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RESEARCH ARTICLE

Many Videos Demonstrate the Operation, Few Teach the Operation: Educational Completeness and Workflow Representation in Oncologic Laparoscopic Adrenalectomy Videos on YouTube

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ABSTRACT

Objective: Video-based learning is increasingly used in minimally invasive oncologic surgery; however, whether YouTube videos of oncologic laparoscopic adrenalectomy convey a complete operative workflow remains unclear. This study assessed educational quality, workflow presentation, and educational completeness in such videos.

Materials and Methods: A systematic YouTube search was performed on February 1, 2026, using "laparoscopic adrenalectomy." Of 120 videos screened, 36 met predefined oncologic eligibility criteria. Educational quality was evaluated using DISCERN, JAMA, GQS, and LAP-VEGaS. Educational completeness was assessed using the Adrenalectomy Educational Completeness Score (AECS; 0–9), a procedure-specific score evaluating key workflow components. Associations between scores, video format, narration, and video characteristics were analyzed.

Results: Mean DISCERN, JAMA, GQS, and LAP-VEGaS scores were 55.3±10.5, 1.9±0.9, 3.8±1.0, and 7.1±1.1, respectively. Adrenal vein ligation (86.1%) and dissection (75.0%) were most frequently shown, whereas pathology reporting (33.3%) and discussion of complications or technical challenges (30.6%) were less common. The mean AECS was 4.6±2.6 and correlated significantly with DISCERN, GQS, JAMA, and LAP-VEGaS. Workflow-oriented videos had higher AECS than highlight and partial-operation videos (7.75±1.89 vs. 4.25±2.26 and 4.25±2.49; p=0.044). Narrated videos also showed higher educational completeness (p<0.001). Popularity metrics were not associated with educational quality.

Conclusion: YouTube videos of oncologic laparoscopic adrenalectomy vary in educational completeness. Technical steps are commonly demonstrated, but workflow-defining and oncologic safety-related elements are often underrepresented. Workflow-oriented structure and narration may improve educational value.

Keywords: Educational completeness, laparoscopic adrenalectomy, oncologic adrenal surgery, procedural reproducibility, surgical education, video-based learning, workflow completeness, YouTube

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INTRODUCTION

The increasing adoption of minimally invasive techniques in adrenal surgery has expanded the role of laparoscopic adrenalectomy in the management of both benign and selected malignant adrenal lesions.[1–4] Although laparoscopic adrenalectomy offers well-established perioperative advantages, its application in oncologic settings remains particularly demanding because oncologic adequacy depends not only on successful tumor removal but also on meticulous adherence to fundamental surgical principles.[2–5] Avoidance of capsular disruption, precise vascular control, appropriate specimen handling, and maintenance of oncologic integrity throughout the procedure are critical determinants of surgical quality and long-term outcomes.[2–5] Consequently,

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oncologic laparoscopic adrenalectomy should be viewed not merely as a technical operation but as a complex sequence of workflow-dependent decisions requiring procedural reproducibility, operative judgment, and structured surgical training. In this context, the educational value of a surgical video cannot be judged solely by whether key technical maneuvers are demonstrated; rather, it should be assessed according to its ability to convey the operative workflow, decision-making process, and safety-critical principles that underpin oncologically sound surgery.

The role of minimally invasive surgery in adrenal malignancy remains a subject of ongoing debate, making the quality of surgical education particularly relevant in this field.[2–5] Although laparoscopic adrenalectomy has been shown to be feasible in carefully selected patients with localized adrenocortical carcinoma, metastatic adrenal disease, and other potentially malignant lesions, concerns persist regarding capsular disruption, margin status, tumor spillage, local recurrence, and long-term oncologic outcomes.[2–5] These concerns highlight a fundamental principle: oncologic adrenalectomy is not merely a sequence of technical maneuvers but a procedure in which operative planning, trocar strategy, exposure, dissection planes, vascular control, specimen retrieval, and intraoperative decision-making collectively determine oncologic safety and procedural success.[1–5] Consequently, educational resources intended to support training in oncologic laparoscopic adrenalectomy should extend beyond the demonstration of isolated technical steps and provide a comprehensive representation of the operative workflow. Procedural reproducibility in oncologic surgery depends not only on technical execution but also on understanding how individual operative steps are integrated into a coherent workflow. Whether publicly available surgical videos adequately convey these workflow-defining educational elements remains largely unknown.

Video-based learning has become a cornerstone of contemporary surgical education, particularly in minimally invasive and oncologic surgery, where procedural understanding increasingly relies on the visual demonstration of complex operative workflows.[6,7] Surgical trainees and practicing surgeons routinely use operative videos to review anatomy, understand procedural sequencing, anticipate technical difficulties, and refine operative decision-making before undertaking challenging procedures.[6–8] Among available platforms, YouTube has emerged as one of the most frequently accessed sources of surgical videos because of its unrestricted accessibility, extensive content volume, and global reach.[7–9] However, unlike peer-reviewed video libraries and society-endorsed educational repositories, YouTube content is not required to adhere to standardized reporting criteria, demonstrate the complete operative workflow, disclose outcomes, or undergo expert educational review before publication.[8–10] Consequently, substantial variability exists in the quality, reliability, and educational completeness of publicly available surgical videos.[8–11] More importantly, videos that successfully demonstrate isolated technical maneuvers may still fail to convey the broader workflow, operative context, and decision-making processes required for safe and reproducible oncologic surgery. As procedural reproducibility increasingly becomes a central objective of surgical training, educational value should be assessed not only through global quality metrics but also through the completeness with which a video communicates the operative workflow.

Several instruments have been developed to evaluate the quality and reliability of online surgical videos. DISCERN, the Journal of the American Medical Association (JAMA) benchmark criteria, and the Global Quality Score (GQS) are among the most frequently used tools for assessing the transparency, reliability, and overall educational value of medical content.[12,13] More specifically, the LAParoscopic surgery Video Educational GuidelineS (LAP-VEGaS) assessment tool was developed and validated to provide a structured framework for evaluating the educational quality of laparoscopic surgical videos.[14] Although these instruments have substantially improved the objective assessment of surgical video content, they predominantly generate global quality metrics. In the context of oncologic laparoscopic adrenalectomy, however, educational adequacy extends beyond overall quality scores. A video may achieve acceptable ratings while still failing to demonstrate critical workflow-defining elements such as patient positioning, trocar strategy, anatomical orientation, specimen retrieval, pathology reporting, or the management of intraoperative challenges. Consequently, global quality assessment alone may not adequately reflect whether a video teaches the procedure as a reproducible and oncologically sound operation. As procedural reproducibility increasingly becomes a central objective of modern surgical training, evaluating educational completeness at the procedure-step level may provide a more meaningful assessment of the true educational value of surgical videos.

