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Thromboembolic complications in Takotsubo Syndrome during Covid-19 outbreak. A review with case report

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Abstract

New coronavirus (COVID-19) outbreak, which started in Wuhan, China and spread rapidly all over the world, has become the most important cause of the emotional distress for susceptible people. Because the people also remained in fear and anxiety during the period when the elderly population in the whole country was desperate due to the COVID-19 outbreak and was asked to stay at home in fear of death. In addition, the fact that the patients were hospitalized together with COVID-19 patients caused his psychological distress to be experienced even more. Takotsubo Syndrome (TTS) is known as a distress-induced transient left ventricular dysfunction. In our patient with TTS, it was found that a new apical thrombus, which was not seen in the left ventricle, was seen in previous echo and computerized tomographic investigation, and that it was a source of thromboemboli, by stress triggering neurocardiac reactions. While under the medical treatment of viral pneumonia, under the Coronavirus transmission measures, thrombus in the LV was removed by being taken to the emergency open heart surgery. Our case is the first patient in the literature where a new thrombus developed in the LV and splenic infarction in TTS triggered by the pandemic. In this article; We have presented the experience of TTS triggered by pandemic, etiopathogenesis of left ventricular thrombus, open heart surgery indications when COVID-19 is suspected, coronavirus transmission measures in the surgical approach, the postoperative treatment and literature is reviewed.

Keywords: splenic artery occlusion, takotsubo syndrome, left ventricular motile giant thrombus, thromboembolism

1. Introduction

Takotsubo syndrome (TTS) also known as Takotsubo cardiomyopathy or distress cardiomyopathy due to distress was first described in a series of 5 Japanese patients in 1991. Both emotional and physical stimuli that activate the central nervous system can trigger the disastrous response of the sympathetic nervous system and eventually lead to catecholamine-mediated damage to the final organ. However, most of the data support a widely accepted theory that the clinical manifestation of TTS is secondary to the plasma excess of catecholamines associated with increased release of adrenomedullary epinephrine and increased norepinephrine triggered by primary psychological or physical distress with a high sympathetic tone (Templin et al., 2015; Wybraniec et al., 2014).

Novel Coronavirus infection disease (COVID-19) continues its fatal spread globally, demonstrating that it significantly affects the mental health and well-being of individuals. Clinical experience so far shows that there is a relationship between the distress in the COVID-19 pandemic and the involvement and treatment of various diseases (Konstantinos et al., 2020).

Approximately 5.3% of TTS cases are complicated by left ventricular thrombosis (Wybraniec et al., 2014; Kurisu et al., 2011). Recent reports have linked major emotional stress caused by COVID-19 to distress-induced / TTS, which occurs as acute heart failure (Parodi et al, 2007). As the number of COVID-19 cases increases worldwide, it is predicted that there will be an increase in the number of associated cardiovascular complications. Clinicians should be aware of the diversity of cardiovascular complications and develop appropriate strategies for diagnosis and treatment (Minhas et al., 2020). In fact, some researchers have reported that thromboembolic complications occurred in 20-33.3% of TTS cases (de Gregorio et al., 2008; Haghi et al., 2008; Suzuki et al., 2013).

The infarction of the spleen (SI) is caused by thromboembolism or direct thrombotic occlusion of the spleen artery. The spleen has a rich vascular source and takes about 5% of the cardiac output. However, SI is a rare event. In the retrospective analysis of many academic hospitals, only 32 (0.016%) of the patients admitted within 10 years were identified (Schattner et al., 2015).

In this presentation, emergency open cardiac surgery as a suspicion of COVID-19 in our patient with TTS, a recently

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developed mobile thrombus causing splenic artery occlusion in the left ventricle (LV), will be discussed. Due to this phenomenon, we will review the symptomatology, etiopathogenesis and treatment methods of diseases in the light of the literature, and we will present our precautions and experiences in the operating room and cardiovascular surgery intensive care unit.

2. Case report

2.1. The Medical history of a 65-year-old female patient before COVID-19 outbreaks

About 12 years ago, after his 17-year-old son died in a traffic accident, he suffered severe depression, received psychological support to deal with his troubles, and regularly received 60 mg of sertraline (Misol), 1x30 mg of mirtazapine (Zestat), and duloxetine (Duxet) for the past 6 years was learned to use. There were no risk factors such as smoking, alcohol, hyperlipidemia, diabetes mellitus, hypertension or obesity in the background, and there was no family history of ischemic heart disease. Coronary angiography performed 12 years ago when she presented with chest pain while under psychological distress revealed that significant stenosis in the left anterior descending artery (LAD) and treated with percutaneous coronary intervention Echocardiography showed apical akinesia in the LV.

