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An organizational model to improve the robotic system among general surgeons*

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SUMMARY: **An organizational model to improve the robotic system among general surgeons.**

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Introduction. *Robotic surgery has gained wide acceptance in recent years. However its development is slower and the lack of high level experience with this technique is an important limitation. This manuscript discusses some of the reasons of it and aims to describe the organizational system we have progressively established in our center in order to improve the development of Robotic program in our surgical area.*

Methods. *Some points may be required to improve the robotic program development in a general surgical department, including: a broad availability of robotic system in a surgical area; an ideal setting area with mainly oncological and hepato-biliary-pancreatic disease; the need of a mainly young team; a broad application of the robotic system in more general surgical fields; a high motivation on robotic use; a departmental and institutional economical effort. We have tried to achieve these goals before starting the robotic program in our department at October 2010.*

Results. *From October 2010 until November 2013 a total of 170 procedures have been performed, 92% of them for malignant diseases. Conversion rate and overall morbidity was 5% and 19%, respectively.*

Conclusions. *The organizational model defined in our center is facilitating the constant and progressive development of the robotic program. A broad and flexible availability of the robotic system, a progressive increase of young surgeons joining this technology as well as the institutional and departmental economical effort are the points with which the robotic system may increase its development in a surgical department.*

KEY WORDS: Robotic - Minimally Invasive Surgery - Organizational model.

Introduction

Among minimally invasive surgery, Robotic System is considered the most advanced surgical technology available. Since its beginning in 1997 its development has been constant and progressive and the number of surgeons across multiple specialties adopting this system has grown rapidly, especially in the last few years. In 2012, in United States of America, it was used 26% more than the previous year. Therefore, there is an increasing demand from both patients and surgeons (1, 2). Robotic system has been developed in different surgical areas such as urology, gynecology, cardiovascular and thoracic surgery as well as neurosurgery and general surgery. Furthermore, it has been used successfully to perform increasingly more complex procedures (2-6). This is due to the fact that Robotics offers several advantages when compared with laparoscopy; including the 3-D vision, enhanced dexterity through articulated instruments, a higher magnification of the surgical field and a more ergonomic position for the surgeon (8-10). In July 2000, the Da Vinci surgical system was the first robotic device to be approved by the FDA. It consists of 3 components: 3D vision cart, a control console for the surgeon, and 3 or 4 mechanical arms. One of the arms houses the 3D optic system, while the others are equipped with tools. During the procedures hand tremor is eliminated, allowing a 360º instrument movements. Robotics, as mini-invasive surgery, has widely recognized advantages over the open approach. However, the issue comes when it is compared to the

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laparoscopic approach, and it is still difficult to state which indications are beneficial for patients (11, 12). Despite its progressive increase in popularity during the last decade, its use continues to be slower. The reasons of it can be found especially in the high cost of this system. However, there are also some other less known reasons of its slower diffusion, such as the low interest of most of the surgeon, still more attracted by the laparoscopic surgery and the organizational model of most of the hospitals and department that are not able to afford wider development of such new technologies (13, 14). The first step in developing a correct robotic program in a surgical department is to define what goals are required

1) Broad availability of robotic system in a surgical area;
2) An ideal setting area;
3) Need of a team;
4) Broad application in general surgery fields;
5) Motivation on robotic use;
6) Departmental and institutional economical effort.

Each of these categories must be considered both on their own as well as how they relate to each other in order to improve the robotic system in a surgical department. This manuscript discusses these and further issues, and aims to describe the organizational system we have progressively established in our center in order to improve the development of Robotic program in our surgical area. To support and validate this model we present the results of the robotic activity at our center.

Methods

1) Broad availability of robotic system in a surgical area

In almost every hospital, due to its economic cost, the number of the Robotics devices is limited to one device. Therefore, it is shared among different surgical specialties (urology, cardiac, gynecology, etc). Logically, this limits its use and its development in each surgical field. Furthermore, its availability most of the time depends more on the department policy than to a real need or interest to develop it. In our opinion, an equilibrium must be found among different specialties for its use, based mainly on the number of potentially robotics procedures and the type of disease they manage (priority to oncological disease). In our hospital, because of the high number of patients that underwent surgery, as well as the type of disease we treat (we are a well-established oncological center), the robotic system is available for general surgery department almost every day of the week.

