



“Lockdown-thrombosis”—an unexpected problem of the COVID-19 pandemic?

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Abstract

Seated immobility thromboembolism syndrome (SIT) is the association of prolonged seated immobility with increased risk of venous thromboembolism (VTE). The advent of COVID-19 resulted in implementation of lockdowns to curb its spread. This resulted in compulsory work from home and minimization of outdoor activities. Consequently, this would have likely led to increased prolonged sitting and reduced mobility. Few case reports and studies have observed an increase in VTE incidence during the lockdown period. We likewise performed a clinical audit of our weekly thrombosis clinic cases and revealed three cases of VTE associated with prolonged sitting during Singapore’s COVID-19 lockdown. Notably, all had other minor VTE risk factors in addition to prolonged sitting. All cases had intermediate-high risk pulmonary embolism and were given extended anticoagulation. With the pandemic still ongoing, periodic lockdown and quarantine measures may continue to be imposed. While the overall VTE risk conferred by prolonged seated immobility associated with lockdown measures is likely to be small, this risk can be easily mitigated and possibly prevented by simply staying mobile.

Highlights

- 1. Prolonged seated immobility is a weak VTE risk factor and is possibly more a compounding risk factor in the presence of other VTE risk factors, rather than an independent risk factor on its own.
- 2. Workup for unprovoked VTE should be undertaken in patients with VTE events with seemingly no other risk factors and only a reported prolonged seated immobility.
- 3. Reducing VTE risk associated with prolonged seated immobility by staying mobile is simple and effective.
- 4. Public healthcare education during lockdown periods should encompass encouraging people to stay mobile even in the confines of their home.

Keywords COVID-19 · Lockdown · Venous thromboembolism · Seated immobility syndrome · Prolonged sitting

Introduction

When COVID-19 first broke out in early 2020, many countries attempted to control the spread of the virus by

implementing lockdowns. Majority of a country’s population had to work from home and consequently had increased hours of sitting in front of computers and home entertainment systems. This raised the concern of a possible increase in incidence of seated immobility thromboembolism syndrome (SIT). SIT was proposed in 2005¹ and encompasses venous thromboembolism (VTE) related to prolonged seated immobility (SI) at work, long distance travels and sedentary lifestyle activities such as computer gaming ². In Singapore General Hospital, we performed an internal clinical audit and identified three VTE cases diagnosed during the lockdown period that were potentially related to SIT. We present these cases and review the current literature.

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Case series

VTE cases were classified as possible lockdown-related if they fulfilled two of the following criteria:

1. VTE occurred during and till one month after lockdown.
2. VTE occurred without major clinical risk factors for VTE including surgery, trauma, major illness such as cancer, infection and thrombotic diseases, pregnancy, puerperium, on oral contraceptive pills, recent air travel within three months, and known acquired or inherited thrombophilia.

Singapore implemented a lockdown from 7 April to 1 June 2020. Our clinical audit of all new VTE cases referred to our Thrombosis Clinic between 7th April 2020 and 1st July 2020 revealed seven VTE cases, of which three were deemed possibly lockdown-related (Table 1). The cases are highlighted below.

Case 1

A 56-year-old school teacher with hypertension, hyperlipidaemia and knee osteoarthritis presented with new onset chest pain in May 2020. He had been working from home during the lockdown and reported prolonged sitting of six hours daily. He was diagnosed with bilateral central pulmonary embolism (PE) with right heart strain and right lower limb deep vein thrombosis (DVT).

Case 2

A 67-year-old housewife presented with three days of shortness of breath in May 2020. She reported prolonged sitting in front of computer during lockdown. The duration of prolonged sitting was not clear from the documentation. She had a history of left breast cancer in 1997 of which she underwent left mastectomy followed by chemotherapy and a course of tamoxifen. She was diagnosed with bilateral PE extending to segmental branches with right heart strain. In view of her history of breast cancer, computed tomography of abdomen and pelvis (CTAP) and mammogram were performed during admission. They were negative for malignancy.

Case 3

A 68-year-old security guard with hypertension, hyperlipidaemia, diabetes mellitus and chronic venous insufficiency (CVI) presented with shortness of breath and syncope in May 2020. He reported prolonged sitting of up to five hours at his work desk and prolonged sitting, exact duration

Table 1 Thrombosis cases during Singapore lockdown

	Case 1	Case 2	Case 3
Age	56	67	68
Gender	Male	Female	Male
Thrombosis	PE + DVT	PE	PE + DVT
Right heart strain	Present	Present	Present
Cardiac markers (Troponin, Pro-BNP)	Both raised	Pro-BNP raised	Both raised
Lupus anticoagulant	Positive initially while on Rivaroxaban Negative when repeated 6 months later	Negative	Not done
Anti-cardiolipin IgG and IgM	Negative	Negative	Not done
Computed tomography of abdomen and pelvis	Not done	No malignancy	No malignancy
Other VTE risk factor	BMI 34.4 kg/m ²	BMI 27.5 kg/m ²	Weight 106 kg, height not available History of chronic venous insufficiency
Extended anticoagulation	Yes	Yes	Yes
Occupation	School teacher	Housewife	Security guard
Seated immobility	Worked from home with prolonged sitting of 6 h daily during lockdown	Prolonged sitting in front of computer during lockdown	5 h of continuous sitting at work due to knee pain

DVT: deep vein thrombosis; PE: pulmonary embolism; BMI: body mass index; VTE: venous thromboembolism

uncertain, at home during the lockdown period. In addition, on the day of syncope, he had been sitting at his work desk for five continuous hours. He was diagnosed with bilateral PE with right heart strain and right lower limb DVT. CTAP was negative of malignancy.

