

Acute coronary syndrome associated with occlusion of the main trunk of the left coronary artery in patients with a previously negative exercise stress test

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Abstract

Objective. A case report of a patient with acute coronary syndrome with occlusion of the left main coronary artery with a typical clinical picture and a negative exercise stress test result.

Case report. A 44-year-old patient is presented to our service as STEMI with elevation in the inferior leads and ST depression in the precordial leads. After intrahospital cardiac arrest and resuscitation, primary PCI of left main coronary artery is performed, after which hemodynamic stabilization occurs. Retrospective review of medical history reveals that he was evaluated three years before the acute event due to occasional chest pain. The pretest probability for coronary heart disease was 38%, so in accordance with the then valid ESC guidelines for stable coronary heart disease, a stress ECG test was performed, which was assessed as negative for significant coronary heart disease. All analyzed test parameters indicated a low risk of adverse cardiovascular events: functional capacity, ST segment denivelation, chronotropic competence, blood pressure variations, Duke treadmill score. With a posttest probability of 9%, the patient was not further evaluated for coronary heart disease and was asymptomatic for the next three years and did not respond to follow-up examinations. If he presented himself after 2019 according to the newer ESC guidelines for chronic coronary syndromes, the patient would be indicated to perform a functional imaging test or CT coronary angiography at the time of the initial clinical evaluation.

Conclusion. The diagnostic algorithm for patients with chest pain is based on a pretest probability that determines further diagnostic workup. Patients with a negative exercise test and a typical clinical presentation should be referred for further diagnostic imaging test because of the risk that a small number of them may have significant and even critical coronary stenosis.

Key words pretest probability, coronary artery disease, CAD, ECG stress test, cardiovascular adverse events

Introduction

Chest pain is a common problem in everyday clinical practice. Of all visits to a general practitioner in the UK, 1% are due to chest pain. The importance of this cardinal clinical symptom is evidenced by the fact that mortality was doubled in the year after the presentation of a patient with chest pain¹. Since the introduction of invasive coronary angiography (ICA) into routine clinical practice, it has become the gold standard for the diagnosis of coronary artery disease (CAD)² and in the United States alone about 1.1 million procedures³ are performed each year. However, due to the wide availability of the method, there is an expansion of indications for referral of patients to ICA and only 41% of patients have obstructive CAD⁴. Therefore, there is a need to use non-invasive methods to assess the likelihood of CAD. This is achieved by determining the pretest probability (PTP) for the CAD. One of the oldest in

use is the Diamond and Forrester method, which uses the patient's age, gender and chest pain typicality for coronary heart disease⁵ in the pretest probability assessment. More recently, the European Society of Cardiology (ESC) has used a modified version of this model⁶.

Case presentation

A 41-year-old patient presented to outpatient clinic for atypical chest pain. He had positive family history, was a smoker and had dyslipidemia with total cholesterol 6.1 mmol/L and an LDL fraction of 4.3 mmol/L. The patient was referred to a stress electrocardiographic test that was performed on an ergobicycle in December 2016 using the Bruce protocol. The PTP for CAD was 34%. The test was interrupted at 2th minute of V level at 223W workload and 10.9 MET due to patient fatigue, no angular discomfort, no ST segment denivelation, and heart