It was triggered by the neurocardiac response of TTS in our patient following her sister's death due to breast cancer in a very short time after diagnosis in 2017. This syndrome was detected when it was brought to our cardiovascular surgery clinic for the first time due to leg pain due to thromboembolic occlusion in the subacute phase in his tibial artery. After being admitted to the hospital, i.v. heparin and oral anticoagulant coumadin were given. Cardiac echocardiography was performed to investigate the source of the embolism, but the embolism outlet was not found. Anticoagulation was continued with the novel oral anticoagulant (NOAC) apixaban 2x5 mg, since effective international normalized ratio (INR) could not be achieved for approximately 6 months.

After a detailed examination at the clinic where she went for breast cancer screening a year ago, the patient's chest pain developed, and the level of troponin increased moderately in the blood analysis. On the coronary angiography, it was reported that there was no stenosis in the coronary arteries and thrombus in the apical region, except for the apical enlargement of the LV.

2.2. The medical history of the last application during the COVID-19 outbreak period

On 13 March 2020, the patient applied to the Samsun Training and Research Hospital emergency department with complaints of headache, fever, shortness of breath, cough, weakness and pain on left upper quadrant of the abdomen. In the thorax Computerized Tomography (CT) performed here, viral pneumonia infiltration was observed in the reticular and ground glass pattern in the lower and upper lobe segments of the bilateral lungs (Fig. 1). However, there was not any thrombotic event in left ventricular cavity and spleen in the thoracic and abdominal CT's (Fig. 2).

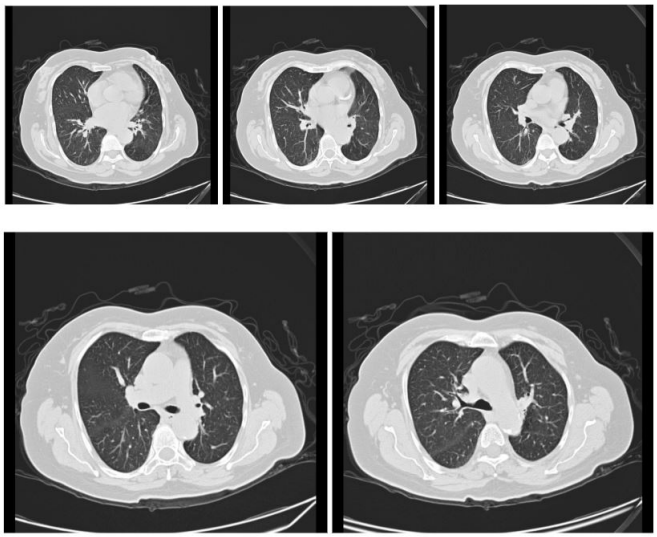

Fig. 1. Virus pneumonia image showing bilateral ground glass appearance in the lungs on chest CT taken in hospitalization of the patient

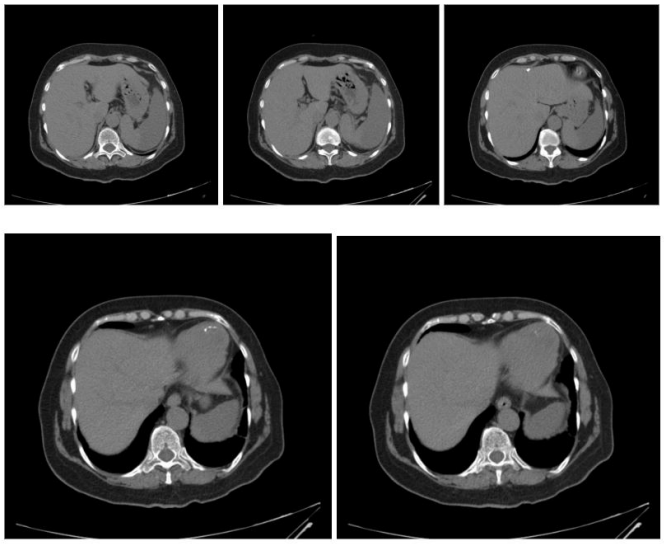

Fig. 2. Normally monitored spleen image in the abdominal CT taken during hospitalization of the patient

Hydroxychloroquine 600 mg / day and Azithromycin 3x250 mg were started with the pre-diagnosis of COVID-19. Samples from the throat and nasal swabs for COVID-19 polymerase chain reaction (PCR) Nucleotide test at two-day intervals had two negative results. Thoracal CT and Echocardiography performed to investigate the thrombus source showed a large thrombus moving in the LV (Fig. 3). In the abdominal CT performed for the cause of the patient's new severe abdominal pain, splenic infarction, occlusion in the splenic artery and thrombosis in the splenic vein were observed (Fig. 4). Bedside transesophageal echo (TTE) showed a large mobile thrombus starting and extending from the akinetic apical wall in addition to normal contraction in the middle and basal segments of the LV (Fig. 5) in different angles of TTE.

