Review Article

Live surgical workshops: Balancing patient care and professional development

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ABSTRACT

The dissemination of skills acquired by master surgeons remains an unmet need within the surgical community. Live surgical workshops (LSWs) are envisaged as comprehensive initiatives to foster ongoing learning and skill enhancement for surgeons across all surgical sub-specialties. With advances in technology, these workshops are now being conducted worldwide and are commonly featured in major scientific meetings. A public interest litigation filed in the Supreme Court of India has sparked controversies, raising questions about the utility of LSW and the ethical considerations surrounding their conduct. We provide a comprehensive review of the existing literature pertaining to LSWs. A body of literature related to LSWs was identified, outlining the perceived benefits and risks associated with such workshops. Overall, LSWs were perceived by surgeons to have immense educational potential. However, concerns regarding the perceived benefits for the audience and anticipated issues related to ethics and safety need to be addressed. These appear to be pre-dominantly rooted in qualitative studies that explore the perspectives of surgeons and attendees, rather than in objective quantitative studies that investigate patient safety and outcomes. Recognizing the potential for underreporting adverse events from LSWs, reliance on published figures of equality between groups is at best subject to further studies. Field experts have proposed several interventions to conduct LSWs safely, based on their experience.

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[To cite: Singhal S, Jayraj AS, Malhotra N, Somashekhar SP. Live surgical workshops: Balancing patient care and professional development. *Natl Med J India.* DOI: 10.25259/NMJI_444_2024]

Natl Med J India Article in Press

INTRODUCTION

Surgical training encompasses a multifaceted cognitive learning journey and involves acquiring knowledge, refining judgment, and mastering technical skills through observation of experienced mentors in surgical training programmes. Mastery in this art is a lifelong endeavour. Technological advancements in surgical equipment and techniques require surgeons to adapt quickly to provide optimal patient care; however, the extended learning curves for innovations pose major hurdles, demanding extensive training, practice, and resources.[1] Surgeons encounter unexpected challenges and complications, emphasizing the need to recognize, prevent and manage them effectively. Therefore, disseminating these skills globally is crucial to ensure that surgeons worldwide have access to the latest advancements and can provide optimal care.[2,3] To ensure continued learning, innovative and specialized modalities are essential. The dissemination of skills acquired by master surgeons remains an unmet need within the surgical community.

Live surgical workshops (LSW) were created to facilitate ongoing learning and skill development for surgeons across surgical subspecialties. Since the first live broadcast of a surgical procedure in 1996,[4] these workshops have expanded globally and are now common features at major scientific meetings. Surveys consistently show that attending surgeons find them useful,[5,6] although occasional controversies arise due to unforeseen events, prompting concerns about ethical, legal and patient safety issues, as well as surgeon distress and operating room (OR) chaos.[7,8] Various societies have responded by issuing advisory policy statements to regulate LSWs.[9–11]

In India, a public interest litigation was filed in the Supreme Court, alleging that many private hospitals are commercially exploiting patients by using them as models to promote companies and allowing surgeons to showcase their skills and hospitals to showcase their resources.[12] This has sparked controversies, raising questions about the utility of LSWs and the ethical considerations surrounding their conduct. Numerous commentaries and articles expressing diverse opinions, some in agreement while others critical of live broadcasts, have been published.[13,14] Nevertheless, there is a crucial need to delve deeper into the available evidence and move beyond subjective opinions.

We provide a comprehensive review of the existing literature pertaining to LSWs. Specifically, we delve into the perceived benefits and ethical dilemmas associated with these workshops. By analyzing the available research and intellectual discussion, this narrative review aims to provide insights into options for overcoming barriers surrounding LSWs in the field of surgical education and practice.

METHODS

We searched the PubMed/Medline database for articles reporting on LSWs from inception to 31 March 2023. Search terms included 'live surgical workshop', 'live surgical broadcasting', 'live surgical events', 'live surgery' and 'telecasting' (Table 1). Backward and forward referencing was done to retrieve any articles reporting on outcomes of interest. Studies were grouped into articles reporting on surgical and patient outcomes, survey studies on acceptability, issues faced, and feasibility, as well as guidelines and position papers. Common themes and issues were grouped into three sections: (i) advantages of live surgical broadcasting (LSB), (ii) disadvantages faced, and (iii) solutions to overcome identified problems.