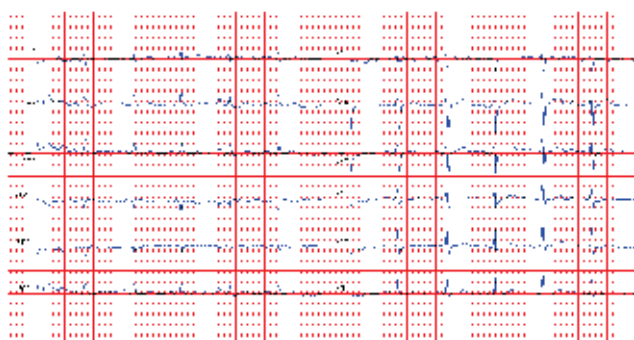


Figure 1. ECG at the beginning of the stress test

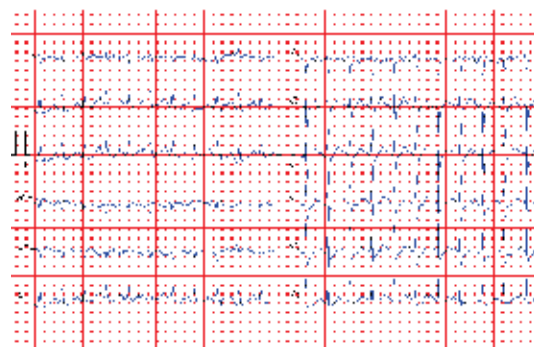


Figure 2. ECG in peak workload of 220W

rhythm disturbances. A heart rate of 179/min (91% of maximum predicted), a BP of 190/100 mmHg, and a double product of 34010 were achieved (Figures 1 and 2). The test was rated as negative for significant CAD with a calculated post-test probability of 9%.

Three years later, in August 2019, the patient presented with myocardial infarction with ST segment elevation in D2, D3, aVF and deep ST segment depression in leads V1-V4 (Figure 3) with intrahospital cardiac arrest immediately upon admission to the Internal Department of the Zajecar Health Center. The patient was resuscitated for about 40 minutes using advanced life support measures including 8 asynchronous DC shocks and 20 ampules of Adrenaline. After that, he recovered cardiac activity with a frequency of 25 / min and an complete heart block, the patient was placed on mechanical ventilation, and a temporary pacemaker lead was placed. Coronary angiography verifies the occlusion of the distal segment of the left main coronary artery. After placement of coronary wires in the distal segments of LAD and Cx (Figure 4), the lesion was predilatated with a Sprinter Legend 2.5x15mm balloon and then implanted with a Resolute Onyx 4.5x18mm stent in LM-LAD with provisional technique and excellent angiographic result with TIMI3 flow through LAD and Cx arteries (Figure 5). The patient was hemodynamically stable, following intervention. After 24 hours, control coronary angiography conformed patent stent. In the further course of hospitalization, clinical improvement occurs with weaning the patient from mechanical ventilation. Echocardiography registers the left ventricle diameter of 66/43mm, left ventricular ejection fraction of 35-40% with hypoakinesia of distal anterior, septal and lateral walls. The patient was discharged on the 18th hospital day. Four months after the acute event, control coronary angiography was performed with a transradial approach, showing patent coronary arteries without in-stent restenosis, and intermedaite lesion in medial segment of LAD and mild stenosis in RCA. In further clinical follow-up the patient was asymptomatic, with maximal doses of drugs and LDL cholesterol value of 1.5 mmol/L.

Discussion

In patients with chest pain, the first step in the diagnostic algorithm is to determine the pretest probability (PTP). PTP predicts the existence of angiographic stenosis of at least 50% of the diameter of at least one coronary artery. The patient's complaints at the initial pre-

sentation were understood as atypical angina with 2 of 3 features of anginal pain and a calculated pretest probability of 38% for CAD according to the ESC guidelines from 2013⁷. Since he had an normal electrocardiographic finding at rest and preserved functional ability, we decided to perform a stress electrocardiographic test. The test was considered negative.

According to the valid ESC guidelines, at the time of testing, the most important predictors of exercise stress test were: functional capacity, test duration, changes in arterial blood pressure and myocardial ischemia according to clinical and electrocardiographic parameters. Functional capacity was shown as the most important prognostic parameter for mortality and adverse cardiovascular events, regardless of gender, age, presence and severity of CAD^{8,9,10,11,12,13,14}. It can be expressed in metabolic equivalents (1 MET corresponding to O₂ consumption of 3.5ml/kg/ min), workload in watts (W), heart rate at peak load and double product. It has been shown that each achieved MET in the stress test reduces the total mortality and cardiovascular events by 13-15%¹⁵. Another predictor of adverse events is chronotropic incompetence during the stress test. A study of 1575 healthy men who underwent an ECG stress test and were followed for 7.7 years showed that failure to achieve submaximal HR, the level of HR increase during the test, and the chronotropic index were predictors of overall mortality and incidental coronary heart disease¹⁶. Interestingly, according to all parameters, the ergometric test of our patient was clearly low risk. Another widely used and validated predictor of adverse CV events is the Duke treadmill score designed by Mark et al¹⁷. It uses the duration of the test in minutes, the value of the ST segment of denivelation and angina level in the calculation. Low-risk values are 5 and higher, intermediate -11 to 4 and below -11 patients are stratified as high-risk. According to the ESC guidelines, the one-year risk of CV death over 3% was a category of high-risk patients in whom potential revascularization has prognostic significance and they should be referred to ICA⁷. It has been shown that low risk carries only 0.25% of annual CV mortality as opposed to high risk which carries over 5%. Of the patients with calculated low risk, 60% did not have significant obstructive CAD and 16% had single-vessel disease (stenoses over 75% of the diameter were considered angiographically significant). Better test performance was also shown in women and poorer in the elderly¹⁸. Our patient had a Duke score of



