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Implications of a Recurrent In-Hospital Cardiac Arrest on Survival and Neurological Outcomes

Maya L. Chan[#], John A. Spertus, MD, MPH^{*,†}, Yuanyuan Tang, PhD^{*}, Monique Anderson Starks, MD, MHS[@], Paul S. Chan, MD, MSc^{*,†}, and for the American Heart Association's Get With The Guidelines-Resuscitation Investigators

[#] Pembroke Hill High School, Kansas City, MO

^{*} Saint Luke's Mid America Heart Institute, Kansas City, MO

[†] University of Missouri - Kansas City, Kansas City, MO

[@] Duke Clinical Research Institute, Duke University School of Medicine

Abstract

Background: Despite the high incidence of in-hospital cardiac arrest (IHCA) in U.S. hospitals, the prognosis and end-of-life decision-making patterns of a patient with a recurrent IHCA are unknown.

Methods: Within Get-With-The-Guidelines-Resuscitation, we identified 192,250 patients from 711 hospitals with an IHCA from 2000–2015. Patients were categorized as having no recurrent IHCA (only 1 event), recurrent IHCA (≥ 2 IHCAs), and recurrent out-of-hospital cardiac arrest (OHCA), defined as an IHCA after an OHCA. Using multivariable hierarchical logistic regression, rates of survival to discharge and favorable neurological survival (mild or no disability) between the 3 groups were compared. Rates of *de novo* Do-Not-Attempt-Resuscitate (DNAR) and withdrawal of care orders among successfully resuscitated patients were also evaluated.

Results: Overall, 165,446 (86.1%) had no recurrent IHCA, 23,643 (12.3%) recurrent IHCA, and 3162 (1.6%) recurrent OHCA. Compared with patients with no recurrent IHCA, patients with recurrent IHCA were less than half as likely to survive to discharge (12.7% vs. 22.1%; adjusted

Corresponding Author Contact Information: Paul S. Chan, MD, MSc, Mid America Heart Institute, 9th Floor, 4401 Wornall Road, Kansas City, MO 64111, pchan@saint-lukes.org.

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Study Concept and design: M. Chan, P. Chan

Acquisition of Data: P. Chan, Tang

Statistical Analysis: Tang

Analysis and interpretation of data: M. Chan, Spertus, Tang, Starks, P. Chan

Drafting of the manuscript: M. Chan and P. Chan

Critical revision of the manuscript for important intellectual content: M. Chan, Spertus, Tang, Starks, P. Chan

Study Supervision: P. Chan

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OR: 0.46 [0.44, 0.48] $P<0.001$) and have favorable neurological survival (7.0% vs. 13.1%; adjusted OR: 0.44 [0.42, 0.47] $P<0.001$). Compared with patients with recurrent OHCA, patients with recurrent IHCA also had lower rates of survival to discharge (12.7% vs. 16.1%; adjusted OR: 0.81 [0.71, 0.94] $P=0.005$) and favorable neurological survival (7.0% vs. 8.9%; adjusted OR: 0.66 [0.54, 0.81] $P<0.001$). Despite worse survival outcomes, patients with recurrent IHCA were least likely to adopt DNAR orders within the first 24 hours after successful resuscitation compared with patients with no recurrent IHCA or recurrent OHCA (17.2% vs. 18.9% and 26.6%, respectively) or withdraw care at any time (17.7% vs. 24.4% and 31.2%, respectively).

Conclusions: Nearly 1 in 8 patients with an IHCA has a recurrent IHCA, and these patients have worse outcomes than patients with only a single IHCA and those with an IHCA after being hospitalized for an OHCA. Despite worse survival, rates of DNAR and withdrawal of care were lowest for patients with recurrent IHCA. These findings provide important prognostic information for clinicians caring for patients with recurrent IHCA and suggest the need to better align resuscitation and end-of-life decisions with patients' prognoses after IHCA.

