EVOLVING TECHNOLOGY

A SIMPLE ELECTRONIC DEVICE FOR RESOLVING PARADOXIC MOTION IN VIDEO-ASSISTED THORACOSCOPIC PROCEDURES

Eugenio Pompeo, MD, Carlo Luigi Cardini, MD, Simona Servetti, MD, and Tommaso Claudio Mineo, MD, *Rome, Italy*

Video-assisted thoracoscopic surgery (VATS) is increasingly used to carry out various thoracic surgical procedures, due in part to continuing improvements in video technology and endoscopic surgical instrumentation. In VATS, the ideal operating strategy is to keep the camera, instruments, and targeted pathology in that order along the same line to maintain the correct spatial relationship for instrument maneuvering.[1] However, when the surgeon is operating on a wide area, the camera may be focused on the instruments, generating a paradoxic motion in which the normal spatial relationship is completely reversed (Fig 1, *A*). This disturbing effect is also called "mirror image" because the right side of the surgical field is seen on the left of the screen and vice versa. As a result, the surgeon's movements appear specular, rendering them more difficult and less precise. At our university institution we routinely use VATS to perform a number of minor and major surgical procedures. We have found that paradoxic motion is more often encountered during extensive lysis of adhesions, sectioning of the pulmonary ligament during lobectomy, reduction pneumoplasty for end-stage emphysema, or dissections to isolate the esophagus. Recently, Yim, Izzat, and Lee[2] have proposed a method by which a normal spatial relationship for instrument maneuvering might be restored by simply turning the camera 180°.

We have since applied this solution, and we have found that it indeed restores a normal left-to-right spatial relationship. However, as a consequence of the camera rotation, a reverse upright image is generated as well (Fig 1, *B*). For this reason, we have tried to find a more effective solution to this disturbing effect.

We propose the application of a simple steady diverter switch that allows sole horizontal synchronicity to be electronically reversed whenever a mirror image is generated. In this way normal spatial relationship is restored without losing the correct vertical orientation and without the need for any rotation of the camera.

Setting up the device is simple and inexpensive. At the internal extremity of the cathode ray tube, close to the elec-

From the Division of Thoracic Surgery, Tor Vergata University, Rome, Italy.

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Address for reprints: Eugenio Pompeo, MD, Department of Thoracic Surgery, University Tor Vergata of Rome, Rome, Italy (E-mail: pompeo@med.uniroma2.it).

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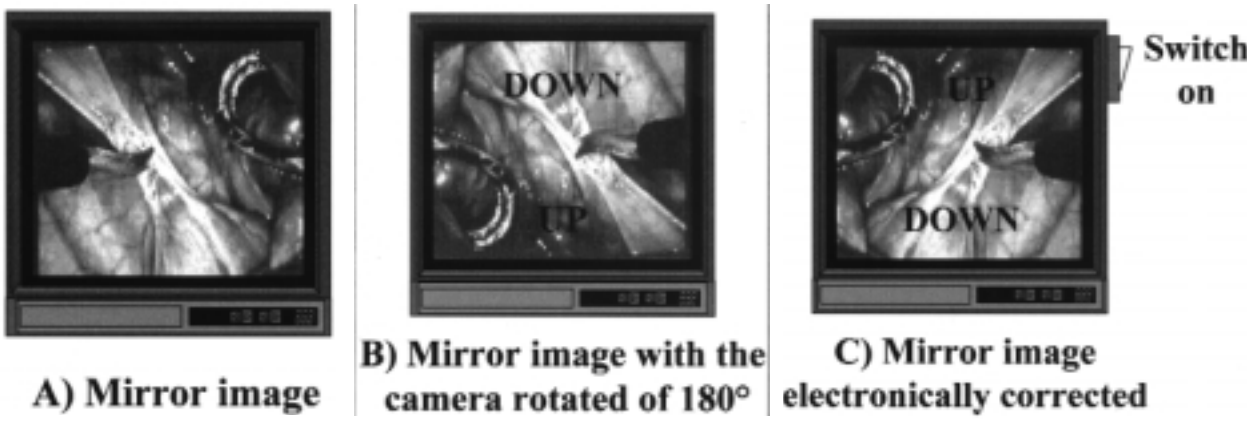

Fig 1. Appearance on the screen of the targeted pathology and surgical instrumentation when paradoxic motion is generated without correction **(A),** with the camera rotated **(B),** and after electronic correction **(C).**

tromagnetic coil, a 4-cable system is present. Two of these cables transmit the image signal in horizontal synchronicity; the other 2 are assigned for vertical adjustment. Just at the take-off of the horizontal synchronicity leading cables, the cables are welded to a diverter switch screw driven on the monitor case by passing and exchanging the outputs. Switching the control lever when paradoxic motion is generated rotates the image 180° so that correct horizontal synchronicity is restored without changing the vertical adjustment (Fig 1, *C*). Although virtual, the image so created allows the surgeon's best ergonomic advantage in VATS endoscopic procedures. This is particularly helpful whenever frequent changes of orientation of the camera and instruments are needed. As a result, the surgeon's maneuvers become quicker, safer, and more precise, and operative time is shortened.

In conclusion, we believe that this simple electronic device can alleviate paradoxic motion without losing correct vertical synchronicity, thus facilitating surgical maneuvers in VATS.

REFERENCES

1. Landreneau RJ, Mack MJ, Hazelrigg SR, Dowling RD, Acuff TE, Magee MJ, et al. Video-assisted thoracic surgery: basic technical concept and intercostal approach strategies. Ann Thorac Surg 1992;54:800-7.
2. Yim APC, Izzat MB, Lee TW. Counteracting paradoxical motion in videoendoscopic operations. Ann Thorac Surg 1998;66:965.