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COMMENTARY

Care Variation in the Treatment of Acute Coronary Syndrome Patients in India vs the United States

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INTRODUCTION

Controlling healthcare costs and expanding coverage have been the central domestic policy priorities of the Obama administration. While the Affordable Care Act will provide an avenue for insurance coverage to millions of previously uninsured Americans, it fails to address many of the fundamental problems perpetuating the ever-increasing strain healthcare costs place on the government, businesses, and the individual American citizen.

The United States healthcare system is the most expensive in the world. National healthcare expenditures top an estimated 17.9% of gross domestic product (GDP) and are expected to continue their trend upwards to 19.6% of GDP by 2021, with per capita spending double that of our European peers.[1] As the largest driver of the country's increasing debt, soaring costs in the health sector necessitate national and state governments to take drastic measures to meet their bottom lines through a combination of restrictions to Medicaid eligibility, increased taxes, as well as cuts to public education and other state programs.[2] Soaring medical expenditures and evidence that our high national investment is not producing the overall health results expected from such spending, signal that change is necessary if America is to rein in healthcare costs while improving the quality of care administered.

As the democratic process has stymied attempts for broader health reform, the necessary change required must come from within the existing system if American healthcare is to be transformed into something that is both self-sustaining and high performing for society as a whole. Developed nations around the world have found ways almost universally to deliver effective healthcare to their citizenry for a fraction of the United States' annual costs, however, successful models exist even in developing nations such as India.[3] As a developing nation with a nominal per capita income of only $1,500 and average "out-of-pocket" costs sitting at 60% of healthcare expenditures, ensuring access to medical treatment to a population over 1.2 billion starts with lowering the costs inherent with providing care to the masses.[4] In response to this huge demand for quality, cost-effective healthcare, many Indian hospitals have found ways to drive down the costs associated with healthcare to levels less than a fifth of those reported by hospitals in the United States.[5] In doing so, these institutions have expanded their impact in a country with so much need by increasing the quantity of care they provide for each healthcare dollar received.

Variation in the care provided between physicians and institutions leads to increased costs if the procedures ordered do little to improve the outcome of the care provided.[6] In fact, care variation and uneven adherence to evidence based standards in the treatment of many complex episodes of care, has led to cost differences reaching 50% between institutions in the US. More efficient care delivery to under-insured or non-insured patients, the largest contributors to overall health expenditures, could save the United States an estimated 300 billion dollars per year.[6]

In studying the care pathway for chest pain patients at hospitals in India and the US, differences between the provided care were determined. These findings, as well as more general observations from each institution, provided input into ways in which Indian hospitals have reduced the costs associated with care. Chest pain was chosen as it is an area that is evidence-based and has a high incidence rate, which also makes it a large contributor to the overall healthcare dollars spent. Due to the strong evidence backing specific treatment protocols in high-risk and STEMI acute coronary syndrome (ACS) patients, there is usually little variation in the care of patients on this end of the spectrum, setting up a control of sorts for the comparison. There is, however, a large variation in the care of those patients falling into lower risk categories, providing a suitable population in which to compare how these cost saving measures potentially impact the treatment path of these patients.

Through cumulative observational experiences at CARE and Osmania Hospitals, private and public respectively, in Hyderabad, India and at the University of Kansas Hospital (KUHA) in the United States, care-tracks for the treatment of low, medium, and high-risk chest pain patients were established. These tracks were designed to reflect the actual care provided, rather than stated treatment process maps at each institution. All observed patients were documented in terms of age, sex, time and day of arrival, chief complaint, onset of chest pain, risk factors (including diabetes, hypertension, hyperlipidemia, diabetes, family history of coronary artery disease, smoking, aspirin use in last seven days, and prior stenosis), as well as electrocardiogram (EKG), troponin, and two-dimensional echocardiogram (2D ECHO) results. These patients were followed to document the labs, procedures, and ongoing treatment decisions ordered throughout their hospitalization. Data concerning chest pain patients in the Clinical Throughput Unit (CTU) at the KUHA were obtained. The CTU is an outpatient observational unit that serves as an extension of the ER and supplements the observational data gathered separately at KUHA.

