

**Research Article**
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## Utstein-Based Analysis of Out-of-Hospital Cardiac Arrest Onze-Lieve-Vrouw Hospital Aalst, Belgium

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### ABSTRACT

**Introduction:** We provide the out-of-hospital cardiac arrest (OHCA) data from January 1, 2015 up to December 31, 2019 from Onze-Lieve-Vrouw Hospital Aalst (OLVA), Belgium.

**Methods:** We enrolled all the OHCA cases served by the mobile urgency group of OLVA. The four subgroups were composed as follow: “shockable and bystander witnessed”, “shockable and non-bystander witnessed”, “non-shockable and bystander witnessed” and “non-shockable and non-bystander witnessed”.

**Results:** There were 568 confirmed OHCA cases of which 69 were suicides. Resuscitation was attempted in 328 cases. Witnessed arrest happened in 137 cases, bystander cardio-pulmonary resuscitation (CPR) was performed in 98 cases of which phone CPR was started in 41 cases. First monitored rhythm was asystole in 221 cases, pulseless electrical activity in 53 cases, ventricular fibrillation in 36 cases and pulseless ventricular tachycardia in 3 cases. Pathogenesis was medical in 430 cases, traumatic in 53 cases, drug overdose in 6 cases, drowning in 9 cases, electrocution in 2 cases and asphyxia in 63 cases. 103 patients reached the hospital of which 2 died at arrival. 28 patients survived to discharge and 26 patients survived 12 months.

**Discussion:** There was no significant difference in the different Utstein subgroups between death on street after advanced life support started and also at hospital discharge. Only once a public AED was used, this was at a school after an electrocution. It is important to have sufficient AED's in public spaces and to train the population. The telephone operators recognized phone CPR started in Belgium in 2011, not every arrest. (Ethics committee 2819-MA-1002).

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### Introduction

Out-of-hospital cardiac arrest (OHCA) is a major cause of death in high-income countries [1]. Survival is affected by early cardio-pulmonary resuscitation (CPR) and defibrillation together with a good strategy of in-hospital care, summarized by the chain of survival [2]. The incidence of emergency medical services (EMS)-treated OHCA has been reported as 40.6 per 100,000 person-years in Europe [3]. High-quality OHCA registries with a uniform collecting system are crucial to compare epidemiology, effect of treatments, and outcome in different regions aiming to monitor performance and improve survival. For these reasons, the International Liaison Committee on Resuscitation (ILCOR) proposed the Utstein template with current edition published in 2014 [4]. A worldwide and an European database are based on OHCA results published with the Utstein-template [5,6].

To supplement data on those registries, Onze-Lieve-Vrouw Hospital Aalst (OLVA), in Belgium, wants to publish their results of OHCA. The results were collected in the period 2015 up to 2019, as in 2020 Covid-19 epidemic changed methods of resuscitation. The hospital provides out of hospital emergency services during 26 weeks a year, half of each month.

### Materials and Methods

We enrolled for analysis all the OHCA cases served by the mobile urgency group (MUG) of OLVA from January 1, 2015 to December 31, 2019. We evaluated for each patient all the data regarding the pre-hospital treatment, the survival and the outcome at 1 and 12 months accordingly Utstein-template [4]. OLVA has a MUG available during 26 weeks a year, of each month half of the days. The MUG-team exists of an emergency medicine doctor and an Advanced Life Support (ALS) trained nurse. For each MUG-intervention an ambulance with 2 emergency care assistants is sent on site. The total area covered by MUG OLVA is 250 square kilometers (sq km) and has a total population of 220.000 inhabitants.

### Utstein Subgroups

We divided our population according to the Utstein 2014 recommendations. “All-MUG treated” included all the OHCA patients in whom CPR was done by the MUG and it was recommended for system effectiveness comparisons. The four subgroups were composed as follow: “shockable and bystander witnessed”, “shockable and non-bystander witnessed”, “non-shockable and bystander witnessed” and “non-shockable and non-bystander witnessed”.

### Data Management

Study data are collected from the intervention fiche and the medical files KWS<sup>®</sup> and MetaVision<sup>®</sup>. The processing was done anonymously. Ethics committee approval was 2819-MA-1002.

### Statistical Analysis

Statistical analyses were performed by using the SPSS 28.0.1.0 analysis program (SPSS Inc, Chicago, Illinois). We used the Kruskal-Wallis analysis with log-rank test to compare the different Utstein groups. P-values ≤ 0.05 were considered statistically significant.

### Results

#### System

The population served by the area of EMS system was 220.000. The area covered was 250 sq. The period covered was 26 weeks a year, of each month half of it. The MUG-team existed of an emergency medicine doctor and an advanced life support (ALS) trained nurse. For each MUG-intervention an ambulance with 2 emergency care assistants was sent on site. ALS algorithm was followed. The ambulanciers had an automated defibrillator, the MUG-team had a manual defibrillator and 12-lead ECG.

