Effect of Diabetes on Laboratory Markers in Patients with Non-ST Elevation Acute Coronary Syndromes

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Abstract. Background: Diabetic population are at high cardiovascular risk especially in the setting of acute coronary syndromes. This study aimed to investigate the role of diabetes in affecting the main biochemical and haematological markers in patients with non-ST elevation acute coronary syndromes (NSTE-ACS). Methods: A multicentre cross-sectional study recruited patients who were admitted and diagnosed as NSTE-ACS, data were collected from patients using a prepared printed form that recorded patients' age, comorbidities and results of investigations. Patients were categorized into diabetics and non-diabetics. Results: Ninety-nine patients were enrolled, 39.4% were diabetic, mean age of diabetics was (61.3±10.9) years vs (57.7±12.6) years in non-diabetics, diabetic patients were more to be females 23.1% vs 21.7%, more to have IHD history 58.97% vs 35%, more be hypertensive 69.2% vs 55%, less to be smokers 33.3% vs 38.3% and hyperlipidaemic 30.8% vs 33.3% when compared to non-diabetic counterparts, however, the differences in baseline characteristics between the two groups did not reach statistical significance apart from the more reported history of IHD in diabetics; p=0.019. Diabetic patients tend to be presented more with dyspnoea compared to non-diabetics 41% vs 26.7%. Positive troponin was more to be positive in diabetics (48.7% vs 40%), diabetic patients tend to have higher urea (46.2±19.2 vs 39.6±23.6) and higher creatinine (1.07±0.37 vs 0.95±0.37). Random blood sugar (268.3±115 vs 125.5±50.2, p<0.001) and serum potassium (4.4±0.3 vs 4.12±0.52, p=0.015) were significantly higher in diabetic patients. Conclusion: Apart from higher blood glucose and serum potassium levels, in the setting of NSTE-ACS; presence of diabetes has no remarkable impact on biochemical and haematological markers when compared to non-diabetic population. This needs larger studies in the future to validate these findings and to assess the prognostic significance of laboratory markers in diabetics with acute coronary syndromes especially in low-resources countries where more sophisticated markers are not feasible.

Keywords: Troponin, Cost-effective, Low-resources countries, Biomarker, Haematology, Biochemistry
1. Introduction

Diabetes is a leading cardiovascular risk factor, in same line diabetic population are considered at high-risk in cardiovascular context, in general and in setting of acute coronary syndromes (ACS), in particular, leading to consider this comorbidity on adopting specific guidelines' recommendation whether regarding diagnostic approach, risk assessment, pharmacotherapy or making the decision of invasive strategy [1-4]. Despite many earlier studies focused on characteristics and outcomes of diabetic patients with ACS [5-8], yet there is limited literature discussed the impact of presence of diabetes on laboratory investigations in this population as well as the prognostic significance of these markers in this population. Accordingly, the purpose of this study was to determine if presence of diabetes can affect the biochemical and haematological markers in patients with non-ST elevation acute coronary syndromes (NSTE-ACS).

2. Methods:

Study Design and Setting: A multi-centre cross-sectional study involved patients who were diagnosed and admitted as NSTE-ACS, who were admitted to Al-Yarmouk Teaching Hospital and Ibn Al-Bitar Cardiac Centre during the period from February 2018 to January 2019. Patients were categorized into diabetics versus non-diabetics.

Baseline criteria and investigational markers: Data were collected from patients using a prepared printed form that documented patients' age, comorbidities and results of investigations.

Ethical Approval: The research was conducted in accordance with the declaration of Helsinki and approved by local ethical and scientific committee. All participants accept enrolment in the study by formal consent.

Statistical Analysis: Data were coded and input into computer using SPSS version 24. Numerical variables were expressed as mean ± standard deviation, categorical variables were expressed as percentages. Numerical variables were compared using t-test, while categorical variables were compared using Chi-Square test.

3. Results

Ninety-nine patients were enrolled in the study, among whom 39.4% were diabetics, mean age of diabetics was (61.3±10.9) years vs (57.7±12.6) years in non-diabetics; p=0.14, diabetic patients were more to be female 23.1% vs 21.7%, more to have IHD history 58.97% vs 35%, more be hypertensive 69.2% vs 55%, less to be smokers 33.3% vs 38.3% and hyperlipidaemic 30.8% vs 33.3% when compared to non-diabetic counterparts, however, the differences in baseline characteristics between the two groups did not reach statistical significance apart from the more reported history of IHD in diabetics; p=0.019, these findings are illustrated in figure 1.
Diabetic patients tend to be presented more with dyspnoea compared to non-diabetics 41% vs 26.7%, figure 2. Positive troponin was more to be positive in diabetics (48.7% vs 40%), diabetic patients tend to have higher urea (46.2±19.2 vs 39.6±23.6) and higher creatinine (1.07±0.37 vs 0.95±0.37), random blood sugar (268.3±115 vs 125.5±50.2, p<0.001) and serum potassium (4.4±0.63 vs 4.12±0.52, p=0.015) were significantly higher in diabetic patients, figure 3 and table 1.

