# A SYSTEMATIC REVIEW TO ASSESS THE EFFECTIVENESS OF WEB BASED TRAINING VIDEO FOR LAPAROSCOPY SURGERY

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## Abstract

**Background:** Surgical training for generations has followed the example of an apprenticeship model propagated by William Halsted; teaching method of "see one, do one, teach one". [1-3] Teaching of surgical trainee is time consuming and costly in the operating room when it involves a procedure, [4, 5] and the surgical skills acquired from operating room are of variable effectiveness because of the learning curve. [6, 7]

The objective of this review is to determine if web-based training video (WBTV) is effective to supplement and /or replace the standard surgical training model (SLT). However, the value of this modality for trainees with or no laparoscopic experience is unknown.

**Study Hypothesis:** Multimedia or Web-based training video (WBTV) learning is equivalent to conventional teaching (Standard surgical training-SLT) in improving scores in cognitive surgical skills.

**Search Method:** Randomized clinical trials addressing this issue were identified from The Cochrane Library trials register, Medline, Embase, Science Citation Index Expanded, grey literature and reference lists and other databases. The Cochrane Central Register of Controlled Trials: search was narrowed to Issue of 6 of 12, June 2014. Included studies were randomized controlled trials (RCTs) assessing any training technique using at least some elements of surgical simulation, which reported measures of surgical task performance. The Cochrane search yielded one relevant article.[8] In the MEDLINE search, the medical Subject Heading (MeSH) was used to search for; Surgical stimulation, surgical training, "Web-based training" and "online education or teaching, training, internet, multimedia teaching" (retrieved articles 78, relevant articles 50) and the headings "Laparoscopy" and "education" (retrieved 103, relevant 91) other provisional abstract (review 3). I focused the search on articles published from 1990 onwards, and I limited it to articles published in English. I did not include case reports and data from abstracts in data synthesis. All of the identified articles were examined for relevance. Retrieved studies were screened for duplication, and additional studies were identified using a manual search of the reference list of the relevant included articles. Since my review focused on Web-based training video effectiveness for teaching laparoscopic surgery techniques, my search strategies was limited to identifying articles focusing on surgical education.

**Selection Criteria:** I included all randomised clinical trials comparing Web-based model trainers versus other forms of training including standard laparoscopic training and supplementary animal model training use for teaching surgical trainees with or no laparoscopic experience. I also included trials comparing different methods of simulation surgical training.

**Results:** Thirty RCTs with 831 participants were included, although the quality of the RCTs was often poor. The Web-based training video (WBTV) had one RCTs, the RCT had four intervention groups, they were groups multimedia (WBTV) training, Practical Training (Standard training, Multimedia (WBTV) plus practical training and none of the trainings had different skills but all participants were homogeneous with the same basic skills on laparoscopic cholecystectomy. The result was that multimedia – based (WBTV) training improved surgical performance of Laparoscopic cholecystectomy in a pelvic –trainer significantly when used alone or as combination training.  While Virtual reality simulation had shown better results than no training at all, but had no evidence of superiority over standard training practised. When it is done purposefully or video box simulation based on operative performance. Video simulation did not show consistently better results than groups with no training at all, and there were not enough data to determine if video simulation was better than standard training or the use of models. Model simulation may have been better than standard training. Two trials (mostly with a high risk of bias) involving 110 participants were included in this review. In trainees without surgical experience, WBTV training decreased the time taken to complete a task, increased accuracy and decreased errors compared with no training. In the same participants, WBTV training was more accurate than Standard practical training. In participants with laparoscopic experience practical training plus Web-based video training, WBTV training resulted in a greater reduction in operating time, error and unnecessary movements than standard laparoscopic training. In these participants, the composite performance score was better in the WBTV group than the practical group (standard).

**Conclusion:** WBTV can supplement standard surgical training. However the quality is poor,  It is at least as effective as no standard training in supplementing standard laparoscopic training. While there may be compelling reasons to reduce reliance on patients, cadavers, and animals for surgical training, none of the methods of simulated training has yet been shown to be better than other forms of surgical training.

*Keywords:* Web Based Training Video; Laparoscopy Surgery; Surgical Training.

## 1. Introduction

Traditionally surgery has always been taught through 2D anatomy in medical school which is gained in form of lectures, PowerPoint presentations and videos in class. But over 500 years ago it shift to 3D training  involving using  cadavers.[9] Surgical trainees were educated through the years, the method "see one, do one, teach one", where the surgical trainee learns to perform surgery under the supervision of a trained surgeon.[1-3] Surgical procedures are affected by learning curve problem because various operations have different learning curve.[6,7]

Conventional surgery or open also is affected with Surgeon variants in experience because a surgeon with certain experience may lack the other and this lead to the desire to improve. The drive to achieve improved patient outcomes and patient safety has led to innovation in surgical education.

Because complete open surgeries are complex to copy or simulate, surgical procedures are complex motion sequences that require a high level of preparation, training, and concentration. Only with the acceptance of laparoscopic surgery into regular surgical practice, did innovators started creating multimedia-based (WBTV) in internet platform modelling the video image seen by surgeons doing laparoscopy and used as a surgical training technique.[8]

The various techniques of laparoscopic surgical training include live animal training, human and animal cadaver training, training using a box trainer (also called a video trainer, VT), Web-based training video (also called multimedia, E-learning, Computer-assisted learning or regarded as other resources using recorded laparoscopic surgery for learning, and also called Observational Learning on Surgical performance[10]) and virtual reality (VR) training (training using computer simulation).[11] WBTV is currently being used widely for laparoscopic training [12-15] and has been shown to be better than standard training.[8,16] WBTV training has been reported to improve learning outcomes in different surgical procedures [8,10,12,16,17]. It also offers an ethical way of assessing the competency of a surgeon in performing a procedure, after using WBTV without risk to a patient.

