Psychiatry Research xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Clinical depression and anxiety among ST-elevation myocardial infarction hospitalizations: Results from Nationwide Inpatient Sample 2004–2013

Elizabeth C Pino[a], Yi Zuo[a], Christina PC Borba[b], David C Henderson[b], Bindu Kalesan[a,*]

[a] Center for Clinical Translational Epidemiology and Comparative Effectiveness Research, Department of Medicine, Boston University School of Medicine, Boston, MA, United States

[b] Department of Psychiatry, Boston University School of Medicine, Boston, MA, United States

ARTICLE INFO

Keywords:
Myocardial infarction
Depression
Anxiety
Revascularization

ABSTRACT

Depression and anxiety are common among patients who have a major cardiovascular event. However, despite their frequency, there is a lack of evidence regarding the relationship between depression and/or anxiety and receiving revascularization in ST-elevation myocardial infarction (STEMI) hospitalizations. Using data from the Nationwide Inpatient Sample (NIS) from the years 2004 to 2013, we assessed whether a clinical co-diagnosis of depression and/or anxiety decreases the likelihood of revascularization among STEMI hospitalizations. Our central finding is that, paradoxically, the odds of in-hospital mortality were lower among STEMI hospitalizations with a clinical co-diagnosis of depression and/or anxiety as compared to those without. We further discovered that clinical diagnoses of depression and/or anxiety were less prevalent among revascularized as compared to non-revascularized STEMI hospitalizations. However, the percentage of clinical diagnoses of depression and/or anxiety among STEMI hospitalizations increased at a similar rate over a 10-year period irrespective of revascularization status. In conclusion, these results are suggestive of the potentially underdiagnosed mental health issues surrounding major cardiovascular events, and indeed, chronic disease as a whole. To our knowledge, this is the first study to document and examine the "depression paradox" among a population of cardiac patients.

1. Introduction

Depression and anxiety are common among patients who have chronic cardiovascular disease (CVD). Although depression and anxiety are distinct disorders, people with depression often experience symptoms similar to those of an anxiety disorder, and more than 50% of those diagnosed with depression are also diagnosed with an anxiety disorder (Hirschfeld, 2001). However, despite their frequency, these psychiatric syndromes often go unrecognized and can persist for months to years, substantially impacting quality of life (Ziegelstein et al., 2005; Huffman et al., 2006; Kaptein et al., 2006). In addition to having an elevated prevalence in CVD patients compared to the general population (Rumsfeld and Ho, 2005), both depression and anxiety have been independently associated with poor post-procedure prognosis and negative cardiac outcomes in patients with acute cardiac events and across the spectrum of cardiac disease (Frasure-Smith et al., 1995; Barth et al., 2004; Frasure-Smith and Lesperance, 2008; Wang et al., 2013). Furthermore, studies show that pre-existing depression may also be a risk factor for incident CVD, although this association remains to be fully explored (Huffman et al., 2008; Grewal et al., 2010).

Rather than being a transient reaction to having cardiac disease, depression and anxiety in cardiac patients, especially those suffering a severe cardiac event, is often both chronic and recurrent (Grace et al., 2004; Glassman et al., 2006; Lespérance et al., 2007; Hanssen et al., 2009). The American Heart Association (AHA) currently recommends that the psychosocial status of all acute myocardial infarction (AMI) patients should be evaluated, including information regarding symptoms of adjustment disorder, depression and anxiety (Antman et al., 2004). Indeed, up to 40% of patients who suffer a major cardiac event meet the criteria for major depressive disorder (MDD), compared to 5% of the general population (Narrow et al., 2002; Thombs et al., 2006; Celano and Huffman, 2011). Elevated levels of self-reported anxiety are present in 20–50% of patients following AMI, with up to one quarter experiencing symptoms of anxiety at least as intense as the average inpatient on a psychiatric unit (Crowe et al., 1996; Hanssen et al., 2009). Nonetheless, the AHA guidelines do not recommend specific procedures for assessing depression/anxiety, differentiating their symptoms from those of AMI, or addressing the need for long term

