Portable Video Media Versus Standard Verbal Communication in Surgical Teaching: A Prospective, Multicenter, and Randomized Controlled Crossover Trial

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OBJECTIVE: This study aims to evaluate the effectiveness of portable video media (PVM) compared to standard verbal communication (SVC) as a novel adjunct for surgical education of junior medical officers and medical students, in terms of knowledge acquisition and participant satisfaction.

BACKGROUND: The effective, continued education of final year medical students and junior doctors is the foundation of quality healthcare. The development of new media technologies and rapid internet streaming has resulted in an opportunity for the integration of PVM into medical education. PVM is an educational platform with the advantage of being standardized, efficient, and readily available.

DESIGN: This is a multicenter, prospective, and randomized controlled crossover study. Participants completed a preintervention knowledge test and were then randomized in an allocation ratio of 1:1 to receive surgical education regarding cystoscopy and ureteric stenting for acute renal colic via either PVM or SVC. A 32-point knowledge test and a modified Client Satisfaction Questionnaire-8 were then administered and the participants were then crossed over to the other educational method. The knowledge and satisfaction tests were then readministered.

RESULTS: Fifty-four participants were recruited for this study with 27 participants in each group. Both groups had a 18% to 20% increase in knowledge scores following the first intervention $p < 0.001$ and on crossover there was a further 4% increase in knowledge scores, $p < 0.01$. There was no significant difference between the groups in knowledge scores before intervention, $p = 0.23$ after first intervention $p = 0.74$ or following crossover $p = 0.09$. After first intervention, participants in the group receiving PVM education first had a significant 8% higher satisfaction score compared to the SVC group, $p = 0.023$.

CONCLUSIONS: Our study has shown that PVM shows similar efficacy in information uptake to traditional forms of education. Furthermore, PVM was shown to have higher satisfaction scores compared to SVC. Further studies will need to evaluate the use of PVM for education in other surgical and medical domains and assess the long-term knowledge retention. (J Surg Ed 76:440–445. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Surgical Education, Portable Video Media, Video Education, Participant satisfaction

COMPETENCIES: Medical Knowledge

INTRODUCTION

The effective education of final year medical students and junior doctors is the foundation of continued quality healthcare provision. With the advent of new media technologies and rapid internet streaming there exists a

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novel opportunity for the integration of portable video media (PVM) into medical education. PVM is an educational platform with the advantage of being standardized, efficient, effective, and readily available. PVM is a potential adjunct to traditional education methods as a response to pressures in medical education.

Educational Framework

The Just-in-Time (JIT) model for clinical information is a framework proposed to address the challenges to modern education.[1] According to the JIT model, clinicians must maintain clinical information inventories which they can draw upon, so that in making clinical care decisions they have immediate access to the most current and relevant information. Clinical information inventories consist of rapidly accessible and repeatedly used information stored as long-term memory in conjunction with a set of up-to-date resources that a health practitioner can consult for detailed and infrequently employed information. The JIT model posits that effective education of health care professionals requires resources that are easily accessible, up-to-date, and directly relevant to the practitioner's informational needs at a given point in time. External stores of information are used to broaden the amount of knowledge to which a health care professional can consult and then implement at any given time. PVM as a novel educational method has many advantages over traditional educational practices within this educational framework.

Review of Literature

The integration of portable video media (PVM) resources into medical education has the potential to mitigate the shortcomings of standard medical education. The pressure on curriculum design and inclusion of adequate content is a principle obstacle. There is a tension in course design between the growing body of medical knowledge and the limitation in time and resources to deliver it.[2] It is frequently the case that time pressure forces the development of goals, education methods, and implementations strategies before a formal needs assessment of the students themselves is performed.[3]

These pressures on course design are often passed onto medical students at undergraduate level[4–6] and as they progress onto becoming Junior Medical Officers.[7,8] Within the body of literature principal stressors have been identified as; the lack of resources,[9] the severity of workload,[4] a worry that the individual will not master the pool of resources,[5] and concern about the quality of pedagogy.[4] The availability of learning resources featured highly as a concern because of student's preference for active-strategies such as revision as a means of coping.[10,11]

Precedents exist for the effective use of PVM as adjuncts to traditional education methods.[12,13] PVM has been shown to have efficacy in outcome similar to standard educational methods in the education of nurses in various contexts.[14,15] It has also proven an effective platform for the delivery of information before consent to patients undergoing surgical procedures.[16] Various studies have also canvased its possibilities and established its efficacy in terms of knowledge retention.[12,13,17,18] Its preferability to either audio resources or standard verbal resources had been published in a small number of papers.[13,19]

Objectives

This study aims to evaluate the effectiveness of PVM compared to standard verbal communication (SVC) as a novel adjunct for surgical education of junior medical officers and medical students

METHODS

Trial Design

This study was a multicenter, prospective, and randomized controlled crossover study. Participants completed a preintervention knowledge test and were then randomized in an allocation ratio of 1:1 to receive surgical education via either PVM or SVC. They then completed the same knowledge test to assess the amount of knowledge acquired and a separate questionnaire assessing satisfaction with the method of information delivery. Participants were then crossed over on the same day and received education via the alternative method of information delivery and retested.

