Three-dimensional video-assisted thoracoscopic pericardiectomy

Fabio Luison and W. Douglas Boyd

Ann Thorac Surg 2000;70:2137-2138

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Fabio Luison, MD, and W. Douglas Boyd, MD

Cardiac Surgery, London Health Sciences Center, University Hospital, London Ontario, Canada

Video-assisted thoracic surgery has proven to be safe and effective for the diagnosis and management of pericardial disease. Three-dimensional (3-D) video imaging technology has been developed to allow the laparoscopic surgeon more precision and efficiency in advanced laparoscopic cases. This case report describes the marriage of 3-D video imaging and thoracoscopy that allowed performance of a technically difficult pericardiectomy without incident. Our aim is to describe the use of state-of-the-art 3-D video imaging to allow success in difficult cases.

(Ann Thorac Surg 2000;70:2137–8)

As experience with video-assisted cardiac surgery has grown, more complex cardiac procedures are increasingly being investigated in both the laboratory and clinical arena. With these efforts, a considerable number of limitations are apparent. Foremost is that even experienced surgeons have difficulty translating a flat video image into a three-dimensional (3-D) surgical environment, especially motions along the visual axis (z-axis). Restoration of true 3-D perception with 3-D endoscopes was expected to facilitate performance of advanced minimally invasive surgical procedures. Different views are found in the literature with regards to the benefits or lack thereof of 3-D video imaging in surgery [1–4]. These initial reports based their findings on the use of first-generation 3-D video equipment. Shortcomings of these early generation systems include lack of true stereopsis and limited resolution. In this report, we describe a new 3-D video system applied to thoracoscopic pericardiectomy. The new video system allowed superior stereoscopic vision and a high-resolution image that facilitated a difficult dissection.

The cardiovascular service was consulted on a 39-year-old female with an admitting diagnosis of pericardial effusion. The woman had a 1-year history of worsening myalgias, arthralgias, and central chest pain. Dyspnea and three-pillow orthopnea were present for 2 months. Intermittent night sweats, spiking temperatures, and weight loss were other presenting features. Investigations included blood, urine, and sputum cultures, tuberculin skin test, echocardiography, CAT scan of the chest and abdomen, bone marrow biopsy, and serum for markers of various autoimmune and connective tissue disorders. Echocardiography revealed a small pericardial effusion with thickened pericardium. An attempted pericardiocentesis was unsuccessful. All other investigations were nondiagnostic. A surgical approach to the pericardial effusion/thickening was deemed necessary. After full disclosure, the patient consented to a thoracoscopic pericardiectomy.

The 3-D endoscopic system consisted of the Stereoscope 3-D camera (8190; Vista Medical Technologies, Westborough, MA) coupled with the 3-D 30/70-degree Stereoscope (8191-2; Vista Medical Technologies). The unique 30/70-degree endoscope allows angled direction of view with the ability to change the viewing angle even while the camera orientation is maintained constant. The Vista 8000 Advanced Visualization and Information System and Vista Cardioview head-mounted displays (HMD) were interfaced with the camera/endoscope system (Fig 1). The HMD units have 3.3-cm diagonal liquid crystal display with 922K full-color VGA with resolution of 640 $\times$ 480 pixels.

