Collaboration in Surgical Training

A qualitative study of mentoring laparoscopic surgeons by using videoconference in northern Norway

Line Lundvoll Warth*, Etai M Bogen°, Rolv-Ole Lindsetmo°, Hitendra RH Patel‡ and Knut M Augestad*

*Norwegian Centre for Integrated Care and Telemedicine
University Hospital of North Norway
Tromsø, Norway

°Department of Gastrointestinal Surgery
University Hospital of North Norway
Tromsø, Norway

‡Department of Urology &
Norwegian Centre for Pelvic Dysfunction
University Hospital of North Norway

line.lundvoll.warth@telemed.no, etai.bogen@unn.no, rolv-ole.lindsetmo@unn.no, hitendra.patel@unn.no, knut.magne.augestad@telemed.no

***Abstract*—This paper describes a work in progress, a project studying collaboration among laparoscopic surgeons who are instructed during their education. Access to expert surgeons is a problem at many hospitals. Implementing videoconferencing (VC) as a tool for instruction (telestration) and knowledge-sharing overcomes the distance between mentors and mentees, and has the potential to improve surgical training. Understanding of VC is limited in surgical practice, and the educational and clinical benefits of telementoring should be explored. This project will meet this demand by seeking in-depth understanding of the non-technical aspects or social processes of collaboration in surgical training. Over a three-year period, from 2015 to 2017, this project will examine collaboration in surgical training (CoaST). A hospital in northern Norway at which surgeons collaborate in surgical training to complete their surgical education in general surgery will be investigated. This paper discusses how we will collect the data. When they start to use VC for mentoring in distance surgical training, this will be included. An explorative study will be carried out using video-recorded observations of interactions. The paper is relevant for the conference focusing on the topic of distributed surgery and collaboration between professionals creating new telemedicine practices. This paper outlines the objectives of the study and the qualitative design; the study will explore non-technical aspects or social processes of collaboration in surgical training. The paper concludes by presenting a design for collecting video recordings to explore surgical training.**

Keywords-collaboration; surgical training; telementoring; interaction; qualitative methods.

I. INTRODUCTION

Surgical education in general surgery requires six years of education, training and clinical practice. The clinical practice involves hands-on training during which the surgeons who are being educated (mentees) are instructed by expert surgeons (mentors). Access to mentors for education is a problem at many hospitals. Improving access to mentors in surgical training can be accomplished by implementing videoconferencing (VC) as a tool for knowledge-sharing to overcome geographic distance between mentors and mentees and to allow for organization and full concentration on training locally and through geographic distance.

In surgical practice, procedures are often challenging as unexpected challenges arise and can lead to a point of no return where decisions must be made in the moment [1]. The skills of a surgeon and the collaborating operating team are a prerequisite for a good surgical outcome [2][, 3]. Thus, collaboration and training of team performance are important in surgical practice. Optimal teamwork is essential when mentors and mentees are located in the same room, and if they are located over distance. VC for telementoring is well suited for collaborating and overcoming distance [4]. However, a recent review of surgical telementoring reported limited understanding of VC in surgical practice. The review concluded that little attention has been paid to the educational and clinical benefits of telementoring, and instead, focused on piloting the technology [5]. Studies report that surgical mentoring by VC provides opportunities to alter surgical practice and offers patients the best expertise in surgical treatment despite geographic distance [6]. However, little in-depth understanding of the non-technical aspects or social processes of collaboration in surgical training exist.

During this project, collaboration in surgical training (CoaST), we will examine the organization of surgical training today and the use of VC, as well as how knowledge

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is shared and constructed in order to complete surgical procedures, that is, the organization of training and practice, the team that participates, the knowledge shared, the knowledge needed and the use of resources to solve the problem. Together, this gives insight into team performance and how non-technical aspects or social processes of collaboration influence the way surgeons are mentored.

The rest of this paper is organized as follows. Section II describes the framework for the field, and the need for knowledge about collaboration and teamwork in surgical training. Section III describes the empirical context. Section IV addresses the qualitative design and illustrates how the design with video-recorded observations will be used to explore the field, connecting practice to the design method in Section V. The conclusion is in Section VI.

