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# Assessing the educational value and content of YouTube videos for ultrasound-guided subclavian vein catheterization

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## Abstract

**Background:** The European Society of Anaesthesiology (ESA) published a guideline regarding continuous ultrasound guidance for central venous catheters in 2020. YouTube has been a popular educational platform since its inception. The purpose of the present study was to evaluate the adequacy of videos on ultrasound-guided subclavian vein catheterization posted on YouTube based on this guideline.

**Method:** YouTube was scanned using the keywords associated with ultrasound-guided subclavian vein catheterization and 46 of the 106 most-watched videos were included in the study. The videos were divided into three groups, as individual, manufacturer, and academic according to their sources, and were evaluated as poor, satisfactory, and good in terms of the overall content. The videos were then evaluated based on ESA's six-title guide for more specific informational content.

**Results:** A total of 46 videos were reviewed and 52.2% ($n=24$) were found to be prepared by individuals. Among the videos, the rate of videos describing only venipuncture (poor) was 23.9% ($n=11$), 73.9% ($n=34$) of videos described the verification of the guidewire location with venipuncture, and 2.2% of videos described all the recommendations suggested by the guide ($n=1$). At the end of the catheterization procedure, 4.3% ($n=2$) stated that the catheter location should be confirmed by using ultrasound, 15.2% ($n=7$) recommended chest-X-ray, and 80.4% ($n=37$) did not suggest any.

**Conclusion:** Manufacturer and academic videos can be watched due to their high-quality scores, but it may be practical to prepare training videos with guidelines both for educators and students to have global access to the renewed guideline information.

## Keywords

YouTube, subclavian vein catheterization, ultrasound

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## Introduction

YouTube is a video-sharing platform that was founded in 2005 and has since gained popularity as an educational platform hosting countless videos for medical practice. YouTube is preferred for sharing informative videos because it does not require a paid subscription, allowing trainees to readily combine their theoretical knowledge with visual materials.[1] The platform is also convenient in providing practical details not generally included in textbooks or written information sources and the ability to learn from alternative videos. This visual information bridges the gap between textbook information and bedside clinical practice. For this reason, YouTube has become a global educational tool, especially for young students and residents.[2] Despite all these advantages, viewers must be cautious about the accuracy of the information in the videos. One important concern is the disparity between the number of views and likes of YouTube videos and the

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accuracy of their information. With widespread use, it is important to ensure good quality with accurate and complete medical information in YouTube videos.[1,2]

Central venous catheters, especially subclavian vein catheters, are commonly used in the perioperative period and the intensive care setting. Central venous catheter insertion is an invasive procedure with serious potential complications such as arterial puncture and pneumothorax.[3] To mitigate these risks, the use of ultrasound (USG) in subclavian vein catheterization has become popular in the last two decades and USG-guided venous puncture is the gold standard technique for subclavian vein catheterization.[4] Continuous use of real-time USG is also recommended to avoid catheter misplacement. The European Society of Anaesthesiology (ESA) guideline for "perioperative use of ultrasound-guided for vascular access" in 2020 provides the most recent information on best practices and evidence-based standards.[5] The purpose of the present study was to evaluate the informational content of videos posted on YouTube based on this guide.

## Methods

On YouTube (http://www.youtube.com), the following keywords "ultrasound-guided subclavian central line," "ultrasound-guided subclavian central line insertion," "ultrasound-guided subclavian vein cannulation," "US-guided subclavian central line," and "USG-guided subclavian line insertion" were systematically searched on November 21st, 2022 and the most viewed videos were determined using YouTube's default settings. The 106 selected videos were watched by two reviewers (TS and BB). Videos not in English, missing audio or text, irrelevant (internal jugular vein, arterial cannulation), duplicates of other videos, made for the pediatric/neonatal patient groups, explained on a mannequin, not involving the use of USG, or with resolutions lower than 360p were excluded from the study.

