“Orthobot, To Your Station!” The Application of the Remote Presence Robotic System in Orthopaedic Surgery in Ireland. A Pilot Study on Patient and Nursing Staff Satisfaction.

ABSTRACT

BACKGROUND The Remote Presence Robotic System (RPRS) enables an individual to 'be in two places at once'. Its application includes various uses in medicine and surgery. However, its usefulness in the field of orthopaedic surgery has not been described. The objective of our pilot study was to determine patient as well as nursing staff satisfaction to the RPRS in an orthopaedic clinical setting in Ireland. METHODS We performed evening and weekend ward rounds to gain feedback and determine patient and nursing staff satisfaction with this innovative system. Questionnaires were handed to all patients and staff nurses involved. FINDINGS Both patients as well as nursing staff had very positive reactions to the RPRS in an orthopaedic postoperative care setting. CONCLUSIONS Potential uses in orthopaedic surgery include clinical outreach in the setting of trauma, supervision in theatre or watching theatre cases from outside of the hospital, providing both patient and parent reassurance in paediatric orthopaedic cases and finally in the setting of outpatient departments. The integration of the RPRS in an orthopaedic clinical setting has exciting and limitless potential. More so in this era where it would allow trainees to benefit from teaching and training while cutting down their in-house time and thus hospitals costs, too.

INTRODUCTION

The words, 'patient' and 'compassion' share a common Latin origin; the verb *pation*, which means, 'to bear a burden'. While the patient is the one with the burden of illness, the lively and compassionate physician is the one who shares this burden, lifting it when possible. Traditionally what this involves is care provided, characterized and dare we say, defined largely by bedside rounds. However, advancements in technology, especially in the field of robotics, are beginning to challenge this ideology. As defined by the *INTOUCH HEALTH RP-7 Reference Manual*, "The Remote Presence Robotic System (RPRS) is a mobile, robotic telecommunications platform that enables an individual to 'be in two places at once.'" The application of the RPRS has been described for its use in medical training and education[1, 2], management of stroke patients[3, 4], urologic surgeries[5], paediatric laparoscopic surgeries[6] and clinical outreach[5, 7] to name just a few. However, its usefulness in the field of orthopaedic surgery has not been described. The objective of our pilot study was to determine patient as well as nursing staff reaction to the RPRS in an orthopaedic clinical setting in Ireland.

MATERIALS AND METHODS

This was a prospective study of telerounding and its effect on both patient as well as staff nurse satisfaction. Patient inclusion criteria included those who had undergone primary or revision total knee or hip arthroplasty and were able to understand, speak and read English. Informed consent was obtained with no patient refusing to participate in the study. With regard to the staff nurses involved, all nursing staff on our dedicated elective orthopaedic ward were asked if they would like to participate in the study. Verbal consent was obtained with no nurses refusing to participate in the study. Our study comprised a total of 20 patients and five staff nurses. Nine patients had undergone primary total knee arthroplasty, one had a revision total knee arthroplasty, eight had undergone a primary total hip arthroplasty and the remaining two had a revision total hip arthroplasty. Twelve patients were female and eight were male with an average age of 66 (range 50 – 86 years). Our participating staff nurses comprised of one male and four females. By using the RPRS as an adjunct to the daily morning ward round, we performed evening as well as weekend ward rounds to gain feedback and determine patient as well as staff satisfaction with this innovative system. Telerounds were performed by a single registrar from home through a specifically configured laptop and used a secure wireless internet connection. Under direct control of the control station (laptop), the robot was made to roam untethered via an 802.11 secure wireless network. At the end of each ward round, the single registrar who conducted the teleround returned to the hospital and ward to hand out a constructed and validated questionnaire[18] to all staff nurses involved as well as every patient who had undergone telerounding with our RPRS (Figs. 1, 2). It should be noted that questionnaires were only handed out to patients who had at least three experiences with our RPRS.

RESULTS

A total of 25 people were enrolled in the study, consisting of 20 patients and five nursing staff. Twenty-five (100%) individuals responded to the questionnaire. All patients who filled in a questionnaire strongly agreed that their care was better because of telerounding and that it should be a regular part of patient care in the hospital. The majority felt that the quality of the video and sound was excellent. They all also strongly agreed that they could communicate easily with their doctor and that if they were hospitalized again, they would feel comfortable with telerounding on a daily basis. Finally, all patients strongly agreed that they would be very comfortable and happy with having only telerounds on weekends and that if their doctor was out of town and they were hospitalized, they would rather be seen by their own doctor with telerounds than be directly cared for by one of their doctor's colleagues. Table 1 summarizes these findings. Answers by the staff nurses correlated with those by the patients except that the majority agreed rather than strongly agreed with the same questions. Table 2 summarizes these findings.