This distinction is particularly important in oncologic adrenal surgery. A video may achieve acceptable global quality scores while still failing to demonstrate critical workflow-defining components, including patient positioning, trocar placement, anatomical orientation, operative indication, specimen retrieval, pathology reporting, and the management of intraoperative challenges. Conversely, a visually

appealing highlight video may successfully showcase adrenal vein dissection and ligation yet provide little insight into operative planning, procedural sequencing, technical decision-making, or strategies required to maintain oncologic integrity. For malignant adrenal lesions, such omissions extend beyond educational limitations and may compromise the transmission of fundamental oncologic surgical principles. Importantly, the educational objective of an oncologic surgical video is not merely to demonstrate individual technical steps but to communicate how those steps are integrated into a safe, reproducible, and oncologically sound operative workflow. Consequently, assessment of educational value should incorporate not only overall quality metrics but also the completeness with which a video represents the operative workflow of oncologic adrenalectomy.

Although previous studies have evaluated online surgical videos using global quality assessment tools and engagement metrics, relatively little attention has been paid to procedure-step completeness and operative workflow representation.[8–11,14–16] While these investigations have consistently demonstrated substantial heterogeneity in the quality of publicly available surgical content, they provide limited insight into whether videos adequately convey the workflow-defining elements required for reproducible and oncologically sound laparoscopic adrenalectomy. Furthermore, the educational implications of video format—highlight clips, partial procedures, and workflow-oriented videos—remain poorly characterized. This knowledge gap is clinically important because the distinction between a highlight video and a comprehensive workflow video may determine whether the viewer acquires an isolated technical maneuver or a meaningful understanding of the operation as a complete oncologic procedure. Consequently, educational completeness and workflow representation may provide a more clinically relevant assessment of surgical video quality than global quality metrics alone.

Therefore, the present study aimed to evaluate YouTube videos demonstrating oncologic laparoscopic adrenalectomy using established educational quality assessment instruments while simultaneously assessing operative workflow representation. In addition to DISCERN, JAMA, GQS, and LAP-VEGaS scores, we evaluated the representation of workflow-defining educational components, including patient positioning, trocar placement, anatomical explanation, adrenal vein dissection and ligation, specimen extraction, operative indication, pathology reporting, and discussion of complications or technical challenges. Furthermore, we assessed educational completeness using a novel procedure-specific metric, the Adrenalectomy Educational Completeness Score (AECS), and investigated its relationship with video format and conventional educational quality measures. We hypothesized that although technical dissection-related steps would be frequently represented, workflow-defining and oncologic safety-related educational elements would remain substantially underrepresented, particularly in highlight and partial-operation videos.

MATERIALS and METHODS

Study Design and Ethical Considerations

This study was designed as a retrospective cross-sectional observational analysis to evaluate the educational quality, workflow representation, and educational completeness of YouTube videos demonstrating oncologic laparoscopic adrenalectomy. In addition to conventional video quality assessment instruments, the study specifically focused on the representation of workflow-defining educational components considered essential for procedural reproducibility and oncologic surgical practice.

All videos analyzed in this study were obtained from YouTube (https://www.youtube.com), a publicly accessible online platform. The study involved neither direct human participation nor access to patient-level data, personal identifiers, or protected health information. Because the investigation consisted exclusively of the evaluation of publicly available educational content, ethics committee approval and informed consent were not required.

Search Strategy and Video Selection

A systematic search was performed on YouTube on February 1, 2026, using the search term "laparoscopic adrenalectomy." Search results were screened according to YouTube's default relevance algorithm to reflect the typical experience of users seeking educational surgical content.

Initially, 120 videos were identified and reviewed for eligibility. All videos were screened according to predefined inclusion and exclusion criteria. Duplicate videos, patient-oriented educational videos, non-operative content, videos unrelated to laparoscopic adrenalectomy, videos demonstrating clearly benign adrenal procedures without oncologic relevance, and videos with insufficient visual quality were excluded.

Of the 120 initially identified videos, 84 were excluded, including duplicate videos (n=13), patient-oriented educational videos (n=27), benign or non-oncologic adrenal procedures (n=28), videos with insufficient visual quality for detailed assessment (n=12), and non-operative videos (n=4). Following the screening process, 36 videos demonstrating malignant, potentially malignant, metastatic, or otherwise oncologically

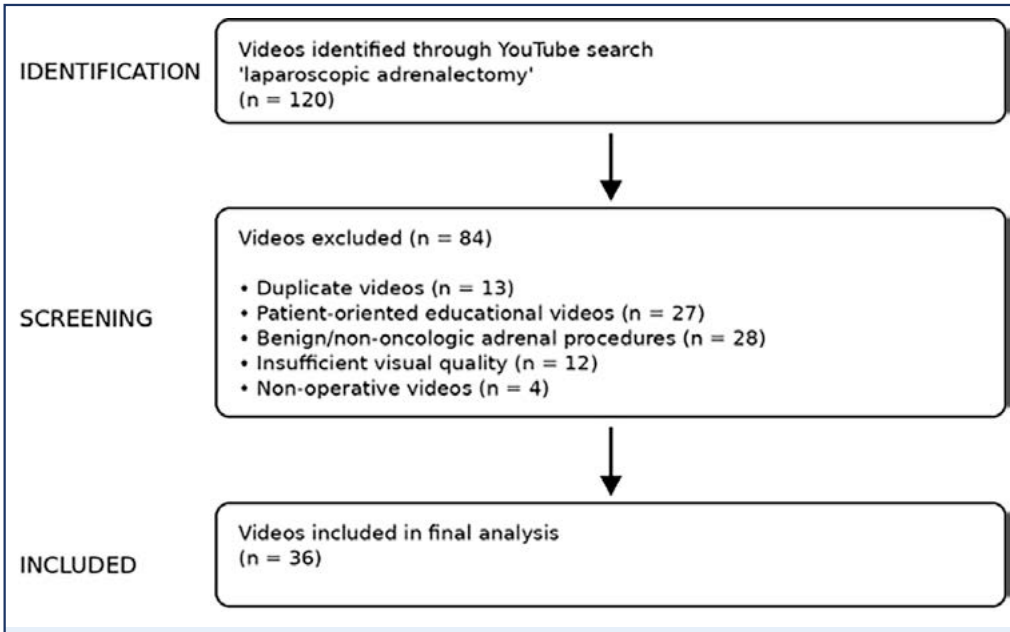

Figure 1. Flow diagram of video selection

managed adrenal lesions met all eligibility criteria and were included in the final analysis (Fig. 1).

Inclusion and Exclusion Criteria

Videos were eligible for inclusion if they:

- Demonstrated laparoscopic adrenalectomy performed for malignant, potentially malignant, metastatic, or otherwise oncologically managed adrenal lesions;
- Were intended for surgical education;
- Contained operative footage;
- Provided sufficient visual quality for detailed evaluation;
- Contained sufficient information within the title, description, narration, or video content to establish an oncologic surgical context.

Videos were excluded if they:

- Were duplicates;
- Did not contain operative content;
- Were designed exclusively for patient education or public information;
- Consisted solely of animations, lectures, interviews, or non-operative presentations;
- Demonstrated clearly benign adrenal procedures without oncologic relevance;
- Lacked sufficient information to establish an oncologic context;
- Had insufficient visual quality for objective assessment.

