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Simultaneous acute pulmonary embolism and isolated septal myocardial infarction in a young patient

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Introduction

While the overall incidence of myocardial infarction (MI) has been decreasing since 2000 [1], there is an increasing number of younger patients presenting with MI [2]. Few studies have focused on MI in very young patients, aged 35 years or less, as they only account for a minority of all patients with myocardial infarction [3]. According to the age category, MI differs in presentation, treatment and outcome, as illustrated in *table 1*.

Echocardiography is considered mandatory according to scientific guidelines in the management and diagnosis of MI [4,5,6]. However, new imaging techniques such as cardiac magnetic resonance (CMR) and computed tomography (CT) are increasingly performed and enable further refinement of the diagnosis of MI. These techniques allow, in particular, precise location and quantification of MI. In this case, MI was located to the septum, which is an unusual presentation of MI.

The incidence of pulmonary embolism (PE) has also increased in young patients over the past years [7]. Since symptoms and signs of PE may be non-specific, establishing its diagnosis remains a challenge [8]. Therefore, PE is one of the most frequently missed diagnosis in clinical medicine.

Because of the widespread use of CT and its improved visualization of pulmonary arteries, PE may be discovered incidentally [9]. In the absence of a congenital disorder, multiple and/or simultaneous disease presentation is uncommon in the young.

We report the rare case of a 35 year old male with isolated septal MI and simultaneous PE. The diagnosis of this rare clinical entity was only possible by means of newer imaging techniques.

	MI in patients <39 years	MI in patients >39 years
Risk factors	More smoking, dyslipemia, family history of coronary heart disease, comorbid conditions	More likely to have a history of diabetes mellitus, hypertension and angina
Symptoms	Less symptoms, atypical chest pain, rarely signs of heart failure	Common signs such as chest pain, dyspnea, signs of heart failure
ECG properties	More STEMI, more Q-wave MI	Significantly more NSTEMI, more left bundle branch block
Angiographic findings	Less diffuse atheroscleric lesions	
Treatment	More likely to receive guideline-recommended treatment More primary percutaneous coronary intervention and thrombolysis	More use of angiotensin-converting inhibitors and calcium antagonists Time from the onset of the symptoms to reperfusion higher
Outcome	Excellent, significantly less mortality	More in-hospital mortality More complications such as atrial fibrillation/flutter and atrio-ventricular block, greater incidence of heart failure post-infarction

Table 1. Clinical characteristics of MI in the young versus patients aged >39 years [10, 11, 12, 13].

Methods

The aim of this case report was to describe a rare clinical entity and to explain why these two pathologies were present at the same time in a young patient.

A review of literature was established, focusing on the young patient under 39 years. 20 out of 150 articles were selected based on relevance and more recent date of publication, on databases such as Pubmed, Sciencedirect and on books. A non-exhaustive list of keywords used for searching the relevant publications is shown in the appendix. The search focused on articles in English. Furthermore, PE in young women was not considered. Population trends, cohort studies, meta-analyses, case reports and guidelines were included. Literature confirmed the uniqueness of our case, and few

articles focusing on MI of the young or PE of the young were found. Articles about isolated septal MI were even more poorly described : four case reports were found, out of which only one appeared relevant.

A meeting with an interventional radiologist was organized for recollection of the images, analysis of cardiac CT imaging and MRI to confirm the septal localization, review the extend of PE and confirm the acute feature of these two events. To try to explain the double diagnosis of this young patient, a multidisciplinary discussion with specialists was organized. An interventional cardiologist, an interventional radiologist and a lung specialist were invited for a presentation of the case and reviewing of the images. Based on clinical, laboratory and imaging features, a consensus was established. Interpretation of laboratory data and coagulation test with the haematologist was performed separately. The follow-up of the patient was discussed with the cardiologist in charge of the patient.

Overall, this case report has taken about 400 hours of full-time work.

Case presentation

A 35-year-old male patient presented to the emergency department with typical retrosternal chest pain. A first episode of respiratory chest pain had occurred 4 days before with spontaneous disappearance. Cardiovascular risk factors included smoking and class II obesity. Electrocardiography (ECG) demonstrated evolution from a normal ECG to the development of a new right bundle branch block on the day of admission [*fig1*].

