

Assessing the Quality of Central Venous Catheter and Peripherally Inserted Central Catheter Videos on the YouTube Video-Sharing Web site

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Abstract

Background: Video sharing networks such as YouTube have revolutionized communication. Whilst access is freely available uploaded videos can contain non peer-reviewed information. This has consequences for the scientific and health care community, when the challenge in teaching is to present clinical procedures that follow empirical methods.

Objective: To review 50 central venous catheter and peripherally inserted central catheter videos posted on YouTube. The aim was to appraise these videos using current evidenced-based guidelines.

Methods: We searched YouTube using the key words central venous cannulation and peripherally inserted central catheter insertion on September 21, 2012. We consecutively reviewed 50 videos for both procedures.

Results: There was poor adherence to evidence-based guidelines in the critiqued videos. There was a difference in adherence with the use of appropriate skin antisepsis in the 2 groups (18% for central venous catheters vs 52% for peripherally inserted central catheters; $p=0.009$). And a large proportion in both groups compromised aseptic technique (37% for central venous catheters vs 38% for peripherally inserted central catheter; $p=0.940$). The use of ultrasound guidance during procedures was also different between the 2 groups (33% for central venous catheters vs 85% for peripherally inserted central catheters; $p=0.017$).

Conclusions: This critique of instructional videos related to the insertion of central venous catheters and peripherally inserted central catheters uploaded to YouTube has highlighted poor adherence to current evidence-based guidelines. This lack of adherence to empirical guidelines can pose risks to clinical learning and ultimately to patient safety.

Keywords: Centers for Disease Control and Prevention, central venous catheter, Clinical Excellence Commission, National Institute Clinical Excellence, peripherally inserted central catheter, video sharing networks

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Introduction

The advent of video sharing networks (VSNs) such as YouTube created enormous potential to link people and share information across the world. YouTube generates 1 billion unique visits per month¹ and has become a readily

available resource for teaching and learning with the increasing accessibility of the Internet across the globe.² Acquiring and developing competency in clinical procedural skills has evolved from the traditional *see one, do one, teach one* method to the use of instructional videos and structured scenario immersion aided by high-fidelity simulation.³ The YouTube platform is an exemplar of the effectiveness of VSNs in disseminating information. It has demonstrated effectiveness in generating viewership of clinical skills.⁴ It provides students with the ability to watch instructional material at their convenience and as frequently as needed until material is comprehended, thereby improving students' understanding from a visceral level to a deeper learning experience.⁵ Although there may be distinct advantages with using VSNs, some clinicians have voiced concern regarding the clinical quality of the information presented in such material.⁶ Content devoid of peer review poses a number of risks to a student's learning experience and can potentially increase patient safety risks. Clinical specialities such as cardiology and rheumatology have published concerning reviews of YouTube content specific to their specialities.⁶⁻⁸

We contend that instructional content on central venous catheter (CVC) and peripherally inserted central catheter (PICC) insertion pose similar risks with the potential existence of substandard instructional videos uploaded to YouTube. To our knowledge no critique of uploaded content in YouTube covering insertion of vascular access devices has ever been undertaken or published. CVCs and PICCs have many purposes in clinical areas with variable patient acuities. These include intravenous therapies that are unsuitable for peripheral administration, hemodynamic monitoring, and blood sampling for laboratory analysis.⁹ The accurate insertion and management of vascular access devices is an international issue. It is reported that >5 million CVCs are inserted each year in hospitalized patients in North America alone.^{10,11} The reported estimated incidence of peripheral intravascular device use is estimated to be >200 million devices per year.¹² The numbers relating to CVC and PICC use worldwide are unknown, but they are widely used in clinical environments.¹³

The increased use of CVCs and PICCs has seen a concomitant increase in associated adverse events that have contributed to patient mortality and morbidity.^{9,11} A number of factors have been identified that contribute to such adverse events, including experience, nonadherence to maximal barrier precautions, lack of real-time ultrasound use, and incorrect device and vessel selection.¹⁴ The implementation and use of predetermined insertion and maintenance bundles every time a device is placed or accessed for routine care can mitigate such risks. Bundles have proven to be effective in reducing and eliminating intravascular infections, particularly in confined settings such as intensive care units.¹⁵⁻¹⁹

Study Aim

The aim of our study was to critique the quality of CVC and PICC insertion procedures videos uploaded to YouTube and to assess if these videos follow current evidenced-based guidelines.