KUHA and CARE are accredited institutions by The Joint Commission and The National Accreditation Board for Hospitals & Healthcare Providers, its Indian equivalent, respectively, that have built their reputation on excellence in cardiac care. As a high-performing, cost-conscious Indian hospital, CARE provides an excellent

contrast to KUHA. Osmania General Hospital was included to obtain a more holistic view of the Indian healthcare system.

COMPARISONS

Clinical information from 38 patients presenting to CARE hospital in June 2014 and 257 patients to KUHA for complaints of chest pain was gathered and used to draw conclusions on the care of this patient population at each institution. Of these 257 patients at KUHA, 10 were direct observations made over the course of a week's time in May 2014, with the remaining clinical data obtained through a review of hospital medical records from November 2013 to May 2014. These clinical encounters were used to construct process maps reflecting the typical care pathway for chest pain patients presenting to KUHA and CARE, as detailed in Figures 1 and 2 respectively.

At KUHA, EKG screening and blood work for bedside troponin were performed on all 257 patients presenting to the emergency room (ER) with complaints of chest pain, with the exception of two patients in which EKG data could not be found. Patients with significant EKG changes, defined as ST-elevation, ST-depression, or T-wave inversion in two contiguous leads and positive troponin after this initial testing, were admitted for conventional angiography, with a sped-up process occurring for ST-elevated individuals that sometimes bypassed troponin screening in the emergency room. Those individuals without definitive ST segment elevation on EKG or positive troponin, but with other non-specific EKG changes were admitted to cardiology for ongoing care management. Additionally, patients who could not be ruled out for ACS with a single EKG and troponin, largely those with intermittent or ongoing pain of less than six hours onset, the amount of time it takes troponin to rise following a myocardial infarction (MI), were sent to the outpatient CTU unit for observation with serial EKG and troponin taken at six-hour intervals. The majority of patients undergoing observation received three or four troponin draws, average of 3.4 for CTU patients prior to leaving the unit. From the CTU, upwardly trending troponin or significant EKG changes were an indication for conventional angiography.

In the absence of these findings, the vast majority of patients were sent for thallium or exercise ECHO stress testing, which determined whether conventional angiography was performed or the patient was discharged with outpatient follow-up. In lieu of stress testing, a minority of lower-risk patients underwent cardiac computed tomography angiography (CCTA) evaluation if a non-ACS cause for the patient's symptoms was suspected.

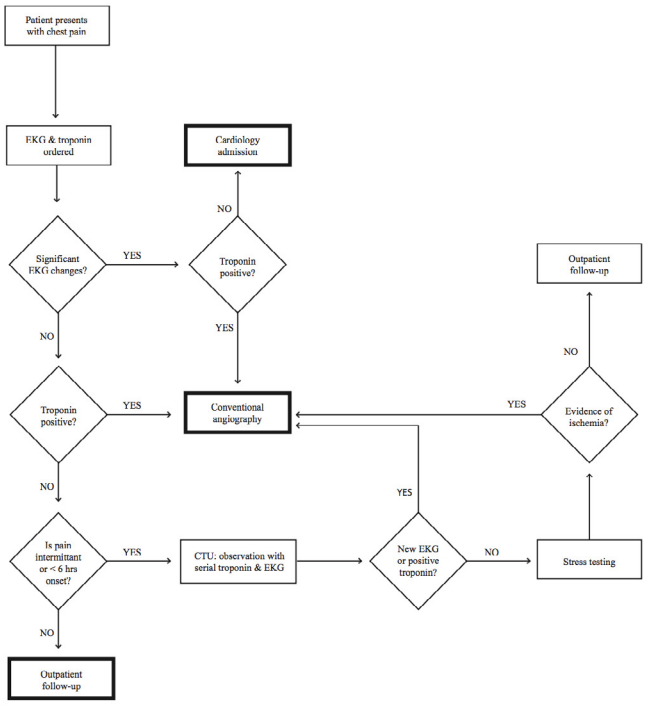

Figure 1. The University of Kansas Hospital observed chest pain protocol.

