Increase in rapid defibrillation programmes after publication of guidelines

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Abstract

Objectives. To monitor the implementation of in-hospital resuscitation strategies including (i) rapid defibrillation programmes, (ii) the use of amiodarone for prolonged ventricular fibrillation, and (iii) uniform data collection on resuscitation, all recommended by international guidelines published in 2000 and by Finnish national resuscitation guidelines published in 2002.

Design. In 2004, a questionnaire was sent to the chief anaesthesiologists. The results were compared with those of a previous study performed using similar methods in 2000.

Setting. All public hospitals that provide anaesthetic services in Finland.

Main outcome measures. Number of hospitals allowing nurses to perform defibrillation without the presence of physician and number of hospitals using amiodarone as primary antiarrhythmic drug in resuscitation and performing uniform data collection.

Results. The response rate was 95% (52/55). The proportion of the hospitals with rapid defibrillation programmes on general wards had increased from 15% in 2000 to 67% in 2004, and most (79%) hospitals had obtained automated external defibrillators. Amiodarone was used in 88% of the hospitals. Data collection of resuscitation attempts using definitions provided in the Utstein guidelines was performed only in 22% of the hospitals.

Conclusions. Rapid defibrillation programmes have markedly increased, and the use of amiodarone has been established in Finnish hospitals since the publication of the international and the national resuscitation guidelines.

Keywords: cardiopulmonary resuscitation, defibrillators, guidelines, nurses

The outcome of in-hospital cardiac arrest patients with ventricular fibrillation or pulseless ventricular tachycardia as the initial rhythm is highly dependent on the delay to defibrillation [1,2]. Rapid defibrillation programmes, including the use of automated external defibrillators and defibrillation by non-physician personnel, are strongly encouraged by the statements of several organizations, including, for example, the American Heart Association and International Liaison Committee on Resuscitation as well as the European Resuscitation Council and the European Society of Cardiology [3,4]. However, the implementation of in-hospital rapid defibrillation programmes appears to have been sporadic [5].

Our previous study [6], performed right after the publication of the international resuscitation guidelines in 2000, highlighted a need for improving resuscitation training and management in Finnish hospitals. Most importantly, few hospitals had established rapid defibrillation programmes outside critical care areas. The endorsement of rapid defibrillation in health care facilities was one of the main goals of the Finnish national resuscitation guidelines, which are based on the international guidelines and were published in 2002 [7].

The guidelines also introduced amiodarone as a new drug to be used for prolonged ventricular fibrillation or ventricular tachycardia and emphasized the importance of data collection in resuscitation and uniform identification of ‘do not attempt resuscitation’ orders.

The aim of this study was to monitor the developments of in-hospital resuscitation strategies in Finland with emphasis on rapid defibrillation programmes after publication of international and national resuscitation guidelines. The use of amiodarone as well as data collection and documentation of ‘do not attempt resuscitation’ orders were also evaluated.

Methods

In Finland, with a population of 5.2 million distributed in an area of 330 000 km², the hospital network consists of 26 district general hospitals and 20 central hospitals, five of which are university hospitals. All these hospitals are public and tax-funded. Private hospitals provide some 3% of bed-days only.

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The national resuscitation guidelines

The Finnish national guidelines for cardiopulmonary resuscitation were published in the series of clinical practice guidelines, Current Care. These evidence-based clinical practice guidelines in various fields of medicine are published by The Finnish Medical Society Duodecim in collaboration with the national medical specialist societies. At present (in 2005), there are a total of 53 guidelines in the series. The guidelines are published in the journal of the Finnish Medical Society Duodecim. The journal is mailed to every member of the society, i.e. 80% of physicians in Finland. Additionally, the guidelines are available free of charge through the Internet portal of this society.

The national resuscitation guidelines [7], published in 2002, are with some modifications based on the international Guidelines 2000 [4]. The main recommendations concerning the organization of in-hospital cardiac arrest management are as follows:

1. Rapid defibrillation should be encouraged in institutional settings. Defibrillation, in case of ventricular fibrillation or ventricular tachycardia, should be performed within 3 minutes from the arrest, and defibrillation should be included in resuscitation training of nursing and medical staff. Defibrillation training should also be made available for other than medical or nursing staff, e.g. personnel in hospital reception, cafeterias, and restaurants.