Methods

On September 21, 2012, we accessed the Internet and searched YouTube content. Our search terms were *central venous cannulation* and *peripherally inserted central catheter insertion*. Our critique concerned videos that displayed insertion of CVC and PICC videos. We found similar videos when we substituted *central venous cannulation* with *central venous catheterisation* and *catheters*. However, we found more procedures not related to central vascular access and therefore agreed on the *central venous cannulation* as the search term representing CVCs and *peripherally inserted central catheter insertion* as the search term representing PICCs.

We reviewed the first 50 consecutive videos that the YouTube search engine returned using *central venous cannulation*. Once we viewed the first video we returned back to the search results page and clicked on the subsequent video until we viewed 50 videos. We identified each video's source by using the uniform resource identifier unique to each YouTube video. We then entered the uniform resource identifier of each CVC video that met our inclusion criteria (ie, clinical insertion videos of CVC or PICC), into a spreadsheet program (Microsoft Excel; Microsoft Corp, Redmond, WA). We excluded mannequin and animation videos. We performed the same procedure with the term *peripherally inserted central catheter* and also excluded mannequin and animation videos.

We critiqued and scored included videos according to an assessment tool (see Table 1) established by the authors utilizing evidence-based guidelines from the Centers for Disease Control and Prevention, the Australian Clinical Excellence Commission, and the United Kingdom's National Institute for Health and Clinical Excellence.²⁰⁻²² Each set of guidelines advocated the use of maximal barrier precautions; monitoring the insertion with real-time ultrasound; applying

Table 1. Procedures Critiqued for Central Venous Catheter/Peripherally Inserted Central Catheter Insertions, Based on Evidence-Based Guidelines

1. Hand hygiene
2. Aseptic technique
3. Cap, mask
4. Goggles
5. Gown
6. Sterile gloves
7. Full sterile drape
8. Ultrasound preassessment
9. Ultrasound real time
10. Skin antisepsis prep with 2% chlorhexidine gluconate and 70% isopropyl alcohol

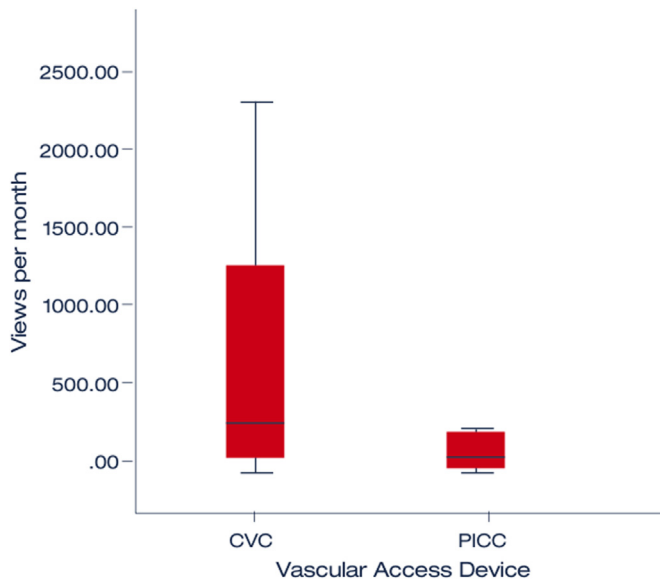


Figure 1. YouTube views. There was significant difference ($p=0.007$) between the type of central venous access (central venous catheter [CVC] or peripherally inserted central catheter [PICC]) viewed per month. Median values for CVC = 328 and PICC = 62).

skin antisepsis with chlorhexidine gluconate 2%; and donning personal protective equipment, such as a cap, mask, and protective eyewear. Each video for CVC and PICC insertion

techniques/instruction were scored for the presence of each assessment criterion, with 1 point awarded for each criterion covered. If all steps were covered, the highest score possible was 10. Data critique and scores were computed into a final rating out of 10. Data were exported into SPSS version 20 (SPSS IBM Company, Armonk, NY) for statistical testing.

Outcome Measures

The quality of the procedural moments between CVC and PICC insertions, as outlined in Table 1 concerned us and we wanted to find out if the quality of insertion type differed with respect to evidence based guidelines. We further focused our critique on use of maximal barrier precautions; use of ultrasound for PICC and CVC placement; and use of skin antisepsis, as outlined in our measurement tool. All of these procedures were evident in the included CVC and PICC videos. This is our rationale for our specific focus on 3 significant procedures. We also wanted to measure the difference in number of views per month from upload to September 21, 2012, to assess popularity of CVC and PICC videos.

Statistical Analysis

The Mann-Whitney U test assessed the median rating video score between CVC and PICC insertion videos viewed. Confidence intervals (calculated at 95%) were used to estimate the range in the views per month and adherence to evidenced-based guidelines. χ^2 Distribution and the Fisher exact test were used to assess differences in adherence to each evidence-based element.

