

## The Work Practice of Videoconferencing in Acute Stroke Treatment

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**Abstract**—In Norway, a local hospital and a specialist hospital have implemented real-time videoconferencing to exchange knowledge in order to obtain more complete stroke diagnoses and increase the thrombolytic treatment supported by specialists. In this paper, the objective is to explore the tension between the potential for using videoconferencing and its realization in practice. In 18 months, there were four videoconferencing consultations. Videoconferencing is only used when considering a thrombolytic treatment. As the thrombolytic treatment depends on several contra-indications written in a guideline, the guideline shape the work practice. In principle, the guideline represents a meaning potential for dialogue and for exploring knowledge in stroke treatment. But, in most cases, the guideline is followed strictly, and thus thrombolysis is not a treatment option in such cases. There is a breakdown in the potential for using videoconferencing, since they only four times have realized the meaning by creating sense and a shared repertoire of knowledge. This includes small turnouts and a lesser strictness to the guideline might lead to more frequently used videoconferencing in acute stroke treatment.

*Keywords*-videoconferencing; telestroke; work practice; meaning potential; meaning realized

### I. INTRODUCTION

In Norway, a local hospital and a central hospital have both implemented real-time videoconferencing (VC) so that the small local hospital can access specialist knowledge from the large hospital to discuss acute cases in which patients have suffered a stroke [1]. By using VC as a tool, practitioners are able to examine patients in a virtual collaborative process. In acute situations, when time is critical, this collaborative process can shorten decision times and improve treatment outcomes.

Approximately 15,000 people in Norway suffer from strokes each year, constituting the third most frequent reason for death [2]. The stroke incidence is three per 1000 inhabitants [2], estimated at 69 patients per year (1,32 per week) in *this* local hospital. In most cases, strokes are treated with medicament intravenous thrombolytic therapy. Thrombolytic therapy is a treatment used to break up dangerous clots inside the blood vessels. To perform this treatment, the physician injects clot-dissolving medications into a blood vessel. The effect of thrombolytic

treatment diminishes over time, while the risk for complications increases [3]. Thrombolytic treatment should be given as soon as possible, but within 4 ½ hours after the symptoms start [2]. As time matters, decisions about diagnosis must be made as soon as possible. Shortening the time to pre-hospital stroke treatment might be possible by remotely assessing patients with stroke prior to their arrival at the hospital through discussions over ambulance computers [4] and through bedside assistance from real-time video smartphones [5]. Once a patient with a suspected stroke reaches the emergency unit, the local hospital might use in-hospital VC to shorten the decision process, and improve the quality of care [6].

Each patient needs to complete a computer tomography (CT), an image digitizing cerebral scanning of the brain, before an exact diagnosis is determined. The professionals have a guideline they follow when patients arrive at the hospital. The decision to start thrombolytic treatment within 4 ½ hours depends on several criteria, or contra-indications, and every case should be considered individually. Giving stroke patients thrombolytic treatment in the acute phase improves their prognosis. The national goal is to give 20 % of the patients thrombolytic treatment within 4 ½ hours after the symptoms' debut. Today, the average in Norway is about 5 % [7].

Many emergency physicians do not use thrombolytic treatment, because they have a sole responsibility for the patient [8]. In the local hospital described here, thrombolytic treatment should be given under the supervision of a specialist. To access specialist competence for a second opinion for supervising thrombolytic treatment over distance, and to save time, VC has been implemented. Implementing VC increases the number of thrombolytic treatments and the patients threatened in the 4 ½ hours window [9]. Therefore, VC can further support the decision about thrombolysis and potentially lead to an increase in the number of thrombolytic treatments given. In September 2010, the VC service was ready to be used, so that the visual sight of the patient could supplement the spoken descriptions, traditionally communicated by telephone. In this way, the physicians and nurses at smaller referring hospitals could communicate with the specialists in the specialist hospital, seeing each other and the patient.

