Biomarker associated trends in mortality in myocardial infarction as an example of clinical data warehouse analyses - new opportunities of data-driven cardiovascular research

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Background: Healthcare data collected during clinical routine bears an immense potential for various clinical research questions. With the rapid use and development of structured electronic health records, this abundant source of data can be utilized to efficiently comprise large datasets based on actual, unselected patients. In this study, we examined 4,205 patients who presented with myocardial infarction (MI) since the implementation of a new hospital information system at a tertiary hospital. We sought to evaluate mortality trends using routinely collected biomarkers.

Methods: 4,205 patients admitted with MI at a high-volume tertiary hospital between September 2016 and September 2022, were retrospectively analyzed. Statistical analyses comprised data from a data warehouse sourced from the hospital information system including ICD and OPS codes, biometric data, and biomarker values.

Results: Of the 4,205 patients with MI, 28% (1,176) were female, the mean age was 67 years. 28% (1,171) were diagnosed with ST-segment elevation myocardial infarction (STEMI). 15% of all MI patients (645) showed coronary single-vessel disease, whereas 65% of patients (2,746) suffered from multi-vessel disease. Percutaneous coronary intervention was performed in 47% (1,961) of all included NSTEMI and STEMI patients. Concomitant arterial hypertension was present in 51% of STEMI patients compared to 65% of the NSTEMI population. Regarding STEMI, diabetes mellitus (DM) was prevalent in 22% of cases, whereas 31% in NSTEMI were diagnosed with DM. We observed a significant linear association between in-hospital mortality and peak biomarker levels of high-sensitive Troponin I (hsTnI), serum lactate, and creatine kinase myocardial band (CKMB) (figure 1). MI patients with a peak lactate measurement of > 17.01 mmol/l had a mortality rate of > 80%. Two-thirds of patients (66%) with CKMB values of > 1474.50 U/l died during the index hospitalization.

Conclusion: In our study, we observed significant linear associations between biomarker levels and in-hospital mortality in patients with myocardial infarction. Furthermore, we demonstrated that hospital information systems can efficiently be used to generate large, comprehensive datasets not only to characterize real-world patient populations but also to evaluate data of prognostic relevance. With careful evaluation of data quality and within the frameworks of patient privacy, future research in this field holds promising potential.

Figure 1 displays effects of laboratory values on mortality. The laboratory data are shown on a logarithmic scaled axis (x). The y axis shows the in-hospital mortality. The dotted blue line represents the global mortality rate. Please note that mortality estimates for extremely high laboratory values are partially based on a low number of cases (rug plot on x, each line for one patient).