In echocardiographic update evaluation, EF measured 24% in measurement with Simpson method, and left ventricular thrombus sizes grew compared to the previous one. Pulmonary pressure was measured at 25 mm Hg. Electrocardiogram (ECG) with ST elevation and anterior T-wave inversions between V3 and V5 revealed frequent premature ventricular contractions and anterior wall infarct in sinus rhythm. Emergency surgery was decided after applying coronary angiography (Fig. 6). An abnormal value was not detected when performing thrombophilia investigation. Troponin T levels were normal.

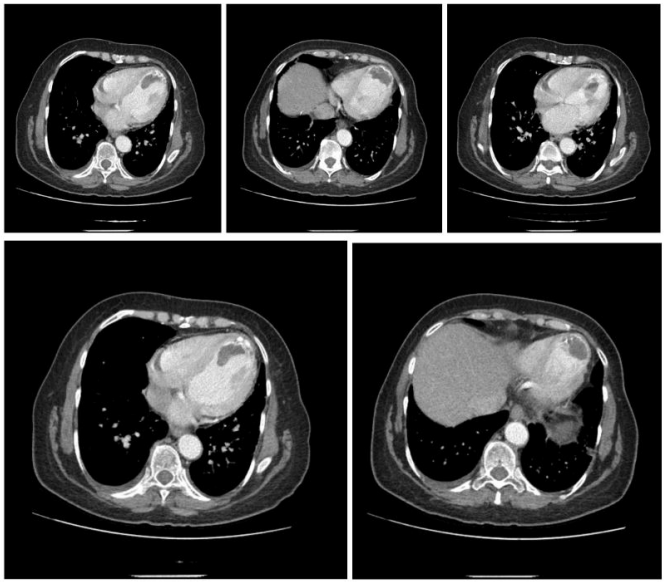

Fig. 3. Chest CT taken on the 10th day of hospitalization; a view of the newly developed thrombus localized to the left ventricular apex

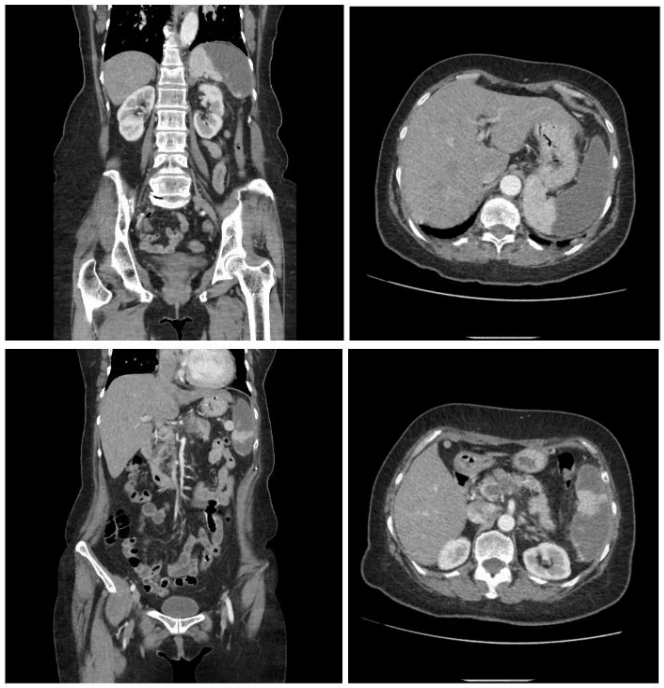

Fig. 4. Splenic infarct images on abdominal CT taken on the 10th day of hospitalization

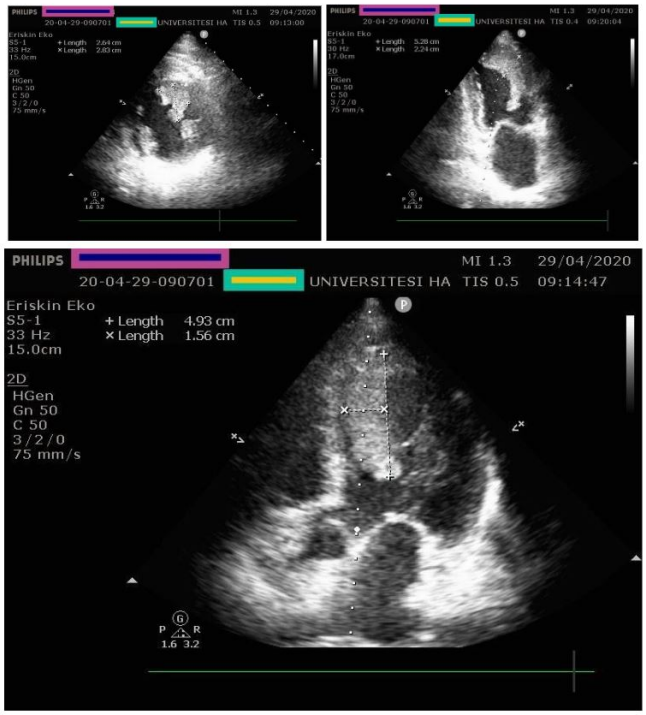

Fig. 5. Preoperative TTE images of the newly developing mobile large-sized thrombus localized in the left ventricular apex