Oncologic Case Selection

The primary objective of this study was to evaluate educational content relevant to oncologic adrenal surgery. Therefore, only videos demonstrating malignant adrenal tumors, metastatic adrenal lesions, pheochromocytomas managed within an oncologic surgical context, or adrenal masses explicitly presented within an oncologic surgical context were included.

Because pathological confirmation was not independently available, classification relied on information provided by the uploaders. Accordingly, the term "oncologic laparoscopic adrenalectomy" in the present study refers to procedures presented as malignant, potentially malignant, metastatic, or otherwise managed according to oncologic surgical principles.

Data Collection

For each included video, the following characteristics were recorded:

- Video duration (seconds);
- Number of views;
- Number of likes;
- Number of comments;
- Upload date;
- Video age (days);
- Uploader type;
- Laterality (right or left adrenalectomy);
- Presence of subtitles;

- Presence of voice narration;
- Video format.

Video age was calculated as the number of days between the upload date and the date of data collection.

Uploader type was categorized as either an individual surgeon (coded as 1) or an institutional source (coded as 2). Institutional sources included universities, hospitals, professional organizations, academic centers, and officially affiliated educational channels.

Video Format Classification

Videos were categorized according to the extent of operative workflow representation:

- Highlight video: videos demonstrating selected operative moments or key technical maneuvers without comprehensive representation of the overall procedure.
- Partial-operation video: videos demonstrating substantial portions of the operation but omitting one or more major workflow-defining stages.
- Workflow-oriented video: videos presenting the procedure comprehensively, including operative setup, key technical steps, and procedural completion.

Video format classification was independently performed by the reviewers based on the extent to which the complete operative workflow was represented. Disagreements were resolved through consensus discussion.

Procedure-Step Assessment

The presence or absence of workflow-defining educational components was assessed for each video. Components were selected based on their relevance to operative orientation, technical execution, procedural reproducibility, specimen management, and oncologic surgical practice.

The following variables were evaluated:

- Patient positioning;
- Trocar placement;
- Anatomical explanation;
- Adrenal vein dissection;
- Adrenal vein ligation;
- Specimen extraction;
- Operative indication;
- Pathology reporting;
- Discussion of complications or technical challenges.

Additionally, the presence of voice narration and subtitles was recorded.

Each variable was assessed dichotomously and recorded as absent (0) or present (1).

Adrenalectomy Educational Completeness Score (AECS)

To evaluate educational completeness beyond conventional quality metrics, an Adrenalectomy Educational Completeness Score (AECS) was developed specifically for this study.

The AECS consisted of nine workflow-defining components:

1. Patient positioning;
2. Trocar placement;
3. Anatomical explanation;
4. Adrenal vein dissection;
5. Adrenal vein ligation;
6. Specimen extraction;
7. Operative indication;
8. Pathology reporting;
9. Discussion of complications or technical challenges.

The AECS components were selected a priori by the study investigators based on their relevance to procedural reproducibility, operative orientation, technical execution, specimen management, and oncologic safety in laparoscopic adrenalectomy. Component selection was informed by the educational domains emphasized in LAP-VEGaS and by workflow-defining elements considered essential for understanding and reproducing an oncologic minimally invasive adrenal procedure. The aim of the AECS was not to replace established quality assessment instruments but to provide a procedure-specific measure of educational completeness.

Each component contributed one point if present. Consequently, total AECS values ranged from 0 to 9, with higher scores indicating greater educational completeness and a more comprehensive representation of the operative workflow.

Educational Quality Assessment

Educational quality was independently evaluated by three reviewers experienced in minimally invasive and oncologic surgery. The following validated assessment tools were used: the DISCERN score, the Journal of the American Medical Association (JAMA) benchmark criteria, the Global Quality Score (GQS), and the LAParoscopic surgery Video Educational GuidelineS (LAP-VEGaS). All assessments were performed independently by the three reviewers. For each video, the final DISCERN, JAMA, GQS, and LAP-VEGaS scores were calculated as the mean values of the three independent evaluations.

Interobserver Reliability

Interobserver agreement among reviewers for LAP-VEGaS scoring was assessed using the intraclass correlation coefficient (ICC), as LAP-VEGaS required the greatest degree of subjective reviewer judgment among the assessment instruments employed. ICC values greater than 0.75 were considered indicative of good agreement, whereas values greater than 0.90 were considered indicative of excellent agreement.

Use of Artificial Intelligence–Assisted Technology

Artificial intelligence–assisted technology was used only for editorial and language-related support during manuscript preparation. Specifically, ChatGPT (OpenAI, GPT-5.5 Pro) was used to improve language clarity, assist with Turkish–English translation, shorten the abstract according to journal word limits, refine the manuscript title, and draft submission-related text. Representative prompts included requests to translate the abstract into Turkish, limit the Turkish and English abstracts to 250 words, refine the title, and prepare a cover letter emphasizing the contribution of the study to the literature. The tool was not used to identify or select videos, determine eligibility, extract study data, assign DISCERN, JAMA, GQS, LAP-VEGaS, or AECS scores, perform statistical analyses, generate tables or figures, interpret the results, or draw scientific conclusions. All AI-assisted outputs were reviewed, edited, and approved by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the final manuscript.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 22.0 (IBM Corp., Armonk, NY, USA).

The distribution of continuous variables was assessed using the Shapiro–Wilk test. Continuous variables were presented as mean±standard deviation or median and interquartile range (IQR), as appropriate.

Comparisons between two groups were performed using the Mann–Whitney U test. Comparisons among video format categories (highlight, partial-operation, and workflow-oriented videos) were performed using the Kruskal–Wallis test.

Correlations between educational quality metrics and educational completeness measures, including AECS, DISCERN, JAMA, GQS, LAP-VEGaS, video duration, views, likes, and comments, were evaluated using Spearman's rank correlation coefficient.

Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate.

All statistical tests were two-sided, and a p-value<0.05 was considered statistically significant.

Table 1. General characteristics of included videos (n=36)

Variable	Value
Video duration, seconds	412 (293–511)
Views	233.5 (102.3–956.3)
Likes	4 (1–16.3)
Comments	0 (0–1)
Video age, days	1065.5 (548–1626.8)
Individual surgeon upload, n (%)	24 (66.7)
Institutional upload, n (%)	12 (33.3)
Left adrenalectomy, n (%)	20 (55.6)
Right adrenalectomy, n (%)	16 (44.4)
Highlight video, n (%)	12 (33.3)
Partial-operation video, n (%)	20 (55.6)
Workflow-oriented video, n (%)	4 (11.1)
Voice narration present, n (%)	23 (63.9)
Subtitles present, n (%)	15 (41.7)

Data are presented as median (interquartile range) or number (percentage), as appropriate

RESULTS

Video Selection

A total of 120 videos were initially identified through the YouTube search. After application of the predefined inclusion and exclusion criteria, 84 videos were excluded, including duplicate videos (n=13), patient-oriented educational videos (n=27), benign or non-oncologic adrenal procedures (n=28), videos with insufficient visual quality for detailed assessment (n=12), and non-operative videos (n=4). Consequently, 36 videos demonstrating malignant, potentially malignant, metastatic, or otherwise oncologically managed adrenal lesions met all eligibility criteria and were included in the final analysis (Fig. 1).

