
# Senhance Surgical System in Benign Hysterectomy: A Real-World Comparative Assessment of Case Times and Instrument Costs vs da Vinci Robotics and Laparoscopic Assisted Vaginal Hysterectomy Procedures

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# Senhance Surgical System in Benign Hysterectomy: A Real-World Comparative Assessment of Case Times and Instrument Costs vs da Vinci Robotics and Laparoscopic Assisted Vaginal Hysterectomy Procedures

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## Abstract

**Objectives:** Comparison of retrospective, learning curve benign hysterectomy cost and case time data from Senhance total laparoscopic hysterectomy (TLH) cases with similar da Vinci robot cases and laparoscopic-assisted vaginal hysterectomy (LAVH) cases.

**Methods:** Instrument costs, console time, and case time analysis from 6 surgeons at 4 US and European hospitals compared with retrospective, sequential da Vinci TLH and standard laparoscopic LAVH cases extracted from the CAVAlytics database.

**Results:** Senhance Gyn surgeons in their learning curve when compared to da Vinci learning curve Gyn surgeons achieved lower median instrument costs ($559 vs $1,393, respectively, p<0.001) with comparable console times (91.5 vs 96 minutes, p=0.898); Senhance and LAVH case costs were comparable ($559 vs $498, p=0.336).

**Conclusion:** In benign hysterectomy, the Senhance system may present a lower-cost approach with equivalent case times compared with similar da Vinci robotic cases.


**Keywords:** Senhance; da Vinci; benign hysterectomy; laparoscopy; robotics

## Introduction

Over the last two decades, the da Vinci® robot (Intuitive Surgical, Inc.) has emerged as a prevalent minimally invasive approach to hysterectomy.[1] As its use has increased, there has also been a concomitant reduction in the number of abdominal hysterectomies for benign indications, both overall and relative to other approaches to hysterectomy. Together with total laparoscopic hysterectomy (TLH), laparoscopic-assisted vaginal hysterectomy (LAVH), vaginal hysterectomy, and laparoscopic supracervical hysterectomy, the increase in robotic hysterectomy has resulted in the decrease of abdominal hysterectomy to approximately 28%.[2] Since its approval by the FDA for benign gynecology in 2005, scores of studies and publications have assessed the clinical and economic strengths and weaknesses of the Intuitive Surgical da Vinci robot's use in benign hysterectomy, with the vast majority of studies underscoring robotic surgery as generally equivalent clinically to laparoscopy together with some reports of reduced pain, less blood loss, and shorter length of stay albeit with generally higher cost and longer operative times, though this variable may also be dependent on patient characteristics and co-morbidities.[3,4,5]

Today, surgical costs and operative times are increasingly critical given the need to improve contribution margins in surgical procedures as a key driver in hospital profitability. Moreover, with the growing understanding of best practices in robotic surgery and related robotic program optimization,[6,7] newer studies and publications are demonstrating that, in specific robotic surgery case types, including benign hysterectomy, cases can be performed for comparable or even lower cost when compared to laparoscopy, with equivalent clinical outcomes. [6,7,8,9,10]

## Senhance Surgical System

In 2018, the introduction of the Senhance® Surgical System (Asensus Surgical US, Inc.) in the US and Europe presented robotic and laparoscopic surgeons with an alternative to the Intuitive Surgical da Vinci robot. Comprised of an open-platform, modular architecture with three mobile arms that allow for use of existing laparoscopic vision systems, trocars, and OR tables **(Figure 1),** the Senhance system's instruments are reusable. The system incorporates eye-tracking camera control, haptic sensing, and 3DHD visualization. Case set-up for Senhance procedures generally includes raising the patient so the camera port is aligned with the front of the arms' collar; setting the patient in Trendelenburg; setting the scope to 0° to provide clearance for anesthesiology; and using the xyphoid process as the point for arm placement. Both arms use instruments that are 310 mm in length. **(Figure 2)**

For Gyn cases specifically, cameras in Senhance cases should be placed proximal to the umbilicus, but can also be located distally, subject to patient anatomy. Instrument port placement is suggested to be set a minimum of 8 cm from the camera port. **(Figure 3)** Surgical instrument set-up, docking and undocking can be performed by a surgical assistant and surgeon. Docking and undocking take place on a robotic arm using a clamp and lock system, which does not require attachment of the robotic arm directly to a trocar. Standard laparoscopes, cameras, insulflators, trocars, and reusable instruments reduce surgical expense. Use of other instruments like ultrasonic energy are compatible with the system which can use both 3 mm and 5 mm trocars and instruments for minimally invasive surgery advantages.

For reference, an overview of the key specifications of the da Vinci Si and Xi robot models, as well as the LAVH surgical procedure and associated technology, has been covered previously in the literature in great depth.[11,12,13,14,15]

**Materials and Methods**

Given the objective of assessing the comparative costs and case times between the Senhance robot, the da Vinci robot and the LAVH cases, retrospective instrument cost, console times (Senhance and da Vinci), and operative time data were evaluated based on 28 sequential Senhance total laparoscopic hysterectomies (with and without adnexa removal) performed by 6 gynecologic surgeons in their robotic learning curve from 4 hospitals in the United States and Europe between June 2019 and January 2020. **(Table 1 and Table 2)**

All surgery was performed by attending gynecological surgeons who were experienced laparoscopists prior to learning the Senhance technology. All surgeons using the Asensus Surgical Senhance robotic had previously used an Intuitive Surgical da Vinci robot.

Two retrospective cohorts of 56 da Vinci TLH cases **(Table 3)** and 34 standard laparoscopic LAVH cases, respectively, **(Table 4)** were extracted from the CAVAlytics™ database (CAVA Robotics International, LLC). The CAVAlytics database aggregates operational, clinical, and financial robotic surgery data in connection with hospital robotic programs including other comparative minimally invasive laparoscopic data across service lines. The database is used to track efficiency and to guide and measure change management and program improvement at the surgeon, service line, and system-wide levels.

The da Vinci cohort included 10 surgeons and the LAVH cohort included 12 surgeons. Surgeons were selected based on their initial independent cases for both da Vinci and LAVH. All had completed residency training, were board certified and had laparoscopic privileges. The range of private practice experience was 3 to 30 years. Each surgeon was adding da Vinci TLH or LAVH as a new procedure thereby presenting two comparative cohorts, each with similar surgeon experience versus the Senhance initial case data. All cases reflect the surgeons' learning curves in independent practice.

When comparing the operation, which includes cuff closure at the console for a Senhance TLH and da Vinci TLH, the operative time (i.e., cut to close) for LAVH was selected as the best comparison because it includes the cuff closure and is a more accurate representation of the complete operation. Instrument costs include the life-limited adapters and instruments such as graspers and energy devices (monopolar, bipolar and ultrasonic) as well as robotic vendor-specific drapes, seals and other single-use disposable accessories. (**Table 5 and Table 6**) Patient drapes, sutures, gowns, gloves and other disposables used in all three cohorts were excluded from the supply cost analysis. Disposable single-use instruments such as energy devices (monpolar, bipolar, ultrasonic or other advanced sealing devices) were included in the costs of LAVH cases. Capital equipment costs for all procedures were not included in instrumentation or supply costs. No protected health information was collected and the data was Institutional Review Board (IRB) exempt. With the exception of the co-author (S. McCarus), data was de-identified consistent with the US Centers for Medicare and Medicaid Services (CMS) Limited Data Set (LDS) guidelines,[16] further preventing inference of surgeon / facility identities. As a real-world assessment, however, this study nevertheless has inherent limitations and flaws, addressed in the Limitations section.

