Value of an Action Cam in Surgical Pathology

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Abstract

Grossing of surgical pathology specimens is a complex task, which may be challenging to master correctly. Despite the growing use of digital technology in other aspects of surgical pathology, little has been done so far to modernize the documentation of grossing. We used a portable video camera ("GoPro") to document different grossing procedures. The video material may be used for teaching purposes or might enhance the more commonplace macroscopic description by adding another dimension. Furthermore, video documentation may encourage the discussion of upcoming clinical questions or help rectify some possible initial impreciseness.

Keywords gopro, grossing, digital, education, pathology

Background

Grossing of surgical pathology specimens is intriguing and can be challenging (1). Clinicians require their specimens to be correctly orientated and need reliable information on entities and resection margins (2). In an oncologic setting, precise tumor staging and grading is vital for further patient management (3). In daily practice this demanding task is commonly left to the most junior residents.

Many aspects of the actual work make grossing challenging on a daily basis. Examples include the following:

- Specimen orientation may not be clear or is completely missing.
- Specimen degradation or relevant alteration of the specimen (e.g. following transport, specimen conservation, formalin artifacts).
- Divergent standard operating procedures (no consent on resection margins, e.g. in pancreaticoduodenectomy (2)).
- Frequent lack of consensus in general.

Grossing of specimens is an important skill for every anatomic pathologist – the results of this task represent the first important step in the diagnostic process after the specimen has been received (1). However, grossing itself is an unfamiliar discipline for every beginner in surgical pathology and may be a reason for significant anxiety (4). Junior trainees are often introduced into grossing by directly confronting them with the procedure itself, whilst receiving oral instructions from more senior colleagues. Notwithstanding, grossing manuals do exist – these may be specifically tailored to the needs of the adjunct clinic or may be internationally accepted works (5, 6). Commonly, however, the instructions included in these works diverge in between the sources and may at times seem incomplete. In addition, there are several ways to gross a particular specimen (2, 7), each with its advantages and disadvantages.

Whilst textbooks in surgical pathology and grossing in particular exist (5, 6), written word is often insufficient for a beginner in surgical pathology to fully understand and correctly apply grossing strategies (8). A more “hands-on” visual approach showing the actual perspective of the pathologist

may therefore benefit beginners (9). A video recording of the actual procedure offers the possibility for repetition and individual adjustment to the pace of the teaching. Moreover, it conveys a sense of plasticity, essentially the main advantage of visual teaching techniques (10, 11).

The aim of this work is to present examples of video-assisted grossing using a GoPro HERO 7 (see *Hardware*) in real-life situation and present the experiences gained (by two second-year residents, KB and LC). To the best of our knowledge, the use of an action camera in grossing has so far, not been described elsewhere.

Activity

Hardware

A GoPro HERO 7 cam (GoPro, San Mateo, CA, USA; **Fig. 1**) was used to document grossing procedures. The GoPro HERO 7 is a light-weight (116g) 12-megapixel camera with "4K60" video quality and a stabilization element. For still photos the GoPro HERO 7 offers a 12 megapixel sensor with the highest resolution of 4.000x3.000 pixels. Essential further features include voice control, a touch screen and live streaming option. Due to a nonsterile working environment, a GoPro SUPER SUIT (GoPro) was employed to protect the camera and lens. A 128 Gigabyte microSD memory card was sufficient for the purpose of documentation. For the actual filming the GoPro HEADSTRAP (GoPro) and a lightweight chest mount ("Chesty") were used. Mostly the ultra-wide field mode was applied for recording. Highest resolution documentation consumed about 200 megabytes per minute. Video editing was done using Adobe Premiere Pro 2020 (Adobe, San José, CA, USA).

Documentation

Using the GoPro action cam we could document the processing of various specimens in detail during the entire daily workflow (**Fig. 2**). The highest resolution was used (see *Hardware*). The selection criteria for specimens were complexity of specimen grossing, frequency of the specimen and illustration of in-house grossing standards. The preparation time for the set-up needed before grossing was negligibly small (usually <1 minute). Complex specimen documentation (e.g. pancreaticoduodenectomy, mastectomy) took up to twelve minutes of recording. Video editing could reduce the video length significantly (on average to one third of the initial length). Resection margins, specimen plasticity and consistence, tumor borders, tumor infiltration, specimen orientation, inking before sectioning, presentation of tumor beds and adequacy of resection could be documented.

Results and Discussion

The above described set up was used for approximately seven months and twelve different specimens - among others, the processing of partial pancreaticoduodenectomies ("Whipple procedure"), mastectomies, prostato-cystectomies, oropharyngeal and native biobanking specimens - were recorded (**Fig. 2**). Video material was established in order to standardize and improve the introduction into grossing for new trainees. The video material has further been used in internal case discussions and university lectures for medical students. Furthermore, we have observed that video documentation also offers continuous medical education to seniors.