General Characteristics of Included Videos

The general characteristics of the included videos are presented in Table 1.

The median video duration was 412 seconds (IQR: 293–511). The median number of views was 233.5 (IQR: 102.3–956.3), while the median numbers of likes and comments were 4 (IQR: 1–16.3) and 0 (IQR: 0–1), respectively. The median video age at the time of analysis was 1065.5 days (IQR: 548–1626.8).

Most videos were uploaded by individual surgeons (n=24, 66.7%), whereas 12 videos (33.3%) originated from institutional sources. Twenty videos (55.6%) demonstrated left adrenalectomy, and 16 (44.4%) demonstrated right adrenalectomy.

Table 2. Conventional educational quality assessment scores of included videos (n=36)

Variable	Mean±SD	Median (IQR)
DISCERN score	55.3±10.5	54.5 (50–63)
JAMA score	1.9±0.9	2 (1–3)
GQS score	3.8±1.0	4 (3–5)
LAP-VEGaS score	7.1±1.1	7.0 (6.3–7.3)

SD: Standard deviation; DISCERN: Quality Criteria for Consumer Health Information; JAMA: Journal of the American Medical Association benchmark criteria; GQS: Global Quality Score; LAP-VEGaS: LAParoscopic surgery Video Educational GuidelineS

With respect to video format, 12 videos (33.3%) were classified as highlight videos, 20 (55.6%) as partial-operation videos, and only 4 videos (11.1%) were classified as workflow-oriented videos. Voice narration was present in 23 videos (63.9%), whereas subtitles were available in 15 videos (41.7%).

Conventional Educational Quality Assessment

Conventional educational quality metrics are summarized in Table 2. The mean DISCERN, JAMA, GQS, and LAP-VEGaS scores were 55.3±10.5, 1.9±0.9, 3.8±1.0, and 7.1±1.1, respectively. Interobserver agreement for LAP-VEGaS assessment was good, with an average-measures intraclass correlation coefficient (ICC) of 0.80, supporting the reliability of the educational quality assessments performed in this study.

Table 3. Representation of workflow-defining educational components in included videos (n=36)

Category	Educational component	n (%)
Technical	Adrenal vein ligation	31 (86.1)
Technical	Adrenal vein dissection	27 (75.0)
Workflow	Anatomical explanation	21 (58.3)
Workflow	Operative indication	21 (58.3)
Workflow	Patient positioning	15 (41.7)
Workflow	Trocar placement	15 (41.7)
Outcome/Context	Specimen extraction	14 (38.9)
Outcome/Context	Pathology reporting	12 (33.3)
Outcome/Context	Discussion of complications or technical challenges	11 (30.6)

Data are presented as number (%)

Representation of Workflow-Defining Educational Components

Marked heterogeneity was observed in the representation of workflow-defining educational components (Fig. 2 and Table 3). Adrenal vein ligation was the most frequently demonstrated educational component, appearing in 31 of 36 videos (86.1%), followed by adrenal vein dissection in 27 videos

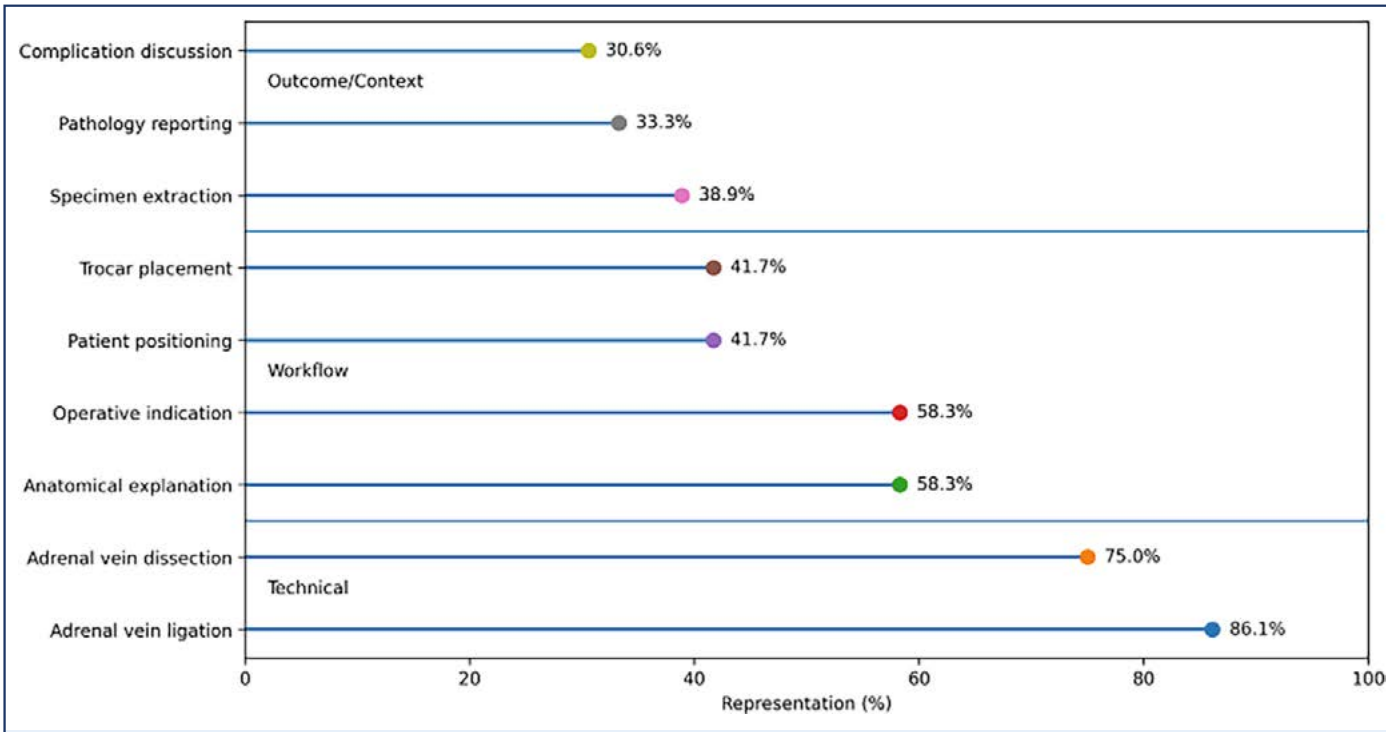

Figure 2. Educational component representation in oncologic laparoscopic adrenalectomy videos