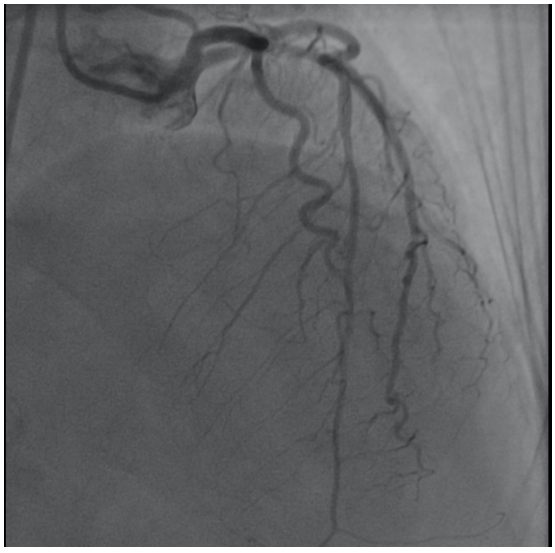

Fig. 6. Preoperative coronary angiogram, left anterior descending artery is open

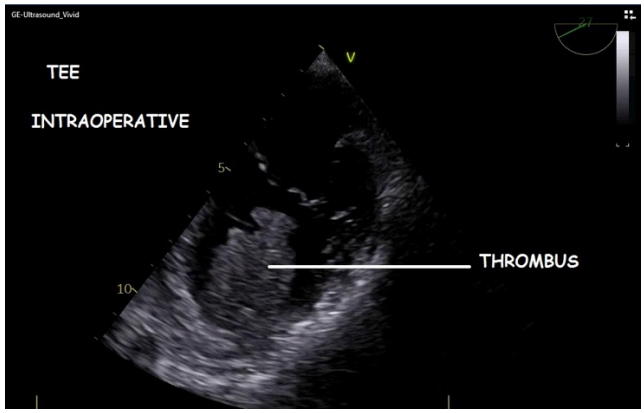

Fig. 7. Preoperative TEE images of newly developing mobile large-sized thrombus localized in the left ventricular apex

