Original Article

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Tele-Monitoring of Patient in ICU

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Abstract

Background: The tele-ICU has an off-site command center in which a critical care team (intensivists and critical care nurses) is connected with patients in distance intensive care units (ICUs) through a real-time audio, visual and electronic means and health information is exchanged. Care provided in intensive care units (ICUs) is notable for its high cost and high rates of morbidity and mortality. *Methods:* The study is an observational retrospective study conducted in the Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education & Research (JIPMER), Pondicherry from March 2015 to April 2016. The tele-ICU system consisted of an audiovisual monitoring aid comprising IP camera. At the end of the study period, the feedback was obtained from consultants, residents and analysed. *Results:* The consultants and residents found the tele-monitoring system to be user-friendly, good quality, economical and frequent interaction and advice from consultants and experts possible. *Conclusion:* Tele-monitoring of ICU patients is found to be a promising path, especially where there is a limited number of consultants. It is User-friendly, good quality, economical and frequent interaction possible between consultant and resident.

Keywords: Telemedicine; Monitoring; Intensive Care Unit.

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Introduction

It has been more than 25 years since Grundy et al. first described the use of intermittent remote telemedicine consultation to improve the delivery of health services [1-3]. Historically, the previous models of ICU teleconsultation have demonstrated several clinical benefits like-reduction in length of stay for infants of very low birth weight in neonatal ICUs, improved management and transfer of trauma patients, and improved consultations for pediatric critical care inpatients [4]. The terms "tele-ICU," "virtual ICU," "remote ICU," and "e-ICU" all refer to the same care concept; a centralized or remotely based critical care team is networked with the bedside ICU team and patient via state-of-the-art audiovisual communication and computer systems. The tele-ICU team can provide surveillance and support for a large number of ICU patients in disparate geographical locations for multiple hospitals.

Methods

This study is an observational retrospective study conducted in the Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education & Research (JIPMER), Pondicherry from March 2015 to April 2016. The tele-ICU system consisted of an audiovisual monitoring aid comprising IP camera (Macroplus Robot Ball HR101-W wireless camera) with a resolution of 720 p with live HD streaming. The camera is synchronized to the mobile phone of the consultant and intensivist and also through an application installed on a tablet that provides video chat and voice call services using

the IP address. The device also has inbuilt audio and video recording in addition to online transmission facility. At the end of the study period, the feedback was taken from consultants, residents and analysed.

Results

The feedback was taken from consultants and resident. It was found that Tele-ICU system was user friendly, good quality, economical and with Frequent interaction between possible between consultants and residents. The audiovisual quality of the IP camera was satisfactory. Total of 130 interactions were possible between consultant and resident. All the 130 patients were viewed and monitored by the consultants in their mobile, tablet, laptop or desktop.

Fig. 1: Wall mounted Wi-Fi IP camera

Fig. 2: Tablet synchronized to mobile

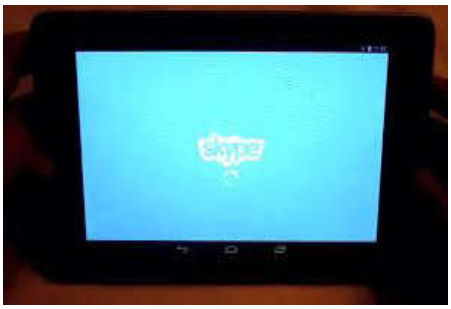

Fig. 3: Tablet with Skype program installed

Fig. 4: Consultant giving telemedicine consultation

Discussion

Alexander Graham Bell made the first telephone transmission to his assistant Mr. Watson. It was: "Watson, come here, I need to see you." He was asking for Watson's help, as he had spilled acid on his leg. The call for medical help remotely marks the first event in modern TM [5].

Types of TM

1. Store and forward (SAF) or pre-recorded (asynchronous) TM
2. Real-time or video conference (VC) (synchronous) TM
3. Hybrid TM
4. Mobile or cellular TM
5. Integration model [6].

Asynchronous TM

In this, information about the wound is acquired and stored in some format before being sent by some appropriate means for expert interpretation. It involves transmission of digital images, and asynchronous evaluation is practiced. The simultaneous presence of the health care professional is not required. It is the commonly used technology. SAF TM has been found to be cheap and easy to set up and practice.

Synchronous TM

There is no appreciable delay between the information being collected, transmitted and displayed about the wound. Interactive communication about wound care between

individuals at the site is, therefore, possible. Real-time interaction requires an expert to be available to give an opinion. Real-time or video consultation (VC) uses videoconferencing equipment to connect the patient, often with their General Practitioner (GP) or nurse present, with a distant consultant.

Hybrid TM

The combination of SAF TM in the first step followed by VC TM in the second step is called hybrid TM. It saves time, clarifies doubts and avoids misinterpretation from both the ends. It process achieves the best physician and patient satisfaction as far as wound care is concerned.

Cellular TM

Portable devices like cellular phones and Personal Digital Assistants (PDAs) (like laptops and handheld computers) provide an inbuilt camera to capture wound's digital images, and computing and networking features to deliver wound care at a distance. They provide immediate image access and direct interaction, and it is possible to obtain clarification. Quality and speed of image transmission is no longer an obstacle. New generation cellular phones allow taking good-quality images and transmitting them directly to other cellular phones (via multimedia messages) and computers (via e-mail or blue tooth-wireless connection) with diagnosis agreement of 82% compared to face-to-face consultation.

Integration Model

The systematic functional integration of electronic devices and software to capture, transfer, store, measure and deliver follow-up wound care is the principle of integration model and has been used effectively for wound care in remote geographical regions. Immediate access to visual parameters and measurement of wounds is achieved. Routine follow-up care in a remote area under the close supervision of higher center is performed. Computerized measurements are rapid, easy and precise, and suited for SAF TD.

Conclusion

Tele-monitoring of ICU is found to be user friendly, good quality, economical with frequent interaction possible between consultant and resident.

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