II. FRAMEWORK

Research regarding the *educational aspects* of VC in surgery stresses the educational benefits [7] and refers to telementoring as effective for the development of surgical skills [8], allowing young surgeons to be educated through distance learning by an expert surgeon [9]. Past research has suggested that VC provides access to the best educational resources and experience without the limitations of distance and time; thus, VC facilitates learning [7]. For example, community surgeons with no formal advanced laparoscopic training benefit from expert advice during procedures [10]. Students reported that the experience was better than conventional procedures because of the enhanced learning, better visibility and verbal accuracy in describing the procedures, since the instructor was not standing in the way [11]. These studies illustrate the outcomes possible with the technology, but no studies have explored the social processes of collaboration and the knowledge necessary to complete the surgery (i.e., the guidance, problem solving and surgical process). Neither did these studies explore how learning might be an outcome of the collaboration.

Understanding of the effects of VC on surgical practice is limited [5]. A special focus is needed for better understanding of the factors that influence surgical outcomes, that is, communication and team performance [12]. The CoaST project expands upon previous work by investigating knowledge-sharing between surgeons and how their use of resources affects the treatment outcome. It aims to investigate the organization of surgical training today, the use of VC, collaboration in practice and the problem-solving process. The project also provides insight into how and why telementoring can be an important tool for improving surgical training.

III. EMPIRICAL CONTEXT

This study which starts in 2015 aims to investigate mentoring among laparoscopic surgeons in northern Norway. First, traditional methods of mentoring locally will be investigated. When VC for improving surgical training and practice is implemented at the hospital (during 2015/2016), this use will be included in the study. The empirical context will include collaboration between the mentor and mentees during surgical training in one hospital in northern Norway (Hospital A). The use of VC will include distance surgical training between Hospital A and a collaboration hospital (Hospital B).

The surgical training will involve laparoscopic surgery and telementoring. Laparoscopic surgery uses several small abdominal incisions. At each abdominal incision (i.e., port), an instrument is inserted. Telementoring happens by connecting the laparoscopic surgery, the surgeon (mentee), the expert (mentor) and the technological artifacts, that is, robots, monitors and a mobile touch screen device. The laparoscopic procedure, which is visual, is transmitted to a monitor in the operating theater. The expert can view the procedure on a touch screen device in the operating theater, when in the operating theater or at a distance. On a mobile touch screen device, they draw freehand mark-ups over the video (telestration) so that the visuals can supplement the verbal instructions.

Telementoring over distance is possible by using VC [13]. VC is when sound and picture are shared in two- or multi-channel communication. By connecting the monitor or the mobile touch device to an external computer and using microphones locally to send the audio to an external computer, the local mentee in the operating theater and the remote mentor are able to collaborate. The surgical operation is viewable on the monitor, transferred to the expert mentor's device. The mentor can be mobile, in the surgical theater and at distance while providing full attention to giving the required training and instructions to the mentee. Together, the visual representation of the picture on the monitor, the instructions given and the mentor's drawing on the device can supplement the collaborative work during surgical training.

IV. QUALITATIVE DESIGN

Exploring collaborative processes requires empirical data and analysis of the social processes and interactions of those who participate. These data and analyses make it possible to explore knowledge-sharing among surgeons, mentors and mentees who collaborate and use VC in surgical training and practice. This research project will use qualitative methods, designed as an explorative study of the practices of interaction. The knowledge shared and constructed will be explored as surgeons with different experience and expertise interact and perform surgeries over periods of time. Observations will constitute the main source of data. The second source of data will be qualitative interviews.

A. Observations

The observations are built on interaction analyses—the empirical investigation of talk and the use of resources [14]. The observations will be undertaken as surgeons collaborate in surgical training and practice, guiding and discussing treatment using tools such as VC. Observations are well suited to exploring team interaction because reconstructing the medical language and using artifacts are not possible. To intercept the social aspects in the collaborative work between the mentors and mentees, the interaction will be video-recorded using three sources: (1) output from a

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laparoscopic camera/monitor, (2) connecting the mobile touch screen device to a recording unit and (3) a camera recording an overview of the operating room.

The use of video recordings during the observation provides access to complex forms of interaction and to collaboration in the visual and spoken data [15-17]. By following the language and the use of resources, that is, talk, gestures, mobile touch screen, and surgical equipment such as knives, scissors and needles, it is possible to see how the mentor and mentees organize the instruction and practice, how problems and routine practices occur and how the surgery (the medical problem) is solved.

B. *Interviews*

To complement the observations, the participating surgeons will be interviewed. The purpose of the interviews is to enrich the context by giving the participants the opportunity to express themselves about the surgical training and the use of VC in training, instructions and collaboration. It is also essential to discuss themes based on the observations. The interviews will be semi-structured [18][, 19]. They will involve dialogue resulting from a mixture of structured questions (from an interview guide) and the themes that emerge in the dialogue. Interviews will provide insight into mentor and mentee experiences. The interviews will be used to validate the interaction analysis. All participating surgeons who have been trained using VC will be interviewed.