DISCUSSION

A large body of literature related to LSW was identified, outlining the perceived benefits and risks associated with LSWs. Various aspects related to the perspectives of patients, surgeons, and attendees were explored through clinical studies reporting on intraoperative and postoperative complications, as well as long-term outcomes of surgical procedures. Surveys evaluated the experiences of surgeons and attendees with live surgeries, and studies assessed LSWs as a teaching model.

Benefits of LSWs for patients and surgeons

LSWs offer important benefits to both the surgical community and patients (Table 2). For surgeons, LSW is an excellent training tool that allows real-time observation of surgical procedures by expert surgeons. Apart from honing important surgical skills, such live events allow participants to learn about mundane yet critical steps in surgical planning and execution, such as theatre management, patient positioning, surgical instrument setup, layout of instrument stacks, and team communication. A LSW also provides an unparalleled opportunity for attendees to engage directly with expert surgeons, gaining a deeper understanding of the reasons behind the implementation of specific protocols.[15] Several studies have emphasized the benefits derived from such LSWs as participants have expressed their intent to attend fewer workshops if LSWs were not part of the programme.[16] They also consider LSWs preferable to other forms of surgical training such as edited video broadcasting in terms of improvement of surgical skills, on-the-spot decision-making and higher probability of transfer of acquired skills into clinical practice.[5,17,18] However, concerns have been raised by the community regarding the perceived benefits for the audience and anticipated issues related to ethics and safety.

From the patient's standpoint, LSWs are immensely beneficial as they are performed by expert surgeons with extensive experience in the field, which may not be available locally.[5] The surgeries are performed according to best practices and evidence-based guidelines, with meticulous planning and attention to detail. LSWs also help increase the transparency of surgical procedures and enhance patients' understanding. The constant feedback, continuous refinement, and advancement of surgical techniques are the objectives of such LSWs, which translate into better patient outcomes in the future. The continuous feedback, improvisation and refinement in surgical techniques that occur during LSWs ultimately translate into better patient outcomes in the future.

Patient safety and efficacy of surgeries conducted during LSW

The data regarding the safety and success of surgical procedures performed as live events in various fields, such as urology, gynaecology, cardiology, gastroenterology, and bariatric surgery, are provided in Table 2. All the studies are retrospective with no comparison arm or a historical cohort serving as a comparison. In addition, the studies are heterogeneous in terms of setting (international or national workshops), place of surgery (home or foreign institution), surgical approach (open versus minimally invasive), surgical discipline, diagnosis, surgical complexity and surgeon proficiency. The majority of studies show comparable results in terms of complication rates, surgical events, and long-term outcomes for patients operated in LSWs compared to those operated in a clinical setting.[19–32] Only one study by Ruiz *et al*. showed a slightly higher morbidity and reoperation rates in patients undergoing bariatric procedures in the LSW arm compared to the overall series of patients operated on in their institute. The authors acknowledged the presence of differences in patient characteristics of the LSW arm and the overall series, but they did not conduct statistical tests to quantify these differences, thereby raising concerns about the comparability of the arms. Notably, 85% of their cases were performed by invited surgeons from outside the home institution, and 35.2% of patients underwent revision surgery following a failed primary operation, indicating higher surgical complexity.[33] Similarly, concerns regarding under-reporting of adverse events, variations in surgical efficiency and outcomes when operating at home versus 'foreign' institutes have been raised by several authors.[18,34,35] The majority