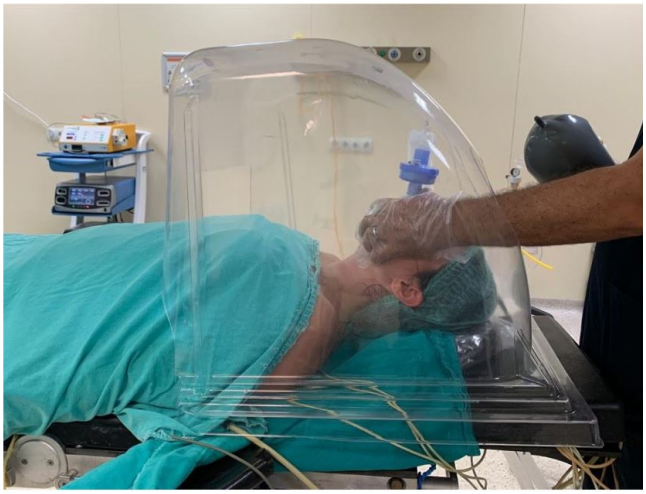

Fig. 8. Transparent cage used as an infection measure in anesthesia

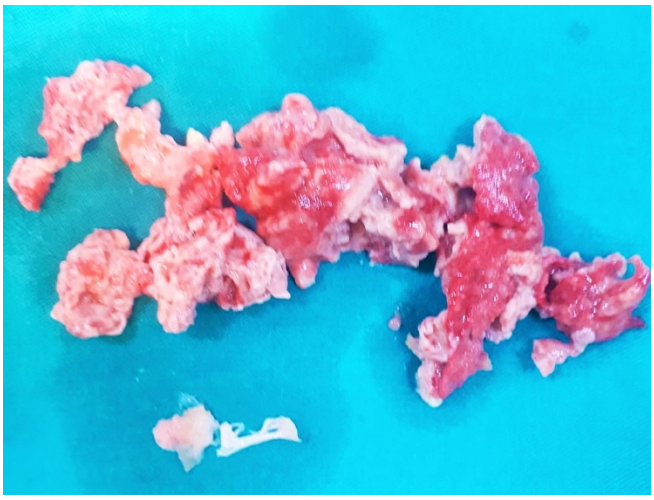

Fig. 9. Thrombus material extracted from the LV

In the context of coronavirus contamination measures, the patient's head was intubated into the lantern and ND95 masking to prevent airway conduction in the isolated operating theater (Fig. 7). Preoperative TEE images of newly developing mobile large-sized thrombus localized in the left ventricular apex (Fig. 8) Cannulation was achieved with a full dose of heparinization. After diastolic arrest was achieved with cold blood cardioplegia given to the aortic root, the left ventricular apex was suspended and a vertical incision was made through the avascular area. The region where the thrombus originated was investigated. The new fresh thrombus between the left ventricular apical trabeculae and the prolonged mass of the thrombus at the sub-acute stage was completely removed (Fig. 9). The presence of residual thrombus was investigated by rigorous observation of the left ventricular cavity with a fiber optic endoscope. Left ventricular air was removed after reduction was applied to the apical dyskinesia area. When the cross clamp was removed, the heart worked spontaneously again in the sinus rhythm. In patients with low left ventricular ejection fraction (LVEF), medication causing catecholamine discharge was avoided and milrinone was used as positive inotropic. While intubated, the patient was taken to the cardiovascular surgery intensive care unit. Supraventricular tachycardia and atrial fibrillation developed at the 6th hour postoperatively returned to sinus rhythm with Cordarone. In the pathological examination, it was reported that the thrombus was in the subacute period. Control echocardiography performed one week later showed normalization of left ventricular dysfunction in the apical segment, and left ventricle ejection fraction (LVEF) increased to 38%, except for hypokinesia. There was no detectable finding of left ventricular thrombus. On the 14th postoperative day, metoprolol succinate, amiodarone hydrochloride, rivaroxaban, and triple antidepressant (Sertraline, mirtazapine and duloxetine) were discharged. It was learned in the first control examination that there were no complaints.

3. Discussion

The COVID-19 epidemic, which started in mid-March in our country, caused intense emotional stressful days with television programs that continued with the fear of not leaving home and showing death to 65 and older. When our patient was hospitalized with a pre-diagnosis of COVID-19, there was a deep anxiety and fear of death. In this period, we think that the root cause of the thromboemboli and the left ventricular thrombosis was provoked coagulation and complication of TTS due to the excessive emotional stress in COVID-19 process. In addition, it is possible that thrombosis in the spleen vein is caused by the thrombophilia phenomenon caused by arterial occlusion secondary to the venous stasis and the excessive stress. When the root cause of coagulation predisposition is investigated, the idea that TTS, COVID-19 and both will be effective is increasingly supported.

In this case, we will try to discuss the specific features of coagulopathy, which is the cause of intracardiac thrombus and splenic embolism, and its relationship with each other.

3.1. Symptoms and signs

Since the symptoms of our patient developed during the COVID-19 outbreak period, the etiology was investigated. The fact that the symptoms did not exactly match those of the classical COVID-19 did not rule out the disease. Indeed, patients with positive PCR tests but with asymptomatic or mild findings have been frequently encountered. For this reason, before the result of swab tests, the diagnosis of COVID-19 was made with thorax CT and the delay in the treatment was prevented in our country. Thus, mortality was reduced to lower levels in patients diagnosed with COVID-19. Despite the fact that viral pneumonia and related changes in the thorax CT of our patient were very similar to COVID-19, although the cardiac findings were similar to the findings in the literature, definitive diagnosis could not be made due to negative PCR tests.

In the COVID-19 outbreaks, it was reported that about 19% of patients hospitalized from many hospital records showed cardiac involvement. Although a recent study reported (Shi et al., 2020) that 12% of patients had COVID-19 associated acute cardiac injury, manifesting as an LVEF decline and all ECGs

were abnormal, with findings compatible with myocardial ischemia, such T-wave depression and inversion, ST-segment depression, and Q waves. Fatal complications in patients were often explained with respiratory and cardiac involvements. The most common ECG finding in TTS is ST segment elevation, typically in the precordial leads (Suzuki et al., 2013; Icli et al., 2016), but ECGs can have normal findings or show T-wave abnormalities or Q waves (Peters et al., 2015). Our patient had an abnormal ECG finding in mention case report above.

