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Review article

Initial assessment of chest pain

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Abstract **The aim** of this paper is to show the procedure with the patient presenting with anginal chest pain during every day clinical routine.

Out of all patient presenting with chest pain, only 5.1% are with acute coronary syndrome (ACS), while half of the patients does not have a cardiac cause of the pain. So, we need to distinguish cardiac pain, or we shall make an emphasis on ischemic, from other forms. This pain judged by the patient description can be dubbed Typical anginal pain, or on the other hand what it was called atypical anginal pain, or so called "pain equivalent" e.g. like dyspnea. The pre-test probability (PTP) assessment is done based on: 1. The circumstances of pain onset (like physical exertion or emotional stress). 2. Localization of the pain (retrosternal) 3. Circumstances of pain cessation (rest or nitroglycerin intake). Based on these three characteristics we are judging the type of the pain. So, if we have only one criterion-the pain is **not anginal pain**., 2 criteria is dubbed like so called **atypical anginal pain.** And if we have all three presents, then this pain is called **typical anginal pain**. On the other hand, the numeric value of pre-test probability puts the patient into low, intermediate or high-risk group for coronary artery disease (CAD). So, the patients from the low-risk group can be excluded from further investigation. Intermediate group patients are pushed towards non invasive tests for CAD (physical exercise test, physical or pharmacological imaging tests (stress echocardiography, myocardial perfusion imaging). The patients from the high-risk group, high likelihood of CAD can be directly referred to invasive angiographic imaging. Based on the chest pain and ECG changes it is necessary to differentiate, whether we have a patient with acute coronary syndrome in our office, which would require urgent hospital treatment, or it is a patient with chronic coronary syndrome which would not require urgent treatment. Modern concept of chronic coronary syndrome diagnostic is characterized by diagnostic algorithm which is actually based on the above mentioned pre-test probability for CAD likelihood.

Kew words chest pain, pre-test probability, coronary artery disease

Introduction

Chest pain is a common symptom which patient are presenting with. As mentioned before, out of all patients presenting with chest pain to various services, only 5.1% have acute coronary syndrome, while half of them does not have a cardiac cause of the pain at all (1). So it is necessary to distinguish cardiac-ischemic pain from other types of it.

The characteristics of cardiac ischemic (anginal) pain are: 1. type 2. Localization with propagation characteristics 3. The duration of the pain 4. The type of onset 5. The type of cessation. So, based on those, the pain can be characterized as cardiac (ischemic, or as it was used to be called typical) and chest pain equivalent (as it was used to be called atypical) for CAD.[1]

Clinical presentation of typical anginal pain is represented by its characteristics: 1. Type, like squeezing, pressure, throbbing, heaviness, burning. The patient describes it as "dull" with no relation to movement or position. 2. Localization and propagation of the pain, retrosternal, left sided, larger area affected, propagating to the inner portion of left upper arm, elbow and lower arm, but also to lower jaw, to the back (interscapular), left scapula, sometimes to the both arms, epigastrically. 3. Duration of the pain, from couple of minutes, and up to 20 minutes (in differentiation to other types of pain which last couple of seconds, or on the other hand several hours on end). 4. Pain onset, usually is provoked by physical exertion, mental stress, cold air intake, large meal. The pain has an upstream tendency with physical exertion. 5. Pain cessation, after rest, or after nitroglycerin intake[2].

Clinical presentation of atypical anginal pain or pain equivalent, is usually differentiated in pain type, with its equivalents, like feeling of air loss, squeezing in lower jaw or neck, dyspeptic symptoms (heartburn, burping)[2]. This atypical of CAD presentation is to be expected

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in older people, women, diabetics, demented patients, and patients with chronic kidney failure (3).
The aim of this paper is to show the procedure with the patient presenting with anginal chest pain during every day clinical routine.

Discussion

When we are presented with a patient complaining of chest pain, we need to make some first contact assessments for patients with acute coronary syndrome (need urgent hospitalization and treatment) or chronic coronary syndrome (out hospital diagnostics and treatment CAD):
The character of the chest pain
- Anginal pain
- Non anginal pain

The pain characterized like heaviness, pressure, squeezing, tension, burning, positioned behind the sternum, centrally, provoked by exertion or stress point to HIGH clinical likelihood of anginal chest pain. On the other hand, sharp, migrating, respiratory movement, or rib cage movement related, pointed pain, usually points to LOW clinical likelihood of anginal chest pain (1).
Pain duration:
- Short - up 20 minutes
- Long - over 20 minutes

20 minutes makes a critical demarcation between short and long pain duration, so inf the pain shows the abovementioned characteristics of anginal chest pain, and lasts over 20 minutes, this patient usually requires hospitalization and observation. If the duration is under 20 minutes, and pain subsided to the moment of the exam, this patient rarely requires hospitalization but this patients stay into diagnostics algorithm.
ECG picture
- ST elevation
- ST depression or negative T waves
- Newly diagnosed left bundle branch block
- No ST and T changes

Further diagnostic work-up
- Troponin levels (highly sensitive preferably)
- Echocardiography
- Coronary angiography-invasive

Additional non-invasive work up is not necessary with patients presenting with all the above anginal pain characteristics, followed by ECG changes. This work-up is of the essence with patients presenting with non-ischemic pain characteristics in order to rule in or rule out acute coronary syndrome or other non-ischemic cardiac conditions (aortic dissection, acute pericarditis, valvular heart disease, hypertrophic cardiomyopathy), or on the other hand non cardiac conditions (esophageal spasm, pneumothorax, muscle spasm etc.)[1].

