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Thou shalt not trust online videos for inguinal hernia repair techniques

Desmond Huynh[1] · Negin Fadaee[2] · Hakan Gök[3] · Andrew Wright[4] · Shirin Towfigh[2]

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Abstract

Background Videos are used by surgeons when learning new techniques; however, online videos are often not vetted. Our aim is to review online videos of laparoscopic inguinal hernia repairs based on a benchmark for critical view of the myopectineal orifice (MPO) and safe inguinal hernia repair as defined by Daes and Felix and commonly referred to as "the 9 Commandments."

Methods and materials YouTube® was queried for "laparoscopic inguinal hernia repair." The top 50 videos were ranked based on number of views. Those endorsed and/or vetted by surgical societies were excluded ($n=4$). Three expert hernia surgeons scored the videos based on adherence to the 9 Commandments.

Results The 50 videos originated from 11 countries. They had 72,825 mean views and a mean runtime of 14 min. Videos obeyed a median of 77.8% of commandments shown. Eight videos (16%) obeyed all 9 (100%) commandments. Three videos (6%) failed to obey any commandments. Operations employed TEP (18, 36%), TAPP (28, 56%), and rTAPP (4, 8%) approach. Stratification by approach showed significant variance in commandments obeyed (Kurskal–Wallis, $p=0.016$) with significant difference between TEP and rTAPP scores ($p=0.008$) and no significant difference between TEP and TAPP or rTAPP and TAPP scores.

Twenty-three videos (46%) displayed unsafe techniques including: threatened critical structures (16, 32%), rough tissue handling (15, 30%), and dangerous placement of fixation (9, 18%).

Conclusion Online surgical videos on YouTube are not reliable in demonstrating best practices for minimally invasive inguinal hernia repairs. In our study, only 16% of the most viewed videos followed all 9 Commandments for critical view of the MPO. Many showed suboptimal repairs with significant safety concerns. While a significant number of online videos are a free and readily available resource for surgeons around the world, we recommend caution in relying on non-vetted videos as a form of surgical education.

Keywords Inguinal hernia · Education · Technology · Robotic · Minimally invasive · Video

The internet is filled with opportunities and resources for surgical education, including e-texts, discussion groups, educational applications, and videos [1, 2]. Surgical videos are provided online as educational tools by a variety of dedicated sources, including such as online educational platforms (e.g., GibLib, WebSurg) [3, 4] and surgical societies (e.g., SAGES) [5]. The most accessible surgical videos are found on YouTube®. This is the most popular forum for videos, with over 2 billion users from over 100 countries watching 1 billion hours daily [6]. YouTube is also the most used educational video platform among surgeons [7] and is considered to be a valuable adjunct in surgical education [8]. According to Rapp et al., 86% of surgical video-based learning in the United States is via YouTube.

Unlike dedicated surgical video sources, the open access nature of YouTube provides no mechanism for quality control [9]. Anyone can publish a surgical video on YouTube, and thus there is no mechanism by which a surgeon or

✉ Shirin Towfigh
drtowfigh@beverlyhillsherniacenter.com

1 Department of Surgery, Cedars-Sinai Health System, Los Angeles, CA, USA

2 Beverly Hills Hernia Center, 450 N Roxbury Drive #224, Beverly Hills, CA 90210, USA

3 Hernia Istanbul®, Hernia Surgery Center, Istanbul, Turkey

4 University of Washington Medical Center, Seattle, WA, USA

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trainee can differentiate among these videos to determine which represent best practices and thus would be suitable from which to learn surgical techniques.

Because of its relevance in surgical education, many aimed to evaluate the quality of surgical videos found on YouTube. These studies have shown that many online surgical videos are suboptimal. For example, among videos of laparoscopic cholecystectomy found on YouTube, 5 of the top 10 videos demonstrated concerning maneuvers and only one demonstrated an adequate critical view of safety [10].

