy-related cardiomyopathy | LV restrictive filling pattern and/or LVEF ≤30%[32] |
| Cardiac amyloidosis | AL type and/or LV restrictive filling pattern[33] |
| Cardiomyopathy attributable to Chagas disease | Apical aneurysm[34] |
| Eosinophilic myocarditis | Prior embolic episode[35] |

Journal of Thrombosis and Thrombolysis (2023) 55:649–659
https://doi.org/10.1007/s11239-023-02790-1

# An exploratory study of effectiveness and safety of rivaroxaban in patients with left ventricular thrombus (R-DISSOLVE)

Qing Yang[1,2] · Xin Quan[1,3] · Yang Zhang[1,4] · Guangxun Feng[1,5] · Tao Zhang[1,5] · Chuangshi Wang[1,6] · Dongze Yu[1,4] · Litian Yu[1,2] · Yanmin Yang[1,5] · Jun Zhu[1,5] · Yan Liang[1,2]

| | Total N | N thrombus resolved | % | 95% CI |
|---|---|---|---|---|
| At 6 weeks | | | | |
| Complete thrombus resolution at 6 weeks | 62 | 41 | 66.1 | 53.0–77.7 |
| Resolved or reduced thrombus at 6 weeks | 62 | 59 | 95.2 | 86.5–99.0 |
| Unchanged or enlarged thrombus at 6 weeks | 62 | 3 | 4.8 | 1.0–13.5 |
| At 12 weeks | | | | |
| Complete thrombus resolution at 12 weeks | 64 | 50 | 78.1 | 66.0–87.5 |
| Resolved or reduced thrombus at 12 weeks | 64 | 61 | 95.3 | 86.9–99.0 |
| Unchanged or enlarged thrombus at 12 weeks | 64 | 3 | 4.7 | 1.0–13.1 |

In patients with LV thrombus, we reported a high thrombus resolution rate with acceptable safety by rivaroxaban, which could be a potential option for further LV thrombus treatment.