TABLE 1. Search strategy for the review of literature

Item	Specification
Date of search	31 March 2023
Databases and other sources searched	PubMed/Medline
Key search terms used	'live surgical workshop', 'live surgical broadcasting', 'live surgical events', 'live surgery' and 'telecasting'
Timeframe	Inception to 31 March 2023
Inclusion and exclusion criteria	Inclusion: All articles reporting on outcomes related to live surgical broadcasts, including original articles, surveys, position statements and guidelines Exclusion: Narrative and systematic reviews, opinion papers and commentaries
Selection process	Retrieved articles were reviewed independently for eligibility for inclusion by two reviewers (AJ and SS). Any conflicts in data interpretation were resolved by the senior authors (SP and NM)

TABLE 2. Summary of studies reporting on attendees and surgeons' experience related outcomes

Author, year	Survey respondents	Response rate (%)	Main advantages	Main drawbacks	Alternate methods of training	Should LSWs be allowed to continue?	Comments
Hollick and Allan, 2008[34]	National survey of ophthalmology consultants from the Royal College of Ophthalmologists	63	Demonstration of surgical practice unedited (65%), interesting to watch (60%), interactivity, opportunity to observe the reality of other people's surgery	Greater stress of surgeon (92%), unfamiliar situation (91%), concerns regarding patient safety (83%), distractions compromising surgical performance	Edited video recordings (68%)	64%	–
Ackermann *et al.*, 2020[36]	Participants of the 23rd Annual Meeting of the Gynaecological Endoscopy Working Group (2018, Hamburg/ Germany) questionnaire comparing live laparoscopic surgery on real patients versus embalmed cadaver	42.7	Very high' value for surgical education and training acquisition of innovative surgical techniques (median 98%), benefits of avoiding (median 95%) complications in their own patients (median 91%), value of improving their own surgical skills (median 95%)	Not evaluated	Live surgery on body donors/ cadavers: 'Very high' value for surgical education and training (median 95%), authenticity (median 85.5%), option of replacing real patients with body donors at live surgery events (median 14.5%)	–	Clearly defensive attitude on the part of most participants, suggesting that a complete renunciation of the real patient might cause an unacceptable loss of educational and sustainable quality
Salami *et al.*, 2014[35]	Urology faculty who performed or moderated a live case demonstration at any World Congress of Endourology from 2008 to 2012	81.4	79.2% regarded LCDs as an ethical practice and were more likely to allow themselves or a family member to be a patient in a LCD beneficial and a great way to educate (90.5%)	Inappropriate case selection (69.9%), increased technical complexity (24.4%), surgeon anxiety (79.8%), language barriers (22.6%), Distractions: Film equipment and crew (32.1%); audience and moderator discussions (45.7%); unfamiliar instruments and tools (66.2%); unfamiliar team (67.5%); having to narrate to the audience through procedure (43.2%), fatigue, jet lag and accents of observers	35.7% (30/84) would prefer LCDs to be replaced by edited or unedited surgical videos	95.2% would agree to participate in another LCD	–

(contd.)

TABLE 2. Summary of studies reporting on attendees and surgeons' experience related outcomes *(contd.)*

Author, year	Survey respondents	Response rate (%)	Main advantages	Main drawbacks	Alternate methods of training	Should LSWs be allowed to continue?	Comments
Elsamra *et al*., 2014[6]	Participants of live surgery session at the American Urological Association 2012 national meeting (Atlanta) and the second International Challenges in Endourology meeting (Paris); survey comparing LCDs with edited and unedited videos; 31% respondents had previously performed a LCD	25	Learning experience 'extremely/very helpful' than edited/unedited videos ($p<0.001$); 78% considered LSW ethical; 58% will allow themselves to be a patient of an LSW; 86% will incorporate skills learnt into clinical practice	26% concerned about surgeon distraction	72% of respondents would accept edited movies if the unedited version was available online	–	–
Sugarman *et al*., 2011[5]	Internetbased survey of clinicians who have served as faculty or attended the 2009 and 2010 professional meetings sponsored by VIVA	13.1% for VIVA 2009 attendees and 14.9% for VIVA 2010 attendees	More suspenseful than watching videos ($p<0.05$), majority found LSW useful over videos, better patient perceived benefit than the average patient, majority would support the decision of a family member or friend to be a patient in an LSW, fewer indicated that they personally would agree to be an LSW patient	44%–49% respondents felt that LSW is commercially influenced, patients seldom refuse when approached by physician to participate, confidentiality concerns, exposed to more risk: (i) LSW takes more time than a routine case; (ii) logistics of scheduling during a conference may result in delay; (iii) operators may be distracted; and (iv) interruption by expert panel	–	–	Respondents who had experience as an operator were more likely to agree that patients who participate in LCDs are exposed to more risk than those who had not had that experience
Chandrasekharam *et al*., 2021[16]	Participants of the Society of Paediatric Urology, subchapter of the Indian Association of Paediatric Surgeons, 2019	77%	62% would only attend workshops if LSWs were incorporated; 79% would let their own child for surgery in LSW by an expert	–	50% respondents felt that video demonstrations may be an effective alternative to LSW	90% respondents felt that LCDs should be continued	No significant difference between junior (<45 years) and senior (>45 years) surgeons regarding support for LCDs