Web-based training videos for Laparoscopic Surgery are developed from live recorded laparoscopic procedures at operating theatres. The videos are customized and formatted with instructor support[18] To improve surgical skills, different simulation training are used such as Virtual reality (VR) and practical training in lab training ,didactic lectures are used and most cases surgical trainees refer to their book for surgical manuals which is time consuming and updating difficulties of the print apply. It is easy updating videos on the internet compare to the long process of publication. Surgical simulation techniques available like VR is very expensive about cost ($120000). VR has been validated to be of effective value compare to other techniques[19-23] and the training a resident and time taken to complete an instruction during a surgical procedure based on cost value is ($12,000) per year.[4,24] The internet plat form has created a better alternative to learning Laparoscopic skills because it cheaper, unlike Websurg charges user $14.95 per video[12] and a WBTV is easily accessible, current, convenient can be access anytime from home and office [8,12,16,25] and effectiveness is assumed to be better than standard practical training.[8] [26]However, the effect of Web-based training video on practical surgical skills has not yet been evaluated; there is paucity of data about its value. This study aimed to evaluate the effectiveness of Web-based training with laparoscopic or no laparoscopic experience to supplement or/replace standard surgical training. Though there was one selected article to be relevant from The Cochrane HepatoBiliary Group Controlled Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL). The Web-based training video technique has a gap of knowledge compare to the voluminous papers that have been published in support of the other methods of teaching Laparoscopic Surgery.[27-33]

Schreduder et als[13] stated in his article; that traditional classroom problem-based learning can be transferred to a virtual environment, like in Second Life, thus enabling a modern yet familiar

environment for problem-based learning (Conradi et al. 2009). Besides, Schreduder article is in line with the publication of Didier et als [12] articles that assess the impact of Web-based application World Electronic Book of Surgery (WebSurg). His study which was based on the analysis from a Web-based laparoscopic learning site concluded that the (WebSurg) are widely used in the surgical community. The website based training enhances but the consideration of ethical principles of accreditation of scientific societies is important. The result from the study was obtained by using software to monitor of all that visited the WebSurg from the different surgical field and what they accessed from different languages 5 different languages, namely, English, French, Spanish, Japanese, and Chinese. WeBSurg is made up of files totaling 260 gigabytes of data (videos, pictures, Flash animations, scripts, text files, etc.). The Limelight Networks' CDN (content delivery network) is used to display and broadcast its contents all over the world it was seen that between 2004 and 2010, the number of visitors, members, active members, and video hits show an impressive development. In September 2010, WeBSurg gathered more than 202 000 members. Of these, 60% are fellows and young surgeons aged between 28 and 34 years. The age distribution demonstrates that the Web site responds to a wide range of surgical experience. Worldwide coverage is confirmed by an analysis of the geographic distribution of its members. From September 1, 2009 to September 1, 2010, WeBSurg recorded a total of 1396 784 visitors originating from 213 countries or territories. Of which Australia; No. of Visits 12 468, Pages/Visit, 4.7, Average Time on Site (min) 5.7, Percentage New Visits 51. Which infer Australia surgical trainee and surgeon have access and Queensland surgical trainees as it would be applicable to the purpose of this review. Because of my scope of study other countries visit rate was not included. During this period, Limelight transmitted 17670 gigabytes (17.25 terabytes) of video data. Limelight control report also enables to learn about the video connection length equalling a total of 3716 days (i.e. 10.2 years).

Online web-based learning portal for teaching laparoscopic surgery has become very popular and contains a large collection of streaming and downloadable HD quality videos of surgical procedures, combined with how-to step-by-step surgical teaching guidelines to aid the implementation of laparoscopic surgical procedures for various surgical disciplines.[12,13] According to Schreduder et. als [13] there has been advancement to bring to validation the WBTV because recently the first interactive e-learning program for laparoscopy was introduced[13]. This is called "SimpraxisTM Laparoscopic Cholecystectomy Trainer" a customizable interactive simulation software training platform for cognitive learning of surgical procedures. The technology integrates multimedia (such as video, 3D models, radiology, illustrations, text, and still images, all captured from live procedures) and combines them with expert cognitive training pedagogy to create a powerful simulation of the procedure. All these elements combined simulate the feeling of performing the actual physical procedure while only using a computer.

The web-based training video used for learning laparoscopic surgery is one of the various techniques for teaching laparoscopic surgery. However, no clear evidence of the superiority of one over the other in skill acquisition. But there are arguments that it has some educational value though more studies should be completed to evaluate it validity and added value compare to other surgical training techniques. From a systematic review, concluded that simulation-based training is more effective than video-based instruction[34]

However, three major classes of surgical simulators are recognised.27 Reality-based simulators are ones in which the learner interacts with solid, real life materials and uses surgical instruments expected to be used in the operating room. E.g.:

Fundamentals of Laparoscopic (FLS) Box trainer (VT)[35-37.30,38-40] (also Called Video trainer)

A program of the society of America Gastrointestinal and Endoscopic Surgeons (SAGES) and the American College of Surgeon (ACS).[41] Image see below.



