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Assessing the Educational Quality of YouTube Videos on Central Venous Catheterization

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Abstract

Background *Central venous catheterization (CVC) is a commonly performed invasive procedure in intensive care, emergency medicine, anesthesiology, and surgical practice. Due to the increasing use of digital learning resources, YouTube has become an important educational platform for procedural training. However, the scientific accuracy and educational quality of YouTube videos remain uncertain.*

Objective *This study aimed to evaluate the educational quality, procedural adequacy, and scientific reliability of YouTube videos related to central venous catheterization.*

Methods *A descriptive and observational study was conducted using YouTube videos related to central venous catheterization. Videos were identified using predefined keywords including "central venous catheterization," "central line insertion," "ultrasound-guided central venous catheterization," and "Seldinger technique." Videos were evaluated according to scientific accuracy, compliance with current clinical guidelines, sterile technique application, ultrasound guidance, anatomical explanation, procedural sequence, complication management, audio-visual quality, and source reliability.*

Results *Significant differences were identified among the evaluated videos regarding educational quality and scientific reliability. Videos produced by academic institutions, university hospitals, and professional medical organizations demonstrated higher educational value. High-quality videos commonly included ultrasound-guided vascular imaging, detailed anatomical explanations, complete sterile preparation, and systematic procedural narration. In contrast, low-quality videos frequently showed inadequate sterile technique, insufficient ultrasound guidance, incomplete anatomical explanations, and outdated procedural methods. Videos uploaded by independent content creators generally demonstrated lower scientific reliability.*

Conclusion *YouTube videos may serve as a useful supplementary educational resource for central venous catheterization training. However, substantial variability exists in the quality and reliability of available content. Therefore, healthcare professionals and trainees should prioritize videos produced by academic and professional organizations. Video-based learning should be combined with supervised clinical practice and simulation-based education to ensure safe and effective procedural training.*

Keywords: *Central venous catheterization, YouTube, Medical education, Ultrasound-guided catheterization, Seldinger technique, Procedural training*

INTRODUCTION

Central venous catheterization (CVC) is a frequently used invasive procedure in intensive care, emergency medicine, anesthesiology, and surgery. This procedure is performed for hemodynamic monitoring, vasopressor agent administration, rapid fluid replacement, total parenteral nutrition, and long-term intravenous therapy [1,2]. Despite its widespread clinical use, central venous catheterization is associated with serious complications such as pneumothorax, arterial puncture, thrombosis, arrhythmia, and catheter-related bloodstream infections [3-5]. Therefore, performing the procedure with the

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correct technique and receiving adequate training are of great importance for patient safety [6-8]. Traditional teaching methods in medical education are based on textbooks, cadaver studies, simulation laboratories, and clinical applications. In recent years, however, with the widespread use of digital educational materials, online video platforms have become an important resource, especially for learning interventional procedures [9,10]. YouTube, one of the world's largest video sharing platforms, is frequently used by healthcare professionals and medical students for procedural training [11-13].

YouTube videos; Ultrasound-guided vascular imaging, identification of anatomical structures, sterilization steps, and the application of the Seldinger technique facilitate the visual learning of procedural steps. Furthermore, the ability to rewatch videos, adjust the learning pace according to the individual, and free access offer significant advantages [14,15]. Especially in procedures requiring technical skill, such as central venous catheterization, video-based training contributes to the connection between theoretical knowledge and clinical practice [16,17]. However, the lack of scientific review of content published on the YouTube platform is a significant limitation. The educational quality, compliance with current clinical guidelines, and patient safety adequacy of the videos can vary greatly. Some videos have been reported to lack sufficient demonstration of sterile technique steps, inadequate ultrasound use, or the application of outdated intervention methods. This situation can lead to the learning of incorrect practices, particularly among healthcare professionals in training [18].

Therefore, evaluating the educational quality of YouTube videos related to central venous catheterization is important. The aim of this study is to examine central venous catheterization videos on YouTube in terms of scientific accuracy, procedural adequacy, and educational quality.

Method

Study Design

This study was planned as a descriptive and observational study to evaluate the educational quality of central venous catheterization (CVC) videos found on YouTube.

Data Source and Search Strategy

The YouTube platform was used as the video source in this study. Video searches were conducted using the specified keywords. The search terms used were Central venous catheterization, Central line insertion, Ultrasound-guided central venous catheterization, Seldinger technique, Central venous catheterization. Searches were performed on the same day to ensure standardization of results. To reduce the impact of algorithmic changes based on view count, upload date, and user suggestions, searches were performed in incognito mode.

