A clot in Transit: a cause of death or a bystander?

Recommended Citation

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Abstract

Introduction: The clot in transit is a rare manifestation of thromboembolic disease occurring usually in the setting of PE and frequently associated with poor outcomes. The best therapeutic option is not well established. We describe a series of 35 patients diagnosed with clots in transit including their therapeutic interventions and outcome between the period January 2016 to December 2020.

Methods: a retrospective chart review of all patients with an Echocardiogram showing thrombi in the right heart chambers including patients with thrombus in the presence of central lines or other devices. We exclude patients where masses were described as tumors or vegetation and masses in the presence of bacteremia.

Results: There were 35 patients with echocardiographic evidence of a thrombus in the right heart chambers. In 12 of those patients, the thrombus was related to an intracardiac catheter. 37.1% of CT chest was done along with Echocardiogram and showed a concomitant PE in 77%. On echocardiogram, 66% of the thrombi were mobile. RV strain was present in 17% while abnormal RVSP (>30 mmHg) was present in 74%. Respiratory support was required in 37.1% and only 17% required inotropic support. There was a total or partial resolution in 80% those who had repeated echocardiogram after four weeks of therapy. Heparin was started in the majority of patients (74%). Warfarin was the most frequently used follow-up anti-coagulant in 51.4%. The mortality rate was significantly higher in those patients with RVSP >50, UFH group, O2 or inotropic support. 26% of patients died within the first 28 days after the diagnosis, while first 7 days mortality was 6% only.

Conclusion: a clot in transit in our study was not directly associated with poor outcomes in the first week of therapy, UFH is still the most frequently used initial method to treat clots in transit. However, only 26% had a total resolution of clot within 4 weeks of treatment.

Keywords: Thrombus in transit, Pulmonary embolism, Echocardiogram, Bystander, CT chest, Embolectomy

1. Introduction

Thrombus in transit (TIT) is the term used to describe a free-floating thrombus in the right heart. It mainly occurs in the setting of pulmonary embolism (PE) but can rarely occur independently of this diagnosis. The incidence ranges from 4 to 18% in patients with pulmonary embolism and about 98% of TIT cases are known to be associated with PE [1–4]. Thrombus in transit usually originates in the deep veins of the pelvis but may also arise primarily in the heart due to primary cardiac conditions like atrial fibrillation or heart failure [2].

Thrombus in transit is a rare yet life-threatening manifestation of the thromboembolic disease that is associated with high mortality of more than 20% in

the first 2 weeks after diagnosis [1]. Right heart thrombus is an independent risk factor for death in the setting of pulmonary embolism. High mortality may also be attributed to the associated comorbidities usually associated with high risk of thromboembolic disease like malignancies.

Diagnosis of clot in transit is usually made during Echocardiography but rarely can also been seen in CT angiography performed to diagnose pulmonary embolism.

In echocardiography, clots in the right heart can be freely mobile or partially attached to the wall of right atrium or ventricle. The former usually originate outside the heart while the latter is formed within cardiac chambers [5].

The appropriate intervention when clot in transit is diagnosed in the setting of pulmonary embolism is not clear. Those patients are usually started on standard anticoagulation with unfractionated heparin or low-molecular-weight-heparin. Other measures like systemic or catheter-directed thrombolysis or thrombectomy are used in the setting of PE with certain indications like hemodynamic instability and do not take the presence of thrombus in transit as an independent indication [6−8].

Few data suggests that systemic standard anticoagulation alone to treat pulmonary embolism with clot in transit may be associated with higher risk of further embolization and that systemic thrombolysis or surgical removal may provide better options for this syndrome regardless of hemodynamic indications [9,10].

2. Methods

Using the Cardiac echocardiogram database, a retrospective chart review of all patients with either a trans-thoracic or trans-esophageal Echocardiogram showing masses/thrombi/clot in the right heart chambers from the period between January 2016 to December 2020, including patients where the right heart masses are described as thrombi but occurring in the presence of central lines or other devices in the right heart chambers. We excluded patients where masses are described as tumor masses or infectious vegetation, mass in the presence of bacteremia.