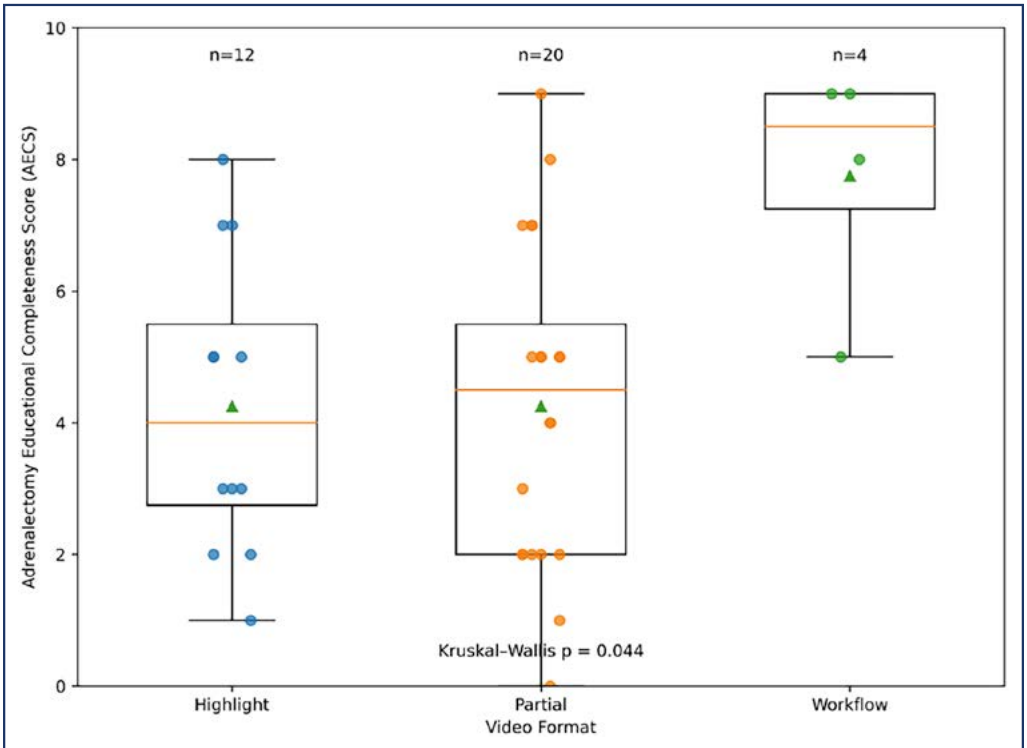

Figure 3. Educational completeness according to video format

(75.0%). Anatomical explanation and operative indication were each demonstrated in 21 videos (58.3%).

In contrast, several educational elements related to operative setup, specimen management, and postoperative context were considerably less frequently represented. Patient positioning and trocar placement were demonstrated in only 15 videos (41.7%), specimen extraction in 14 videos (38.9%), pathology reporting in 12 videos (33.3%), and discussion of complications or technical challenges in 11 videos (30.6%).

A progressive decline in representation was observed from technical dissection-related components to workflow-related and outcome-related educational elements. While technical steps such as adrenal vein dissection and ligation were frequently demonstrated, educational components related to operative preparation, specimen management, pathology, and complication-related decision-making were substantially underrepresented. This pattern suggests that technical execution was more consistently represented than broader workflow-defining educational content.

Adrenalectomy Educational Completeness Score

The mean Adrenalectomy Educational Completeness Score (AECS) was 4.6±2.6, with a median score of 5.0 (IQR: 2–7). AECS values ranged from 0 to 9, indicating substantial variability in the completeness with which operative workflow components were represented across videos.

The AECS demonstrated significant positive correlations with the DISCERN score (ρ=0.682, p<0.001), GQS (ρ=0.558, p<0.001), JAMA score (ρ=0.463, p=0.004), and LAP-VEGaS score (ρ=0.456, p=0.005). Videos with higher AECS values consistently achieved higher scores across established educational quality instruments, supporting the validity of AECS as a procedure-specific measure of educational completeness.

Despite moderate overall quality scores, considerable variability in AECS values was observed, indicating that videos with similar global educational ratings may differ substantially in their representation of workflow-defining educational elements. This finding suggests that educational completeness captures an aspect of video quality that is not fully reflected by conventional assessment instruments alone.

Influence of Video Format on Educational Completeness

Educational completeness differed significantly according to video format (Fig. 3 and Table 4).

Workflow-oriented videos achieved the highest AECS values, with a mean score of 7.75±1.89, compared with 4.25±2.49 for partial-operation videos and 4.25±2.26 for highlight videos

Table 4. Educational quality and educational completeness according to video format

Variable	Highlight (n=12)	Partial- operation (n=20)	Workflow- oriented (n=4)	p
AECS	4.25±2.26	4.25±2.49	7.75±1.89	0.044
DISCERN score	54.42±7.81	53.90±11.87	64.50±7.19	0.153
JAMA score	1.25±0.45	2.15±0.93	3.00±0.00	<0.001
GQS score	3.50±0.90	3.85±1.04	4.50±0.58	0.189
LAP-VEGaS score	6.56±0.67	7.07±0.83	9.08±1.20	0.003

Statistical significance was defined as p<0.05. AECS: Adrenalectomy Educational Completeness Score; DISCERN: Quality Criteria for Consumer Health Information; JAMA: Journal of the American Medical Association benchmark criteria; GQS: Global Quality Score; LAP-VEGaS: LAParoscopic surgery Video Educational GuidelineS. Continuous variables were compared using the Kruskal–Wallis test

(p=0.044). Notably, workflow-oriented videos demonstrated nearly twofold greater educational completeness than both highlight and partial-operation videos.

A similar pattern was observed for LAP-VEGaS scores. Workflow-oriented videos demonstrated the highest educational quality, with a mean LAP-VEGaS score of 9.08±1.20, compared with 7.07±0.83 for partial-operation videos and 6.56±0.67 for highlight videos (p=0.003). JAMA scores also differed significantly according to video format, with workflow-oriented videos achieving the highest values (3.00±0.00), followed by partial-operation videos (2.15±0.93) and highlight videos (1.25±0.45) (p<0.001).

In contrast, no statistically significant differences were observed among video format categories for the DISCERN score, GQS, video duration, or view count. Collectively, these findings suggest that workflow-oriented videos were associated with higher educational completeness and selected quality metrics; however, these exploratory subgroup comparisons should be interpreted cautiously because the workflow-oriented group included only four videos.

Influence of Voice Narration and Subtitles

Videos containing voice narration demonstrated significantly greater educational completeness than videos without narration. The median AECS was 5.0 (IQR: 5–7.5) in narrated videos compared with 2.0 (IQR: 2–3) in non-narrated videos (p<0.001), indicating substantially more comprehensive workflow representation in videos accompanied by verbal explanation.

Narrated videos also achieved significantly higher DISCERN (p=0.010), JAMA (p=0.005), and GQS scores (p=0.044). However, no significant difference in LAP-VEGaS scores was observed according to the presence of voice narration (p=0.219).

In contrast, the presence of subtitles was not significantly associated with AECS, DISCERN, JAMA, GQS, or LAP-VEGaS scores. Overall, videos incorporating voice narration demonstrated greater educational completeness and higher conventional educational quality scores than videos relying solely on visual presentation.

