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Editorial

Video-on-command for thoracic and cardio-vascular surgery[1]

Ludwig K. von Segesser*

Department of Cardio-vascular Surgery, Centre Hospitalier Universitaire Vaudois, CHUV, Rue du Bugnon 46, CH-1011 Lausanne, Switzerland

Nowadays, new technology for imaging, information storage, and its transmission is almost everywhere. In the medical field, multi-slice computed tomography (CT), allowing for simultaneous acquisition of many images in parallel, and quick three-dimensional reconstruction is just one example that has the potential to make significant changes in the daily practice, not only for thoracic and cardio-vascular surgeons, but others too. The fact, that the lumen of the main coronary arteries can be demonstrated quite well with multi-slice CT makes clear, that for a number of questions, it is no longer necessary to realize a coronary angiography. There can be little doubt, that the advent of new players in the coronary artery scene will also impact its future development. In addition, the age of multi-slice CT is just beginning and numerous other applications can be expected like, e.g. systematic preoperative identification of the origin of Adamcievic's artery in thoraco-abdominal aortic aneurysms, postoperative functional assessment of a totally implantable left ventricular assist device [1], etc.

For traditional access to information, it is sufficient to indicate its source (ref. [1]) in order to be able to retrieve the corresponding document. However, the function of a totally implanted pulsatile pump, that by definition includes moving parts, is best assessed by a streaming video (see video 1 in ref. [1]). Following the experience of *Interactive Thoracic and Cardio-vascular Surgery* [2,3] the *European Journal of Cardio-thoracic Surgery* [1] now offers and accepts short video clips for illustration of the manuscripts submitted (see Instructions to Authors, pp. 674–675 of this issue; http:www.elsevier.com/locate/ejcts). It is essential for the time being to keep these video clips short in order to achieve reasonable delays for downloading. However, the increasing availability of broad-band transmission will certainly allow for larger files shortly.

Better availability of information brings up a new type of problem, which is its transformation into knowledge. We all know very well the daily practice in the operating theatre, where it is of prime importance for the *life* of the patient, to keep in *sight* his vital parameters (*www.lifesight.org*). As a matter of fact the information from the operating field (Fig. 1a) has to be frequently up-dated by the continuously collected information about haemodynamics, etc. (Fig. 1b). For the time being, it is for the surgeon necessary in most operating theatres, to slightly change the position of his head, to focus onto a remote screen, where he has to catch the displayed curves and numbers before he can return to the operating field, the place, where the focus of his activity is supposed to be. This sequential process happens several times a minute and increases in frequency during haemodynamically critical situations – exactly then, when full attention to the surgical field is required most. Although it has been standard for quite some time in endoscopic surgery to present on the same screen exposure parameters and video-endoscopically achieved operative views (Fig. 2), more integration of information is now not only feasible, but mandatory.

Thoracic and cardio-vascular surgery is not the only stressful activity requiring rapid integration of visual information from various sources during critical missions. Head-up displays that bring important information into the optical field have been used by pilots and in other technology driven fields. Such devices, also called cyber displays, are carried close to one eye and allow either for intermittent feeding with still images, streaming video, or both. Alternatively, the information mentioned, can be displayed as an overlay into semi-transparent glasses, where it is positioned in the peripheral optical field, either a quadrant, or the upper and lower zones. A demonstration of continuous *lifesight*, and its potential is given in Video 1[1]: vital parameters (curves, digital values, limits, and interpretation) are displayed as an overlay to the surgical view. Simulated ventricular tachycardia (near the end of Video 1)[1] impacts all, EKG, percutaneous oxygen saturation

* Tel.: +41-21-314-2280; fax: +41-21-314-2278.
E-mail address: ludwig.von-segesser@chuv.hospvd.ch (L.K. von Segesser).

[1] See video 1 in the online version of this paper.