Figure 3. ECG at the admission to the Coronary unit – 30 minutes after the onset of chest pain

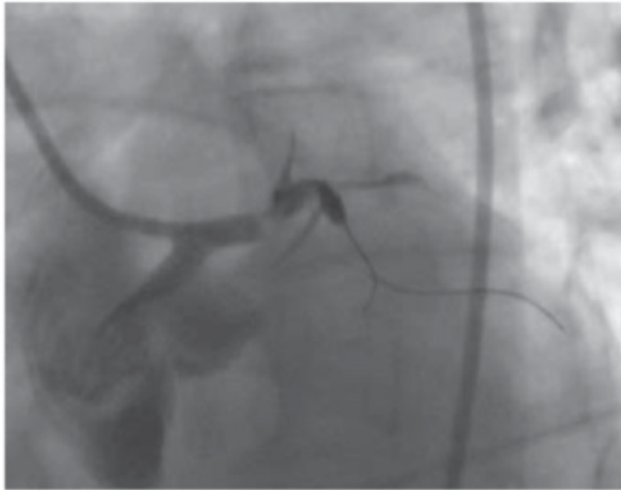


Figure 4. Angio after wiring LAD and Cx

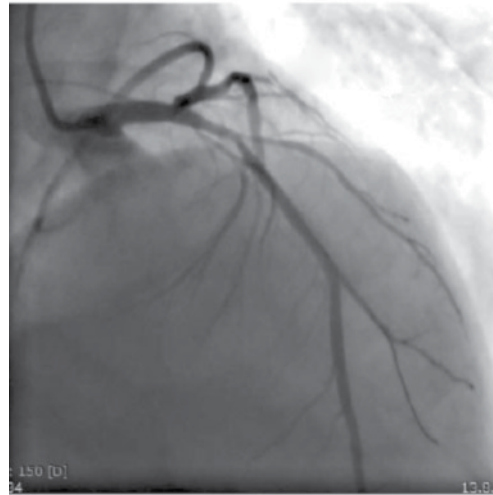


Figure 5. Angio after stent implantation in LM-LAD

+13 which stratified him as low risk for CV events with a one-year mortality below 1%. The question was whether something would change in the diagnostic algorithm and stratification of the CV risk of our patient if he was evaluated in the light of the new ESC guidelines for chronic coronary syndromes from 2019¹⁹. They retained the earlier concept of PTP based on gender, age, and typicality of chest pain with the addition of a PTP assessment for patients presenting with dyspnea only. The values of PTP are noticeably lower because the pooled analysis of three contemporary studies indicated a threefold lower prevalence of CAD than previously considered²⁰. It is recommended that non-invasive diagnostic treatment be performed in patients with PTP over 15%, and in case of refractory angina or if PTP is very high invasive diagnostic assessment. Patients with PTP below 5% have a very low risk of adverse CV events so no further diagnostic workup is required. In patients with intermediate PTP 5-15%, additional diagnostics are indicated according to the factors that modify PTP, giving the so-called clinical probability of CAD. Our patient would have a PTP of 10%. According to the factors that modify PTP (hypertension, smoking, positive family history) and the normal finding of the ECG stress test which is a factor in reducing the clinical probability for CAD, he would also be excluded from further diagnostic workup. But if we stratified the patient based on clinical assessment, we should do a non-invasive functional imaging test or CT coronary angiography, which have better sensitivity and specificity in relation to the specificity of 85-90% and sensitivity of 45-50% of the stress ECG test^{21,22}. In the case of our particular patient, this would mean referring the patient to a stress cardiocardiography test or stress-rest myocardial perfusion scintigraphy. Would