Selection of Senhance TLH vs. da Vinci TLH vs Traditional LAVH

Senhance and da Vinci TLH procedures were compared to traditional LAVH rather than total laparoscopic hysterectomy for several pragmatic reasons. Standard straight stick laparoscopic TLH cases are under-represented in the CAVAlytics data base compared to standard LAVH cases. Additionally, these two techniques are more similar than they are different. Specifically, the steps of the surgery from port placement to sealing and transecting the uterine artery are similar. The biggest differences in techniques include the additional time of robotic set-up and docking for the Senhance and da Vinci cases and the surgeon return to the patient for the colpotomy and vaginal cuff closure in the LAVH.

Of note, all three techniques require an energy source (bipolar, monopolar, ultrasonic or other advanced seal/cut device) to seal and transect the infundibular, utero-ovarian and uterine artery pedicles, and each approach includes similar uterine manipulator placement, port placement and dissection techniques. The time interval selected for comparison in this analysis is slightly different but is designed to reflect the commonality of technique: Senhance and da Vinci TLH console times include the cuff closure and are compared to the cut-to-close surgery time, whereas LAVH cut-to-close surgery time includes the cuff closure and is more similar to the console time when compared with Senhance and da Vinci TLH cases.

Data Source for da Vinci and Laparoscopic Cases

All da Vinci and LAVH data were obtained from the CAVAlytics data base, protected by applicable US Health Insurance Portability and Accountability Act (HIPAA) and the European Union General Data Protection Regulation (GDPR) privacy and security policies. Subject to data use agreements between the hospitals and CAVA, data is aggregated for independent benchmarking of key performance indicators without commercial biases from robotic or equipment vendors. Although average performance metrics are available from Intuitive Surgical, more detailed case- and surgeon-level data can be accessed and analyzed with the CAVAlytics database, which is not available in the public domain. Blinded and aggregated data is also used to establish robotic and laparoscopic surgery performance benchmarks for clinical, operational, and financial metrics. Data used herein did not include PHI and was IRB exempt. Endpoints included OR room time; console time (for Senhance and da Vinci); surgery time (for LAVH); and average instrument cost per case.

Vendor-specific supplies unique to the case (i.e., Asensus Surgical and Intuitive Surgical instruments and accessories) were included in the analysis, as well as unique disposable laparoscopic devices for LAVH cases. Supplies that are common to each of the three case types such as patient drapes, gloves, gowns, etc. were removed from the analysis given that these supplies are similar across all modalities and do not represent incremental costs of minimally invasive surgery.

Statistical analysis included comparison of instrument costs (Senhance vs da Vinci vs LAVH), console times (Senhance vs da Vinci), and total operative time (Senhance vs da Vinci vs LAVH) using the nonparametric Mann-Whitney test. P-values were not adjusted for multiple comparisons and may not be interpreted as confirmatory but rather descriptive.

Senhance instruments were assigned a per-case instrument cost based on Asensus' commercial price guide, assuming an adaptor with 250 lives and an insert with 50 lives. Da Vinci instruments were similarly assigned a per-case instrument cost based on life limits of 10 uses each and Intuitive's commercial pricing, as of June 1, 2020. Instrument pricing is the same between the US and Europe for both vendors.

**Results**

This is the first comparative assessment of the Senhance surgical system in benign hysterectomy. Summary analysis of the three cohorts is presented in **Table 7.** Findings demonstrated a median Senhance benign hysterectomy instrument cost savings per case of $834 compared to similar da Vinci cases; this difference in median instrument costs between Senhance ($559) and da Vinci ($1,393) was statistically significant ($p < 0.001$). Median benign hysterectomy console times for Senhance cases were 91.5 minutes compared to da Vinci console times at 96 minutes, which was not statistically significant. It was noted that the total surgery elapsed time is longer for Senhance cases compared to the da Vinci cases, which can lead to less efficient use of OR resources. This is likely longer in the Senhance cases due to the surgeons' and crews' lack of experience with the new Senhance technology, compared with the da Vinci technology which they had used previously. In addition to the console time, which is surgeon dependent, the robotic set-up time, including port placement decisions and docking, are included in the total surgery elapsed time.

Compared to LAVH, Senhance median instrument costs unique to the case were $559 compared to $489 for LAVH, which was not statistically significant ($p=0.336$). The majority of cost in the LAVH cases is related to single-use disposable energy devices such as Ligasure, Enseal, or Harmonic Ace shears.

Additional findings include statistical significance of longer operating times for Senhance TLH (median 138.5 minutes) compared to LAVH (97.5 minutes) (*p-value<0.001).* However, when comparing the average *console time* of Senhance TLH (91.5 minutes) to the *operative time* of LAVH (101 minutes), there is no statistical significance (p-value = 0.6772).

**Discussion**

As is commonly known, the increase in robotic surgery adoption in gynecology has been challenged because of its associated high costs and longer operative times.[17,18] It appears these historical barriers — higher per-case instrument costs and longer case times — are lowering as robotic surgeons become more experienced in robotic best practices.[6,7] With the inclusion of a new technology such as Senhance, laparoscopic surgeons can leverage aspects of robotic surgery, such as instrument control, image stability, and 3D visualization, while maintaining the patient benefits of minimally invasive surgery together with surgeon familiarity of laparoscopic techniques[19,20] at lower instrumentation costs – a key objective of facility's seeking to improve surgical contribution margins.

It bears repeating that, despite the fact that the Senhance hysterectomy operative times were significantly longer than the LAVH (due in large measure to increased time associated with docking, port placement, etc.), when comparing the core operative time – i.e., the console time of the Senhance hysterectomy vs. the LAVH operative time – the difference is not significant. Moreover, overall times have improved over the past 15 years with da Vinci technology as experience of surgeons and operative teams has increased.[21,22] It can be reasonably posited, therefore, that the difference in overall operative and console times of Senhance TLH cases will also likely decrease with surgeon and operative team experience and will likely approach parity with da Vinci as port placement and docking times for Senhance improve; however, further assessment of this parameter is required.

Moreover, as previously discussed, the complete operation for all steps of the hysterectomy is most closely represented by *the console time of the robotic cases* compared to the *total time of the LAVH cases* in order to capture all steps of the technique including cuff closure.

Over the past decade, the decision by laparoscopic and open gynecologic surgeons to adopt robotic surgery has become increasingly widespread,[2,6] with approximately 35% of all benign hysterectomies performed robotically in the US.[17,23,24] This increase in robotic benign hysterectomy cases is a result of many factors, including surgeon preference attributed to robotic technologies as well as patient preferences.[25]

Despite the widespread adoption of robotic surgery in gynecology, surgeons often struggle to maintain adequate robotic case volumes due to the recent decline in utilization of hysterectomy in benign conditions such as abnormal uterine bleeding. Notably, clinical quality and consistent surgical outcomes are not as favorable for low-volume robotic surgeons in gynecology (which is similarly true for other robotic service lines), thus increasing risk and decreasing patient safety.[6,26] Longer case times and decreased operational efficiencies also result in increased costs. In fact, the prevalence of low-volume gyn surgeons – though performing the majority of gyn robotic procedures – contributes to higher overall surgical complication rates, longer lengths of stays, and higher cost of care compared to high-volume gyn surgeons.[2,27]

Several other points bear illuminating. Regarding the comparative case times, even though this real-world study examined surgeons' initial independent LAVH case, it should be noted that these surgeons were already experienced in laparoscopy, meaning there is inherent efficiency expected. Set-up for traditional laparoscopy is also less demanding than robotic set-up for both da Vinci and Senhance.

