Prehospital guidelines for use of hypertonic saline are not followed systematically

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ABSTRACT

INTRODUCTION: Hypertonic saline (HS) was introduced in our physician-based mobile emergency care unit (MECU) in September 2006 for patients with severe traumatic brain injury and hypotension. HS has, however, rarely been used and we sought to identify barriers to its implementation.

MATERIAL AND METHODS: We conducted a survey based on a questionnaire administered to all 40 anaesthesiologists employed at the MECU in Copenhagen as per August 2010.

RESULTS: A total of 31 anaesthesiologists (84%) returned the questionnaire. Three physicians were excluded because of leave. Almost half of the physicians considered the evidence for use of HS insufficient, and 29% found that guidelines were lacking. Noticeable barriers were inadequate familiarity with and unawareness of the guideline. Some believed that they may have failed to use HS because the option did not occur to them during the relevant incidents. Many physicians stated that training at the MECU should be more thorough and that instructions were missing.

CONCLUSION: Barriers to the implementation of HS were lack of familiarity with the guideline and disagreement regarding the evidence supporting its use. Possible solutions to these implementation issues include additional instructions and internal MECU meetings.

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Between 30% and 50% of all patients are not treated in accordance with existing scientific evidence [1-3]. It is therefore important to identify barriers to the implementation of guidelines that may improve outcome, including those on treatment of patients with traumatic brain injury (TBI) [4].

Hypertonic saline (HS) was introduced to the physician-based mobile emergency care unit (MECU) in Copenhagen and was recommended for patients with severe TBI and a systolic blood pressure (SBP) below 90 mmHg. It was introduced via oral information at two internal MECU meetings in 2006, and has since then formed part of the standard medical drugs in an emergency utility bag. Every day the physicians need to confirm (by signature) that they know how to use the contents of these bags. An internal instruction on HS does not exist at the MECU. The introduction of HS was based on literature regarding prehospital treatment of patients with TBI and hypotension [5, 6]. In 2008, Scandinavian guidelines based on the Brain Trauma Foundation's guidelines [7] were issued. These recommended prehospital HS in hypotensive patients with severe TBI [8]. Nevertheless, the evidence supporting the use of HS must be considered controversial [6, 9, 10].

Only few patients have been treated with HS by the MECU in Copenhagen. Out of the 39,936 patient contacts from 1 September 2006 to 30 June 2010, only seven patients with TBI had HS even though 54 patients qualified for such treatment according to our database information on suspicion of TBI, Glasgow Coma Score < 9 and hypotension (SBP < 90 mmHg or not measurable/not registered). All physicians at the MECU are specialists in anaesthesiology and may decide to deviate from the guidelines according to clinical judgement. In this study we aimed to identify barriers to HS usage and to suggest possible solutions.

MATERIAL AND METHODS

Study design

We conducted a questionnaire-based survey among all physicians employed at the MECU in Copenhagen. Respondents were asked to assess statements related to 24 questions, focusing on the use and knowledge of HS, barriers to its implementation and ways to overcome such barriers. Six questions related to demographic data, including the physician's professional background.

Hypertonic saline. The physician-based mobile emergency care unit in Copenhagen.

ORIGINAL ARTICLE

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Questions on problems and barriers were constructed on the basis of empirical and theoretical insights [11-13] as well as our practical knowledge on other conceivable barriers. Two research fellows in anaesthesiology assessed the questions to ensure comprehensibility. Furthermore, we included partially open-ended questions, i.e. we added the response option "other", which the physicians could complete where possible and relevant, to allow for themes/answers not conceived when constructing the questionnaire.

In the autumn of 2010, a questionnaire was emailed to all anaesthesiologists employed at the MECU in Copenhagen on 1 August 2010, and a printed copy was also distributed to their individual drop box. Enclosed were instructions to return the questionnaire in an anonymous envelope to the secretaries at the MECU, who would then administer incoming replies. This gave us the possibility to send out reminders to individual physicians, while still maintaining anonymity. Reminders were sent by email to non-responders three and five weeks after they received the initial email.

Data analysis

Data are reported as numbers (percentages). Questionnaires were completed anonymously by the physicians and treated confidentially.

Trial registration: not relevant.

RESULTS

The questionnaire was sent to 40 physicians. Three were excluded due to leave, and 31 physicians returned the questionnaire, equivalent to an 84% response rate.

