The advantages of 3D HD laparoscopy over the standard 2D vision

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Abstract

Introduction and objectives. Laparoscopic urologic surgeries have been introduced in the early 1990s, and have gradually become the standard of care for many urologic pathologies, as they minimize perioperative morbidity and provide a fast recovery, without compromising on safety or radicality. As time passes, laparoscopy benefits the most form the progress of technology, and although robot assisted interventions grab all the attention, the high running costs make them often prohibitive.

Materials and methods. In our center, various urologic pathologies are treated laparoscopically. The most common interventions are radical nephrectomy, partial nephrectomy, nephroureterectomy, pyeloplasty, adrenalectomy and renal cyst removal. For the most recent 12 months (December 2015 – December 2016) a 3D HD Storz system has been used in parallel with the standard 2D version, accounting for the majority of the interventions. And a total of 166 operations have been done in this fashion. The surgeons involved observed a shorter dissection time, more accurate gestures and overall faster and easier interventions. So the 3D lot of patients was compared with a similar lot of 2D interventions that had already been performed.

Results. Mean cyst removal time was 40 minutes in 2D vs 30 minutes in 3D HD. Mean radical nephrectomy time was 80 minutes in 2D and 60 minutes in 3D. Mean partial nephrectomy time was 120 minutes with an ischemia time of 25 minutes in 2D, vs 90 minutes and 20 minutes of ischemia in 3D. Nephroureterectomy was performed in 100 minutes using the 2D vision and 85 minute using 3D. Pyeloplasty took a mean of 125 minutes in 2D and 95 minutes in 3D. Pyelolithotomy was a mean 80 minutes in 2D and 55 minutes in 3D. And adrenalectomy had a mean operative time of 70 minutes in 2D and 45 minutes in 3D. Intraoperative blood loss was reduced when switching to 3D, while complication rates were similar and neglectable. Hospital stay and recovery time were equally similar between the two study groups.

Conclusions. The 3D HD laparoscopic system ensures a more accurate view inside the abdominal cavity, with superior image quality and depth perception, which in turn enable faster and safer surgical gestures. And as a result operative time was 15-30% shorter, and blood loss was reduced. 3D HD vision also has a steeper learning curve in comparison with standard 2D laparoscopy.

Keywords: laparoscopy, urologic surgeries, 3D, 2D

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Introduction and Objectives

Laparoscopy is a type of minimally invasive surgery in which operations are performed through small incisions in the abdominal wall, far inside the body. These 5 – 20 mm long incisions house trocars, that permit the placement of the laparoscope and other various instruments, like scissors, graspers or dissectors. The laparoscope is the main tool, composed of a lens, optic cables and light source, that gives us a look inside an artificial cavity of the body. (1)

The cavity is obtained by insufflating carbon dioxide gas in a predefined space, usually the peritoneum, to create a working field. CO2 was chosen because it is an inert compound, ubiquitous within our bodies, that can be absorbed by the tissues and removed through the circulatory and respiratory systems, and its non-flammable properties make it suited for use with electrosurgical devices. (2)

It is difficult to credit one individual with the pioneering of the laparoscopic approach. In 1901 Georg Kelling, from Dresden, Germany performed the first laparoscopic procedure in dogs, and in 1910 Hans Christian Jacobaeus from Sweden performed the first laparoscopic operation in humans. (3) In the ensuing several decades, numerous individuals refined and popularized this approach further.

In the early 1990s, laparoscopic urologic surgeries have been initiated. William Schuessler performed the first urologic laparoscopic procedure: the pelvic lymphadenectomy for a patient with prostate cancer. (3) Shortly after, the first laparoscopic nephrectomy was conducted, in 1991, by Clayman. (4)

Laparoscopic procedures have gradually become the standard of care for many urologic pathologies, as they minimize perioperative morbidity and provide a fast recovery, without compromising on safety or radicality. (5) As time passes, laparoscopy benefits the most form the progress of technology, and although robot assisted interventions grab all the attention, the high running costs make them often prohibitive. But new 3D HD vision systems bring some of the benefits of robot assisted laparoscopy, making the procedures easier to learn and perform with a lower cost.

The most commonly performed urologic laparoscopic procedures are: simple nephrectomy for non-functioning kidney, simple renal cyst removal, ureterolithotomy, pyelolithotomy, radical nephrectomy for renal tumors, pyeloplasty, adrenalectomy for adrenal tumors, nephroureterectomy and orchidopexy. Other more complex interventions are conducted only in major centers, by experienced laparoscopic surgeons: live donor nephrectomy, partial nephrectomy, ureterolysis, ureteroneocystostomy, radical prostatectomy, radical cystectomy, augmentation cystoplasty, vesico-vaginal fistula repair, ileal replacement of the ureter and retroperitoneal lymph node dissection.