Troponins T were elevated at 1.93 ng/mL (normal value : < 0.01 ng/mL). Immediate coronary angiography revealed a non significant lesion of the left anterior descending artery (LAD) suggesting plaque rupture extending into an occluded first septal branch [*fig2*]. Subsequent coronary CT angiography scheduled to characterize the plaque at the level of LAD confirmed this diagnosis and revealed fortuitously multiple segmental acute PE of left segments 6, 9 and 10 [*fig3*]. Echocardiography revealed a maintained left ventricular ejection fraction with localised septal akinesia. It also revealed a moderate patent foramen ovale at valsalva maneuver. Finally CMR confirmed the diagnosis of

isolated septal myocardial infarction [*fig4*]. Total creatine kinase rose up to a level of 663 U/L (normal range : 25-190 U/L) and further investigation demonstrated a heterozygous Factor V Leiden mutation.

A conservative strategy was chosen and secondary prevention with aspirin, ACE inhibitor, beta blocker and statins was introduced. Furthermore, because of the diagnosis of PE, oral anticoagulation with warfarin was started.

At present, three years after the initial presentation, the patient is asymptomatic. Furthermore, he does not present any bundle branch block anymore.

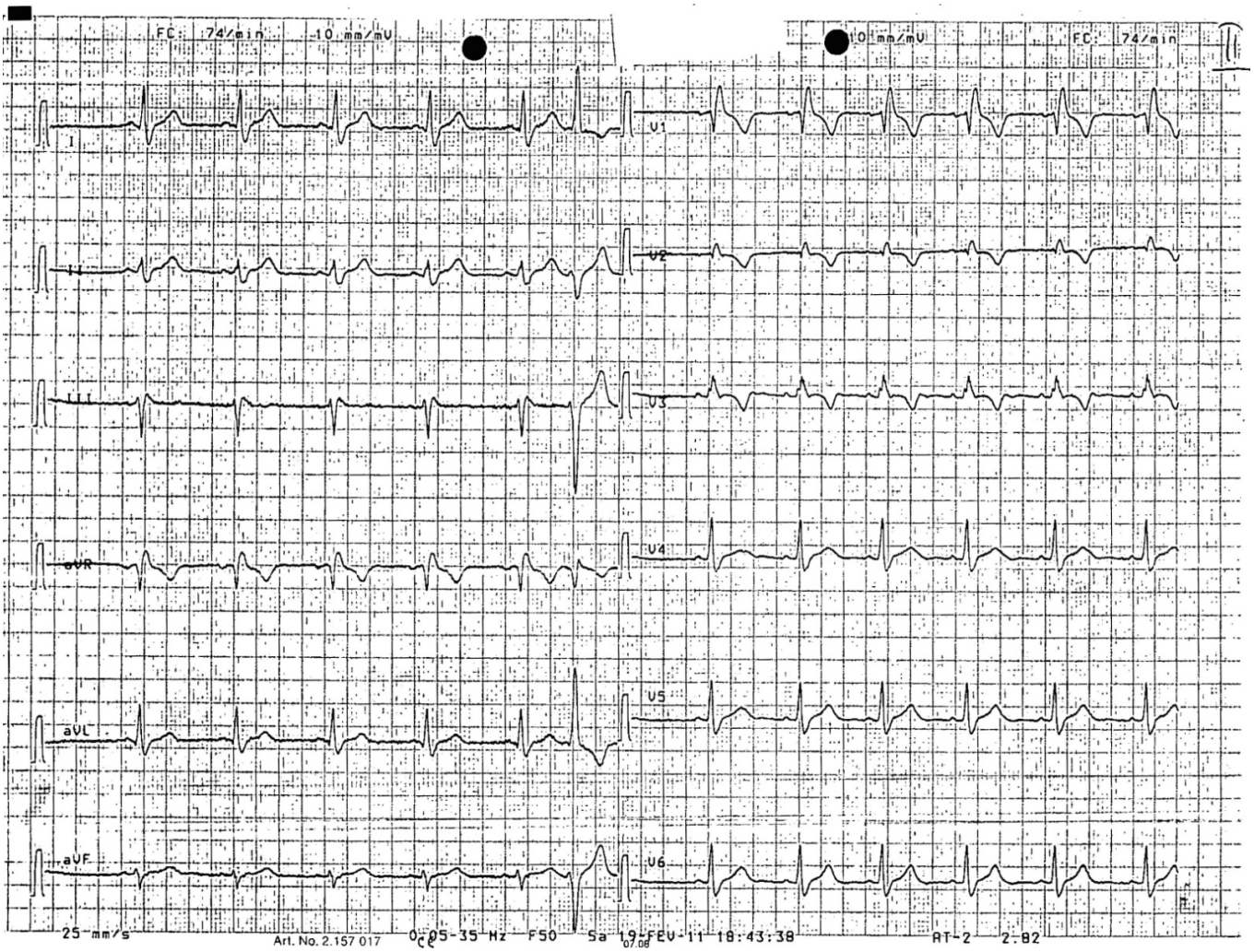

Fig 1. ECG on the day of admission showing a new right bundle branch block.