Participants

This study was performed at 4 sites, Gosford Hospital, Wyong Hospital, Royal North Shore Hospital, and Lismore Base Hospital in New South Wales, Australia over a 40-week period from October 2015 to July 2016. Study participants were recruited from final year medical students and interns undertaking surgical rotations at 4 hospitals. Inclusion criteria for this study were age over 18 years and English language competency.

Interventions

Education on cystoscopy and stent insertion for the treatment of acute renal colic was delivered via PVM and SVC. The information delivered included: (1) indications for cystoscopy and ureteric stent insertion, (2) how the cystoscopy is performed, (3) risks and benefits of the procedure, and (4) postprocedure care and follow-up. This information was deliberately chosen because junior

doctors are often asked about these aspects of management by their patients and thus would aid junior doctors with their interactions with patients during the perioperative period. PVM consisted of a 7:07-minute audio-visual presentation with cartoon animations presented on a tablet or laptop. SVC involved delivering the same information verbally as would be typical for a urology registrar explaining the procedure to junior doctors or medical students on the wards during a bedside or small group teaching session.

Outcome Measures

The outcome measures for this study were (1) knowledge acquisition and (2) participant satisfaction with the educational method, following education via PVM or SVC. The level of knowledge acquisition was measured with a test containing 32 "true" or "false" questions (Appendix). One point was assigned to a correct answer and zero points for an incorrect or omitted answer, for a maximum score of 32. Satisfaction with the method of information delivery was assessed with the validated Consumer Satisfaction Questionnaire (CSQ-8) (Appendix; Larsen, 1979). The CSQ-8 rates, on a 4-point Likert scale (1—very unsatisfied to 4—very satisfied), the participant's satisfaction with the information delivered and the medium in which it was delivered. The patient satisfaction score was determined by adding the total amount of points the participant had recorded for a maximum score of 32.

Sample Size

A planned sample size of 25 participants in each arm was chosen after power calculations to determine a >5% difference between groups or on crossover analysis.

Randomization

At the start of the trial, participants were computer randomized in an allocation ratio of 1:1 into the 2 study groups: (1) receiving information via PVM first and (2) receiving information via SVC first. There was no blinding in this study.

Statistical Methods

Data was analyzed with IBM SPSS Statistics for Windows, Version 24.0 (Armonk, New York). Normality tests were performed on all continuous variables. Independent samples t tests were performed for comparisons between groups for normally distributed variables. Mann-Whitney U test was used for comparison of variables which were not normally distributed. Fisher's exact test was performed on discrete variables. Wilcoxon signed-rank test was used to compare results within groups for crossover analysis.

RESULTS

Sample Description

Fifty-four participants were recruited to our study. Twenty-seven patients were randomized to each group. There was no significant difference in the patient demographics between 2 groups (Table 1).

Effect of Intervention-Knowledge Acquisition

There was no significant difference between the groups in knowledge scores before intervention, PVM 20.4 (95% confidence interval [CI] 18.3 to 22.5) vs. SVC 21.5 (95% CI 19.6 to 23.5), $U = 269$, $p = 0.23$ after first intervention PVM 25.4 (95% CI 24.4 to 26.5) vs. SVC 26.1 (95% CI 25.5 to 26.75), $U = 345.5$, $p = 0.74$ or following crossover PVM 26.4 (95% CI 25.8 to 27.1) vs. SVC 27.1 (95% CI 26.7 to 27.6), $U = 271$, $p = 0.09$ (Fig. 1).

Within group analysis revealed a significant increase in knowledge scores following the first intervention and on crossover (Fig. 1). In the group receiving PVM first there was a significant 20% increase in knowledge scores from baseline after first intervention ($Z = -3.96$, $p < 0.001$) and 4% increase after crossover ($Z = -2.621$, $p = 0.009$). In the group receiving SVC education first, there was a significant 18% increase from baseline knowledge scores ($Z = -4.315$, $p < 0.001$) after first intervention and a 4% increase following crossover ($Z = -3.362$, $p = 0.001$).

