Editorial

The issue of the cost of robotic distal pancreatectomies

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Robotic approach is already a new technological system in surgery and its potential advantages such as ergonomics, reduced tremor, 3D view and improved instruments movements have been well described (1,2). Concerning the current literature, the studies addressing the robotic benefits on left pancreatectomies are few. However, it has been showed that robotic distal pancreatectomy is both feasible and safe as well as the laparoscopic and the standard open approach. Although, there is a lack of high-level economic studies comparing these techniques (3-6).

It is clear that the major questionable drawback of robotic in surgery is still its high cost, which should be matched to its benefits for the patient and operating surgeons. For the health care system, whenever a new technology is introduced to a hospital, such as that of the robotic system, cost versus benefits is an issue. Therefore, among surgical community, there remains mixed opinion regarding the robotic surgery cost compared with laparoscopy, especially in distal pancreatic resection, which is probably being in the last years the most performed robotic procedure in the hepato-biliary-pancreatic field.

The raison why costs of robotic approach is poorly reported is mainly due to its difficult calculation. Despite equity and hardware are easily to be calculated, the overall cost impact of a new surgical procedure are harder to be quantified.

In fact, costs should include operative costs, hospitalization costs, visiting nurses, rehabilitation facility, job loss and missed work after surgery and acquisition cost of the system including its amortization. The exact calculation of all these factors is challenging and requires the help of an economic data manager.

Given this background, the paper of Pessaux group is very interesting and useful, examining the cost of the different approaches for pancreatic left resection (7).

In their analysis they included a total of 89 patients (21 robotic, 25 laparoscopic, and 43 open procedures) along a period of time of 3 years including 2 centers. It is true that the load number for each center is low and it might have influenced the results. However, this load number is in line with the majority of previous report of robotic distal pancreatectomies (5).

Concomitant with previous reports (1), they found that the robotic distal pancreatectomy is a safe and reproducible procedure, achieving comparable postoperative outcomes, similar oncological outcomes and reduced blood loss. But the most relevant aspect that they found is that the cost of robotic approach is similar to that of the laparoscopy (21,219 *vs.* 22,150 Euros) and significantly lower compared with the open approach (30,929 Euros; P=0.02).

As expected the operative costs were higher in the robotic group (2,152 *vs.* 36 Euros; P=0.0001) but at the end balanced by the reduced cost of the hospital stay of the robotic approach (14,522 *vs.* 17,608 Euros; P=0.02).

These results agree with our previous report were the overall cost of the robotic were similar to that of the laparoscopy mainly because of the decreased hospital stay and conversion as well (6).

Interestingly, the study of Pessaux (7) and that of some

Table 1 Robotic cost differences of distal pancreatectomy

Study ref.	Country	Currency	LDP procedures	LDP mean cost	RDP procedures	RDP mean cost	ODP procedures	ODP mean cost	% extra cost: % Costs RDP *vs.* LDP	% extra cost: % Costs RDP *vs.* ODP
LDP *vs.* RDP										
Lyman 2019	USA	USD	53	3,815	21	5,122	–	–	+26%	
Souche 2018	France	EUR	23	12,509	15	13,611	–	–	+8%	
Ielpo 2017	Spain	EUR	26	9,399	28	9,198	–	–	−2%	
Butturini 2015	Italy	EUR	21	1,500*	22	3,000*	–	–	+100%	
Kang 2011	Korea	USD	25	3,861	20	8,304	–	–	+54%	
Lin 2019	China	Yuan	41	57,792	41	80,563	–	–	+28%	
LDP *vs.* RDP *vs.* ODP										
Fisher 2019	USA	USD	146	32,148	53	34,870	693	38,350	+8%	−10%
Rodriguez 2018	France	EUR	25	22,150	21	21,219	43	30,929	−4%	−46%
Waters 2010	USA	USD	18	12,900	17	10,588	22	15,521	−22%	−47%
Magge 2018	USA	USD	93	16,733	196	15,440	85	23,228	−8%	−50%

*, butturini only presented surgery costs. RDP, robot distal pancreatectomy; LDP, laparoscopic distal pancreatectomy; ODP, open distal pancreatectomy.

authors also, did not include in their analysis the acquisition costs and maintenance costs of the robot, because these costs, due to the multidisciplinary nature of the device, are reduced by the multidisciplinary use of the device. This is what we can define as the hospital amortization cost that, even if it is difficult, it should be included in the cost analysis.

