THERE IS A LOW RATE OF MAJOR ADVERSE CARDIOVASCULAR EVENTS IN CHEST PAIN PATIENTS WITH A MODERATE RISK HEART SCORE REFERRED FROM URGENT CARE FOR EXPEDITED OUTPATIENT CARDIOLOGY EVALUATION: A MULTI-CENTER STUDY

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Highlights

This was the first experience of an expedited outpatient cardiology evaluation for stable patients who present to urgent care with chest pain and HEART score 4–6. This approach was proven to be safe, effective, and associated with low risk of myocardial infarction and no death due to delay of care during 6 weeks of follow-up.

Background	The HEART score is an effective method of risk stratifying emergency department (ED) patients with chest pain. The rate of major adverse cardiovascular events (MACE) in patients with moderate HEART score referred from an urgent care (UC) for an expedited outpatient cardiology evaluation for 11 months was described in 133 patients in a previous study. This is a follow-up study with 18 months of data and 206 patients.
Aim	The primary outcome was to examine the rate of MACE when patients with moderate HEART score were referred for an expedited outpatient cardiology follow-up after evaluation in urgent care. The secondary outcome was to determine if there is a decrease in rate of ED transfer after this protocol was introduced.
Methods	A cross-sectional study was conducted by a multispecialty group in Las Vegas, Nevada, which included 206 patients with a HEART score of 4 to 6 (i.e.: moderate risk) who presented to one of five UC centers with chest pain or an anginal equivalent. A streamlined evaluation protocol to assess each HEART score component was adopted by all UC providers to facilitate an expedited outpatient cardiology follow-up, as an alternative to referral to the emergency department. Data was collected from February 14, 2019 through August 13, 2020. The population was followed for 6 weeks with a primary endpoint of MACE determined by electronic medical record review and direct phone contact with patients. Outcomes were confirmed in 98% of patients. Chest pain transfer data was compared between 12 months prior to implementing HEART protocol and 18 months of data analysis while using the new protocol.
Results	Over the course of 18 months, 206 patients with a moderate risk HEART score were referred to outpatient cardiology in an expedited manner. The average age was 65 with 53% female and 47% male patients. 150 patients (73% of the 206) were seen within 3 days, 114 (55%) underwent stress testing, 6 (3%) had coronary computed tomography angiogram, and 6 (3%) received an invasive coronary angiogram. Five patients were found to have MACE: one patient who had a non-ST-elevation myocardial infarction and subsequent coronary stent, two patients were found to have obstructive disease after coronary angiography with subsequent coronary artery bypass graft, one patient had an abnormal stress test and subsequent coronary stent, and one patient had critical mitral stenosis, multi-vessel coronary artery disease and underwent coronary artery bypass graft with mitral valve replacement with complications of renal failure and COVID-19 and expired. The emergency department referral rate declined by 21%.
Conclusion	Patients with a moderate risk HEART score referred from UC for an expedited outpatient cardiology evaluation had a low rate of MACE and no deaths due to delay of care. There was also a significant decrease in the rate of ED referrals.
Keywords	Chest pain • HEART • Risk stratification • Outpatient cardiology

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Abbreviations			
CABG	– coronary artery bypass graft	MVR	– mitral valve replacement
ED	– emergency department	nSTEMI	– non-ST-elevation myocardial infarction
MACE	– major adverse cardiovascular event	UC	– urgent care

Introduction

The HEART score is a risk-stratification tool for assessing the likelihood that a patient with chest pain will experience a clinically important, irreversible cardiac event (i.e., myocardial infarction, revascularization, or cardiac death). Each component of the HEART score is assigned a point value between 0 and 2, depending on the extent of the abnormality. A total HEART score between 0 and 3 represents a 2.5% risk for an event, while a score >7 carries a 72.7% risk [1].

The advent of the HEART score [1] and it's validation [2, 3], has resulted in a more appropriate disposition of low risk patients (HEART score 0–3) due to a low risk of a major adverse cardiovascular event (MACE), as defined by revascularization, myocardial infarction, or death within 4–6 weeks. In over 2,440 patients Backus et al showed a 1.7% risk of MACE in low-risk patients in the Netherlands [3] though a recent analysis of North American patients has shown a lower rate of 0.8% [4].

MACE outcomes for patients in the moderate-risk HEART category (score of 4–6), in the Netherlands were shown to be 17% [3], with a recommendation of admission for further evaluation, but less is known about the safety of an expedited outpatient evaluation. In 2018, the American College of Emergency Physicians (ACEP) published a practice guideline for patients seen in the emergency department with a negative evaluation for chest pain, recommending follow-up within 1–2 weeks, and an acceptable miss rate of MACE of 1–2% (ACEP 2018 policy statement) [5].

