Dissemination of laparoscopic and robotic-assisted novel surgical technology through social media

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Abstract: Social media (SM) has dramatically changed the way surgeons interact and communicate in both private and public spheres. Similar to other medical specialties, novel technologies and techniques (NTTs) are continually being introduced. In this respect, SM provides an avenue for surgeons to communicate in an unimpeded manner. In particular, the ability to exchange clinical vignettes and videos has paved the way for rapid developments in laparoscopic and robotic-assisted surgery. These practices are evident through events such as grand rounds, morbidity and mortality conferences, and national symposia which are now increasingly hosted online. Overall, this ability to engage in global discourse, incorporate diverse perspectives, and foster collaboration increases accessibility and enhances professional development, which in turn improves patient care. Exciting new advancements taking advantage of recent developments in virtual reality (VR) and augmented reality (AR) are also being applied to further lower logistical and geographical barriers to increase surgical knowledge and benefit health outcomes. Beyond the clear advantages and opportunities afforded by SM, however, lie practical and ethical concerns, some of which pertain to bias and misinformation as well as professionalism. Ultimately, while SM may not entirely replace in-person interactions, it holds significant promise to change how surgeons connect in the future.

Keywords: Novel technologies and techniques (NTTs); social media; research communication; research dissemination; surgical research

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Introduction

Ongoing lifelong learning remains a critical aspect of a surgeon's professional development. While the specific means through which surgeons acquire knowledge and improve upon technical skills are complex, both formal and informal peer interactions serve a central role in surgical maturity (1). Benefits of peer communication have been observed in several key areas of surgical education including counseling and mitigating against "second victim" effect, coaching and feedback, and through direct sharing of updated evidence and data (2,3). Indeed, lack of surgeon interaction has been linked to worse performance on certification exams and to inferior overall outcomes (2,4). While communication has classically occurred in person, the internet has become a major venue for surgeons to connect: a phenomenon augmented during the coronavirus disease 2019 (COVID-19) pandemic (5,6). Today, events such as grand rounds, morbidity and mortality conferences, and national symposia are routinely held online.

Perhaps the most common tool surgeons utilize to connect online is social media (SM). In the past two decades, SM has dramatically increased surgeons' ability to disseminate and promote science, conference news, and articles, as well as to connect with peers and patients alike in both private and public spheres (7). As SM expanded its reach and gained popularity, surgeons, surgeons-in-training, and other healthcare stakeholders have also increased their presence online to varying degrees on par with that of the general population (8).

Throughout history, novel technologies and techniques (NTTs) have been continually introduced into surgical practice and often themselves represented major milestones. Notably, the evolution of diagnostic and therapeutic endoscopy was marked by numerous crucial NTTs, ultimately paving the way for modern laparoscopic surgery and robotic-assisted surgery (9). Certainly, for surgeons to adopt NTTs into practice, unimpeded communication remains key. To that end, SM has emerged as a natural and fitting means for surgeons to share emerging data on NTTs in real-time (10,11). Herein, we review the effect of SM on the dissemination of NTTs and focus on laparoscopic and robotic-assisted surgery.

Background and notable SM platforms

In 2014, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) published guidelines aimed at facilitating the promotion of useful NTTs while simultaneously safeguarding patient interests, given the potential for increased adverse events with unregulated implementation (12,13). In that statement, NTT definitions included four key categories: new devices, modifications to existing devices, new procedures, and modifications to existing procedures. While dissemination of the former two categories occurs regularly on SM, literature documenting and measuring frequency and mode of such practice remains sparse. On the other hand, several publications have addressed SM's utility in disseminating procedures, techniques and modifications.

