



## Cross-sectional Study

# Comparison of surgical recordings using cameras with and without laser pointer for focusing in gastrointestinal surgical field in COVID-19 pandemic: A cross-sectional study

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## ABSTRACT

**Background:** Surgical recording has become very important for digestive surgery skill training in the COVID-19 pandemic. In addition to high quality recordings, the directions of vantage points are also important. To assist our vantage point for our camera, we frequently use a laser pointer to increase accuracy in the shooting range. **Materials and methods:** We recorded surgery more than 2 h with a fixed top-mounted Panasonic HC-V770 camcorder and otherwise with an action-cam Sony FDR. We installed a laser Pointer TaffLED Tactical Red Dot Laser Gun Picatinny Mount Airsoft Rifle HJ 11. We compared focus field video recordings with and without laser pointer guiding. We divided them into four groups: head mounted with, head mounted without, top mounted with and top mounted without. We recorded a total of five digestive surgery cases of superficial, visceral, and deep visceral procedures for each group after adjusting the laser pointer direction to the center of the cameras' focus.

**Results:** The laser pointer on camcorder Panasonic HC-V770 can assist recording on operation fields to prevent the field of view from being blocked by movement of an object compared to either camera without laser pointer. The head mounted Sony FDR-X3000 action-cam can easily depict surgeon's eye while recording and be controlled by the slightest movement of the surgeon's head by tracking with a red dot.

**Conclusion:** From either mounting, the laser pointer aided in focusing the surgical field of view and could increase visibility for surgical recording.

## 1. Introduction

The Corona Virus Disease 19 (COVID-19) pandemic has created an obstacle for medical education, especially in surgical skill training for clinical students, residents and trainees, due to the limited number of patients admitted to the hospital, decreased number of surgical cases and limited time permitted for medical students to attend rotations in the training hospital. As a result, video-based study material has gained significant importance [1,2].

Surgical recording is widely increasing in this era. Recording surgical procedures has many advantages for education and care purposes because ever-decreasing opportunities and time for training due to the

lack of cases causes limited means for reviewing the results. Accordingly, video recording can be used for research and as a quality control tool to assess the skills of professionals or students. They can also provide supplementation material for demonstrating procedures to improve medical students' quality, efficiency, and professionalism [3–5].

During recordings of surgical procedures, despite the cameras' specifications for better images, we need a method that makes the process easier. The key point when recording involves the direction of vantage points, since when we record the wrong direction from the beginning it will ruin the entire video. The best surgical recordings can depict the view through the surgeon's eyes. Focus of the camera is another key point, but while recording and conducting surgical