A total of 71% of the respondents were males, and the median age was 48 years. The median level of experience was 17 years of service as a physician and seven years as a specialist in anaesthesiology. In all, 13% had worked at the MECU for less than two years, 45% between two and five years, and 38% for more than six years. All physicians agreed that HS should be available for prehospital treatment at the MECU.

Half (51%) of the physicians assumed that they had used HS once every second year or more, 32% had never used it. 19% believed that they might have used it without registering it. Nearly all physicians (88%) found the indication stated for the use of HS to be clear, and almost all (97%) agreed that HS is indicated for severe TBI and hypotension.

TABLE 1

Questions answered. The values are n (%), N = 31. Do you agree …?

	Strongly agree	Agree	Disagree	Strongly disagree	Not answered
Q1. … on the following statements concerning the use of hypertonic saline at the MECU?					
Lack of guidelines in the area	0 (0)	9 (29)	16 (52)	5 (16)	1 (3)
Unsubstantial evidence supporting use	0 (0)	15 (48)	13 (42)	2 (6)	1 (3)
Q2. … that the following factors may have been barriers to implementation of hypertonic saline in your treatment of severe traumatic brain injury and hypotension?					
Lack of awareness of the guideline	4 (13)	7 (23)	11 (35)	5 (16)	4 (13)
Lack of familiarity with the contents of the guideline (e.g. due to rare indication)	3 (10)	13 (42)	8 (26)	4 (13)	3 (10)
Lack of agreement with the guideline	0 (0)	2 (6)	17 (55)	7 (23)	5 (16)
Lack of self-efficacy (believe that you are unable to perform the guideline recommendation)	0 (0)	1 (3)	17 (55)	8 (26)	5 (16)
Lack of outcome expectancy	0 (0)	1 (3)	16 (52)	9 (29)	5 (16)
Difficulties changing existing practice/habits	0 (0)	5 (16)	14 (45)	7 (23)	5 (16)
External barriers (e.g. practical circumstances, lack of time, organizational constraints, missing reminder systems, etc.)	0 (0)	5 (16)	15 (48)	7 (23)	4 (13)
Q3. … with the following statements concerning the work at the MECU?					
Instructions for the work at MECU are missing	0 (0)	13 (42)	14 (45)	1 (3)	3 (10)
If I am unable to participate at a MECU meeting, I always read the minutes of the meeting afterwards	14 (45)	13 (42)	1 (3)	1 (3)	2 (6)
Training at the beginning of employment should be more thorough	2 (6)	12 (39)	13 (42)	0 (0)	4 (13)
In general, I obtain information about new prehospital clinical guidelines from the following sources:					
MECU internal meetings/meeting minutes	10 (32)	17 (55)	1 (3)	0 (0)	3 (10)
PubMed search	4 (13)	17 (55)	6 (19)	0 (0)	4 (13)
Cochrane	2 (6)	9 (29)	15 (48)	0 (0)	5 (16)
Cochrane articles	7 (23)	21 (68)	0 (0)	0 (0)	3 (10)
Cochrane scientific books	6 (19)	17 (55)	5 (16)	0 (0)	3 (10)
Other, please note: 5 (16%) answered: conferences/training					26 (84)

MECU = mobile emergency care unit.

TABLE 2

Questions answered. The values are n (%), N = 31. How great an influence …?

	Very large influence	Large influence	Some influence	Little influence	No influence	Not relevant	Not answered
Q4. … do you believe the following factors have on your current practice *at the MECU?*							
MECU meetings (and minutes from these)	5 (16)	12 (39)	11 (35)	2 (6)	0 (0)	0 (0)	1 (3)
Instructions at the MECU	3 (10)	17 (55)	7 (23)	3 (10)	0 (0)	0 (0)	1 (3)
Guidelines in pocket book size	3 (10)	9 (29)	9 (29)	4 (13)	1 (3)	3 (10)	2 (6)
Conversation with colleagues	2 (6)	16 (52)	9 (29)	3 (10)	0 (0)	0 (0)	1 (3)
Simulation practice/interactive instruction	4 (13)	10 (32)	7 (23)	4 (13)	2 (6)	2 (6)	2 (6)
Conferences/conventional training	3 (10)	17 (55)	5 (16)	4 (13)	0 (0)	0 (0)	2 (6)
Reminders	4 (13)	12 (39)	7 (23)	2 (6)	3 (10)	1 (3)	2 (6)
Scandinavian clinical guidelines	4 (13)	11 (35)	13 (42)	1 (3)	0 (0)	0 (0)	2 (6)
European or other international clinical guidelines	5 (16)	14 (45)	9 (29)	1 (3)	0 (0)	0 (0)	2 (6)
Articles	3 (10)	15 (48)	10 (32)	1 (3)	0 (0)	0 (0)	2 (6)
Other, please note: 0 (0%) answered							31 (100)

MECU = mobile emergency care unit.