3.2. Hyper activation of the coagulation with the stress

Emotional and physical stressors associated with TTS are very much eg. unexpected death of relative or friend, domestic abuse, confrontational argument, catastrophic medical diagnosis, devastating business, armed robbery, gambling losses, surprise party, surprise reunion, car accident, fear of procedure, fear of choking, court appearance, public performance, exacerbated systemic disorders, invasive procedures, cardiac events etc. The high prevalence of emotional triggers in TTS suggests that some individuals are particularly vulnerable to experiencing psychological distress that may result in this syndrome. The prevalence of depression and anxiety disorders in TTS ranges from 21–60 % (Konstantinos et al., 2020; Jeon et al., 2018; Ghadri et al., 2018; Dawson, 2018; Smeijers 2016; Tsamakis et al., 2020). The huge emotional distress at the population level and respiratory infections caused by COVID-19 may represent potential triggers in this context. Myocardial injury, frequently reported in patients with COVID-19, is usually attributed to sepsis and/or hypoxemia and/or underlying coronary artery disease, as well as myocarditis. We are also considered this thought, which TTS can also play an important role in the COVID-19 pandemic (Minhas et al., 2020; Meyer et al., 2020; Moderato et al., 2020).

In any biological disaster fear, uncertainty and stigma prevail and they can act as barriers to proper psychiatric care (Xiang et al., 2020). The distress and uncertainty caused by the lack of endpoint for the COVID-19 pandemic, while treatment is still not in sight, has a significant psychological impact on individuals. Furthermore, the lengthy, massive-scale, unprecedented social distancing and isolation that we are currently undergoing has additive implications; quarantine has been associated with negative psychological effects including emotional disturbance, depression, distress, low mood, irritability, panic attacks, phobic symptoms, insomnia, anger, emotional exhaustion and post-traumatic distress symptoms and in extreme cases, e.g suicide (Brooks et al., 2020). Patients are distressed and reluctant to be transferred to a COVID-19 hospital during the pandemic, which explains the potential delays in treatment for other medical problems (Chadha, 2020). In our case it was most likely a provocative cause the stress concerning ongoing COVID-19 outbreak and her health.

High concentration of norepinephrine in distress cardiomyopathy was undeniably proven in numerous reports (Kurisu et al, 2004; Akashi et al., 2004). Wittstein et al., 2005 documented that concentration of norepinephrine was 3-fold higher in TTS than in acute myocardial infarction (AMI). Furthermore, prolonged stimulation of β1-AR and β2-AR is thought to induce apoptosis of cardiomyocytes (Ueyama et al., 2002; Lyon et al., 2008). In cases with TTS which leads to reversible LV dysfunction following intense physical or emotional distress, rarely formation of a LV thrombus can be seen. In these cases, thrombus has been generally observed during the periods of LV systolic dysfunction (de Gregorio et al., 2008; Prasad et al., 2008; Wiyono et al., 2010). Sasaki et al., 2004 reported formation of LV thrombus with resultant renal artery embolization after normalization of LV function in a patient followed up with the diagnosis of TTS (Kahya Eren et al., 2013; Santoroet al., 2017; Santoro et al., 2016; Vasilieva et al., 2011; Martin, 2010).

Finally, a hypercoagulable state induced by a catecholamine surge may also be present (Santoro et al., 2014). It has been recently shown that patients with TTS show significantly greater values of whole blood viscosity, von Willebrand factor, and lower erythrocyte deformability (Cecchi et al., 2013). von Willebrand factor was 10 times of normal in our patient also. In a study Lodigiani et al., 2020 thromboembolic complications were found 16% of 388 patients in the intensive care patients during the COVID-19 outbreak. Despite All of them used thromboprophylaxis, thromboembolic events corresponded to a cumulative rate of 21%. Half of thromboembolic events were diagnosed within 24 hours of hospitalization. When VTE imaging test was performed in forty-four patients, 16 (36%) VTE was confirmed.

SARS-CoV-2 may damage vascular integrity and cause the myocardial abnormalities observed in TTS. Some authors have reported cases of TTS associated with CMV infection: the virus may mediate coronary endothelial dysfunction with consequent increased expression of endothelial adhesion molecules and trans endothelial migration within the vasculature. SARS-CoV-2 may exert a direct toxic action on myocytes; indeed, the SARS-CoV-2 spike protein shows high-affinity binding to angiotensin-converting enzyme 2 (ACE2), a human cell receptor which is highly expressed in the heart (Roca et al., 2020). Cardiac CT and Cardiac Magnetic Resonance (CMR) should be used for differentiating between distress cardiomyopathy and frequently suspected myocarditis, since TTS is characterized by the absence of late enhancement on gadolinium CMR (Wybraniec et al., 2014; Hombach et al., 2008).

In our case, greater myocardial reactivity to sympathetic stimulation (caused by COVID-19 or TTS) in the apical region combined with abnormal vascular reactivity was thought to cause the left ventricular dysfunction seen in TTS. Therefore, SARS CoV-2 should be considered in patients presenting with TTS to further investigate the role of viral infections in the

pathophysiological mechanisms responsible for this syndrome. As patients with cardiac complications during COVID-19 have a higher mortality rate, we believe that early diagnosis of this disease is important in order to improve patient outcome. In addition, patients infected with TTS and / or COVID-19 appears to be at an increased risk for venous thromboembolism (VTE). There are reports of abnormal coagulation parameters in hospitalized patients with COVID-19 disease (Akar et al., 2020; Tang et al., 2020; Fan et al., 2020). Vascular inflammation may also contribute to the hyper coagulation state and endothelial dysfunction in these patients. Thromboembolic disease should be considered in patients with COVID-19 who have clinically worsening clinical disease, as evidenced by hypoxia or hemodynamic instability (Akashi et al., 2004).