A second point relates to the benefits associated with a surgeon being able to sit peri-operatively. One recent study of 289 gynecologic surgeons cited that those who managed robotic ergonomics effectively reported a lower rate of physical discomfort associated with performing surgery ($p<0.05$).[28]

A third point of note is that, for surgeons learning the Senhance system, familiar port placement and instrumentation can speed learning curve adoption, while advantages of an open console, 3D visualization, and haptic feedback are at once a part of the operation. Such capabilities fill a gap for common cases such as benign hysterectomy, which have been vigorously challenged historically as inappropriate da Vinci cases due to their associated higher cost.[17,29,30] However, being able to achieve the advantages of robotics at a lower cost per case vs. da Vinci – and with costs similar to but not statistically lower than LAVH – suggests the Senhance system should garner further consideration.

Although not addressed in this analysis, a final parallel consideration involves the needs of lower-volume gyn surgeons. Specifically, many lower-volume surgeons (surgeons who perform less than an average of two robotic cases monthly) struggle with the increased technical demands required to transition from traditional laparoscopy to da Vinci robotic surgery, which often makes additional training and consistent robot utilization difficult to achieve and sustain.[31] Such assessment may prove to be a worthwhile prospective exploration.

**Limitations**

As a retrospective, pragmatic, real-world assessment, the three patient populations herein assessed – although inclusive of cases performed by learning curve surgeons –

were similar but not strictly matched with regards to patient age, BMI, co-morbidities, uterine size / weight, presence of uterine or other pelvic pathology, length of stay, pain measures, and post-op complications. Despite the fact that these clinical endpoints were not available in the retrospective data sets, it is known that the surgeons selected did not exclusively perform Senhance, da Vinci or LAVH procedures over the timeframe analyzed. Other familiar approaches to hysterectomy (abdominal, vaginal, or laparoscopic) were utilized by each, suggesting some initial case selection bias. The bias in selecting *initial learning curve cases* was thus universal across each group, and most likely favored less clinically complex, and therefore more similar cases, selected by the surgeons for their first independent cases. The methodology of extracting the comparative robotic and LAVH data points used in this analysis from a proprietary database may also raise the question of potential bias as well as the fact that this methodology is not widely accepted in the medical literature, and presents an acknowledged limitation of real-world, pragmatic assessments.

An additional limitation is the small numbers of da Vinci and LAVH cases per surgeon; sometimes only one case was available from low-volume surgeons. Qualifying cases of initial independent cases with complete supply cost and time metrics were selected in an effort to achieve slightly larger cohorts of cases and surgeons, thereby gaining more data to compensate for the smaller individual surgeon numbers. Senhance first-time users also had previous robotic experience; it may have provided a more robust assessment had the Senhance users been a totally robotic-naïve population.

This assessment also relies on small sample sizes; 7 of 28 Senhance cases were performed by one laparoscopic surgeon (Table 4, surgeon E) whose case and console times were notably faster than the other 5 surgeons in this cohort, as well as faster than the average da Vinci cohort case times. While this surgeon's performance reduced the average Senhance case time in this limited series, it begs the question whether, and to what degree, experienced laparoscopic surgeons might achieve faster benign hysterectomy robotic case and console times on Senhance compared to the da Vinci robot, at least in their learning curve. To better assess this finding, future comparative research is called for inclusive of case-matched demographic, clinical, and cost comparisons. Additional areas of research should also include same-surgeon experience and comparison between Senhance TLH, laparoscopic TLH and da Vinci TLH.

Finally, this analysis was supported by industry, which opens the door to criticisms such as non-randomization and bias associated with the cost of consumables reported to be better for Senhance vs da Vinci cases.

**Conclusion**

On the basis of the findings in these initial, similar-case cohort comparisons, the Senhance system appears to offer a cost-effective minimally invasive surgical option in benign hysterectomy surgery compared to the da Vinci, with comparable case time; and statistically comparable costs to LAVH albeit with longer case times, at least during the learning curve period.

**Disclosures**

Dr. Coussons and Mr. Feldstein are employed by CAVA Robotics International, which received support from Asensus Surgical to perform independent analysis of data and drafting of this manuscript. The commercial source had no influence on either the data analytics or the drafting of the paper. Dr. McCarus has no conflicts of interest and has nothing to disclose.

**Data Availability Statement**

The data that support the findings of this study are available from the corresponding author upon reasonable request.

# Tables

**Table 1. Senhance Hospitals and Case Volumes**

| Location | # of Senhance Cases |
|---|---|
| Site 1 | 7 |
| Site 2 | 10 |
| Site 3 | 9 |
| Site 4 | 2 |
| TOTAL | 28 |

## Table 2. Asensus Surgical Senhance Data Summary

| Date | Location | Surgeon | Procedure | Cockpit Time (minutes) | Surgery Elapsed Time (minutes) | Instrument Costs |
|---|---|---|---|---|---|---|
| 8/15/19 | Site 3 | A | Total Hysterectomy | 208 | 286 | $662 |
| 9/5/19 | Site 3 | A | Total Hysterectomy | 153 | 198 | $162 |
| 6/20/19 | Site 3 | A | Total Hysterectomy | 192 | 241 | $162 |
| 9/5/19 | Site 2 | B | Total Hysterectomy | 125 | 172 | $666 |
| 9/12/19 | Site 2 | B | Total Hysterectomy | 100 | 163 | $624 |
| 8/29/19 | Site 2 | B | Total Hysterectomy | 69 | 120 | $624 |
| 9/26/19 | Site 2 | B | Total Hysterectomy | 47 | 124 | $624 |
| 9/5/19 | Site 2 | B | Total Hysterectomy | 123 | 175 | $582 |
| 8/22/19 | Site 2 | B | Total Hysterectomy | 110 | 148 | $582 |
| 8/22/19 | Site 2 | B | Total Hysterectomy | 89 | 131 | $582 |
| 9/26/19 | Site 2 | B | Total Hysterectomy | 101 | 130 | $124 |
| 6/24/19 | Site 3 | C | Total Hysterectomy | 118 | 173 | $204 |
| 10/28/19 | Site 3 | C | Total Hysterectomy | 89 | 128 | $162 |
| 2/28/20 | Site 3 | C | Total Hysterectomy | 91 | 149 | $162 |
| 7/12/19 | Site 3 | C | Total Hysterectomy | 95 | 135 | $124 |
| 1/10/20 | Site 3 | C | Total Hysterectomy | 95 | 151 | $120 |
| 12/6/19 | Site 3 | C | Total Hysterectomy | 92 | 155 | $120 |
| 10/3/19 | Site 2 | D | Total Hysterectomy | 80 | 136 | $162 |
| 10/3/19 | Site 2 | D | Total Hysterectomy | 90 | 141 | $162 |
| 1/28/20 | Site 1 | E | Total Hysterectomy | 51 | 87 | $624 |
| 10/8/19 | Site 1 | E | Total Hysterectomy | 58 | 88 | $624 |
| 2/25/20 | Site 1 | E | Total Hysterectomy | 48 | 93 | $578 |
| 1/7/20 | Site 1 | E | Total Hysterectomy | 22 | 84 | $540 |
| 10/15/19 | Site 1 | E | Total Hysterectomy | 83 | 118 | $540 |
| 10/1/19 | Site 1 | E | Total Hysterectomy | 67 | 115 | $624 |
| 1/28/20 | Site 1 | E | Total Hysterectomy | 65 | 103 | $580 |
| 1/23/20 | Site 4 | F | Total Hysterectomy | 93 | 237 | $580 |
| 1/23/20 | Site 4 | F | Total Hysterectomy | 172 | 209 | $162 |
| | Average | | | 97.36 | 149.64 | $409.36 |
| | Range | | | 22-208 minutes | 84-286 minutes | $120-$666 |