The paper is organized as follows. Next section gives a background to the paper, by presenting the research question, illuminated and made current by previously research. Section III provides the environment where the VC is situated, and provides a framework for analyzing social interaction. Section IV is methods, describing the research method and how the data is analyzed. Section V is the results, discussed in Section VI. Conclusion and further work are provided in the last section of the paper.

## II. BACKGROUND

Using VC in stroke treatment has been referred to as “telestroke”. Since the end of 1990s and early 2000s, telestroke networks have been developed. The use of telestroke networks has shown great promise for improving access to expertise and for giving more precise diagnosis. Studies, many of which are connected to funded programs, report outcome, i.e. factors related to successful telestroke interventions, such as levels of satisfaction, acceptance, positive experiences and improved quality of care [10]. Patients treated in hospitals with telestroke networks receive more complete stroke diagnosis and earlier rehabilitation therapy than patients treated in other hospitals [11]. There have been reviews on the motivations for telestroke programs and the barriers to program adoption [12]; the barriers are, i.e., lack of technology support and lack of funding [12]. Research reporting success and barriers to the development of telestroke programs focus on the effectiveness, cost-effectiveness and quality of the technology [8, 10-12]. Little is known about the use of telestroke in daily work practice and what affects the work processes that lead either to success or failure.

Grounded in international findings of satisfaction, positive experiences and improved quality of care using telestroke equipment, as well as our own results on how VC technology *per se* is not the reason for the low frequency use[13], the aim of this work is to explore why VC use is lower than expected. Here, the paper focuses on the work practice of stroke treatment and how the organization of stroke treatment affects VC use in acute care. The objective is to explore the tension between the potential for using VC for collaborative work to increase thrombolytic treatment and for the realization of VC in practice.

## III. MATERIALS AND FRAMEWORK

The local hospital examined in this paper has a stroke unit, but no neurologist. Traditionally, the physicians in this local hospital seek a second opinion from the larger specialist hospital over the telephone. The distance between them is about 63 miles or 100 kilometers by airplane over the sea. Using VC instead of a telephone gives the specialist the opportunity to see the patient and the local team when giving advice about treatment. In

September 2010, the service was used for the first time, and it is still running.

The VC is located in the local hospital’s emergency room (Figure 1). In the specialist hospital, the VC equipment is located in a dedicated room used only for this purpose (Figure 2). When the referring hospital calls up the specialist hospital by telephone and initiates a VC meeting, the specialist immediately moves to this room. During their social interactions, the professionals are able to draw on resources such as their different knowledge and the patient him/herself when discussing the medical problem. The professionals discuss and make sense of the signs and actions that are a part of the collaborative work; i.e., results from the CT, dialogue with the patient, information from the physicians and the nurses.

Social interaction is a difference between meaning potential and meaning realized [14]. The meaning potential in work practice is the way stroke treatment is performed, where the blood test, the CT and the clinical signs and information represent the potential. Through the use of dialogue and VC, the professionals create sense and a shared repertoire of knowledge.

When using VC the professionals meet, medical discussions arise and problems are handled. It is the tension and the gap-closing between the knowledge of the local physicians, their traditional approach to stroke treatment, and their collaboration with the specialist by using VC, which might increase the number of thrombolytic treatments and the patients treated within the hours window, i.e., the meaning realized.



Figure 1. Emergency room at the local hospital



Figure 2. The dedicated room in the specialist hospital

## IV. METHODS

### A. Research methods

The VC equipment was introduced to the clinics in September 2010, and it has been studied since. All activity using VC is automatically logged. As a consequence, one can know how many times, when, and for how long the VC equipment has been used. The log data have then been used as a basis for conducting the interviews. As the results will show, the VC equipment logs indicated four total uses.

Thirteen professionals, nurses, physicians and specialists from both hospitals were interviewed, through 12 semi-structured interviews in the autumn of 2011. There were seven informants from the local hospital and six informants from the specialist hospital. In one of the interviews there were two participants. The informants were selected on the basis of their roles: working with stroke patients in the acute phase and/or having participated in VC consultations. Five of them had used the VC equipment. Twelve interviews were conducted face-to-face. One interview was conducted by telephone, since the informant had to postpone the interview appointment when visiting the hospital.