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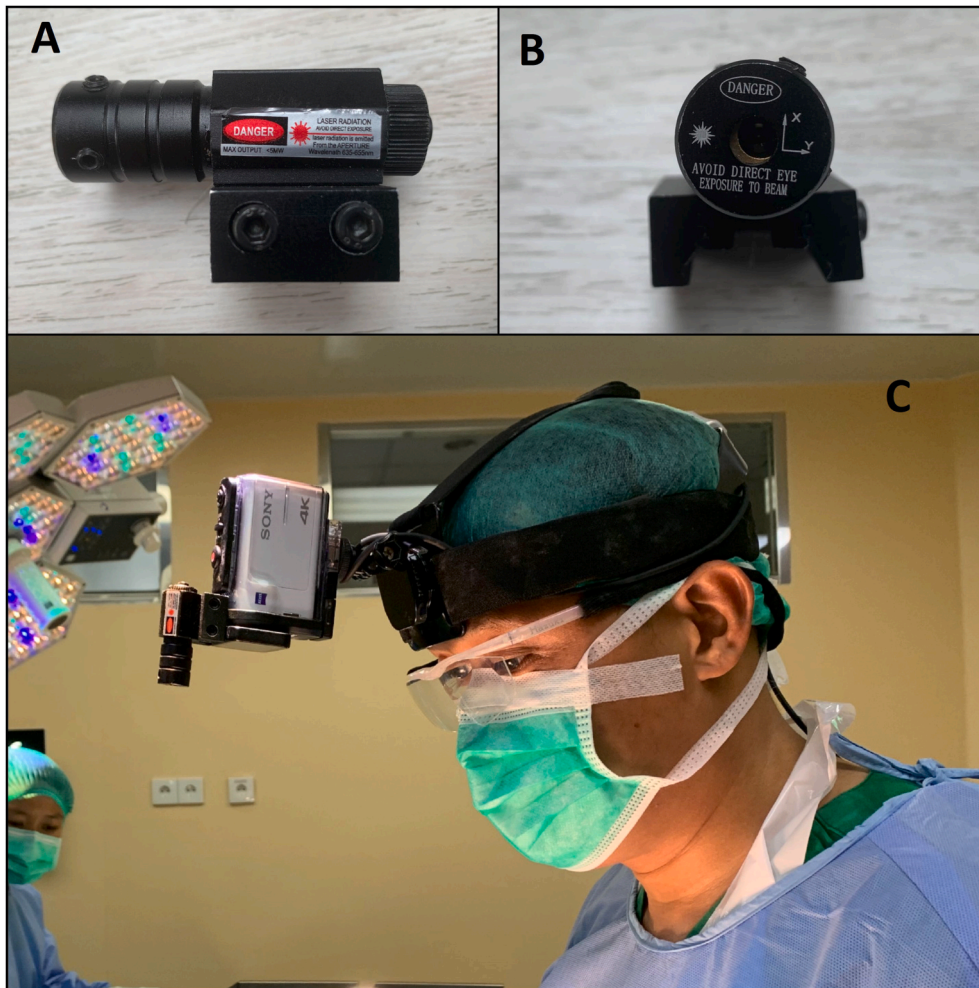
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**Fig. 1.** (A) Side view laser pointer TaffLED Tactical Red Dot Laser Gun Picatinny Mount Airsoft Rifle HJ11 (B) Front view, there is vertical and horizontal axis to adjust laser direction (C) laser pointer installed on head mounted action-cam. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

**Table 1**

Devices specification.

Laser pointer TaffLED Tactical Red Dot Laser Gun Picatinny Mount Airsoft Rifle HJ11	Panasonic HC-V770 camcorder	Sony FDR-X3000 action-cam
Wave Length: 635–655 nm Range: About 100 m Dimension Tube Diameter: 17 mm Length: Approx. 56–57 mm Tube Size: 48 mm × 17 mm 5.5 × 3 × 3 cm Price *USD: 3	Resolution: Up to 1080P/120FPS Video Format: AVCDH MP4 Sensor: 1/2.3 type (1/2.3") BSI MOS Sensor Image Stabilizer: HYBRID O.I.S. with Active Mode, O.I.S. Lock, Level Shot Function Pixel: 12 MP Optical zoom: 20x Build-in Wi-Fi: Yes Build-in Bluetooth: Yes Microphone: 5.1ch Surround, Zoom, Focus and Stereo Microphone USB: USB 2.0 High Speed Working Voltage: 5.0 V Power: Rechargeable Built-in Lithium-Ion Working current: 1940mAh External memory card: SD + Internal memory Compatibility: Windows XP or above/Mac OSX 10.5 or above Size: 2.6"W*2.9"H *5.5"D Weight: 354 g Price *USD: 671,1	Resolution: 4608 × 2592 Video Format: MPEG-4, XAVC S, H264 Sensor: BSI CMOS Image Stabilizer: Optical/Optically Stabilized Ultra-Wide Lens Pixel: 8 MP Optical zoom: -Build-in Wi-Fi: Yes Build-in Bluetooth: Yes Microphone: Built-in Stereo Mic USB: USB 2.0 Working Voltage: 5.0 V Power: Rechargeable Built-in Lithium-Ion 1.89 A Battery Working current: 800mAh External memory card: Micro SD + Memory Stick Duo Compatibility: Windows XP or above/Mac OSX 10.5 or above Size: 48*53*19 mm Weight: 114 g Price *USD: 346,92



