Right Ventricular Infarction in Patients with Acute Inferior Myocardial Infarction

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Abstract

Background: Right ventricular infarction (RVI) complicating inferior wall myocardial infarction (IWMI) is common. Electrocardiogram (ECG) through right pericordial leads (V_4R) is a useful & convenient toll of diagnosing RVI.

Objectives: To study the frequency of occurrence of RVI in patients with IWMI using the standard ECG through right precordial lead (V_4R), to define the risk factors for its occurrence and to identify the associated physical signs & other ECG abnormalities.

Patients & methods: 90 patients admitted to the coronary care unit (CCU) were studied, we assessed the prevalence of (RVI) using the right precordial lead (V_4R), risk factors for its occurrence & other important physical signs & ECG finding.

Results: RVI was diagnosed in (28.9%) of patients with IWMI, defined by the presence of o.1 mm ST-segment elevation in V_4R. Increasing age, diabetes mellitus (DM) & smoking were significantly associated risk factors. Atrioventricular block (AV block) occurred in 23% patients with RVI compared to 10.9% in patients with isolated IWMI. The classical triad of hypotension raised jugular venous pressure & absence of rales on chest auscultation occurred in 7.9% of patients with RVI compared to none of patients with isolated IWMI. Hypotension following the administration of morphine & nitroglycerin were found in 66.6% of patients with RVI compared to non of patients with isolated IWMI.

Conclusion: Standard surface ECG by using V_4R could aid clinical recognition of concomitant RVI in patients with IWMI. Hypotension following the administration of anti-ischemic medications & atrioventricular block (AV block) were more common in patients with RVI. Increasing age, male sex diabetes mellitus & previous history of ischemic heart disease were risk factors for the occurrence of RVI.

الخلاصة

يعتبر احتشاء البطين الأيمن احد المضاعفات الشائعة عند المرضى المصابين باحتشاء عضلة القلب السفلى الحاد . تخطيط القلب الكهربائي باستخدام القطب الصدري الرابع من اقطاب جهاز تخطيط القلب بوضعه على الجهة اليمنى من الصدر احد الطرق المفيدة والمقنعة لغرض تشخيص هده الحالة.

الاهداف:دراسة نسبة حدوث احتشاء البطين الأيمن احد المضاعفات الشائعة عند المرضى المصابين باحتشاء عضلة القلب السفلى الحاد .

1- التعريف بعوامل الخطورة المرافقة لحدوثه.
2- دراسة العلامات السريرية والعلامات الاخرى فى تخطيط القلب الممكنة الحدوث.

الطرق :تسعون مريضا مصابون بالاحتشاء السفلي الحاد الدين ادخلوا العناية القلبية تم فحصهم سريريا وكذلك اجري لهم رسم القلب الكهربائي.

النتائج :أظهرت النتائج ان نسبة حدوث احتشاء البطين الايمن هى 28.9% من المرضى المصابين بالاحتشاء السفلى الحاد. زيادة العمر، داء السكري والتدخين هي عوامل مصاحبة لحدوثة. عطب حزمة القلب حدثت فى 23% عند مرضى احتشاء البطين الايمن بالمقارنة مع 10% من مرضى الاحتشاء السفلى الحاد. نسبة حدوث الثلاثية المتكونة من انخفاض ضغط الدم، ارتفاع الضغط فى

الوريد الودجي ومع عدم وجود علامات ودمة رئوية هى 7.9% من مرضى احتشاء البطين الايمن، فيما حدث انخفاض حاد فى ضغط الدم بعد اعطاء المرضى المصابين باحتشاء البطين الايمن بعض الادوية مثل المورضين والنايتروكلسيرين فى 66.6% منهم.
الاستنتاجات:رسم القلب الكهربائى باستخدام القطب الصدرى الرابع يساعد فى تشخيص احتشاء البطين الايمن عند المرضى المصابين بالاحتشاء السفلى الحاد. العمر، داء السكرى،التدخين وعطب حزمة القلب كانت من العوامل المرافقة لحدوثه. حدث انحفاض فى ضغط الدم(بعد اعطاء بعض الادوية مثل المورفين والنايتروكلسيرين) فى نسبة عالية عند المرضى المصابين باحتشاء البطين الايمن.

Introduction

RVI had been initially described 70 years ago. However, it was until 1974 when Cohn et al [1] published the results of their landmark study & described the clinical & homodynamic features of RVI that the abnormality was recognized as a distinct clinical entity.