Uploader Type, Laterality, and Popularity Metrics

No significant differences were observed between videos uploaded by individual surgeons and those uploaded by institutional sources with respect to AECS, DISCERN, JAMA, GQS, or LAP-VEGaS scores. Similarly, no significant differences were identified between right- and left-sided adrenalectomy videos regarding educational completeness or educational quality metrics.

View count and comment count were not significantly correlated with either AECS or LAP-VEGaS scores. Like count demonstrated weak positive correlations with AECS (ρ=0.363, p=0.030) and the LAP-VEGaS score (ρ=0.336, p=0.045).

DISCUSSION

The principal finding of this study is that publicly available YouTube videos of oncologic laparoscopic adrenalectomy preferentially emphasize technical execution while frequently underrepresenting workflow-defining educational elements. Although adrenal vein dissection and ligation were demonstrated in the majority of videos, critical components such as patient positioning, trocar placement, specimen extraction, pathology reporting, and discussion of complications or technical challenges were substantially less common. These findings suggest that many videos successfully demonstrate how an adrenalectomy is technically performed, yet comparatively few teach how the procedure is planned, contextualized, and completed as an oncologically sound operation. Consequently, technical exposure and educational completeness should not be considered synonymous, particularly in procedures where procedural reproducibility and oncologic safety depend on a sequence of interconnected operative decisions.

This observation is particularly relevant in adrenal oncology. The role of minimally invasive surgery in malignant adrenal disease remains controversial, particularly in adrenocortical carcinoma and other potentially malignant adrenal lesions.[2–5] Concerns regarding capsular disruption, tumor spillage, margin status, and long-term oncologic outcomes continue to influence surgical decision-making.[2–5] Contemporary adrenal oncology guidelines and outcome studies consistently emphasize that procedural quality in adrenal surgery extends beyond successful tumor removal and requires meticulous adherence to oncologic principles throughout the operative process.[1–5] Consequently, educational resources intended to support oncologic adrenal surgery should ideally communicate not only technical maneuvers but also the sequence of workflow-dependent decisions that contribute to oncologic safety. In this context, the underrepresentation of patient positioning, trocar placement, specimen extraction, pathology reporting, and complication management identified in the present study represents a meaningful educational deficiency rather than a simple limitation of video editing. Indeed, these components are directly related to procedural reproducibility and may influence how surgeons translate operative knowledge into safe oncologic practice. As a result, incomplete workflow representation may affect not only educational quality but also the transmission of fundamental oncologic surgical principles.

A distinguishing feature of the present study is the evaluation of educational completeness at the procedure-step level. Previous investigations examining surgical videos on YouTube have predominantly focused on global quality assessment instruments such as DISCERN, JAMA, GQS, and LAP-VEGaS.[8–16] While these tools provide valuable information regarding transparency, reliability, and overall educational quality, they do not necessarily determine whether a procedure is presented as a complete and reproducible workflow. Similar limitations have been highlighted in recent studies of video-based surgical education, which emphasize that procedural understanding depends not only on technical visualization but also on the representation of operative sequencing, contextual decision-making, and workflow continuity.[17–22]

To address this limitation, we developed the Adrenalectomy Educational Completeness Score (AECS), a procedure-specific metric designed to quantify the representation of workflow-defining educational components. The significant correlations observed between AECS and DISCERN, JAMA, GQS, and LAP-VEGaS support its construct validity and suggest that workflow completeness represents an important educational domain that is only partially captured by existing assessment instruments.[12–14] Notably, the substantial variability observed in AECS values despite relatively similar global quality scores indicates that videos with comparable educational ratings may differ considerably in their ability to communicate a reproducible operative workflow. This finding supports the concept that procedural reproducibility, rather than technical visualization alone, may represent a more meaningful indicator of educational value in oncologic surgical videos.

Importantly, the purpose of AECS was not to evaluate technical complexity or oncologic difficulty but rather to assess whether workflow-defining educational elements were adequately represented in a manner that supports procedural understanding and reproducibility. Consequently, AECS may complement existing educational quality instruments by providing procedure-specific information regarding workflow completeness that cannot be fully captured by global quality metrics alone.

A key exploratory finding of this study was the association between video format and educational value. Workflow-oriented videos achieved significantly higher AECS, LAP-VEGaS, and JAMA scores than both highlight and partial-operation videos. Notably, workflow-oriented videos demonstrated nearly twofold greater educational completeness than highlight videos. Although previous studies have documented substantial heterogeneity in the educational quality of online surgical videos,[9–11,15,16] relatively little attention has been paid to the educational implications of video format itself.

The present findings suggest that educational quality depends not only on what is shown but also on how the procedure is presented. Highlight videos often provide excellent visualization of isolated technical maneuvers; however, they frequently omit procedural context, operative sequencing, and decision-making processes. In contrast, workflow-oriented videos appear to provide a more comprehensive representation of procedural conduct, thereby reducing the cognitive gap between observing an operation and understanding an operation. This observation is consistent with contemporary concepts of competency-based surgical education, which emphasize procedural understanding, cognitive integration, and workflow mastery in addition to technical exposure.[17–22]

Importantly, workflow-oriented videos achieved higher performance across multiple educational domains, including educational completeness, procedural reporting quality, and

transparency. However, because only four videos were classified as workflow-oriented, these findings should be regarded as exploratory and hypothesis-generating rather than definitive. Furthermore, workflow representation appeared to demonstrate stronger associations with educational value than traditional popularity metrics or video duration. Collectively, these findings suggest that workflow completeness may be an important determinant of educational quality in oncologic surgical videos while emphasizing the need for confirmation in larger video datasets.

An additional observation was the progressive decline in representation from technical dissection-related components to workflow-related and outcome-related educational elements. Adrenal vein dissection and ligation were among the most frequently demonstrated procedural steps, whereas pathology reporting and discussion of complications were among the least represented. This pattern likely reflects the way surgical videos are commonly produced. Technical moments are visually appealing, easier to edit, and often perceived as the most educational parts of a procedure. Similar trends have been reported in previous evaluations of online surgical videos, where technical execution was frequently emphasized at the expense of procedural context and decision-making.[9–11,15,16]

However, from a surgical education perspective, pathology reporting, specimen management, and complication discussion may be equally important because they provide insight into operative judgment, oncologic reasoning, and the management of unexpected events. In malignant adrenal disease, these elements are directly related to procedural reproducibility and oncologic safety.[1–5] Indeed, many videos demonstrated the operation, but comparatively few taught the operation. This distinction reflects a fundamental challenge in video-based surgical education: technical visualization alone cannot fully substitute for the cognitive apprenticeship required to understand why a procedure is performed in a particular manner and how operative decisions are made in real time.[17–22] Consequently, educational completeness should be viewed not only as the demonstration of technical steps but also as the communication of operative reasoning, workflow continuity, and context-dependent decision-making.