## Table 3. Intuitive Surgical da Vinci Data Summary

| Date | Surgeon | Procedure | Console Time (minutes) | Surgery Elapsed Time (minutes) | Room Time (minutes) | Instrument costs |
|---|---|---|---|---|---|---|
| 7/26/18 | G | ROBOTIC LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL WITH SALPINGECTOMY | 91 | 102 | 141 | $1,393 |
| 10/23/17 | G | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 98 | 115 | 134 | $1,393 |
| 12/11/17 | G | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 80 | 96 | 129 | $1,393 |
| 6/7/18 | G | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 99 | 113 | 154 | $1,393 |
| 8/3/18 | G | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 117 | 129 | 155 | $1,393 |
| 10/18/18 | G | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 81 | 97 | 134 | $1,393 |
| 10/19/18 | G | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 113 | 121 | 153 | $1,393 |
| 12/20/18 | G | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 75 | 94 | 122 | $1,393 |
| 4/12/19 | H | ROBOTIC LAPAROSCOPIC HYSTERECTOMY TOTAL UTERUS GREATER THAN 250 G W/ SALPINGECTOMY | 100 | 108 | 144 | $1,393 |
| 7/19/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY | 38 | 56 | 100 | $1,125 |
| 11/1/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY | 46 | 61 | 88 | $1,125 |
| 11/8/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY | 50 | 68 | 88 | $1,393 |
| 5/3/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 63 | 71 | 111 | $1,393 |
| 5/10/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 50 | 63 | 101 | $1,393 |
| 6/21/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 79 | 96 | 138 | $1,393 |
| 7/12/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 55 | 73 | 103 | $1,125 |
| 9/6/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 74 | 93 | 124 | $1,125 |
| 10/11/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 76 | 93 | 121 | $1,125 |
| 10/18/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 61 | 71 | 104 | $1,125 |
| 11/8/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 62 | 71 | 92 | $1,125 |
| 11/22/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 67 | 83 | 114 | $1,125 |
| 12/27/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 58 | 70 | 97 | $1,125 |
| 4/29/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGOOPHORECTOMY | 65 | 80 | 118 | $1,393 |
| 5/3/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGOOPHORECTOMY | 88 | 106 | 140 | $1,393 |
| 11/22/19 | H | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGOOPHORECTOMY | 65 | 83 | 118 | $1,125 |
| 11/10/17 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGOOPHORECTOMY | 106 | 116 | 153 | $1,393 |
| 12/1/17 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGOOPHORECTOMY | 185 | 195 | 232 | $1,393 |
| 8/2/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGOOPHORECTOMY | 125 | 135 | 183 | $1,393 |
| 12/19/19 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGOOPHORECTOMY | 101 | 109 | 134 | $1,125 |
| 1/4/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 103 | 113 | 161 | $1,393 |
| 1/26/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 100 | 112 | 147 | $1,393 |
| 3/16/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 155 | 163 | 203 | $1,393 |
| 4/12/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 90 | 104 | 135 | $1,393 |
| 5/11/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 120 | 140 | 166 | $1,393 |
| 6/29/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 110 | 125 | 156 | $1,393 |
| 7/6/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 79 | 99 | 139 | $1,393 |
| 7/27/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 103 | 112 | 145 | $1,393 |
| 8/29/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 139 | 147 | 195 | $1,393 |
| 9/26/18 | I | ROBOTIC LAPAROSCOPIC TOTAL HYSTERECTOMY SALPINGECTOMIES | 105 | 125 | 167 | $1,393 |
| 7/10/20 | J | ROBOTIC ASSISTED HYSTERECTOMY, BILATERAL SALPINGECTOMY, CYSTOSCOPE | 107 | 118 | 142 | $1,408 |
| 1/17/20 | J | ROBOTIC ASSISTED HYSTERECTOMY, BILATERAL SALPINGECTOMY, OBSERVATIONAL CYSTOSCOPY | 66 | 81 | 109 | $1,168 |
| 6/12/20 | J | ROBOTIC ASSISTED HYSTERECTOMY, BILATERAL SALPINGECTOMY, OBSERVATIONAL CYSTOSCOPY | 79 | 96 | 123 | $1,168 |
| 2/21/20 | J | ROBOTIC ASSISTED TOTAL LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINGO OOPHORECTOMY, OBSERVATIONAL CYSTOSCOPY | 72 | 93 | 124 | $1,168 |
| 7/13/20 | K | ROBOTIC ASSISTED LAPAROSCOPIC HYSTERECTOMY BILATERAL SALPINGO OOPHORECTOMY ANTERIOR REPAIR CYSTOSCOPY | 94 | 116 | 154 | $1,150 |
| 7/28/20 | K | ROBOTIC ASSISTED TOTAL LAPAROSCOPIC HYSTERECTOMY BILATERAL SALPINGO-OOPHORECTOMY CYSTOSCOPY | 108 | 123 | 153 | $1,270 |
| 2/12/20 | K | ROBOTIC ASSISTED TOTAL LAPAROSCOPIC HYSTERECTOMY BILATERAL SALPINGECTOMY CYSTOSCOPY | 111 | 126 | 154 | $1,150 |
| 7/28/20 | K | ROBOTIC ASSISTED TOTAL LAPAROSCOPIC HYSTERECTOMY BILATERAL SALPINGO-OOPHPRECTOMY CYSTOSCOPY | 88 | 100 | 134 | $1,150 |
| 7/13/20 | K | ROBOTIC ASSISTED TOTAL LAPAROSCOPIC HYSTERECTOMY LEFT SALPINGO-OOPHORECTOMY RIGHT SALPINGECTOMY CYSTOSCOPY | 125 | 137 | 169 | $1,150 |
| 3/3/20 | K | ROBOTIC TOTAL LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINGO-OOPHORECTOMY, CYSTOSCOPY | 124 | 142 | 166 | $1,150 |
| 7/23/20 | L | ROBOTIC ASSISTED TOTAL LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINGECTOMY, OBSERVATIONAL CYSTOSCOPY | 56 | 76 | 116 | $1,172 |
| 6/12/20 | M | ROBOTIC ASSISTED TOTAL LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINECTOMY, OBSERVATONAL CYSTOSCOPY, REMOVAL OF SKIN TAGS ON LEFT THIGH AND RIGHT ABDOMINAL FOLD | 138 | 148 | 176 | $1,408 |
| 3/10/20 | N | ROBOTIC TOTAL LAPAROSCOPIC ASSISTED HYSTERECTOMY BILATERAL SALPINGO OOPHORECTOMY | 129 | 142 | 225 | $1,360 |
| 7/8/20 | O | ROBOTIC ASSISTED TOTAL LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINGECTOMY | 108 | 130 | 156 | $1,168 |
| 2/7/20 | P | ROBOTIC ASSISTED LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINGO-OOPHORECTOMY, CYSTOSCOPY | 120 | 132 | 156 | $1,238 |
| 2/7/20 | P | ROBOTIC ASSISTED LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINGO-OOPHORECTOMY, CYSTOSCOPY | 122 | 132 | 156 | $1,238 |
| 1/31/20 | P | ROBOTIC ASSISTED TOTAL LAPAROSCOPIC HYSTERECTOMY, EXAM UNDER ANESTHESIA, BILATERAL SALPINGO-OOPHORECTOMY, CYSTOSCOPY, UTERAL STENTS | 221 | 236 | 259 | $1,173 |
| | | Average | 95 | 110 | 143 | $1,287 |
| | | Range | 38-221 minutes | 56-236 minutes | 88-259 minutes | $1125-$1408 |