DISCUSSION AND CONCLUSIONS

Both patients as well as nursing staff had very positive reactions to the RPRS in an orthopaedic postoperative care setting with all patients strongly agreeing that this technology be integrated as part of routine postoperative management. With traditional teaching claiming that a diagnosis can be made through history alone in 90% of cases and in the remaining 10% with a subsequent physical examination, this emphasizes the pivotal role of communication to the art of medicine. While physical findings are undoubtedly important for making clinical decisions, many decisions are made on gathering this clinical information by conversing with both patient as well as nursing staff. The power of observation and its importance must not be forgotten. Take for example, postoperative ward rounds. Wound reviews, dressing changes, assessment of range of motion and the like solely require conversational and observational skills. The RPRS provides just this. Some have claimed that moving away from the bedside leads to medical errors. Others have stated that rather than bridging barriers between patients and doctors through bedside interaction, remote presence systems of any form increase them. On the contrary, literature suggests otherwise with early studies of the use of remote critical care physicians for ICUs managed by internists demonstrating a considerable improvement in measureable patient parameters[8, 9, 10]. And as already mentioned in the introduction, the application of the RPRS has also been described for use in medical training and education[1, 2], management of stroke patients[3, 4], urologic surgeries[5], paediatric laparoscopic surgeries[6] and clinical outreach[5, 7] to name just a few.

The provision of specialist care to patients in remote areas who would otherwise have these services unavailable to them only dispels the myth that it increases barriers to appropriate medical care[11]. There is also a vast amount of literature supporting operative telementoring

with many of these studies showing no measurable increase in adverse event rates when patients are operated on by less experienced surgeons supervised by a senior surgeon from a remote location through an audiovisual link[12, 13, 14, 15, 16, 17].

The objective of our pilot study was to determine patient as well as staff reaction to the RPRS in an orthopaedic clinical setting in Ireland and found it to be excellent. In comparison to a previous study questioning whether their positive findings translated to either those patients with longer hospitalizations or those undergoing more complicated open surgical procedures[18], our study answers this question.

While the introduction and integration of the RPRS may prove to be advantageous in a number of ways, there are various disadvantages and key issues that need to be addressed. For example, the integrity of a secure wireless network and the transmission of sensitive and confidential information. Ensuring the same is paramount and forms the basis of the implementation of this technology. From a practical point of view, possible loss of the internet connection or network makes the use of the system both impractical and frustrating. The fact that the RPRS cannot open doors, maneuver stairs or press lift buttons also limits its functionality. Our current model also needs to be plugged in manually. However, it must be noted that later models have been designed to overcome this by a self-plugging mechanism.

Potential uses of the RPRS in orthopaedic surgery include the following.

1. Clinical outreach in the setting of trauma.

- In tertiary referral centres, the ability to provide greater expertise in the management of trauma patients in centres where specialist expertise is limited has great potential. With

the use of remote presence, inappropriate referrals can be prevented and appropriate referrals managed well and accordingly in order to ensure the optimal outcome for patients by providing expertise at a moment's notice.

2. Supervision in theatre.

- We have all heard the phrase, "see one, do one, teach one." Taking into account that, "doing one" supervised as opposed to unsupervised is far better for both the trainee and more importantly, the patient, the RPRS has tremendous potential in the operating theatre. By implementing supervised surgery through the RPRS, responsibility is instilled into the trainee while maintaining his or her independence with regard to the procedure to be performed. Knowing that they are under the watchful eye of a trainer forces them to be meticulous. In comparison to a trainer who is physically present and able to set up the patient and theatre accordingly, by being remotely present, the trainee is forced to think on their feet and be meticulous while the trainer guides and teaches them but makes them, "do one" themselves. An added benefit includes saving hospital cost by not having the trainer to be on site.

3. Providing both patient and parent reassurance in paediatric orthopaedic cases.

- In comparison to adult orthopaedics where very often we have to deal with just the patient, paediatric orthopaedics requires the reassurance of not only the patient who is a child, but also of the child's parent or parents. It has been shown that any patient who is discharged from a casualty department and referred to an orthopaedic clinic feels more reassured when they hear the same management plan from the orthopaedic surgeon rather than the accident and emergency physician. For this reason, the presence of the RPRS in a casualty department and more so a paediatric casualty department allows the provision of

such reassurance. This in turn not only ensures appropriate discharges and referrals but also improves patient satisfaction and lowers hospital costs for unnecessary call ins by the orthopaedic surgeon on call.

4. In the setting of the outpatient department.

- The RPRS may serve a multitude of functions with regard to outpatient clinics.
    - Allows the concurrent running of two or more clinics, ALL under supervision.
    - Allows the running of remote clinics without added time/travel/cost constraints.
    - Allows the continuous running of a wound dressing clinic without having to wait for the physical presence of a surgeon; the surgeon is able to cast an eye on the wound through the high-resolution magnifying lens while running his or her trauma or elective clinic. Furthermore, taking a high-resolution close-up photo without running the risk of contaminating the wound allows accurate documentation of what the wound looks like and makes it possible for a different surgeon to objectively assess the healing or worsening of a wound over a period of time.

5. Weekend ward rounds.

- The current economic climate dictates cost savings to be the priority of hospitals. Hence, the necessity for the physical presence of a registrar to perform a ward round may be substituted by conducting a ward round through the use of remote presence. More so when decisions regarding discharge or necessary management are based more on observational findings rather than tactile stimulus.

With our pilot study having excellent results in terms of acceptance and satisfaction from both patients as well as staff nurses with regard to telerounding, the integration of the RPRS in an orthopaedic clinical setting has exciting and limitless potential. More so in this era where it would allow trainees to benefit from teaching and training while cutting down their in-house time and thus hospitals costs, too.

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FIGURE LEGENDS

Figure 1.

Patient questionnaire.

Figure 2.

Staff nurse questionnaire.

Figure 3.

Results of patient questionnaire.

Figure 4.

Results of staff nurse questionnaire.