## Evaluation criteria of videos

The date of publication, video duration, view count, number of likes, comments, and the source of the videos were recorded. The videos were divided into three groups according to their source: individual (unaffiliated), academic (associated with a university or prepared for educational purposes), and manufacturer (associated with an ultrasonography manufacturer). The videos were also divided into three groups based on quality: poor (only describes the anatomy of the insertion site and vein localization with ultrasound), satisfactory (explains venipuncture and guidewire location with ultrasound guidance), and good (describes all the steps recommended by the ESA guideline).[5]

For an evaluation of the accuracy and reliability of the videos, the ESA guideline on perioperative use of USG-guidance for vascular access (PERSEUS vascular access) was used.[5] The guideline consists of six titles: identification of the anatomy of the insertion site and localization of the vein, confirmation of vein patency, using real-time USG guidance for puncture of the vein, confirming needle position in the vein, confirming wire position in the vein, confirming catheter position in the vein. All sub-items under these six headings were given 1 point (Figure 1). The quality of the video contents was given a score with a maximum of 12. All evaluations were performed independently by the two authors and videos that received different scores were re-evaluated. The percentage of the ESA guideline subheadings that each video followed was visualized using a heatmap (Figure 2). The quality of the videos prepared before and after the publication of the guideline was also compared.

Additionally, the videos were evaluated in terms of essential recommendations for clinical practice, such as the indications and complications of subclavian vein catheterization, including the supraclavicular approach, as well as recommendations for validating the location of the catheter.

## Statistical analyses

Statistical analysis was performed using the SPSS v25.0 statistics package (IBM, Armonk, USA). Categorical variables are given as numbers and percentages, and continuous parameters are given as mean and standard deviation. Categorical variables were compared using the Chi-square test. Continuous variables with normal distribution were compared using Student's *t*-test, and continuous variables without normal distribution were compared using the Mann-Whitney *U* and Kruskal-Wallis tests. For visualization of data, the ggplot2 package of R for Windows version 4.2.1 was used. Significance was set as $p < 0.05$.

## Results

After searching for the specified keywords on YouTube on November 21st, 2022, a total of 106 videos were evaluated. Videos without audio ($n = 6$), that did not use USG ($n = 28$), addressing pediatric/neonatal patients ($n = 7$), duplicate videos ($n = 9$), describing internal jugular or arterial catheterization ($n = 7$), and those describing the procedure on mannequins ($n = 3$) were all excluded from the study. The 46 remaining videos were evaluated in terms of content quality (Table 1). Thirty (65.2%) of the reviewed videos were produced before 2020, and 16 (34.8%) were produced after 2020. Twenty-four (52.2%) videos were produced by individuals, six (13.0%) by academic institutions, and 16 (34.8%) by manufacturers. Among the reviewed videos, 15 (32.6%) explained the indications of subclavian vein catheterization, 25 (54.3%) included the potential complications, and 12 (26.1%) described both the infraclavicular and the supraclavicular approaches. Regarding confirmation of the catheter position at the end of the procedure, two videos (4.3%) recommended the use of USG, seven videos (15.2%) recommended chest X-ray,

| Ultrasound-guided subclavian vein catheter placement Quality score | Score |
|---|---|
| 1. Identify anatomy of insertion site and localization of the vein | |
| E1. Identify vein, artery, anatomical structures | 1 |
| E2. Check for anatomical variations | 1 |
| E3. Use short axis (transverse; A) and long axis (longitudional; B) view | 1 |
| E4. Perform this step before prepping and draping of the puncture site | 1 |
| 2. Confirm patency of the vein | |
| E5. Use compression ultrasound to exclude venous thrombosis | 1 |
| E6. Use colour Doppler imaging and Doppler flow measurements to confirm the patency of the vein and to quantify blood flow | 1 |
| 3. Use real-time US guidance for puncture of the vein | |
| E7. Use an aseptic approach | 1 |
| E8. Use a short axis/out-of-plane (A) or a long axis/in-plane (B) approach | 1 |
| E9. Try to the tip of the needle during the needle approach to the vein and puncture of the vein | 1 |
| 4. Confirm needle position in vein | |
| E10. Confirm that the needle tip is placed centrally in the vein before the guide wire | 1 |
| 5. Confirm wire position in vein | |
| E11. Confirm the correct position of the guide wire in a short axis (a) and a long axis (b) view | |
| 6. Confirm catheter position in vein | |
| E12. Confirm the correct position of the central venous catheter in the vein in a short axis (a) and a long axis (b) view | 1 |
| TOTAL | 12 |

