



# Feasibility study of wearable cameras: GoPro Hero7, Panasonic HX-A500 and Patriot F850 glass camera for anal surgery recording. A video demonstration

C.-W. Hsu<sup>1,2</sup> · C.-C. Wu<sup>1</sup> · M.-C. Chang<sup>1</sup> · J.-H. Wang<sup>1</sup> · M.-H. Lee<sup>1</sup> · Y.-H. Chen<sup>1</sup>

Received: 17 March 2019 / Accepted: 13 April 2019 / Published online: 24 April 2019  
© Springer Nature Switzerland AG 2019

Capturing a clear surgical video is important to share novel surgical techniques and to achieve effective training for surgical residents and students. The ideal recording camera should be able to obtain high-quality images, highly portable, comfortable and price-friendly [1]. In this decade, the progress of the digital and optical technology has made available several types of wearable camera, which medical professionals can use for surgical recording as first person's field of view (FOV). These small and light-weight wearable cameras with high-quality video recording enable surgeons to record videos during surgery easily without high costs, a bulky camera system, or a professional video team. The notable wearable cameras invented for surgical recording include GoPro Hero series [2], Panasonic HX camera [3] and Google Glass [4], which have been widely used in most fields of surgery such as general surgery, urological surgery, orthopedic surgery, plastic surgery and maxillofacial surgery, with the exception of anal surgery. Anal surgery has several special considerations including the deep and narrow surgical space in the anal canal, short distance from eye to surgical field and inadequate lightening [5], which make proper video recording difficult.

In Taiwan, GoPro Hero7 (GoPro Inc, San Mateo, CA, USA) and Panasonic HX-A500 action camera (Panasonic Corporation of North America, One Panasonic Way,

Secaucus, NJ, USA) are commercially available. Google Glass is still in beta testing and is not available in Taiwan. Furthermore, one wearable glass camera, Patriot F850 glass camera (KAETERNG CO., Taipei, Taiwan), similar to the Google Glass, has been recently released. Therefore, we compared the feasibility of these three wearable cameras commercially available in Taiwan and propose our method for appropriate anal surgery recording.

Three commercially available cameras commercially available in Taiwan were tested: GoPro Hero7, Panasonic HX-A500 action camera and Patriot F850 glass camera. All the cameras are easily wearable and were used for same purpose focusing on the video recording in anal surgery, such as hemorrhoidal ligation, hemorrhoidectomy and fistulectomy. We obtained video recordings of all three cameras in anal surgery (see Video).

GoPro Hero7 and Panasonic HX-A500 showed similar results with 4K resolution (3840 × 2160 pixels) and variable resolution depends on light condition, which provides the best image quality. However, the image captured by Patriot F850 glass camera has half the resolution (full HD, 1980 × 1080 pixels) of the other two cameras and showed the worst image quality.

For normal wearing, GoPro Hero7 needs a special head strap for surgical video recording. Panasonic HX-A500 has a head mount as well and has a separate camera controller, which can be put in the pocket of the scrub. GoPro Hero7 is positioned on the surgeon's forehead and Panasonic camera to the left of the surgeon's left eye. FOV was adjusted until the optimal center of view was acquired. Patriot F850 glass camera was worn like glasses on the nose and ear.

Furthermore, our currently used headlight (TI-818-22B, Transverse Industries, Co., LTD, Taiwan) still can be installed in the proper position for all three cameras. But in the case of GoPro Hero7, we needed two head straps for camera and headlight, respectively, which made it the least comfortable to wear. The most convenient and

**Electronic supplementary material** The online version of this article (<https://doi.org/10.1007/s10151-019-01990-3>) contains supplementary material, which is available to authorized users.

✉ C.-W. Hsu  
ss851124@gmail.com

<sup>1</sup> Division of Colorectal Surgery, Department of Surgery, Kaohsiung Veterans General Hospital, 386 Ta-Chung 1st RD, Kaohsiung 81346, Taiwan

<sup>2</sup> Faculty of Medicine, National Yang-Ming University, Taipei, Taiwan

light-weighted camera for wearing and holding throughout the long operation time was the F850 glass camera (54 g in weight).