2. Amiodarone is the primary drug used for prolonged or recurrent ventricular fibrillation or pulseless ventricular tachycardia. Lidocaine can be used if amiodarone is unavailable.

3. Data collection and quality assurance of in-hospital cardiac arrest should be performed. A special form for data collection of resuscitation attempts, including sufficient data for uniform Utstein style reporting, should be used. A physician or nurse responsible for the coordination of resuscitation activities should collect the resuscitation forms and analyse resuscitation performance annually using definitions of the Utstein style reporting for in-hospital cardiac arrest [8].

4. ‘Do not attempt resuscitation’ orders should be indicated clearly in the patient’s records, and staff responsible for the patient’s care should be informed.

In order to facilitate the implementation of the guidelines, the Finnish Medical Society Duodecim also produced an educational video in Finnish about the use of an automated external defibrillator in case of cardiac arrest.

Data collection

In May 2004, 2 years after the publication of the national resuscitation guidelines, a questionnaire was sent to the chief anaesthesiologist in all public hospitals that provide anaesthetic services in Finland. Of the separate units of university hospitals, those with anaesthetic services were included and analysed as individual hospitals. A total of 55 forms were sent. The responders were asked to fill out the questionnaire themselves or to forward it to the physician in charge of the local in-hospital cardiopulmonary resuscitation organization. The data collection form included detailed questions about the present in-hospital resuscitation strategies and training. The questions are shown in the Appendix. If necessary, up to three reminders were sent, after which the heads of the department of anaesthesiology were contacted by e-mail or telephone.

Results

Completed questionnaires were returned from 52 (95%) of the 55 hospitals. In 75% of the hospitals, the person formally in charge of resuscitation activities filled out the questionnaire. In the rest of the hospitals, the questionnaire was filled out by the head of the department of anaesthesiology.

Resuscitation guidelines

Of the respondents, 63% reported that the national resuscitation guidelines were in use in the hospital. Nine hospitals (17%) used a resuscitation protocol of their own, in seven hospitals based on the national guidelines and in two based on the Guidelines 2000. Two hospitals (4%) used the Guidelines 2000. The rest of the hospitals (15%) had no formal guidelines. The developments of in-hospital resuscitation strategies after 2000 with reference to the national resuscitation guidelines are summarized in Table 1.

Table 1 Comparison of in-hospital resuscitation strategies in 2000 and 2004 in Finland with reference to the national resuscitation guidelines

<table>
<thead>
<tr>
<th></th>
<th>2000 (%)</th>
<th>2004 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid defibrillation by nurse on general wards</td>
<td>15</td>
<td>67</td>
</tr>
<tr>
<td>Amiodarone used for prolonged ventricular fibrillation or ventricular tachycardia</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Uniform style for indicating ‘do not attempt resuscitation’ order in patient charts</td>
<td>11</td>
<td>22</td>
</tr>
</tbody>
</table>

The 2000 data are from questionnaire study with similar methods performed in 2000 [6].

1 Data on the use of amiodarone in 2000 are not available.
Rapid defibrillation programmes

Most respondents reported that nurses generally perform defibrillation before the arrival of the physician on general wards, as well as in monitored areas, such as the cardiac care unit (Table 2). Forty-six per cent of the hospitals had a defibrillator placed on every ward.

In 15% of the hospitals, defibrillation training was given also to other than medical or nursing staff. A standardized 4-hour course on cardiopulmonary resuscitation and defibrillation, adapted by the Finnish Resuscitation Council from the European Resuscitation Council, was used in 33% of the hospitals. The defibrillation training video by the Finnish Medical Society Duodecim was used in 25% of the hospitals. Seventy-nine per cent of the hospitals had obtained either additional or their first automated external defibrillators after the publication of the national resuscitation guidelines.

Antiarrhythmic therapy

Several hospitals (44%) reported using only amiodarone and few (4%) only lidocaine for prolonged or persistent ventricular fibrillation or pulseless ventricular tachycardia. Both drugs were in use in 44% of the hospitals. A β-blocking agent was used in one hospital. The rest of the hospitals had no formal guidelines on the use of antiarrhythmic drugs in resuscitation.