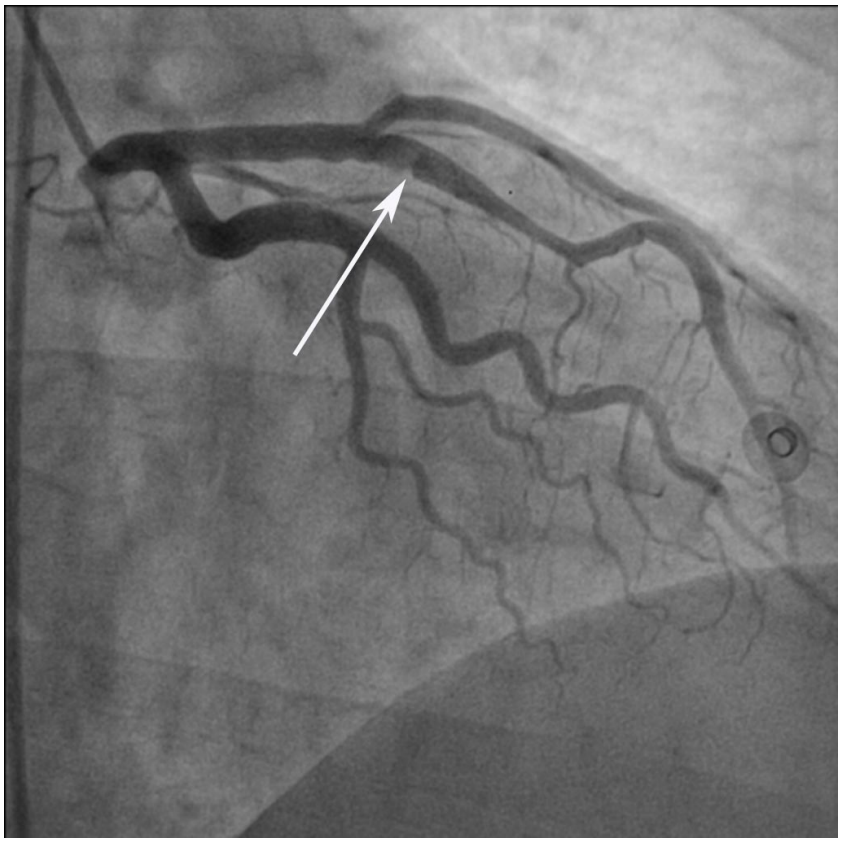

Fig 2 Selective left coronary angiography demonstrating (arrow) sight of the plaque rupture at the level of the mid-LAD and absence of the septal branch.