Figure 1: FLS Box Trainer by FLS[42] and VTI Medical

**Web-based Training Video (WBTV)** [8 ,12,16,17,43,44]

Web-based simulation allows learners to interact with online curricula, exercising the cognitive aspects of surgery (e.g., what are the steps of a gallbladder removal, what surgical instruments are needed). Internet platforms providing surgical content have been established. Used as a surgical training method, the effect of multimedia-based training on practical surgical skills has not yet been evaluated. This study aimed to evaluate the effect of multimedia-based training on surgical performance.[8]



Figure 2: Screenshot of a WeBsurgery[12] high-definition video – Web-based training Video (WBTV) Model

## Virtual Reality simulator (VR) [40,45-48]

The most technologically sophisticated class of simulator is the VR simulator, which features a computer-generated model of anatomy and requires that learner use near similar instrumentation to interact with virtual tissue structures and models



Figure 3: CAE Laparoscopy VR surgical simulator

Laparoscopic surgery has influence surgical practice rapidly since its acceptance in the eighties and patients prefer Laparoscopic surgery to the traditional open surgery. Laparoscopic Surgical procedure is preferred because of the short stay in hospital, small incision and low incidence of complications. But the teaching of laparoscopic surgical skills is challenging, because of the complexities around the instruction and the different techniques of teaching skills. Thus laparoscopic surgery introduction had evolving barriers there is a need for good knowledge of anatomical structure which is crucial. Surgeons identify anatomical structure from screen because of this tactile feedback and spatial oriental is reduced. An additional challenge associated is gradual learning curve which had created the need for effective teaching mode.

## 2. Objective

The selection of trial studies and data extraction was only randomized clinical trials regardless of the language. And assessment was targeted for effectiveness of Web-based training video (WBTV) compared with or no training or standard laparoscopic training (SLT) (irrespective of generic skills or procedure-specific skills) were included in the review.

### 2.1. Method and Literature Search Strategy

All randomized controlled trials (RCTs) and nonrandomized comparative studies (non-RCTs) reporting on the use of different techniques for learning Laparoscopic Surgery  and the transfer of these skills to the operative setting were included for review. The literature search was performed in MEDLINE, EMBASE, CINAHL, PubMed, the Cochrane Library and Current Contents databases that was update until June 2014 and science citation index expended.[49]  The Cochrane Library 2014, Issue 3 [37] was check to see changes,  I searched the Clinical Trials

Database (US), the NHS Centre for Research and Dissemination Databases (UK), the National Research Register (UK), the Meta Register of Controlled Trials (SRCTN)   and the Australian New Zealand Clinical Trials Registry, last data file imported on 14 July 2014  and using the Cochrane strategies.[49] And the clinical trial information via the World Health Organization (WHO) search portal (ICTRP search portal)   Searches were conducted without language restrictions. The search terms used were (surg∗ and simulat∗) and (skill∗ or train∗). Scanning of Literature was then undertaken to locate articles that may have been missed by the electronic database searches.  MeSH terms were used and searched for  (Therapy, Computer-Assisted OR Surgery, Computer-Assisted OR Computer-Assisted Instruction), free-text terms ( Web-based* internet* Multimedia, online* OR simulat*) combined with the terms 'train' and 'laparoscopy' (MeSH term and equivalent free-text search terms). A filter for identifying the randomized controlled trials recommended by The Cochrane Collaboration[50] was used to filter out non-randomized studies in Medline and Embase. In addition to the databases, SCOPUS, education indexes (ERIC Education Resources Information Center, Australian Education Index (replace by Informit), and British Education Index (Replace EBSCO Information services), computer databases (ACM Digital Library, collection of Computer Science Bibliographies, IEEE/IEE Electronic Library), Meta-register of Controlled Trials and Google Scholar were searched. Grey literature, abstracts and conference proceedings were identified by searching the ISI proceedings, Zetoc General Search (this needed a password to access), 'index to thesis', GrayLIT Network (replaced by Science.gov), abstracts from AMED(Allied and Complementary Medicine Database), biological abstracts, biotechnology abstracts, British Nursing Index, dissertation abstracts (American institutions) and SIGLE (grey literature in EC member countries and held at The British Library). References of the identified trials were also searched to identify further relevant trials. I identified the trials for inclusion and extracted the data related to first author, year of publication, inclusion and exclusion criteria, participant characteristics, details of training such as software used, tasks in training, duration of training, outcomes of interest, methodological quality of the studies (without masking the study names), whether intention-to-treat analysis was followed and whether sample size calculations were reported.

This systematic review was limited to the literature relating to surgical education. The comprehensive Australian Safety and Efficacy Register of New Interventional Procedures-Surgical reports 613 and 80, 4 which include additional procedures investigated, which could be found online at http://www.surgeons.org/asernip-s/. And a details review report on surgical simulation was studied and analysed for update issues on laparoscopic surgical education and surgical training in Australia.

### 3.  Data Extraction and Analysis

Data from all included studies were extracted by me and checked for standardized data extraction tables developed a priori. Each included study was critically appraised for its study quality and assigned a level of evidence according to the hierarchy of evidence developed by the National Health and Medical Research Council of Australia.[51] Study quality was assessed according to the methods given in  of the Cochrane Reviewers' Handbook[50] on a number of parameters, including quality of the reporting of study methodology, methods of randomization and allocation concealment (for RCTs), blinding of trainers and outcomes assessors, and sample sizes. It was judged that no data were suitable for statistical pooling due to the heterogeneity of the results.

**Outcomes**

Data for the following outcomes were extracted: patient or animal mortality or morbidity (reported separately in trials where both patients and animals were used for assessing outcome measures); time taken to perform the evaluation task on the simulation model (after training); operating time (if the evaluation task was performed on humans or animals) (after training); error score: the number of undesirable movements, for example, injury to gallbladder or burning non-target tissue; accuracy; improvement in task performance (objective or subjective); and participant satisfaction. Definitions or scales used by the authors were accepted for the various outcomes.