Data collection of resuscitation attempts

A special form for data collection of resuscitation attempts was used in 69% of the hospitals. The forms were collected and routinely reviewed in 46% of the hospitals. A total of 43% performed data collection of in-hospital cardiac arrests, and 22% used definitions provided in the Utstein guidelines for in-hospital cardiac arrest [8].

‘Do not attempt resuscitation’ orders

A unified style for the documentation of ‘do not attempt resuscitation’ orders was used in 22 (48%) of the hospitals. There were various ways of indicating a ‘do not attempt resuscitation’ order: the letter combination ‘DNR’ (14 hospitals), a symbol (six hospitals), or written as the sentence ‘not for resuscitation’ (two hospitals). Of the hospitals, 19% had orders concerning decision-making of ‘do not attempt resuscitation’ orders. Withholding resuscitation, without a previous ‘do not attempt resuscitation’ order, was usually based on a decision by the physician in charge in most hospitals (94%) and in some hospitals also based on a decision taken by a nurse (12%).

Discussion

Our study results show a wide-scale implementation of in-hospital rapid defibrillation programmes in a whole country. In our previous study from the year 2000 using the same methodology, only 15% of the hospitals had rapid defibrillation programmes on the general wards [6]. The proportion has since then increased to 67%, and most hospitals have purchased automated external defibrillators. Moreover, changes towards recommended practices were observed also in other resuscitation strategies, including documentation of ‘do not attempt resuscitation’ orders as well as data collection and quality assurance. Also, a high proportion of hospitals reported using amiodarone for the treatment of ventricular fibrillation or ventricular tachycardia in cardiac arrest as recommended by the national resuscitation guidelines.

In-hospital rapid defibrillation programmes

There is little doubt that the time to first shock is critical for survival in in-hospital cardiac arrest patients with ventricular fibrillation or ventricular tachycardia [1,2,9]. Since the 1990s, the recommendations of several organizations, including AHA and resuscitation councils of the UK and Australia, have emphasized the role of nursing staff as first responders using an automated external defibrillator [4,5,10,11]. However, the implementation of in-hospital automated external defibrillator programmes has generally been sporadic [5]. For example, in an interview study by Sandroni et al. [12], most hospitals in Rome had less than one defibrillator per floor. In 2002, only 33% of the American hospitals participating in the National Registry of Cardiopulmonary Resuscitation (NRCPR) reported having some form of automated external defibrillator technology as a part of in-hospital cardiac arrest management, and from 2000 to 2002, only 1.4% of the patients with

Table 2 Nurse rapid defibrillation programmes indexed by type of ward

<table>
<thead>
<tr>
<th>Ward Type</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using automated external defibrillator (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General ward (n = 52)</td>
<td>48</td>
<td>33</td>
</tr>
<tr>
<td>Ward with monitored care (n = 40)</td>
<td>38</td>
<td>11</td>
</tr>
<tr>
<td>Cardiac care unit (n = 38)</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>Intensive care unit (n = 30)</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Emergency unit (n = 50)</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>Using conventional defibrillator (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General ward (n = 52)</td>
<td>8</td>
<td>33</td>
</tr>
<tr>
<td>Ward with monitored care (n = 40)</td>
<td>38</td>
<td>11</td>
</tr>
<tr>
<td>Cardiac care unit (n = 38)</td>
<td>66</td>
<td>3</td>
</tr>
<tr>
<td>Intensive care unit (n = 30)</td>
<td>63</td>
<td>7</td>
</tr>
<tr>
<td>Emergency unit (n = 50)</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>Using automated external defibrillator or conventional defibrillator (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General ward (n = 52)</td>
<td>12</td>
<td>33</td>
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<td>28</td>
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</table>
ventricular fibrillation or ventricular tachycardia as the initial rhythm were defibrillated using an automated external defibrillator [13]. In the present study, we found that the majority of Finnish hospitals have rapid defibrillation programmes outside critical care areas, and a substantial increase has occurred in the 4-year period since our previous study [6]. We assume that this favourable trend is a result of the national resuscitation guidelines, which present the rapid defibrillation principle in health care units as a primary goal.