**Table 4. LAVH Data Summary**

| Date | Surgeon | Procedure | Cockpit Time (minutes) | rgery Elapsed Time (m | Room Time (minutes) | Instrument costs |
|---|---|---|---|---|---|---|
| 6/24/20 | Q | TOTAL LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINGECTOMY, ASPIRATION OF RIGHT OVARIAN CYST, OBSERVATIONAL CYSTOSCOPY | NA | 98 | 122 | $501 |
| 1/2/20 | R | VAGINAL HYSTERECTOMY LAPAROSCOPIC ASSISTED (LAVH) EXCISION OF ABDOMINAL WALL MASS X2 | NA | 26 | 136 | $461 |
| 1/3/20 | S | TOTAL LAPAROSCOPIC HYSTERECTOMY BILATERAL SALPINGO OOPHORECTOMY,EXCISION LEFT CHEST WALL NODULE | NA | 88 | 118 | $515 |
| 1/6/20 | T | LAPAROSCOPIC TOTAL HYSTERECTOMY, cystoscopy, bilateral salingoectomy | NA | 86 | 111 | $517 |
| 6/11/20 | U | LAPAROSCOPIC ASSISTED VAGINAL HYSTERECTOMY, BILATERAL SALPINGOOPHORECTOMY, ANTERIOR ANDPOSTERIOR REPAIR. | NA | 123 | 164 | $500 |
| 2/13/20 | V | LAPAROSCOPIC TOTAL HYSTERECTOMY WITH BILATERAL SALPINGECTOMY AND OBSERVATIONAL CYSTECTOMY | NA | 154 | 176 | $490 |
| 5/29/20 | V | TOTAL LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINGECTOMY, OBSERVATIONAL CYSTOSCOPY | NA | 137 | 166 | $476 |
| 5/1/20 | W | LAPAROSCOPIC TOTAL HYSTERECTOMY | NA | 133 | 170 | $510 |
| 5/21/20 | X | LAPAROSCOPIC ASSISTED VAGINAL HYSTERECTOMY, BILATERAL SALPINGECTOMY | NA | 88 | 125 | $524 |
| 5/29/20 | X | LAPAROSCOPIC ASSISTED VAGINAL HYSTERECTOMY, RIGHT SALPINGO-OOPHORECTOMY. | NA | 105 | 130 | $448 |
| 1/16/20 | X | VAGINAL HYSTERECTOMY LAPAROSCOPIC ASSISTED (LAVH) BILATERAL SALPINGECTOMY | NA | 129 | 168 | $460 |
| 2/20/20 | Y | LAPAROSCOPIC ASSISTED VAGINAL HYSTERECTOMY BILATERAL SALPINGECTOMY | NA | 134 | 172 | $485 |
| 3/5/20 | Y | LAPAROSCOPIC TOTAL HYSTERECTOMY BILATERAL SALPINGECTOMY | NA | 108 | 145 | $460 |
| 2/20/20 | Y | TOTAL LAPAROSCOPIC ASSISTED HYSTERECTOMY BILATERAL SALPINGECTOMY | NA | 95 | 128 | $459 |
| 1/16/20 | Y | TOTAL LAPAROSCOPIC HYSTERECTOMY BILATERAL SALPINGECTOMIES | NA | 149 | 187 | $489 |
| 2/6/20 | Y | VAGINAL HYSTERECTOMY LAPAROSCOPIC ASSISTED (LAVH) BILATERAL SALPINGO- OOPHURECTOMY, ANTERIOR AND POSTERIOR REPAIR | NA | 111 | 156 | $467 |
| 3/5/20 | Y | VAGINAL HYSTERECTOMY LAPAROSCOPIC ASSISTED BILATERAL SALPINGECTOMIES | NA | 84 | 131 | $522 |
| 2/20/20 | Z | VAGINAL HYSTERECTOMY LAPAROSCOPIC ASSISTED (LAVH) BILATERAL SALPINGECTOMY | NA | 115 | 149 | $456 |
| 3/9/20 | AA | TOTAL LAPAROSCOPIC HYSTERECTOMY, BILATERAL SALPINGECTOMY, CYSTOSCOPY | NA | 180 | 215 | $489 |
| 10/1/18 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 69 | 126 | $492 |
| 11/9/18 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 77 | 107 | $480 |
| 11/30/18 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 85 | 124 | $509 |
| 3/18/19 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 90 | 122 | $483 |
| 3/22/19 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 76 | 113 | $487 |
| 4/22/19 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 132 | 171 | $504 |
| 10/25/19 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 114 | 147 | $518 |
| 11/15/19 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 76 | 109 | $454 |
| 11/18/19 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 74 | 102 | $500 |
| 1/24/20 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 60 | 100 | $506 |
| 6/26/20 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL | NA | 85 | 121 | $456 |
| 6/25/18 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL WITH SALPINGOOPHORECTOMY | NA | 105 | 143 | $478 |
| 6/21/18 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL WITH SALPINGECTOMY | NA | 99 | 119 | $499 |
| 2/8/19 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL WITH SALPINGECTOMY | NA | 66 | 93 | $470 |
| 6/7/19 | AB | LAPAROSCOPIC ASSISTED HYSTERECTOMY VAGINAL WITH SALPINGECTOMY | NA | 97 | 129 | $524 |
| | | Average | | 101 | 138 | $488 |
| | | Range | | 60-180 minutes | 93-215 minutes | $448-$524 |