### 3.1. Assessment of Methodological Quality

**Inclusion Criteria**

Only studies pertaining to Laparoscopic surgical education methods are included in this review. Included studies had to report on effectiveness of training techniques and the impact should have a benefit measure of task performance in the operative setting including global rating score, pass/fail score, time to complete task/procedure.

**Hierarchy of Evidence Checklist**[52]

| Level | | Study Type |
|---|---|---|
| 1 | A | Systematic review ( with homogeneity) of randomised controlled trials |
| | B | Individual randomised controlled trail with narrow confidence interval |
| | C | All or None |
| 2 | A | Systematic review ( with homogeneity) of cohort studies |
| | B | Individual cohort study (including low quality randomised controlled trials) |
| | C | "Outcomes" research ; Ecological studies |
| 3 | A | Systematic review ( with homogeneity) of case-control studies |
| | B | Individual case- control study |
| 4 | | Case series ( and poor quality cohort and case-control studies) |
| 5 | | Expert opinion without explicit critical appraisal |

**Article Selection rating**

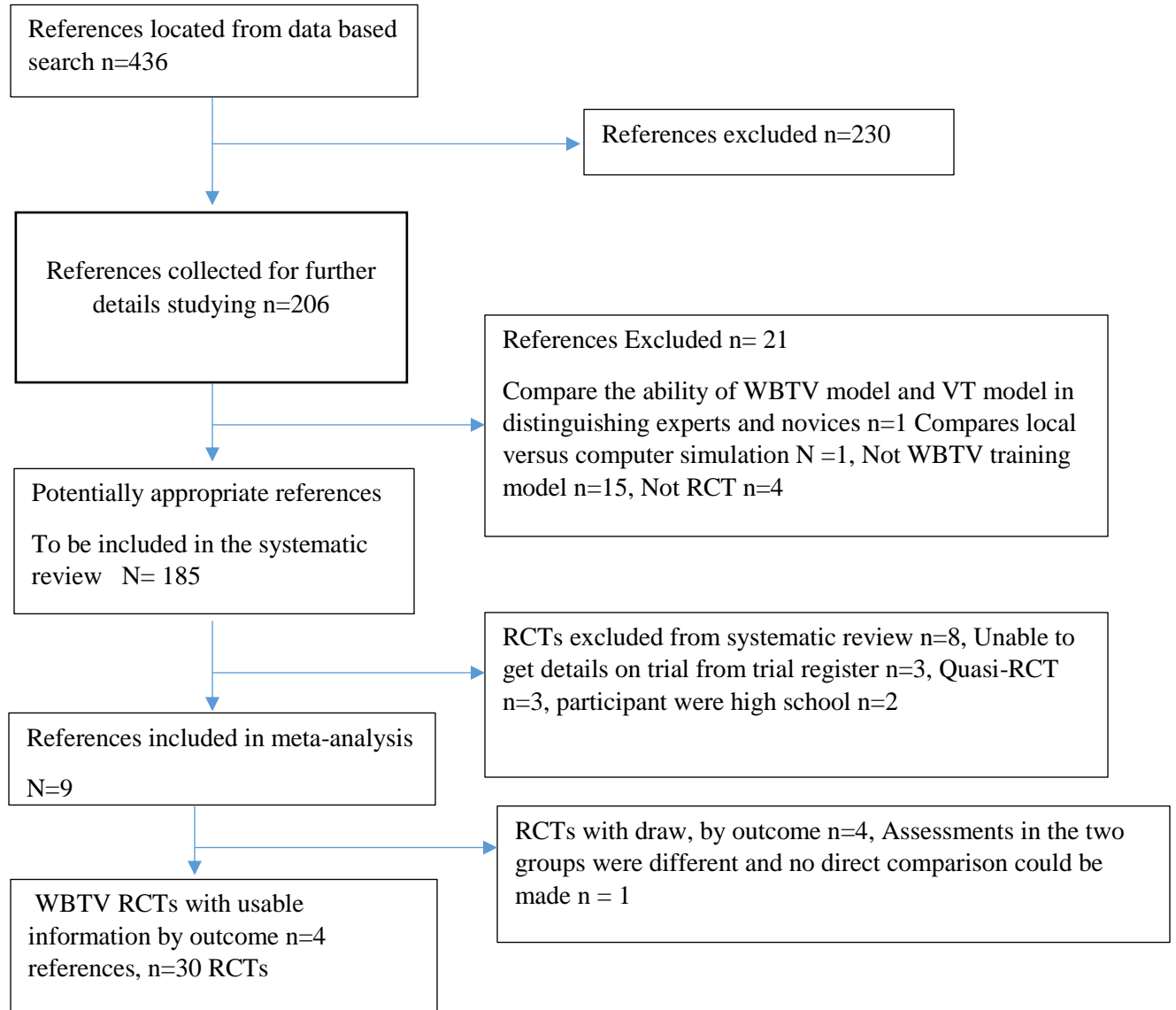| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Quantitative** | | | | | | | | | | | |
| Non-clinical, Non-laparoscopic surgery | | | | 3 | | | | | | | |
| Clinical  Non-laparoscopic surgery | | | 5 | | | | | | | | |
| Non-clinical Laparoscopic Surgery | 1 | | | | | | | | | | |
| Qualitative | | | | | | | | | | | |
| Clinical Non-Laparoscopic Surgery | | | 1 | | | | | | | | |
| Non-clinical Laparoscopic Surgery | 4 | | | | | | | | | | |

The order of exclusion criteria for article selection
  1) Unable to obtain full text
  2) Articles published before 1990.