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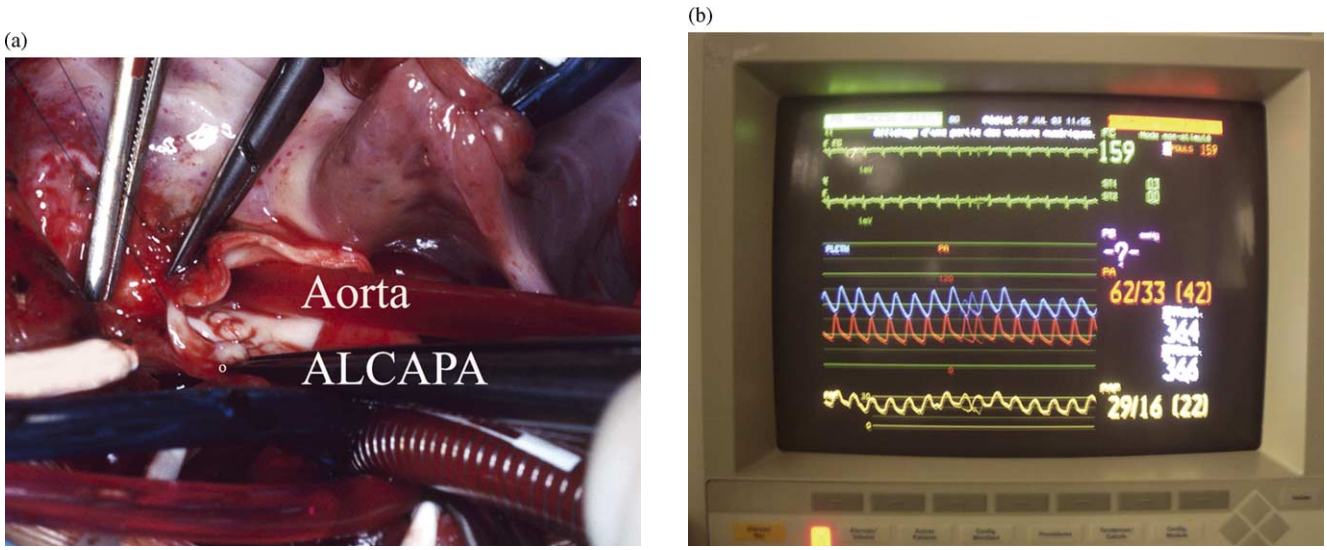

Fig. 1. (a) Perprocedural view of an anomalous left coronary artery originating from the pulmonary artery (ALCAPA: ostium at the tip of forceps) during reimplantation into the aortic root (vent). (b) Typical view of a monitor display during congenital heart surgery showing (curves from the top) EKG × 2, transcutaneous oxygen saturation (blue), arterial blood pressure (red), and pulmonary artery pressure (yellow). Digital values on the right side.

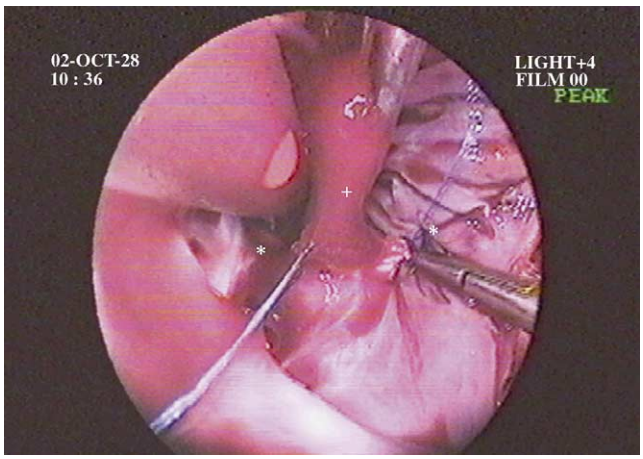

Fig. 2. Videoendoscopic view of the right atrium during an ASD closure ('direct suture') through a small posterior thoracotomy: blood jet (+) is filmed at lung inflation for de-airing of the left side: date, time and exposure parameters are displayed within the same screen.

curve, digital values, and software based diagnosis. Of course, the same device can be used during an operation for on-line visualization of the last coronary artery angiography, a recent CT-scan, or any other information, which is stored in a data warehouse with broad-band access, allowing for rapid communication. In addition, images generated during the surgical procedure itself, may also be viewed within the same display. Typical examples include peroperative angiography, transesophageal echocardiography, intravascular and intracardiac ultrasound, etc.

There can be no doubt that real time *lifesight* in conjunction with on-line access to key diagnostic data including still images and video on command, is of prime importance for rapid decision making, or better, decision making within a useful time frame, all key requirements for successful thoracic and cardio-vascular surgery.

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