**Figure 1.** Ultrasound-guided subclavian vein catheter placement quality score.

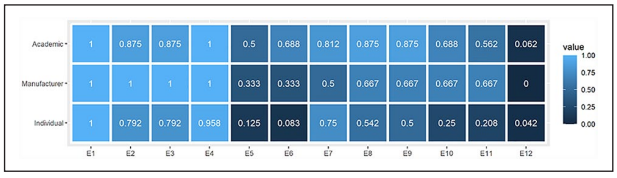


**Figure 2.** Heatmap to visualize the percentages of the subheadings of the ESA guideline against video sources.

and 37 videos (80.4%) did not mention any method. Eleven videos (23.9%) described only venipuncture and consequently were of poor quality. Twenty-four (73.9%) videos described the verification of the guidewire location using venipuncture, which was considered satisfactory quality. Only one (2.2%) video described all the recommendations suggested by the guideline and was of good quality. The details of the evaluation of the videos for their quality are given in Table 2.

## Discussion

In our analysis of YouTube videos on ultrasound-guided subclavian vein catheterization using the 2020 ESA guidelines on "perioperative use of ultrasound-guided for vascular access (PERSEUS vascular access)" as a reference, only one video was identified that included all the steps in the guideline, which was prepared by an academic institution. Additionally, regardless of the source, the majority of the videos contained no recommendations about confirming the catheter position after the procedure.

Conditions in which face-to-face education was disrupted, such as during the Covid-19 pandemic, reminded the medical community that YouTube videos were a useful educational tool, however, video contents must be correct and thorough to provide high-quality educational material. When the videos on the YouTube platform were examined, half were produced by individuals, most of which had low quality. The first and third sections of the ESA guideline (both identification of the anatomy of the insertion site by localization of the vein and puncturing of the vein using real-time USG guidance) are explained in almost all of the videos, regardless of their source. Nearly all videos from individual sources contain only this information or continue the procedure without the use of USG. The following steps (confirming vein patency and wire position in the vein) recommended by the ESA guideline are not explained in most videos by individuals. During subclavian vein catheterization, the main challenge for the practitioner is the visualization of the targeted vein and puncture of the central vein before catheterization.[6] Because most of the videos by individuals were published before the publication of the ESA guideline, they appear to have focused on

**Table 1.** Evaluation of the contents of the videos.

| | |
|---|---|
| Video duration (s) | 470.6 ± 364.9 |
| Upload date | |
| <2020 | 30 (65.2%) |
| ⩾2020 | 16 (34.8%) |
| Views | 36,226.6 ± 76,863.0 |
| Likes | 175.0 ± 252.5 |
| Comments | 4.3 ± 7.8 |
| Indication | |
| Yes | 15 (32.6%) |
| No | 31 (67.4%) |
| Complication | |
| Yes | 25 (54.3%) |
| No | 21 (45.7%) |
| Method | |
| Supraclavicular | 12 (26.1%) |
| Infraclavicular | 45 (97.8%) |
| Total points | 7.24 ± 2.6 |
| Source | |
| Individual | 24 (52.2%) |
| Academic | 6 (13.0%) |
| Manufacturer | 16 (34.8%) |
| Guidance | |
| USG | 2 (4.3%) |
| X-ray | 7 (15.2%) |
| None | 37 (80.4%) |
| Quality | |
| Poor | 11 (23.9%) |
| Satisfactory | 34 (73.9%) |
| Good | 1 (2.2%) |

Number of videos (percent). Mean ± standard deviation.

these steps (Figure 3). It has been demonstrated that ultrasound-guided cannulation is safer and more effective than the USG assistance method.[7] These steps mentioned in the ESA guideline are important to ensure better outcomes, reduce complications, and increase success rates.[5] The most common shortcoming in the videos was the absence of these steps. Another frequent shortcoming was the mislabeling of the axillary vein as the subclavian vein. The ultrasound-guided infraclavicular approach described in the reviewed videos is actually a puncture of the axillary vein, it only becomes the subclavian vein when it crosses the lateral border of the first rib.[5]

The second step in the ESA guideline (confirming vein patency by compression and color Doppler) was explained in only 14 videos, nine of which were prepared by the academic institutions. A fundamental advantage of USG imaging is the demonstration of vein patency before cannulation and patients exposed to repeated venous cannulation are more likely to have thrombosed veins.[7] Unfortunately, this step is among the least mentioned in the videos. It is important to detect venous anomalies such as anatomic diameter changes, non-compressible veins, stenosis, and thrombosis, as well as visualization of the appropriate vessel and needle tip for safe subclavian catheter insertion.[6,7] Any of these venous anomalies can lead to failure of guidewire and catheter placement. Compression and using color Doppler are accurate and time-saving methods for the detection of thrombosed veins.[6–11] However, as seen in the heatmap summary, the majority of the videos lacked a suggestion on the use of color Doppler during the procedure.