Voice narration emerged as another important determinant of educational value. Videos containing narration demonstrated significantly greater educational completeness than videos without narration, with a median AECS more than twice as high in narrated videos. Interestingly, subtitles alone were not associated with improved educational quality. This finding suggests that the educational benefit of narration extends beyond simple information delivery. Verbal explanation allows surgeons to communicate operative rationale, anatomical landmarks, procedural sequencing, decision-making processes, and responses to technical difficulties. Similar observations have been reported in the broader surgical education literature, where guided audiovisual instruction consistently outperforms passive observation alone in promoting procedural understanding and skill acquisition.[6,7,17,18,20,22]

The present findings reinforce this concept and suggest that narration may serve as a critical bridge between technical visualization and meaningful educational engagement. Notably, the absence of a similar association for subtitles implies that educational value may depend less on the availability of supplementary information and more on the active communication of operative reasoning. Consequently, voice narration should be considered a core component of future workflow-oriented educational videos in oncologic surgery.

The lack of meaningful associations between educational quality and popularity metrics is also noteworthy. Neither view count nor comment count demonstrated significant correlations with AECS or LAP-VEGaS scores, while like count showed only weak positive associations. These findings are consistent with previous studies demonstrating that online engagement metrics are poor surrogates for educational value and should not be interpreted as indicators of instructional quality.[8–11,15,16] For trainees, this observation is particularly important because it challenges the common assumption that highly viewed videos are necessarily superior educational resources.

In the present study, educational completeness was more strongly associated with workflow representation and voice narration than with visibility or user engagement metrics. This finding suggests that educational design may be a more important determinant of learning value than platform popularity. Consequently, the most visible videos are not necessarily the most educational, and trainees may benefit more from selecting videos based on instructional structure and workflow completeness rather than audience engagement alone. Collectively, these findings indicate that how educational content is organized and delivered may be more important than how widely it is viewed.

Interestingly, institutional videos did not outperform videos uploaded by individual surgeons, and educational quality

did not differ according to operative laterality. These findings suggest that educational value is influenced less by the source of publication and more by the completeness, structure, and instructional design of the educational content itself. Similar variability in educational quality has been reported across different forms of online surgical educational content, where institutional affiliation was not consistently associated with superior educational performance.[9,18,21,23] From an educational perspective, these findings reinforce the notion that effective surgical teaching depends primarily on how procedural knowledge is organized and communicated rather than on who publishes the material. Consequently, institutional affiliation alone should not be considered a guarantee of educational quality.

The broader implications of these findings extend beyond adrenal surgery. Modern surgical training increasingly relies on video-based learning, particularly in minimally invasive and oncologic procedures, where opportunities for direct operative exposure may be limited and procedural complexity is high.[6,7,17,18,20,22] However, if online videos disproportionately emphasize technical execution while neglecting workflow-defining educational elements, trainees may acquire fragmented technical knowledge without fully understanding the procedural logic that underpins safe surgical practice. This concern may be particularly relevant in oncologic surgery, where procedural reproducibility is intimately linked to patient safety, oncologic adequacy, and long-term outcomes.[1–5] The present findings therefore support a shift from evaluating whether videos merely demonstrate technical steps toward assessing whether they communicate a complete operative workflow. From an educational perspective, workflow completeness may represent a more meaningful indicator of instructional value than technical visualization alone and may better reflect a video's capacity to support procedural understanding and reproducible surgical practice.

The findings of this study also support the development of procedure-specific educational standards for online surgical videos. Existing frameworks such as LAP-VEGaS have significantly advanced the assessment of laparoscopic video quality by promoting transparency and standardized reporting.[14] However, the present findings suggest that educational quality should be evaluated not only through global quality metrics but also through the completeness with which workflow-defining elements are represented. Future educational standards may therefore benefit from greater emphasis on patient positioning, trocar strategy, operative context, pathology reporting, complication management, and procedural decision-making.[14,17,19,20,24] Such an approach may improve both the reproducibility and educational utility of surgical videos intended for oncologic training, particularly as social media platforms are increasingly used for surgical education and research dissemination.[25] In addition, randomized evidence in basic surgical skills training supports the educational value of structured video-based learning, reinforcing the need for surgical videos to be designed as instructional resources rather than passive visual demonstrations.[26]

Moreover, the superior performance of workflow-oriented videos across multiple educational domains in the present study provides empirical support for incorporating workflow completeness into future surgical video reporting frameworks. Accordingly, workflow representation should be considered not merely an educational supplement but a core component of high-quality surgical video design.

This study possesses several important strengths. Unlike many previous evaluations of online surgical videos, the present analysis focused specifically on malignant or potentially malignant adrenal lesions, thereby maintaining a clear oncologic perspective throughout the study. This distinction is important because the educational requirements of oncologic adrenalectomy extend beyond technical execution and include procedural reproducibility, oncologic safety, and operative decision-making. Furthermore, educational quality was assessed using both established assessment instruments and a novel procedure-specific framework. By combining DISCERN, JAMA, GQS, and LAP-VEGaS with the Adrenalectomy Educational Completeness Score, we were able to evaluate not only overall educational quality but also the completeness of workflow representation. Additional strengths include independent evaluation by three reviewers and good interobserver agreement. Together, these methodological features provided a comprehensive assessment of both educational quality and workflow completeness in videos demonstrating oncologic laparoscopic adrenalectomy.

Several limitations should be acknowledged when interpreting the present findings. First, YouTube is a dynamic platform in which video availability, metadata, and ranking algorithms may change over time; consequently, the analyzed dataset represents a snapshot of the content available at the time of the search. Second, although the Adrenalectomy Educational Completeness Score (AECS) demonstrated significant correlations with established educational quality instruments, it was developed specifically for this study and should therefore be considered exploratory un-

til externally validated in independent datasets. Third, despite efforts to restrict inclusion to malignant or potentially malignant adrenal lesions, the accuracy of pathology and oncologic context depended on information provided by uploaders and could not be independently verified. Finally, the relatively small number of workflow-oriented videos (n=4) represents an important limitation of the subgroup analyses. Although non-parametric methods were used, the small size of this subgroup may have reduced statistical power and increased the risk of Type II error, particularly for comparisons in which no statistically significant difference was observed. Therefore, the subgroup findings should be interpreted cautiously and considered exploratory. Nevertheless, the small workflow-oriented subgroup also reflects the scarcity of videos meeting predefined oncologic eligibility criteria and presenting a complete operative workflow. Accordingly, the observed distribution likely represents the current state of publicly available educational content rather than a sampling artifact.

CONCLUSION

YouTube videos demonstrating oncologic laparoscopic adrenalectomy exhibit considerable variability in educational completeness. While technical dissection-related components are frequently represented, workflow-defining educational elements—including patient positioning, trocar placement, specimen management, pathology reporting, and complication discussion—remain substantially underrepresented. Workflow-oriented and narrated videos were associated with higher educational completeness, suggesting that educational quality depends not only on technical visualization but also on the completeness with which the operative workflow is communicated.

The findings of this study indicate that procedural reproducibility, rather than technical exposure alone, may represent a meaningful indicator of educational value in oncologic surgical videos. Future educational content should prioritize comprehensive workflow representation, structured narration, and transparent reporting of operative context to better support training in oncologic minimally invasive surgery. In addition, YouTube-based surgical educational content may benefit from a predefined educational format in which the intended video type—highlight, partial-operation, or complete workflow—is specified during recording or upload. Ultimately, workflow completeness should be regarded as a core component of high-quality surgical video design and a key determinant of educational value in oncologic surgical education.