Discussion

Till date, there is no universally accepted definition of “prolonged sitting”. The exact seated duration and duration spent sitting without getting up to precipitate a DVT remains unknown. Numerous definitions have been proposed with duration of prolonged sitting ranging from six to twelve hours 2–7. The inability of patients to give an

accurate history of duration of their prolonged sitting results in creating a universally accepted definition challenging.

Lockdowns during the COVID-19 pandemic likely led to prolonged sitting in front of computers for work purposes or on couches for entertainments. This provided a unique opportunity to observe if there would be an increase in incidence of VTE during the lockdown period. Will “lockdown-thrombosis” become part of the SIT syndrome? Cheng et al. described the first case of lockdown related VTE—a 40 year-old man who spent nine hours at his desk bound job and six hours watching TV during a quarantine period developed PE twelve days after his quarantine ended 8. This was followed by a few others as summarized in Table 2. Two larger studies were firstly, an observation in Spain which saw an increase in PE cases during the lockdown period compared the same period the year before (17 versus 9). This study however suggested immobility, defined as quarantine in the study, as a compounding factor in patients who already had strong risk factors for VTE rather than prolonged seated immobility as an independent predictor on its own 9. Secondly, a retrospective study by Karaali et al. reported an increase in incidence of deep vein thrombosis (DVT) during its lockdown compared to the same period the year before (0.084% vs. 0.017%) and suggested that quarantine measures could have led to the increase 10.

To date, reports on what we would propose as “lockdown thrombosis” are still uncommon. While prolonged immobility has been studied and shown to be associated with an increase in VTE events, in the VTE cases that were reported during lockdown periods, the majority of patients had other VTE risk factors. This was similar to our observations where two of three of our cases had other weak VTE risk factors like high BMI and CVI in addition to prolonged seated immobility. Given the heterogeneity of cases and with no universally accepted definition of what duration would constitute prolonged seated immobility, it is more plausible to believe that prolonged sitting would trigger VTE in patients who have other risk factors for developing VTE. As such, the workup for VTE should still be undertaken in these patients with VTE events with seemingly no other risk factors and only a reported prolonged seated immobility.

All our three cases had intermediate-high risk PE (right heart strain with raised cardiac markers). This shows that SIT can be severe. As we recognized seated immobility as a minor VTE risk factor with potentially severe consequences, all three patients were advised on extended anticoagulation. Although the definitive period of anticoagulation for SIT has not been directly studied, extended anticoagulation is consistent with the recommendations by the 2019 European Society of Cardiology Guidelines 11. In cases in which patients decline extended anticoagulation, end of treatment assessments such as D-dimer testing and Doppler

Table 2 Summary of case reports on thrombosis during COVID-19 lockdown

Authors	Patient	Type of thrombosis	BMI	Other VTE risk factors ^a	Sitting/Immobility duration
Cheng et al. 8	40-year old man	Bilateral PE and left lower limb DVT	26.5	NA	9 consecutive hours of desk-bound work and 6 h of watching television
Speletas et al. 12	18-year old man	Left lower limb DVT	Reported as non-obese	Factor V leiden heterozygosity	10 consecutive hours seated in front of computer
Ali et al. 13	45-year old man	Bilateral PE and right lower limb DVT	24	NA	8 consecutive hours seated in front of computer
Franch-Llasat et al. 14	16-year old male	Bilateral PE	21	Positive lupus antibody	2 consecutive hours seated, total sitting duration 6 h
	36-year old male	Bilateral PE	28	NA	2 consecutive hours seated, total sitting duration 8 h
	44-year old male	Bilateral PE	36	NA	1.5 consecutive hour seated, total sitting duration 9 h
	49-year old male	Bilateral PE	32	Recent surgery,	2 consecutive hours seated, total sitting duration 10 h

DVT: deep vein thrombosis; PE: pulmonary embolism; NA: Not reported

^a Other risk factors based on Padua prediction score for Risk of VTE include active cancer, previous venous thromboembolism, thrombophilia, recent trauma/surgery in ≤1 month, heart or respiratory failure, acute myocardial infarction/ischemic stroke, acute infection/rheumatologic disorder, ongoing hormonal treatment

ultrasound of the affected limb may provide additional information to evaluate the risk of VTE recurrence and to assist the discussion and decision-making process on anticoagulation duration between the patients and the clinicians.

Conclusions

Even as countries start to live with the COVID-19 pandemic, periodic lockdown and quarantine measures may be imposed to stamp out severe waves of infection and thus “lockdown thrombosis” remains relevant. Current observations can contribute to future public education policies in the event that similar emergencies were to happen again. Although the overall VTE risk conferred by prolonged seated immobility associated with lockdown measures is likely to be small, this risk can be easily mitigated and possibly prevented—by staying mobile. Simple measures including scheduled, regular exercise or physical activities and avoiding sitting in front of the desk for an extended period of time should be encouraged during lockdown periods.

Authors' Contribution CE, JYT and CWT analyzed the data and drafted the manuscript; CE and CWT obtained patient data; CE, CWT and HJN designed the study, interpreted the results, and revised the manuscript; and all authors read and approved the final version of the manuscript.

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Declarations

Conflict of interest The authors report that they have no competing interests or financial disclosures to declare.

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