further treatment have a different course? Due to the higher sensitivity, functional imaging would reveal a significant coronary disease and the patient would be referred to ICA. Earlier publications indicate high sensitivity of both stress ECG test and myocardial perfusion imaging in patients with angiographically verified left main stenosis above 50%. In a study of 57 patients with left main stenosis who underwent a stress ECG test according to the Bruce protocol, only 4% of the tests were negative and 9% were non-conclusive. In 91% of patients, the test was stopped before reaching the level IV, the achieved HR was 76 +/- 2% predicted and achieved double product of 20490 +/- 830. Our patient had significantly better test scores compared to the results of this cohort, which calls into question the clinical significance of the putative initially stable atherosclerotic plaque. What distinguishes the patients in this series from ours is the degree of anatomical prevalence of CAD: only 2% had left main lesion as the only one, 32% two vessel and 61% three vessel disease²³. In a study of 101 patients with angiographically significant left main stenosis without previous infarction or myocardial revascularization who underwent SPECT myocardial perfusion imaging in 13% visually and 15% quantitatively there were no significant perfusion defects larger than 5% of the left ventricular myocardium. 56% of patients visually and 59% by quantitative analysis of scans had a high-risk scan (perfusion defect over 10% of left ventricular myocardium). By including nonperfusion variables, primarily transient ischemic dilatation of the left ventricle, it was obtained that 83% of patients with angiographically significant left main stenosis had a high-risk scan. This method, in the conclusion of the researchers, identifies most patients with angiographi-

cally significant stenosis of the left main coronary artery as high-risk²⁴. This method could therefore be of great importance in assessing the functional significance of patients with a potential lesion of the left main coronary artery, especially in patients whose ECG stress test is undiagnostic: resting ECG changes or poor functional capacity of patients. Acute coronary syndrome with dramatically difficult clinical presentation in our patient probably occurred in the field of destabilization of previously angiographically insignificant atherosclerotic plaque. Reviews of patients with a similar clinical scenario have been published - a patient with a negative ECG stress test and achieved functional capacity of 12.1 MET is presented two months after the test as anterior STEMI and two-vessel CAD with occlusion of the proximal LAD²⁵. It has been shown that the long-term prognosis of patients with angiographically nonsignificant stenosis of the left main coronary artery is worse than patients with normal findings based on the CONFIRM register of 5166 patients, 18% of whom had insignificant left main disease (diameter stenosis below 50%). Multivariate analysis concluded that nonsignificant left main stenosis was a predictor of cumulative adverse events (death, myocardial infarction, and revascularization) over a 5-year follow-up period in women (HR 1.78, $p < 0.005$) but not in men (0.98, $p = 0.806$)²⁶.

Conclusion

The diagnostic algorithm for patients with chest pain is based on a pretest probability that determines further diagnostic workup. Patients with a negative exercise test and a typical clinical presentation should be referred for further diagnostic imaging test because of the risk that a small number of them may have significant and even critical coronary stenosis.

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Sažetak

Akutni koronarni sindrom udružen sa okluzijom glavnog stabla leve koronarne arterije kod bolesnika sa prethodno negativnim nalazom stres elektrokardiografskog testa

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Cilj rada. Prikaz slučaja bolesnika sa akutnim koronarnim sindromom sa okluzijom glavnog stabla leve koronarne arterije sa tipičnom kliničkom slikom i negativnim nalazom testa fizičkog opterećenja.