Table 2. Central Venous Catheter (CVC) and Peripherally Inserted Central Catheter (PICC) Insertion Procedures Performed and Completed

Evidence-based procedures recommended by empirical guidelines	CVC ($n = 27$)		PICC ($n = 21$)		p
	n	%	n	%	
Hand hygiene displayed	0	0.0	4	18.1	.031
Aseptic technique compromised	10	37.0	8	38.1	.940
No cap worn	8	29.6	3	14.3	.304
No mask worn	8	29.6	2	9.5	.304
No gown worn	7	25.9	1	4.8	.064
Sterile gloves worn	27	100	21	100	1.00
Application of full sterile drape	22	81.5	19	90.5	.445
Ultrasound preassessment	10	37.0	7	33.3	.790
Ultrasound real-time	9	33.3	18	85.7	.017
Skin decontamination performed with 2% chlorhexidine gluconate and 70% isopropyl alcohol	5	18.5	11	52.4	.239

Results

Number of Viewings and Duration of the Videos

Twenty-seven CVC videos met the inclusion criteria for review. These contained an aggregated 708,993 views and 166 minutes 53 seconds of footage. 21 PICC insertion videos were included for final critique. These videos reviewed totalled 301,920 hits and consisted of a total of 189 minutes 44 seconds of footage.

There was a significant difference ($p=0.007$) between the type of central venous access device viewed per month (median number of times the videos were viewed was CVC = 328 and PICC = 62) (see Figure 1). The mean number of minutes uploaded of CVC and PICC videos was 7.59 minutes, with the longest video being 15.31 and the shortest 0.36 seconds. PICC videos had a mean running time of 6 minutes 16 seconds, whereas CVC videos returned a mean running time of 9 minutes 40 seconds.

Ultrasound

Of the total 27 CVC videos assessed, only 9 (33.3%) promoted real-time ultrasound guidance during insertion. This was different to PICC insertions where 18 (85.7%) used ultrasound guidance ($p<0.001$).

Skin Asepsis and Barrier Precautions

The proportion of videos where chlorhexidine gluconate was not identified as a necessary step in site preparation was different between the CVC and PICC insertion videos ($p=0.009$; Fisher exact). Only 5 (18%) CVC videos viewed displayed effective skin preparation supported by current empirical guidelines. Only 2 (10%) PICC videos viewed lacked full sterile drapes; however, we did not find a difference between the 2 groups ($p=0.327$). In our critique, poor adherence to aseptic technique was found in both groups ($p=0.940$) with 11 (41%) CVC videos compromised aseptic technique, whereas 8 (38%) PICC videos compromised aseptic technique (see Table 2).

Overall Ratings

PICC videos uploaded were more likely to have followed evidence-based guidelines. We found better adherence to evidence-based guidelines in the PICC video group compared with the CVC group. This is reflected in the median rating for PICC was significantly higher than CVC (Mann-Whitney U test $p=0.03$) (see Figure 2).

Discussion

This study is the first attempt to our knowledge that reviews the procedural aspects of central venous cannulation from a popular social media and VSN site. Instructional videos of CVC and PICC insertion procedures uploaded to VSNs should follow empirical guidelines that include bundles of care. The Association of Vascular Access launched a dedicated YouTube Channel at the 26th scientific meeting in San Antonio, TX in 2012. It intends to publish evidence-based vascular access videos and related procedures using current evidence-based practices.

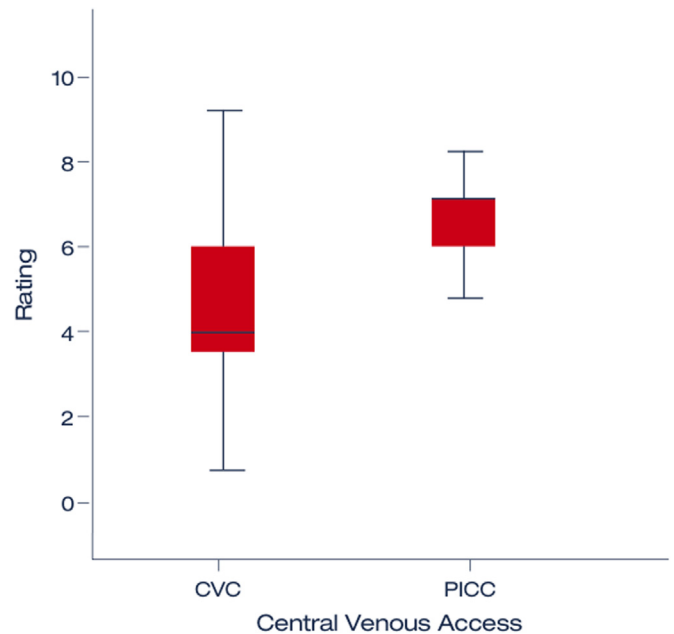


Figure 2. Evidence-based guidelines. Peripherally inserted central catheter (PICC) videos uploaded were more likely to have followed evidence-based guidelines than central venous catheter (CVC) videos. The median rating for PICC videos was significantly higher than CVC videos. Mann-Whitney U test $p=0.03$.