Cohn et al reported that the delay in recognizing RVI was due to the notion that the right ventricle was not a necessary component of the circulation. This idea was fueled by experiments in dogs that showed that when the right ventricle was excluded, no changes in the venous pressure or cardiac output occurred [2- 3]. Successful surgical procedures that bypass the right ventricle were being used at the time to treat cyanotic congenital heart disease, further supporting) the "lack of impotence" of right ventricle [2-4]

After the publication of Cohn et al in 1974, a new era of investigation of RVI had began, when previously the ideas were held.

RVI accompany extensive inferior myocardial infarction. The occurrence of inferior myocardial infarction involving the right ventricle range from 14 to 84%, but is typically thought to be about 50% [2-5-6]. In autopsy series 2 to 7 approximately 13% of heart with anterior wall myocardial infarction had evidence of RVI & isolated RVI was detected is in less than 3% of examined specimens [2-7]. Unlike the left ventricle, the right ventricle receives its blood supply during systole & diastole through its rich network of collateral vessels.

This pathophysiological situation occurs because the right ventricle is a low pressure chamber. The right ventricle functions as a thin-walled volume pump that is sensitive to preload & afterload, especially when contractile function is impaired. Most often RVI occurs in concert with an inferior wall myocardial infarction caused by proximal occlusion of the coronary artery [6].

The diagnosis of RVI should always be considered in patients who have inferior wall myocardial infarction. Early diagnosis is critical to avoid therapy that may adversely affect the outcome [8-9]

Nitroglycerin, morphine & dieuretics are not well tolerated by patients with RVI & may lead to sever hypotension. The effects of these medications may cause a reduction in preload & subsequently decreasing cardiac output.

Therefore, volume loading with an isotonic solution is recommended as an initial therapy in RVI. The presence of ST-segment elevation on leads 11, 111, & aVF on an ECG are always suggestive of RVI [10-11].

Aright sided ECG should be obtained immediately. Normal placement of the precordial leads to the left of the sternum does not result o are placed to the right of the sternum, over the right ventricle, elevation of ST-segment in lead V4R is highly suggestive of RVI. The combination of elevated JVP, hypotension & clear lung fields also suggestive of RVI [2-5-10-12]. Bradycardia & complete heart block may also occur as a result of RVI, these may be due to Bezold-Jarisch reflex, which results in bradycardia & hypotension due to the stimulation of receptors heavily concentrated in the inferior & posterior walls of the heart.

The vagus nerve is close to the inferior aspect of the heart, a situation that results in augmented activation in association with IWMI.

Many studies concerning the prevalence, hemodynamic, echocardiographic & angiographic features of RVI had been conducted. The present study was designed to estimate the prevalence, risk factor & some important findings using clinical examination & surface ECG.

Patient & methods

90 patients, 52 (57.8%) male & 38 (42.2%) female with inferior myocardial infarction, were selected for the current study. They admitted to the coronary care units (C.C.U.) in Marjan teaching hospital at Hilla city & Al-Hussein general hospital at Karbala city were selected for the study. The age range was 35-83 years) with the mean age of (59+16 years) All patients were subjected to medical questionnaire form designed for the study purposes including (age, sex, smoking, hypertension, diabetes mellitus & previous history of ischemic heart disease).

A through clinical examination including weight, height, cardiovascular examination blood pressure, jugular venous pressure (JVP) & auscultation of lung bases.

A standard ECG & right pracordial leads (V4R) were recorded immediately after admission to the C.C.U.

The presence of RVI in association with IWMI was defined by ST-segment elevation =0.1 mm in V4R ( ), the other associated ECG finding including atrio-ventricular blocks (AV blocks) were also studied.

Results

RVI was diagnosed in 29 patients (28.9%) using 12 lead standard ECG (=0.1 mm ST-elevation inV4R) while 64 patients (71.1%) showed no ECG evidence of RVI (table 1).

Increasing age, D.M & smoking showed statistically significant association with RVI (p value≤0.05), while BMI, smoking, hypertension & history of ischemic heart disease showed no such association (table 2).

As shown in table (3), Av blocks were more common in patients with RVI (6 patients 23%) versus (7 patients 10.9%) in those without RVI, the triad of raised JVP, hypotension & clear lung field were observed only in 2 patients(7.9%) with RVI compared to non of patients with isolated IWMI & significant hypotension (30 mmHg reduction in systolic BP) following the administration of anti-ischemic medications were observed in 4 (66.6%) out of 6 patients with RVI compared to only one patient out of 64 patients without RVI.