Two prior studies sought to evaluate online videos of laparoscopic totally extraperitoneal (TEP) inguinal hernia repair videos found on WebSurg[4] and YouTube [4, 11]. The surgical technique from these videos was evaluated via a 25-question TEP scoring system (TEPSS) developed based on the European Hernia Society guidelines [12]. Both studies showed low TEPSS score and concluded that though the viewership was significant, neither website provided quality education for surgical technique in laparoscopic TEP inguinal hernia repairs. One study of the top 20 laparoscopic transabdominal preperitoneal (TAPP) inguinal hernia repair videos found on YouTube used the Global Operative Assessment of Laparoscopic Skills-Groin Hernia (GOALS-GH) to evaluate surgical technique [13]. This is a tool used as an interactive, in-person evaluation of trainees performing laparoscopic inguinal hernia repair. It tests not only generalized surgical technique, but also surgeon knowledge and operation flow, and so it is a difficult tool for evaluation of surgical videos [14]. Nevertheless, the authors found that only $^1/_3$ of videos demonstrated sound surgical technique.

To date there is no validated scoring method to evaluate the optimal step-by-step performance of MIS inguinal hernia repair. The GOALS-GH is the closest such tool, but it evaluates surgical technique based on only three broad surgical steps: creation of workspace, reduction of the hernia sac, and mesh placement. It does not provide step-by-step details to highlight pitfalls in performing an MIS inguinal hernia repair.

Our goal was to evaluate the top MIS inguinal hernia repair videos found on YouTube based on step-by-step technical details that can minimize complications and improve outcome. In laparoscopic cholecystectomy, the critical view of safety is considered the foundation of reducing biliary injury and improving patient outcomes [10]. With similar goals, Daes and Felix have outlined nine steps in developing the critical view of the myopectineal orifice for MIS inguinal hernia repair, with the goal of minimizing complications and improving outcome [15]. The steps included detailed description of what are acceptable and unacceptable surgical techniques. For example, "Dissect at least 2 cm between CL and the bladder" and "Avoid splitting the mesh." What have been termed "The 9 Commandments" were developed in collaboration with hernia experts based on established technical factors that have shown to reduce complications and recurrences, resulting in optimal patient care. We evaluate top surgical videos of MIS inguinal hernia repair found on YouTube based on their adherence to the 9 Commandments in developing the critical view of the myopectineal orifice.

Methods

Surgical Video Selection: The site www.YouTube.com was accessed on February 29, 2020, from an anonymized account, from Los Angeles, California, USA, after clearance of internet viewing history and preferences. The search terms "laparoscopic inguinal hernia repair" and "robotic inguinal hernia repair" were queried and sorted based on the number of video views. Videos were required to display operative footage of unilateral or bilateral inguinal hernia repairs using either laparoscopic or robotic approaches. The top 50 most viewed videos were categorized as either laparoscopic TEP, laparoscopic TAPP, or robotic (rTAPP) approaches. Only videos published by individual surgeons were included. Those posted by surgical societies were excluded, as they were considered to be already vetted for quality.

Surgical Video Quality Evaluation: The videos were reviewed by three surgeons who specialize in MIS hernia repair. Reviewers scored each video based on their excellence in establishing the critical view of the myopectineal orifice. Reviewers separately scored each video based on the surgeon's adherence to "the 9 Commandments": yes, no, or indeterminate (i.e., relevant portion of the operation was omitted from video). Final adjusted score for each Commandment was determined by majority consensus among the reviewers. If the final video score was indeterminate, then the total video score is reported as a percentage of evaluable Commandments.

Statistical analysis was performed using SPSS version 26.0 (IBM Corp, 2019). The Chi-squared and Fisher's Exact tests were used to compare categorical variables. The Mann–Whitney U test and Kruskal–Wallis test with Dunn post hoc analysis were utilized for continuous variables, assuming non-parametric distributions. A p-value of < 0.05 was considered statistically significant. Cronbach's alpha was used to assess internal consistency amongst reviewers, in which a value of ≥ 0.7 is considered acceptable consistency.