3) Subjects unrelated to a medical profession
4) Articles which examined same-year peer review and assisted learning
5) Non-experimental design

Selected literature reviewed for WBTV outcome - Hierarchy of Evidence

| Authors | Participants | Evidence Level | Intervention | Outcome Measure | Results |
|---|---|---|---|---|---|
| Pape-koehler et als (2013)[8] Germany | Subjects; general surgeons and surgery resident and medical students | RCT 1a | Surgical performance multimedia | Task specific and cognitive skill | Δ OSATS results were highest in the Multimedia-based training group (4.7 ±3.3;p\0.001). |
| Adams et als (2002)[16] USA | General surgeons, surgery residents medical Student | RCT 1b | Multimedia | Cognitive skills | Experimental Group was found to have statistically improved more than the Control Group (p =.023) |
| Snyder et als (2010)[10] USA | Medical students | RCT 1a | multimedia | Improve performance compare to standard | independent versus preceptor training [Hazard Ratio (HR) 1.28; 95% Confidence Interval (CI) 0.96–1.72; p = 0.09]. |
| Carla et als (2009) USA | Surgical professionals | 4a | Tech. advance, political, internet | Surgical education | Challenges and reward |
| Tolerton et als (2012 Australia | WBTV Creator and viewer | RCT 2b | Audio-visuals learning | Surgical training | Teaching tool for laparoscopic cholecystectomy |
| Didier et als (2011) France | Surgeons , trainees & others | 3c | Multimedia, WebSurg | Surgical performance awareness | High percentage of WBTV users Reduce cost |
| Fraser et als (2011) UK | Otolaryngologist | 4d | E-learning | awareness | Variable website, receptive to free, otolaryngology e-learning effective |
| Umar et als Study completed Clinicaltrials.gov. Ncto1866436 (2012) UK | PG general surgical trainees, specialist year3 registrar year or above | 1a | Multimedia group Study day group | Cognitive surgical skill acquisition | |

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┌──────────────────────────────┐
│ References located from data │
│ based search n=436           │
└──────────────────────────────┘
              │
              │──────────────────────────▶  ┌──────────────────────────────┐
              │                              │ References excluded n=230    │
              ▼                              └──────────────────────────────┘
┌──────────────────────────────┐
│ References collected for     │
│ further details studying     │
│ n=206                        │
└──────────────────────────────┘
              │
              │──────────────────────────▶  ┌──────────────────────────────────────────────┐
              │                              │ References Excluded n= 21                      │
              ▼                              │                                                │
┌──────────────────────────────┐            │ Compare the ability of WBTV model and VT model │
│ Potentially appropriate      │            │ in distinguishing experts and novices n=1      │
│ references                   │            │ Compares local versus computer simulation N =1,│
│ To be included in the        │            │ Not WBTV training model n=15, Not RCT n=4      │
│ systematic review   N= 185   │            └──────────────────────────────────────────────┘
└──────────────────────────────┘
              │
              │──────────────────────────▶  ┌──────────────────────────────────────────────┐
              │                              │ RCTs excluded from systematic review n=8,     │
              ▼                              │ Unable to get details on trial from trial     │
┌──────────────────────────────┐            │ register n=3, Quasi-RCT n=3, participant were │
│ References included in       │            │ high school n=2                               │
│ meta-analysis N=9            │            └──────────────────────────────────────────────┘
└──────────────────────────────┘
              │
              │──────────────────────────▶  ┌──────────────────────────────────────────────┐
              │                              │ RCTs with draw, by outcome n=4, Assessments   │
              ▼                              │ in the two groups were different and no direct│
┌──────────────────────────────┐            │ comparison could be made n = 1                │
│  WBTV RCTs with usable       │            └──────────────────────────────────────────────┘
│ information by outcome n=4   │
│ references, n=30 RCTs        │
└──────────────────────────────┘
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## Summary of Findings for the main Comparison
Summary of Relevant Literature Retrieved

| Web-based training Video versus Other Training Techniques Study | Intervention | No of participants |
|---|---|---|
| Pape-koehler et als (2013)[8] | Web-based Video(WBTV) training Versus Standard training and no training | 70 |
| Adams et als (2002)[16] | Web-based video (WBTV) training versus no training | 40 |
| Snyder et als (2010)[10] | Computer(MIST-VR) simulator training Versus WBTV versus No training | 32 |

| Virtual reality stimulation Versus other training Techniques Study | Intervention | Participant No |
|---|---|---|
| Ahlberg et al (2002)[53] Ali et al (2002)[54] | Computer (MIST-VR) simulator training versus no training | 29 |
| Eversbusch and Grantcharov (2004)[55] | Computer (MIST-VR) (medium level) versus computer (MIST-VR) simulator training (easy level | 27 |
| Gallagher et al (2002)[21] | Computer (GI Mentor II) versus no psychomotor training | 20 |
| Grantcharov et al (2004)[56] | Computer (MIST-VR) simulator training versus no training | 16 |
| Hamilton et al (2002)[35] | Computer (MIST-VR) simulator training versus no training | 16 |
| Hyltander et al (2008)[45] Jordan et al (2000) | Computer (MIST-VR) simulator training versus video box simulator training | 49 |
| Jordan et al (2001) | Computer (LapSim) simulator training versus no training | 24 |
| Kothari et al (2002) Lehmann et al (2005) | Computer (MIST-VR) simulator training versus video box simulator training (randomly alternating image) versus video box simulator training (normal image) | 24 |
| Mackay et al (2002) | Computer (MIST-VR) simulator training versus Z-shaped or U-shaped maze video box simulator training versus no training | 32 |
| Munz et al (2004) | Computer (MIST-VR) simulator training versus video box simulator training | 32 |
| | Computer (VEST) simulator training versus video box simulator training | 32 |
| Pearson et al (2002) | Massed practice computer (MIST-VR) simulator training versus 2 types of distributed | 41 |
| Seymour et al (2002) | Computer (LapSim) simulator training versus video box simulator training versus no | 24 |
| Torkington et al (2001) | Computer (MIST-VR) simulator training versus video box simulator training versus self-practice versus didactic instruction versus standard | 43 |
| Watterson et al (2002) | Computer (MIST-VR) simulator training versus standard training | 16 |
| Wilhelm et al (2002) Youngblood et al (2005) | Computer (MIST-VR) simulator training versus standard training versus no training | 30 |
| | Computer (URO Mentor) simulator training versus | 20 |