TABLE 1. Participant Demographics

	PVM 1st (n = 27)	SVC 1st (n = 27)	p Value
Age; yrs (SD)	24.8 (23.4-26.2)	25.4 (23.6-27.2)	ns
Previous ureteric stent	0%	0%	ns
Female gender	48%	33%	ns
JMOs (32)	17	15	ns
Medical students (17)	10	12	ns

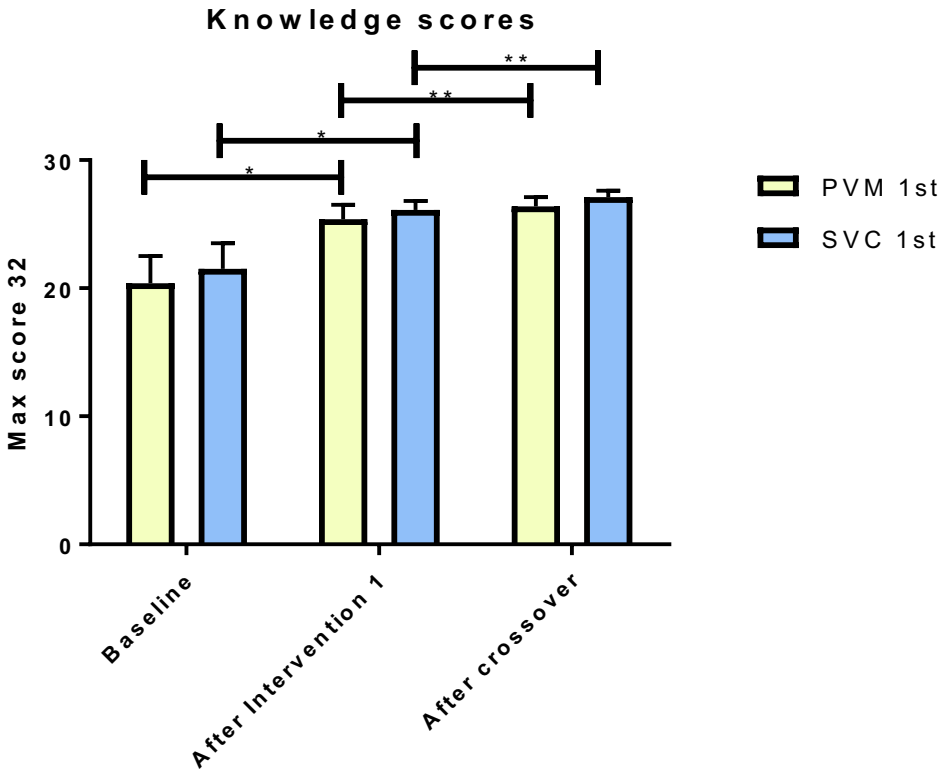

FIGURE 1. Knowledge scores for both groups showing a significant 18% to 20% increase in knowledge scores after the first intervention and a 4% to 5% increase after crossover to the other intervention. There was no between-group differences found. * $p < 0.001$, **$p < 0.01$.

Effect of Intervention-Participant Satisfaction

After first intervention, participants in the group receiving PVM education first had a significant 8% higher satisfaction score compared to the SVC group 28.3 (95% CI 26.9 to 29.7) vs. 25.9 (95% CI 24.5 to 27.3), $U = 269$, $p = 0.023$. There was no difference between groups following crossover, 27 (95% CI 26.1 to 28.8) vs. SVC 27.7 (95% CI 26.4 to 28.9), $p = 0.76$.

In the group undergoing education via SVC first, there was a significant 7% increase in satisfaction scores following crossover to education via PVM ($Z = -2.215$, $p = 0.027$). This was not seen in the PVM group ($Z = -0.992$, $p = 0.32$) (Fig. 2).

DISCUSSION

This study is the first to support PVM as a viable adjunct to current teaching methods for junior medical officers and final year medical students for surgical education. Our study quantitatively demonstrates that surgical teaching taught via PVM has similar increases in knowledge acquisition compared to SVC, which is representative of the traditional bedside or small group teaching practiced in hospitals. Both groups significantly increased their knowledge after first intervention and then on crossover. Our study also demonstrates a preference amongst subjects for PVM over SVC; with a significant 8% higher satisfaction at first intervention in the group who received education via PVM compared to SVC, and a 7% increase in satisfaction after crossover from SVC to PVM. Our study supports PVM as an effective and efficient adjunct to current teaching methods.

The great advantage of PVM is its universal availability as a resource. Two principal contributors to psychological morbidity within groups of medical students are the lack of resources[11] and the quality and availability of teaching staff and teaching opportunities.[4] PVM has the potential to play a role in the solution to these problems, as a readily available, universally accessible resource. A library of PVM resources would allow students to have self-determinacy in addressing the shortcoming of teaching opportunities. Moffat et al. (2004) established a preference amongst students for active coping strategies in the form of revision, for which PVM would be suited.[11] For junior doctors, registrars and consultants are often too busy to provide standardized teaching so teaching opportunities may be missed at the bedside. PVM would allow junior doctors a reliable resource to turn to in