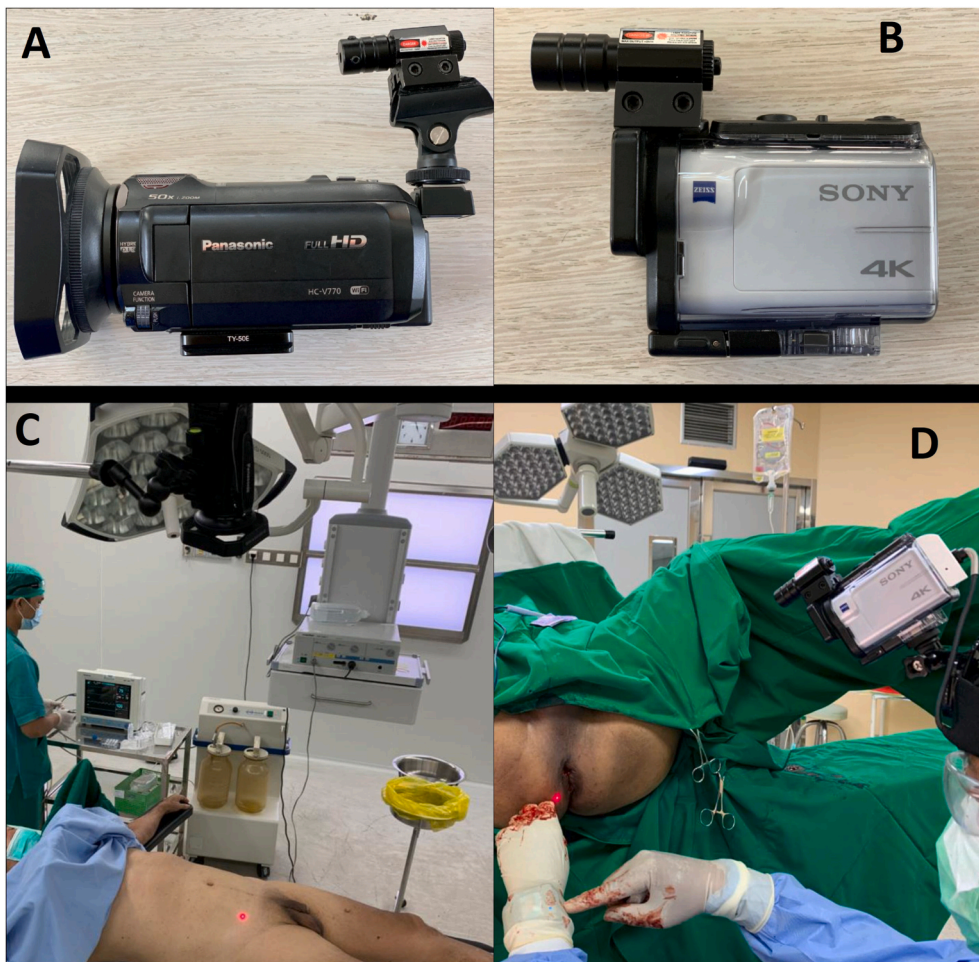


Fig. 2. (A) Camcorder with laser pointer (B) action-cam with laser pointer (C) record process with camcorder (D) record process with action-cam.

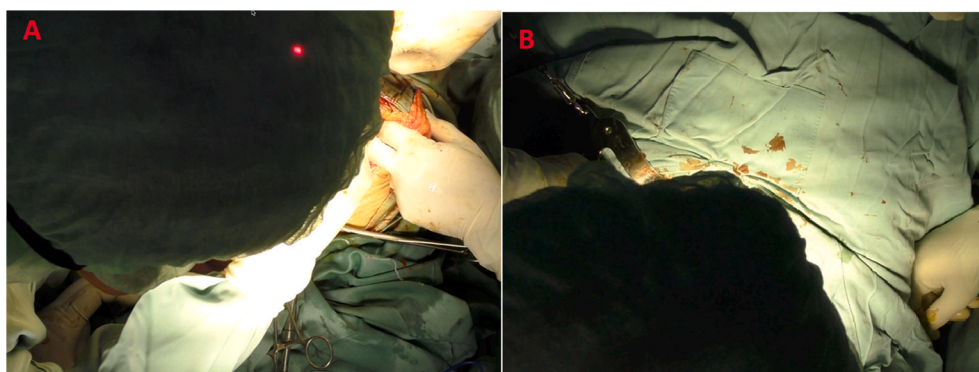


Fig. 3. (A) With laser pointer, blocked recording surgical field by head, can be prevented move the head or blocking object (B) Without laser pointer, blocked recording surgical field by head, cannot be prevented.