Costs of a technique includes direct and indirect cost. The direct costs are made of all items and costs of the services that take care of the patient during his hospitalization, such as surgical equipment, the operating room, patient room, lab tests, nursing and physical therapy. On the other hand, the indirect cost includes the overhead cost of the building, the amortization of capital equipment and supplies, the cost of the maintenance of services, utilities and administrative staff, as well. Robot-specific costs may be divided in direct costs, which are specific to robotic pancreatic distal resection which are robotic drapes, disposable instruments, and other supplies which are required for the surgical use of the robot and in indirect cost, which refers to hospital overhead associated with each surgery, such as building depreciation, salaries of hospital administrators, and hospital services. Robot-specific indirect costs include the purchase price of the robot, which is often reported in the literature as amortized cost, or the total purchase price divided by case load number and capital depreciation and service costs of the robotic system. In this case, the calculation of the indirect cost is really challenging and it the raison of its missing in the analysis.

To the best of our knowledge, including the paper herein discussed, there are only 10 papers reporting costs of distal robotic pancreatectomies (6-15). All the costs are summarized in the *Table 1* and it is clear that cost difference vary among the series.

The first report was by Waters *et al.* in 2010 (13), where overall cost of robotic distal pancreatectomy was lower compared with laparoscopic approach ($10,588 *vs.* $15,521), even if operative costs were higher for robotic distal pancreatectomy ($3,146 *vs.* $5,016). According to our analysis, only 4 out 10 studies reported a significative higher overall cost of robotic distal pancreatectomies (8,10,11,15).

However, cost may also vary depending on experience gained with the surgery as it is commented by Pessaux (7).

However, the simplistic overall cost of an operation can gives only limited information about the benefit of a new technique. Only a cost-effectiveness analysis can help to understand the real difference between two different operations. It is paramount to distinguish a cost analysis of

a health care sector perspective from that of a societal or patient's approach.

If the health care sector analysis includes mainly only a cost analysis study, on the other hand, the societal perspective includes the duration of sick leave after a surgery, patient satisfaction, symptom resolution and health related quality of life, which is the real cost-effectiveness study, about which, in the current literature, there is data only in one study from Gurusamy *et al.* which compare open versus laparoscopy and none including robotic (16). Therefore, a real cost effectiveness analysis of robotic *vs.* laparoscopic distal pancreatectomy is still missing.

However, currently, there is one ongoing controlled trial of the Dutch Pancreatic Cancer Group which aims is to compare open to laparoscopy to robotic distal pancreatectomy including a cost-effectiveness analysis (17). In my opinion, this randomized study suffers from important limitation being multicenter (17 centers recruiting a total of 102 patients) which may invalidate some results using different surgical procedures and devices with a different learning curve from each center.

It is paramount to consider that costs usually vary during the period of time from its setting, and this is especially true for the robotic system.

It is paramount to know that both fixed and variable costs of the robot system have the potential to decrease over time as a result of competitive pricing, standardized routine and proficiency.

We should expect that in the near future, there will be a decrease in overall robotics costs, because of some key patents have recently expired and new devices are expected to be available in the next two years.

Furthermore, we must consider that the laparoscopy is in continuous evolution as well, taking advantage from the robotic development, such as the incorporation of the flexible robotic optic, the 3D vision and fluorescence and the new laparoscopic endowrist instruments which all of them include some technologies derivated from the robotic system. In a near future there might be a fusion of the laparoscopy with the robotic approach, a process that can be named "robotization of the laparoscopy". Future research would benefit from evaluating the utilization implications and cost of this new system.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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