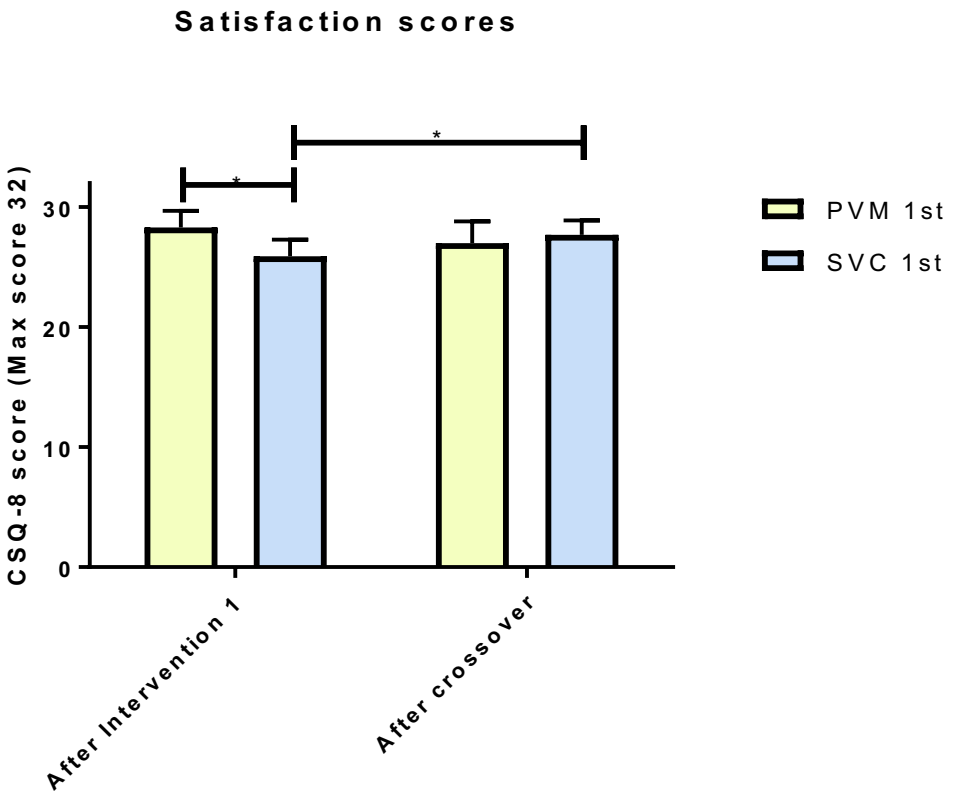

FIGURE 2. Satisfaction scores (CSQ-8) for both groups after first intervention and crossover. Significant 8% higher satisfaction at first intervention in the group who received education via PVM compared to SVC. Significant 7% increase in satisfaction after crossover from SVC to PVM. *$p < 0.01$.

order to bridge knowledge gaps and prevent psychological morbidity through a sense of falling behind.[5]

There is a tension in course design between the growing body of medical knowledge and the limitations in time and resources to deliver it.[2] PVM as an adjunct to traditional teaching methods can increase the cost effectiveness and time efficiency of medical education. According to the University of Sydney enterprise agreement (2015-2017) the cost of a tutor providing a tutorial is between $145.18 and $203.55 per hour depending on the tutor's level of seniority. The cost of face to face teaching places significant fiscal pressures on course coordinators and curriculum designers which are ultimately passed on to students. In comparison the cost of producing a 10-minute PVM is generally less than $1000. Thus, PVM may be a cost-efficient adjunct to traditional education methods. Further a curriculum that included PVM resources would be able to modulate and correct for lack of teaching opportunities by giving students the self-determinacy to fill knowledge gaps.

A limitation of our study lies in the difficulty of aligning academic performance as test scores with an ability to recall and implement knowledge in a clinical setting. Our method of measuring knowledge acquisition though a 32-question "true" or "false" test may not truly replicate the way that knowledge must be recalled and employed in a clinical context (i.e. in the counseling a patient regarding a procedure and its perioperative care), or an assessment of its appropriateness. This method of assessing long-term knowledge recall in a clinical context has not been evaluated for psychometrics and should be addressed in future studies. Furthermore, our study did not assess levels of long-term retention among participants exposed to the different methods of education. Only short-term knowledge acquisition was directly measured, and given the importance of long-term retention of large amounts of knowledge in order to perform in a clinical context, future studies should focused on quantitatively establishing the long-term usefulness of access to a body of PVM resources (Fig. 2).

CONCLUSIONS

In conclusion, our study has shown that PVM shows similar efficacy in information uptake to traditional forms of education. Furthermore, PVM was shown to be preferred by a significantly larger number of participants over traditional forms of education. Further studies will need to evaluate the use of PVM for education in other surgical and medical domains and assess the long-term knowledge retention.

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SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jsurg.2018.08.013.