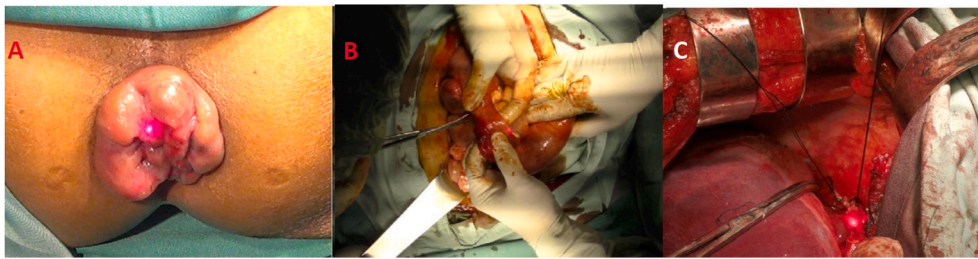
procedures, the surgeon often cannot fully attend to the recording process and in the limited resource hospitals, there are usually not available the properly trained nurses who can help with the recordings.

Since the laser pointer is widely used to increase accuracy for shooting targets with firearms, we adopted this concept to enhance our recording method. In this paper, we discuss our innovation and the advantages of adding a laser pointer to our camera when we record our surgeries.

## 2. Materials and methods

The inclusion criteria of this study were the patients who agreed to undergo surgery recording, signed informed consent forms, and were confirmed COVID-19 free from screening and examinations. All equipment used in this study were disinfected with 70% alcohol prior to entering the operating room.

We used a Panasonic HC-V770 camcorder and Sony FDR-X3000



**Fig. 4.** (A) Superficial shooting (internal hemorrhoid grade 4 surgery), central focusing on hemorrhoid, recorded with head mounted action-cam (B) Visceral shooting (adhesion intestinal surgery), central abdominal field with red dot directed to adhesion site, recorded with camcorder (C) Deep visceral Shooting (Liver Surgery), red dot directed to ligation process of Left hepatic vein, recorded with head mounted action-cam. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

action-cam and installed in the camera body a Laser Pointer TaffLED Tactical Red Dot Laser Gun Picatinny Mount Airsoft Rifle HJ 11a (Fig. 1), specifications were shown below in Table 1. We installed one of the laser pointers with its mounting toward the camcorder by modifying the shape of microphone clip with solder to make it suitable with the laser pointer mount (Fig. 2A). For the action-cam, we were able to clip the laser pointer mount toward its case directly above the lens (Fig. 2B).

We compared video recordings from these two cameras (Fig. 2): inverted L shaped rod top mounted camcorder, head mounted action-cam with and without laser pointer guiding. The Panasonic HC-V770 camcorder as a fixed camera was used for procedures more than 2 h, while for shorter procedures we used the head mounted Sony FDR-X3000 action-cam due to its greater comfort. We recorded five digestive surgery cases of superficial, visceral, and deep visceral procedures for each group after adjusting the laser pointer direction to the center of the cameras' lens that coaxial with surgeon's eye.

We qualitatively assessed the convenience of the operator to direct the vantage point of the recording and compared the recording results whether there was a hindrance or any obstruction of the centre point of the image. This study has been reported in line with the STROCSS criteria [6].

### 3. Results

Laser pointers are cheap, safe, and easy to install to any type of camera. In this study we installed it on a camcorder and an action-cam, and they were useful for assisting in designating the center point of the camera while recording. The recording vantage point was easily directed by the appearance of the pointer. Using laser pointer can definitely help surgeons while recording their procedures to direct the cameras, head position, and body position.