Prikaz slučaja. Pacijent starosti 44 godine prezentuje se našoj službi kao STEMI sa ST segment elevacijom u inferiornim i ST depresijom u prekordijalnim odvodima. Nakon intrahospitalnog srčanog zastoja i sprovedene reanimacije uradi se primarna PCI glavnog stabla leve koronarne arterije nakon čega dolazi do hemodinamske stabilizacije. Retrospektivnom analizom u medicinsku dokumentaciju saznaje se da je tri godine pre akutnog događaja evaluiran zbog povremenih bolova u grudima. Pretest verovatnoća za KB iznosila je 38% pa je u skladu sa tada važećim ESC smernicama za stabilnu koronarnu bolest urađen stres EKG test koji je ocenjen kao negativan za značajnu koronarnu bolest. Svi analizirani parametri testa ukazivali su na nizak rizik od neželjenih kardiovaskularnih događaja: funkcionalni kapacitet, ST segment denivelacija, hronotropna kompetentnost, varijacije krvnog pritiska, Duke treadmill skor. Sa posttest verovatnoćom od 9% pacijent nije dalje evaluiran u pravcu koronarne bolesti i naredne tri godine je bio asimptomatski i nije se javljao na kontrolne preglede. Da se prezentovao nakon 2019. godine po novijim ESC smernicama za hronične koronarne sindrome kod pacijenta bi u trenutku incijalne kliničke evaluacije bilo indikovano uraditi funkcionalni imaging test ili CT koronarnu angiografiju.

Zaključak Dijagnostički algoritam za pacijente sa bolom u grudima baziran je na pretest verovatnoći koja određuje dalji dijagnostički tok. Pacijente sa negativnim testom fizičkog opterećenja a tipičnom kliničkom prezentacijom trebalo bi uputiti na dalju dijagnostičku imaging obradu zbog rizika da mali broj njih može imati i značajnu i čak kritičnu koronarnu bolest.

Ključne reči: pretest verovatnoća, koronarna bolest, EKG stres test, neželjeni kardiovaskularni događaji

Pacemaker lead disposition in an elderly patient - Reel syndrome

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Abstract We present the case of an adult patient with Reel syndrome who had a VVI-mode permanent pacemaker implanted 6 months earlier. X-ray revealed the retraction and winding of the right ventricle chamber electrode around the pulse generator. Subsequently, a new electrode was re-implanted in the right ventricle apex.

Key words Reel syndrome, pacemaker

Introduction

Reel syndrome is an infrequent case of pacemaker dysfunction due to dislocation of the atrial/ventricular or both leads. The cause is the movement of the pulse generator along its long axis in the patient's subcutaneous pocket. This leads to the detachment of the electrode from the point of fixation and subsequent dislocation, retraction and winding of the electrode around the device. It is most often observed in adult patients with cognitive impairment. For the first time, a similar condition (Twiddler Syndrome) was described by Bayliss and Collegium in 1968 as a post-implantation implant of a permanent pacemaker [1], and subsequently reported for implantable cardioverter defibrillators (ICDs)[2], and cardiac resynchronization devices. (CRT) [3].

Case presentation

A 85-year-old man, admitted to the cardiology department in September 2019 due to chest pain and multiple

syncope. Patient had medical history of hypertension and dyslipidemia. The patient was in an impaired general condition, with evidence of cervical venous congestion, lack of breathing in the left thoracic half, and bradycardia. The ECG showed a complete AV block with a heart rate of 80 bpm (class I A indication for implantation of an anti-bradycardia device). Echocardiographic evaluation revealed a reduced ejection fraction and dilated Vena Cava inferior.

Following implantation of a temporary pacemaker, selective coronary angiography was performed, which revealed a two-vessel coronary artery disease - critical LAD stenosis, which was resolved by implantation of a single drug-eluting stent and chronic occlusion of the RCA, with collaterals from LAD. Subsequently, under a local anesthesia, in the left subclavian area, a single-chamber, permanent VVI pacemaker was implanted, with RV-lead with active fixation (Figure 1). After optimizing the drug therapy, the patient was discharged with and with 100% paced rhythm.