## Table 5. Asensus Surgical Senhance Instrument Costs (US / EU; in $)

| US Catalog # | CF # | Catalog Name | US List Price | Per Use Cost |
|---|---|---|---|---|
| 3 mm Monopolar Instruments | | | | |
| X0007212 | 210-11010 | Monopolar Maryland Dissector (Ø 3 mm x 280 mm) | $1,450 | $29 |
| X9007212 | 210-21010 | Adapter, Monopolar 3 mm Maryland Dissector (Ø 3 mm x 280 mm) | $4,500 | $18 |
| X0007215 | 210-11012 | Monopolar Curved Metzenbaum Scissors (Ø 3 mm x 280 mm) | $1,200 | $24 |
| X9007215 | 210-21012 | Adapter, Monopolar 3 mm Curved Metzenbaum Scissors (Ø 3 mm x 280 mm) | $4,500 | $18 |
| 3 mm Bipolar Instruments | | | | |
| X0007309 | 220-11010 | Bipolar Maryland Dissector Insert (Ø 3 mm x 280 mm) | $1,250 | $25 |
| X9007309 | 220-21010 | Adapter, Bipolar 3 mm Maryland Dissector (Ø 3 mm x 280 mm) | $4,500 | $18 |
| X0007306 | 220-11012 | Bipolar Grasping Forceps Insert (Ø 3 mm x 280 mm) | $1,250 | $25 |
| X9007306 | 220-21012 | Adapter, Bipolar 3 mm Grasping Forceps (Ø 3 mm x 280 mm) | $4,500 | $18 |
| X0007303 | 220-11014 | Bipolar 3 mm Shaft (Ø 3 mm x 280 mm) | $250 | |
| 3 mm Passive Instruments | | | | |
| X0007203 | 200-11010 | Atraumatic Single Action Grasper (Ø 3 mm x 280 mm) | $1,450 | $29 |
| X9007203 | 200-21010 | Adapter, 3 mm Atraumatic Single Action Grasper (Ø 3 mm x 280 mm) | $4,500 | $18 |
| X0007206 | 200-11012 | Cobra Grasper (Ø 3 mm x 280 mm) | $1,450 | $29 |
| X9007206 | 200-21012 | Adapter, 3 mm Cobra Grasper (Ø 3 mm x 280 mm) | $4,500 | $18 |
| X0007209 | 200-11014 | DeBakey Grasper (Ø 3 mm x 280 mm) | $1,450 | $29 |
| X9007209 | 200-21014 | Adapter, 3 mm DeBakey Grasper (Ø 3 mm x 280 mm) | $4,500 | $18 |
| X0007218 | 200-11016 | Needle Holder (Ø 3 mm x 280 mm) | $1,450 | $29 |
| X9007218 | 200-21016 | Adapter, 3 mm Needle Holder (Ø 3 mm x 280 mm) | $4,500 | $18 |
| 5 mm Monopolar Instruments | | | | |
| X0007026 | 210-11018 | Monopolar Curved Metzenbaum Scissors (Ø 5 mm x 310 mm) | $1,000 | $20 |
| X9007026 | 210-21018 | Adapter, Monopolar Curved Metzenbaum Scissors (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007029 | 210-11022 | Monopolar Curved Metzenbaum Scissors Short Tip (Ø 5 mm x 310 mm) | $1,000 | $20 |
| X9007029 | 210-21022 | Adapter, Monopolar Curved Metzenbaum Scissors Short Tip (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007032 | 210-11026 | Monopolar Maryland Dissector (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007032 | 210-21026 | Adapter, Monopolar Maryland Dissector (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007035 | 210-11030 | Monopolar L-Hook Electrode (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007035 | 210-21030 | Adapter, Monopolar L-Hook Electrode (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007027 | 210-11032 | Monopolar Curved Metzenbaum Scissors, Long (Ø 5 mm x 410 mm) | $1,000 | $20 |
| X9007027 | 210-21032 | Adapter, Monopolar Curved Metzenbaum Scissors, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007030 | 210-11034 | Monopolar Curved Metzenbaum Scissors Short Tip, Long (Ø 5 mm x 410 mm) | $1,000 | $20 |
| X9007030 | 210-21034 | Adapter, Monopolar Curved Metzenbaum Scissors Short Tip, Long (Ø 5 mm x 410 mm | $4,500 | $18 |
| X0007033 | 210-11036 | Monopolar Maryland Dissector, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007033 | 210-21036 | Adapter, Monopolar Maryland Dissector, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007036 | 210-11038 | Monopolar L-Hook Electrode, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007036 | 210-21038 | Adapter, Monopolar L-Hook Electrode, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| 5 mm Bipolar Instruments | | | | |
| X0005146 | 220-11017 | Bipolar Large Grasping Forceps Insert (Ø 5 mm x 310 mm) | $1,100 | $22 |
| X9000056 | 220-21017 | Adapter, Bipolar Large Grasping Forceps (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0005147 | 220-11015 | Bipolar Curved Grasping Forceps Insert (Ø 5 mm x 310 mm) | $1,100 | $22 |
| X9000057 | 220-21015 | Adapter, Bipolar Curved Grasping Forceps (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0005149 | 220-11019 | Bipolar Maryland Dissector Insert (Ø 5 mm x 310 mm) | $1,100 | $22 |
| X9000058 | 220-21019 | Adapter, Bipolar Maryland Dissector (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0005148 | 220-11021 | Bipolar Curved Scissors Insert (Ø 5 mm x 310 mm) | $1,100 | $22 |
| X9000059 | 220-21021 | Adapter, Bipolar Curved Scissors (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0005150 | 220-11023 | Bipolar Shaft (Ø 5 mm x 310 mm) | $200 | |

| US Catalog # | CF # | Catalog Name | US List Price | Per Use Cost |
|---|---|---|---|---|
| 5 mm Passive Instruments | | | | |
| X0007002 | 200-11026 | Allis Grasper (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007002 | 200-21026 | Adapter, Allis Grasper (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007005 | 200-11030 | Johan Grasper (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007005 | 200-21030 | Adapter, Johan Grasper (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007008 | 200-11034 | Kocher Grasper (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007008 | 200-21034 | Adapter, Kocher Grasper (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007011 | 200-11038 | Strong Grasper (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007011 | 200-21038 | Adapter, Strong Grasper (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007014 | 200-11042 | Mixter Dissector (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007014 | 200-21042 | Adapter, Mixter Dissector (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007017 | 200-11018 | Babcock Forceps (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007017 | 200-21018 | Adapter, Babcock Forceps (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007020 | 200-11045 | Needle Holder Right (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007020 | 200-21045 | Adapter, Needle Holder Right (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007023 | 200-11048 | Needle Holder Left (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007023 | 200-21048 | Adapter, Needle Holder Left (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007038 | 200-11050 | Fundus Grasper (Ø 5 mm x 310 mm) | $1,200 | $24 |
| X9007038 | 200-21050 | Adapter, Fundus Grasper (Ø 5 mm x 310 mm) | $4,500 | $18 |
| X0007003 | 200-11052 | Allis Grasper, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007003 | 200-21052 | Adapter, Allis Grasper, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007006 | 200-11054 | Johan Grasper, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007006 | 200-21054 | Adapter, Johan Grasper, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007009 | 200-11056 | Kocher Grasper, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007009 | 200-21056 | Adapter, Kocher Grasper, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007012 | 200-11058 | Strong Grasper, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007012 | 200-21058 | Adapter, Strong Grasper, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007015 | 200-11060 | Mixter Dissector, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007015 | 200-21060 | Adapter, Mixter Dissector, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007018 | 200-11022 | Babcock Forceps, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007018 | 200-21022 | Adapter, Babcock Forceps, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007021 | 200-11062 | Needle Holder Right, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007021 | 200-21062 | Adapter, Needle Holder Right, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007024 | 200-11064 | Needle Holder Left, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007024 | 200-21064 | Adapter, Needle Holder Left, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| X0007039 | 200-11066 | Fundus Grasper, Long (Ø 5 mm x 410 mm) | $1,200 | $24 |
| X9007039 | 200-21066 | Adapter, Fundus Grasper, Long (Ø 5 mm x 410 mm) | $4,500 | $18 |
| Ultrasonic | | | | |
| X9007619 | 300-11010 | Senhance Ultrasonic Dissector (Ø 5.5 mm x 370 mm) (box of 10) | $5,000 | $500 |
| X9007620 | 300-11011 | Senhance Ultrasonic Transducer | $2,500 | |
| X9007618 | 300-21011 | Adapter, Senhance Ultrasonic | $10,000 | |
| X9007621 | 300-01010 | Senhance Ultrasonic Generator | $20,000 | |
| X9007641 | 300-01012 | Senhance Ultrasonic Footswitch | $1,000 | |
| X9007655 | 300-01020 | Senhance Ultrasonic Generator Power Cable (Type B) | $150 | |
| Drapes | | | | |
| X0005151 | 800-91001 | Senhance Manipulator Arm Sterile Drapes (box of 10 sterile 3-packs) | $2,000 | 200 |
| X0005244 | 800-91002 | Senhance Manipulator Arm Sterile Drapes (box of 10 individual sterile drapes) | $1,000 | 100 |
| Accessories | | | | |
| X0005436 | 800-01013 | Velcro kit for sterile drape attachment (box of 10) | $150 | |
| X0005712 | 800-01014 | InstruSafe Sterilization Tray for Senhance Instruments and Adapters (49.8cm L x 24.4cm W x 10.5cm H) | $4,500 | |
| X0007617 | 800-01015 | InstruSafe Sterilization Tray for Senhance Endoscope Adapter (49.8cm L x 24.4cm W x 6.0cm H) | $2,500 | |
| X9000067 | 800-01018 | Cockpit Handle Inserts (box of 2) | $300 | |
| X0005202 | 800-01019 | Monopolar Cable | $500 | |
| X0005152 | 800-01020 | Bipolar Cable - Erbe | $500 | |
| X0007819 | 800-01021 | Bipolar Cable - Covidien/Valleylab/CONMED | $500 | |
| X0008311 | 800-01003 | Monopolar Cable, 4mm Socket, for Erbe, 5m | $500 | |
| X0008312 | 800-01004 | Monopolar Cable, 4mm Socket, for 8mm Bovie, 5m | $500 | |
| X0008313 | 800-01005 | Monopolar Neutral Cable, for Erbe Nessy, 4.5m | $500 | |
| X0008314 | 800-01006 | Monopolar Neutral Cable, International, REM, 4.5m | $500 | |
| X0008315 | 800-01007 | Bipolar Cable, U.S. Forceps (angled), for Erbe, 5m | $500 | |
| X0008316 | 800-01008 | Bipolar Cable, U.S. Forceps (angled w/ cap), 5m | $500 | |
| X0008272 | 800-01023 | 3D Glasses | $50 | |
| X0008254 | 800-01024 | 3D Clip-ons | $50 | |