It was easier to direct focus to depict surgeon's vision using head mounted action-cam with laser pointer even when the surgeon moved their head. It will also help surgeons direct their head for accuracy.

The laser pointer can be used as an indicator in top mounted camera (Fig. 3). If it was disappeared from sight, we interpreted it as blockage of the focus point by the surgeon's head, hand or instrument. Laser pointer can be used to be a sign if our recording field was blocked by its red dot. This will help the operator make sure that the vantage point was clear.

As shown by examples above, red dot from laser pointer will help surgeon direct their action-cam and can be used for a pointer while editing the videos for educational purpose, focusing to some object or perforation, bleeding point, point to cut, incision point and suture points (Fig. 4).

### 4. Discussion

Laser pointers for the head mounted action-cam can help the recording to be coaxial with the surgeon eyes and make the video observer's view similar to the surgeon's view. The fixed top mounted camera—usually used for long duration and major surgery—will give the video observers a clear third person view.

With diverse types of anatomical variations and cases, medical students and residents might not be exposed to enough cases of digestive surgery during training. These recordings can help them to have a better understanding in handling these cases. Moreover, the digestive surgery is a field in which various cases might require different widths of operation field. Superficial surgeries, for instance in visceral and perianal cases, require a detailed visualization, especially with the intricate details, which may be helped with the use of a laser-pointed camera. Post record editing for teaching materials can be difficult if handled by non-medical editors. The laser pointer can be used to provide direction for video sequencing and for video editing.

We used an inexpensive laser pointer due to its price (approximately \$3 USD), easy to use, and the red dot pointer can be use under any type of overhead operation theater light, compared to the commonly available headlamps in the market. The red dot of laser pointer able to point small structures while recording and direct surgeon head to record, while if we choose to use headlamp, the headlamp will have to project the head movement by a circle of illumination which has 12 cm illumination spot size, uniform light illumination, visualize small structure in any ambient overhead light, and can distinguish red – blue color on anatomical structure [8]. The headlamp used to meet these criteria will be more expensive than the laser pointer.

Apart from the type of camera used, the final quality of the video depends on the operator's ability to become motionless, such as minimizing movement of head and neck where the camera is mounted to prevent the result from being blurry or choppy [7]. This problem can be minimized with assistance of the laser pointer, which can help the surgeon to direct their head to record with the head-mounted action-cam and keep clear the centre vantage point of the top-mounted camcorder.

Limitation of the use of laser pointer in this study is there are no dedicated laser pointer camera mounting available to date. All the mountings used in this study were custom made and each were made to one specific camera. We hope there will be a universal laser pointer camera mounting, a dedicated laser pointer camera mounting, or even a build in laser pointer camera that suitable for surgical recording.

### 5. Conclusion

Laser pointers can aid in making clear focused view of the surgical field in surgical recording and to aid the camera to depict the surgeon's point of view.

### Declaration of interest

No potential conflict of interest relevant to this article was reported

### Funding

The authors declare that this study had no funding source

## Ethical Approval

This study was approved by Institutional Review Board of Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada.

## Author contribution

Adeodatus Yuda Handaya conceived the study. Aditya Rifqi Fauzi, Ahmad Shafa Hanif, and Joshua Andrew drafter the manuscript, and Azriel Farrel Kresna Aditya critically revised the manuscript for important intellectual content. All authors facilitated all project-related tasks.

## Registration of Research Studies

- 1 . Registry used: Research Registry.
- 2 . Unique Identifying number or registration ID: researchregistry6193
- 3 . Hyperlink to your specific registration: <https://www.researchregistry.com/browse-the-registry#user-researchregistry/registerresearchdetails/5f9e0129dc4a190018589a28/>

## Guarantor

Adeodatus Yuda Handaya

## Consent statement

Written informed consent was obtained from all of the patients for publication of study and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

## Declaration of competing interest

No potential conflict of interest relevant to this article was reported.

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## Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.amsu.2020.12.006>.

## Provenance and peer review

Not commissioned, externally peer-reviewed.

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