(contd.)

TABLE 2. Summary of studies reporting on attendees and surgeons' experience related outcomes *(contd.)*

Author, year	Survey respondents	Response rate (%)	Main advantages	Main drawbacks	Alternate methods of training	Should LSWs be allowed to continue?	Comments
Legemate *et al.*, 2018[18]	Participants of 2017 Challenges in Endourology meeting; 51% had previously performed LSD themselves	58%	40% of the faculty members indicated a preference for LSW; 33% of all respondents would not attend conferences if there were no LSWs	Performance pressure (20%–26%), jet lag (13%), unfamiliar circumstances (33%), patient safety concerns (14.7% of all respondents and 18% of LSD performers), higher complication risk (37.6%), pressure and anxiety (35.8%)	82% of all respondents would like to see more edited semilive case discussions	–	–
Schuettfort *et al.*, 2021[37]	Participants of the international meeting on reconstructive urology VIII	39.7%	90%–94% preferred LSW, 73% felt that there are little or no ethical concerns, higher educational value	–	–	Only 33% stated that videos are ethically less concerning than LSW	–
Skouras *et al.*, 2021[17]	Participants of three rhinoplasty meetings and six LMASS	62.9% for three rhinoplasty meetings and 76.4% for six LMASS	Exceptional education value (acquired tips and tricks, learn to manage complications, attractiveness of the learning tool, adopt a new surgical technique, alertness during observation, interactivity), minimal concern about outcomes or the potential complications	Concerns on patients' safety (8%), patients' outcomes (5%), perceived complication risk (5%), pressure and anxiety (5%), moderators' intervention causing distraction (93%)	Live surgery scored better as an educational method compared to prerecorded videos	–	Patient satisfaction scores for LSW showed that they were very high in terms of the result of surgery, familiarity with surgeon, postoperative care, safety and 'natural' results of the surgery
Finch *et al.*, 2015[39]	Participants of the UK section meeting of the SIU and BAUS Endourology meeting	35% for SIU meeting and 62% for the BAUS meeting	–	Important patient safety benefits with video over LSW: less pressurized surgeon; less concern over patients' wellbeing and outcome ($p<0.05$); less likely to volunteer/ recommend a friend or family member to be a patient in a LSW setting ($p<0.05$)	No differences between LSW and unedited videos in the ability to learn new tips, manage complications or question the surgeon/panel	–	–

LSW live surgical workshop SIU Socie'te internationale d'urologie BAUS British Association of Urological Surgeons LCD live case demonstrations LSD live surgical demonstrations LMASS Live makeover aesthetic surgery symposium VIVA vascular interventional advances

highlighted that the success of any treatment relies on the cohesive effort of the entire team working together, and this cohesion is best achieved within the home institution.