The rate of MACE in patients with chest pain and a moderate risk HEART score presenting to an Urgent Care center is unknown. The primary outcome of this study is to examine the rate of MACE after a negative urgent care (UC) evaluation, when this group is referred for an expedited outpatient cardiology follow-up within 3 days. The secondary outcome is to determine the change in emergency department (ED) referral rate after the protocol for expedited outpatient follow-up was introduced.

Methods

A cross-sectional retrospective study was conducted at five UC locations. Two hundred six consecutive patients who presented to UC with chest pain or anginal-equivalent (such as jaw or throat pain with exertion) from February 14, 2019 to August 13, 2020 and were assigned a HEART score 4–6 were included. Patients under the age of 18 or those with positive troponin, paced rhythm, left bundle branch block, significant ST-segment deviation on electrocardiogram, escalating angina or unstable vital signs were excluded.

Conventional troponin I was used. Only one troponin was done if the initial value was <0.03 ng/dl. The troponin (trop) was repeated for values 0.03–0.06 ng/dl (Fig. 1).

Patients were seen by UC providers including physicians, mostly board certified in Family Medicine, and advanced practice clinicians, both physician assistants and nurse practitioners. In cardiology follow-up, patients were seen by cardiologists (if new patients to the practice) or advanced practice clinicians (if established patients).

UC clinicians followed a predefined protocol with disposition recommendations for patients with an intermediate HEART risk score (4–6) to be scheduled for an expedited cardiology consultation within 3 days of discharge.
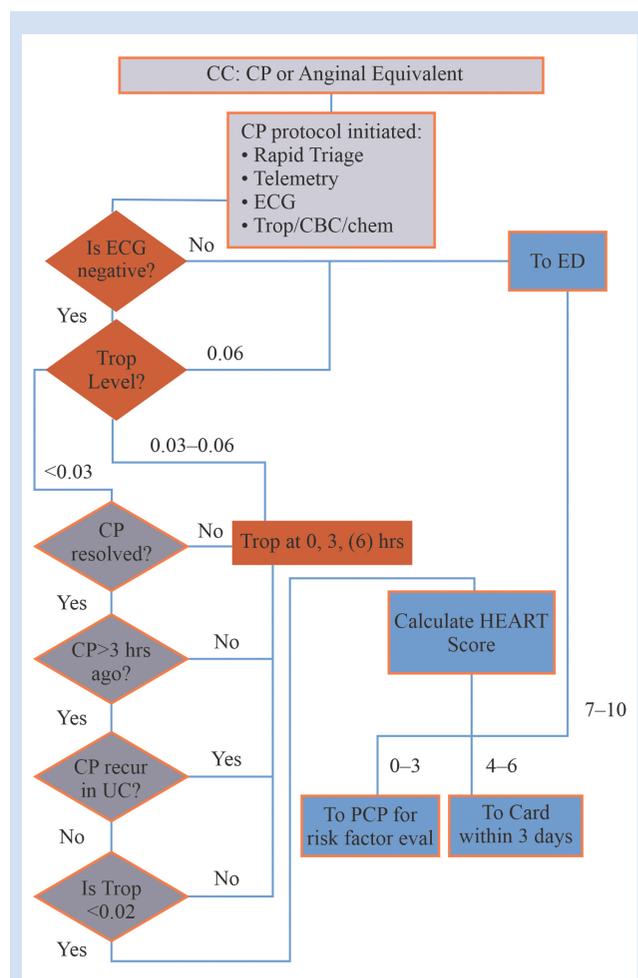

Figure 1. Protocol for disposition of urgent care patients with chest pain
Note: CBC – complete blood count; CC – chief complaint; CP – chest pain; ED – emergency department; ECG – electrocardiography; PCP – primary care physician; UC – urgent care.

The cardiology department created appointments for these patients to be scheduled directly by the UC staff. During the cardiology consultation, additional disposition decisions were made including medical treatment, outpatient stress testing, echocardiography, coronary computed tomography angiography or a conventional coronary angiography.

The TIMI [6] protocol was used for risk stratifications of patients presenting to UC with chest pain or angina equivalent, prior to institution of new HEART model in February 2019. Thus, the percentage of ED referral was compared between the times when each protocol was used.

The study was approved by UnitedHealth Group Office of Human Research Affairs on June 18, 2020.

Results

Data was collected from February 14, 2019 through August 13, 2020. The average age was 65 with 109 female (53%) and 97 male (47%) patients. The population was followed with primary endpoint of MACE at 6 weeks determined by electronic medical record review and direct phone contact with patients (Table 1).