The medical records of those patients were reviewed for demographic data comorbidities, admission diagnosis, predisposing risk factors, history of thromboembolic disease, symptoms at presentation, and radiological images We also collected data about therapeutic interventions used (UFH, LMWH, thrombolysis, thrombectomy, surgery),

Abbreviations:

aPTT	activated partial thromboplastin time
BiPAP	bi-level positive airway pressure
CKD	Chronic Kidney Disease
CT	Computed tomography
DM	Diabetes Mellitus
DVT	Deep venous thrombosis
LMWH	Low molecular weight heparin
LV	Left ventricle
MRI	Magnetic resonance imaging
PE	pulmonary embolism
RA	Right atrium
RV	Right ventricle
RVSP	right ventricle systolic pressure
SPSS	Statistical Package for Social Sciences
TIT	Thrombus in transit
UFH	Unfractionated heparin
BNP	Brain natriuretic peptide

time of initiation of treatment, target anticoagulation in first 24 and 48 h and patients' outcome.

Data on initial echocardiogram findings and all follow up Echocardiograms were also documented including the size, site and mobility of the thrombus, concomitant right ventricular strain and right ventricular systolic pressure.

We recorded both 7 days and 30 days mortality. We also recorded the serum troponin I and BNP levels on the diagnosis day. If more than one test is done on that day, the highest reading is taken.

2.1. Data analysis

The data was analyzed by Statistical Package for Social Sciences (SPSS software version 25). The descriptive statistics were presented as percentage and frequency for categorical variables, while mean and standard deviation were presented for the numerical variables. The relationships between the two groups (good outcome and poor outcome) were analyzed using the chi square test. Quantitative variables will be compared between groups using t-test and nonparametric tests. K−S test was used to check the normality of the data.

A multivariate logistic regression statistical test will be used to design the regression model to predict the associated risk factors for poor outcomes. All tests were two-tailed, and significance was considered at a p-value <0.05.

3. Results

There were 35 patients with echocardiographic evidence of thrombus in the right heart chambers. In 12 (34%) of those patients, the thrombus was

related to an intracardiac catheter. The thrombi were associated with hemodialysis catheter in 11(13%) patients and with peacemaker leads in one patient.

The mean age of patients was 50.6 ± 21 with patients whose thrombus related to an intracardiac catheter slightly younger (49 ± 22.52 vs 52.04 ± 21.22, P = 0.712) as shown in (Table 1). Twenty-Eight (80%) of patients were above the age of 30 years with no difference in gender distribution (p = 0.903).

Preexisting cardiovascular disease (ACS, heart failure) was present in 15 patients (43%), of them, systolic dysfunction was found in 7 patients while diastolic dysfunction in 8 patients. Preexisting cardiovascular disease was more in the group with non-device related thrombi with no statically significant (P = 0.918) (Table 1).

Diabetes mellitus was the second most frequent comorbidity present in 13 patients (37%). Followed by CKD 11 (31.4%) and previous history of a stroke was present in 7 patients (20%). One patient had a history of right atrial clot 10 years earlier and a surgical thrombectomy was done. One more patient had a history of venous thromboembolic disease 5 years earlier (DVT).

In more than half of the patients (54.3%), no added imaging was used apart from the transthoracic echocardiogram during the evaluation. In 13 patients (37.1%), a CT chest was done along with the Echocardiogram and showed a concomitant pulmonary embolism in 10 patients (77%). In 2 more patients, pulmonary embolisms were evident in the higher cuts of a CT abdomen which bring the total pulmonary embolism cases to 12 (80%) in those with CT imaging.

Pulmonary embolism was subsegmental only in one patient while it was segmental or central in the rest of the patients as shown in. (Table 1).

23 patient had initial TTE (65.7%) while 12 patients had TEE.On the follow up, 22 patients were followed by TTE and 6 patients had TEE. The remaining has no follow up.

Single chamber thrombus (either right atrium or right ventricle) was present in 26 patients (74%) and multiple chamber thrombi (either different chambers or multiple thrombi in the same chamber) were present in 9 patients (26%). Concomitant thrombi in the right and left ventricles were present in three cases (9%)

Most of the thrombi in the right atrium were free-walled while thrombi in the right ventricle were either free-walled (23.5%) or attached to the apex (29.4%) and more than two-thirds (66%) were mobile. All thrombi were more than one cm in at least one dimension (large thrombi).

