



## NEW TECHNIQUES AND TECHNOLOGIES

### Global vision system in laparoscopy<sup>☆</sup>



I. Rivas-Blanco<sup>a</sup>, E. Sánchez-de-Badajoz<sup>b,\*</sup>, I. García-Morales<sup>a</sup>, J.M. Lage-Sánchez<sup>c</sup>,  
P. Sánchez-Gallegos<sup>d</sup>, C.J. Pérez-del-Pulgar<sup>a</sup>, V.F. Muñoz<sup>a</sup>

<sup>a</sup> Ingeniería de Sistemas y Automática, Universidad de Málaga, Málaga, Spain

<sup>b</sup> Unidad docente de Urología, Facultad de Medicina, Universidad de Málaga, Málaga, Spain

<sup>c</sup> Hospital Universitario Virgen de la Victoria, Málaga, Spain

<sup>d</sup> Unidad docente de Cirugía, Facultad de Medicina, Universidad de Málaga, Málaga, Spain

Received 8 September 2016; accepted 23 September 2016

Available online 31 March 2017

#### KEYWORDS

Laparoscopy;  
Camera;  
Magnet;  
Nephrectomy;  
Varicocelectomy

#### Abstract

**Objective:** The main difficulty in laparoscopic or robot-assisted surgery is the narrow visual field, restricted by the endoscope's access port. This restriction is coupled with the difficulty of handling the instruments, which is due not only to the access port but also to the loss of depth of field and perspective due to the lack of natural lighting. In this article, we describe a global vision system and report on our initial experience in a porcine model.

**Material and methods:** The global vision system consists of a series of intraabdominal devices, which increase the visual field and help recover perspective through the simulation of natural shadows. These devices are a series of high-definition cameras and LED lights, which are inserted and fixed to the wall using magnets. The system's efficacy was assessed in a varicocelectomy and nephrectomy.

**Results:** The various intraabdominal cameras offer a greater number of intuitive points of view of the surgical field compared with the conventional telescope and appear to provide a similar view as that in open surgery. Areas previously inaccessible to the standard telescope can now be reached. The additional light sources create shadows that increase the perspective of the surgical field.

**Conclusion:** This system appears to increase the possibilities for laparoscopic or robot-assisted surgery because it offers an instant view of almost the entire abdomen, enabling more complex procedures, which currently require an open pathway.

© 2016 AEU. Published by Elsevier España, S.L.U. All rights reserved.

<sup>☆</sup> Please cite this article as: Rivas-Blanco I, Sánchez-de-Badajoz E, García-Morales I, Lage-Sánchez JM, Sánchez-Gallegos P, Pérez-del-Pulgar CJ, et al. Sistema de visión global en laparoscopia. Actas Urol Esp. 2017;41:274–278.

\* Corresponding author.

E-mail address: [sbadajoz@gmail.com](mailto:sbadajoz@gmail.com) (E. Sánchez-de-Badajoz).

**PALABRAS CLAVE**

Laparoscopia;  
Cámara;  
Imán;  
Nefrectomía;  
Varicocelecomía

**Sistema de visión global en laparoscopia****Resumen**

**Objetivo:** La principal dificultad en la cirugía laparoscópica o robótica es la estrechez del campo de visión, restringido por el puerto de acceso del endoscopio. A ello se suma la dificultad en el manejo de los instrumentos, debida no solo al puerto de acceso, sino a la pérdida de la profundidad de campo y de la perspectiva por la ausencia de una iluminación natural. En este artículo describimos un sistema de visión global y explicamos la experiencia inicial en un modelo porcino.

**Material y métodos:** El sistema de visión global consta de una serie de dispositivos intraabdominales, que aumentan el campo de visión y que ayudan a recuperar la perspectiva mediante la simulación de sombras naturales. Consta de una serie de cámaras de alta definición y de luces LED, que son introducidas y fijadas a la pared mediante imanes. La eficacia del sistema se ha evaluado en una varicocelecomía y en una nefrectomía.