Each interview lasted from 20 minutes to two hours. Those informants introducing the topics of equipment and the workplace while talking affected the length of the interviews, and made them the longest. All interviews were audio recorded, then transcribed. All transcriptions were categorized according to utterances that seemed to be repeated by the practitioners.

Understanding the overall treatment of stroke patients, in both the acute and rehabilitation phases, called for an understanding of the organization of stroke treatment in the hospitals. This included conversations with professionals involved in different stages of the stroke treatment (the laboratory personnel, the stroke unit and CT personnel), but as they were not the ones using the VC equipment in the consultations, they were not included as informants, but as a resource for understanding the treatment of stroke patients.

### B. Analysis

All the empirical material was analyzed with emphasis on the collaborative processes and knowledge sharing through medical discussions. It has been important to understand the tension between the use and the non-use of the VC equipment; the patients that could have been discussed by using VC, those patients who have been discussed and why some patients are not discussed.

### C. Ethical considerations

The study has been registered and evaluated as a non-report obliged by the North Norwegian Regional Medical Ethics Committee (REK). The personal data are handled according to the personal informative rules in Norway.

## V. RESULTS

### A. The work practice

The stroke patients arrives the local hospital in the emergency room. The physician on duty meets the patient here and considers the patient condition supported by the nurses. If the patient has symptoms of a stroke, he/she is considered for thrombolytic treatment. The physician evaluates the time limit and other contra-indications for thrombolytic treatment written in the guideline. The patient has blood tests and a CT taken. If the physician and the emergency team want to discuss the patient with a specialist, or if the physician wants to administer thrombolytic treatment, the physician calls up the specialist at the larger hospital while the patient has the blood tests and the CT. This is first done by telephone to let the specialist hospital know that the local hospital want to have a VC. Second, this is done by VC, so that both hospitals are able to both see and hear the patient and the whole team at the local hospital. When the patient has finished the CT, the specialist and the local team wait by the VC to discuss the treatment. This organization prevents lost time by connecting the two hospitals.

Giving thrombolytic treatment depends on several contra-indications; for instance, the time limit is 4 ½ hours, so the onset time must be known, and there are individual criteria such as previous and present medical conditions and medications. Therefore, every patient needs to be considered individually. If the physician evaluates the time limit and the contra-indications in such way that thrombolytic treatment is not an option, the specialist is not connected and the patient is moved to the local medical department and later to the stroke unit for rehabilitation.

### B. Stroke patients

During a one-year period, there were reported 12 patients suffering from a stroke in this area [3]. Only two patients were threatened with thrombolysis. It is important that patients are aware of the symptoms of a stroke (informant 4, 5, 10). If the time of onset is not known, the patient cannot receive the treatment. Following quotes represent this:

- "...we can improve our internal routines, but most important is consciousness-raising among the public, to get in touch" informant 4.
- "...the majority are non-relevant (...); they arrive too late" informant 5.
- "...the majority arrive too late (...); they do not reach us in time" informant 10.

Also, every case must be evaluated individually, first in terms of the time of onset and the time limit for thrombolysis, then for other specific circumstances.

The following utterances illustrate how the physicians (informant 8 and 12) and the specialist (informant 7) reflect the guideline:

- “...one thing we often experience is that patients reach us too late (...) and we might be too strict with the criteria. We might exclude too many small turnouts” informant 8.
- “...we consider it too strict (...) most of the patients are excluded for different reasons” informant 12.
- “The question is if we are too strict. Maybe others have lower limits for giving thrombolytic treatment. It is a clinical judgment. But, we interpret the guidelines very differently from hospital to hospital” informant 7.

As the utterances illustrate, the individual evaluation of the contra-indications, or the guideline, are those cases warranting the potential use of VC.