|  |  |  |
|---|---|---|
|  | standard training |  |
|  | Computer (URO Mentor) simulator training versus standard training | 21 |
|  | Computer (LapSim) simulator training versus video box simulator training versus no training | 46 |
| **FLS Video box Trainer Versus Techniques** |  |  |
| Fried et al (1999) | Video box simulator training versus no training | 12 |
| Harold et al (2002) | Video box simulator training plus additional instruction versus video box simulator | 17 |
| Jordan et al (2000) | Video box simulator training: randomly alternating image versus y-axis inverted image versus normal image; versus simplified simulation (direct vision box training) | 32 |
| Keyser et al (2002) | Video box training versus simplified simulation (indirect vision mirrored box training | 22 |
| Matsumoto et al (2002) | Video box simulator training versus model training versus standard training | 40 |
| Risucci et al (2001) | Video box simulator training plus additional instruction versus video box simulator |  |
| Scott et al (2000) | Video box simulator training versus no training | 14 |
| Taffinder et al (1998) | Video box simulator training versus no training | 22 |
| Traxer et al (2001) | Video box simulator training versus no training | 20 |

## 4. Results

**Description of Studies**

A total of 436 references were identified through electronic searches of the Cochrane HepatoBiliary Group Controlled Trials Register and the Cochrane Central Register of Controlled Trials in The Cochrane Library (n = 78), Medline (n = 96), Embase (n = 72), Science Citation Index Expanded (n = 89) and other databases (n =101). Fifty two duplicates and thirty clearly irrelevant references identified through reading abstracts were excluded. The remaining nineteenth references were retrieved for further assessment. No references were identified through scanning reference lists of the identified randomized trials. It was not possible to identify details concerning one trial identified from the trial register {Pape-Koehler, 2013 #419}. No information was available from the authors of this trial, so it was excluded from the review. Twenty-six other references were excluded as they did not meet the inclusion criteria. In total, 8 trials were included. Two trials compare WBTV to no training, and standard training, one training compare it with VR and standard training with no training and with training. Seven trials compared VR and VT training, nine trials compared VR and no training or SLT; eight trials compared VR training, VT training and no training; and two trials compared different methods of VR training. Four trials compared VR training in surgical trainees with limited experience in laparoscopic surgery. Four trial compare VT to no training, five trials compare VT to standard training. Five did studies in WBTV did not state the experience of the participants. The other

trials included medical students or surgical residents without any experience in laparoscopic surgery. Three trials that had adequate methodological quality in all four components were considered to have a low risk of bias. Details regarding the tasks in training and endpoint of training are recorded and classified as safety /efficacy study.

## Included Studies (8 Studies) WBTV

Three RCTs and five non-RCTs investigating effectiveness of WBTV after watching Online surgical procedure for training laparoscopic cholecystectomy and endoscopy and were included in this review.  Two studies investigated laparoscopic cholecystectomy procedures, and one studies investigated endoscopic procedures. Participants included general surgery and resident trainees.

| Study | Evidence level | Training Method | Procedure | Assessment | Results |
|---|---|---|---|---|---|
| Web-based training video for laparoscopic surgery | | | | | |
| Pape-koehler et al (2013),15 Germany | RCT 1 1a | Multimedia-based(internet platform) A 2-2 factorial RCT with four IG. a pre- and post-test design was used to test the effect of multimedia-based training from February 2009 until August 2009. Video recorded, encoded, on DVDs.  (OSATS). The main evaluation criterion was the difference in OSATS score between the pre- and post-test (D OSATS) results in terms of a task-specific checklist (Procedural steps scored as correct or incorrect). | laparoscopic cholecystectomy in a Pelvi-Trainer | Video (blinded rater of participants). OSATS Task-specific 1. Exposure errors. 2. Clipping and tissue Division errors. 3. Dissection errors. 4. Operating time. 5. Placement of trocars Δ OSATS Global rating scale 1.Respect for tissue 2.Time and motion 3.Handling of instruments 4.Flow of motion 5. Knowledge of procedure | IG the Δ OSATS results were highest in the Multimedia-based training group (4.7 ±3.3;p\0.001). The practical training group achieved 2.5 ±4.3(p= 0.028), whereas the combination training group achieved 4.6±3.5 (p\0.001), and the control group Achieved 0.8±2.9 (p=0.294). |
| Adams  et .als (2002),33 USA | RCT 1 1b | IG1:Video-based  training; subject watch video intro 15-min sessions Then take 20 questions objective non video-based  = 30 sec or a subjective video based question=45sec , total time 27 minute ,participant can replay if desire but with no added time; pre- and post-test using software place in Microsoft excel | Laparoscopic cholecystectomy, expose to three cases and post training in fourth month) | Video (independently, by 6 general surgeon and resident Observers blinded to training status of participant). 1. Cognitive skills | IG1  Using a one-tailed t-test, this within-subjects difference in scores from pre-test to post-test is significant for the Experimental Group (p < 0.05), but not the Control Group (p = .27). The improvement value from pre-test To post-test for each group was also compared. Using a one-tailed t-test, the Experimental Group was found to have statistically improved more than the Control Group (p =.023) |