As the study involved no contact with patients or patient health information, this study is exempt from institutional review board approval.

Table 1 Top 50 surgical video characteristics

	$n=50$
Views (mean ± σ [median])	72,825 ± 64,510 [50590]
Video age[a] (y) (mean ± σ [median])	6.32 ± 3.20 [5.65]
Comments (mean ± σ [median])	46.9 ± 147 [13]
Likes (mean ± σ [median])	188 ± 220 [111]
Dislikes (mean ± σ [median])	22.8 ± 27.5 [13]
Length (m) (mean ± σ [median])	14.0 ± 11.7 [11.1]
Country of origin	
India (%)	21 (42)
United States of America (%)	12 (24)
Brazil (%)	4 (8)
United Kingdom (%)	3 (6)
Australia (%)	3 (6)
Japan (%)	2 (4)
Belgium (%)	1 (2)
Georgia (%)	1 (2)
Italy (%)	1 (2)
Philippines (%)	1 (2)
Romania (%)	1 (2)
Operative approach	
TAPP (%)	28 (56)
TEP (%)	18 (36)
rTAPP (%)	4 (8)

[a]Age calculated as February 29, 2020 minus date of video publication

Results

The top 50 most viewed surgical videos found on YouTube were chosen after four videos produced by surgical societies were removed. The video characteristics are noted in Table 1. Videos were primarily published by surgeons in India (42%) and the USA (24%). The majority (28, 56%) employed a laparoscopic TAPP approach. There was no association between operative approach (TAPP, TEP, rTAPP) and video age.

We noted a high internal consistency of scoring among the three reviewers, with Cronbach's alpha 0.865. The reviewers found only 8 (16%) videos followed all 9 Commandments, with final adjusted score 100% [Table 2]. Three (6%) failed to follow any Commandments, with final score 0%. The most commonly violated Commandments were #9: appropriate mesh placement (58%) and #6: evaluate, reduce cord lipoma (52%). There was no correlation between final adjusted score and video length, video age, views, comments, likes, dislikes, or country of origin ($p > 0.05$).

The final adjusted score was stratified by operative approach: TAPP/TEP/rTAPP [Fig. 1], showing significant variance in performance on Kruskal–Wallis comparison of all three groups ($p = 0.016$). On post hoc analysis, videos employing the TEP technique had significantly higher scores than those using the rTAPP technique ($p = 0.008$). There was no statistically significant difference between the TEP and laparoscopic TAPP scores ($p = 0.059$) and between the rTAPP and laparoscopic TAPP scores ($p = 0.090$).

Table 2 The "9 Commandments" of the critical view of the myopectineal orifice

The Commandments	Followed: yes (%)	Followed: no (%)	Indeterminant (%)
1. Wide medial dissection	38 (76)	12 (24)	0 (0)
2. Evaluate/reduce direct hernia	40 (80)	10 (20)	0 (0)
3. Space of Retzius dissection	40 (80)	10 (20)	0 (0)
4. Evaluate/reduce femoral hernia	29 (58)	21 (42)	0 (0)
5. Isolation of cord structures	38 (76)	12 (24)	0 (0)
6. Evaluate/reduce cord lipoma	21 (42)	26 (52)	3 (6)
7. Space of Bogros dissection	28 (56)	20 (40)	2 (4)
8. Appropriate fixation	35 (70)	13 (26)	2 (4)
9. Appropriate mesh placement	20 (40)	29 (58)	1(2)
Total commandments obeyed (0–9) (mean ± σ [median])	5.78 ± 2.90 [7]		
Adjusted score (0–100%)	65.5 ± 31.5 [77.8]		
Adjusted score by operative approach (0–100%) (mean ± σ [median])			
TEP	77.8 ± 27.7 [88.9]		
TAPP	62.3 ± 30.5 [77.8]		
rTAPP	33.3 ± 32.7 [33.3]		
Kruskal–Wallis	$p = 0.016$		