The contra-indications are not that strict as the time limit, and are available for clinical discussions. These cases, reflecting the guidelines are those where the guideline can be discussed. The guideline are interpreted differently from hospital to hospital (informant 7), and the professionals say they might evaluate them too strictly (informants 8, 12, 7), excluding too many small turnouts (informant 8). This means, that including the small turnouts and a lack of strict adherence to the guideline, could have resulted in some discussions, evaluating and exploring the standardized knowledge in the guideline. More discussions of the guideline, further leads to more frequently used VC consultations.

### C. The use of VC

Over the course of 18 months, VC has been used four times to discuss stroke patients. In all four cases, the specialist was connected because the local hospital wanted to offer thrombolytic treatment or to discuss the treatment because the patient was considered a possible candidate for thrombolytic treatment.

TABLE 1. THE USE OF VC AND FREQUENCY OF THROMBOLYSIS

Use of VC		
Patient	Outcome	Thrombolysis
1	Diagnosis dismissed and changed	No
2	Possible rejection because of previous heart transplant	No
3	Received thrombolytic treatment successfully in the past	Yes
4	Diagnosis dismissed and changed	No

Patient 1-4: September 2010- March 2012. Patient 3-4: March 2011-March 2012.

As Table 1 illustrates, Patients 1 and 4 had their diagnoses dismissed and changed, so no thrombolysis was given. Patient 2 was rejected because of a previous heart transplant, and Patient 3 had received thrombolytic treatment successfully earlier, and then had it again. The following quotes illustrate the treatment outcome:

- “...we had the image, and were able to talk directly to the patient. So it was easier to evaluate the aphasia and the other parameter as well. Because of other symptoms, we did not do thrombolysis” informant 11.
- “I am not sure this will lead to more thrombolysis, but maybe to thrombolysis to those having the correct indication” informant 12.

When VC is used, it is easier to make clinical judgments because the specialist is able to see the patient and the overall situation. The specialist also talks to the patient, which offers more insight into the patient’s condition. As Informant 11 and 12 expressed, the treatment is given under more correct indications since VC makes it easier to evaluate all the symptoms. Even though the specialist does not think more patients will have thrombolytic treatment, he says that the treatment decisions are of a higher quality.

## VI. DISCUSSION

As giving thrombolytic treatment depends on several factors or contra-indications, the treatment guideline shape the work practice and the use of thrombolytic treatment. If a patient arrives more than 4 ½ hours after symptoms start or the onset time is unknown, he/she is not considered for thrombolytic treatment. There is also guideline for administering thrombolytic treatment, which are discussable and make the evaluation of every patient unique. The guideline represents the meaning potential for exploring knowledge in stroke treatment. But, in most cases, when following the guidelines strictly, thrombolysis is not a treatment option. When thrombolysis is excluded, VC is not connected and stroke treatment is not discussed with specialists using VC. Hence, the guideline limit dialogue and the need for decision support. The work practice, with its routines established in the guideline, makes the use of VC break down.

Before the VC was implemented in 2010, the number of patients with stroke symptoms in this local area was estimated to be 69 patients per year. This local hospital had 12 reported stroke patients in a one-year period resulting in a lower number of candidates for thrombolytic treatment than estimated. By deducting those patients who are identified within 4 ½ hours, only a few patients remain as possible candidates for

thrombolytic treatment per year. These patients represent the meaning potential for knowledge sharing, discussing thrombolytic treatment and hereby the use of VC. In one year, two patients had thrombolysis. One patient had thrombolytic treatment with no discussion of the patient using VC, as the local team made the decision that it was the correct treatment. The second patient was discussed with the specialists using VC.

Over a period of 18 months, VC has only been used four times. Once, the outcome was thrombolytic treatment. When connecting by VC, the local physicians has evaluated the patient's condition and found thrombolytic treatment to be a possible treatment option. Exchanging knowledge using VC as a tool resulted in thrombolytic treatment on one occasion. After consultation, the stroke diagnosis was dismissed and changed in two cases, and once, thrombolysis was refused since the patient had a heart transplant. This illustrate that the guideline serve as a *guide*, and that collaborative work with the specialist might change and/ or influence the decision. When discussion the patient, the meaning potential was realized, as the professionals created a sense and a shared repertoire of knowledge, by interacting and drawing on each other's resources. After the dialogue, the exchanged knowledge had made such sense that the local physician followed the treatment plans being discussed.