Over the past decade, a number of studies have described survival outcomes for patients with an in-hospital cardiac arrest (IHCA), with rates of survival to discharge of approximately 20% to 25%.¹ IHCA remains highly prevalent in U.S. hospitals, affecting approximately 200,000 patients annually.² Nonetheless, the proportion of patients with a recurrent IHCA during the same hospitalization, and the associated prognosis of a recurrent IHCA, remain unknown. Whether there are differences in outcomes between patients with a recurrent arrest in which the index arrest was an IHCA vs. an out-of-hospital cardiac arrest (OHCA) also has not been examined. A better understanding of the epidemiology and prognosis of recurrent IHCA could provide useful information for clinicians and families. Additionally, if patients with recurrent IHCA have worse survival outcomes, patterns of decision-making regarding Do Not Attempt Resuscitation (DNAR) orders and withdrawal of care between those with and without a recurrent IHCA are important to understand, as end-of-life decisions in patients with IHCA have not always been aligned with patients' prognoses.³

Accordingly, within a large national registry, we examined the frequency with which a patient with an IHCA has a recurrent IHCA during a hospitalization, and whether rates of survival to discharge and favorable neurological survival for patients with a recurrent IHCA differs from those with only a single IHCA event or those with an IHCA after an initial OHCA. Moreover, we evaluated patterns of end-of-life care among those with return of spontaneous circulation (ROSC) among these 3 patient groups, with a focus on *de novo* DNAR and withdrawal of care orders after successful resuscitation.

Methods

Data Sources

GWTG-Resuscitation[®] is a large, prospective, national quality-improvement registry of IHCA and is sponsored by the American Heart Association. Its design has been previously described in detail.⁴ In brief, trained hospital personnel identify all patients without do-not-resuscitate orders with a cardiac arrest (defined as absence of a palpable central pulse, apnea, and unresponsiveness) and who undergo cardiopulmonary resuscitation. Cases are identified

by multiple methods, including centralized collection of cardiac arrest flow sheets, reviews of hospital paging system logs, and routine checks of code carts, pharmacy tracer drug records, and hospital billing charges for resuscitation medications.⁴ The registry uses standardized Utstein-style definitions for all patient variables and outcomes to facilitate uniform reporting across hospitals.^{5, 6} In addition, data accuracy is ensured by rigorous certification of hospital staff and use of standardized software with data checks for completeness and accuracy.

Study Population

The study cohort included 192,250 patients with at least 1 IHCA from 711 acute-care hospitals that submitted data to GWTG-Resuscitation between January 1, 2000 and December 31, 2015. As we were interested in comparing patients with no recurrent IHCA with those who had a recurrent cardiac arrest, we categorized patients into 3 groups: 1) no recurrent IHCA (only 1 IHCA event); 2) recurrent IHCA, defined as 2 cardiac arrests during the same hospitalization in which the initial cardiac arrest was an IHCA; and 3) recurrent OHCA, defined as an IHCA occurring in a patient with an initial OHCA.

Study Outcomes

The primary outcome was survival to hospital discharge, and the secondary outcome was favorable neurological survival. Based on prior work showing large prognostic differences in long-term survival between patients with a discharge cerebral performance category (CPC) score of 1 vs. 2, favorable neurological survival was defined as survival to hospital discharge with a discharge CPC score of 1.⁷ A CPC score of 1 denotes patients with mild to no neurological disability, 2 for moderate neurological disability, 3 for severe neurological disability, and 4 for coma or vegetative state.

