Smartphone photography for smart assessment of post-surgical wounds – an experience during the COVID-19 pandemic

Wykorzystanie fotografii smartfonowej do inteligentnej oceny ran pooperacyjnych – doświadczenie podczas pandemii COVID-19

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ABSTRACT:
Aim: This study was undertaken with an aim to assess the feasibility of monitoring of wound healing by replacement of the traditional real-life clinical follow-up with a review of smartphone-captured digital photographs of post-surgical wounds by a clinician.

Method: The postoperative patients who understood the objectives got enrolled in the prospective study and were followed up. They were requested to capture digital photographs of the wounds using smartphones and send them through WhatsApp on postoperative days 3, 5, 7, 15 and 30 or else whenever they felt need for review due to symptoms like fever, pain, redness or swelling.

Results: 24 abdominal, 2 extremity and 1 neck wounds were followed up in 27 patients. Three patients developed complications and all were detected with 100% accuracy. As many as 81% of the patients were satisfied with this mode of postoperative wound assessment.

Conclusion: The experience shows that in the follow-up of postsurgical wounds, there is a good correlation between real-life clinical and remote photographic review. Incorporating photographic wound assessment into the postoperative follow-up care pathway can potentially decrease the number of postoperative hospital visits and decrease the burden on healthcare facilities.

KEYWORDS: COVID-19, photography, smartphone, social media, wound assessment, wound healing

INTRODUCTION
Mobile phones, internet and online applications have revolutionized our lives over the last few decades and clinicians are increasingly interested in evaluation of these recent scientific advances to monitor the patients after surgery. Digital photographs captured using smartphones offer great advantage of the possibility of online transfer and then immediate reappraisal for alignment, brightness, positioning, and other photographic settings, which aids in avoiding errors and allows for instant repetition of photographs if necessary [1]. The use of photographs has a great potential for rapid wound evaluation as they can be shared with the team to evaluate the treatment plan, and be used as an important tool for legal and teaching purposes [2]. The rapid spread of Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome...
coronavirus 2 (SARS-CoV-2) represents a once-in-a-century challenge to human healthcare system and surgical practice has significantly got impacted during this crisis. One of the ramifications of the pandemic has been the difficulty in follow-up of surgical patients. It was against this backdrop that the current study was undertaken as a pilot project to study the utility of photographic follow-up of postsurgical wounds.

**METHODS**

A prospective study was conducted on postoperative patients from Kashmir valley who volunteered to be followed up by photography after the objectives of the study were explained in local language. The participants were enrolled over the period of one year from September 2019 to August 2020. They were explained...
the objectives of the study as per the ethical guidelines of Helsinki and the consent of the ones who agreed to participate in the study was secured for the use of history, examination details and/or photographs for academic purposes. They were requested to capture the digital photographs of the wounds using smartphones and to send them through WhatsApp on postoperative days 3, 5, 7, 15 and 30 or else whenever they felt need for review due to symptoms like fever, pain, redness or swelling. Real-life face-to-face clinical assessment was advised whenever the photographs pointed towards such a need. The patients were contacted after two weeks of the last interaction and the feedback was sought if they found this medium of doctor-patient contact as ‘Satisfactory’, ‘Dissatisfactory’ or ‘Have no opinion’. The participation in feedback session was however kept optional and the patients were given freedom to reject the request to furnish the feedback without any adverse impact on their follow-up. The data was entered and analyzed with Microsoft Excel 2016.

**RESULTS**

As many as 27 patients (23 males, 4 females) ranging in age from 3 years to 54 years (mean – 29.2 years) participated in the study as shown in Tab. I.

Most of the patients (n – 22; 81.5%), however, got enrolled during the lockdown enforced for containment of COVID-19 pandemic and were derived from self-help social media groups. Complications were detected in 3 (11.1%) patients that were confirmed on real-life clinical assessment (as shown in Fig. 1.–3.). There were neither any false positive nor any false negative cases, making the tool highly specific and sensitive.

The feedback about this medium of contact was provided by 21 out of 27 (77.8%) patients and 6 (22.2%) patients did not provide any feedback. Seventeen out of those 21 patients (81%) found the interaction as satisfactory, 3 (14.3%) did not express their opinion (neutral) and 1 (4.7%) expressed dissatisfaction as shown in Fig. 4. The dissatisfaction of the single patient was related to technical aspects (poor internet facility to transfer the images).

**DISCUSSION**

There is an increased interest being displayed in recent literature to devise the ways and means by which the ever-expanding technological tools like Internet and smartphones can be utilized to decrease the real-life attendance of patients at postoperative follow-up, thereby saving time and effort of the patient and decreasing burden upon the clinicians and the healthcare system. Digital photographs captured using smartphones and shared via social media is one such area that is being explored and a few studies have been published in the last few years. It is against this backdrop that this study was undertaken at an individual level by a single author.

Totty et al. quantitatively analyzed 53 postoperative wounds in a total of 37 patients with a mean age of 61.14 years [3]. Wounds were scored by a study nurse or a doctor, according to the ASEPSIS scale. Wound photographs were then captured, anonymized and independently reviewed and ASEPSIS scored by two independent investigators. The scores were then blinded to compare with those of the original ‘clinical review’ ASEPSIS score. There was greater than 85% agreement between the photograph and clinical reviewers in all categories except erythema. The intraclass correlation coefficient for total ASEPSIS score was R = 0.806 (95% CI 0.694, 0.881), indicating strong reliability between reviewers. The specificity of photograph review for diagnosis of surgical site infection (SSI) was 90%. The study concluded that in the assessment of SSI, there is a good correlation between face-to-face clinical and remote photographic review and it was recommended that incorporation of this method of wound assessment into a postoperative follow-up care pathway may save patients and clinicians from unnecessary hospital visits.

Kummerow et al. undertook a study to determine how wound photography affects surgeons’ abilities to diagnose SSIs in a pragmatic setting [4]. They intervened by requesting the enrolled 523 surgeons to review online clinical vignettes with or without wound photography. They found that for the diagnosis of SSIs, the addition of wound photography did not change accuracy significantly. Surgeons reported greater confidence when vignettes included a wound photograph compared with vignettes without a wound photograph, regardless of whether they correctly identified an SSI

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but they were more likely to under-triage the patients when vignettes included a wound photograph. The study concluded that in a practical simulation, wound photography increased specificity and surgeon confidence, but worsened sensitivity for detection of SSIs and it was felt that the remote evaluation of patient-generated wound photographs may not accurately reflect the clinical state of surgical incisions. The study stressed upon additional development of tools, participant training, and mechanisms to verify image quality for effective widespread implementation of remote postoperative assessment with photography. Drake F T also found the smartphone wound photography to be useful but stressed upon caution with regard to proper interpretation [5].

In the current study that was predominantly undertaken in the backdrop of COVID-19 pandemic-related restrictions in real-life patient follow-up, the author found the smartphone-captured images to be highly specific and sensitive in the follow-up of postsurgical wounds and all the complications were detected and managed as would have been otherwise achieved by real-life, face-to-face interactions. The study however has a small number of participants and may be deemed as a pilot project. Nevertheless, the encouraging results of this study have the potential to initiate and inspire better studies with a higher number of participants to validate the results and suggest improvements, thereby achieving greater comfort levels for patients and decrease in the avoidable burden over the healthcare system.

CONCLUSION
Smartphone-based photography has a great potential as an effective tool for follow-up of postoperative wounds. This tool if used properly, would decrease the number of hospital visits of postoperative patients making it comfortable for them and relieving at the same time the burden over the healthcare system.

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REFERENCES