The total number of cases was 6388. The total number of confirmed OHCA cases that occurred during the study period was 568 (143 in 2015, 106 in 2016, 108 in 2017, 109 in 2018 and 102 in 2019). Resuscitation was attempted in 328 cases (92 in 2015, 58 in 2016, 57 in 2017, 63 in 2018 and 58 in 2019). The total number with death on arrival (DOA) was 240 (50 in 2015, 47 in 2016, 51 in 2017, 46 in 2018 and 43 in 2019).

#### Dispatcher

The number of reanimation calls was 207 (41 in 2015, 48 in 2016, 30 in 2017, 50 in 2018 and 38 in 2019). The number of DOA calls

was 90 (23 in 2015, 7 in 2016, 22 in 2017, 19 in 2018 and 19 in 2019). Phone CPR was started in 41 cases (3 in 2015, 5 in 2016, 10 in 2017, 10 in 2018 and 13 in 2019).

#### Patient

The mean age was 65.4 years (66 in 2015, 65 in 2016, 66 in 2017, 66 in 2018 and 65 in 2019). 375 or 66% of the patients were male (96 in 2015, 71 in 2016, 70 in 2017, 67 in 2018 and 71 in 2019). Witnessed arrest happened in 137 cases, at 7 cases it is unknown (42 in 2015, 28 in 2016, 19 in 2017, 23 in 2018 and 25 in 2019). Bystander CPR was performed in 98 cases (25 in 2015, 21 in 2016, 15 in 2017, 18 in 2018 and 19 in 2019). We do not have data of compression only versus compression and ventilation bystander CPR. In 1 case in 2015, bystander AED was used.

A shock was delivered successfully after electrocution. First monitored rhythm was asystole in 221 cases, PEA in 53 cases, VF in 36 cases, pulseless VT in 3 cases, bradycardia in 2 cases, unknown in 7 cases and ROSC on arrival in 4 cases. The pathogenesis was medical in 430 cases, traumatic in 53 cases, drug overdose in 6 cases, drowning in 9 cases, electrocution in 2 cases, asphyxia in 63 cases and not recorded in 1 case. 296 of the patients had comorbidities, of which 15 were palliative or with do not resuscitate (DNR) code. 68 of the patients had no comorbidities, in 195 comorbidities were unknown or not noted. At 12 patients an ICD was in situ, none of the patients had an external ICD. 24 of the patients had STEMI on the initial ECG after return of spontaneous circulation (ROSC).

Table 1 presents the suicide data. There were 69 suicides. The biggest group is suffocation by rope around the neck with 46 cases. The next group is suicide by jump before or lie under train with 8 cases. 4 patients drowned themselves.

**Table 1: Suicide Data**

	2015	2016	2017	2018	2019	Total
Auto Intoxication	0	1	0	0	0	1
Drowning	1	0	1	2	0	4
Throat Cut	1	2	0	0	0	3
Cut Other Than Throat	0	0	1	0	0	1
Bullet In Head	0	1	0	0	1	2
Death By Train	3	1	1	2	1	8
Jump Off Building	0	1	0	0	0	1
CO2-Intoxication	0	0	0	1	0	1
Suffocation By Rope Around Neck	13	7	9	4	13	46
Suffocation Other Than Rope	0	0	0	0	1	1
Cause Unknown	0	1	0	0	0	1
Total Suicides	18	14	12	9	16	69

#### OHCA Process

The mean time to arrive was 9 min 47 seconds (9:42 in 2015, 9:52 in 2016, 10:17 in 2017, 9:48 in 2018 and 9:30 in 2019). The mean distance in km was 8.96 (8.98 in 2015, 9.02 in 2016, 9.50 in 2017, 8.45 in 2018 and 8.83 in 2019). Defibrillation time and targeted temperature management were not recorded.

In 274 cases adrenaline was given, in 52 cases also amiodarone was given. Shocks were delivered at 77 patients, no shock was delivered in 77 cases and in 6 cases the number of shocks was not noted.

An endotracheal tube was used in 211 cases, a supraglottic airway in 9 cases, an oropharyngeal airway device in 5 cases and a surgical airway in 1 case. 9 patients had multiple airway devices, at 69 patients no airway device was used and at 4 cases the airway device was not recorded. At 211 patients the primary vascular access was a peripheral line and at 69 patients intraosseous access was primary, no central lines were used out of hospital. In 14 cases the vascular access is not known or not recorded. At one patient a mechanical compression-decompression device, type Lucas©, was used.

### Post Resuscitation Process

There were 103 patients who reached the hospital. 2 patients died at arrival and 2 patients appeared to have a DNR code and got only comfort therapy. 99 patients were included in following section.

30 patients had an angiography of which 15 had a percutaneous coronary intervention (PCI). Two of the angiography patients were being resuscitated during procedure and both died before the end. 23 had the procedure within 24 hours and 4 after more than 24 hours but before discharge. The time of the angiography of one patient is not known. None of the patients had a thrombolysis, 41 patients had no reperfusion attempt needed and of 28 patients it was not recorded.

No patient had an extracorporeal life support (ECLS), of 34 patients ECLS use was not recorded. At two patients an intra-aortic balloon pump (IABP) was used. At 63 patients no IABP was used and of 34 patients it was not recorded.