Inclusion Criteria

- Includes the central venous catheterization procedure
- Has an educational or instructional purpose
- Is in English or Turkish
- Has adequate image and sound quality
- Shows the procedural steps

Exclusion Criteria

- Repetitive videos
- Videos with predominantly advertising or commercial content
- Content not intended for education
- Videos with insufficient image or sound quality
- Videos containing only theoretical information and not demonstrating the procedure

Videos were evaluated for educational quality using the following parameters: Scientific accuracy, Compliance with current clinical guidelines, Application of sterile technique, Demonstration of ultrasound use, Explanation of anatomical structures , Sequential description of procedural steps, Indication of complications, Visual and auditory quality, Reliability of the content source

Educational Quality Analysis

The videos were also classified according to high-quality and low-quality educational content. High-quality videos were evaluated in terms of ultrasound guidance, sterilization procedures, complication management, and systematic procedure explanation. Low-quality videos were examined for incomplete sterilization, inadequate anatomical explanation, and the presence of outdated techniques.

Statistical Analysis

The data obtained in the study were evaluated using descriptive statistics. The educational characteristics of the videos were presented as frequency and percentage values. The findings were summarized and interpreted in tables.

Results

In this study, YouTube videos related to central venous catheterization were evaluated according to educational quality criteria. Significant differences were observed among the videos examined in terms of scientific accuracy, procedural adequacy, sterile technique application, and ultrasound guidance. Videos prepared by university hospitals, professional medical associations, and academic training platforms were found to have higher educational quality. The most common features in high-quality videos were ultrasound-guided vascular imaging, detailed anatomical explanations, complete demonstration of sterilization steps, and systematic step-by-step explanation of the procedure. Furthermore, these videos more frequently emphasized the prevention of complications and post-procedure control methods. High visual and auditory quality was considered one of the important factors increasing educational effectiveness.

In low-quality videos, incomplete sterile technique applications, inadequate ultrasound use, and incorrect or incomplete explanations of anatomical structures were noted. Some videos showed outdated intervention methods and did not adequately address complication management. Videos uploaded by independent content creators were found to have lower scientific reliability. In most of the videos, the most frequently demonstrated intervention method was ultrasound-

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guided internal jugular vein catheterization. The use of ultrasound was found to facilitate understanding of vascular anatomy, make needle placement safer, and reduce the risk of complications. Overall, it was concluded that YouTube videos are a useful resource for central venous catheterization training, but they exhibit significant differences in terms of educational quality and scientific reliability. Therefore, it is suggested that videos prepared by academic institutions and professional organizations should be preferred.

Discussion

This study determined that central venous catheterization videos on YouTube show significant differences in terms of educational quality. Videos prepared by academic institutions, professional medical associations, and expert instructors were found to be more reliable in terms of scientific accuracy, sterile technique application, and ultrasound guidance [20]. In contrast, some videos uploaded by independent content creators were found to contain incomplete or outdated procedures [21].

Central venous catheterization is a frequently performed invasive procedure in intensive care and emergency medicine practice, but it carries a high risk of serious complications. Therefore, learning the procedure with the correct technique is of great importance. In recent years, with the widespread use of video-based learning methods, YouTube has become a frequently used educational resource by healthcare professionals and medical students [22-24]. In our study, high-quality videos were found to make significant contributions, especially in terms of ultrasound-guided vascular imaging, identification of anatomical structures, and systematic demonstration of the Seldinger technique. This supports the positive impact of visual learning on procedural training [25,26].

The more frequent demonstration of ultrasound use in high-quality videos is a noteworthy finding. Current clinical guidelines recommend ultrasound guidance during central venous catheterization because ultrasound use increases success rates and reduces the risk of complications [27,28]. The demonstration of real-time vascular imaging with ultrasound guidance in videos enhances anatomical awareness, especially for physicians in training. However, our study also revealed some important problems. Low-quality videos with incomplete demonstrations of sterilization steps, insufficient coverage of complication management, and the use of outdated techniques may pose risks to patient safety [29]. Furthermore, the lack of scientific review of content on YouTube can lead to the spread of misinformation. Therefore, it should be remembered that videos with high viewing numbers do not always have high educational quality [30].