Many conditions have been associated with predisposition to ventricular thrombi. The commonest causes are post myocardial infarct (mural thrombus)1 and dilated cardiomyopathies. Less frequently myocarditis and hypercoagulable states such as protein S and C deficiency and antiphospholipid syndrome have been implicated. Ventricular thrombi have also been noted in muscular dystrophies, Behcet's disease, HIV cardiomyopathy, non-compaction cardiomyopathy and blunt chest trauma. It is rare for a patient to present with a ventricular thrombus in the absence of any underlying disease (Tilling et al., 2007). In our patient, he was using anticoagulant apixaban for prophylactic purposes as well as antidepressant, but it is thought that the development of thrombosis is associated with stress coagulopathy seen in TTS, even though he has never stopped.

We present that may be the first splenic infarct case caused by excessive stress or by itself of COVID-19 process in a TTS patient, in the literature. Genetic predisposition to thrombophilia was investigated because of the arterial occlusion and venous thromboembolism we detected earlier in our patient. There was no evidence to support thrombophilia in methylenetetrahydrofolate reductase (MTHFR), Prothrombin G20210A mutation, Protein C, Protein S and Antithrombin III tests. This also shows that stress induced provocated coagulation is more important than known genetic factors in the thrombosis of the patient with TTS or COVID-19.

3.3. Management of the left ventricular thrombosis

Apical thrombosis complicating TTS was first described in 2003. The majority of the cases had been found female (92%) and above 60 years of age (61%). TTS may be complicated by the formation of left ventricular (LV) thrombus in 1.3-5.3% of patients (Herath et al., 2017). We observed the development of apical akinesia and thromboembolic events in our patient who has been closely monitored for 12 years, as Echocardiographic in routine controls, but intracardiac thrombus was not observed. Our patient had a giant LV thrombus, and his future potential risk for another systemic embolization was thought to be high. Therefore, we performed surgical extirpation of the left ventricular thrombus, because it had morphologic features suggesting a high risk of thromboembolism. Suzuki et al, 2013 recommended surgical management to prevent thromboembolism of mobile and pedunculated left ventricular thrombus related to TTS. However, the area of myocardial infarction does not change the location where the thrombi generally occur. However, the wall abnormalities associated with TTS are usually resolved within a few weeks. Upon normalization of the wall motion, if the left ventricular thrombus remains, the thromboembolic risk rate is being high. We see that the LVEF is improved from %24 to %35 in ECHO in 15th days after operation. Meurin et al., 2005 reported that 73 % of thrombi dissolved with low molecular weight heparin. Niedeggen et al., 2008 reported complete resolution with argatroban. In 57.1% patient's successful lysis was described by Sari et al., 2008 There are reported systemic embolic and high hemorrhagic events after treatment with fibrinolytics (Mallory et al., 1999). Lee et al., 2013 reported the difference between outcomes after anticoagulation, surgical removal, and antiplatelet agents. They could not find a statistically significant difference in event-free survival rate. Mano et al., 2016 demonstrated that left ventricular thrombus can be resolved with apixaban treatment. Apixaban may be an effective alternative to vitamin K antagonist for some patients with acute myocardial infarction complicated by left ventricular thrombus. Bolcal et al, 2019 used Robotic surgery in the surgical treatment of non-pedunculated apical LV thrombus in selected patients.

de Gregorio et al., 2008 reported intracavitary thrombus in 2.5% of the patients with TTS, and stated that 33% of these patients may have thromboembolic complications. However, thromboembolic events may occur even in patients receiving anticoagulant treatment. Our patient was using apixaban 2x5 mg /day for 4 years. Surgical thrombectomy has drawbacks, such as decreasing the LVEF in the early post-surgical period, and the increased risks of anesthesia and operational distress for patients with TTS (Jensen et al., 2006; Niino et al., 2015).

Surgical application is performed atrial or apical ventricular. Since we planned to reduce the akinetic field, intervention from the apical region was preferred. High concentration of norepinephrine in distress cardiomyopathy was undeniably proven in numerous reports (Kurisu et al., 2004; Akashi et al., 2004). Wittstein et al., 2005 documented that concentration of norepinephrine was 3-fold higher in TTS than in AMI. Furthermore, prolonged stimulation of β1-AR and β2-AR is thought to induce apoptosis of cardiomyocytes (Ueyama et al., 2002; Lyon et al., 2008). Conversely, the density of β-AR is higher in the apical segments, inferring from the increased fibrosis of the apical region in response to isoprenaline infusion.