Over the course of 18 months, 206 patients with a negative UC evaluation and a moderate risk HEART score were referred for an expedited cardiology follow-up. Of the 206 patients referred for outpatient evaluation, 171 presented for the appointment; of these 150 (73% of the 206) were seen within 3 days. Of 206 patients, 114 (55%) underwent stress testing, 6 (3%) had coronary computed tomography angiogram, 6 (3%) received an invasive coronary angiogram.

Five patients were found to have MACE: one patient who had a non-ST-elevation myocardial infarction (nSTEMI) and subsequent coronary stent in right coronary artery, two patients were found to have obstructive disease after coronary angiography with subsequent coronary artery bypass graft (CABG), one patient had an abnormal stress test and subsequent stent in left anterior descending artery and one patient had critical mitral valve stenosis, multivessel coronary artery disease and underwent CABG with mitral valve replacement (MVR). That patient was the only death identified one week following CABG/MVR complicated by renal and respiratory failure and COVID-19 (Table 2).

The secondary outcome was to determine if this protocol decreased referrals to the ED. Institution of the outpatient HEART protocol from February 14, 2019 through August 13, 2020, decreased the rate of ED referral rate by 21%, compared to February 14, 2018 and February 13, 2019 (Fig. 2).

The number of UC presentations for chest pain from February 14, 2018 to February 13, 2019 was 3,330 with 466 transfers to the ED (14%). After introduction of the protocol (on February 14, 2019), UC visits for chest pain and referrals were reassessed: from February 14, 2019 to August 13, 2020 there were 4,721 presentations for chest pain with 519 transfers (11%) representing a 21% reduction in referrals to the ED (Z statistic -4.6992, $p < 0.00001$, 95% confidence interval).

Discussion

Though clinicians still have considerable concern for MACE when discharging patients from ED with chest pain [7], the practice of referring patients with a low risk HEART score for outpatient evaluation

Table 1. Patient demographics

Average age (yrs)	65
Females	109 (53%)
Males	97 (47%)
HEART score:	
4	124 (60%)
5	64 (31%)
6	18 (9%)
Arteriosclerosis	81 (40%)
Hypertension	152 (73%)
Diabetes mellitus	70 (34%)
Dyslipidemia	164 (80%)
Obesity	42 (36%)
Tobacco abuse	33 (16%)
CVA/TIA	18 (9%)

Note: CVA – cerebrovascular accident; TIA – transient ischemic accident.

Table 2. Patients referred for expedited outpatient cardiology follow-up with MACE within 6 weeks

Patient age and sex	Symptoms	HEART score	Positive components	Time to cardiology evaluation, days	Diagnostic test	MACE outcome
70, M	CP at rest, relieved w/ NTG	6		2	LHC: multivessel CAD	CABG
68, M	CP w/ exertion for 3 mo		History: 2 Age: 2 Risk: 2	3	Nuclear stress, LHC: severe LAD disease	DES to LAD
67, M	Throat pain w/exercise for 2 wk			1	Delayed stress test scheduling, LHC: severe RCA disease	nSTEMI 12 days later, DES to RCA
65, F	Chest pressure at night, DOE		History: 1 ECG: 1 Age: 2 Risk: 2	2	LHC: multivessel CAD	CABG
54, M	Chest pain with CHF	4	History: 1 ECG: 1 Age: 1 Risk: 1		Echo: critical mitral stenosis LHC: multivessel CAD	Expired after CABG with MVR Hypoxic COVID+

Note: CABG – coronary artery bypass graft; CAD – coronary artery disease; CHF – congestive heart failure; CP – chest pain; DES – drug eluting stent; DOE – dyspnea on exertion; ECG – electrocardiography; LAD – left anterior descending; LHC – left heart catheterization; MACE – major adverse cardiovascular event; MVR – mitral valve replacement; nSTEMI – non-ST-elevation myocardial infarction; NTG – nitroglycerin; RCA – right coronary artery.

has become more widely accepted. Less is known about the risk of patients with a moderate risk HEART score and safety of referring them from UC for an expedited outpatient cardiology evaluation.

After introduction of a protocol to evaluate UC patients with chest pain as outpatients, over a span of 18 months, only 5 of 206 patients had a MACE; one with a positive stress test and subsequent stent to the left anterior descending, two with subsequent CABGs, one who returned and was found to have an nSTEMI (note that the outpatient referral deviated from the instituted protocol with a delay in scheduling of the stress test), and one patient with critical mitral stenosis and congestive heart failure

Figure 2. Emergency department referral percentages comparing the last 12 months of TIMI (2/14/2018 to 2/13/2019) to the time since implementation of HEART protocol (2/14/2019 to 8/13/2020) for chest pain risk stratification

who was found to have severe coronary artery disease, underwent CABG with MVR and ultimately expired from his medical condition and COVID-19.