2) An ideal setting area

In Italy there are more than 60 robotic systems, the third owner in the world (after United States and Japan) and it is the one that has invested more on it among Europe countries. The current economic climate has placed significant pressure on all of health care, for this reason it is important use this technology rationally. At this special period of time robotic system should be used mainly in selected setting department, where its potentiality can be absolute maximum. Establishing a structured plan and support structure is critical to success. We believe that a promising robotics program can be settled only if the following points are main characteristics of a general surgery department:

a: High volume center: Logically a center with a high volume of patients can guarantee a continued use of the robotic system. Our general surgery department has 4 surgery rooms per day with a total of 2000 mean surgeries per year.
b: Main oncological patients: as reported recently in literature, robotic approach main advantages are especially for oncological procedures (15). Almost 90% of our surgical procedures are for oncological diseases. Furthermore, our hospital has a comprehensive oncological integrated center.
c: Experienced laparoscopic center: unlike other procedures, robotic requires a highly skilled laparoscopic surgeons that quickly familiarize themselves with this new technology. We are a well established laparoscopic center with more than 100 complex laparoscopic procedures per year.
d: High Hepato-Biliary-Pancreatic (HBP) volume center: one of the surgical fields where the robotic system raised a great interest in the last years is the HBP. The Laparoscopic approach in this field has been especially underestimated because it was considered to be inadequate from the oncologic point of view. Furthermore, laparoscopy has severe limitations to manage such complex procedures, propensity to bleeding during manipulation. Robotic approach was developed in an effort to overcome these limitations and major pancreatectomies and liver resections reports are increasing in the current literature (16-18). We believe that the potentiality of robotic is higher especially in HBP field (19). In 2012, in our department, almost 80 pancreatic and 50 liver resections have been performed.
e: University center: for the development of a new technology and maintain its high interest, it is important to carry out simultaneously a scientific and an investigative research. Our department is settled in the context of a university hospital: CEU San Pablo.

3) Need of a team

The adaptation of new technologies and the realization of new technical procedures are usually limited to a reduced number of professionals in a surgical department. It happens also with the robotic system. As in most of the center, there are only one or two surgeons who are able to perform surgeries with this device. In our opinion, once the first training step is overcome, almost all the staff of the surgical department should perform the corresponding training course and use it. A modern surgeon should not be taken apart from this new technology. In our department, the first 70 robotics cases were performed exclusively by the 2 chief surgeons during the first year. After that, three more surgeons joined the robotic system 2 years ago. The remaining three surgeons of the staff-department are now waiting for the corresponding training course. A higher number of surgeons in the same department able to use Robotics allows the creation of a real "Robotic team" that, logically, may improve its development and reduce the surgical complications related to its learning curve. Nevertheless, it is well known that a "team" enhances the passion and enthusiasm for a new project. Newly trained robotic surgeons may perform few robotic cases during the first years following training as this new technique is incorporated into their practice, and there may be significant degradation of skills during this time frame. A "team" may reduce this degradation skill time as more procedures can be performed together.

4) Broad application in general surgery fields

We think that the current trend of sub-specialization in general surgery (Esophago-gastric, Colo-rectal, etc.) is limiting the development of new technologies. It is due to the low number of potentially robotic procedures that can be performed in these different surgical fields. We recommend that to reach enough experience with

this new device, a general surgeon should use it in all the surgical areas he has experience with (20). We believe that to employ the robotic system to their full potential in a surgery department, it is essential that it is used in all general surgical fields, from colorectal to esophageal-gastric ones. In our department, the staff is not organized in such different sub-specialties. Patients requiring moderate complexity procedures are treated by any surgeon under the guidance of the more 2 experienced surgeons. Very high complex surgical procedures such as liver and pancreatic, up to now, are commonly performed exclusively by the 2 experienced surgeons.