* Correspondence to: Bindu Kalesan, Center for Clinical Translational Epidemiology and Comparative Effectiveness Research, Sections of Preventive Medicine, Department of Medicine and Community Health Science, Boston University School of Medicine and Public Health, 801 Massachusetts Ave, Room 475, Boston, MA 02118, United States.
E-mail address: kalesan@bu.edu (B. Kalesan).

https://doi.org/10.1016/j.psychres.2018.03.025
Received 24 October 2017; Received in revised form 13 February 2018; Accepted 13 March 2018

mental health care (Cavanaugh et al., 1983; Thombs et al., 2006), suggesting that this vulnerable population could be suffering from an under-diagnosis of depression/anxiety.

In recent years there has been a marked decrease in the incidence of ST-elevation myocardial infarction (STEMI) hospitalizations, concurrent with an increase in STEMI-related revascularization using percutaneous coronary intervention (PCI), leading to improved in-hospital outcomes (McManus et al., 2011; Shah et al., 2015). However, to date, there is limited evidence regarding an association between depression and/or anxiety and receiving revascularization in ST-elevation myocardial infarction (STEMI) hospitalizations in a real-world setting using nationally representative data (Schulman-Marcus et al., 2016). Further, anxiety and/or depression may act synergistically to increase the risk of death or other in-hospital outcomes (Carney and Freedland, 2003; Shibeshi et al., 2007; Doering et al., 2010). In this study, we assessed whether a clinical co-diagnosis of depression and/or anxiety decreases the likelihood of revascularization among STEMI hospitalizations using data from the Nationwide Inpatient Sample (NIS) from 2004 to 2013. Further, we assessed the role of clinical co-diagnosis of depression and/or anxiety in the association between prognostic indicators (odds of in-hospital mortality and length of stay) and the likelihood of receiving revascularization.

2. Methods

2.1. Data source

We used NIS hospitalization data from 2004 to 2013, developed by the Agency for Healthcare Research and Quality (AHRQ), to conduct a repeated cross sectional analysis of hospitalized STEMI patients with and without a co-diagnosis of depression and/or anxiety. The NIS is a nationally representative claims database of hospital inpatient discharges from the State Inpatient Databases (SID) and primarily developed for the Healthcare Cost and Utilization Project (HCUP). (Agency for Healthcare Research and Quality, 2004–2013) NIS consists of a 20% stratified sample of US hospitals collected from over 1000 hospitals in 46 states, it includes approximately 8 million hospital stays each year. Beginning in the 2012 data year, the NIS redesigned its sampling methodology to include 95% of the target universe (previously included 90%), changed its sample strata from “US region” to “US census region”, and modified its sample unit from “20% stratified sample of hospitals” to “20% of discharges from US community hospitals” (Agency for Healthcare Research and Quality, 2004–2013). Boston University IRB deemed this study exempt from federal regulations for the protection of human research participants.

2.2. Study population

The inclusion and exclusion criteria for the study population is detailed in Supplementary Fig. 1. The hospitalizations occurring due to ST-elevation myocardial infarction (STEMI) were derived from primary diagnostic International Classification of Diseases, Ninth edition (ICD-9) codes. We excluded neonatal and maternal hospitalizations and those <45 years of age (due to their greatly decreased risk of AMI compared to older adults), and those with missing gender or race/ethnicity information. STEMI was identified on the basis of the site by using ICD-9 primary diagnosis codes: anterolateral wall (410.00 and 410.01), other anterior wall (410.10 and 410.11), inferolateral wall (410.20 and 410.21), inferoposterior wall (410.30 and 410.31), other inferior wall (410.40 and 410.41), other lateral wall (410.50 and 410.51), true posterior wall (410.60 and 410.61), or other specified sites like atrium, papillary muscle and septum tone (410.80 and 410.81).