On echocardiogram, the right ventricular strain was present in only 6 patients (17%) while abnormal right ventricular systolic pressure (>30 mmHg) was present in 26 patients (74%). Right ventricular systolic pressure >60 was present in only 4 (11.2%) patients. Respiratory support (oxygen therapy, BiPAP, mechanical ventilator) was required in 13 patients (37.1%) and only 6 (17%). required inotropic supports (17%), as shown in (Table 1).

BNP was done on 26 patients (74.2%) and was abnormal in 16 patients (62%) while Trop I was done in 25 (71.4%) patients and was abnormal in 15 patients (60%). Both were insignificantly abnormal in the non-catheter-related thrombus.

Follow-up echocardiogram was done for 14(40%) patients after the initial echocardiogram while cardiac MRI was done in one.

There was a total resolution or partial resolution in 12 out of 15 patients (80%) who had repeated echocardiograms after four weeks of therapy with total resolution seen in 6 (40%) of those patients as shown in (Table 3) Only one patient still demonstrated an RV strain and all patients had variable decrease in right ventricular systolic pressure in the follow up echocardiogram details presented in table (Table 4).

Another echocardiogram was done 8 weeks from the initial one for a total of 6 patients, five as a follow up from the second echocardiogram and one as a follow-up from the initial and the findings of the second echocardiogram is shown in Tables 3 and 4

Unfractionated heparin was started in the majority of patients, 26 patients (74%) while other anticoagulants were given only in 6 patients (17.1%) (Enoxaparin in 5 and Apixaban in one). Two patients did not receive any anticoagulation and one more patient was treated with removal of intracardiac catheter only. Warfarin was the most frequently used follow-up anti-coagulant used in 18 patients (51.4%) followed by 6 patients with enoxaparin (17.1%), 5 with Apixaban (14.3%) and 6 (17.1%) patients had no follow-up therapy. as shown in (Table 1).

In patients receiving non-fractionated heparin for non-cathter-related thrombus 17.6% (3 out of 17) achieved a target therapeutic aPTT in the first 24 h with no significant difference between mean aPTT in both groups. (Table 2).

A total of 9 patients (26%) died within the same admission. Two of them died within 7 days (5.7%) and 7 (20%) died within 28 days. Seven patients of the twenty-three (30%) with no catheter related thrombi died while 2 of the 12 (16%) died. Patients with thrombi-related catheter as shown in (Table 5).

In multivariate analysis, predictor of mortality did not explore any significant correlation with, gender,

Table 1. Patient characteristics.