Almost half of the physicians found that the evidence for treatment with HS is insufficient, and 29% thought that guidelines in this area were missing (**Table 1**).

29% believed there could have been incidents in which they did not treat a patient with severe TBI and hypotension with HS although available. This was mainly ascribed to HS simply not occurring to the physician while treating (78%).

Half of the physicians found that a lack of familiarity with the guidelines was a barrier to guideline adherence, and 35% found that a lack of awareness of guidelines was possibly a barrier.

Nearly half of the physicians stated that instructions for the work at the MECU were missing, and an equal number stated that education at the MECU should be more thorough.

Most physicians at the MECU stated that internal meetings, European guidelines, instructions and conferences/conventional education had considerable influence on their current practice at the MECU (**Table 2**).

Most physicians saw instructions at the MECU, pocket book guidelines and internal MECU meetings as very effective in terms of influencing their future practice regarding the implementation of new guidelines. 90% found that instructions were very effective or to some extent effective, and 87% found relevant articles placed in their inbox effective (**Table 3**).

DISCUSSION

Our main findings were that the MECU physicians expressed a lack of familiarity with the contents of the guideline and that instructions for the work at the MECU are lacking.

It seems that implementation could be enhanced by giving instructions and providing guidelines in pocket book size, and by providing relevant information at MECU meetings.

Some physicians might have suspected that there was a risk of revealing their identity as they handled questionnaires personally or because the questionnaire comprised demographic questions. Memory bias cannot be excluded; in the questionnaire, physicians were asked about their use and knowledge of HS over a period of four years. It is possible that the survey itself made the physicians gather knowledge of HS, thus increasing their knowledge. The responses may have been influenced by concerns about compromising anonymity, memory bias and knowledge gathered during the research process.

The questionnaires were sent to those physicians presently working at the MECU. It would have been interesting also to contact those who had left the MECU within the past four years as they possibly have different views on the subject.

Not all physicians employed at the MECU returned the questionnaire and among those who did, some left a number of questions unanswered. This could cause selection bias; a main concern being whether physicians with barriers to guideline adherence would be overrepresented among non-respondents, but the demographic data for respondents and non-respondents do not seem to be different. Some MECU physicians work very few shifts and this may explain why some decided not to fill in the questionnaire. In this light, we consider the 84% response rate to be high.

We predominantly used closed-ended questions, i.e. a priori response options which can be processed and analyzed directly. The reliability of the questions is

TABLE 3

Questions answered. The values are n (%), N = 31. How effective …?

	Very effective	To some extent effective	Less effective	Not effective	Not answered
Q5. … would the below mentioned factors be in influencing your future practice *in connection with the implementation of new guidelines at the MECU?*					
MECU meetings (and minutes from these)	14 (45)	11 (35)	2 (6)	1 (3)	3 (10)
Instructions at the MECU	18 (58)	10 (32)	1 (3)	0 (0)	2 (6)
Guidelines in pocket book size	16 (52)	7 (23)	5 (16)	0 (0)	3 (10)
Conversation with colleagues	11 (35)	12 (39)	4 (13)	0 (0)	4 (13)
Simulation practice/interactive instruction	10 (32)	13 (42)	4 (13)	1 (3)	3 (10)
Conferences/conventional education	8 (26)	16 (52)	4 (13)	0 (0)	3 (10)
Reminders	8 (26)	14 (45)	5 (16)	1 (3)	3 (10)
Scandinavian clinical guidelines	8 (26)	15 (48)	4 (13)	0 (0)	3 (10)
European or other international clinical guidelines	10 (32)	14 (45)	4 (13)	0 (0)	3 (10)
Articles	11 (35)	13 (42)	3 (10)	1 (3)	3 (10)
Relevant articles placed in my inbox	10 (32)	17 (55)	1 (3)	0 (0)	3 (10)
Other, please note: 1 (3%) answered					30 (97)

MECU = mobile emergency care unit.

therefore relatively high, although the validity may be lower. To increase validity, we included half open-ended questions, ref. Boolsen [14], which allowed respondents to report any barriers, problems, and solutions not thought of by the authors.