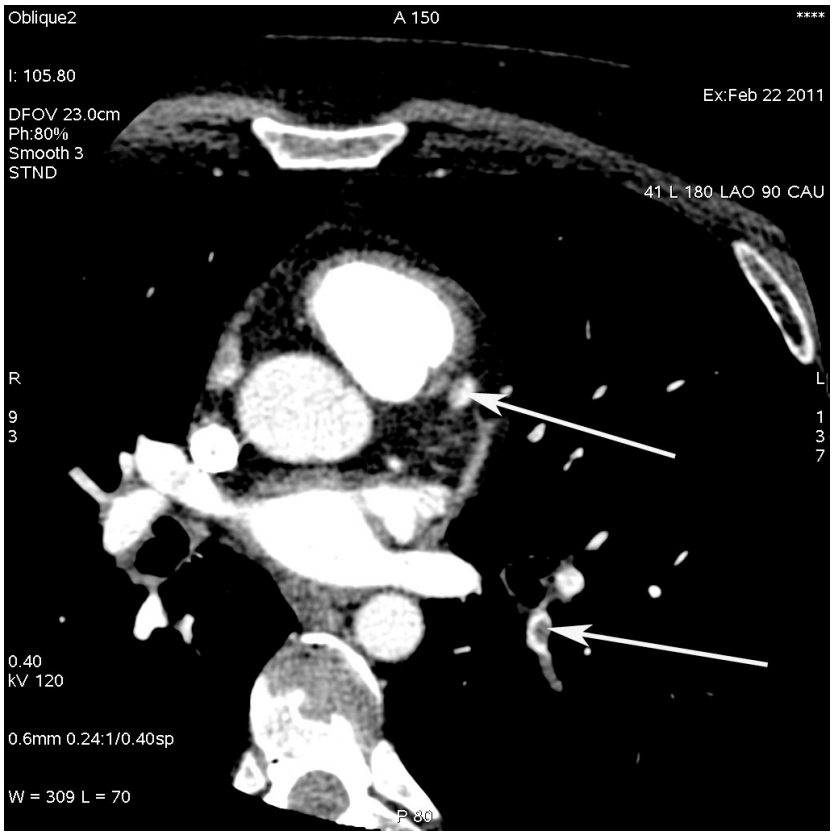

Fig 3 Enhanced cardiac CT (axial transverse image) that demonstrates homogenous non calcified plaque in proximal LAD (upper arrow) and segmental PE (lower arrow).

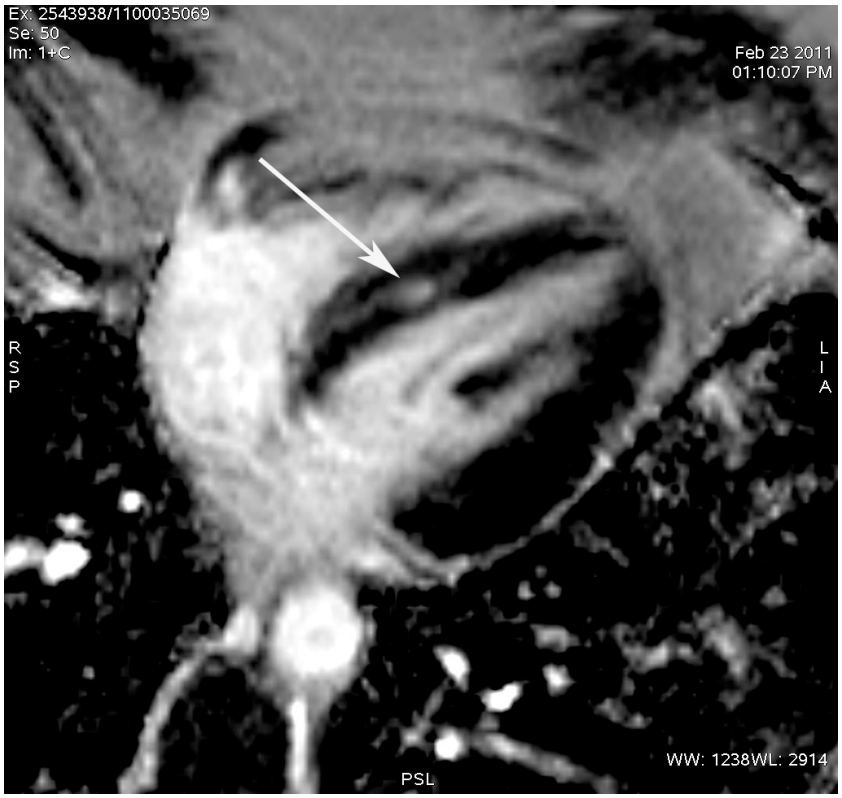

Fig 4 Late enhancement CMR sequence after gadolinium injection in four chamber view, showing a focal mid-mural enhancement in the anterior septum (arrow), highly suggestive of myocardial infarct in the territory of the first septal branch.

Discussion

To our knowledge, this is the first description of isolated septal MI with simultaneous a-/or paucisymptomatic PE in a young patient.

On admission the diagnosis of acute coronary syndrome was evident, based on the clinical presentation, biomarkers rise and ECG changes. The appearance of a new RBBB on ECG together with the angiographic findings suggested the presence of an isolated septal MI, which was confirmed by CMR. In this case, limited plaque rupture at the level of the mid-LAD occluded accidentally the septal branch, causing septal MI.

MI in the young has been poorly described, young patients aged 35 years or less representing less than 1% of all patients with MI [10]. However, the incidence of MI in the young is increasing [2] with smoking being the most important risk factor [10].