We excluded the STEMI hospitalizations for subsequent care or a second episode of STEMI using secondary ICD-9 codes (410.02 for subsequent episode of care for anterolateral wall STEMI, 410.12 for subsequent episode of care for anterior wall STEMI, 410.22 for subsequent episode of care for inferolateral wall STEMI, 410.32 for subsequent episode of care for inferoposterior wall STEMI, 410.42 for subsequent episode of care for inferior wall STEMI, 410.52 for subsequent episode of care for lateral wall STEMI, 410.62 for subsequent episode of care for true posterior wall STEMI, 410.82 for subsequent episode of care for STEMI at other specified sites). We also excluded hospitalizations in which both the length of stay was equal to zero days and the patient died in hospital as it was assumed that the patient died before full demographic information was collected and prior to any therapeutic intervention.

2.3. Exposure

We categorized all STEMI hospitalizations into those were identified as having a concurrent diagnosis of depression and/or anxiety during that particular hospitalization and those who did not. Since the primary reason for hospitalization was due to STEMI, it was presumed that psychiatric disorders would not be newly diagnosed during this hospitalization (Lavoie and Fleet, 2000). Depression was diagnosed on the basis of the ICD-9 diagnosis codes as major depression (296·2, 296·3), depressive disorder NOS (311), unspecified episodic mood disorder (296·90), and dysthymic disorder (300·4). A clinical diagnosis of anxiety included ICD-9 codes for anxiety disorder NOS (300·00), panic disorder (300·01), generalized anxiety disorder (300·02), acute reaction to stress (308·0–308·9), post-traumatic stress disorder (309·81, 309·82, 309·83, 309·89), and other anxiety states (300·09).

2.4. Variables

2.4.1. Patient characteristics

The demographic variables were race/ethnicity (white, blacks, Hispanics and other), gender (male/female), age (45–54, 55–64, 65–74, and ≥ 75 years), neighborhood income based on national income quartiles for patient's zip code (low-income $\leq$ \$24,999 and not low $\geq$ \$25,000), and type of primary insurance (private/Medicare or self-pay/Medicaid/no charge/other source). Insurance type was dichotomized in this way to allow comparison of patients more likely to be covered by private insurance or who have paid into and aged into the federal Medicare program, to those patients who are more likely to be uninsured or qualify for the Medicaid health safety net program.

Patient hospitalization characteristics considered were weekend admissions, patient received from the emergency room (ER), and 29 comorbidities categorized by the AHRQ into the Elixhauser Comorbidity Index. A “weekend effect” of hospital admission has been well reported, whereby there is higher mortality among patients admitted for acute myocardial infarction (among other diseases) on weekends than on weekdays, providing strong evidence that this may be due to a lack of invasive cardiac services on weekends (Hansen et al., 2013; Isogai et al., 2015). The Elixhauser Comorbidity Index is a method for measuring patient comorbidity based on the International Classification of Diseases (ICD) diagnosis codes found in hospital administrative data. It is meant to be used with large administrative data sets to predict hospital resource use and in-hospital mortality (Elixhauser et al. 1998; Hude et al., 2005). Each comorbidity category is dichotomous – it is either present or it is not. Comorbidities have independent effects on outcomes and, thus have to be separated from the primary diagnosis. The following 29 comorbidities were considered: congestive heart failure, valvular disease, pulmonary circulation disorders, peripheral vascular disease, hypertension, paralysis, other neurological disorders, chronic pulmonary disease, diabetes (with and without chronic complications), hypothyroidism, renal failure, liver disease, chronic peptic ulcer disease, HIV/AIDS, lymphoma, metastatic cancer, solid tumor without metastasis, rheumatoid arthritis/collagen vascular diseases, coagulation deficiency, obesity, weight loss, fluid and electrolyte disorders, blood loss anemia, deficiency anemias, alcohol/