Final adjusted score was calculated based on the percentage of evaluable Commandments followed in each video

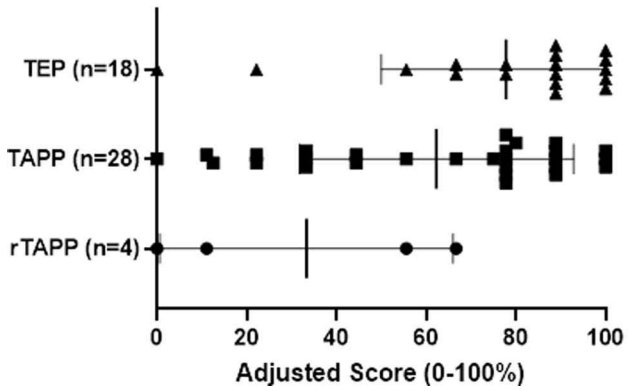

Fig. 1 Final adjusted as score stratified by operative approach for MIS inguinal hernia repair. Means (long vertical line) and standard deviations (short vertical lines) are noted for each approach (TEP, TAPP, rTAPP). Significant variance was demonstrated on Kruskal–Wallis comparison of all three groups ($p=0.016$). Post hoc analysis shows a significant difference between TEP and rTAPP adjusted scores ($p=0.008$) and no significant difference between TEP and TAPP or rTAPP and TAPP adjusted scores

Table 3 Technical errors and safety concerns as noted by Reviewers

	$n=50$
Technical errors	
Misidentified anatomy (%)	3 (6)
Split mesh (%)	5 (10)
Mesh "clamshell" (%)	17 (34)
Inadequate peritoneal closure (%)	1 (2)
High-risk maneuvers	
Rough handling of tissue (%)	15 (30)
Dangerous fixation (%)	9 (18)
Threatened critical structure (%)	16 (32)

During the evaluation process, reviewers also made additional comments regarding quality of tissue handling, common pitfalls, and any notably dangerous technique in the videos. They commented that nearly all videos (46, 92%) demonstrated at least one serious technical error or high-risk maneuver [Table 3]. Technical errors included misidentified anatomy, splitting of the mesh to encircle the spermatic cord, inappropriate folding in the mesh by the end of operation, and poor peritoneal closure. High-risk maneuvers were present in 23 (46%) of the videos and included: rough tissue handling (e.g., frequent tearing of tissue), dangerous placement of fixation (e.g., tacks or sutures into the triangle of pain, triangle of doom, and in one case directly into the inferior epigastric artery), and threatened critical structures (e.g., nerves, vessels, cord structures, or intestine) [Fig. 2]. There was no association between operative approach and technical errors or high-risk maneuvers.

Discussion

Our study shows that 84% of the 50 most viewed surgical videos on YouTube failed to demonstrate best practices in MIS inguinal hernia repair, as outlined by the 9 Commandments for critical view of the MPO. The majority of the videos also exhibited serious technical errors and concerning high-risk maneuvers (92%). In addition to suboptimal technique, nearly half of displayed serious safety concerns.

Subgroup analysis of the surgical videos demonstrated that surgeons who performed rTAPP were significantly less likely to follow the 9 Commandments than those performing laparoscopic TEP ($p=0.008$). This was an unexpected finding, as the learning curve for robotic approach has been shown to be shallower than laparoscopic approach [16,