For descriptive purposes, we also examined the proportion of patients in each of the 3 groups with ROSC who were made DNAR. Rates of DNAR were examined after successful resuscitation from the second cardiac arrest for patients with recurrent IHCA or recurrent OHCA and after the index cardiac arrest for patients with no recurrent IHCA, since this latter group of patients would not have had a second cardiac arrest. Since many patients who eventually die have DNAR orders closer to the time of death, and as we were interested in examining whether DNAR decisions correlated with an index or recurrent cardiac arrest, we defined DNAR status as a patient for whom a DNAR order was placed *within 24 hours* after ROSC, based on our prior work,³ but also examined rates of DNAR at any time after ROSC in the 3 patient groups. Furthermore, we compared rates of withdrawal of care (i.e., “comfort care”) among patients with no recurrent IHCA, recurrent IHCA, and recurrent OHCA who achieved ROSC

Statistical Analysis

Baseline differences between patients with no recurrent IHCA, recurrent IHCA, and recurrent OHCA were evaluated using χ^2 tests for categorical variables and analysis of variance for continuous variables.

To evaluate differences in survival outcomes between patients with no recurrent IHCA vs. those with recurrent IHCA, we constructed multivariable hierarchical logistic regression models. Hierarchical logistic regression was used to account for clustering of patients within hospitals,⁸ wherein hospitals were modeled as random effects and the following clinical variables were modeled as fixed effects: age, sex, race (white, black, and other), initial cardiac arrest rhythm (asystole, PEA, ventricular fibrillation, pulseless ventricular tachycardia), hospital location of cardiac arrest, comorbid conditions and medical conditions present within 24 hours of cardiac arrest (heart failure, myocardial infarction, diabetes mellitus, renal insufficiency, hepatic insufficiency, respiratory insufficiency, baseline neurological deficit, acute stroke, pneumonia, hypotension, sepsis, metabolic or electrolyte abnormality, and metastatic or hematologic malignancy) and interventions in place at the time of cardiac arrest (continuous intravenous vasopressor, mechanical ventilation, and hemodialysis). The model also adjusted for calendar year of the arrest, duration of the acute cardiopulmonary resuscitation to achieve ROSC (i.e., code duration), as well as the time of day (work hours [7:00 am to 10:59 pm] vs. after hours [11:00 pm to 6:59 am]), and day of the week (weekday vs. weekend) of the cardiac arrest.⁹

Separate models were constructed to examine differences in rates of survival to discharge and favorable neurological survival between patients with no recurrent IHCA and those with a recurrent IHCA. Similarly, separate multivariable hierarchical logistic regression models were constructed to evaluate differences in these two outcomes between patients with recurrent OHCA and those with recurrent IHCA.

Data on discharge neurological status was missing in 7584 (3.9%) patients and was assumed to be missing at random. IVEWARE software was used to perform multiple imputation with 10 data sets, the results of which were pooled.¹⁰ Results with and without imputation were not meaningfully different, so only the former are presented.

All other study analyses were performed with SAS 9.2 (SAS Institute, Cary, NC) and R version 2.10.0.¹¹ The institutional review board of the Mid America Heart Institute waived the requirement of informed consent and the American Heart Association's GWTG-Resuscitation research and publications committee approved the final manuscript draft.

Results

Of 192,250 patients with IHCA, 165,446 (86.1%) had no recurrent IHCA, 23,643 (12.3%) recurrent IHCA, and 3161 (1.6%) recurrent OHCA. Compared with patients with no recurrent IHCA, patients with recurrent IHCA were younger, more frequently female and of black race, and had higher rates of respiratory insufficiency, renal insufficiency, hepatic insufficiency, hypotension, sepsis, and metabolic and electrolyte abnormalities prior to their index cardiac arrest (Table 1). Also, compared with those with no recurrent IHCA, patients with recurrent IHCA were more likely to have been on a vasopressor infusion and mechanical ventilation prior to their index cardiac arrest and to have their arrest in the intensive care unit.

Among the 23,643 patients with a recurrent IHCA, 18,466 (78.1%) had a total of 2 IHCAs, 3759 (15.9%) had 3 IHCAs, 967 (4.1%) had 4 IHCAs, and 451 (1.9%) had 5 or more IHCAs. Patients with a recurrent IHCA were likely to have the same cardiac arrest rhythm as with their initial IHCA, but there was no consistent pattern (Table 2). A comparison of patients with recurrent IHCA who survived to discharge and who died is provided in supplementary appendix Table 1, and predictors of survival to discharge in only those patients with recurrent IHCA were similar to known predictors of survival in all patients with IHCA (supplementary appendix Table 2). Lastly, there was a temporal increase in the proportion of patients with recurrent IHCA annually (supplementary appendix Table 3).