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| Snyder et. als (2010)[10] USA | RCT 11 2c | Medical students were randomized to proficiency-based training on VR laparoscopy and endoscopy simulators by two different methods proctored training (automated simulator feedback plus human expert feedback) or independent training (simulator feedback alone) | tasks in a live por- Cine model. Prior to their entry into the animal lab, all trainees watched an instructional video of the procedure | surgical performance Virtual reality (VR) surgical simulation and Web-based multimedia instruction are useful Supplemental. | Cox regression modelling with adjustment for relevant covariates demonstrated no significant difference in the likelihood of successful task completion for independent versus proctored training [Hazard Ratio (HR) 1.28; 95% Confidence Interval (CI) 0.96–1.72; p = 0.09]. Trainees who observed the actual procedure were more likely to be successful than those who watched the instructional Video alone (HR 1.47; 95%CI 1.09–1.98; p = 0.01). |
| Umar et als Study completed Clinicaltrials.g ov. Ncto1866436 (2012) UK | RCT 1a | PG surgeon were randomized to proficiency-based training on multimedia Laparoscopy colorectal surgery | 30 minutes online procedural steps in open and laparoscopic anterior resection surgery | Competency in surgical skills combination of technical and nontechnical skills cognitive comprise factual knowledge and decision making | Mean change of 24.4 (SD 4.9) in the intervention group is assumed |

| Study | LOE | participant | Training Method | Procedure | Assessment | Result |
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| Comparison simulation training versus no simulation training | | | | | | |
| Ahlberg et al (2007),15 Sweden | RCT II | IG = 7, CG = 6, surgical residents PGY 1–2 | LapSim (without force feedback) version 2.0 VR simulator: as many 1-h supervised training sessions during 1 wk. (maximum 8 per day) as required to reach proficiency levels on each of the 6 examination tasks at Least twice. | Laparoscopic cholecystecto my (assessed first, fifth, and tenth) | Video (2 observers blinded to training status of participants). 1. Exposure errors. 2. Clipping and tissue Division errors. 3. Dissection errors. 4. Operating time. | IG fewer intraoperative errors for entire procedure and separate portions vs CG (P = 0.037).Exposure errors reduced from 53 to 15 (P = 0.0402), clipping and Tissue division from 7.1 to 1.9 (P<0.008), and dissection from 29.5 to 11.5 (P < 0.03). Operating time reduced by 58% in IG (P = 0.0586 NS). |
| Beyer et al (2011),33 France | Non-RCT III-3 | IG1 = 6, IG2 = 6, CG = 7, general surgery or gynaecology residents. | IG1: FLS Training Box simulator; proficiency-based training through MISTELS program, 5 tasks with 5 individual 60-min sessions during a period of 1 mo.; IG2: LAP Mentor VR simulator; Organized in pairs undergoing five 120-min | Dissection of the vesicular bed (assessed retraining, first month, and post Training in fourth month). | Video (independently, by 2 Observers blinded to training status of participant). 1. Depth perception. 2. Bimanual dexterity. 3. Efficiency. 4. Tissue | Improvement in GOALS scores IG1 (mean 9.3 vs 12.4; P = 0.04) and IG2 (mean 9.2 vs 13.2; P = 0.03) but not in CG in the second evaluation (12.2 vs 11.7; P = 0.35). Progression score higher in IG1 (P = |

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| | | | sessions during a period of 1 mo. and participants attempting all 9 basic exercises, the extracorporeal knot suture exercise, and cholecystectomy. | | handling. 5. Autonomy. | 0.03) and IG2 (P = 0.007) vs CG. There was no significant difference between IG1 And IG2 (P = 0.28). |
| Cosman et al (2007),16 Australia | RCT 11 | IG = 5, CG = 5, volunteer basic Surgical trainees. | LapSim (without haptic feedback). Basic Skills package version 1.5 VR Simulator; access for maximum of 1 h/d as required to satisfy the performance criteria on 2 successive repetitions of the clipping task. | Clips application and division of cystic artery (assessed first) | Video (independently by 5 laparoscopic surgeons Blinded to training status). 1. Composite error. score, 6 items 2. Global rating score. 3. Operating time. | IG fewer intraoperative errors for the entire procedure than CG (median 10 vs 18; P = 0.05). IG better bimanual coordination (mean 3.0 vs 1.8; P = 0.05) and higher global score (median 3.2 vs 1.8; |
| Grantcharov et al (2004),17 Denmark | RCT II | IG = 8, CG = 8, general surgical Residents. | MIST-VR simulator; fixed number, 10 repetitions of 6 abstract tasks of progressive complexity that are designed to simulate the techniques used during laparoscopic Cholecystectomy. | Clips application and division of cystic and gallbladder (assessed second). | Video (independently by 2 surgeons blinded to Training status). 1. Operating time. 2. Errors (2 items). 3. Economy of movements (2 items). | Operating time reduced in IG compared with the CG P = 0.04) than CG. Procedure time reduced from 172 to 94 s (46%) in IG (P = 0.075). (P = 0.021). IG greater Improvement in intraoperative errors (P = 0.003) and economy of movement (P = 0.003) scores than CG |
| Hogle et al (2009),18 United States (only Study 1) | RCT II | IG = 6, CG = 6, surgical residents PGY 1 | LapSim VR simulator; 2 simulation training sessions per week until level 3 passed for each task: camera navigation, instrument navigation, coordination, grasping, lifting and grasping, cutting, and clip Applying. | Laparoscopic Cholecystecto my (assessed 2 Consecutive). | Video; combined GOALS scores from supervising surgeon and reviewers blinded to training status of Participants. | No significant difference between IG and CG in the 5 GOALS domains: depth perception (mean 3.6 vs 3.35; P = 0.99), bimanual dexterity (mean 3.17 vs 2.90; P = 0.55), efficiency (mean 2.89 vs 2.82; P = 0.93), tissue handling (mean 2.96 vs 3.10; P = 0.56), autonomy (mean 3.23 vs 3.11; P = 0.85). |