Parameters	Total N=35 n(%)	Non catheter related N=23 n(%)	Catheter related N=12 n(%)	P- value
Age				
≤ 30	7 (20)	4 (17.4)	3 (25)	
31 − 65	19 (54.3)	12 (52.2)	7 (58.3)	0.712[d]
> 65	9 (25.7)	7(30.4)	2(16.7)	
Age (Mean ± SD)	50.6±21.5	51.4 ±21.5	49 ± 22.52	0.764
Gender				
Male	17 (48.6)	11(47.8)	6 (50)	0.903
Female	18 (51.4)	12 (52.2)	6 (50)	
Nationality				
Saudi	30 (85.7)	20(87)	10(83.3)	1[a]
Non Saudi	5 (14.3)	3(13)	2(16.7)	
Comorbidities				
Preexisting Cardiac disease[a]	15 (43)	10 (43.5)	5 (41.7)	0.918
Atrial Fibrillation	3 (8.6)	2 (8.7)	1(8.3)	1
DM	13 (37)	6 (26.1)	7 (58.3)	0.079
Chronic Lung disease	5 (14.3)	2 (8.7)	3 (25)	0.31[a]
Chronic kidney disease	11 (31.4)	3 (13)	8 (72.7)	**0.002[a]**
Connective tissue disease	3 (8.6)	2 (8.7)	1(8.3)	1[a]
Chronic liver disease	3 (8.6)	3 (13)	0	NA
Previous stroke	7 (20)	5 (21.7)	2(16.7)	1[a]
Risk factors of thromboembolic disease				
History of past thromboembolism[b]	2(5.7)	2(8.7)	0	0.289
Immobilization	3(8.6)	2(8.7)	1(8.3)	
Trauma	1(2.8)	1(4.3)	0	
Malignancy	8(22.9)	6(26.1)	2(16.7)	
Morbid obesity	3(8.3)	2(8.7)	1(8.3)	
Imaging				
Echocardiogram alone	19(54.3)	10(43.5)	9(75)	0.478[a]
Echocardiogram and CT chest	13 (37.1)	-	-	
Positive	10/13(77)	8(34.7)	2(16.7)	
Negative	3/13(33)	2(8.7)	1(8.3)	
Echocardiogram and Abdomen CT	2(5.7)	2(8.7)	0	
Echocardiogram and LL Doppler	1(2.8)	1(4.3)	0	
Pulmonary embolism location				
Peripheral segmental	8(22.8)	-	-	0.733
Unilateral	4/8(50)	3(13)	1(8.3)	
Bilateral	4/8(50)	3(13)	1(8.3)	
Peripheral sub segmental	1(2.8)	1(4.3)	0	
Central bilateral	3(8.6)	3(13)	0	
Respiratory support				
Nasal cannula	9(25.7)	6(26.1)	3(25)	0.709
Mechanical ventilation	4(11.4)	2(8.7)	2(16.7)	
No oxygen needed	22(62.9)	13(56.5)	9(75)	
Inotropic support				
Yes	6(17.1)	4(17.4)	2(16.7)	1[a]
No	29(82.9)	19(82.6)	10(83.3)	
Echocardiogram findings				
Single thrombus	**26(74.3)**	17(74)	9 (75)	0.944[a]
RA	17/26(65.4)	8(43.7)	9 (75)	
RV	9/26 (34.6)	9 (39)	0	
Multiple thrombus[c]	**9 (25.7)**	6(26.1)	3(25)	
RV and RA	2/9(22.2)	0	2(16.7)	
RV and LV	3/9 (33.3)	3(13)	0	
RV	2/9(22.2)	1(4.3)	1(8.3)	
RV	2/9(22.2)	2(8.7)	0	
Clot attached site				
RV	**17 (48.6)**			
Free wall	4	4(17.3)	0	
Septum	4	3(13)	1(8.3)	**0.001[a]**

(continued on next page)

Table 1. (continued).

Parameters	Total N=35 n(%)	Non catheter related N=23 n(%)	Catheter related N=12 n(%)	P- value
Apex	5	5(21.7)	0	
Subvalvular	1	1(4.3)	0	
Chordae	3	1(4.3)	2(16.6)	
RA	18(51.4)			
Free wall	5	3(13)	2 (16.7)	
Interatrial septum	9	2(8.6)	7(58.3)	
Anterior wall	2	2(8.6)	0	
Posterior wall	2	1(4.3)	1(8.3)	
Clot characteristics				
Catheter				
Attached directly to catheter	7 (20)	0	7 (58.3)	< 0.001
Not Attached to the catheter	4 (11.4)	0	4 (33.3)	
Wire attached	1 (2.8)	0	1 (8.3)	
Mobility (yes)	23 (65.7)	15 (65.2)	8 (66.7)	
RV strain	6 (17.1)	5(21.7)	1(8.3)	0.64[a]
RVSP				0.805
20-30	4(11.4)	3(13)	1(8.3)	
30-40	8(22.8)	5 (21.7)	3(25)	
40-50	12(34.3)	8(34.8)	4(33.3)	
50-60	2(5.7)	1(4.3)	1(8.3)	
60-70	2(5.7)	2(8.7)	0	
>70	2(5.7)	2(8.7)	0	
NA	5(14.3)	2(8.7)	3(25)	
Systolic dysfunction reported				0.259
Yes	11(31.4)	9(39)	2(16.7)	
No	24(68.6)	14(60.8)	10(83.3)	
Catheter removal	6(17)	-	6(50)	NA
Initial anticoagulation				0.752[a]
Heparin infusion	26(74.3)	17(74)	9 (75)	
Enoxaparin	5(14.3)	3(13)	2(16.7)	
Apixaban	1(2.8)	1(4.3)	0	
No anticoagulation	3(8.5)	2(8.7)	1(8.3)	
Follow up anti coagulation	18(51.4)	10(43.5)	8 (66.7)	0.1
Warfarin	6(17.1)	6(26.1)	0	
Enoxaparin	5(14.3)	2(8.7)	3(25)	
Apixaban	6(17.1)	5(21.7)	1(8.3)	
No follow up				
BNP (pmol/l)	452.8 ± 1044	368.5 ±501	611.8 ±1692	0.389
Mean BNP	10 (28.6)	5 (21.7)	5 (41.6)	
Normal < 28	16 (45.7)	12 (52.2)	4 (33.3)	
Abnormal >28	9 (25.7)	6 (26.1)	3(25)	
Not done				
Trop I (pg/ml)	255±621	193.8± 249.3	370.4±1028.4	0.397
Mean Trop I	12(34.3)	6(26.1)	6 (50)	
≤ 10	14(40)	11(47.8)	3 (25)	
>10	9(25.7)	6 (26.1)	3 (25)	
Not done				
Hospital Outcome	26 (74.3)	16 (69.5)	10(83.3)	0.45
Survival	9 (25.7)	7(30.4)	2(16.7)	
Death				
Mortality	9 (25.7)	7(30.4)	2(16.7)	0.536
7-day mortality	2 (5.7%)	2(8.69)	0	0.380
28-day mortality	7 (20%)	6(26.1)	1(8.3)	