Experiences of operating surgeons and attendees during LSWs

Several surveys have evaluated experience of surgeons and attendees regarding multiple avenues such as the educational benefit of LSWs compared to other training methods, stress on surgeons to showcase their proficiency, distractions during surgery (comments from moderator or questions from participants), physical factors (jet lag), unfamiliarity of surgical team, operating theatre and/or instruments. The summary of studies highlighting these factors is presented in Table 3. Nearly all attendees unequivocally endorsed the educational advantages of LSWs.[5,6,17,35–37] Most surveys comparing the perceived learning benefits and preferences of attendees consistently favoured LSWs over cadaveric surgery and edited/unedited videos.[5,17,38] However, few studies supported pre-recorded videos over LSWs.[6,16,34,39] The option of LSB, where surgeons operate in familiar surroundings alongside trusted associates, has been deemed equally effective, offering the added benefit of reducing stress and anxiety levels amongst surgeons. The perception of the surgical community regarding LSB versus LSW has been conflicting. One school of thought supports LSW; that the human body is a universe unto itself, teeming with boundless potential. Surgeons, whether in live procedures or not, inevitably encounter unforeseen challenges. The essence of learning in LSW lies in participants gaining insights from field masters on navigating these unexpected intricacies and surgical challenges. During an LSW, participants are immersed in and actively engage with the surgical experience from both the patient's and the operating surgeon's perspectives. Simultaneously, they maintain an objective stance, observing the procedure from an independent third perspective. The distinctive experience of an LSW cultivates a deep learning process amongst participants.

Another perspective supports using LSBs from the surgeon's own environment, ensuring patient confidentiality. Unedited, LSBs offer the same educational value as LSWs in foreign settings, reducing surgeon stress and addressing ethical concerns. During unexpected incidents, a team member or moderator can assist in decision-making, preventing additional stress for the operating surgeon. Hence, LSBs are perceived as a means to combat the challenges of disseminating complex surgical skills while maintaining the continuity of care. Some surgeons advocate for the use of practical scenarios or videos to sharpen on-the-spot decision-making skills with equal utility. Such pre-recorded videos can also be used to stimulate conversations surrounding personal experiences in managing difficult cases and receiving expert opinions on alternative or better management and/or surgical techniques. However, watching pre-recorded videos often results in surface-level learning, where participants tend to adopt a narrow viewpoint and aim for rote memorization rather than true comprehension, as discussed by Marton and Säljö in their concepts of deep and surface learning.[40] Overall, no well-designed quantitative studies have been done to ascertain the superiority of any of these modalities over others.

Most surgeons expressed concerns about factors such as distracting discussions, jet lag and unfamiliar surroundings.[35] It is noteworthy that the potential harms of LSWs were perceived to be greater by operating surgeons compared to the attendees who benefited more from such live surgical events.[40] Hence, there is a need to address the potential concerns affecting surgeon's experience during the conduct of LSWs.

Ethical concerns related to surgeries performed in LSWs

Opinions of performing surgeons and attendees of LSWs regarding concerns on patient confidentiality, consenting, ethical issues of LSWs, selection of difficult cases and/or surgical techniques for purposes of showcasing surgeon's proficiency have also been analysed.[35] Other potential concerns include infection control issues due to the presence of non-medical professionals in a sterile OR (camera man and technical support), impact of potential waiting times for workshop on patient outcomes, limited availability of surgical time, interruption of surgery to perform the subsequent case, ethics of operating on patients with little interaction preoperatively and lack of postoperative care.

Efforts such as delaying transmission until the patient is fully draped, selecting cases after multidisciplinary team discussions with shared reports and images, limiting the number of non-OR staff present during LSWs and conducting patient interactions before the day of surgery while informing them about the surgeon's unavailability for postoperative care have been implemented. However, there has been no systematic analysis of these practices. In response to the concerns mentioned above, many studies have adapted good practices such as obtaining consent specifically tailored to the live relay of surgery by the invited surgeon, citing the impact of stressors on surgical performance during LSB, involving a patient advocate in conducting LSWs and assigning responsibility to surgical teams for preoperative and postoperative care of the patient and establishing thresholds for stopping transmission to reduce distractions.[19,26] There should be sufficient transparency in the process. It is essential to emphasize that no economic incentives should be offered to patients in exchange for their consent. However, there is no universal mandate for the format of ethical consent for this issue that is legally valid.

