Introducing the E100: Will the improvement make a significant difference? Financial analysis based on sleeve gastrectomy

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Abstract

Robotic Assisted surgery has proven to show significant advantages in surgery, for patients and surgeons alike. Nonetheless the elevated cost remains a barrier to its acceptance in the medical field. Strategies to reduce cost should be implemented as a way to ensure cost-effectiveness in robotic-assisted procedures. The aim of this article was to compared the performance of the new generator E100 (Intuitive Surgical, Inc.) vs. VIO dV 2.0 (Erbe Elektromedizin GmbH) by analyzing the number of times the generators were activated, the average time per seal, total sealing time, and console time. Financial impact based on annual volume was determined. A total of 1,457 sleeves gastrectomies (Erbe:746, E100:711) were analyzed, the average activation per case was similar in both groups. The sealing time dropped by 42.3% and the average console time dropped by 8 minutes in cases with the E100. The financial analysis concluded that transitioning to the E100, will in fact save $33K to $34K/year. Proving that Introducing the new generator is a successful strategy to reduce costs.

Introduction

Robotic-assisted surgery was born from the desire to improve surgical procedures, aiming to optimize the overall procedure and outcome by enhancing the surgeon’s abilities [1]. The two main benefits of robotic-assisted surgery are increased range of motion, the highest degrees of freedom in minimally invasive surgery, and improved visibility through tridimensional images with high-definition optics [2,3]. Additionally, it confers surgeons’ dexterity, steadiness, and superior ergonomic benefits compared to conventional or laparoscopic surgery [4].

These benefits apply to many surgical specialties, including bariatric surgery, in which the ergonomic benefits of robotic assistance portend a huge advantage by minimizing the physical strain and procedural difficulties inherent to the patient’s BMI. Even though there has been controversy in the past regarding the benefits of robotic-assisted surgery in bariatrics, recent studies show significant advantages such as decreased infectious rate, readmissions, interventions, and transfusions [5,6].

Despite the benefits of robotic-assisted surgery, it is yet to be accepted for its elevated costs. Therefore every approach to reduce it during surgery in robotic-assisted procedures should be recognized and implemented [7,8]. The OR time plays one of the most relevant roles in this, by reducing it, the surgery becomes more cost-effective, which could be accomplished with the introduction of the E100 generator (Intuitive Surgical, Inc.) [9].

The VIO dV 2.0 (Erbe Elektromedizin GmbH) was the generator of choice to power the sealing instruments throughout the procedures in robotic-assisted surgeries, but in 2019 Intuitive released the E100, an internal generator that improves the sealing times at lower temperatures than the ERBE [10]. In robotic procedures the generators are used constantly and activated countless times, consequently decreasing seconds in sealing time could have an important impact on the OR time, making the procedure shorter and less expensive.
The goal of this paper is to analyze the impact of the new generator, as a strategy to reduce costs during bariatric surgery specifically in sleeve gastrectomy.

**Materials And Methods**

This is a retrospective study that included patients that underwent robotic sleeve gastrectomy between January 2019 to July 2022 at Orlando Regional Medical Center. The patients from January 2019 to December 2020 were operated on with the ERBE generator, while the patients from January 2021 to July 2022 were operated on using the E100 generator. The following variables were studied for each group: energy activation per case, time per seal, total sealing time per case and console time. Data was obtained from DaVinci Xi procedural log (Intuitive Surgical). The collected data was analyzed as descriptive statistics and was presented as a mean standard deviation. A t-test was used to compare both groups. P < 0.05 was considered significant. The data was analyzed using excel (Microsoft Excel Spreadsheet Software, Microsoft Office) and organized in graphs using tableau (Tableau Software, LLC. Seattle, Washington. 2003–2022). Since this study does not involve human research, institutional review board approval is unnecessary.

**Results**

A total of 1,457 procedures were studied, 746 were performed with the ERBE generator and 711 with the new E100 generator (Table 1).

The number of times that the generator was activated to complete the surgery was 56 ± 20 with the ERBE system and 62 ± 20 with the E100, the difference between the two was not statistically significant. (Fig. 1) The sealing time dropped significantly, 3.92 ± 0.42 seconds for the ERBE and 2.09 ± 0.28 seconds for the E100. (p < 0.05) (Fig. 2).

The above means that the total sealing time to complete the procedure of the vessel sealer decreased by 42.3% going from 219.50 seconds to 126.53 seconds. (p < 0.05) (Fig. 3).

The average console time was 38 ± 15 and 30 ± 13 minutes for the cases performed with the ERBE and the E100 respectively (Fig. 4).