[a] ischemic cardiac disease and heart failure.
[b] DVT and cardiac thrombus.
[c] Either different chambers or multiple thrombi in the same chamber.
[d] Fisher exact test.

Table 2. Therapeutic targets (patients treated with non-fractionated heparin).

aPTT value	Clot in transit NOT related to catheters	Clot in transit related to catheters	P- value
Initial PTT			
Mean ± SD	30.8 ± 4	21.5 ±15	0.007
Median	30.4	23.9	
24h PTT			
Mean ± SD	44.9 ± 18.8	32.7 ± 25	0.12
Median	35.18	34.8	
48h PTT			
Mean ± SD	54 ± 26.7	42.3± 32.9	0.266
Median	47	42.3	
% achieving 2X aPTT	17.6%	44.4%	NA
in first 24h	Total (17) achieved 3	Total (9) achieved 4	
% achieving 1.5X aPTT	47%	22.2%	NA
In the first 24h	Total (17) achieved 8	Total (9) achieved 2	

Table 3. Clots size changes with treatment (non-catheter related clots).

First Echocardiogram (23 patients)			Second Echocardiogram (4 weeks) (15 patients*)					Third Echocardiogram (8 weeks) (6 patients*)						
Clot size	Clot location		Clot size				Clot location		Clot size				Clot location	
	RA	RV	Same size	Larger	Partial resolution	Total resolution	RA	RV	Same size	Partial resolution	Total resolution		RA	RV
Large	9	14	1	2	6	6	5	10	1	2	3		3	0

ONE PATIENT HAD Follow up MRI.

comorbidities, clot characteristics (clot site and burden, mobility), RV strain, pulmonary acceleration time, and targeted aPTT within 24. However, older age, RVSP >30, Initial use of unfractionated heparin, oxygen, and inotropic use, were significantly associated with higher mortality rate. While warfarin use as a follow-up therapy was significantly correlated with better outcome, as shown in (Table 6).

4. Discussion

Thrombus in transient is one manifestation in the spectrum of thromboembolic disease. Occurrence is reported more frequently in the setting of massive and sub massive pulmonary embolism [1,11,12].

Thrombus in transit is likely underdiagnosed because of the limited number of echocardiograms performed on patients with pulmonary embolism.

Table 5A. Survival per therapy.

Initial therapy	Follow up therapy	No	Outcome same admission (survived/died)
Fractionated Heparin (26)	Heparin alone	3	0/3
	Warfarin	18	15/2
	Enoxaparin	6	3/1
	Apixaban	5	2/0
Non fractionated heparin (6)	Enoxaparin	2	2/0
	Warfarin	1	1/0
Enoxaparin (5) Apixaban (1)	Apixaban	3	3/0
No therapy given (3)	-	-	0/3

One research estimated the prevalence of thrombus in transit at 9% of all PE [13]. In that publication, echocardiogram was done in 76% of patients with PE in the first 72 h which is a relatively high percentage of echocardiograms done in this setting.

Table 4. Clots size and pulmonary pressure changes with treatment (non-catheter related clots).