16 patients had a pH  $\geq 6.50$  and  $< 7.00$ , 18 patients had a pH  $\geq 7.00$  and  $< 7.20$ , 15 patients had a pH  $\geq 7.20$  and  $< 7.35$  and 4 patients had a pH  $\geq 7.35$  and  $< 7.45$ . At 46 patients the pH was not

recorded. Lactate was  $\leq 2$  at 5 patients,  $> 2$  and  $\leq 8$  at 28 patients and  $> 8$  at 17 patients. Lactate was not recorded at 49 patients.

### Core Outcomes

99 patients survived until transfer of care at the receiving hospital. 7 extra patients had ROSC but died before arriving transfer of care. 28 patients survived for 30 days or to discharge and 26 patients survived 12 months. Neurological outcome was measured subjectively at one of the next medical consultations. A good neurological outcome was seen in 20 patients and a moderate in 4 patients. For one patient it is not known and for 3 patients it is not recorded.

At 21 patients treatment was withdrawn, 19 other patients died without decision to stop treatment. At 29 patients who died, a treatment withdrawn was not recorded. Treatment withdrawn was in our hospital usually after negative somatosensory evoked potentials, neuron-specific enolase, electroencephalogram and clinical tests. Usually after day 3 or 4, but in unfavorable circumstances at day 1 or 2. We do not have numbers of organ donation.

### Statistics

In table 2 we present the characteristics of the patients in whom CPR was started by EMS staff. We differentiated in four groups namely shockable bystander witnessed, shockable non-bystander witnessed, non-shockable by-stander witnessed and non-shockable non-bystander witnessed. To detect statistical significance we used the Kruskal-Wallis test. At 328 patients ALS started, but at 19 patients the first rhythm or the bystander status was not noted. In the different groups was no statistic difference in etiology, patients of OHCA being transported to hospital and patients discharged alive from hospital.

**Table 2: Utstein Subgroup Analysis**

	All EMS-treated (328)	Shockable and bystander (37)	shockable non-bystander (2)	non-shockable bystander (137)	non-shockable non-bystander (133)	p-value
Men, N (%)	199 (61)	30 (83)	2 (100)	81 (59)	86 (65)	0.029
Age, Years (Sd)	68 (18)	68 (13)	46 (6)	68 (17)	65 (20)	0.134
EMS Arrival Time, Mins (Sd)	10 (5)	9 (4)	11 (7)	10 (6)	9 (5)	0.960
Etiology of Arrest, n (%)						0.113
Medical	253 (82)	34 (91)	1 (50)	114 (83)	104 (78)	
Trauma	26 (8)	1 (3)	-	14 (10)	11 (8)	
Drowning	1 (0,3)	-	-	-	1 (0,8)	
Medication Overdosis	2 (0,6)	-	-	1 (0,7)	1 (0,8)	
Electrocution	1 (0,3)	1 (3)	-	-	-	
Asphyxial	26 (8)	1 (3)	1 (50)	8 (6)	16 (12)	
Transported To Hospital, N (%)						0.570
Yes	97 (31)	10 (27)	0 (0)	41 (30)	46 (35)	
No	212 (69)	27 (73)	2 (100)	96 (70)	87 (65)	
Hospital Discharged Alive, N (% after ROSC)						0.660
Yes	23 (24)	3 (27)	-	11 (28)	9 (20)	
No	74 (76)	8 (73)	-	29 (72)	37 (80)	

EMS: Emergency Medical Service, Rosc: Return of Spontaneous Circulation

## Discussion

Our team was from 2015 until 2019 involved at 568 OHCA. Resuscitation was attempted in 297 (52%) patients. DOA was in 271 (48%) patients. 103 patients (35% of the REA attempts) were transported to a hospital of which 2 had a DNR code and 2 patients died at arrival. 28 patients (9.4%) survived for 30 days and 26 (8.8%) patients survived 12 months. 20 (6.7%) patients had a good neurological outcome at 12 months and 4 (1.3%) patients a moderate outcome. The neurological outcome at the other 4 patients is not known.

Reading through the cases, surprisingly only 1 time a public AED was used. From 2017 phone CPR was relatively more common with 10 cases a year, but to our opinion it seemed more cases could have benefit of phone CPR. Regrettable are the cases in which a problem was seen by inmate but who did not call the emergencies immediately. Our advice is to provide more sensibilization and training to civilians.

To our surprise there is no significant difference between the different Utstein subgroups between OHCA death after ALS started and also at hospital discharge. A study of Baldi of 4924 patients could show a significant difference when there was a shockable rhythm, but not in the difference between witnessed or not-witnessed [7].

Our hospital recorded a posteriori the medical files of the OHCA. Our intention is to make a file based on the Utstein registry resulting in less data loss [4]. There is also need to actively contact the admitting hospitals when the patient did not come to our center.

## Conclusion

A file was made from 568 OHCA following the Utstein criteria. Resuscitation was attempted in 297 cases of which 99 patients were admitted to the hospital. 28 patients (9.4%) survived for 30 days of which 20 had a good neurological outcome and 4 a moderate outcome.

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