Viewpoint

Distal pancreatectomy in the new era of minimally invasive surgery: the on-going debate on the cost-effectiveness

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We read with great interest the article of Rodriguez *et al.*, "Which method of distal pancreatectomy is cost-effective among open, laparoscopic, or robotic surgery?" (1). In the current climate of limited hospital sources and control of medical costs, the authors afford the interesting topic of the cost-effectiveness evaluation of the robot-assisted distal pancreatectomy (RDP) in comparison to the laparoscopic (LDP) and open approaches (ODP). To accomplish this purpose, they focused their attention on both the clinical and the economical outcomes of the three different techniques.

Under the clinical point of view, the robotic approach related to a lower intra-operative blood loss, a higher spleen preservation rate, a lower incidence of Clavien-Dindo ≥ grade III complications and a shorter length of hospital stay. As counterpart, RDP brought to a more prolonged operative time than the laparoscopic and open techniques.

As expected, the economic evaluation evidenced higher operative costs for the robot-assisted procedures, both in terms of costs of materials (2,152 Euros *vs.* 36 and 26 Euros for the LDP and ODP groups, respectively; P=0.0001) and operative room occupation (3,456 Euros *vs.* 3,066 and 2,517 Euros in case of laparoscopic and ODP, respectively; P=0.01). Conversely, the reduced hospital stay of the RDP cohort reflected in a significant reduction of the hospitalization costs (14.522 Euros) as compared to both LDP (17,608 Euros) and ODP (22,593 Euros) (P=0.007). Notably, the final balance between these operative and non-operative costs, as a whole, evidenced economic advantages in favor of RDP (21,219 Euros) as compared to both the laparoscopic (22,150 Euros) and open (30,929 Euros) approaches (P=0.02). The authors justify this last finding with the improved recovery, the shorter hospitalization and the lower rate of post-operative complications of the RDP group that have overcome the overall intraoperative costs.

Despite these promising results, contrasting data are currently present in the literature on the cost-effectiveness of RDP. Although the clinical advantages evidenced in most case series, costs remain the foremost barriers in the widespread of the robotic platform use, especially for complex procedures such as pancreatectomy.

In 2019, we performed two cost-benefit analyses (2,3) aimed to evaluate the clinical and economic impacts of the robotic approach in general surgery. Regarding the RDP, we retrospectively compared a cohort of 96 RDPs and 85 LDPs. As for Rodriguez *et al.* (1), the use of the robotic platform brought to clinical advantages in terms of spleen preservation rate and intra-operative blood loss but a more prolonged operative time as compared to laparoscopy. Conversely, we did not evidence any statistical difference between the two approaches in terms of post-operative outcomes, here including post-operative complication rate and length of hospital stay.

This reflected in similar non-operative costs between robotics and laparoscopy, while mean operative room and surgical equipment costs were significantly higher for the

RDP group. Consequently, the final cost analysis evidenced higher overall costs when the robotic platform was used.

Our findings are in line with the results already presented by other authors (4,5), who found significantly higher total costs when the RDP was performed. Conversely, Waters *et al.* (6) reported higher cost savings in case of RDP in comparison to both the open and laparoscopic techniques.

According to this overview of the literature, it is, thus, undeniable that the existing data are still insufficient and incomplete to draw solid conclusion on the cost-effectiveness of the robotic platform for distal pancreatectomy. This may find justification in two main factors: the indications to the robotic approach and the design of the economic study.

For instance, the clearly higher operative expenses of the RDP may be effectively counterbalanced by the reduction of the hospital expenses, by reducing the post-operative complication rates and the length of hospital stay. This inevitably led to the need of a strict selection of low-risk patients in order to perform the robotic procedure in a risk-minimizing setting.

In terms of economic design of the studies, current financial data of the literature are based on simple cost models, limited to the subdivision of costs into operative and non-operative. This implies the exclusion of the amortization of the robotic platform acquisition and the annual maintenance costs from most of the studies. Of note, the current robotic platform cost varies from 910,000 USD to 2.5 million USD, with an annual maintenance cost of 125,000 USD (7). This entails that an additional value of 1,300 USD should be calculated per each procedure when the financial costs are evaluated (6). In this regard, only one study in the literature (6) analyzed total costs including the amortization expenses, reporting, a cost saving of almost 6,000 USD and 2,600 USD for the robotic approach when compared to the open and laparoscopic techniques, respectively.

This is in evident contrast with most of the other studies that reported higher costs (2,4,5) even when the amortization expenses were not included.

This discrepancy may be due to the small number of patients involved in the current studies, and further highlights the need of additional larger cohorts specifically focusing on the economic aspect of RDP to balance with the clinical outcomes.

We do believe that, although the reduction of the non-operative expenses could be a valid option in order to reduce the excessive operative costs, the acquisition and maintenance costs of the platform itself are still the main limitations to the widespread of RDP.

This is due to the current existence of a sole market supplier of both the robotic platform and instruments. However, with the upcoming expiration of the patents, new competitors will enter the market in the near future with the introduction of new robotic/digital platforms. This will hopefully path the way to the routine use of robotics in the surgical field, implementing innovation, reducing costs, and expanding the robotic approach to more complex surgical procedures such as pancreatectomy.

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Footnote

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

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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