As the present study reports the changes in resuscitation strategies and policies in the hospitals, the actual use of automated external defibrillators by nurses in the resuscitation situations cannot be estimated. Others have reported successful implementation of rapid defibrillation programmes [1,14], but there is, however, some evidence of reluctance of nurses towards defibrillation despite adequate training [15].

**Amiodarone**

Amiodarone is the antiarrhythmic agent recommended in both the international and Finnish national resuscitation guidelines for the treatment of recurrent or prolonged ventricular fibrillation or ventricular tachycardia [4,7]. According to data from the NRCPR, lidocaine was used more often than amiodarone in the USA [13]. In the present study, amiodarone seems to be used in most Finnish hospitals, either as the only antiarrhythmic drug or as an alternative to lidocaine.

**Data collection and quality assurance**

Systematic data collection is essential for quality assurance and research. The use of the Utstein model for in-hospital cardiac arrests enables comparisons in outcome between different hospitals. In the area of out-of-hospital emergency medical services, the value of Utstein style data collection for organizational development has been documented [16]. The Utstein guidelines for reviewing and reporting in-hospital cardiac arrest were published in 1997 [8]. In 2000, 11% of Finnish hospitals performed data collection using Utstein definitions, and in the present study, the proportion had doubled. Nevertheless, most hospitals did not routinely collect data on resuscitation attempts, and consequently, quality assurance is not possible. The situation seems to be similar in other countries as shown in a study by Sandroni et al. [12], concluding that merely one of 32 hospitals in Rome performed Utstein style data collection.

**‘Do not attempt resuscitation’ orders**

Only 19% of Finnish hospitals had written guidelines concerning decision-making and documentation of ‘do not attempt resuscitation’ orders. The findings seem to be in line with earlier studies; for example, a Dutch survey showed that most hospitals have a ‘do not attempt resuscitation’ policy, but few have written guidelines [17]. In the year 2000, a unified style for the documentation of ‘do not attempt resuscitation’ orders was used in 15% of Finnish hospitals [6]. In the present study, the proportion increased to 48%. Still, we found a great variability in indicating a ‘not for resuscitation’ status. In almost all hospitals, withholding a resuscitation attempt was possible without a previous ‘do not attempt resuscitation’ order.

**Impact of national resuscitation guidelines**

Studies in various clinical areas have shown that clinical practice guidelines have only a limited effect on practices in health care, especially if applied without clearly targeted implementation interventions [18]. In a literature-based evaluation of quality of care in the USA, a rough estimate was that 70% of patients received acute care as recommended, or nearly as recommended, whereas 30% received acute care that in most cases could be considered contraindicated [19]. Interestingly, the present study demonstrated marked changes in resuscitation organizations of the hospitals in a whole nation after publication of international and national guidelines. On the contrary, the observed changes can also be the result of many other reasons. Firstly, the marketing of user-friendly automated external defibrillators for in-hospital use has increased in recent years. Secondly, growing scientific evidence on impact of in-hospital rapid defibrillation programmes has probably also promoted rapid defibrillation programmes [1,2], and thirdly, the importance of rapid defibrillation in hospitals, and elsewhere, has probably been recognized in medical education.

Even so, we observed changes in many areas of resuscitation organizations: use of guidelines, rapid defibrillation, pharmacotherapy, ‘do not attempt resuscitation’ policy, and data collection. The national resuscitation guidelines were also used as resuscitation instructions in the majority of the hospitals. There are some issues that can explain the favourable acceptance of the national resuscitation guidelines. The fact that the national guidelines were published in a guidelines programme by a recognized medical society instead of as separate single guidelines may be an important reason why national guidelines have been adopted even without large implementation interventions. The Current Care guidelines are available free of charge, through the Internet and through the local intranet of most hospitals. The recommendations in the guidelines are clearly defined, an attribute shown to facilitate the implementation of the guidelines. In addition, the appointment of a nurse or physician in charge of resuscitation organization in the hospitals may have played an important role in implementing the guidelines into practice.