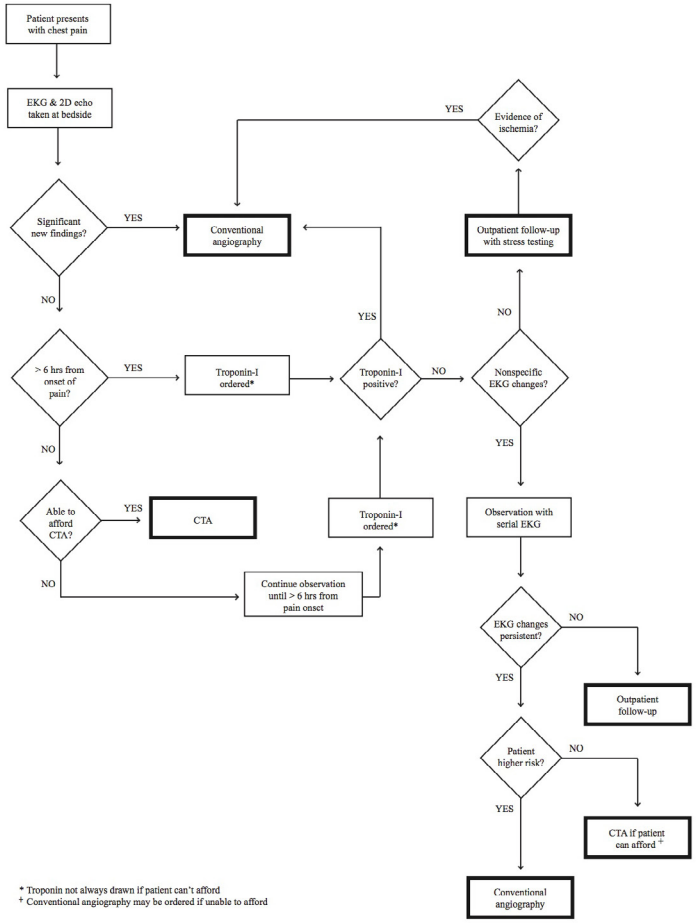

Figure 2. CARE Hospital observed chest pain protocol.

Patients presenting to CARE Hospital with complaints of chest pain quickly underwent EKG and resting ECHO evaluation, with interpretation by cardiologists, at the bedside. ST-segment elevation and new ST-depression or T-inversion accompanied with a bundle branch block, regional wall motion abnormalities on ECHO, or longstanding hypertension and diabetes were indications for the patient to be admitted straight to the heart catheter lab for conventional angiography. With two exceptions due to cost concerns in lower-risk patients, individuals who did not meet these criteria had troponin drawn once six hours had passed since the onset of their symptoms.

In a single instance, computed tomography angiography (CTA) was offered to a patient with atypical pain of one-hour onset with the means to afford this procedure instead of continuing observation until this six-hour threshold had been reached. A positive troponin draw resulted in a planned catheterization in all four observed cases. Three of these patients sent for conventional angiography following positive troponin had new nonspecific EKG changes at admission, while the fourth, who had a history of coronary artery disease without new EKG changes, was sent to the heart catheter lab after he remained symptomatic overnight. Chest pain patients with negative troponin values and without EKG changes were discharged for outpatient follow-up, repeat EKG, and stress testing in two to three days' time at the CARE cardiology clinic, while those with nonspecific EKG findings were kept for observation and serial EKG at two hour intervals. Persistent EKG changes, specifically ST-depression or T-wave inversions, resulted in either conventional angiography or CTA procedures depending on the patient's perceived risk level and ability to afford a CTA. A patient planned for a CTA may receive conventional angiography instead due to patient cost concern or higher risk features, such as elevated calcium scores, determined during the pre-CTA work-up.

DISCUSSION

Contrary to hospitals in the United States, the private Indian healthcare system has developed in an environment of chronic underfunding from the Indian government whose healthcare expenditure per capita in 2013 was only $61.[7] According to the Indian judicial system, every hospital in India is mandated to provide timely care to all individuals regardless of their ability to pay. In practice, however, this is not always the case. While CARE hospital has foundational money set aside for the treatment of non-paying patients, doctors, especially those seeing entry level patients, have to be very cognizant of the costs associated with the medical care provided. Many of the doctors at CARE expressed frustrations that the government does not realize that providing emergency care requires money for equipment and resources, money that is not refunded to the hospital fully from the government. In a country where the majority of citizens are unable to afford medical care, private hospitals are under pressure to keep costs down and to balance the care of these patients with paying patients. This is achieved at CARE through the utilization of a "hub and spoke" healthcare structure through which patients with the ability to pay and those requiring urgent care are referred from more rural clinics to centrally located hospitals where specialists and expensive equipment are concentrated.