Patients usually do not have any symptoms, and ventricular thrombi are therefore an incidental finding on echocardiography, which has a sensitivity of almost 95 percent

and a specificity of 90 percent. The main concern is that they will embolize, and for this reason anticoagulation is mandated. Surgical thrombectomy may be considered, particularly in the case of a large, protruding, mobile thrombus, after failure of attempts at anticoagulation, or in patients who are unable to take warfarin (Tilling et al., 2007).

There is a few data of NOAC use in TTS patients (Mano et al., 2016; Bolcal et al., 2019; Ohashi et al., 2015). Although many patients have complete resolution with anticoagulant therapy, recurrent embolic phenomena are a common complication, as seen in our patient. Having discussed the relative success of thrombus resolution with anticoagulation, the mere presence of an embolic source in the ventricle poses an immediate threat to a patient's life, and emergent surgical intervention to remove the thrombus and to definitively diagnose the mass seems appropriate. Possible treatment options include anticoagulation and thrombolysis (Tanaka et al., 2014). Given the drug-drug interactions between some antiviral treatments and direct oral anticoagulants, unfractional heparin or enoxaparin may be preferred in all patients with COVID-19 if possible (Akay, 2020). Still, patients with this syndrome should undergo repeated TTE assessment, as dynamic left ventricular outflow tract obstruction may occur in up to 25% of cases (El Mahmoud et al., 2008). Different studies revealed that dynamic, transient intraventricular pressure gradient occurred in about 16–24% of individuals with TTS (Wybraniec et al. 2014). In TTS, approximately 40% of patients can develop left ventricular thrombus (LVT) despite anticoagulation and therapeutic INR (Wybraniec et al., 2008; Vasilieva et al., 2011). Sasaki et al., 2004 reported a case with apical TTS and LVT detected on the 5th day of admission by echocardiography. It was reported that Renal infarction developed in a patient on the 8th day.

3.4. splenic infarction and venous thrombosis

Although splenic artery occlusion is rare, TTS was reported to be among the etiological causes in the literature for the first time in our case. In our case, spleen infarction was seen in abdominal CT. (Fig.4) Spleen infarction (SI) occurs when the spleen artery or 1 or more branches is blocked by an embolus or in situ thrombosis. The spleen has a rich vascular source and makes 5% of the cardiac output sensitive to embolism (cardiogenic, aortic, paradoxical). In addition, it is rarely affected by malignant hematological disorders that increase the risk of thrombosis. However, SI is a rare event. In a retrospective 10-year series with 196.625 patients, only 32 patients with a diagnosis of SI were found - 0.016% of admissions (Schattner et al., 2015).

3.5. Protection for Covid-19 during the surgery

In the first reports of the COVID-19 outbreak, infection rates of up to 29% were identified among healthcare professionals (Tang et al., 2020; Pan et al., 2020; Tang et al., 2020). All procedures for virus infection should be performed by experienced personnel. Patients should be prepared in negative pressure isolation rooms. All laboratory samples should be used carefully. Procedures should be performed with appropriate personal protective equipment for surplus contact measures in the air, including N95/filtering face piece 2 (FFP2) mask, apron, cap, eye protection. The heart-lung machine should be considered as the main source of splash and aerosol production; therefore, a higher level of protection (eg The Association for the Advancement of Medical Instrumentation [AAMI] Level 3 or equivalent) should be considered. Heparinization is recommended from the upper limit. Active clotting time is not a strong indicator at that time. If available, viscoelastic test is the most suitable option. If not, active partial thromboplastin time is a more useful test for monitoring. In patients with multiple thrombosis during cardio pulmonary bypass (CPB) or extracorporeal membrane oxygenation (ECMO) / extracorporeal life support (ECLS), direct thrombin inhibitors may be an alternative in experienced centers. Accumulating evidence suggests that a subgroup of patients with severe COVID-19 may have cytokine storm syndrome. It is recommended identifying and treating hyperinflammation using existing, approved treatments with proven safety profiles to meet the need to immediately reduce rising mortality rates (Günaydın, 2020).

As a result, the rapidly spreading COVID-19 epidemic throughout the world has been the major cause of both emotional and biological distress. It is observed that new neuro cardiac and thromboembolic complications appear in individuals with TTS, in which excessive catecholamine discharge occurs in the face of distress. The operation of the surgical team involved in the treatment of life-threatening complications under special isolation measures requires reducing the patient's emotional distress and adding anticoagulant therapy to the current treatment at a higher dose. Since the biomolecular mechanism of thrombotic reactions occurring under distress is not known exactly, it should be studied in detail.

Conflict of interest

None to declare.

Acknowledgments

None to declare.

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