The CVC insertions videos we viewed should concern authors of vascular access guidelines, as well as clinicians and patient safety groups. Advocates for best practice, using evidence-based guidelines, should be made aware that translating evidence-based guidelines from “bench to bedside” is a real concern. The 27 CVC insertion videos reviewed revealed poor operator adherence to evidenced-based guidelines for real-time ultrasound guided CVC insertion. This lack of adherence to use of ultrasound guidance may be attributed to clinicians being unaware of such guidelines. The use of ultrasound has developed interesting critical questions and debate with its potential to mitigate procedural risk.^{23,24} Others advocate for comprehensive training and use of adjunct diagnostics (eg, combination of manometry/pressure transduction) to prevent inadvertent carotid puncture.^{25,26}

The first scientific paper detailing the effectiveness and efficacy of the use of real-time ultrasound in central line placement was published in 1986.²⁷ A decade later, a meta-analysis providing the superior benefits of real-time ultrasound insertion would improve the evidence base for ultrasound use.²⁸ In 2002, the National Institute for Health and Clinical Excellence published guidelines concerning the use of ultrasound-guided central line insertion.²⁹ Since then clinicians have witnessed technological advances in the past decade that improve safety when inserting CVCs and PICCs, and ultrasound has proven to be successful in reducing insertion-related complications and catheter malposition.³⁰

Table 3. Recommended Evidence-Based Videos of Central Venous Catheter and Peripherally Inserted Central Catheter Insertion

Central line insertion	https://www.youtube.com/watch?v=KzDrIUSBspQ
Peripherally inserted central catheter	https://www.youtube.com/watch?v=kXyeHUZ-2AA
Association for Vascular Access YouTube channel	http://www.avainfo.org/website/article.asp?id=281458

Poor insertion techniques, as were viewed in this study, will misrepresent the importance of vascular access procedures. This, combined with a lack of operator experience to recognize the insertion pitfalls, can lead to procedural complications such as pneumothorax, accidental arterial puncture, and catheter tip malposition. This can disrupt an understanding and awareness of standards expected in post-insertion procedures. We believe this will lead to intravascular infection during the dwell time of a vascular access device in particular when skin preparation and solutions are sub optimal.³¹ Several investigators have identified clinician procedural volume (ie, the number of devices inserted) as an important predictor of reduced adverse events.³²⁻³⁶ Increased experience with PICC placement has been shown to improve both procedural and patient outcomes.³⁶ As such, evidenced-based instructional videos are critical in improving insertion related outcomes with PICCs and CVCs. The emergence of a Global Medical Education Project³⁷ is proof of the benefits and future of open access online medical educational resources supporting evidence-based procedures.

It is well established in the literature that 2% chlorhexidine gluconate and 70% isopropyl alcohol is the appropriate, most effective solution for skin preparation before insertion of a vascular access device.³⁸⁻⁴⁰ In the CVC video group, only 18% ($n = 5$) accurately displayed skin preparation advocated by current empirical standards.^{38,41} A successful evidence-based vascular access procedure includes many individual facets, ranging from pre-insertion assessment to safe removal of the device. The actual needle insertion takes up only a small, but significant part of the procedure.

Limitations

Our study results should be interpreted in the context of some limitations. We only present the outcomes from 1 VSN. Further, our results represent the keyword(s) search strategy outlined in our methods.

Conclusions

YouTube and other VSNs can be a useful resource to display best practice for the insertion of CVCs and PICCs to large numbers, but our critique of CVC and PICC videos highlight the lack of adherence to current empirical guidelines. Health care professionals should compare and measure

vascular access videos based on current empirical guidelines. That such a significantly high percentage of videos from our sample displayed insertion techniques without real time ultrasound use is of concern. The videos we analyzed were misleading and may be unhelpful for clinicians who advocate best practices in vascular access.

The Association for Vascular Access has established its own dedicated YouTube vascular access channel. Submissions on all facets of vascular access are encouraged. These submissions will be subject to peer review by clinician and academic members who advocate for safety and excellence in all vascular access procedures. One advantage of this peer review will be the uploading of the best videos that reflect all the procedural steps of evidence-based guideline insertions (see Table 3).

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