The patient was intubated with a double-lumen endotracheal tube. She was positioned supine with the left hemithorax elevated to 30 degrees with a roll and her left arm suspended from a horizontal bar. The left lung was deflated after the prep and drape was completed. The initial port site was the eighth intercostal space in the anterior axillary line. Videoscopic entry into the chest revealed numerous adhesions between lung, chest wall, and pericardium. Digital dissection allowed breakdown of the inflammatory adhesions and placement of the other port sites under endoscopic visualization. The second port was introduced via the seventh intercostal space in the midaxillary line and the third port at the sixth intercostal space in the anterior axillary line. All ports were 11 mm (Ethicon Endopath, Cincinnati, OH). To facilitate lung collapse and exposure, warm CO_2 insufflation to 8 mm Hg was employed (20-L High Flow Insufflator; Stryker Endoscopy, Santa Clara, CA). The endoscope was introduced through the sixth intercostal port site. A grasper and the harmonic scalpel (Ethicon Endo-Surgery; Cincinnati, OH) placed through the eighth and seventh intercostal port sites, respectively, were then used to dissect multiple adhesions between the lung and pericardium. A second grasper was placed through a stab incision in the eighth intercostal space at the midaxillary line. The thickened pericardium could not be tented for safe entry, and needle aspiration did not identify a free space. With cautious dissection, the pericardial space was entered. Numerous adhesions and areas of cardiac symphysis were successfully dissected to allow resection of a 20-cm^2 piece of pericardium. The specimen and some serosanguinous pericardial fluid were sent for pathological and microbiologic examination. Complete hemostasis was ensured followed by endoscopically guided placement of a straight 24F chest tube through the sixth intercostal space port site. Muscle layers were closed with running 2-0 Vicryl (Ethicon, Somerville, NJ) sutures followed by 4-0 Vicryl subcuticular closure of the dermis. The operative time was 130 minutes. The chest tube was removed the next morning, and pain was controlled with oral narcotic.

Comment

Thoracoscopic pericardiectomy has been shown to be an effective modality in the treatment of effusive pericardial

Accepted for publication Feb 3, 2000.

Address reprint requests to Dr Boyd, Cardiac Surgery, London Health Sciences Center, University Hospital, 339 Windermere Rd, London, ON N6A 5A5, Canada. e-mail: boyd@robosurgeon.com.

Published by Elsevier Science Inc

0003-4975/00/$20.00
PII S0003-4975(00)01944-5

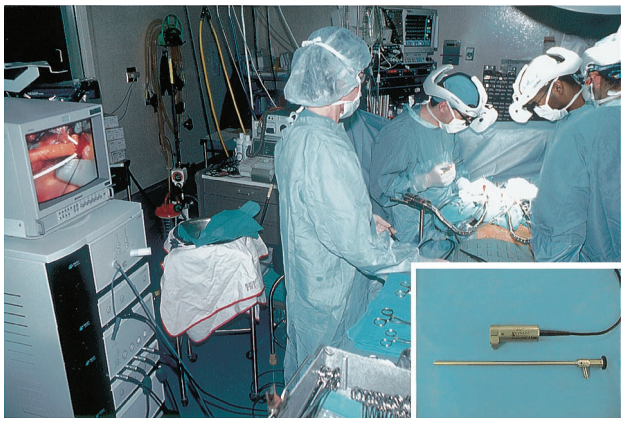

Fig 1. Surgical team wearing Cardioview head-mounted displays with Vista console to the far left. Vista 3-D scope and camera head shown in inset.

disease [5–8]. However, caution has been expressed in the literature over the use of this technique for a thickened pericardium with minimal fluid or numerous adhesions. The usual recommendation in these instances is to perform the procedure in an open fashion [9]. In this case, the use of state-of-the-art 3-D video technology with head-mounted display and the harmonic scalpel combined to provide a more detailed and possibly safer dissection.

Mixed reviews about the potential benefits of 3-D video technology are present in the literature [1–4]. However, there does appear to be the notion that 3-D video technology allows faster task completion, especially for more complex maneuvers such as knot tying and suturing [2, 4]. All these papers were written describing first-generation 3-D video systems. These early systems may not have completely demonstrated the true enabling potential of 3-D endoscopes when applied to precise surgical maneuvers. Although subjective, it is felt that the 3-D system employed allowed for a precise dissection without mishap that would not have been possible with existing two-dimensional technology. Further trials involving this new 3-D video technology need to be conducted to determine its full potential.