In 2021 the sleeves gastrectomies volume reached 600+ cases. Considering the total sealing time, the total saved minutes using the E100 reached 930". Given the fact that the estimated OR cost per minute in the US is between $36 and $37/minute, we can estimate that the total savings using the new generator are between $33K - $34K/year [9].
Table 1
ERBE vs. E100

<table>
<thead>
<tr>
<th></th>
<th>ERBE</th>
<th>E100</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 746)</td>
<td>(n = 711)</td>
<td></td>
</tr>
<tr>
<td>Energy Activation Per Case</td>
<td>56.35 ± 20.16</td>
<td>62.10 ± 20.78</td>
<td>NS</td>
</tr>
<tr>
<td>Average Time Per Seal</td>
<td>3.92 ± 0.42</td>
<td>2.09 ± 0.28</td>
<td>S</td>
</tr>
<tr>
<td>Total Sealing Time Per Case</td>
<td>219.50 ± 71.77</td>
<td>126.53 ± 33.88</td>
<td>S</td>
</tr>
</tbody>
</table>

Table 2
Sleeves Gastrectomies using E100 Savings

<table>
<thead>
<tr>
<th>CY</th>
<th>Total Saved Time (ERBE vs. E100)</th>
<th>OR</th>
<th>Total Savings CY 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>+ 600 minutes 930 minutes</td>
<td>$36 - $37 [9]</td>
<td>$33,480 – $34,410</td>
</tr>
</tbody>
</table>

Avg. Activation per case Time per seal. (ERBE vs E100)

(ERBE vs. E100)

Total sealing time per case. Console Time (ERBE vs E100)

Discussion

Bariatric surgery has become the gold standard treatment for morbid obesity and the best long-term solution, being the sleeve gastrectomy the most common procedure performed. Even though minimal invasive surgery has proven to be a significant advance in the surgical field, robotic assistance is still very controversial in many surgical specialties, such as bariatrics, for its elevated costs. [11]

The elevated costs associated with robotic-assisted surgery represent one of the main limitations to its endorsement in hospitals worldwide, making it available only in certain hospitals that can afford the newest technology. Therefore, decreasing the costs related to the procedure has become a priority, since the robotic approach has proven to have a good clinical outcome with fewer complications compared to the conventional laparoscopic approach [5,6]. For these reasons, any strategy that can be implemented to reduce the cost associated with robotic surgery will be advantageous since it will make it more accessible in the healthcare system [12,13].

In an attempt to reduce costs, new technology has been developed to improve surgical procedures while making them cost-effective. With that in mind, the E100 generator was released in 2019. With its new software and hardware, the E100 seems to be superior to older generators due to its amplified
performance, precise control, and most importantly, its rapid sealing time while increasing efficiency throughout the procedure. The E100 can speed activation time, in the present study it was able to save up to 42% of the time per activation. In addition to this E100 keeps a lower thermal profile and has a quicker cooling time; minimizing thermal spread, and providing greater force gripping tissue with its textured jaws [10].

The console time was reduced by 20%, and even though the generator does decrease the sealing time, in turn reducing the OR time, we cannot attribute the reduced OR time only to the generator. Through accumulated experience the surgeon’s performance has improved, reducing the OR time of their procedures as well. Nonetheless, the time per seal is significantly lower with the E100, still making it an important reason for the lowered time during procedures.

With the newest inventions comes initial investments. While the generator implies an investment that could seem expensive, in the long run, it pays off, comparing the E100 to the ERBE, the generator pays itself within the year. E100 is a valuable tool that will make a significant strategy to reduce cost during the surgery.

The new generator has proven to be a great addition to the OR, with the added benefit of reducing costs during procedures making it an ideal strategy for hospitals to increase their cost effectiveness during surgery as it increases satisfaction in our surgeons due to the reduced sealing time since they were able to perform at a better speed with the same results.

Conclusion

The E100 generator effectively reduces costs in robotic-assisted surgery by decreasing sealing time and, thus, procedure durations. Since time means expenses in an OR, saving minutes in sealing minimizes the costs of robotic-assisted sleeve gastrectomies which will increase hospital savings.

Statements & Declarations

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Competing interests

Dr. Alexis Sanchez and Dr. Andre Teixeira have been proctors of Robotic Surgery (Intuitive). The rest of the authors have no relevant financial or non-financial interests to disclose.

Author contributions
All authors contributed to the study’s conception and design. Material preparation, data collection, and analysis were performed by Dr. Alexis Sanchez, Dr. Andre Teixeira, Dr. Muhammad Ghanem. The first draft of the manuscript was written by Victoria Lam, Oriana Guevara, Dr. Simon Arias and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

**Ethics approval**

This is an observational study. Institutional review board approval is unnecessary.

**Consent to participate**

Consent was not obtained since the study did not involve patient participation.

**Consent to publish**

Consent was not obtained since the study did not involve patient participation.

**References**


Figures

![Figure 1](image)

**Figure 1**

Avg. Activation per case (ERBE vs. E100)
**Figure 2**

Time per seal. (ERBE vs E100)
**Figure 3**

Total sealing time per case.

**Figure 4**

Console Time (ERBE vs E100)