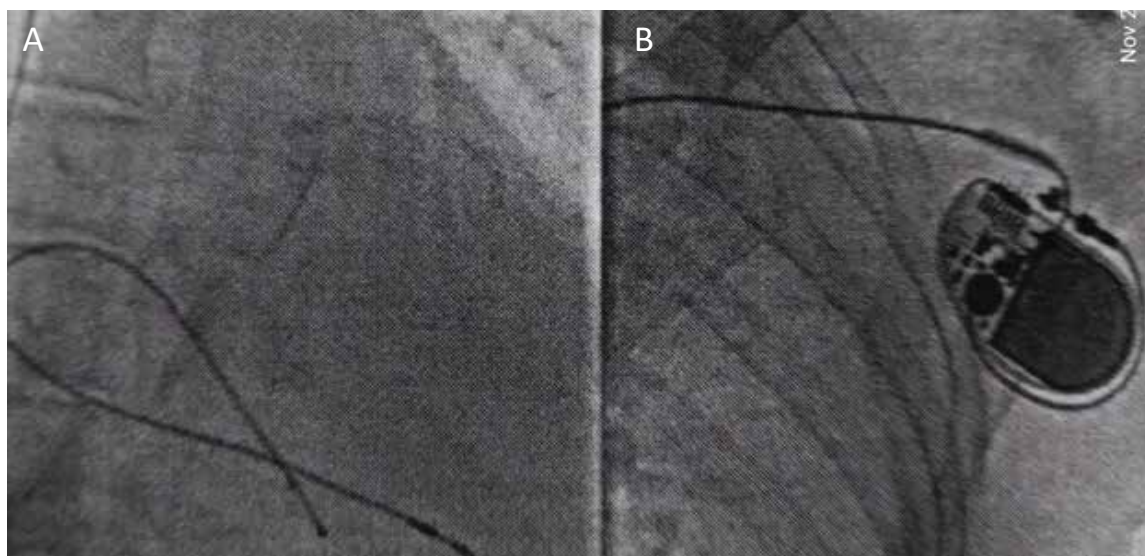


Figure 1. (A) Electrode from temporary PM and lead from VVI in RV and the pulse generator, (B) after the PM implantation

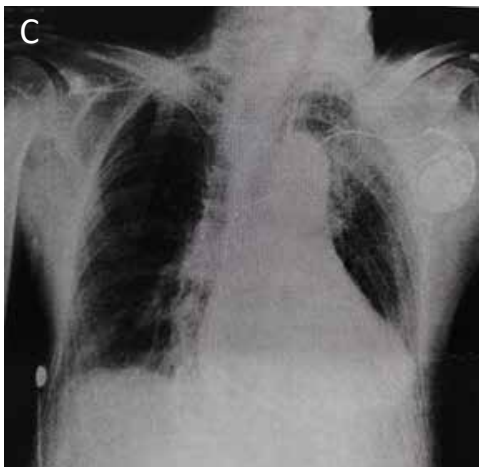
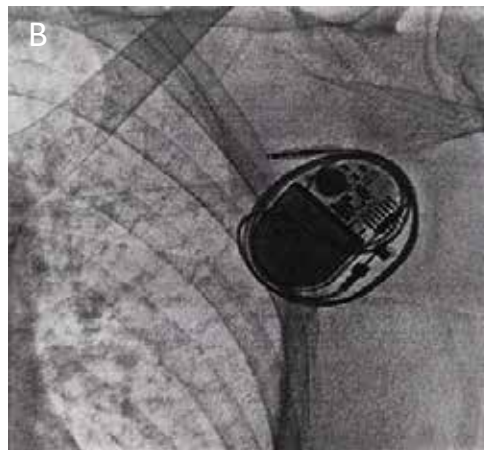
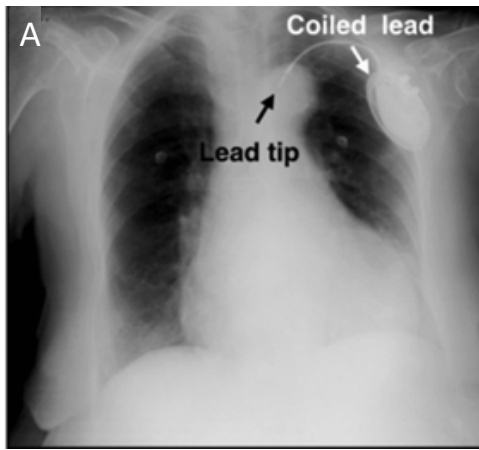


Figure 2. Six months later: (A) The chest X-ray of pacemaker placement - coiled lead; (B) Complete displacement of permanent pacemaker's RV lead, which is curved around the pacemaker itself; (C) The chest X-ray of pacemaker placement on discharge from hospital

which showed a complete displacement of permanent pacemaker's RV lead, which was curved around the pacemaker itself (Figure 2B). A new RV electrode with active fixation was implanted in the apex of the right ventricle. The silicone sleeve of the electrode was firmly sutured to the fascia of the thoracic muscle. The patient was discharged with an x-ray showing proper position of the RV electrode and with pacemaker rhythm on ECG (Figure 2C).