In comparing KUHA and CARE, there were several differences noted in the care of patients presenting with chest pain at each institution. At CARE Hospital, troponin is used in a more focused and deliberate manner. Instead of using troponin in tandem with EKG to rule-in ACS in each chest-pain case, CARE first relies on 2D bedside echocardiography (ECHO) and EKG screening to catch high-risk ACS patients who require immediate catheterization. In using 2D-ECHO in place of an immediate troponin draw, CARE replaces lab work with imaging that has little additional per-use costs associated with it. Patients without significant EKG or ECHO findings will receive troponin lab work, but only after six hours from their reported onset of pain to insure that troponin levels have had sufficient time to show up in the blood. No patient observed at CARE received serial troponin draws, despite that being the stated treatment plan for one patient prior to his care ultimately being shifted to GI, which stands in stark contrast to standard protocol at KUHA. It is clear that CARE uses troponin testing in an effort to maximize the clinical usefulness of a single troponin draw per patient to cut down on the need for additional laboratory testing. Additionally, in sending patients to the heart catheter lab directly upon significant EKG findings, or nonspecific changes supported by ECHO, CARE cut back on much of the standard testing that is a part of the full-workup for these patients at KUHA prior to conventional angiography.

These differences in protocol do not come without clinical implications for patients who present with chest pain to each institution. At both KUHA and CARE, EKG is the first priority followed by troponin or ECHO, respectively. Although EKG is recognized as the first-line diagnostic tool for the detection of cardiac abnormalities, this testing is insensitive, yielding normal findings in 6-7% of ACS patients and non-diagnostic results in 50% of acute myocardial ischemia cases.[8] Troponin and ECHO testing are utilized in an attempt to bridge this gap, but each has its limitations. Troponin has proven to be a useful diagnostic test for myocardial infarction detection, however, while positive enzyme values strongly correlate with increased morbidity and mortality, non-elevated values far from rule out the presence of smaller episodes of ACS induced ischemic episodes that are predictive for future cardiac events.[9]

Troponin testing is positive in 5% of "low risk" patients and only 40% of patients that require revascularization procedures.[9] Likewise, while 2D resting ECHO screening is useful in visualizing regional wall motion abnormalities (RWMA) that develop within seconds of coronary artery occlusion, without stressing the heart, it is limited in its ability to assess the presence of smaller occlusions

or ischemic events.[10] Echocardiography has the advantage of detecting cases of ACS before EKG or troponin changes occur, however, it cannot differentiate between alternate causes of motion abnormalities such as left and right bundle branch blocks, which are a significant cause of false positives with this diagnostic tool. It also has the added benefit of providing prognostic information of the expectations for recovery following revascularization in cases of suspected hibernating myocardium through the measurement of end-diastolic wall thickness and left ventricular filling patterns.[11] Parato et al.[10] supported the role of EKG as the mainstay in ACS detection, especially in low-risk cases, but also demonstrated the value of a combination approach, one which utilizes the strengths of each diagnostic modality in making the prompt, accurate diagnosis of ACS.

Given the stated limitations, KUHA may be over-utilizing troponin testing, especially in patients that have recorded positive values already and will continue to have elevated levels for several weeks. In combining troponin testing with increased use of ECHO, KUHA may be able to replace some of the more costly laboratory testing with this proven imaging technique that requires minimal additional per-screening costs. Under existing payment structures within the American healthcare system, however, evaluation with ECHO involves a large charge markup. Effective use of ECHO also requires physicians trained in using and interpreting the results from this technology and is more time consuming. While CARE has trained cardiologists doing this screening in their emergency room, not all emergency medicine physicians at KUHA, who largely function on their own in the initial work-up of chest pain patients, are competent in utilizing this imaging modality. There are signs, however, that this may be changing. With bedside ultrasonography recently added to the list of core competencies expected from Emergency Medicine residency graduates, and with increasing numbers of ultrasonography fellowship trained emergency physicians entering the marketplace, it is not unreasonable to expect that this initial imaging could be performed without the added involvement of cardiology which increases the associated costs.