One can assume that several patient cases were the basis for thrombolysis discussions using VC, creating a meaning potential for expanding the knowledge exchange and the use of VC in stroke treatment.

From a retrospect evaluation of the cases, the professionals determined non-thrombolytic treatment to be the correct option. One patient could have been given the treatment, but even though the patient did not receive it, the patient recovered well. This illustrates that the situation has the potential for knowledge sharing, treatment modifications or corrections, and perhaps an increased number of thrombolytic treatments. Over time, discussing cases with may change the way the guideline is used in stroke treatment. The professionals strictly evaluate the use of the guideline and their use differs from hospital to hospital. Using VC gives the professionals access to specialist expertise, and over time realizing the meaning potential by exchanging knowledge so that the guideline can be discussed and the thrombolytic treatment can be used more frequently.

Telestroke research reports on successful telestroke interventions, i.e., satisfaction, acceptance, positive experiences and improved quality of care [6]. Studies reporting barriers explain the obstacle for use, i.e., by the lack of technology supports and the lack of funding. This paper discusses the processes leading to the outcome; VC was only used four times in acute stroke treatment over a period of 18 months. Findings illustrate how work practice, with guideline for treatment, affects the need for a second opinion and the use of VC as a tool for

exchanging knowledge. Accordingly, the basis for acute stroke consultations cannot be estimated merely by the number of stroke patients.

Lesson learned, when considering implementing VC, the amount of patients sufficient for the investment needs to be accounted for; i.e. the extent on knowledge sharing and the use of VC consultations is affected by the organization of work practice. There is a tension between the potential for collaboration by using VC as a tool for increasing thrombolytic treatment, and how the traditional way of performing treatment affects the realization of VC in practice. VC represents a tool for potential meaning making. When the patient arrives in the emergency unit, the professionals make decisions affecting how they realize the meaning potential in the situation. Many emergency physicians do not traditionally use thrombolytic treatment, because the rare event of giving thrombolysis and because they have the responsibility solely [4]. By using VC, they can consult specialists and increase the number of thrombolytic treatments supported by specialist competence [5]. Hence, the way the guideline is handled affects the use and the number of thrombolysis as treatment for stroke.

## VII. CONCLUSION AND FUTURE WORK

When a stroke patient arrives at the hospital, the blood test, the CT and the clinical signs and information represent the potential for sharing knowledge and creating a shared repertoire of knowledge. Through the use of dialogue and VC, medical discussions arise and problems are handled. The workflow affects how often and if the dialogue using VC and the guideline are used as tools for decision support. The professionals might create a sense and a shared repertoire of knowledge when treatment is discussed and carried out. Hereby, more frequent use of VC consultations can lead to knowledge exchanges and a greater number of thrombolytic treatments made by confident professionals. The specialists are connected on the VC after the physicians have decided giving thrombolysis. Therefore, only a small number of stroke patients are discussed. Including small turnouts and discussions about the guideline might lead to knowledge exchange about several cases. Hereby, videoconferencing consultations will be used more frequently in acute stroke treatment.

It is the tension and the gap-closing between the knowledge of the local physicians, their traditional way of treating stroke, and their collaboration with specialists through the use of VC, which might increase the number of thrombolytic treatments and the patients threatened in the hours window. Changing the work practice, by practicing the knowledge discussed in the VC consultations, realize the meaning potential in acute stroke treatment.

Even though the VC only has been used four times for discussing acute patients suffering from stroke, these cases are important. The knowledge exchange by the use of VC might have an important influence on the patient's condition and rehabilitation. For future work, it will be interesting exploring the four cases and the processes of knowledge sharing.

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