Prognosis of Recurrent IHCA vs No Recurrent IHCA

Overall, 40,116 (20.9%) patients survived to hospital discharge. Rates of survival to discharge were 12.7% (2995/23,643) for patients with recurrent IHCA and 22.1% (36,613/165,446) for patients with no recurrent IHCA. After adjusting for differences in demographics and patient characteristics, patients with recurrent IHCA were less than half as likely to survive to hospital discharge as compared with those with no recurrent IHCA (adjusted odds ratio [OR]: 0.46; 95% confidence interval [CI]: 0.44, 0.48; $P < 0.001$) (Table 3). Patients with recurrent IHCA were also less likely to have favorable neurological survival than those with no recurrent IHCA (7.0% vs 13.1%; adjusted OR: 0.44; 95% CI: 0.42, 0.47; $P < 0.001$).

However, regarding patterns of end-of-life care, among patients who achieved ROSC, patients with recurrent IHCA were less likely to be made DNAR within the first 24 hours compared with patients with no recurrent IHCA (2993/17,372 [17.2%] vs 12,541/66,214 [18.9%]; $P < 0.001$), even as overall rates of DNAR within the first 24 hours in the study cohort increased over time (see supplementary appendix Table 3). DNAR rates at any time after ROSC were also lower for patients with recurrent IHCA than for patients with no recurrent IHCA (35.4% vs 43.9%, Table 4). Similarly, rates for withdrawal of care at any time after ROSC were lower for patients with recurrent IHCA than for patients with no recurrent IHCA (17.7% vs 24.4%, $P < 0.001$).

Prognosis of Recurrent IHCA vs Recurrent OHCA

Of 3161 patients with recurrent OHCA, 508 (16.1%) survived to hospital discharge, as compared to 2995 (12.7%) patients with recurrent IHCA. The mean time from the index arrest to the recurrent arrest was similar between patients with a recurrent IHCA ($2.2 \pm$ standard deviation [SD] of 9.3 days) and a recurrent OHCA (2.5 ± 14.2 days; P of 0.25), as was the median duration of the recurrent resuscitation event in the two groups (see Table 1). After adjusting for differences in demographics and patient characteristics, patients with recurrent IHCA had a 19% lower odds of surviving to hospital discharge as compared with those with recurrent OHCA (adjusted OR: 0.81; 95% CI: 0.71, 0.94; $P = 0.005$) (see Table 3). Additionally, patients with recurrent IHCA were less likely to have favorable neurological survival than those with recurrent OHCA (7.0% vs 8.9%; adjusted OR: 0.66; 95% CI: 0.54, 0.81; $P < 0.001$).

However, among patients who achieved ROSC, compared with patients with recurrent OHCA, patients with recurrent IHCA were less likely to be made DNAR within the first 24 hours (17.2% vs. 26.6%; P of <0.001) or at any time after ROSC (35.4% vs 48.9%, see Table 4). Moreover, withdrawal of care rates at any time after ROSC were lower for patients with recurrent IHCA than for patients with recurrent OHCA (17.7% vs 31.2%, P of <0.001).

Discussion

In a contemporary national registry of IHCA, we found that 1 in 8 patients with an IHCA had a recurrent IHCA. Patients with recurrent IHCA were less than half as likely to survive to hospital discharge or have favorable neurological survival than patients with only one IHCA. Compared to patients with an OHCA who subsequently had an IHCA, patients with a recurrent IHCA were 19% less likely to survive to discharge and 34% less likely to have favorable neurological survival. Despite worse outcomes, patients with recurrent IHCA were the least likely to be made DNAR or to have withdrawal of care after being successfully resuscitated for a second time. Collectively, our findings provide important insights into the incidence and prognosis of patients with recurrent IHCA, and suggest that current patterns of care regarding DNAR and withdrawal of care decisions among patients with a recurrent cardiac arrest are not well aligned with their prognoses.