Isolated septal MI has previously only been reported a few times, mainly because of the lack of accurate diagnostic imaging techniques [14]. According to European and American guidelines, echocardiography is mandatory but CMR is considered optional [4,5,6]. Nevertheless, CMR imaging is useful to assess myocardial viability and precise location of MI [5,15], which in our case confirmed focal septal localization of infarction.

Acute PE was incidentally discovered on chest CT intended for further evaluation of the lesion of the LAD. An increasing number of asymptomatic PE are being detected due to an increased spatial resolution and a better visualization of peripheral arteries on CT scanning. According to a recent meta-analysis [9], the prevalence of incidental PE is 2.6%. Untreated, it may be associated with higher recurrence rate and mortality [16, 17] The patient presented respiratory chest pain four days before admission, which may indicate the onset of the PE. The main risk factors for incidental PE are advanced age, recent surgery and the presence of cancer[18], all of which were absent in our case.

The association of PE and isolated septal MI in young patients has never been described. Furthermore, multiple and/or simultaneous disease presentation is rare in young patients. Despite moderate patent foramen ovale on echocardiography, paradoxical embolism was ruled out. The patient didn't present any pulmonary hypertension which could have induced right-to-left shunting, multiple pulmonary segments were affected by PE and coronary angiography strongly suggested atheroma rupture.

After extended investigations, no explanation linking the two events was found. Research for deep vein thrombosis resulted negative, and there was no central venous catheter placement, which could also have been a risk factor for PE. Nevertheless, PE and MI share common risk factors such as smoking and obesity, which the patient presented. Research of thrombophilia only revealed heterozygous Factor V Leiden mutation (activated protein C resistance), which according to a literature [19] significantly increases the risk of venous thromboembolism by a 9.45-fold. It represents the most common inherited cause of an increased risk of venous thrombosis and occurs in approximately 4% of Caucasian factor V alleles [20].

An obvious limitation of this study is its uniqueness, and therefore the topic was poorly described in literature. This feature represents at the same time also an advantage and opens the possibility to make an original contribution to the literature. Another methodological weakness may rely in the under-reporting of such combined cardiothoracic events in the literature. This under-reporting can originate from either under diagnosis or by neglecting the medical significance, judging it is not worth

publishing such case reports. In the case of submitting such publication, the authors may have also faced rejection of their manuscript, hence with no findings in the medical databases. The strengths of this case report were its extended medical documentation with the availability of the most recent and sophisticated imaging techniques .

With the increasing incidence of MI in the young and the rapidly improving performances of imaging techniques for the diagnosis of asymptomatic PE, such cases are likely to become more frequently identified in the future. Potential loss of life-years are more dramatic in these very young patients, thus retrosternal chest pain should be more carefully studied in this population. Furthermore, isolated septal MI should be considered in the presence of RBBB on ECG and at subocclusion of a large septal branch.

The simultaneous occurrence of two unfrequent events in a single patient raises the question of a potential causal relationship. It was beyond the scope of this study to explore this particular point. However, the distinct pathophysiological mechanisms that lead to MI or PE, the absence of any coagulation abnormalities, together with the absence of such correlation in the medical literature, make such a link very unlikely.

Conclusion

In conclusion, this is a unique case of isolated septal MI presenting simultaneously with PE in a young patient. This presentation was probably fortuitous, but worth reporting to our opinion.

Isolated septal MI should be considered in the presence of RBBB at sub-occlusion of a large septal branch. The final diagnosis can optimally be confirmed by CMR.

An increasing number of asymptomatic PE are being detected due to the advances in CT scanning. This is important because if untreated, incidental PE may be associated with higher recurrence rate and mortality.

References

1. Yeh RW, Sidney S, Chandra M, Sorel M, Selby JV, Go AS. Population Trends in the Incidence and Outcomes of Acute Myocardial Infarction. *N Engl J Med*. 2010;362(23):2155-65.

2. Radovanovic D, Nallamothu BK, Seifert B, Bertel O, Eberli F, Urban P, et al. Temporal trends in treatment of ST-elevation myocardial infarction among men and women in Switzerland between 1997 and 2011. *Eur Heart J Acute Cardiovasc Care.* 2012;1(3):183-91.

3. Anderson RE, Pfeffer MA, Thune JJ, McMurray JJV, Califf RM, Velazquez E, et al. High-risk myocardial infarction in the young: The VALsartan In Acute myocardial INfarcTion (VALIANT) trial. *Am Heart J*. 2008;155(4):706-11.