Common themes identified in position papers/guidelines to overcome perceived challenges in conducting LSWs from various surgical societies

Various surgical societies have endorsed several common themes to mitigate the untoward concerns in the conduct of LSWs.[9–11] This period starts from the preoperative phase until the patient is discharged from care. Surgeons are encouraged to perform surgical procedures at their respective home institutions to avoid undue anxiety and stress associated with travel, and to have the comfort of operating with familiar teams. These surgeries are then streamed on a digital platform and transmitted to a conference centre, leveraging technological advancements. This approach preserves the fundamental essence and educational value of a live surgery event, while prioritizing patient safety above all else. Unlike traditional live surgery broadcasts, where case selection, preoperative assessment and postoperative care may not be directly overseen by the operating surgeon, in this format, these aspects are managed by the operating

TABLE 3. Review of studies reporting on patient-related safety and efficacy outcomes

Study	Meeting	Procedure	Study characteristics	Comparison	Perioperative complications (safety)	Efficacy
Urology and urogynaecology						
Ogaya-Pinies *et al.*, 2019[19]	Florida hospital celebration health meeting 2008–2016	RARP	High volume centre, single surgeon for both LSB and controls, EAU and AUA compliance maintained, consent, patient advocate included	36 cases *v.* 108 controls	No difference in intraoperative complications; longer OR for LSB (136 *v.* 125 minutes; p=0.01) but shorter console time (73 *v.* 78 minutes; p=0.03)	Recurrence rates at 31month FU (2.7% *v.* 3.7%; p=0.7) Potency rates: 69% *v.* 70%; p=0.8) PSM: 8.3% *v.* 9.2%; p=0.9)
Rocco *et al.*, 2018[20]	12 congress challenge in laparoscopy and robotics 2004–2015	Laparoscopic and robotic radical prostatectomy, cystectomy, reconstructions, LND	27 surgeons	224 cases (no control arm)	Complications: 11.6% (acceptable as per standard)	–
Schuettfort *et al.*, 2019[21]	The International meeting on reconstructive urology	Diverse urological procedures	32 surgeons	57 cases (no control arm)	Complication rate: 15.8% (acceptable as per standard)	–
Misrai *et al.*, 2019[22]	17 live surgical demonstrations	Green LEP	Single surgeon in home unit	37 cases *v.* 89 controls	No differences in overall complication rate 18.9% *v.* 24.7% (p=0.64), operative time of 61 *v.* 55 minute (p=0.10), morcellation time of 3 *v.* 4 minute (p=0.82), catheterization time and length of stay	No difference in total energy of 62 *v.* 56 (p=0.068)
Ramírez Backhaus *et al.*, 2019[23]	Pelvic laparoscopic surgery courses 2014–2017	LRP	Three institutional expert laparoscopic surgeons operating at home unit	23 LSW *v.* 46 controls	No difference in operative time, blood loss, and intraoperative and postoperative complications, and long-term functional outcomes	Higher PSM rate for LSW (43.5% *v.* 17.4%; p=0.02); no difference in adjuvant therapy and relapse rate
Andolfi and Gundeti, 2020[24]	LSB meetings (not specified)	Paediatric urology procedures (RALP, RALUR, RALHN)	Single surgeon (Home unit)	22 cases *v.* 52 historical cohort	No difference in OT time and LOS; revision: 0 *v.* 3; overall complication rates: 11.1% *v.* 22.2%	Comparable success rates
Somani *et al.*, 2021[25]	18 live surgical events 2015–2020	Robotic, laparoscopic procedures, transurethral bladder procedure, prostate enucleation, etc.	EAU-endorsed	246 cases (no control arm)	44 (17.8%) short-term complications and 9 of 79 (11.3%) long-term complications observed; Clavien grade III/IV complications were seen in 5.2% and 7.5% of cases over short and long-term follow-up	No difference in 5-year outcomes

contd.