**Conclusions**

During a 4-year period since 2000, most Finnish hospitals have launched rapid defibrillation programmes outside the critical care areas. Important changes in resuscitation strategies were also observed concerning the use of antiarrhythmic medication, style of indicating a ‘do not attempt resuscitation’ order, and data collection. Although strongly emphasized, we cannot, however, conclude that the publication of the national resuscitation guidelines would be the only reason for the positive changes observed.
Acknowledgements

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References


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Appendix: the questionnaire (translated)

Hospital
Name and contact information of respondent

Background information

Type of hospital (primary local hospital/secondary central hospital/tertiary university hospital/unit of university hospital/other, specify)
Number of beds (n)
Type of monitored areas in hospital (tick all that apply: cardiac care unit/intensive care unit for medical and surgical patients/intensive care unit for medical patients/intensive care unit for surgical patients/high dependency monitoring ward/medical emergency ward/emergency room)
Presence of an anaesthesiology (always/during office hours/no)
Appointed person to be in charge of resuscitation preparedness (yes, specify profession and speciality/no)

Resuscitation practices

Orders for physicians in the management of cardiac arrest [national resuscitation guidelines/guidelines by ILCOR from 2000/Meilahden akuuttihoito-opas (acute care pocket guide published by Duodecim in Finnish) 2002/Meilahden akuuttihoito-opas 1997/guidelines by European Resuscitation Council from 1997/guidelines by American Heart Association from 1992/instructions produced in hospital, tick also guidelines if instructions are based on some/no orders for management of cardiac arrest, practices depend on physicians]
Antiarrhythmic drug for prolonged or recurrent ventricular fibrillation (lidocaine/amiodarone/β-blocker/other, specify/varying practice)

**Rapid defibrillation**

Deployment of defibrillators (every ward has defibrillator/only wards treating cardiac patients have defibrillator/defibrillators are in shared use)
Defibrillators on general wards (manual defibrillators/automated external defibrillators/both)
In addition to wards, defibrillators are deployed also to (tick all that apply: department of radiology/lobbies/cafeteria/outpatient clinic/other, specify)
Defibrillation on general wards (by nurse using automated external defibrillator before arrival of physician or resuscitation team/by nurse using manual defibrillator before arrival of physician or resuscitation team/nurses do not defibrillate without the presence of physician)
Defibrillation on wards treating monitored cardiac patients (by nurse using automated external defibrillator before arrival of physician or resuscitation team/by nurse using manual defibrillator before arrival of physician or resuscitation team/nurses do not defibrillate without the presence of physician/no ward of that type in hospital)
Defibrillation in cardiac care unit (by nurse using automated external defibrillator before the arrival of physician or resuscitation team/by nurse using manual defibrillator before arrival of physician or resuscitation team/nurses do not defibrillate without the presence of physician/no cardiac care unit in hospital)
Defibrillation in intensive care unit (by nurse using automated external defibrillator before arrival of physician or resuscitation team/by nurse using manual defibrillator before arrival of physician or resuscitation team/nurses do not defibrillate without presence of physician/no intensive care unit in hospital)
Defibrillation in emergency department (by nurse using automated external defibrillator before arrival of physician or resuscitation team/by nurse using manual defibrillator before arrival of physician or resuscitation team/nurses do not defibrillate without presence of physician/no emergency department in hospital)
Defibrillation training for non-medical staff, for example personnel in lobbies and cafeterias (yes/specify/no)
CPR-D course concept by Finnish resuscitation council has been used in defibrillation training (yes/no/do not know)
Defibrillation training video by the Finnish Medical Society Duodecim has been used in defibrillation training (yes/no/do not know)

**Data collection and quality assurance**

Special form for note keeping in resuscitation situations (yes/no)
Centralized collection of resuscitation forms (yes/no)
Review of resuscitation forms (yes, specify by whom/no)
Statistics compiled for quality assurance (yes, using Utstein template/yes, using other template/no)

‘Do not attempt resuscitation’ orders

Uniform style for indicating ‘do not attempt resuscitation’ order in patient charts (yes, specify/no)
In cases where ‘do not attempt resuscitation’ decision is not documented, resuscitation attempt can be withheld based on decision taken by nurse (yes/sometimes/no)
In cases where ‘do not attempt resuscitation’ decision is not documented, resuscitation attempt can be withheld based on decision taken by physician (yes/sometimes/no)
Written orders concerning decision-making and documenting do not attempt resuscitation orders (yes/no)