Six months later, during an admission to the urology department for hematuria, the patient felt a general malaise and difficulty in speech, according to relatives. After an ECG and consultation with a cardiologist on duty, he was referred to the clinic with suspected dysfunction of the pacemaker. The ECG performed registered a complete AV block. Following implantation of a temporary pacemaker, a chest x-ray (Figure 2A) was performed,

Discussion

Reel Syndrome [Table 1, Figure 3C] is rare condition and is seen in elderly patients with cognitive obese patients, women, and children which mostly occurs during the first year after implantation. It is characterized by the unintentional rotation of the pulse generator along its sagittal axis by the patient, which leads to retraction and winding of the electrode around the pacemaker, causing

Table 1

	Twiddler	Reel	Ratchet
Mechanism	Rotation on its long axis	Rotation on its transverse axis	Retraction with ratcheting of the lead
Consequences on Leads	Damage can occur	No damage	No damage
X-Ray	Tangling of leads	Leads coiled around the generator	Leads retracted without coiling
Occurrence	Within a year	Within a month	Within a month
	<p>Normal Position</p>		

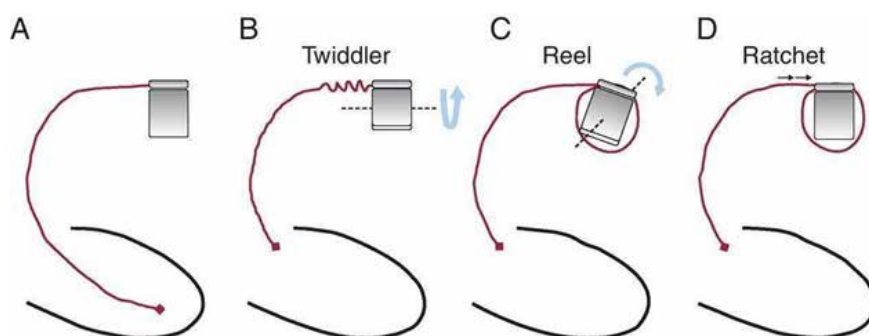


Figure 3. Presentation of lead dysposition

the dysfunction of the device. The reason is the unintentional manipulation of the device in the subcutaneous pocket.

Two other similar conditions have been described - Twiddler [Table 1, Figure 3B] and Ratchet [Table 1, Figure 3D] syndrome with a similar etiology (4,5). The first one has a rotation of the pulse generator along its long axis with retraction and twisting of the electrodes similar to a spiral, which can damage them. Ratchet syndrome is characterized by the fact that patient manipulates the pacemaker in a clockwise and anticlockwise direction, thus like a ratchet mechanism, retracts and locks the electrode without disposition of the pacemaker.

The first choice method in diagnostic work-up for specifying dysfunction of a permanent pacemaker is to perform a chest X-ray. Another option is through a pacemaker programming device. These conditions can also be observed with implantable cardioverter defibrillators (ICD), and resynchronization devices (CRT-D / P). Complications of these dysfunctions can lead to syncope with subsequent trauma or life-threatening tachyarrhythmias.

There are various countermeasures, such as re-tightening the loose attachments, affixing the pacemaker to the underlying fascia, and deep brain stimulation (for dystonia). However, there are not many reports that focus

on countermeasures. Although there are many reports of the pacemaker being attached under the fascia, this method does not guarantee a solution every time.

Patient education, use of a smaller subcutaneous pocket, and suturing of the pulse generator to surrounding tissues would lead to a decrease in the frequency of displacement syndromes in susceptible patients. Frequent check-ups and patient monitoring should not be underestimated.

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Sažetak

Dispozicija odvoda pejsmejke kod starijeg pacijenta - Reel sindrom

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Predstavljamo slučaj odraslog pacijenta sa Reel sindromom kome je implantiran VVI stalni pejsmejker 6 meseci ranije. Rendgen grudnog koša je pokazao retrakciju i uvijanje electrode za desnu komoru oko generatora, koja je rešena ponovnim postavljanjem nove electrode u vrh desne komore.

Ključne reči: Reel sindrom, VVI pejsmejker