5) Motivation on robotic use

As stated before, currently there is still a low interest of most of the surgeons on robotics, as they have already reached enough experience with the laparoscopic approach (13, 17). They argue that there is not sufficiently beneficial for patients to justify spending so much money. With respect to this topic, we want to underline that Robotic and laparoscopy should not be considered as competitive approaches. Their characteristics are different, so the Robot has to be considered as a system, allowing the integration of further applications like immunofluorescence, the identification of sentinel lymph nodes that may potentially enhance the oncological results of surgeries. Indeed, the Robotic system may simplify the use of other minimally invasive procedures, like the SILS, NOTES and TEM procedures. In fact, laparoscopy and robotic approach are performed both by each surgeon in our center, depending mainly by patients characteristics and disease. What is more is that in our department we incorporated to the robotic program mainly young surgeons (mean age of 36 years old), eager to develop their surgical and investigative skills. We underline that a new generation of surgeons will grow into this emerging technologic evolution with the need of training and education starting in their residency.

6) Departmental and institutional economical effort

Cost versus benefits for the health care is always an issue whenever a new technology is introduced in a hospital. Politicians and private investors should decide if such costs balance the relevant profit for the health care system. In a no-public hospital, its use exclusively for patients without an insurance coverage may be an important limitation for the Robotic development. In this context only few patients may be able to afford it, and consequently, a low number of procedures can be performed, compromising the training of the surgeon. The different people involved in the process should reach an agreement: (health insurance; politics; surgeons; hospitals), looking for benefit in a long term time. In our center (a no-public hospital) we achieved an agreement between health insurance and hospital in order to reduce the potentially benefit of the robotic procedures at the present, looking for real benefit only in the future, when we think there will be an important development of this system. Logically it is possible to reach mainly in a no-public hospital, where such agreements are less influenced by politics rules as in a public one.

Results

Our center is a no-public university hospital with an integrated comprehensive oncological center. The robotic program starts on October 2010 and was planned with a triple goal: assistance, educational and investigative. From October 2010 until November 2013 a total of 170 procedures have been performed in 161 patients (71 male; 88 women) with a mean age of 58 years (range: 36-82). A total of 156 procedures were for malignant disease (92%). The following procedures have been performed: 14 gastrectomies; 16 liver resections (including a totally robotic right hepatectomy and 1 associated liver partition and portal vein ligation procedure, the first described, up to now, in the literature); 40 pancreatic surgical procedures (including 8 duodeno-cephalic pancreatectomies); 8 esophagectomies; 80 colo-rectal resections (64 of them for rectal cancers); 4 Nissen procedures; 1 achalasia; 2 adrenalectomies; 4 partial duodenal resections; 1 mesenteric cyst resection. Conversion rate and overall morbidity was 5% and 19%, respectively. There was no mortality. Mean intensive care and hospital stay was 1.5 days (range 0-12 days) and 13 days (range: 6-45), respectively.

Discussion

At a time when there is a demand for more fiscal responsibility and transparency in health care, the use of expensive medical technology should be questioned when less-costly alternatives provide equal or better patient outcomes. Robotics may provide in the future better results in selective cases as in the HBP field or in more complex procedure where laparoscopic may not guarantee enough safety. We think that laparoscopy is not going to be replaced completely by the robotic approach, except for complex procedures, up to now, reachable only by few gifted surgeons. However, it is essential in a first step to perform by robotic approach less complex surgeries before feel confident to perform more complex procedures, like liver and pancreatic major resection. For this reason it is important keep on developing a robotic program. Therefore, benefits from robotic approach can be a real advantage only if a structured organizational model is settled, if not, it would be a real challenge to achieve.

Conclusion

The organizational model defined in our center is facilitating the constant and progressive development of the robotic surgery. A broad and flexible availability of the robotic system, a progressive increase of surgeons joining this technology, the absence of sub-specialty areas as well as a departmental and institutional economic effort are the points with which the robotic system may increase its development in a surgical department. Larger experience and more complex robotics procedures are needed to support this model.

Conflict of interest. The Authors declare they have no conflict of interest.

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