Discussion

ST-segment elevation in right precordial leads is a relatively sensitive & specific sign of RVI [13-14]. In this study RVI was detected in 26 patients 28.9% of patients with IWMI (table1). Most of previous studies showed the prevalence of comparable results ranging from 33% to 54% [15-16-17-18].Our study showed that old age, DM & smoking were more prevalent in patients with RVI, while gender, BMI, hypertension & previous history of I.H.D. showed no differences between patients with RVI & isolated IWMI. (Table 2)

A study was done in the national institute of cardiovascular disease, Karachi, Pakistan

Table -1 No. of patients with RVI & patients with isolated IWMI

No. of cases	RVI		Isolated IWMI	
	No.	%	No	%
90	26	28.9	64	71.1

Table -2 Descriptive data of the study group

clinical	RVI	IWMI	P value
Age(yrs) Mean range	 68+_12.5 (60-83)	 51+_13.2 (35-63)	 < 0.005
Sex Female male	 No. =12 (46.1%) No. =14 (53.9%)	 No. =26 (40.6%) No. =38 (59.4%)	 NS*
BMI(kg/m2)	28.1	27.2	NS
D.M.	28.7%	12.6%	< 0.005
Hypertension	No. =6 (23%)	NO. =17 (26.5%)	NS
Smoking	NO. =10 (38.4%)	NO. =14 (21.8%)	< 0.005
History of I.H.D.	NO. =3 (11.5%)	NO. =11 (17.2%)	NS

*NS= p value is not significant

Table -3 ECG & clinical findings in patients with RVI & patients with isolated IWMI

Parameter	RVI		Isolated IWMI		P value
	No.	%	No.	%	
AV blocks	6	23	7	10.9	< 0.005
Raised JVP,hypotension& clear lung fields	2	7.9	0%	0%	< 0.005
Hypotension * following anti-ischemic drugs	4	66.6	0	0. %	< 0.005

*Taken in consideration only after the exclusion of other cause of hypotension in the setting of AMI (cardiogenic shock & mechanical complications of AMI).

which showed that smoking & DM were more prevalent in patients with RVI [19].

This study obviated that there trioventricular block (AV block) is more common in patients with RVI 6 patients (23%), compared with patients with isolated IWMI 7 patients (10.9%) as shown in(table 3).

Some researchers stated that dysrhythmias such as bradycardia, high degree heart block & atrial fibrillation are associated with approximately 50% of RVI [20]

The influence of AV block is particularly important in patients with RVI because such patients have a markedly increased mortality risk [21].

Although the triad of hypotension, raised JVP & clear lung fields is a characteristic clinical finding in RVI [22], in our study we found only 2 patients (7.9%), compared to non of patients with isolated IWMI (table3)

Because of their ability to reduce preload, medications routinely prescribed for patients with left ventricular infarction may produce profound hypotension in patients with RVI [23].

So giving these agents (namely nitroglycerine) to our patients with RVI were avoided, but we were obligated to give these medications for 6 patients with RVI (4 of them because of persistent pain & 2 in whom V4R was not done immediately & discovered latter on to have RVI, all of 6 patients were admitted at night). We found that 4(66.6 %) out of the 6 patients experienced profound hypotension (reduction in systolic BP = 30mmHg), following the administration of morphine & small dose nitroglycerine, necessitating the withdrawal of these agents & immediate loading with I.VG fluid & dobutamin.

These findings were compatible with the concept that marked hypotension in response to small doses of nitroglycerine in patients with IWMI should lead to the prompt consideration of the diagnosis of RVI[24] At present the only groups of patients in whom sublingual nitroglycerine should not be given are those with IWMI & suspected RVI [25].

In conclusions standard surface ECG by usingV4R can aid in clinical recognition of RVI in patients with IWMI. Increasing age, D.M, smoking & A.V blocks are significantly associated with RVI. Hypotensions after using preload reducing agents were associated with profound hypotension when it is given to patients with RVI.

Recommendations

1- RVI occurs in about one third of patients with IWMI. Standard ECG using V4R is indicated for every patient with IWMI (especially aged, diabetic & smoker patients) as a simple & available tool for the diagnosis.

2- AV block is more common in patients with RVI, so early diagnosis of RVI & recognition of such problem is of paramount importance.

3- In patients with IWMI, preload reducing agents should not be used (or used cautiously if highly indicated) before the exclusion of RVI, owing to the occurrence of profound hypotension in those with RVI.

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