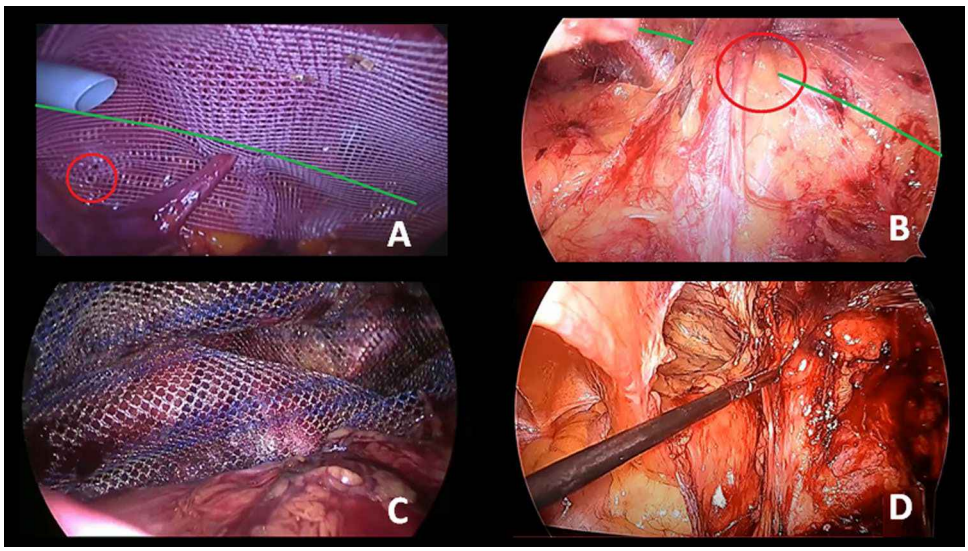

Fig. 2 Examples of violated commandments, intraoperative technical errors, and safety concerns. (Green line delineates iliopubic tract). **A** Violation of Commandment #8 with dangerous fixation with tacks (red circle) placed in the triangle of pain. **B** Violation of Commandment #6 with a retained cord lipoma (red circle). **C** Violation of Commandment #9, with poor retroperitoneal dissection resulting in excessive folding of mesh upon desufflation. **D** Rough handling of tissue with direct grasping of the vas deferens (Color figure online)

17]. To help explain this finding, we analyzed the dates of video publishing. We found no significant difference in age between TEP and rTAPP. We cannot comment on the difference in experience of the surgeons who posted the videos. Alternatively, perhaps rTAPP has enabled a subset of surgeons that may be less facile with advanced laparoscopic principles to perform and post videos of their repairs.

In summary, our study suggests that non-vetted video resources, though free and readily accessible, should not be relied upon. Trainees and surgeons seeking to advance their learning should rely on vetted video sources, such as those provided by private production companies (e.g., Giblib) and surgical societies (e.g., SAGES).

Our conclusions are based on review of videos by three hernia experts. To mitigate bias, reviewers were selected from separate institutions in multiple countries. Reviewers were not affiliated with any of the reviewed videos or the operating surgeons. We confirmed high internal consistency amongst the reviewers (Cronbach's alpha 0.865). The reviewers were only able to score the videos based on edited versions published on YouTube. As a result, 1.7% of Commandments could not be evaluated; these were adjusted for final scoring.

We chose the 9 Commandments as our scoring system as this is the best delineation of steps for MIS inguinal hernia repair. Though the 9 Commandments have been touted by hernia experts to be valid, it has not itself been internally validated as an assessment tool. The goal of the Commandments was to delineate critical steps in viewing the MPO with the goal of minimizing complications and improving outcome. No study has as yet confirmed that following these steps will assure lower complications and improve outcome. It would be a useful study to correlate following the 9 Commandments with patient outcome after MIS inguinal hernia repair. In order to improve education of surgical technique, we also believe it is important to validate a cognitive task analysis for MIS inguinal hernia beyond laparoscopic TEP [18].

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Compliance with ethical standards

Disclosures Desmond Huynh, Negin Fadaee, Hakan Gök, Andrew Wright, Shirin Towfigh have no conflicts of interest or financial ties to disclose.