The aim of this paper is to present the advantages of 3D HD laparoscopy over the standard 2D HD approach.

Materials and Methods

In our center, various urologic pathologies are treated laparoscopically. The most common interventions are radical nephrectomy, partial nephrectomy, nephroureterectomy, pyeloplasty, pyelolithotomy, adrenalectomy and renal cyst removal. For the most recent year (December 2015 – December 2016) a 3D HD Storz system has been used in parallel with the standard 2D version, accounting for the majority of the interventions.

We established two groups of patients, both operated on by the same urologic team, with experience in laparoscopic procedures. The first one consists of patients that were subjects to interventions using the old 2D HD system, either prior to the 3D HD Storz system,
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or in parallel due to the overlapping of the surgeries. The second one is comprised of patients that benefited exclusively from the 3D HD Storz system.

In total the first group numbered 112 patients with 2D laparoscopic procedures, while the second group reached 166 patients with 3D laparoscopic interventions.

Results

The surgeons with a laparoscopic background observed a shorter dissection time, more accurate gestures and overall faster and easier interventions with the 3D vision system. After comparing the 3D lot of patients with the lot of 2D interventions that had been performed, the advantages were clear.

Mean cyst removal time was 40 minutes in 2D vs 30 minutes in 3D HD. Mean radical nephrectomy time was 80 minutes in 2D and 60 minutes in 3D. Mean partial nephrectomy time was 120 minutes with an ischemia time of 25 minutes in 2D, vs 90 minutes and 20 minutes of ischemia in 3D. Nephroureterectomy was performed in 100 minutes using the 2D vision and 85 minute using 3D. Pyeloplasty took a mean of 125 minutes in 2D and 95 minutes in 3D. Pyelolithotomy was a mean 80 minutes in 2D and 55 minutes in 3D. And adrenalectomy had a mean operative time of 70 minutes in 2D and 45 minutes in 3D.

So operative time was on average 15% to 30% shorter, while ischemia time in partial nephrectomies was decreased with approximately 20%. This in turn improved renal perfusion and renal function.

Intraoperative blood loss was reduced when switching to 3D, especially in more complex interventions, while complication rates were similar and neglectable. Hospital stay and recovery time were equally similar between the two study groups.

The second team of younger surgeons observed a shorter learning curve while using the new 3D system than if they had tried with the old 2D laparoscope, being able to perform the interventions easier and safer.
Discussions

The new 3D HD vision systems bring some of the benefits of robot assisted laparoscopy, making the procedures easier to learn and perform.(6)

The advantages brought by the 3D HD laparoscopic vision over standard 2D are obvious: superior image quality, depth perception, faster and more accurate surgical gestures and a shorter operative time.(7) And although they can not be denied, the main question that remains in our minds is whether they provide any form of economic advantage to justify the cost of the new system, as hospital stay and recovery time were quite similar comparing the 3D and 2D operated patients.

But decreasing the OR time by as much as 30% means that more interventions can be performed in the same time frame, increasing the effectiveness of the surgical team and the clinic. Additionally, a shorter ischemia time at a partial nephrectomy on a solitary kidney can be the difference between a fast recovery of the normal renal function.

We also have to take into account the steeper learning curve younger urologists experience while beginning with laparoscopic procedures performed in 3D vision, which in turn increases the performance and efficacy of the whole clinic.

And last but not least, because 3D laparoscopy has some of the advantages of the much more expensive robot assisted laparoscopy, it can be viewed as a cheaper middle way of achieving almost the same results in some interventions, at a fraction of the costs.

Conclusions

The most important advantages of laparoscopic procedures over conventional open techniques is the absence or smaller parietal incisions and consequently less pain and faster return to normal life status.

The 3D HD laparoscopic system ensures a more accurate view inside the abdominal cavity, with superior image quality and depth perception, which in turn enable faster and safer surgical gestures. And as a result operative time was 15-30% shorter, and blood loss was reduced. 3D HD vision also has a steeper learning curve in comparison with standard 2D laparoscopy.

3D laparoscopy also has some of the advantages of the robot assisted laparoscopy, it can be viewed as a cheaper middle way of achieving almost the same results in some interventions, at a fraction of the costs.

References

1. *Mastery of Endoscopic and Laparoscopic Surgery*. W. Stephen, M.D. Eubanks; Steve Eubanks (Editor); Lee L., M.D. Swanson (Editor); Nathaniel J. Soper (Editor) Lippincott Williams & Wilkins 2nd Edition 2004
5. EAU extended Guidelines 2016 Edition