The fourth step of the guideline (confirming that the needle tip is placed centrally in the vein before guidewire advancement) was explained in 21 videos, 11 of which were from academic institutions, four from manufacturers, and six from individual sources. The fifth step (confirming the correct position of the guidewire in short-axis and long-axis views) was explained in 18 videos, nine of which were from academic institutions, four from manufacturers, and five from individual sources. The fourth and fifth steps were missing in most videos, constituting a major flaw. During venipuncture, confirmation of the needle tip in a short-axis view was the most important step for preventing hematoma formation and arterial puncture.[4] Guidewires and catheters can rarely migrate retrogradely from the subclavian to the internal jugular vein, and the use of USG for guidewire and catheter navigation has been strongly suggested by ESA guidelines because it allows redirecting wires and catheters ensuring a correct direction and placement.[5] Adrian et al.[8] reported a 14.6% rate of misplacement of guidewires to the ipsilateral internal jugular vein or the left brachiocephalic vein during right infraclavicular subclavian catheterization. Poth et al.[4] also demonstrated the value of continuous USG guidance in correcting guidewire advancement in their case report. This finding strongly supports the necessity of detecting the location of the guidewire using USG during the procedure.[7] In manufacturer and academic institution-produced videos, it was more frequently mentioned that the guidewire location must be determined using USG, therefore, these videos had higher quality scores (Figure 4). We recommend videos from these two sources for educational purposes over individual sources.

The last step of the guideline (confirming the correct position of the central venous catheter in the vein in short and long-axis views) was explained in only two videos, one from an academic source and the other from an individual. The vast majority of videos, regardless of the source, had no recommendations about checking the final catheter position and excluding post-procedural lung complications. In a meta-analysis published in 2018, Smit et al. reported the rates of central venous cannula malposition and pneumothorax as 6.8% and 1.1%. Moreover, the mean time for catheter location to be confirmed using chest-X-ray was 34.7 min, compared with only 2.83 min on average with USG.[12] Saul et al.[13] argued that USG was reliable in detecting the occurrence of pneumothorax and locating the catheter tip, also stating that USG had the advantages of saving time, no need to transfer the patient, and no

**Table 2.** Evaluation of the videos according to the qualification category.

| | Poor ($n=11$) | Satisfactory and Good ($n=35$) | $p$ Value |
|---|---|---|---|
| Video duration (s) | 391.0 ± 348.5 | 495.6 ± 371.2 | 0.461 |
| Upload date | | | 0.722 |
| <2020 | 8 (72.7%) | 22 (62.9%) | |
| ⩾2020 | 3 (27.3%) | 13 (37.1%) | |
| Views | 37,238.8 ± 46,960.4 | 35,908.5 ± 84,677.4 | 0.144 |
| Likes | 254.0 ± 273.2 | 150.2 ± 244.5 | 0.151 |
| Comments | 7.3 ± 10.7 | 3.3 ± 6.5 | 0.111 |
| Indication | | | 0.074 |
| Yes | 1 (9.1%) | 14 (40.0%) | |
| No | 10 (90.9%) | 21 (60.0%) | |
| Complication | | | **0.039** |
| Yes | 3 (27.3%) | 22 (62.9%) | |
| No | 8 (72.7%) | 13 (27.1%) | |
| Method | | | |
| Supraclavicular | 2 (18.2%) | 19 (28.6%) | 0.701 |
| Infraclavicular | 10 (90.9%) | 35 (100.0%) | 0.239 |
| Total points | 5.1 ± 1.9 | 7.9 ± 2.4 | 0.001 |
| Source | | | 0.193 |
| Individual | 8 (72.7%) | 16 (45.7%) | |
| Academic | 3 (27.3%) | 13 (37.1%) | |
| Manufacturer | 0 (0%) | 6 (17.1%) | |
| Guidance | | | 0.554 |
| USG | 0 (0%) | 2 (5.7%) | |
| X-ray | 1 (9.1%) | 6 (17.1%) | |
| None | 10 (90.9%) | 27 (77.1%) | |

Number of videos (percent). Mean ± standard deviation. $p < 0.05$ was accepted as significant, marked bold.