<u>Emergencies which require urgent hospitalization and treatment patients with ACS:</u>
Emergencies with hospital admission and treatment of CAD in patients presenting with typical chest pain over 20 minutes followed by ECG changes. Here we have several possible scenarios:

1. **Typical chest pain over 20 minutes duration accompanied by new ST elevation or new left bundle branch block**
This scenario requires urgent treatment according to STEMI guidelines with urgent pPCI or fibrinolytic therapy if pPCI is not available[4].

2. **Typical chest pain over 20 minutes duration accompanied by new ST depression or T wave changes**
This scenario requires urgent treatment according to NSTEMI/UA guidelines, low risk vs high risk patients, meaning urgent invasive strategy vs medical therapy and then invasive strategy during hospitalization[3].

3. **Typical chest pain over 20 minutes duration not accompanied by ECG changes**
These patients require additional diagnostic work-up, with hsTni levels (1 or 3hr rule in/rule out protocol if feasible, or hospitalization and observation for rule in/out differentiation, regarding local feasibility), echocardiography for other cardiac and non-cardiac causes. We should point-out that this population of patients is not small, meaning that almost 30% of NSTEMI patients do not present with ECG changes during first medical contact[3].

<u>Conditions which require diagnostic and therapy work-up of chronic coronary syndrome</u>
1. **Typical chest pain under 20 minutes duration, accompanied by new ST depression or T wave changes**
hsTNI levels with ACS rule in/rule out. Ruled out patients are referred to further non or invasive CAD risk assessment.
2. **Typical/atypical chest pain or equivalent, under 20 minutes duration not accompanied by ECG changes**
This where pre-test likelihood of CAD comes into place, low likelihood patients are ruled out of further CAD work up, intermediate to high likelihood patients are refereed to further non or invasive CAD work up.
For PTP assessment we need only three chest pain characteristics:
- Pain onset factors (exertion, mental stress)
- Pain localization (retrosternal)
- Pain cessation (rest, or nitroglycerin uptake)

So, we use them to judge about the presumed pain origin:
- One criterion -**Non anginal pain**
- Two criteria – **atypical anginal pain**
- All three criteria-**typical anginal pain**[2]

Diamond i Forrester[5], showed in their original work in 1979. that simple clinical and anamnestic work up can yield very useful and reliable data for CAD likelihood assessment in patients with chest pain. The showed on 4952 patients after invasive angiography that CAD likelihood is dependent on chest pain characteristics. Patients that had chest pain with ischemic characteristics, had CAD proven by invasive angiography in 90% of total number. On the other hand, those percent were 50% and 16% respectively for pain equivalent and non-cardiac group ($p<0,001$). The other part of their research were autopsy findings from 23996 adults who were not diagnosed with CAD during their lives. They showed with high significance that in women under the age of 40, CAD was present only in 0.3% of the patients, while

the number in men of the same age was 1.9%. In men over 60 years of age this number was 12.3%, and 7.5% for women of that age. Combining these two (angiography and autopsy) the made charts with pre test likelihood of CAD by the age, gender, and chest pain characteristics.

After this study, another study was published in 1981, CASS (Coronary Artery Surgery Study)[6]. This study was done on 20391 patients, divided in groups by age, sex, and chest pain characteristics, where presence of CAD was proven by angiography. In their words, 93% of men, and 72% of women with "definitive anginal pain" had a CAD on angiography, 66% of men, and 36% of women with "probable anginal pain", and 14% of men and 6% of women with "nonspecific pain" (p<0,001). They concluded that age, sex, and pain characteristics are important determinants in CAD prevalence and severity assessment. Regarding that the data on CAD prevalence in relation to pain, sex, age was similar in both studies, the are combined in one table (Table 1)

Table 1. Pre-test likelihood of CAD in percent in symptomatic patients, related to type of chest pain, sex, age. Combined data from Diamond/Forrester i CASS-Coronary Artery Surgery Study[2]

Age (years)	Non anginal pain		Atypical anginal pain		Typical anginal pain	
	M (%)	Ž(%)	M(%)	Ž(%)	M(%)	Ž(%)
30-39	4	2	34	12	76	26
40-49	13	3	51	22	87	55
50-59	20	7	65	31	93	73
60-69	27	14	72	51	94	86

Patients with low pretest probability for CAD, <20%, with intermediate pretest probability, 20-80%, high pretest probability, >80%[2].