To our knowledge, this is the first study to describe the outcomes of adult patients with recurrent IHCA. This is because, until recently, large registries of patients with IHCA have not been available. Worse outcomes among patients with a recurrent IHCA is not altogether surprising, especially given that we found that patients with a recurrent IHCA were sicker than those with no recurrent IHCA, although they were also younger. Our adjusted models accounted for these differences and we were able to quantify the extent to which patients with a recurrent IHCA were likely to survive to discharge or have favorable neurological survival compared with patients with no recurrent IHCA. Such information can be used by clinicians to better inform families and patients with a recurrent IHCA about their prognosis. In addition, our findings provide preliminary insights into the prognosis of patients with an index OHCA who were successfully resuscitated and who subsequently had an IHCA, wherein nearly 1 in 5 patients survived to discharge.

Contrary to our expectations, patients with recurrent IHCA who achieved ROSC had lower rates of DNAR and withdrawal of care orders than either patients with no recurrent IHCA or recurrent OHCA, despite the fact that patients with recurrent IHCA had lower survival rates. This was the case for DNAR orders within the first 24 hours or at any time after ROSC. We did find that patients with recurrent IHCA were nearly 3 years younger than those with no recurrent IHCA, which may have explained some of the differences in DNAR rates, but we also found that patients with recurrent IHCA were sicker and had higher illness severity. These patterns were surprising because DNAR orders and withdrawal of care decisions are typically adopted by patients who have the worst perceived prognosis. Indeed, our findings suggest a corollary to the risk-treatment paradox in medicine — a risk to end-of-life decision-making paradox, whereby those with the worst prognosis are the least likely to be made DNAR or to have care withdrawn. Indeed, a prior study found that DNAR orders

among patients with IHCA who achieved ROSC were not always aligned with patients' prognoses.³ Our study extends those initial findings and suggests that efforts to better communicate prognoses after IHCA with patients and their families may be needed.

Our study should be interpreted in the context of the following potential limitations. First, this study analyzed data from patients in a large national quality improvement registry, and survival outcomes of patients in non-participating hospitals may differ, although there is no *a priori* reason to expect that our study findings by patients' recurrent IHCA status would differ at other centers. Second, although our models were able to adjust for a wide range of patient variables, the possibility for unmeasured confounding still exists. Third, for the cohort of patients with recurrent OHCA, we only examined patients with an IHCA after being hospitalized for an index OHCA, and patients with multiple OHCAs but without a subsequent IHCA were not included in the study because GWTG-Resuscitation collects data only on patients with IHCA. Therefore, our analyses for patients with recurrent OHCA should be interpreted in this context. Fourth, patient preferences on DNAR and withdrawal of care decisions were not collected within the registry, so we were unable to determine if the risk to end-of-life decision-making paradox we observed was due to patient preferences or physician recommendations.

Conclusions

Recurrent IHCA occurs in nearly 1 in 8 patients with an initial IHCA and is associated with lower rates of survival to discharge and favorable neurological survival than patients with only a single IHCA and those with an IHCA after being hospitalized for an OHCA. Despite worse survival outcomes, rates of DNAR and withdrawal of care were lowest for patients with recurrent IHCA. These findings provide important prognostic information for clinicians and families of patients with recurrent IHCA and suggest a critical need to better align resuscitation and end-of-life decision-making with patients' prognoses after IHCA.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.
Baseline Characteristics of Study Cohort

Characteristics for the recurrent IHCA and OHCA groups are based on the second cardiac arrest event for these patients.

