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Brief Report

Evaluation of 2 different instruments for exposing the chest in conjunction with a cardiac arrest☆,☆☆

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Abstract

Background: Time between onset of cardiac arrest and start of treatment is of ultimate importance for outcome. The length of time it takes to expose the chest in out-of-hospital cardiac arrest (OHCA) is not known. We aimed to compare the time from onset of OHCA until the time at which the chest was exposed using a new device (S-CUT; ES Equipment, Gothenburg, Sweden) and a pair of scissors.

Methods: In a manikin study, the 2 devices were compared in a simulated cardiac arrest where the initial step was exposure of the chest. The tests were performed using ambulance staff from 3 different ambulance organizations in Western Sweden. Six different types of clothing combinations were used. The primary choices of clothing for analyses were a knitted sweater and shirt (indoors) and a jacket with buttons, a shirt, and a college sweater (outdoors).

Results: The mean difference from onset of OHCA until the chest was exposed when S-CUT was compared with a pair of scissors varied between 6 seconds ($P = .006$) and 63 seconds ($P = .004$; shorter with the S-CUT), depending on the type of clothing that was used. The mean differences for the clothing that was chosen for primary analyses were 23 and 63 seconds, respectively.

Conclusion: We found that a new device (S-CUT) used for exposing the chest in OHCA was associated with a marked shortening of procedure time as compared with a pair of scissors.

1. Introduction

The time between onset of cardiac arrest and the start of treatment, including cardiopulmonary resuscitation (CPR) and defibrillation, is of ultimate importance for the outcome [1-6].

It has been recommended that the time it takes to verify a cardiac arrest should not exceed 30 seconds. However, there is no definition of the time limit from establishing a cardiac arrest until the start of CPR. It is simply recommended that CPR should begin as soon as possible. It is most probably of ultimate importance that CPR is started within the first few minutes after the onset of cardiac arrest [7].

At the present time, scissors of different models are used to expose the chest to start treatment. To our knowledge, no studies reporting the length of time it takes to expose the chest are available.

The S-CUT cutting tool is used at emergency departments (EDs) and in ambulances to rapidly expose the chest of patients by cutting clothing and so on (Fig. 1).

☆ The authors have all seen and approved the paper and the work has not been, and will not be, published elsewhere.

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Fig. 1 Illustration of S-CUT.

The tool is used to cut the patient's clothing by pulling it through the clothing, and the S-CUT replaces scissors, secateurs, knives, and other similar tools.

The aim of this study was to evaluate the time from establishing a cardiac arrest until the time at which the chest was exposed when the S-CUT was compared with standard scissors.

2. Methods

2.1. Studies

The tests (1 pilot study, n = 4 and 1 main study, n = 10) were performed at the CPR Education Center at Sahlgrenska University Hospital in Göteborg, Sweden.

2.2. End point

The end point was the time from estimated onset of cardiac arrest until exposure of the chest.

The measurement of time began with the manikins lying on the floor, after which the test subject put his/her hand on the manikin's neck to check the pulse and counted "1, 2, 3." At "3," the timing began, and the test subject then had to expose the chest and 1 arm to enable defibrillation and intravenous access. The timing stopped when the chest and 1 arm were exposed and the test subject said "ready." The manikins were dressed in 6 different combinations of clothing, with the combination of "indoor" and "outdoor" clothing being the main focus of the analysis.

2.3. The device

The S-CUT (ES Equipment, Gothenburg, Sweden) was equipped with a new blade before the test, and the blade was rotated to expose a new cutting edge after each type of clothing (Table 1). The edge of the blade that had been used was marked with a marker pen.

Six new (main study) scissors of the same model as those used at the ED at Sahlgrenska University Hospital were used when the test started. The scissors were made in China and imported by Ferno Norden AB to Sweden. They were of type clothing scissors to cut with plastic handle (18 cm).

Six different types of clothing were used. A new pair of scissors was used for each clothing model.

2.4. Test subjects

Among the 10 test subjects were 5 women and 5 men. Their mean age was 39 years (range, 30-51 years). Eight of them were nurses, 1 was a paramedic, and 1 was responsible for health care at the coast guard in Western Sweden. All of them, with the exception of the health care responsible subject, had experiences from work in an ambulance for a mean of 14 years (range, 5-30 years) and thus extensive exposure to management of cardiac arrest victims. All of the test subjects had experience with the use of a pair of scissors, and 8 of the 10 had experience with the use of S-CUT. The test subjects were not blinded to the intent of the study.