## Table 6. Intuitive Surgical da Vinci Instrument Costs (US / EU; in $)

| Commonly used instruments and accessories | Size | Part | Price | Uses | Quantity | Per Use |
|---|---|---|---|---|---|---|
| Hot Shears | 8mm | 470179 | $3,200 | 10 | 1 | $ 320.00 |
| Permanent Cautery Hook | 8mm | 470183 | $2,000 | 10 | 1 | $ 200.00 |
| Permanent Cautery Hook Spatula | 8mm | 470184 | $2,000 | 10 | 1 | $ 200.00 |
| Maryland Bipolar Forceps | 8mm | 470172 | $2,700 | 10 | 1 | $ 270.00 |
| Fenestrated Bipolar Forceps | 8mm | 470205 | $2,700 | 10 | 1 | $ 270.00 |
| Force Bipolar | 8mm | 470405 | $3,100 | 10 | 1 | $ 310.00 |
| Curved Bipolar Dissector | 8mm | 470344 | $2,700 | 10 | 1 | $ 270.00 |
| Micro Bipolar Forceps | 8mm | 470171 | $2,900 | 10 | 1 | $ 290.00 |
| Long Bipolar Grasper | 8mm | 470400 | $2,900 | 10 | 1 | $ 290.00 |
| Medium Large Clip Applier | 8mm | 470327 | $1,400 | 100 | 1 | $ 14.00 |
| Large Clip Applier | 8mm | 470230 | $1,400 | 100 | 1 | $ 14.00 |
| Small Clip Applier | 8mm | 470401 | $2,800 | 100 | 1 | $ 28.00 |
| Large Needle Driver | 8mm | 470006 | $2,200 | 10 | 1 | $ 220.00 |
| Mega SutureCut Needle Driver | 8mm | 470309 | $2,400 | 10 | 1 | $ 240.00 |
| Mega Needle Driver | 8mm | 470194 | $2,200 | 10 | 1 | $ 220.00 |
| Large SutureCut Needle Driver | 8mm | 470296 | $2,400 | 10 | 1 | $ 240.00 |
| ProGrasp Forceps | 8mm | 470093 | $2,200 | 10 | 1 | $ 220.00 |
| Tenaculum Forceps | 8mm | 470207 | $2,200 | 10 | 1 | $ 220.00 |
| Long Tip Forceps | 8mm | 470048 | $2,800 | 10 | 1 | $ 280.00 |
| Tip-Up Fenestrated Grasper | 8mm | 470347 | $2,200 | 10 | 1 | $ 220.00 |
| Small Graptor (Grasping Retractor) | 8mm | 470318 | $2,400 | 10 | 1 | $ 240.00 |
| Cadiere Forceps | 8mm | 470049 | $2,100 | 10 | 1 | $ 210.00 |
| Cobra Grasper | 8mm | 470190 | $2,200 | 10 | 1 | $ 220.00 |
| Potts Scissors | 8mm | 470001 | $1,950 | 10 | 1 | $ 195.00 |
| Round Tip Scissors | 8mm | 470007 | $2,035 | 10 | 1 | $ 203.50 |
| Resano Forceps | 8mm | 470181 | $2,200 | 10 | 1 | $ 220.00 |
| Atrial Retractor Short Right | 8mm | 470246 | $3,500 | 10 | 1 | $ 350.00 |
| Dual Blade Retractor | 8mm | 470249 | $3,500 | 10 | 1 | $ 350.00 |
| Black Diamond Micro Forceps | 8mm | 470033 | $3,000 | 15 | 1 | $ 200.00 |
| Cardiac Probe Grasper | 8mm | 470215 | $2,400 | 10 | 1 | $ 240.00 |
| DeBakey Forceps | 8mm | 470036 | $2,000 | 10 | 1 | $ 200.00 |
| Harmonic ACE Curved Shears | 8mm | 480275 | $3,270 | 1 | 6 | $ 545.00 |
| EndoWrist Suction Irrigator | 8mm | 480299 | $1,590 | 1 | 6 | $ 265.00 |
| Vessel Sealer | 8mm | 480322 | $3,570 | 1 | 6 | $ 595.00 |
| Arm Drape | NA | 470015 | $1,040 | NA | 20 | $ 52.00 |
| Column Drape | NA | 470341 | $360 | NA | 20 | $ 18.00 |
| 5mm - 8mm Universal Seal | 5-8mm | 470361 | $180 | NA | 10 | $ 18.00 |
| 8mm Cannula | 8mm | 470002 | $600 | NA | 1 | NA |
| 8mm Cannula, Long | 8mm | 470004 | $650 | NA | 1 | NA |
| 8mm Blunt Obturator | 8mm | 470008 | $550 | NA | 1 | NA |
| 8mm Blunt Obturator, Long | 8mm | 470009 | $590 | NA | 1 | NA |
| 8mm Bladeless Obturator | 8mm | 470357 | $150 | NA | 6 | $ 25.00 |
| 8mm Bladeless Obturator, Long (Disposable) | 8mm | 470358 | $150 | NA | 6 | $ 25.00 |
| 8mm Bladeless Obturator (Optical) | 8mm | 470359 | $180 | NA | 6 | $ 30.00 |
| 8mm Bladeless Obturator, Long (Optical) | 8mm | 470360 | $180 | NA | 6 | $ 30.00 |

## Table 7. Summary Analysis

**Comparative Results of Senhance vs. da Vinci (in Benign Hysterectomy)**

| | Senhance (n=26) | | Da Vinvi (n=56) | | |
|---|---|---|---|---|---|
| **Parameter** | **Median** | **IQR** | **Median** | **IQR** | **P-Value** |
| Console Time (min) | 91.5 | 68-114 | 96 | 69.5-122 | 0.898 |
| Surgery Elapsed Time (min) | 138.5 | 119-172.5 | 108.5 | 88-127.5 | <0.001 |
| Instrument Costs ($) | $559 | $162-624 | $1,393 | $1150-1393 | <0.001 |
| **Median Cost Savings by Senhance ($)** | **-$834.00** | | | | NA |

**Comparative Results of Senhance vs. LAVH (in Benign Hysterectomy)**

| | Senhance (n=26) | | LAVH (n=34) | | |
|---|---|---|---|---|---|
| **Parameter** | **Median** | **IQR** | **Median** | **IQR** | **P-Value** |
| Console Time (min) | 91.5 | 68-114 | NA | NA | NA |
| Surgery Elapsed Time (min) | 138.5 | 119-172.5 | 97.5 | 84-123 | <0.001 |
| Instrument Costs ($) | $559 | $162-624 | $498 | $467-506 | 0.336 |
| **Median Cost Savings by LAVH ($)** | **$61.00** | | | | NA |

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**Comparative Results of Senhance vs. da Vinci (in Benign Hysterec**

| | Senhance |
|---|---|
| **Parameter** | **Median** |
| Console Time (min) | 91.5 |
| Surgery Elapsed Time (min) | 138.5 |
| Instrument Costs ($) | $559 |
| **Median Cost Savings by Senhance ($)** | |