Figure.1 Baseline Characteristics of Study Groups.

Figure.2 Presenting Symptoms in Study Groups.
### Table 1. Laboratory Markers in Study Groups

| Laboratory Marker | Mean±SD          | p value |
|-------------------|------------------|---------|
|                   | Non-diabetics    | Diabetics |       |
| RBS (mg/dl)       | 125.5±50.2       | 268.3±115| <0.001 |
| Urea (mg/dl)      | 39.6±23.6        | 46.2±19.2| 0.13   |
| Creatinine (mg/dl)| 0.95±0.37        | 1.07±0.37| 0.11   |
| Potassium (mg/dl) | 4.12±0.52        | 4.4±0.63 | 0.015  |
| Sodium (mg/dl)    | 137.2±4.3        | 136.4±4.9| 0.33   |
| Haemoglobin gm/L  | 13.6±2           | 13.1±2.1 | 0.2    |
| WBC count         | (9.5±3.1)×10³ mcL| (9.3±3.4)×10³ mcL | 0.73   |
| Platelet count    | (224.7±67.6)×10³ mcL | (223.6±64.4)×10³ mcL | 0.93   |
| Ejection fraction %| 54.4±13.6        | 49.5±12.2| 0.1    |

4. Discussion:

There is limited data in literature about impact of presence of diabetes on laboratory parameters in NSTE-ACS setting, so this study investigates whether or not presence of diabetes affects laboratory markers in NSTE-ACS, it disclosed higher potassium levels besides the higher random blood sugar (RBS) levels in diabetic patients, all other biochemical and haematological markers were not statistically significant between the two groups.

This study revealed that diabetic patients were older and with more female representation than their non-diabetic counterparts, history of ischaemic heart disease (IHD) reported more in diabetics, this was concordant with other studies [9,10] as diabetes is associated with remarkable proinflammatory and prothrombotic states leading to higher rate of IHD [9,11-13].

No significant differences were observed in the presence of other cardiovascular risk factors like hypertension, smoking and hyperlipidaemia in diabetic group; a finding supported by other researchers [14] while others contradict these results [8].

Diabetic patients were more to be presented with dyspnoea in this study, this was supported by other researchers [15] and it can be explained by the higher rate of atypical presentation which...
is reported more in diabetic population or it can be due to heart failure which occurs at higher incidence in diabetics with ACS compared to non-diabetics [16,17]. It is noteworthy to mention that the atypical presentation of ACS in diabetics can be due to autonomic neuropathy [18] and altered threshold of pain sensitivity [17,19].

Renal indices tend to be higher in diabetics in current study despite not reaching statistical significance, these results were consistent with other studies which further suggested worse outcomes in patients with diabetes and in those with worse renal functions [12,20], however, it had been reported that diabetes even without renal impairment is a predictor of high mortality in STEMI but not in NSTE-ACS and renal failure regardless co-existent diabetes is a stronger predictor than diabetes alone for mortality in all types of ACS [20].

Our study revealed remarkable higher level of potassium in diabetic group, during ACS; intracellular components, including potassium can leak out due to damaged cardiomyocytes by ischaemia leading to higher serum potassium levels, however, a study showed that there was a remarkable potassium dip in ACS especially in diabetics and this dip was associated with worse cardiovascular outcomes, and it correlated tightly with glucose levels, furthermore, in that study there was no correlation between change in potassium levels and creatinine kinase (CK) levels during ACS suggesting that the change in potassium levels in ACS is mainly reflecting the severity of ischemic stress rather than the extent of cellular injury [21], while other studies showed that potassium levels in ACS tend to be higher in diabetic population who did not exhibit the early dip seen in non-diabetics, this can be due to sympathetic nerve dysfunction that commonly complicates diabetes [22,23].

Haematological parameters did not differ significantly between the two study groups, however, prior studies revealed lower haemoglobin in diabetic population with ACS which can be explained by subclinical renal impairment which affects the haemopoietic response of erythropoietin [24-26]. Interestingly, it had been reported that co-existence of diabetes and anaemia in ACS have a higher mortality rate than each predictor alone [27]. Despite white blood cells (WBC) counts did not differ between our study groups, it is worthy to mention that WBCs are crucial for the development and instability of the atherosclerotic plaque, WBCs induce the formation of micro-vascularity in tunica intima which result in plaques that are vulnerable to rupture, WBC count also is considered a valuable prognostic indicator of worse cardiovascular outcomes [28-32].

Main limitation of this study was the small sample size, also we did not assess the correlation between laboratory markers and glycaemic control represented by HbA1c due to lack of this marker in our facilities. Additionally, due to limited study timeframe, we could not assess the long-term prognostic significance of laboratory markers in diabetic population.

5. Conclusion:
Apart from higher blood glucose and serum potassium levels, in the setting of NSTE-ACS; presence of diabetes has no remarkable impact on biochemical and haematological markers when compared to non-diabetic population. This needs larger studies in the future to validate these findings and to assess the prognostic significance of laboratory markers in diabetics with acute coronary syndromes especially in low-resources countries where more sophisticated markers are not feasible.

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