Disclosures

Ethics Committee Approval: This study analyzed publicly available YouTube videos and did not involve human participants, patient data, animal subjects, or identifiable personal information. Therefore, ethics committee approval and informed consent were not required.

Informed Consent: Not applicable.

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REFERENCES

1. Fassnacht M, Tsagarakis S, Terzolo M, Tabarin A, Sahdev A, Newell-Price J, et al. European Society of Endocrinology clinical practice guidelines on the management of adrenal incidentalomas, in collaboration with the European Network for the Study of Adrenal Tumors. Eur J Endocrinol 2023;189:G1–G42. [CrossRef]
2. Brix D, Allolio B, Fenske W, Agha A, Dralle H, Jurowich C, et al. Laparoscopic versus open adrenalectomy for adrenocortical carcinoma: surgical and oncologic outcome in 152 patients. Eur Urol 2010;58:609–15. [CrossRef]
3. Autorino R, Bove P, De Sio M, Miano R, Micali S, Cindolo L, et al. Open versus laparoscopic adrenalectomy for adrenocortical carcinoma: a meta-analysis of surgical and oncological outcomes. Ann Surg Oncol 2016;23:1195–202. [CrossRef]
4. Giordano A, Feroci F, Podda M, Botteri E, Ortenzi M, Montori G, et al. Minimally invasive versus open adrenalectomy for adrenocortical carcinoma: the keys surgical factors influencing the outcomes-a collective overview. Langenbecks Arch Surg 2023;408:256. [CrossRef]
5. Zheng GY, Li HZ, Deng JH, Zhang XB, Wu XC. Open adrenalectomy versus laparoscopic adrenalectomy for adrenocortical carcinoma: a retrospective comparative study on short-term oncologic prognosis. Onco Targets Ther 2018;11:1625–32. [CrossRef]
6. Rapp AK, Healy MG, Charlton ME, Keith JN, Rosenbaum ME, Kapadia MR. YouTube is the most frequently used educational video source for surgical preparation. J Surg Educ 2016;73:1072–6. [CrossRef]

7. Mota P, Carvalho N, Carvalho-Dias E, João Costa M, Correia-Pinto J, Lima E. Video-based surgical learning: improving trainee education and preparation for surgery. J Surg Educ 2018;75:828–35. [CrossRef]
8. Farag M, Bolton D, Lawrentschuk N. Use of YouTube as a resource for surgical education-clarity or confusion. Eur Urol Focus 2020;6:445–9. [CrossRef]
9. Gorgy A, El Hawary H, Galli R, MacDonald M, Barone N, Thibaudeau S. Evaluating the educational quality of surgical YouTube® videos: a systematic review. Health Sci Rev (Oxf) 2023;5:100067. [CrossRef]
10. de'Angelis N, Gavriilidis P, Martínez-Pérez A, Genova P, Notarnicola M, Reitano E, et al. Educational value of surgical videos on YouTube: quality assessment of laparoscopic appendectomy videos by senior surgeons vs. novice trainees. World J Emerg Surg 2019;14:22. [CrossRef]
11. Rouhi AD, Roberson JL, Kindall E, Ghanem YK, Ndong A, Yi WS, et al. What are trainees watching? Assessing the educational quality of online laparoscopic cholecystectomy training videos using the LAP-VEGaS guidelines. Surgery 2023;174:524–8. [CrossRef]
12. Charnock D, Shepperd S, Needham G, Gann R. DISCERN: an instrument for judging the quality of written consumer health information on treatment choices. J Epidemiol Community Health 1999;53:105–11. [CrossRef]
13. Silberg WM, Lundberg GD, Musacchio RA. Assessing, controlling, and assuring the quality of medical information on the Internet: Caveant lector et viewor--Let the reader and viewer beware. JAMA 1997;277:1244–5. [CrossRef]
14. Celentano V, Smart N, Cahill RA, Spinelli A, Giglio MC, McGrath J, et al. Development and validation of a recommended checklist for assessment of surgical videos quality: the LAParoscopic surgery Video Educational GuidelineS (LAP-VEGaS) video assessment tool. Surg Endosc 2021;35:1362–9. [CrossRef]
15. Rouhi AD, Roberson JL, Kindall E, Ghanem YK, Yi WS, Williams NN, et al. Assessment of YouTube as an online educational tool in teaching laparoscopic Roux-en-Y gastric bypass: A LAP-VEGaS study. Surg Pract Sci 2023;14:100199. [CrossRef]
16. Hashemi SA, Shakiba B, Golshan A, Esmaeil Soofian S, Maghsoudi R. Assessment of the quality of YouTube educational videos on laparoscopic right adrenalectomy and laparoscopic partial nephrectomy surgeries. J Laparoendosc Adv Surg Tech A 2024;34:300–4. [CrossRef]
17. Ahmet A, Gamze K, Rustem M, Sezen KA. Is video-based education an effective method in surgical education? a systematic review. J Surg Educ 2018;75:1150–8. [CrossRef]
18. Green JL, Suresh V, Bittar P, Ledbetter L, Mithani SK, Allori A. The utilization of video technology in surgical education: a systematic review. J Surg Res 2019;235:171–80. [CrossRef]
19. McQueen S, McKinnon V, VanderBeek L, McCarthy C, Sonnadara R. Video-based assessment in surgical education: a scoping review. J Surg Educ 2019;76:1645–54. [CrossRef]
20. Augestad KM, Butt K, Ignjatovic D, Keller DS, Kiran R. Video-based coaching in surgical education: a systematic review and meta-analysis. Surg Endosc 2020;34:521–35. [CrossRef]
21. Srinivasa K, Moir F, Goodyear-Smith F. The role of online videos in teaching procedural skills in postgraduate medical education: a scoping review. J Surg Educ 2022;79:1295–307. [CrossRef]
22. Youssef SC, Aydin A, Canning A, Khan N, Ahmed K, Dasgupta P. Learning surgical skills through video-based education: a systematic review. Surg Innov 2023;30:220–38. [CrossRef]
23. Lima DL, Viscarret V, Velasco J, Lima RNCL, Malcher F. Social media as a tool for surgical education: a qualitative systematic review. Surg Endosc 2022;36:4674–84. [CrossRef]
24. Pakkasjärvi N, Anttila H, Pyhältö K. What are the learning objectives in surgical training - a systematic literature review of the surgical competence framework. BMC Med Educ 2024;24:119. [CrossRef]
25. Yamamoto T, Goto K, Kitano S, Maeshima Y, Yamada T, Azuma Y, et al. Current insights on social media as a tool for the dissemination of research and education in surgery: a narrative review. Surg Today 2024;54:1113–23. [CrossRef]
26. Dantas I, Jorge I, Nicolau A, Vales M, Coutinho C, Rodrigues S, et al. Video-based learning for basic surgical skills - A randomized trial. Surg Open Sci 2025;26:94–106. [CrossRef]