The use of the harmonic scalpel was also felt to be a significant adjunct for two reasons. The first was the lack of plume generation. The second was the nonelectrical nature of the device, which lessened the concern of arrhythmia generation. These two features allowed for a continuous dissection that was not marred by any arrhythmias. Other reports confirm the efficacious use of this technology [8].

The operative time of 130 minutes was related to the level of technical difficulty for this particular case. It has been demonstrated that patients with massive pericardial effusions can have thoracoscopic pericardiectomy performed in an average of 27 minutes. However, if chronic pericarditis was present, this operative time more than doubled [8].

Overall, two-dimensional thoracoscopic pericardiectomy is a safe technique when applied to relatively straightforward pathology. The application of 3-D state-of-the-art technology should allow for more complex dissections to be performed safely and with fewer conversions to an open procedure. Such technology should continue to be evaluated with the goal of redefining the limits of laparoscopic surgery.

References

1. Hanna GB, Shimi SM, Cuschieri A. Randomized study of influence of two-dimensional versus three-dimensional imaging on performance of laparoscopic cholecystectomy. Lancet 1998;351:248–51.
2. Jones BJ, Brewer JD, Soper NJ. The influence of three-dimensional video systems on laparoscopic task performance. Surg Laparosc Endosc 1996;6:191–7.
3. McDougall EM, Soble JJ, Wolf JS Jr, Nakada SY, Elashry OM, Clayman RV. Comparison of three-dimensional and two-dimensional laparoscopic video systems. J Endourol 1996;10:371–4.
4. Peitgen K, Walz MV, Walz MV, Holtmann G, Eigler W. A prospective randomized experimental evaluation of three-dimensional imaging in laparoscopy. Gastrointest Endosc 1996;44:262–7.
5. Flores RM, Jaklitsch MT, DeCamp MM Jr., Sugarbaker DJ. Video-assisted thoracic surgery pericardial resection for effusive disease. Chest Surg Clin North Am 1998;8:835–51.
6. Hazelrigg SR, Mack MJ, Landreneau RJ, Acuff TE, Seifert PE, Auer JE. Thoracoscopic pericardiectomy for effusive pericardial disease. Ann Thorac Surg 1993;56:792–5.
7. Mack M. Thoracoscopy. In: Pearson FG, Deslauriers J, Ginsberg RJ, eds. Thoracic surgery. New York: Churchill Livingstone, 1995:1488–94.
8. Ohtsuka T, Wolf RK, Wurnig P, Park SE. Thoracoscopic limited pericardial resection with an ultrasonic scalpel. Ann Thorac Surg 1998;65:855–6.
9. McKneally MF. Comments and controversies. In: Pearson FG, Deslauriers J, Ginsberg RJ, eds. Thoracic surgery. New York: Churchill Livingstone, 1995:1493.

Video-Assisted Thoracic Surgery Resection of Chest Wall En Bloc for Lung Carcinoma

Mark D. Widmann, MD, Robert J. Caccavale, MD, Jean-Phillipe Bocage, MD, and Ralph J. Lewis, MD

Division of Thoracic Surgery, Robert Wood Johnson Medical School, University of Medicine and Dentistry of New Jersey, New Brunswick, New Jersey

A video-assisted thoracic surgery approach to en bloc resection of lung cancer invading the chest wall is described. Using a minimally invasive surgical approach combined with neoadjuvant external beam radiotherapy, complete resection of an upper lobe carcinoma invading two rib segments was performed in a manner that permitted complete resection with curative intent and allowed for rapid recovery.

(Ann Thorac Surg 2000;70:2138–40)

Accepted for publication April 18, 2000.

Address reprint requests to Dr Widmann, North Jersey Thoracic Surgical Associates, P.C., 111 Madison Ave, Suite 301, Morristown, NJ 07960; e-mail: mdw@north-jersey-thoracic.com.

0003-4975/00/$20.00
PII S0003-4975(00)02057-9

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