TABLE 3. Review of studies reporting on patient-related safety and efficacy outcomes *(contd.)*

Study	Meeting	Procedure	Study characteristics	Comparison	Perioperative complications (safety)	Efficacy
Gynaecology and gynaecologic oncology						
Itam *et al.*, 2018[26]	Female urology and urogynaecology masterclass 2008–2015	Wide range of urogynaecology procedures (SUI surgery, POP repair, VVF, UD excision, mesh complications surgery, others)	Only typical cases and extremes were avoided, informed consent, experience patient advocate urologist	53 cases *v.* historical cohorts	No difference in intraoperative complications between two groups within 30 days, 1/53 infection and mesh erosion by 90-day followup	Surgical success rates: 78%–100% *v.* 75%–100% (NS)
Altmann *et al.*, 2022[27]	Seven Charite-MAYO conferences from 2010 to 2019	Urogynaecology, gynaecologic oncology and breast surgery	Surgeons performed at the home unit and other institutions	69 cases (no control arm)	Perioperative complications: No difference	High rate of complete resection and high frequency of multivisceral procedures
Gastrointestinal surgery						
Ruiz *et al.*, 2018[33]	International bariatric surgery course 2006–2016	Complicated bariatric procedures (Primary 65%, revision cases)	20 surgeons (both institutional and visiting surgeons)	107 cases *v.* historical series (~1800 patients)	Higher morbidity and reoperation rates compared to the overall series Complications: 13% *v.* 6.7%; Revision: 5.2% *v.* 3.1%; ED consultations: 21.1% *v.* 16.6%	No difference in weight loss success
Ebigbo *et al.*, 2019[28]	Augsburg Endo-Update live endoscopy events	Endoscopic submucosal dissection	Three endoscopists at high-volume centre (home unit)	38 cases *v.* 38 controls	No difference in intraoperative complications; resection rates 87% *v.* 71%; procedure time: 135 *v.* 125 minutes	Similar rates of recurrence (4% *v.* 0%) and 5-year survival rates (70% *v.* 65%)
Unal *et al.*, 2020[29]	LSB by five surgeons between 2006 and 2018	Minimally invasive colorectal surgery	Five surgeons	39 cases *v.* 39 controls	No statistically significant difference in conversions and intraoperative complications. Longer OT (200 *v.* 165; p=0.002) Higher EBL (100 *v.* 55; p=0.008); longer stay (6 *v.* 5; p=0.001)	Comparable number of harvested lymph nodes in colorectal cancer cases (p=0.603)
El Rahyel and Rex, 2022[30]	Live broadcast of live endoscopic procedure in routine practice	Polypse≥20 mm	Single surgeon	317 lesions *v.* 866 controls	No difference in procedure time and adverse event (5% *v.* 3.4%)	No difference in recurrence rates
Interventional cardiology						
Waksman *et al.*, 2014[31]	LSW from six sites in the USA, Canada, Germany, Italy, Switzerland and the UK	Transcatheter aortic valve intervention	Five centres	110 patients (46 matched case and control pairs and 18 in in the case registry)	Similar rates of fluoroscopy time, contrast volume and length of hospital stay and inhospital complications; procedure time: 130.2 *v* 100.6 minutes	Similar final valve position; success rates: no difference

contd.

TABLE 3. Review of studies reporting on patient-related safety and efficacy outcomes *(contd.)*

Study	Meeting	Procedure	Study characteristics	Comparison	Perioperative complications (safety)	Efficacy
Shimura *et al.*, 2016[32]	Global cardiology congresses in the USA, Europe and Asia, including local meetings in Japan from 2006 to 2013	CTOPCI	Collected from database at Toyohashi Heart Centre, Toyohashi, Japan	199 cases *v.* 540 controls	No significant differences in procedural complications such as coronary dissection (p=0.53), coronary perforation (p=0.12) and cardiac tamponade (p=0.40), 30-day mortality (p=0.28)	Success rates: 91.5% *v.* 86.7% (p=0.07), similar survival rates at median follow-up of 51.2 months (p=0.45)