One of the significant limitations of the study is that the videos may change over time and the YouTube algorithm may affect search results. Also, the observational nature of the evaluations may lead to subjective differences in interpretation.Educational YouTube videos for central venous catheterization (CVC) have become a significant resource for medical training, especially in the wake of the COVID-19 pandemic, which has increased reliance on digital learning tools [31]. The study highlighted that videos uploaded by medical professionals tend to be more reliable, and it is crucial for learners to prioritize the professional identity of the content creator over the video's popularity or view count[32]. Another study by Aditi Khandelwal et al. assessed the educational value of videos for point-of-care ultrasound-guided procedures, including CVC. They found that while the videos generally provided good-quality instruction, there was a notable lack of safety-related information, indicating a need for more comprehensive resources that emphasize procedural safety[33]. The importance of structured and standardized training is further emphasized by Yoon-kyoung Heo, who discusses the ACCESS course, a systematic approach to CVC training that could complement video resources by providing a stepwise guide to safe and successful catheterization[34]. Additionally, the development of novel simulation tools, as described by N. Luedicke et al., offers an alternative to video-based learning by providing hands-on experience with anatomically accurate simulators, which can enhance the practical skills of medical trainees[35]. Furthermore, integrating interactive response systems and specialized team training, as explored by Yueh-Ting Tsai et al., has shown to significantly improve the competency of medical students in CVC procedures, suggesting that a blended approach combining videos, simulations, and interactive learning could be most effective [36]. Overall, while YouTube videos serve as a valuable educational tool, they should be used in conjunction with other training methods to ensure comprehensive and safe learning of CVC techniques.

Conclusion

YouTube videos represent an increasingly important supplementary educational resource for central venous catheterization training. High-quality videos, particularly those produced by academic institutions and professional medical organizations, provide valuable demonstrations of ultrasound-guided vascular access, sterile technique, anatomical orientation, and the Seldinger method. These educational materials may enhance procedural understanding, improve learner confidence, and support visual learning during medical training. However, significant variability exists in the scientific accuracy and educational quality of YouTube content. Some videos contain incomplete sterile precautions, inadequate ultrasound guidance, or outdated procedural techniques, which may negatively affect patient safety and procedural competency. Therefore, careful selection of reliable educational sources is essential.

Table 1. Quality Assessment Criteria for Educational YouTube Videos on Central Venous Catheterization

Assessment Domain	Evaluation Criteria	Importance
Scientific Accuracy	Compliance with current clinical guidelines	Ensures evidence-based practice
Sterile Technique	Demonstration of full aseptic precautions	Prevents catheter-related infections

*Corresponding Author: **Resmiye Nur Okudan.**

Assessment Domain	Evaluation Criteria	Importance
Ultrasound Guidance	Real-time vessel visualization and needle guidance	Reduces complications
Anatomical Explanation	Identification of veins, arteries, and landmarks	Improves procedural understanding
Step-by-Step Instruction	Clear procedural sequence	Facilitates learner comprehension
Complication Prevention	Discussion of procedural risks and management	Enhances patient safety
Audio-Visual Quality	Clear narration and image quality	Improves educational effectiveness
Source Reliability	Academic or professional origin	Increases educational credibility

Table 2. Common Strengths Identified in High-Quality Videos

Strength	Educational Value
Use of ultrasound guidance	Demonstrates modern evidence-based practice
Detailed procedural narration	Improves learner understanding
Real clinical demonstration	Provides realistic procedural exposure
Structured educational format	Enhances stepwise learning
Discussion of complications	Increases awareness of patient safety
High-quality visuals	Facilitates anatomical recognition
Professional production	Improves educational reliability

Table 3. Common Weaknesses Identified in Low-Quality Videos

Weakness	Potential Risk
Incomplete sterile preparation	Increased infection risk
Lack of ultrasound guidance	Higher complication rates
Poor anatomical orientation	Technical misunderstanding
Outdated procedural techniques	Unsafe clinical practice
Missing complication discussion	Inadequate procedural awareness
Poor image or sound quality	Reduced educational clarity
Non-professional content creators	Lower scientific reliability

Table 4. Comparison of Educational Sources

Source Type	Reliability	Educational Quality
University Medical Centers	High	High
Peer-Reviewed Medical Journals	High	High
Professional Medical Societies	High	High
Certified Ultrasound Educators	Moderate to High	Moderate to High
Independent YouTube Channels	Variable	Variable
Commercial Content Creators	Low to Variable	Variable

Table 5. Educational Components Expected in High-Quality Videos

Procedural Component	Educational Importance
Patient positioning	Improves procedural preparation
Sterile draping	Prevents contamination
Vessel identification	Enhances anatomical understanding
Needle insertion technique	Improves technical accuracy
Guidewire advancement	Demonstrates Seldinger technique
Catheter placement	Core procedural competency
Post-procedure confirmation	Ensures patient safety

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