SM is an encompassing term used to describe a variety of internet-based tools for computer-mediated communication. Origins of SM date back to the 2000s when blogs and podcasts gained popularity. Driven by clear demand, uptake in medicine was rapid as available SM platforms served as a stage to discuss topics outside traditional scientific publications ranging from health information to personal narratives and experiences (14). Shortly thereafter, Facebook (Facebook Inc., Menlo Park, CA, USA) introduced personalized updates, which overtook RSS feeds and allowed articles to be shared more deliberately with friends and colleagues. Over time, YouTube (Google LLC, Mountain View, CA, USA) became the most popular form of SM in the United States with over 75% of adults active on the platform (15). As a video-sharing website, YouTube became particularly suited for surgeons as audiovisual educational material as well as instructional content including operative procedures were made readily sharable. More recently, curated surgical SM platforms such as WebSurg and AID (Advances in Surgery) Channel have emerged and gained further visibility during the COVID-19 pandemic (5). Today, Twitter (Twitter, Inc., San Francisco, CA, USA) is the most popular platform among healthcare professionals and surgical "influencers". Twitter allows users to share information and media with an open audience using microblogs searchable through hashtags such as #SurgTwitter or #SoMe4Surgery (16). Other notable SM platforms exist on an interactivity spectrum ranging from less-interactive encyclopedia-style site like Wikipedia to more immersive ones like Second Life where users can create Avatars and interact in a three-dimensional virtual world. Blogs are another important form of SM used by surgeons to connect with patients and the public (14). Akin to personal journals, posts are updated and maintained over time. In fact, several early surgical influencers popular today on popular SM platforms started as bloggers. Medical blogs are unique as they often include the personal perspective and narrative of the author, thereby allowing for an unfiltered and direct link to the reader. A summary of the discussed SM platform types is found in *Table 1*.

In a recent update on SM use among surgeons by Zerrweck *et al.*, general and bariatric surgeons were surveyed (17). In that study, 67.8% considered SM to be extremely useful in medicine whereas 7.8% felt that it may lead to dissemination of misinformation. Moreover, in that study, 43.5% of respondents noted they use SM daily multiple times and Twitter was the most commonly utilized platform. As the topic of surgical NTTs and SM is broad, a detailed discussion of how those two elements interact is beyond the scope of this article. A recent systematic review on how SM can be used as a tool for surgical education noted that a majority of articles focus on laparoscopic and robotic assisted surgical approaches (18). As such, we focused the discussion on how SM has played an important role in disseminating NTTs pertaining to laparoscopic and robotic assisted surgery.

Table 1 Social media platforms and utility for NTTs

Type	Examples	Utility for NTTs
Social network	Facebook, Instagram, LinkedIn	Direct user to user contact
		Used to share updates, techniques, new instruments
		Highly interactive
Scientific platforms	ResearchGate, ORCID	Designed for science and research dissemination
		Can be used to gauge investigator impact
		May allow access to articles behind paywall
Blogging/Microblogging	WordPress, Tumblr, Twitter	User-generated text
		Direct and immediate public engagement
Video-based	YouTube, SurgeOn	Video-focused; may be used to share educational videos, including surgical procedures

NTTs, novel technologies and techniques.

How SM allows for the dissemination of minimally invasive surgery (MIS)

The use of MIS in the treatment of a variety of abdominal disorders has generally been accepted as a more favorable alternative to open surgery and represents a salient example of how NTTs can revolutionize surgical practice. Reducing surgical trauma through MIS is associated with fewer pulmonary and infectious complications, less pain, decreased length of hospital stay, and improved cosmetics (19-22). The ability and ease to record, edit and post MIS multimedia on SM has evolved rapidly over the past decade. Today, it is both common and convenient for surgeons to prepare for upcoming MIS operations by reviewing SM videos and posts ahead of time. In one study, 98.6% of residents and specialists used video-based learning of MIS procedures as a tool for learning (23).

Various online communities exist today on SM platforms that make it possible for surgeons to present challenging cases, post procedural videos, discuss clinical plans, and learn from others' experiences. Among those, closed SM groups that focus on MIS on Facebook gained recognition. For example, in a study using the Robotic Surgery Collaboration (RSC), a Facebook-based closed SM group, membership grew from <100 to ~2,000 over a 12-month period (24). Analysis of data noted that members interacted online during the week, suggesting that SM has become integrated with daily workflow. This has been the authors' experience as challenging cases are presented on those forums for discussion. Similarly, SAGES introduced eight sponsored subspecialty focused groups named "Masters Programs". A recent study found a significant increase in membership among those groups after the COVID-19 pandemic, demonstrating the critical role SM plays in continued surgeon education and development (25). In an analysis of SAGES closed group content, posts ranged from technical, (64%), management questions (54%), to educational (10%), and social (10%) (26). The value of video-based learning was further established in a randomized controlled trial which investigated the effect of video-based peer feedback (27). In that trial, feedback through social networking improved robotic simulator training scores among residents.

As noted above, YouTube (Google LLC, Mountain View, CA, USA) hosts innumerable laparoscopic and robotic-assisted surgical videos, some of which offering step-by-step operative instructions (28). In a study by Rapp *et al.*, resident and attending level surgeons reported using YouTube as the most common platform utilized for operative preparation (29).