GoPro Hero7 and Panasonic HX-A500 can change direction and are easy in maintaining the surgical field by adjusting the camera angle from mount; however, the Patriot F850 glass camera has fixed aim when worn. In clinical practice, with GoPro Hero7, capturing the target lesion was impeded by the surgeon's hand and instrument. This happens because of the 12-cm distance between the eye and camera. In the case of Panasonic HX A-500, capturing the target lesion is also impeded by the surgeon's hand and instrument, due to the 10-cm distance between the eye and camera. In the case of Patriot F850, the target lesion is not in the center of the FOV, because the eye and camera aim in different directions.

To overcome these weak points, we propose introducing a plastic holder (available in the bike store, 1.75 USD) for headlight and Panasonic HX A-500 camera. With this method, the Panasonic HX A-500 camera and the headlight are positioned between the eyes with a perfect angle of view, like that of the eyes, which enables it to capture the appropriate images.

To our knowledge, this is the first study focusing on the feasibility of wearable cameras in video recording anal surgery. For successful image recordings of anal surgery, the camera should have high video resolution, appropriate FOV, easy centering, adjustable aim, be convenient to wear and have a reasonable price. All three wearable cameras were not originally intended to be used for surgical video recording, especially not for anal surgery. Therefore, none of the three devices tested in this study fit these criteria perfectly, but each has their own merits and weak points.

In conclusion, Panasonic HX A-500 has high-quality image resolution (4K resolution, 3840 × 2160 pixels, in 30–240 FPS), wide FOV, and the longest battery life, although, the video quality is not as sharp as that of GoPro and the video looks a little bit darker than real image. By introduction of the plastic holder, this camera can be positioned between the eyes and capture the perfect FOV, surpassing the other two devices. We believe that when innovative improvements in the digital and optical area are made on the basis of surgeons' suggestions, these wearable cameras could be used in this specialized surgical field successfully without technological limitations.

**Acknowledgements** This work was supported by the Kaohsiung Veterans General Hospital, Taiwan (Grant KSB108-056). This work was assisted in part by the Division of Colorectal Surgery of the Department of Surgery, Kaohsiung Veterans General Hospital.

**Author contributions** CWH study concept and design; acquisition of data; analysis and interpretation of data; drafting of the manuscript; statistical analysis. MCC, CCW, YHC acquisition of data. JHW critical revision of the manuscript for important intellectual content.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** This video forum does not contain experimental studies with the patient. The surgery was documented, with proper informed consent and with prior authorization of the patient, it was edited for publication. This study is in accordance with the ethical standards.

**Informed consent** Informed consent was obtained in accordance with the standards set forth by hospital regulations.

## References

1. Paro JA, Nazareli R, Gurjala A, Berger A, Lee GK (2015) Video-based self-review: comparing Google Glass and GoPro technologies. *Ann Plast Surg* 74(Suppl 1):S71–S74
2. Bizzotto N, Sandri A, Lavini F, Dall'Oca C, Regis D (2014) Video in operating room: GoPro HERO3 camera on surgeon's head to film operations—a test. *Surg Innov* 21(3):338–340
3. Kaneko H, Ra E, Kawano K, Yasukawa T, Takayama K, Iwase T et al (2015) Surgical videos with synchronised vertical 2-split screens recording the surgeons' hand movement. *Ophthalmol J Int d'ophtalmologie Int J Ophthalmol Zeitschrift fur Augenheilkunde* 234(4):243–246
4. Evans HL, O'Shea DJ, Morris AE, Keys KA, Wright AS, Schaad DC et al (2016) A comparison of Google Glass and traditional video vantage points for bedside procedural skill assessment. *Am J Surg* 211(2):336–342
5. Philip H, Gordon SN (2007) Principles and practice of surgery for the colon, rectum, and anus, 3rd edn. CRC Press, Boca Raton

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.