Following application in a daily setting, the main observations can be summarized: The GoPro HERO 7 action cam offers recordings in high resolution formats. It is a fast and dynamic way of documenting specimens photo- and video-graphically. It is user friendly, lightweight and intuitive in handling. Moreover, the device itself is more than affordable in comparison to static high-resolution cameras. As specimen grossing is usually faster than most surgical procedures, battery status is not an issue (12).

The above described results are empiric by their very nature but validated by previous literature: Visual documentation of procedures has educational value (13), which is supported by similar experiments in the operating theatre and cadaveric teaching courses (12, 14-17). Video material can be used to explain procedures and principles (18). The perspective of documentation may leave less room for interpretation in the eye of the beholder as it represents the true view facing the trainee. This view is more readily comprehensible and more realistic than a conventional video demonstration (9). Madrigal et al. (19) have successfully tested a 3D video documentation of grossing procedures. The action cam view of a GoPro might even be more realistic and intuitive. In addition, the applicability via headstrap is much easier and does not consume any working space as compared to other set-ups previously described by Madrigal et al.

The GoPro action cam also offers a live streaming option ("GoPro Live"). This feature might help in monitoring the actual case load and may enable more flexible workflows in the future. Empiric studies

using smartphones in the grossing theatre (18) do not offer this option, and are not suitable for a non-sterile working environment. Data protection might also be an issue in locatable devices, e.g. smartphones.

Moreover, video documentation is a form of quality assurance and can support error analysis. As resection margins may pose a matter of conflict, exact documentation serves as a retrospective means of clarifying them. Thereby, patients may possibly be spared unnecessary re-interventions. Case-related documentation of macroscopic features might be educative for clinicians, too, e.g. in a context of interdisciplinary tumor boards. So far, however, usage in tumor boards did not take place.

Despite being educational (9), ethical conduct is paramount and patient privacy has to be respected. Although patient data might be hard to track via a specimen itself, video material should be protected and not readily accessible to workers outside of the respective institute. It is clear that an action cam has to be used in a healthy quality assurance and error analysis culture.

Several limitations in using the action cam were observed. First of all, wearing the action cam with the head strap imposed a certain weight (12) and interfered with the resident's headset, which was used to record the grossing text. The "chesty" was more comfortable. As specimens are potentially infectious and the working environment non-sterile, the use of the touch screen was rarely possible. In addition, when using the aforementioned protection case, the touch screen was not accessible. However, recording and pausing was enabled via voice control (or if necessary, with the help of the technical assistant). Voice control is an important advantage in comparison to documentation with smartphones (18). The use of the zoom is, unfortunately, so far not possible using voice control, thereby certain details may be missed in the recording.

Conclusions

We conclude that an action cam is a means of fast documentation using an acceptable resolution. Action cam documentation seems to be an appropriate means of introducing new residents into grossing techniques and specimen processing. Visual material has a high educational value and excellent didactic potential, in particular for beginners. Long term experience and data are needed to

further evaluate the potential of action cam video documentation for teaching purposes. Patient privacy has to be guaranteed in every respect.

Declarations

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Conflict of interest None declared.

Authors' contributions KB generated video material and wrote the manuscript. LC generated video material, critically reviewed the manuscript and gave significant intellectual input. YB edited the manuscript and gave significant intellectual input.

Ethics approval This study was approved by the local ethics committee (BASEC-Number Req-2020-00902).