C. *Sampling*

The study follows the traditional education program to explore this practice. The observations will continuing until there is a thematic saturation, or until the use of VC for mentoring phase out. The participants will be recruited according to their use of VC for mentoring. When VC is used, it will include the interactions that occur during the training. The sample encompasses all the VCs held and all the cases discussed in two periods until there is methodological saturation. The periods and the length of observation are defined according to the total activity during the education program. Lower frequency of training using VC will require longer periods of data collection. Periods are defined regarding the education program and are referred to as the periods of training. The study will also include empirical material from sequences where VC is not used so that this expansion can offer a complementary focus on the importance of collaborative training in surgery.

D. *Ethical Considerations*

During the surgery, the identification/visibility of the patient in the video-recordings is not possible. The patient is covered by sheets, and only the part of the body undergoing the operation will be visible. The videotapes will be collected and handled according to the guidelines set out by the Regional Committee for Medical and Health Research Ethics (REK). The interviews will be recorded, transcribed and handled according to the REK's code of ethics.

V. CAPTURING SURGICAL PRACTICE

The monitor, which shows the picture inside the abdomen, the same picture the surgeon sees, can record within the unit. The mobile touch device represents the same picture as the monitor can be drawn on. This device has a built-in record unit. These tools record the technical aspects of surgical performance. To capture the social processes of collaboration, an external camera will be located in the room. Figure 1 is an example of how the surgical team, the monitors, the mobile touch device and the camera might be placed during the treatment of the patient. This is an example, since the way the surgical team and their tools are organized might differ between procedures.

The arrows in Figure 1 show the three sources recording the surgical practice. The circles in Figure 1 point out the resources that will be in focus for in-depth understanding of the collaborative work. The green circle illustrates how the social processes of collaboration are an overall understanding of the whole process of surgical practice: the mentor(s), mentee(s), their interaction with each other, the monitor and the mobile touch device as they perform surgery. When connecting VC, the PC is also included in this interaction. The surgical team can see the expert in real time on the computer. The expert sees only what happens on the mobile touch device.

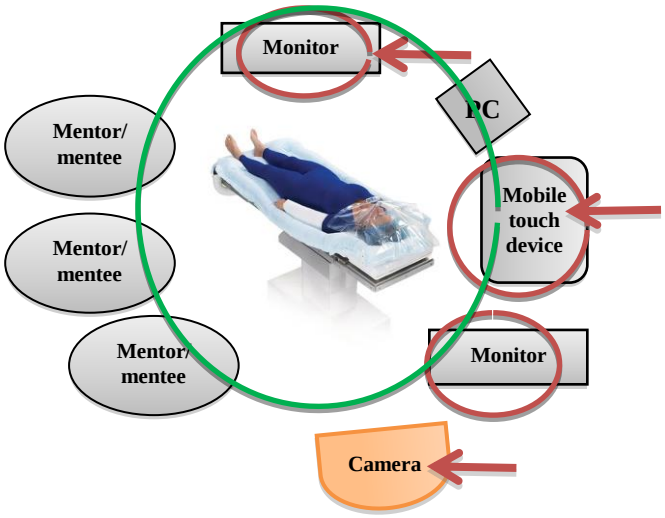

Figure 1. The organization of the surgical team, their resources and the recording units.

By focusing on what happens in the interaction between all elements during surgical training (the green circle), we aim to expand the traditional method of focusing on technical aspects, by capturing the social processes of collaboration among mentors and mentees in surgical training.

VI. CONCLUSION

This paper describes a work in progress, a project studying collaboration among laparoscopic surgeons who are

instructed during education (CoaST). Since there is limited understanding of VC in surgical practice, and in-depth understanding of the non-technical aspects or social processes, this design is outlined to reply to this lack. The project strives to capture the interactions that occur in the team, and their use of resources when training surgeons. The understanding of the social processes can be used to improve surgical education and further the surgical team performance in everyday practice.

Capturing several sources of action is a challenge. The interaction in the team happens in between them around the table, on the monitors that depict the patient's body and the touch device on which to draw. When using VC for overcoming distance, the team can see the expert. It is ideal to include these resources. This challenge will be answered by testing the design and reevaluating it before choosing the ideal design for further investigation.

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