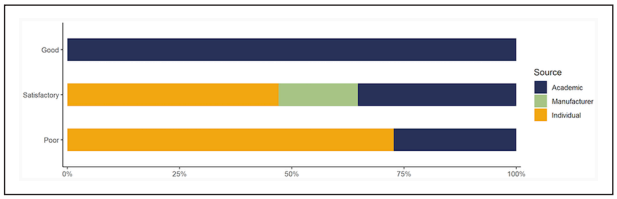


**Figure 3.** Ultrasound-guided subclavian vein catheter placement quality score.

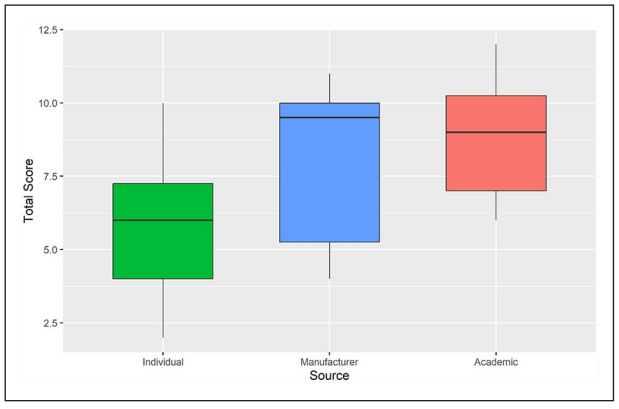


**Figure 4.** Scores of the videos according to the ESA guideline. Data were presented as mean ± standard deviation.

exposure to radiation. The most frequently missing step of the guideline in the reviewed videos was this last step.

Only 12 videos contained information on the supraclavicular approach for subclavian vein cannulation. Although both the supraclavicular and infraclavicular approaches are widely used, there is no consensus on which approach is better.[5] The supraclavicular approach has a clearer insertion site and avoids acoustic shadowing from the clavicle, unlike the infraclavicular approach. However, this approach is characterized by a higher risk of pneumothorax, as the needle is directed toward the pleura. The infraclavicular approach is also more advantageous in terms of the exit site, which allows the catheter to lie in a stable area suitable for dressing and patient comfort.[7] Furthermore, although the supraclavicular exit site can be considered acceptable, it is not ideal for catheter and dressing stability, nor resistance to bacterial colonization when compared with the infraclavicular approach.[14]

Several factors limited our analysis. First, the number of views, likes, and comments on YouTube videos did not always reflect their quality in our opinion, because earlier videos had naturally been watched and interacted with more. Earlier videos were also liked and commented on based on the information current at the time. Some of the

videos were closed for comments, not allowing such an analysis. Although 16 videos were produced after 2020 when the guideline was published, only four recommended the supraclavicular approach, six recommended using color Doppler, and only one recommended using USG to confirm the catheter location. We think that this is a critical piece of information, however, there was no difference in view counts of videos with or without these recommendations. Many authors emphasized that YouTube videos could be used for educational purposes, but missing information has to be considered when making use of these videos.[1] The use of USG-guided subclavian catheter insertion has significant benefits in terms of patient safety and procedure quality. Although its clinical benefits are widely accepted, we think that a guideline must be created for training videos to enhance the education and skills of trainees on this subject in our era when social media is a common learning tool.

In the present study, the informational content of YouTube videos for USG-guided subclavian vein cannulation was reviewed. Learners should be aware of the limitations and potential complications of videos before using them as an educational resource. YouTube videos can be beneficial in medical practice, but there can be gaps in the information presented, which is why peer-review and oversight are important for ensuring patient safety. Major medical associations should be responsible for reviewing videos and making sure they align with current guidelines and best practices, and retracting any unsafe videos. As central vein cannulation guidelines are updated, we propose that training videos must be prepared by associations in conjunction with the publication of the new guidelines. Considerations from the present study should be used to enhance the quality of training videos in the future.

## Declaration of conflicting interests

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## Ethical approval

No ethical approval was required for this project because of the design of the study.

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## Supplemental material

Supplemental material for this article is available online.

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