	Recurrent IHCA (n = 23,643)	No Recurrent IHCA (n = 165,446)	Recurrent OHCA (n = 3161)	Pvalue
DEMOGRAPHICS				
Age, mean $\pm$ SD	63.3 $\pm$ 16.0	66.1 $\pm$ 15.9	61.9 $\pm$ 16.4	<0.001
Female sex	10,344 (43.8%)	68,749 (41.6%)	1263 (40.0%)	<0.001
Race				<0.001
White	14,809 (62.8%)	115,750 (70.2%)	2100 (66.6%)	
Black	6481 (27.5%)	33,360 (20.2%)	724 (22.9%)	
Other	2302 (9.8%)	15,741 (9.5%)	331 (10.5%)	
CARDIAC ARREST FACTORS				
Code duration (minutes), median (IQR) *				
Index arrest	11.0 (5.0, 20.0)	16.0 (8.0, 28.0)	NA	<0.001
Recurrent arrest	11.0 (5.0, 21.0)	NA	11.0 (5.0, 24.0)	0.34
Location of arrest				<0.001
Intensive care unit	13,256 (56.1%)	76,863 (46.5%)	1839 (58.2%)	
Telemetry unit	3445 (14.6%)	28,085 (17.0%)	119 (3.8%)	
Non-monitored hospital unit	2679 (11.3%)	27,582 (16.7%)	78 (2.5%)	
Emergency room	2501 (10.6%)	17,593 (10.6%)	908 (28.7%)	
Procedural area	1402 (5.9%)	11,720 (7.1%)	174 (5.5%)	
Other	358 (1.5%)	3584 (2.2%)	43 (1.4%)	
Time of Arrest				0.037
Night (11 PM to 6:59 AM)	4455 (18.8%)	31,513 (19.0%)	533 (16.9%)	
Weekend	7337 (31.0%)	51,215 (31.0%)	1016 (32.1%)	
Cardiac Arrest Rhythm**				<0.001
Asystole	6862 (29.0%)	57,031 (34.5%)	743 (23.5%)	
Pulseless electrical activity	11,845 (50.1%)	75,108 (45.4%)	1742 (55.1%)	
Ventricular fibrillation	2816 (11.9%)	20,874 (12.6%)	404 (12.8%)	
Pulseless ventricular tachycardia	2120 (9.0%)	12,433 (7.5%)	272 (8.6%)	
PRE-EXISTING CONDITIONS				
Heart failure this admission	4654 (19.7%)	27,949 (16.9%)	321 (10.2%)	<0.001
Heart failure prior to admission	5336 (22.6%)	34,636 (20.9%)	575 (18.2%)	<0.001
Myocardial infarction this admission	4417 (18.7%)	26,884 (16.2%)	832 (26.3%)	<0.001
Myocardial infarction prior to admission	3816 (16.1%)	26,115 (15.8%)	542 (17.1%)	0.049
Hypotension	7840 (33.2%)	42,775 (25.9%)	1038 (32.8%)	<0.001
Respiratory insufficiency	11,357 (48.0%)	68,595 (41.5%)	1714 (54.2%)	<0.001
Renal insufficiency	9542 (40.4%)	54,232 (32.8%)	866 (27.4%)	<0.001
Hepatic insufficiency	2107 (8.9%)	11,907 (7.2%)	176 (5.6%)	<0.001
Metabolic or electrolyte abnormality	5266 (22.3%)	27,042 (16.3%)	730 (23.1%)	<0.001

	Recurrent IHCA (n = 23,643)	No Recurrent IHCA (n = 165,446)	Recurrent OHCA (n = 3161)	Pvalue
Diabetes mellitus	8075 (34.2%)	50,162 (30.3%)	933 (29.5%)	<0.001
Baseline depression in CNS function	2708 (11.5%)	19,012 (11.5%)	427 (13.5%)	0.001
Major trauma	1058 (4.5%)	6863 (4.1%)	221 (7.0%)	<0.001
Acute stroke	731 (3.1%)	6578 (4.0%)	93 (2.9%)	<0.001
Pneumonia	3611 (15.3%)	22,183 (13.4%)	297 (9.4%)	<0.001
Septicemia	4886 (20.7%)	25,806 (15.6%)	310 (9.8%)	<0.001
Metastatic or hematologic malignancy	2544 (10.8%)	20,130 (12.2%)	213 (6.7%)	<0.001
INTERVENTIONS IN PLACE AT TIME OF ARREST				
Continuous intravenous vasopressor	7477 (31.6%)	40,874 (24.7%)	1083 (34.3%)	<0.001
Mechanical ventilation	9385 (39.7%)	50,697 (30.6%)	1861 (58.9%)	<0.001
Hemodialysis	1000 (4.2%)	5499 (3.3%)	44 (1.4%)	<0.001