**Comparative Results of Senhance vs. LAVH (in Benign Hysterecto**

| | Senhance |
|---|---|
| **Parameter** | **Median** |
| Console Time (min) | 91.5 |
| Surgery Elapsed Time (min) | 138.5 |
| Instrument Costs ($) | $559 |
| **Median Cost Savings by LAVH ($)** | |

ctomy)

| e (n=26) | Da Vinvi (n=56) | | |
|---|---|---|---|
| IQR | Median | IQR | P-Value |
| 68-114 | 96 | 69.5-122 | 0.898 |
| 119-172.5 | 108.5 | 88-127.5 | <0.001 |
| $162-624 | $1,393 | $1150-1393 | <0.001 |
| -$834.00 | | | NA |

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| e (n=26) | LAVH (n=34) | | |
|---|---|---|---|
| IQR | Median | IQR | P-Value |
| 68-114 | NA | NA | NA |
| 119-172.5 | 97.5 | 84-123 | <0.001 |
| $162-624 | $498 | $467-506 | 0.336 |
| $61.00 | | | NA |

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Figure 1. Basic Senhance Surgical System Components

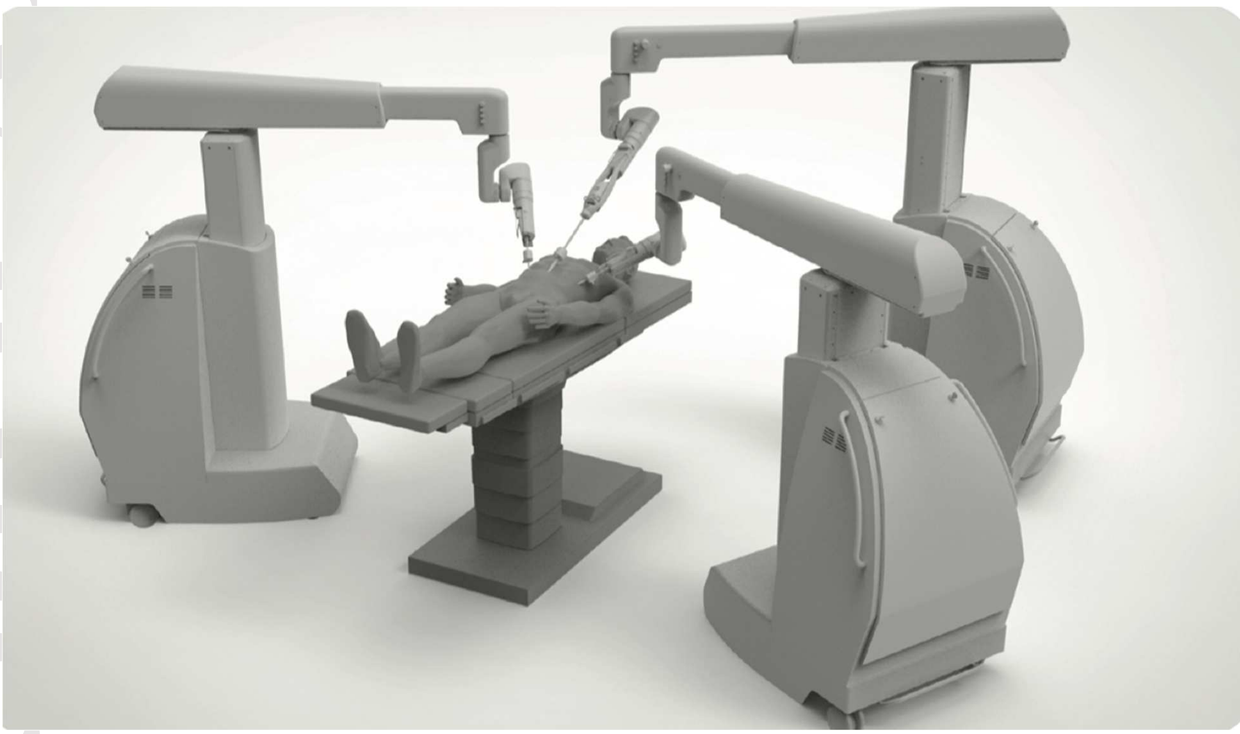

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**Figure 3. Recommended Senhance Gyn Port Placement**

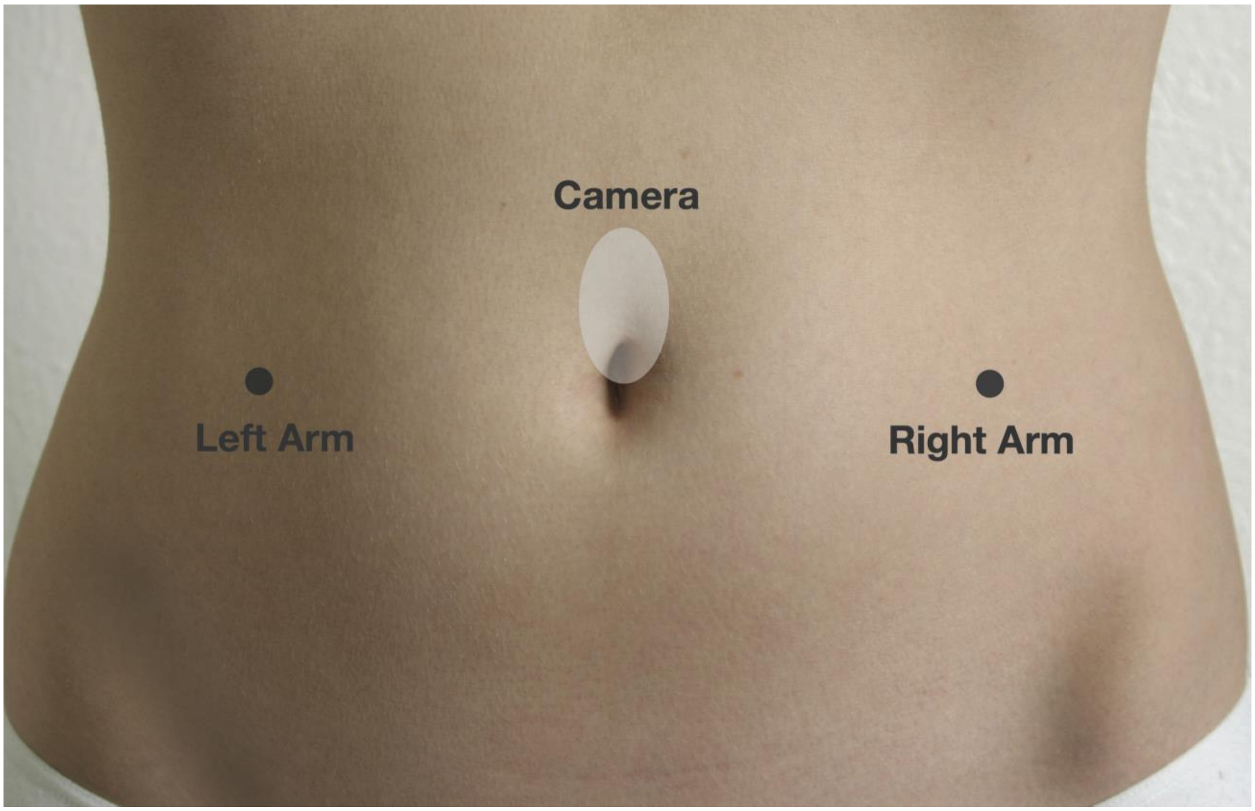

**Figure 2. Initial Senhance Room Set-Up**