Echocardiogram	No.	Clot location		Mobility	RV strain	RVSP						Clot resolution (%)		
		RA	RV			< 30	30-40	40-50	50-60	>60	NA	None	Partial	total
Initial	23	9	14	14	6	3	5	8	1	4	2	-	-	-
4 weeks from initial	15	5	10	3	1	1	3	5	2	1	3	3	6	6
8 weeks from initial	6	3	3	1	0	1	0	3	0	0	2	1	2	3
First echo from initial	1	-	1	-	0	-	-	-	-	-	1	-	-	1
2ed echo from initial	5	3	2	1	0	1	0	3	0	0	1	1	2	2

Table 5B. Survival per therapy.

Initial therapy		Mortality			Follow up (months)				
		7 days	28 days	Hospital	< 1	1-6	6-12	>12	Lost
Fractionated Heparin									
No catheter	17	0	4	5	6	3	1	6	1
Catheter	9	0	0	1	0	2	0	7	0
Non-fractionated heparin (Enoxaparin and apixaban									
No catheter	4	0	0	0	0	1	1	2	0
Catheter	2	0	0	0	0	1	1	0	0

Table 6. Hospital mortality, analysis of outcome.

Parameter	Total N=35 n(%)	Survived N= 26 n(%)	Died N=9 n(%)	P value
Age (Mean ± SD)	50.6 ± 21.5	47 ± 22	61 ± 16	0.087
Gender				0.264
Male	17(48.6)	11(42.3)	6 (66.7)	
Female	18(51.4)	15(57.7)	3(33.3)	
Comorbidities				
DM	13(37.1)	8(30.7)	5(5.6)	0.243
Cardiac disease	15(42.6)	10(38.5)	5(5.6)	0.451
Systolic dysfunction	11(31.4)	7(27)	4(44.4)	0.416*
Atrial fibrillation	3(8.6)	2(7.7)	1(11.1)	1*
Pulmonary disease	5(14.3)	4(15.4)	1(11.1)	1*
Chronic liver disease	3(8.6)	2(7.7)	1(11.1)	1*
Chronic kidney disease	11(34.4)	9(34.6)	2(18.2)	0.685*
Connective tissue disease	3(8.6)	2(7.7)	1(11.1)	1*
Malignancy	8(22.8)	5 (19.2)	3 (33.3)	0.396*
Clot site				0.432
RA	21(60)	17(65.4)	4(44.4)	
RV	14(40)	9 (34.6)	5(5.6)	
Clot burden				0.391
Single	26 (74.3)	18(69.2)	8 (88.8)	
Multiple	9(25.7)	8 (30.7)	1(11.1)	
Clot mobility				0.121
Mobile	23(65.7)	15 (57.7)	8(88.8)	
Non mobile	12(34.3)	11(42.3)	1(11.1)	
RVSP				0.07*
< 30	4 (11.4)	4 (3.8)	0	
30-40	8 (22.8)	7 (27)	1 (11.1)	
40-50	12 (34.3)	8 (30.7)	4 (44.4)	
50-60	2 (5.7)	0	2 (22.2)	
60-70	2 (5.7)	1 (3.8)	1 (11.1)	
>70	2 (5.7)	1 (3.8)	1 (11.1)	
Pressure could not be calculated	5 (14.3)	5 (19.2)	0	
RV strain				0.162*
Yes	6 (17)	3(11.5)	3(33.3)	
No	29 (83)	23(88.5)	6 (66.7)	
Pulmonary acceleration (PAP)				0.56*
Severely elevated (<80)	9 (25.7)	5(19.2)	4 (44.4)	
Mildly elevated (80-100)	7 (20)	3(11.5)	4 (44.4)	
Borderline (101-130)	10 (28.6)	9(34.6)	1(11.1)	
Normal (>130)	5 (14.3)	5(19.2)	0	
Use of oxygen				0.015*
Yes	11(31.4)	5(19.2)	6 (66.7)	
No	24(68.6)	21(91.3)	3(33.3)	
Use of inotropic support	6 (17)	0	6(66.7)	< 0.001
Yes	29 (83)	26(100)	3(33.3)	
No				
Therapeutic used				0.011
Initial therapy heparin	26(74.3)	20 (77)	6(66.7)	
Initial therapy non heparin	6(17.1)	6(23)	0	
Therapeutic follow up				< 0.001
Warfarin	18(51.4)	16 (61.5)	2 (22.2)	
Enoxaparin	6(17.1)	5(19.2)	1(11.1)	
apixaban	5(14.3)	5(19.2)	0	
No follow up	6(17.1)	0	6(66.7)	