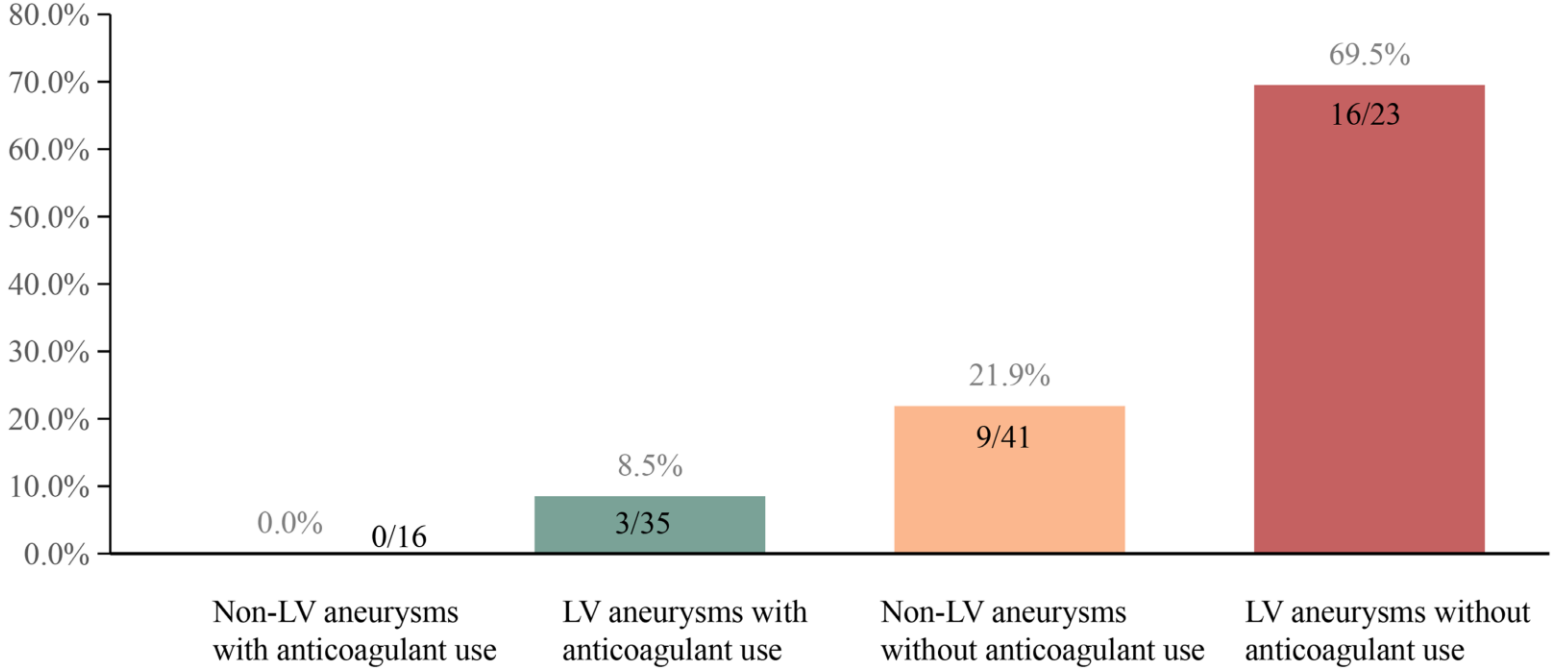



**Table 4. Cox Regression Analyses for Predictors of LVT Recurrence**

| | Univariate analysis | | Multivariable analysis | |
|---|---|---|---|---|
| | HR (95% CI) | *P* value | HR (95% CI) | *P* value |
| Anticoagulant use | 0.12 (0.04–0.39) | 0.001 | 0.12 (0.04–0.41) | 0.001 |
| Akinesis in apical segments | 1.82 (0.86–3.85) | 0.120 | | |
| LV aneurysm | 2.80 (1.30–6.04) | 0.009 | 2.59 (1.20–5.58) | 0.015 |
| LV ejection fraction | 1.01 (0.97–1.04) | 0.661 | | |
| LVT diameter | 1.02 (0.99–1.06) | 0.220 | | |
| LVT area | 1.05 (0.95–1.16) | 0.335 | | |
| Mobile LVT | 1.18 (0.47–2.95) | 0.720 | | |

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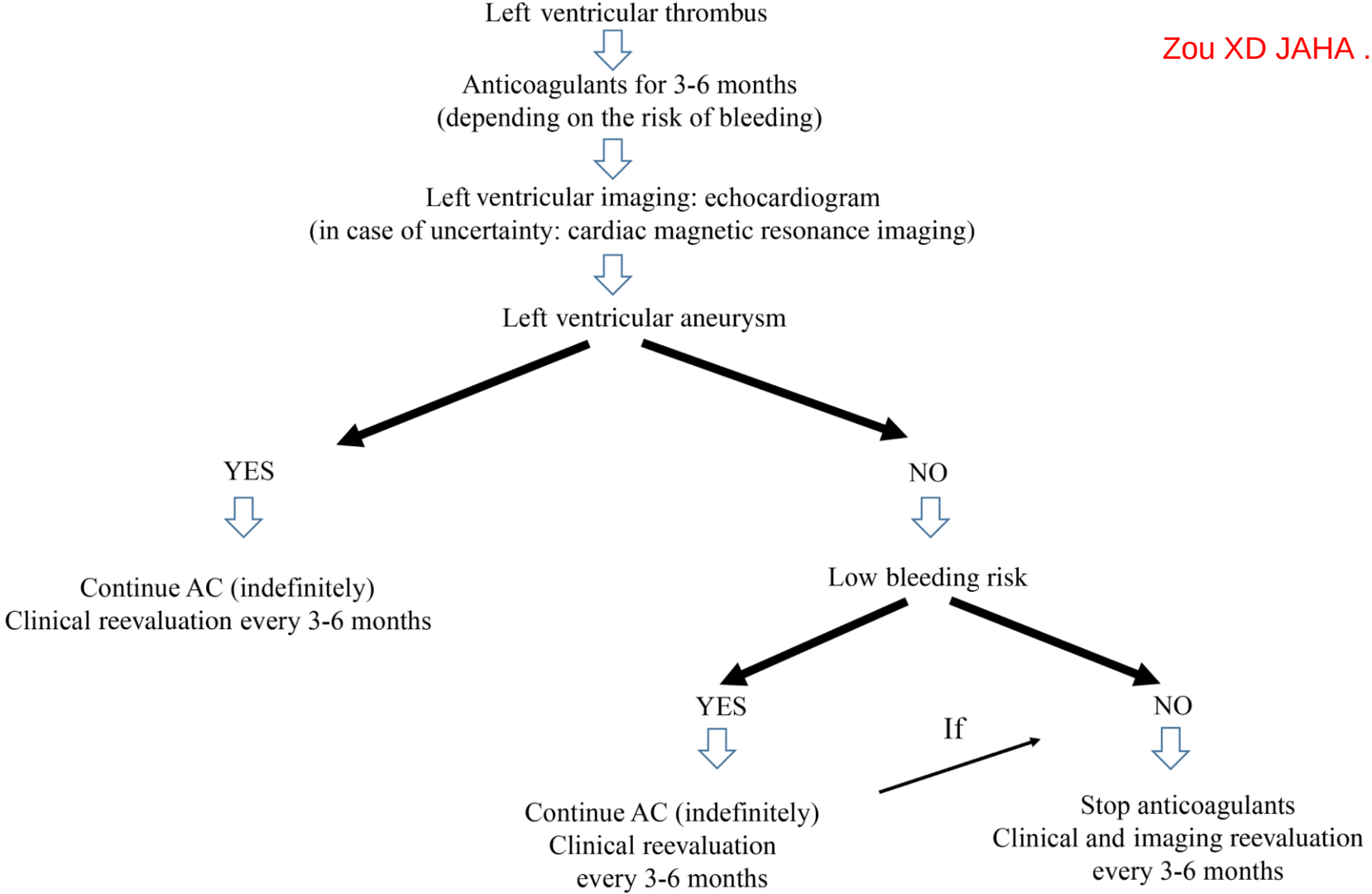


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# Conclusioni

- La trombosi ventricolare sinistra è una complicanza non rara dopo infarto miocardico acuto soprattutto in presenza di condizioni predisponenti come l'aneurisma apicale del ventricolo sinistro
- L'ecocontrasto svolge un ruolo importante nella diagnosi precoce e nel monitoraggio
- I NOA rappresentano una alternativa terapeutica sicura, efficace e paragonabile agli VKA (*ESC GL 2023 II/A*)


**Picano E, Ciampi Q, Cortigiani L et al Stress Echo 2030: The Novel ABCDE-(FGLPR) Protocol to Define the Future of Imaging**
***J Clin Med.* 2021;10:3641**