A potential concern from the pathway observed at both hospitals is the volume of patients undergoing catheterization. A recent meta-analysis by Stergiopoulos et al.[12] found no significant difference in the outcomes of stabilized non ST-elevated patients receiving either percutaneous coronary interventions or medical management for their known coronary artery disease. Given the costs and risks associated with these procedures, a prompt review of the indications for catheterization in non ST-elevated individuals is needed, in particular those receiving this intervention on the basis of positive stress testing and history of coronary artery disease.[12]

Outside of measures directly related to patient care, there were many ways that CARE Hospital reduced the costs related to each patient encounter. While the hospital was kept clean and secure, very little was spent on patient luxuries that are taken for granted in the United States. Individual rooms, which included a small TV, were provided only to patients that could afford to pay for them, otherwise patients were kept in wards with privacy provided through curtaining. Families were allowed in patient care areas for only an hour each day, which allowed the units to avoid congestion and maximize space utilization in this set-up. Additionally, while the hospital environment was kept at a comfortable temperature, it was achieved less through the utilization of air conditioning, although it was available if required, and more through the extensive use of fans and window shading in most units. Each of these areas represented measures that reduce patient costs without substantially impacting outcomes.

Unlike in the United States, patients in India keep track of their own healthcare records following their discharge. As a result of this practice, recording clinical impression, ongoing care plan, and discharge notes for low-risk chest pain patient encounters required "catching" the patient while they were present in the ER prior to their discharge. Additionally, as a hospital having built its reputation on cardiac care and that served as the "hub" in the organization's "hub and spoke" set-up, 70% of cardiac patients seen in the ER at CARE Hospital were higher-risk referrals from outside clinics, which added to the difficulty of gathering an adequate number of low-risk patient encounters. For these reasons, attention focused away from tracking all risk-category chest pain patients in the hospital to harder to observe lower-risk patients in the emergency room. Ultimately, the total volume of lower-risk cases collected likely did not reflect the entire range of clinical presentations screened at CARE, making construction of a process map that included every decision point impossible; however, no process map is broad enough to encompass every presentation. Ideally, pairing the care pathway observed at each hospital with patient risk to healthcare outcome analysis would have been more meaningful. This objective was hindered by the fact that quality outcome data are not mandated by the Indian government, and CARE, along with most private hospitals in India, do not track this information, as doing so requires additional administration and costs. Retroactive analysis of these data also is prevented in a system where medical records leave with the patient at the time of discharge.

In the end, the clinical time spent at Osmania Government Hospital did not prove to be a useful comparison to care in the United States. The healthcare system in India consists of a mixture of public and private allopathic institutions as well as alternative healthcare practitioners. Public hospitals are set up as a place where those living below the poverty line can come to receive medical care free of cost. However, with government investment in the public healthcare sector only totaling 1% of GDP, these institutions lack the resources to provide effective care to the masses that show up to their door.[7] The clinics are overwhelmed; one cardiologist sees 50 patients during their two hour clinic time, important medical equipment goes unfixed when it breaks down,

the heart catheter lab equipment was down during the entirety of my week stay, and large sections of the hospital go without any degree of cleaning. In fact, several patients had been waiting in the cardiology ward for a month for their planned percutaneous transluminal coronary angioplasty procedures due to equipment failures. The lack of consistency in care observed as a result of these factors makes comparison of care at Osmania to KUHA a fruitless exercise.

CONCLUSION

Protocols for chest pain patients at the University of Kansas Hospital in the United States and CARE Hospital in India were produced through clinical observation and compared. Notably, CARE Hospital places a much stronger reliance on 2D resting ECHO, bypassing immediate troponin testing prior to catheterization in ST-segment elevated individuals or those displaying new ST-depression or T-inversion accompanied with a bundle branch block, longstanding hypertension and diabetes, or regional wall motion abnormalities on ECHO. Additionally, as an institution facing tight budget constraints as a result of the socioeconomic and political realities of providing healthcare in India, CARE has found successful ways to reduce their operational costs in areas that do not have a negative impact on the quality of care administered.

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