4. Steg G, James SK, Atar D, Badano LP, Blömstrom-Lundqvist C, Borger MA, et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *Eur Heart Jour*. 2012;33:2569-2619.

5. Hamm CW, Bassand JP, Agewall S, Baex J, Boersma E, Bueno H, et al. ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. *Eur Heart Jour*. 2011;32:2999-3054.

6. Amsterdam EA, Wenger NK, Brindis RG, Casey DE, Ganiats TG, Holmes DR, et al. 2014 AHA/ACC Guideline for the Management of Patients With Non-ST-Elevation Acute Coronary Syndromes: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation.* 2014;000:16-18.

7. Santosa F, Moysidis T, Moerchel C, Kröger K, Bufe A. Pulmonary embolism in young people, trends in Germany from 2005 to 2011. *Hamostaseologie*. 2014;34(1):88-92.

8. Schulman S, Advances in the management of venous thromboembolism. *Best Practice & Research Clinical Haematology*. 2012;25:361–377

9. Dentali F, Ageno W, Becattini C, Galli L, Gianni M, Riva N, et al. Prevalence and Clinical History of Incidental, Asymptomatic Pulmonary Embolism: A Meta-Analysis. *Thromb Res*. 2010;125(6)518-22.

10. Schoenenberger AW, Radovanovic D, Stauffer JC, Windecker S, Urban P, Niedermaier G, et al. Acute coronary syndromes in young patients : Presentation, treatment and outcome. *Int Jour Cardiol*.2011;148:300-304.

11. Doughty M, Mehta R, Bruckman D, Das S, Karavite D, Tsai T, et al. Acute myocardial infarction in the young— The University of Michigan experience. *Am Heart J.* 2002;143:56-62.

12. Morillas P, Bertomeu V, Pabón P, Ancillo P, Bermejo J, Fernández C, et al. Characteristics and Outcome of Acute Myocardial Infarction in Young Patients, The PRIAMHO II Study. *Cardiology*. 2007;107:217–225.
13. Goliasch G, Oravec S, Blessberger H, Dostal E, Hoke M, Wotja J, et al. Relative importance of different lipid risk factors for the development of myocardial infarction at a very young age (≤ 40 years of age). *Eur J Clin Invest.* 2012; 42 (6): 631–636
14.Yamazoe M, Mizuno A, Nishi Y, Niwa K. Usefulness of multimodality imaging on detecting plaque rupture in septal myocardial infarction associated with right bundle branch block. *Int J Cardiol*. 2014;172(1):71-3.
15. Rajiah P, Milind YD, Kwon D, Flamm SD. MR Imaging of Myocardial Infarction.*RadioGraphics.* 2013; 33:1383-1412
16. Bělohlávek J, Dytrych V, Linhart A. Pulmonary embolism, part I: Epidemiology, risk factors and risk stratification, pathophysiology, clinical presentation, diagnosis and nonthrombotic pulmonary embolism. *Exp Clin Cardiol*. 2013;18(2):129-138.
17. Brown MD, Espinosa JA, Shih RD, Silvers SM, Wolf SJ, Decker WW. Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department With Suspected Pulmonary Embolism. Ann Emerg Med. 2011;57:628-652.
18. Fred HL. Unsuspected Pulmonary Thromboemboli, A Continuing Clinical Challenge . *Texas Heart Institute Journal.* 2013;40,10-12.
19. Gohil R, Peck G, Sharma P. The genetics of venous thromboembolism. A meta-analysis involving approximately 120,000 cases and 180,000 controls. *Thromb Haemostas.* 2009;102: 360–70.
20. Hoffbrand AV, Moss PAH, Pettit JE.Thrombosis and antithrombotic therapy. In: Sugden M, Huxley R, editors. Essential haematology. Wiley-Blackwell; 2006. p.303-319.

Appendix

Non-exhaustive list of keywords used for the review of literature :

- Myocardial infarction in the young
- Myocardial infarction, population trends
- Pulmonary infarction, population trends
- Diagnosis of Pulmonary Embolism
- Pulmonary embolism, imaging techniques
- Myocardial infarction, imaging techniques
- Myocardial infarction, risk factors, young
- Pulmonary embolism, young
- Leiden V factor
- Paradoxical embolism
- Myocardial infarction and pulmonary embolism
- Asymptomatic pulmonary embolism
- Incidentalomas, pulmonary embolism
- Septal myocardial infarction