2.5. Contact subject

In the room where S-CUT was used did a test leader (observer; ambulance nurse) film the procedure, and 1 of the test subjects (not active at the moment) made the time measurements.

In the room where the pair of scissors was used did 1 of the test subjects (not active at the moment) film the procedure, and a test leader (observer; a nurse responsible for the education of CPR in Sahlgrenska Hospital) made the time measurements. The contact subjects were not blinded to the intent of the study.

2.6. Clothing

The 6 different types of clothing were as follows: clothing types 1 and 2, 1 layer of clothing; clothing types 3 and 4, 2 layers of clothing; and clothing types 5 and 6, 3 layers of clothing (Table 1). In terms of the types of clothing, the primary analyses were performed on a knitted sweater and shirt (indoors) and a jacket with buttons, a shirt, and a college sweater (outdoors). The test subjects were not aware of the types of clothing that were used for the primary analyses.

2.7. Procedure

Two manikins were placed on the floor in 2 different rooms. The test subjects were divided into 2 groups, each comprising 2 (pilot study) respective 5 (main study) persons. Both test groups used scissors and the S-CUT.

All the tests were documented on film, and observers timed the procedures using a stopwatch. To avoid imposing a load on the muscles in the forearm during the procedure in

which scissors were used, thereby influencing the results, the tests were divided into a morning and afternoon session.

The morning session began with 2 layers of clothing, clothing type 3, 30 minutes break, followed by 1 layer of clothing, clothing type 2, 10 minutes break, and ending with 3 layers of clothing, clothing type 5. After a fairly long break, 60 minutes, the afternoon session began with 2 layers of clothing, clothing type 4, followed by 1 layer of clothing, clothing type 1, and ending with 3 layers of clothing, clothing type 6. The break between 2 layers of clothing and 1 layer of clothing was 30 minutes, whereas the break between 1 layer of clothing and 3 layers of clothing was 10 minutes. The break between the morning and afternoon sessions was 60 minutes. In one room, the test was performed with scissors, and in the other room, the test was performed with the S-CUT.

The manikin was equipped with different sets of clothing (Table 1).

The same test subjects performed the tests with both scissors and the S-CUT. The division of the groups when it came to the group that began with the S-CUT and scissors, respectively, was made at random by drawing lots.

3. Control of measurements

After the test, a subset of the time measurements was controlled via the videotape and found to be identical with the original measurements.

The persons who measured the start and stopping of time were not blinded to the object of the study.

4. Statistical methods

A paired *t* test was used to test for differences between the 2 groups. Because primary end points were specified, the significance level was set at .25. All tests are 2-sided.

The number of test subjects in the main study was calculated based on the results in the pilot study.

Ten subjects were needed to detect a difference of 30 seconds between the 2 instruments with a power of 95%, a significant level of .025 (2-sided test), and an assumed SD of 20 seconds.

5. Results

Table 2 shows the results of the main study. The time taken to expose the chest was significantly shorter with the S-CUT in all 6 scenarios. The mean differences for the types of clothing that were chosen for the primary analyses were 23 and 63 seconds, respectively. The largest mean difference was found when the clothing consisted of a jacket with buttons, a shirt, and a college sweater (63 seconds), whereas the smallest was found when the clothing was made of piqué (6 seconds).

In fact, of all 60 comparisons (6 for each of the 10 test subjects), there was only 1 type of clothing (clothing type 1,