* Index event code duration is not available for patients with recurrent OHCA (as the event occurred outside the hospital), and recurrent event code duration is not available for patients with no recurrent arrest events.

Abbreviations: CNS, central nervous system; IHCA, in-hospital cardiac arrest; IQR, interquartile range; NA, not applicable; OHCA, out-of-hospital cardiac arrest; SD, standard deviation

Table 2.
Cardiac Arrest Rhythms in Patients with a Recurrent IHCA

Patients with a recurrent IHCA were likely to have the same cardiac arrest rhythm as with their initial IHCA, but there was no consistent pattern

Recurrent IHCA	First IHCA Arrest Rhythm				Total
	Asystole	PEA	VF	PVT	
Asystole	3486	2714	366	296	6862
PEA	2454	8365	531	495	11,845
VF	457	733	1222	404	2816
VT	347	612	343	818	2120
Total	6744	12,424	2462	2013	23643

Abbreviations: IHCA, in-hospital cardiac arrest; PEA, pulseless electrical activity; PVT, pulseless ventricular tachycardia; VF, ventricular fibrillation

Table 3.
Survival Outcomes for Patients with Recurrent IHCA

Compared with patients with no recurrent IHCA and recurrent OHCA, patients with recurrent IHCA were less likely to survive to hospital discharge and have favorable neurological survival.

Outcome	Adjusted OR (95% CI)	P
<i>Survival to Discharge</i>		
No Recurrent IHCA	Reference	<0.001
Recurrent IHCA	0.46 (0.44, 0.48)	
Recurrent OHCA	Reference	0.005
Recurrent IHCA	0.81 (0.71, 0.94)	
<i>Favorable Neurological Survival*</i>		
No Recurrent IHCA	Reference	<0.001
Recurrent IHCA	0.44 (0.42, 0.47)	
Recurrent OHCA	Reference	<0.001
Recurrent IHCA	0.66 (0.54, 0.81)	

* Favorable neurological survival was defined as survival to hospital discharge with a cerebral performance category score of 1 (little to no neurological disability)

Abbreviations: IHCA, in-hospital cardiac arrest; OHCA, out-of-hospital cardiac arrest; OR, odds ratio

Rates of DNAR and Withdrawal of Care Orders

Table 4.

End-of-life care orders among patients who achieve return of spontaneous circulation after a cardiac arrest are summarized for each of the 3 groups.

	Recurrent IHCA (n = 17,372)	No Recurrent IHCA (n = 66,214)	Recurrent OHCA (n = 2223)	P**
<i>DNAR Orders After ROSC</i>				
Within 24 Hours of ROSC	2993 (17.2%)	12,541 (18.9%)	591 (26.6%)	<0.001
Any time after ROSC	6156 (35.4%)	29,093 (43.9%)	1087 (48.9%)	<0.001
<i>Withdrawal of Care After ROSC</i>	3081 (17.7%)	16,137 (24.4%)	693 (31.2%)	<0.001

* P value reflects comparisons between patients with recurrent IHCA and those with no recurrent IHCA

** P value reflects comparisons between patients with recurrent IHCA and those with recurrent OHCA

Abbreviations: DNAR, do-not-resuscitate; IHCA, in-hospital cardiac arrest; OHCA, out-of-hospital cardiac arrest; ROSC, return of spontaneous circulation