| Scott et al (2000),19 United State | RCT II | IG = 13, CG = 9, general surgical Residents PGY 1 or 2- on 1-mo rotation. | SCMIS GEM video-trainer; during weeks 2 and 3, residents met for at least 30 min a day for 10 d to perform the 5 established laparoscopic drills on a video trainer: bean drop, running string, checkerboard, block Move, and suture foam. | Laparoscopic Cholecystecto my (assessed pertaining and post training performed with same assistant surgeon). | Direct observation by 3 Surgeons blinded to training status; 8 criteria assessed. | Improved scores for IG compared with CG in 4 of 8 performance criteria: respect for tissue(P = 0.035), instrument handling (P = 0.005), use of assistants (P =0.035), overall performance (P =0.007). No significant difference Between IG and CG for time and motion, knowledge of instruments, flow of operation, and knowledge of specific procedure. Performance improvement defined as baseline minus post training score, adjusted For differences in baseline scores. |
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## 5. Discussion

**Outcomes**

A total of 30 trials involving 766 participants were included in this review. As mentioned in the protocol, the results were reported separately for trainees with no laparoscopic experience and those with laparoscopic experience (such as performing laparoscopic procedures under supervision).The results are summarized in the table above. 3 trial mentioned patient-related outcome (cognitive skills which are factual). None of the remaining trials that used animals or humans to assess the outcomes reported animal or patient morbidity or mortality.

**Description of Studies**

Web-based Training for Laparoscopic Surgery- WBTV training plus standard practical training. To gain a more complete understanding of all of the significant predictors that contribute to score improvement, and to once again verify the significance of video repetition,  by using  stepwise linear regression analysis . This analysis showed that educational level, previous LC experience, and training program version are the only significant predictors of improvement. OSATS Task-specific was use to assess, exposure errors. Clipping and tissue division errors, dissection errors. Operating time. Placement of trocars, Δ OSATS Global rating scale. Respect for tissue, time and motion, handling of instruments, flow of motion,   thus Knowledge of procedure Improvement increases with decreasing educational level, increasing LC experience, and the experimental version T-tests and a linear regression model reveal the significance of program aspects, especially the video repetition feature. Conclusions based on the data set are valid due to the equivalency of the test banks and subject samples. Although this is a pilot version of the program, testing has revealed the significance of the training methods used. This significance justifies further evaluation of the pilot program as well as development of enhanced iterations.

**Laparoscopic Experience with Practice Training (SLT)**
WBTV versus standard training Time taken to perform the job or speed with which the job was completed The meta-analysis showed that there was no statistically ,significant difference in the time taken to complete the task (SMD −0·06, 95 per cent c.−0·40 to 0·52), reduction in the time taken to complete the task after compared with before training (SMD −0·61, 95 per cent c.i. −1·51 to 0·29), speed in performing the tasks between WBTV and SLT (SMD −0·33, 95 per cent c.i. −0·95 to 0·28), or in the change in speed in either hand in performing the task. Hence WBTV is more effective compare to practical training alone without watching a multimedia laparoscopic video that help to develop cognitive skills.

**Error Score**
There was no difference in error scores between the two groups. The error score was assessed by dropping the object, perforation of the object, or by composite error score from the computer.

**WBTV training for laparoscopic Surgery plus SLT with a pelvic –trainer model**
The laparoscopic cholecystectomy computer-based training program developed here has the potential to change medical education dramatically. Combined with the technical skill trainers already widely available, this program can teach the anatomical structure recognition skills that can only be gained through experience of watching actual surgeries.

**WBTV versus VR Simulation**
Surgical training programs may not need to devote time and effort to provide expert feedback during proficiency-based VR simulator training, as long as the proficiency criteria are available and clear. Surgical trainees should recognize that while instructional videos and VR training are useful resources, they do not appear to be adequate substitutes for observation of complex procedures. Observing surgical procedures, in the context of deliberate practice and directed hands-on training, remains a valuable learning experience, even when the operator is a relatively unskilled trainee. Further studies of this topic should be performed in junior surgical residents to validate these conclusions.

Computer simulation showed mixed results, superior in some studies, but not others and was inferior to video simulation in one study. This may have depended on types of tasks, with computer simulation producing better results for tasks such as incisions, but not for knot tying times. However, there were too few studies to determine this.

**WBTV versus No Training**
WBTV groups did not show consistently better results than groups who did not receive training.

## 6. Conclusion

Generally, no clear differences were seen between WBTV and other forms of training such as bench models or standard training. However there are better assessment tool that can show the various benefit - SimpraxisTM Laparoscopic Cholecystectomy Trainer. Since each teaching technique have different function and task, it would be significant to study on how; combined piece of a surgical training method should have both technical and nontechnical skills acquisition

abilities also a better outcome, accessibilities. WBTV is cheap, accessible, but the educational value is unknown because there are few publications written about the effectiveness.

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