Table 1 Design of the study

		A pair of scissors					(S-CUT)				
Indoors 3											
Piqué and college sweaters	Kl 09:00	A	B	C	D	E	F	G	H	I	J
	Kl 09:15	J	I	H	G	F	E	D	C	B	A
Pause, 30 min											
Indoors 2											
Shirts	Kl 10:00	B	C	D	E	A	J	F	G	H	I
	Kl 10:10	I	H	G	F	J	A	E	D	C	B
Pause, 10 min											
Outdoors 5											
Shirts, college sweater, and jacket with buttons	Kl 10:30	I	H	G	F	J	C	D	E	A	B
	Kl 11:00	B	C	D	E	A	I	H	G	F	J
Lunch, 60 min											
Indoors 4											
Shirts and knitted sweater	Kl 12.30	J	I	H	G	F	E	D	C	B	A
	Kl 12.45	A	B	C	D	E	H	G	F	J	I
Pause, 30 min											
Indoors 1											
Piqué	Kl 13:30	C	D	E	B	A	I	J	F	G	H
	Kl 13:40	H	G	F	J	I	B	A	E	D	C
Pause, 10 min											
Outdoors 6											
Shirts, knitted sweater, and jacket with buttons	Kl 14:00	H	G	F	J	I	C	B	A	E	D
	Kl 14:30	C	D	E	A	B	J	I	H	G	F

Table 2 Study results (n = 10)

		A pair of scissors, mean ± SD (minimum, maximum)	S-CUT, mean ± SD (minimum, maximum)	*P*	Difference, mean (95% confidence interval)
Piqué	1 [a]	11 ± 3 (8, 16)	5 ± 3 (3, 14)	.006	6 (2-9)
Shirt	2	16 ± 3 (10, 20)	6 ± 2 (4, 9)	<.0001	10 (8-13)
Piqué and sweater college	3	57 ± 15 (36, 77)	16 ± 6 (9, 30)	<.0001	41 (29-53)
Knitted sweater and shirt [b]	4	35 ± 6 (25, 43)	12 ± 7 (4, 23)	<.0001	23 (16-30)
Jacket with buttons, shirt, and college sweater [b]	5	82 ± 40 (44, 187)	19 ± 9 (7, 36)	.0004	63 (37-89)
Jacket with buttons, shirt, and knitted sweater [c]	6	52 ± 15 (34, 74)	16 ± 6 (6, 28)	.0003	36 (24-48)

[a] Clothing type.
[b] Primary end point.
[c] Three missing observations: 2 in the scissors group and 1 in the S-CUT group.

piqué) for which the scissors took less time (on one occasion) than the S-CUT.

6. Discussion

To our knowledge, this is the first published study using an artificial situation to evaluate 2 different methods of exposing the chest when a patient is found in cardiac arrest. We found that when various types of clothing were used, the time savings when using the S-CUT compared with scissors varied between 6 and 63 seconds.

To our knowledge, no information regarding the use of various types of clothing at the time patients are found in out-of-hospital cardiac arrest (OHCA) is available in the literature. However, because two thirds of all OHCAs take place in the patients' homes, it is reasonable to assume that the first 4 types of clothing used here will be most commonly found. This means that time savings using the S-CUT could vary between a few seconds and nearly a minute in these scenarios.

It is difficult to estimate the number of lives that could be saved by shortening the delay to defibrillation by this extent. Previous experiences indicate that for each minute of delay to defibrillation, there is a 10% decrease in the chance of survival [3,8]. If so, a time gain that varies between 6 and 63 seconds cannot be neglected. In a longer perspective and with a large catchment population, the number of additional lives that could be saved with the device is probably substantial.

There are other advantages when using the S-CUT rather than scissors. The S-CUT reduces the risk of inadvertently injuring the patient. What is more, it reduces the load on the staff because using it only requires a small amount of force.

Finally, in real life, particularly outdoors in bad whether, problems with exposing the chest might be more marked, as compared with the artificial situation associated with a manikin study. On such occasions, the use of the most optimal instrument might be even more important.

7. Limitations

There are 3 major limitations to the present study.

First of all, the study was conducted in a test environment that may not mimic the real world experience. Thus, we do not know whether results had been the same if testing these 2 devices in "cardiac arrest victims in a clinical situation."

Second, none of the subjects were blinded to the intent of the study. Thus, we do not know in what way this might have influenced the performance of the test subject.

Finally, the choice of clothing combinations in general and, specifically, the choice of combinations that was used as primary end point might be criticized. We do not know whether other researchers had chosen other combinations and thereby achieved different results.

8. Conclusions

We found that a new device (S-CUT) used to expose the chest in OHCA was associated with a reduction in procedure time as compared with scissors. With regard to the types of clothing that were expected to be most commonly used, the mean difference was more than 20 seconds for indoor clothing and more than 1 minute for outdoor clothing.

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