While there remain reservations namely relating to the quality and applicability of SM content (30,31), SM's role in the dissemination of MIS NTTs remains significant. This effect, we believe, will continue to expand as MIS uptake and demand continues to increase throughout the world.

Challenges and pitfalls

Despite clear and proven advantages of SM in allowing enhanced accessibility and rapid dissemination of NTTs, several potential pitfalls should be noted. First, content on SM is largely made available to the public without peer review and is therefore susceptible to various forms of bias and misinformation (32). For example, in 2018, a study on the effect smartphone and tablet use on abnormal posture in younger adults gained national attention but was later disputed as methodically flawed (33). While uncertainty remains inherent to the scientific method, SM risks disproportionate amplification and may distort evidence. Moreover, SM success may not correlate with surgical expertise. It is therefore another possible hazard that unproven NTTs are advertised as safe and effective when in fact they are not (34). This effect may be counteracted by designating expert moderators for specific SM platforms who serve to examine and validate posts and videos prior to publication. For example, in the SAGES-sponsored "Colorectal Surgery Masters Program Collaboration" Facebook group, 13 appointed administrators and moderators serve in that capacity and help moderate content. Second, uncritical acceptance through conformity may overwhelm valid viewpoints and quench healthy scientific debate. Otherwise known as SM "echo chambers", this effect refers to an individual with a large online presence to influence majority opinion to strongly counteract opposing views. While the formation of echo chambers may be inevitable due to the basic human tendency towards confirmation bias, means to encourage increased diversity of thought and ideas should be sought out. For example, SM algorithms may be optimized to facilitate exposure to a broader variety of viewpoints by allowing users manage the feed (e.g., Reddit) as opposed to platforms that do not provide such an option (e.g., Facebook or Twitter) (35). While data on specific differences among patient, general public and surgeon SM interact remains limited, a range of measurements have been proposed to help better understand them including assessing real-time behavioral data and geographic market analyses. Third, direct patient interaction on SM—while often beneficial—may cross professional boundaries (36). Last, hesitancy to participate and engage by some surgeons for fear of malpractice lawsuits is yet another barrier. While a systematic review of SM in medical education found no privacy breaches, this may be due to underreporting (37).

Future

The future of SM and NTTs is exciting. A glimpse into what it holds took place in 2014 when Dr. Shafi Ahmed globally livestreamed an oncological operation at The Royal London Hospital through Google Glass (Google LLC, Mountain View, CA, USA). Medical students were able to interact directly via the voice-activated computer glasses, and the surgeon answered questions in real-time. Others have explored the value of virtual reality (VR) as a means to further cross logistical and geographical barriers to interaction. Ever since, companies like Osso VR, ImmersiveTouch, OramaVR or Fundamental VR have used VR as both training or imaging solutions. Augmented reality (AR) has also been harnessed in surgical procedures where more intricate anatomy is involved, as done by Su *et al.* (2009) using pre-operative imaging with intra-operative 3D overlay during robot-assisted laparoscopic partial nephrectomy (38). Both VR and AR have the potential to serve as an interface for surgeons to livestream operations, allowing a larger number of student observers to be present in the operating room virtually. Integrating AR holds potential to further enhance robotic-assisted surgery as demonstrated in a study where fluorescent tissue labeling allowed surgeons to make for loss of tactile feedback and assess oncological adequacy of operations in real-time (39). Studies have so far shown that both VR and AR may act synergistically as effective methods for teaching anatomy (40) and suturing skills (41). Use of combined AR and VR has more recently been utilized to aid in operative planning and execution of complex liver operations as demonstrated in in one study where a mixed reality head up display (Microsoft Hololens) was used to visualize a 3-dimensional (3D) hologram detailing liver anatomy intraoperatively (42). Other iterations have incorporated robotic-assisted surgery and AR by displaying operative video feed on a virtual monitor also using a 3D head-up display to perform transanal total mesorectal excision (43). Recently, the concept of a surgical metaverse where VR, AR, and other digital tools intersect online with SM to allow for virtual training and collaboration has gained attention. In this context and generally, the term "metaverse" refers to a three dimensional, universal and interactive Internet-based space that is made possible by the use of VR headsets. In a recent meeting, it was revealed that well-established medical device makers are partnering with tech giants to build virtual platforms where surgeons can interact in a lifelike environment (44).

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