Thrombus in transit is characterized based on its echogenic shape and appearances into three types, A, B and C. Type A is the most common. It is usually elongated in shape, has a worm-like appearance, mobile and has a high-risk embolization. It usually originate in the lower limb and pelvis venous circulation [4]. Type B thrombus usually originate intracardiac, oval in shape and are firmly attached to the heart walls [4]. Some intracardiac thrombi share both characteristics and are named type C [14].

In our cohort, origin of the thrombi was difficult to determine as only one patient has lower limb Doppler. However, majority were mobile making them more likely as type A or C.

It appears that mortality in patients with PE and a thrombus in the right side of the heart is higher than those without. Mortality as high as 21% in the first 14 days and 29–44% within 3 months have been reported which as much higher that overall, PE mortality of 10–12% [1,15,16].

Unlike previous studies that reported an association with sever pulmonary embolism, an increase in hemodynamic instability, hypotension, and echocardiographic signs of right heart dysfunction, 33% of our patients had a negative CT chest, only 17.1% required inotropic support and RV strain was only reported in 17.1% of patients. The percentage of negative CT angiography imaging, may be overestimated since CT was not done in 57% of patients [1,12,17,18].

The best therapeutic approach of pulmonary embolism with thrombus in transient is not fully explored. In earlier studies, outcome was not dependent on therapeutic approach (systemic thrombolysis, surgical embolectomy, catheter-directed thrombolysis, and anticoagulation) but with occurrence of cardiac arrest [6]. More recent studies however, found some benefit to systemic thrombolysis compared to other treatment modalities [9,10].

In this cohort, 26% of patients died within the first 28 days after the diagnosis. The first 7 days mortality was 6%. The first week mortality may be a more reliable indicator to thrombus in transit while the 28 days mortality will likely represent death from underlying disease [19].

Reported 30 day-mortality of pulmonary embolism with clot in transient ranges between 19% and 45%. Some authors prefer to use the 7 days mortality to better reflect the PE with thrombus in transient direct outcome and reported a 7 days mortality of 13% [1,5,6,10,12,13,17,20–22].

In this current study, no specific Risk factors was significantly associated with mortality (Table 5), Mortality was higher in those treated with unfractionated heparin (30%) as compared to those treated with none fractionated heparin.

Mortality of PE with thrombus in transit is reported >25% [3,4,23–25]. Our cohort mortality is similar to what reported in literature despite the fact that the majority of patients did not require neither oxygen nor inotropic support.

Assuring effective anti-coagulation very early after the diagnosis is crucial to improve outcome. In our cohort, 54.5% of patients did not get effective anticoagulation within the first 24 h when unfractionated heparin was used. This problem is likely to occur with enoxaparin and Apixaban.

5. Limitations

This study has number of limitations including the small sample size, the retrospective nature and despite these limitations, the findings of this study is consistent with previous studies reported in literature.

6. Conclusion

Unlike previously reported, clot in transit in our study was not directly associated with poor outcome in the first week of therapy, UFH is still the most frequently used initial method to treat clot in transit. However, only 26% had total resolution of clot within 4 weeks of treatment.

Author contribution

Conception and design of Study: AZA, MA. Literature review: MA, MA. Acquisition of data: DA, HAJ. Analysis and interpretation of data: RA, HAJ. Research investigation and analysis: YA. Data collection: AZA, MA, MA. Drafting of manuscript: MA, DA. Revising and editing the manuscript critically for important intellectual contents: RA, JS. Supervision of the research: JS. Research coordination and management: YA.

Ethical consideration

Ethical approval was obtained from Institutional Review Board of King Abdullah International Medical Research Centre, Ministry of National Guard-Health Affairs, Riyadh, Kingdom of Saudi Arabia (approval number **IRBC/0268/22**). Patient confidentiality was ensured, and the patients' data were collected and used by the research team only. Due to the retrospective nature of the study, and the use of anonymized patient data, the requirement for informed consent was waived.

Funding source

None.

Conflict of interest

None.

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