References

1. Pugh CM, Watson A, Bell RH et al (2009) Surgical education in the internet Era1. J Surg Res 156(2):177–182. https://doi.org/10.1016/j.jss.2009.03.021
2. McGee JB, Begg M (2008) What medical educators need to know about "Web 2.0". Med Teach. 30(2):164–169. https://doi.org/10.1080/01421590701881673
3. Learn from the world's best doctors, online | GIBLIB. https://www.giblib.com/. Accessed 7 May 2020
4. WebSurg, the online university of IRCAD. https://websurg.com/en/. Accessed 17 May 2020
5. SAGES TV: Laparoscopy and Endoscopy Surgery Videos. https://www.sages.org/video/. Accessed 7 May 2020
6. Press - YouTube. https://www.youtube.com/about/press/. Accessed 7 May 2020
7. Rapp AK, Healy MG, Charlton ME, Keith JN, Rosenbaum ME, Kapadia MR (2016) YouTube is the most frequently used educational video source for surgical preparation. J Surg Educ 73(6):1072–1076. https://doi.org/10.1016/j.jsurg.2016.04.024
8. Frongia G, Mehrabi A, Fonouni H, Rennert H, Golriz M, Günther P (2016) YouTube as a potential training resource for laparoscopic fundoplication. J Surg Educ 73(6):1066–1071. https://doi.org/10.1016/j.jsurg.2016.04.025
9. Topps D, Helmer J, Ellaway R (2013) YouTube as a platform for publishing clinical skills training videos. Acad Med 88(2):192–197. https://doi.org/10.1097/ACM.0b013e31827c5352
10. Sanford DE, Strasberg SM (2014) A simple effective method for generation of a permanent record of the critical view of safety during laparoscopic cholecystectomy by intraoperative "Doublet" photography. J Am Coll Surg 218(2):170–178. https://doi.org/10.1016/j.jamcollsurg.2013.11.003
11. YouTube. https://www.youtube.com/. Accessed 20 June 2020
12. The HerniaSurge Group (2018) International guidelines for groin hernia management. Hernia 22(1):1–165. https://doi.org/10.1007/s10029-017-1668-x
13. Reitano E, Cavalli M, de'Angelis N, Loriau J, Campanelli G (2020) Educational value of surgical videos on transabdominal pre-peritoneal hernia repair (TAPP) on YouTube. Hernia J Hernias Abdom Wall Surg. https://doi.org/10.1007/s10029-020-02171-0
14. Kurashima Y, Feldman LS, Al-Sabah S, Kaneva PA, Fried GM, Vassiliou MC (2011) A tool for training and evaluation of laparoscopic inguinal hernia repair: the Global Operative Assessment of Laparoscopic Skills-Groin Hernia (GOALS-GH). Am J Surg 201(1):54–61. https://doi.org/10.1016/j.amjsurg.2010.09.006
15. Daes J, Felix E (2017) Critical view of the myopectineal orifice. Ann Surg 266(1):e1–e2. https://doi.org/10.1097/SLA.0000000000002104
16. Tam V, Rogers DE, Al-Abbas A et al (2019) Robotic inguinal hernia repair: a large health system's experience with the first 300 cases and review of the literature. J Surg Res 235:98–104. https://doi.org/10.1016/j.jss.2018.09.070
17. Bansal VK, Krishna A, Misra MC, Kumar S (2016) Learning Curve In Laparoscopic Inguinal Hernia Repair: experience at a Tertiary Care Centre. Indian J Surg 78(3):197–202. https://doi.org/10.1007/s12262-015-1341-5
18. Zendejas B, Peyre SE, Smink D et al (2011) Cognitive task analysis of the laparoscopic totally extraperitoneal (TEP) inguinal hernia repair: efficiency, slow-down moments and teaching principles. J Am Coll Surg 213(3, Supplement):S127. https://doi.org/10.1016/j.jamcollsurg.2011.06.304