Based on numeric values of pre-test probability, we put the patient in one of three groups, low, intermediate or high-risk group for CAD. The patients from low-risk group could safely be excluded from further CAD diagnostic work-up, patients from intermediate are referred to further non-invasive work-up (exercise test, stress echo, myocardial perfusion imaging). Patient in high-risk group can be directly referred to invasive strategy.

This concept of calculating pre test probability of CAD likelihood based on anamnestic data Is kept in recent ESC guidelines for chronic coronary syndrome[7]. Genders et al[8] updated these data on CAD prevalence from Diamond and Forester. They modeled previous CAD likelihood numbers according to new data, for patients in low-risk geographical areas, where it's good to know that these numbers can vary for different regions7. Pretest probability of CAD table (Table 2), is now changed by adding separate data for patients aged 70 and over. As another add on, a data on dyspnea like chest pain equivalent are added.

Patients with low pre test probability of CAD <5%, intermediate 5-15%, high >15% [7]. Out of all patients with chest pain or equivalent, 57% had pre-test pretest probability of under 15%. Studies showed that annual risk of cardiovascular death or myocardial infarction is under 1%, so it is safe to adapt routine testing of these patients to local resources, diagnostic test availability and clinical judgment (9). Patients with pretest likelihood of under 5% should be excluded from further CAD diagnostic algorithm, with data showing a larger number of false positives in this group (7).

Table 2. Pre test likelihood of CAD in percent in symptomatic patients in relation to chest pain characteristics, gender, age and dyspnea like chest pain equivalent[7]

Age (years)	Non anginal pain		Atypical anginal pain		Non anginal pain		Dyspnea	
	M (%)	Ž(%)	M(%)	Ž(%)	M(%)	Ž(%)	M(%)	Ž(%)
30-39	3	5	4	3	1	1	0	3
40-49	22	10	10	6	3	2	12	3
50-59	32	13	17	6	11	3	20	9
60-69	44	16	26	11	22	6	27	14
70+	52	27	34	19	24	10	32	12

Based on pre-test probability tables, CAD diagnostics in non anginal chest pain should be done only in patients aged 60 and above. In patients with pain equivalents this border is moved from to 40 and above for both sexes, to 50 and above for men, and 70 and above for women. Patients with ischemic chest pain were diagnosed regardless of age and sex, now this limit is set to 40 and above for men and 60 and above for women.

CONCLUSION

Based on chest pain and ECG characteristics, we need to assess whether we have a patient with acute coronary syndrome, which require urgent therapy and hospitalization, or a patient with chronic coronary syndrome which does not require such urgent procedures. This modern concept of chronic coronary syndrome envelops gradual approach of diagnostic algorithm which is based pretest probability of coronary artery disease.

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Sažetak

Inicijalna procena bola u grudima

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CILJ rada *je prikaz postupka sa pacijentima sa bolom u grudima, u svakodnevnom kliničkom radu.*
*Od svih pacijenata sa bolom u grudima koji se javljaju u službama urgentnog prijema, samo 5,1% ima akutni koronarni sindrom (AKS), a polovina pacijenata nema kardiološki uzrok bola. Zato je neophodno razlikovati srčani, ishemijski bol od drugih. Anginozni bol prema opisu pacijenta može biti tipičan i atipičan za koronarnu bolest. Procena pre-test verovatnoće (PTV) vrši se na osnovu: 1. okolnosti nastanka bola (na napor ili psihički stres), 2. lokalizacije bola (retrosternalni), 3. okolnosti prestanka bola (odmor ili upotreba NTG) . Na osnvou ove tri karakteritike određuje se tipičnost bola: Prisustvo 1 kriterijuma-***bol nije anginozni****; Prisustvo 2 kriterijuma-***atipična angina***, *Prisustvo sva 3 kriterijuma-***tipična angina.** *Na osnovu numeričke vrednosti pre-test verovatnoće pacijent se procenjuje sa niskom verovatnoćom, srednjom verovatnoćom ili sa visokom verovatnoćom za postojanje koronarne bolesti. Pacijenti sa niskom verovatnoćom za postojanje Kkoronarne bolesti mogu se bezbedno isključiti iz dalje dijagnostike. Pacijenti sa srednjom verovatnoćom neinvazivnu dijagnostičku obradu za dokazivanje koronarne bolesti: test fizičkim opterećenjem, fizički ili farmakološki imaging testovi (stres ehokardiografija, stres-rest perfuziona scintigrafija miokarda). Pacijenti sa visokom verovatnoćom za postojanje koronarne bolesti mogu se direktno uputiti na invazivnu dijagnostiku (koronarografiju). Na osnovu bola u grudima i EKG promena potrebno je proceniti da li se radi o pacijentu sa akutnim koronarnim sindromom, koji zahtevaju hitnu hospitalizaciju i terapiju, ili o pacijentu sa hroničnim koronarnim sidromom. Savremeni koncept dijagnostike hronične koronarne bolesti podrazumeva etapnu primenu dijagnostičkog algoritma u čijoj je osnovi upravo vednost pre-test verovatnoće za postojanje koronarne bolesti.*

Ključne reči: bol u grudima, pre-test verovatnoća, koronarna bolest