Comparison with other studies

We examined barriers in implementation four years *after* the introduction of HS. An examination of barriers to guideline adherence performed during the process of implementation may have yielded different outcomes. Tabbers et al [15], concluded that successful implementation of guidelines should take implementation into account during the very development of new guidelines. Furthermore, they stressed the importance of having stakeholders disseminate recommendations before active implementation. They also recommend targeting implementation strategies at identified barriers, thus making implementation guideline-specific [15].

In our study, one apparent guideline-specific barrier is related to the indication for HS in the MECU setting since it is an uncommon situation. A recent focus group survey also found guideline-specific barriers in the implementation of prehospital protocols [16].

An American study investigated the implementation of The Brain Trauma Foundation Guidelines in prehospital treatment of patients with TBI [4]. They found that knowledge of treatment of TBI rose significantly after active implementation (in the form of education/instruction). The study also supported the hypothesis that active implementation leads to a significantly improved outcome for patients with TBI [4].

Other studies have found that successful implementation requires multifaceted interventions [12, 17]. In line with this, physicians in our study proposed several factors that may be instrumental in making the implementation of new guidelines more effective.

Various barriers to guideline adherence have been suggested [11, 13]. One review identified seven general categories of such barriers and categorized them into three main groups: physician knowledge, attitude and behaviour [11]. Identified barriers were lack of awareness and familiarity with guidelines (affecting knowledge). Other barriers were lack of self-efficacy, outcome expectancy, lack of agreement with guidelines, and inertia from previous practice – all of which affect attitude. Furthermore, external barriers to guideline adherence were identified (affecting behaviour).

We identified lack of knowledge as a barrier, more specifically a lack of awareness of the guideline, and a lack of familiarity with the guideline. Moreover, we found that attitudes constituted barriers as evidence supporting the use of HS was perceived as being unsubstantial. The infrequent use might lead us to consider whether HS should be available at the MECU. We, however, would argue that HS should remain available for two reasons. Firstly, HS has been found to increase the survival rate in patients with TBI and hypotension [7]. Secondly, all physicians in our study thought that HS should be available at the MECU in the future.

Inability to appraise evidence is a known barrier to implementation of new guidelines [13], and compliance with guidelines is associated with the quality of evidence [12]. The fact that approximately half of the physicians found that the evidence was insubstantial may indicate a lack of knowledge of the existing evidence. This barrier

may perhaps be managed by presenting physicians with evidence supporting the guidelines. Facts could, according to our survey, be presented at internal MECU meetings and via dissemination of relevant articles to the physicians.

We cannot exclude that the recommendation was prematurely introduced considering the amount of evidence and the fact that no benefit of HS has been found in prehospital studies of TBI without hypotension and hypovolaemic shock compared with normal saline [18, 19].

The benefit of HS given to patients with both TBI and hypotension is controversial [6, 9, 10], but it must be taken into consideration that the basis of this survey was a Scandinavian guideline as well as a local recommendation to use HS at the MECU [8].

Many of the physicians stated that MECU guidelines are missing, and instructions seem to have a large influence on current practice. In addition, instructions are considered the most effective tool to influence future practice in connection with the implementation of new guidelines.

Thus, instructions about HS seem important in overcoming the lack of knowledge about existing guidelines and the perceived lack of guidelines on HS.

Unanswered questions and future studies

It is unclear whether the same barriers would also be found in other highly specialized prehospital units. It is also unclear whether the identified barriers are guideline-specific or are general barriers to implementation. The existing literature suggests that barriers to implementation can be guideline-specific [15, 16]. A qualitative pilot study could help identify which specific factors to include in a future quantitative study which could include outcome data.

CONCLUSION

Barriers to implementation of HS are lack of knowledge of, perceived evidence of, and familiarity with existing guidelines. We suggest instructions, possibly in pocket book format, and further education at internal MECU meetings as possible solutions.

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