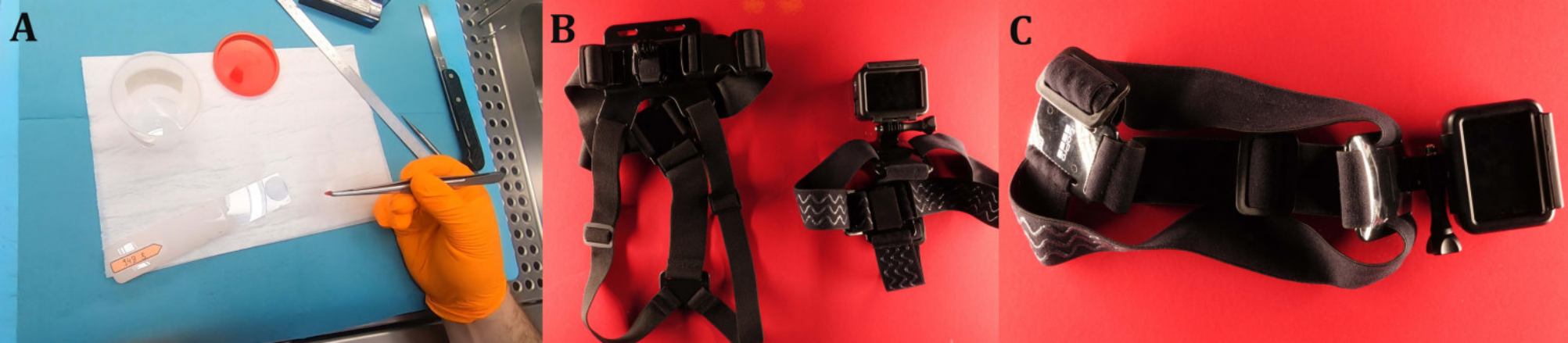
References

1. Dimenstein IB. Grossing Technology Today and Tomorrow. Lab Med. 2019.
2. Shi J, Basturk O. Whipple Grossing in the Era of New Staging: Should We Standardize? Diagnostics (Basel). 2019;9(4).
3. Bell WC, Young ES, Billings PE, Grizzle WE. The efficient operation of the surgical pathology gross room. Biotechnic & histochemistry : official publication of the Biological Stain Commission. 2008;83(2):71-82.
4. Kelly M, Soles R, Garcia E, Kundu I. Job Stress, Burnout, Work-Life Balance, Well-Being, and Job Satisfaction Among Pathology Residents and Fellows. Am J Clin Pathol. 2020;153(4):449-69.
5. Westra WH, Hruban, R.H., Phelps, T.H., Isacson, C. Surgical Pathology Dissection: An Illustrated Guide. 2nd ed: Springer; 2009.
6. Lester SC. Manual of Surgical Pathology 3rd ed: Elsevier; 2010. 608 p.
7. Adsay NV, Basturk O, Saka B, Bagci P, Ozdemir D, Balci S, et al. Whipple made simple for surgical pathologists: orientation, dissection, and sampling of pancreaticoduodenectomy specimens for a more practical and accurate evaluation of pancreatic, distal common bile duct, and ampullary tumors. Am J Surg Pathol. 2014;38(4):480-93.
8. Agha RA, Fowler AJ. The role and validity of surgical simulation. Int Surg. 2015;100(2):350-7.
9. Melín-Aldana H, Carter B, Sciortino D. Documentation of Surgical Specimens Using Digital Video Technology. Archives of Pathology & Laboratory Medicine. 2006;130(9):1335-8.
10. Henson DE, Grimley PM. Pathology Education: Moving On. Arch Pathol Lab Med. 2015;139(12):1480-1.
11. Samulski TD, La T, Wu RI. Adaptive eLearning modules for cytopathology education: A review and approach. Diagn Cytopathol. 2016;44(11):944-51.
12. Ganry L, Sigaux N, Ettinger KS, Salman SO, Fernandes RP. Modified GoPro Hero 6 and 7 for Intraoperative Surgical Recording-Transformation Into a Surgeon-Perspective Professional Quality Recording System. J Oral Maxillofac Surg. 2019;77(8):1703 e1- e6.
13. Marshall R, Cartwright N, Mattick K. Teaching and learning pathology: a critical review of the English literature. Med Educ. 2004;38(3):302-13.
14. Vara AD, Wu J, Shin AY, Sobol G, Wiater B. Video Recording With a GoPro in Hand and Upper Extremity Surgery. J Hand Surg Am. 2016;41(10):e383-e7.
15. Moore MD, Abelson JS, O'Mahoney P, Bagautdinov I, Yeo H, Watkins AC. Using GoPro to Give Video-Assisted Operative Feedback for Surgery Residents: A Feasibility and Utility Assessment. J Surg Educ. 2018;75(2):497-502.
16. Park MS, Brock A, Mortimer V, Taussky P, Couldwell WT, Quigley E. GoPro Hero Cameras for Creation of a Three-Dimensional, Educational, Neurointerventional Video. J Digit Imaging. 2017;30(5):561-5.
17. Graves SN, Shenaq DS, Langerman AJ, Song DH. Video Capture of Plastic Surgery Procedures Using the GoPro HERO 3+. Plast Reconstr Surg Glob Open. 2015;3(2):e312.
18. Bhattacharyya S, Lubin D, Patel V, Uppal G, Jhala N, Khurana J. The Use of a Smartphone (iPhone) As a Tool in Teaching Surgical Pathology Grossing Techniques to Pathology Residents in Training. American Journal of Clinical Pathology. 2015;144(suppl_2):A182-A.
19. Madrigal E, Prajapati S, Hernandez-Prera JC. Introducing a Virtual Reality Experience in Anatomic Pathology Education. American Journal of Clinical Pathology. 2016;146(4):462-8.

Figure legends

Figure 1 Hardware. A View and setting. B “Chesty” and head strap with GoPro cam. C Close-up.

Figure 2 Processing of various specimens, “real-life” snapshots in our laboratory/grossing theatre. A Overhead static images of a mastectomy specimen, outlining dimensions and tumor borders. B Partial glossectomy with complex orientation and several anatomic landmarks. Quality-ensuring documentation in photo- and videographic ways. C Processing of an urinary bladder specimen demonstrating probing of ureter ostia and tumor bed after neoadjuvant chemotherapy.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