It is the consensus of these authors that the patient did not expire due to a delay in care as he was seen by a cardiologist 2 days after presenting to urgent care, an echocardiogram done 2 days later showed severe stenosis of a bioprosthetic mitral valve implanted 11 years earlier, and he was then admitted to the hospital in stable condition. His surgery was postponed by 10 days due to worsening of baseline abnormal renal function and unfortunately expired due to postoperative complications of renal failure and COVID-19 with a cardiac arrest about 10 days after the surgery.

The risk of MACE in patients after a negative evaluation is low, with one of the primary considerations being missed myocardial infarction. Hess et al demonstrated a low rate of adverse outcomes in patients with nSTEMI with a rate of sudden cardiac death of 0.79% in the six months following diagnosis. Even in the ED setting, there is an exceedingly low risk of clinically relevant cardiac events including ST-elevation myocardial infarction, life-threatening arrhythmia, cardiac arrest and death [8]. After a negative evaluation for chest pain, patients are able better understand their individual risk and to make decisions using a shared decision-making model [9, 10].

To our knowledge, this is the first study to evaluate MACE outcomes and decreased ED referrals in UC patients after the institution of a protocol for expedited outpatient referral to cardiology over 18 months of time.

Institution of the protocol resulted in a 21% decrease in patients referred from the UC to the ED, with subsequent potential implications including reduced cost, decreased resource utilization, less patient inconvenience and potential for over-testing and false positive results.

Limitations include missed MACE outcomes with the 2% of patients who were not able to be contacted.
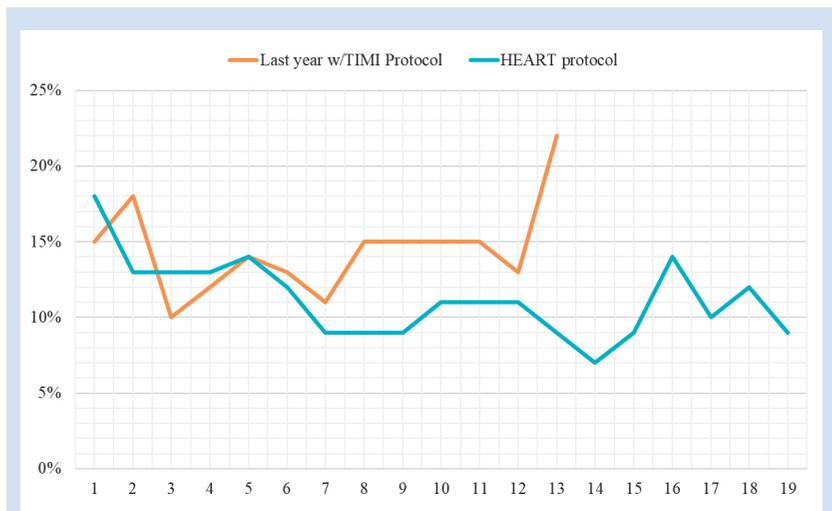
We did not evaluate for adverse cardiac events after the cardiology visit such as complications from a cardiac catheterization or a procedure. Past studies have shown that there is some clinician variation in calculation of the HEART score [11, 12], this study did not standardize the calculation and we did not examine for physician variation. Some patients who did not follow-up may have had an unrecognized MACE such as a silent myocardial infarction. This study is a follow up 18 month data from a study published previously with 11 month data [13].

Conclusions

Patients with a moderate risk HEART score referred from UC for an expedited outpatient cardiology evaluation had a very low rate of MACE outcomes and no deaths from delayed care. The referral rate to the ED decreased by 21% during the study period. Expedited outpatient cardiology referral for UC patients with chest pain and moderate risk HEART score appears to be a reasonable approach for this patient population.

Conflict of interest

S. Barbarash declares no conflict of interest related to this article. D. Lebron-Gallagher declares no conflict of interest. H. Julson declares no conflict of interest. M.B. Weinstock declares no conflict of interest.

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Author Contribution Statement

SB – significant contribution to the concept and design of the study, editing, approval of the final version, fully responsible for the content

DLG – data collection and analysis, editing, approval of the final version, fully responsible for the content

HJ – data analysis, editing, approval of the final version, fully responsible for the content

MBW – significant contribution to the concept and design of the study, manuscript writing, editing, approval of the final version, fully responsible for the content

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