**Resultado:** Las diferentes cámaras intraabdominales ofrecen más puntos de visión intuitivos del área operatoria en comparación con el telescopio convencional y parece ser similar a la visión en cirugía abierta. Incluso se pueden alcanzar áreas inaccesibles al telescopio habitual. Las fuentes de luz adicionales crean sombras que aumentan la perspectiva del campo operatorio.

**Conclusión:** Este sistema parece aumentar las posibilidades de la cirugía laparoscópica o robótica, ya que al ofrecer una visión instantánea de casi la totalidad del abdomen puede permitir realizar procedimientos más complejos, que hoy en día requieren una vía abierta.

© 2016 AEU. Publicado por Elsevier España, S.L.U. Todos los derechos reservados.

**Introduction**

Some laparoscopic procedures are still a challenge compared to open surgery. One of the main limitations is the visual feedback that the surgeon receives from the operative field. On the one hand, the movement of the endoscope is limited by the port of entry, which allows for only 4 degrees of freedom, which inevitably limits both the amplitude of the field of view and the angle of view or angle from which the object or organ can be seen.<sup>1</sup> On the other hand, laparoscopy provides poor depth of field compared to open surgery. This is not only due to 2D vision if the lens is conventional, but to the lack of reference points in the scene. Contrary to what happens with naturally illuminated scenes, endoscopic vision does not provide a true perspective of the field, which makes it sometimes difficult to interpret the images that appear on the monitor.<sup>2,3</sup>

The main limitation of the endoscopic vision is the decrease in perspective and shadows. Both effects provide valuable information regarding the shapes, distances, depth of field and relative position between objects.<sup>4,5</sup> While the perspective depends on the point of view where the observer stands, the shadows depend on the illumination.<sup>6</sup>

The objective of our study is to propose a system of overall vision aimed at overcoming the visual limitations of both conventional laparoscopy and robotics, applied to 2 procedures, a varicocelecomy and a nephrectomy in an animal model. The system is designed to provide a visual feedback as close as possible to open surgery, and it consists of a series of intra-abdominal devices of 2 types: robot camera and robot lighting (Fig. 1). Both systems use external magnets for fixing and guiding through the abdominal wall.

**Material and methods**

The robot camera is composed of a high-definition camera and as a lighting system it has 4 LEDs (Fig. 1A). It also has 2 magnets for attachment to the abdominal wall (Fig. 1B). The camera (model MO-TS0804L (Misumi Electronics Corp., Taiwan) is only 5.5 mm in diameter and 16 mm in length, with a resolution of 400 TV lines, a frame rate of 30 per second, and a focal length of 5 to 12 cm, suitable for providing high-resolution images in laparoscopy. The lighting system is made up of 4 LEDs (XLamp XT-E, Cree Inc., North Carolina., U.S.A.) of 456 lumens each, symmetrically placed on both sides of the camera. The fixation and guiding of the device is done with 2 cylindrical neodymium magnets of 20 mm in diameter and 5 mm high (Webcraft GmbH, Cottmadingen, Germany). The device measures 60 × 22 × 16.5 mm and has been designed to facilitate entry into the abdominal cavity. On the other hand, lighting robots are used as independent sources of illumination, contain 4 LEDs and a magnet just like the ones in the cameras (Fig. 1C and D). Both the cameras and LEDs have a 4.5 mm power cable. The devices are inserted through a small incision and the magnets have been previously lubricated.<sup>7</sup> Once the device is inside the abdomen, the magnet holder is used to fix it to the abdominal wall.<sup>8,9</sup> The magnet holder is shaped like a coin case and allows for additional magnets to fit the thickness of the abdominal wall.

The surgeon can choose which image he wants to see on the monitor, or if he prefers, the 4 can appear. The user interface allows to change 2 parameters: the zoom and the rotation. In most endoscopic procedures, it is essential to maintain the horizon of the image so that the surgeon receives a coherent image. The orientation of the cameras can be changed manually or digitally through the user

Download English Version:

<https://daneshyari.com/en/article/8769495>

Download Persian Version:

<https://daneshyari.com/article/8769495>

[Daneshyari.com](https://daneshyari.com)