LSB Live surgical broadcast RARP robot-assisted radical prostatectomy CTO-PCI Chronic total occlusion percutaneous coronary intervention SUI stress urinary incontinence POP pelvic organ prolapseVVF vesicovaginal fistula UD Urethral diverticulumNS non-significant LOS length of stay RAL-P robot-assisted laparoscopic pyeloplasty RAL-UR ureteral reimplantation RAL-HN hemi-nephrectomy LRP laparoscopic radical prostatectomy GreenLEP green laser enucleation of the prostate LND lymph node dissection PSM positive surgical margins OT operative time

surgeon. By having moderators communicate with non-operating surgeons and assistants in the OR, potential distractions to the operating surgeon are mitigated, thereby allowing for greater focus on the surgery itself. The surgeon may be interviewed at the conclusion of the procedure to share their experience and answer attendee questions.

Consents should be designed specifically for LSW broadcasting, in addition to those for the specific surgical procedure itself, with information on details of the broadcast, the potential number of participants, the impact of such transmission on patient outcomes, and the educational intent of the relay. The patient should also be informed that the visiting surgeon will lead the surgery under the supervision of the local team, who will subsequently take over further management. The patient has the right to refuse participation after being informed of the potential benefits and risks associated with LSWs.[10] Coercing patients into consenting to LSWs with the promise of expedited treatment, financial benefits, or other perks should be avoided. To avoid any disadvantage if they decline, an alternative surgical slot should be provided. Obtaining approval from the Institutional Ethics Board is necessary to ensure strict adherence to good clinical practice and to prevent patient exploitation. A patient advocate must be involved in organizing the LSW to ensure that the procedure is in the patient's best interests. Patient confidentiality is of utmost importance and should be maintained by using de-identified language by OR staff and by conducting regular training sessions. Patient dignity should be maintained by starting transmission only after the patient is appropriately draped. A protocol should be established for training non-medical staff present in the OR on infection control measures.

To conclude, LSWs have immense educational potential and a unique benefit for patients who are otherwise unable to access expert medical care. The concerns raised for such LSWs appear to be more substantiated in qualitative studies exploring the surgeon and attendee's perspectives, rather than objective quantitative studies examining patient safety and outcomes. Overall, while onsite operative workshops have their advantages, these can be replicated in one's native environment, ensuring continuity of care. In addition, it is a fact that several adverse incidents were under-reported, as there is no defined mandate for reporting adverse events at LSWs, nor a system in place to ensure safety procedures and ethical standards that are legally enforceable.

WAY FORWARD

The surgical community, especially surgeons-in-training, perceive LSWs as exceptional in terms of surgical training experience, facilitation of the learning curve, and global exchange of surgical education. However, this has to be balanced against the potential concerns raised by patient advocates and operating surgeons, who perceive the ethical, safety, and personal concerns as too great to justify LSWs. Although the published literature on outcomes and adverse events does not show a difference between LSW and conventional surgeries, it is essential to acknowledge that, as with most medical interventions, adverse outcomes are often not reported transparently. Consequently, we have a responsibility to strike a balance between these concerns without compromising either outcome, as training of surgeons is also a long-term patient safety issue that may impact health outcomes.

A three-pronged approach is required to achieve an optimal surgical setting; facilitating the surgeon's comfort, proper case selection, and mindful consideration of ethics, education, and patient safety, thereby navigating the obstacles of LSWs safely. In addition, we suggest developing a comprehensive training and certification programme for surgeons involved in LSWs to improve psychological resilience, decrease stress and anxiety, and maintain focus on surgery. This programme should also enhance communication skills while maintaining transparency, identify situations where broadcasting can be discontinued in the interest of patient safety, and ensure adherence to ethical conduct. Similarly, moderators could be provided with a set of guidelines to follow during LSW discussions aimed at reducing distractions for the operating surgeon. Finally, there is a need for strict legislative efforts to ensure adequate and transparent reporting of patient outcomes for those participating in LSWs. Alternative methods of surgical education such as broadcasting of pre-recorded videos, cadaveric workshops and artificial intelligence-based simulations can also be harnessed to avoid placing patients at risk potentially.

Conflicts of interest. None

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