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Impact of Surgical Experience on Hysterectomy Outcomes; A Venture to Improve the Linear Curve, Surgical Outcome, and Cost-Effectiveness: A Retrospective Study

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Abstract

Objectives: This study aimed to highlight the influence of surgical experience in performing the abdominal hysterectomy and improving the linear curve of skills.

Materials and Methods: This retrospective study was conducted on 245 women who underwent hysterectomy at Jordan University Hospital, Amman, Jordan, from January 2017 to 2019. The gravidity, parity, age, body mass index, the cause and type of the hysterectomy, duration of surgery, need to blood transfusion, estimated blood loss, time of hospital stay, intraoperative and postoperative complications, and the histopathology results were extracted from records of the participants and analyzed.

Results: This study showed that the leading cause of hysterectomy in participants was abnormal vaginal bleeding. The most common type of hysterectomy was simple abdominal hysterectomy with a mean operation time of 1 hour 12 minutes. In total, 25.6% of women received packaged red blood cells, the main cause of which was preoperative anemia (17.5%). These results reflect an improvement in the linear curve of learning surgical skills.

Conclusions: Our results portrayed the improvement of the surgical technique gained through performing abdominal hysterectomy expressively leading to a lessening in operative time compared with time while using a traditional technique, a decline in the total cost of surgery, and a decreased number in the surgical threads used in each operation. Surgical expertise can be appraised via many clinical parameters; mean operative time, complication rates, and other outcome measures. The expansion of surgical skills and the steadfastness of the medical team were a direct cause of these results.

Keywords: Abdominal hysterectomy, Operative time, Blood transfusion, Histopathology, Surgical skills

Introduction

The origin of the word "Hysterectomy" stems from two ancient Greek words: "hysteron" meaning uterus, and "Ectomy" which means resection from the human body (1). It is one of the most common major gynecological operations (2) and is being performed for several common benign gynecological conditions in more than 85% of cases (3). Mounting surgical training will truncate the learning curve, with less negative ramifications on patients during this passé. Interestingly, there are electrifying ingenuities in various departments of surgical training that will be valid crosswise all surgical castigations. These encompass the mishmash of moralizing monotonous workings coupled with talent training relevant to the same. These enterprises will aid in carrying the core point, from advancing surgical skills for a few individual surgeons to a more widespread approach in the advancement of surgical training, resulting in considerable health benefits to patients.

The value study by McPherson and co-workers suggested that 67% of surgeons still used the abdominal approach as the operation of choice (4). Since Reich and colleagues first reported it in 1989, laparoscopic-assisted vaginal hysterectomy has gained widespread acceptance (5), but the overall rate worldwide remains low (6,7). Abdominal hysterectomy allows the operator to handle any pelvic pathology with the advantage of the direct touch on the tissues. It provides the possibility of the direct three-dimension visualization of the surgical field. It also does not sanction the use of exceptionally classy instruments. It is the gridlock choice for the other applicable methods as the alternative methods could be changed to the abdominal one during the operation. Appropriate indications for hysterectomy endurance are still debated (8,9). Moreover, there is a real struggle in diagnosing some of the circumstances for which hysterectomy is commonly performed (10).

The objectives of this study were to focus on the effects of improved surgical skills for abdominal hysterectomy based on gained surgical experience. By experience,

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Key Messages

- Every surgeon will go through a path of learning obstacles while perfecting a surgical procedure. Depending on the procedure, surgical expertise can be judged by the total operative time, complications, and other outcomes. The improved techniques can be reflected and implemented for benign or malignant situations. The expansion of surgical skills and the steadfastness of the medical team was a direct cause of these results.

this approach sidesteps the potential damage to the nerve supply of the vesical neck and division of the uterosacral ligaments with the simultaneous division of the central neurovascular bundles contained within them by sidestepping reflection of the ureterovesical. It also minimizes the possibility of a postoperative vault or vaginal prolapse, shortening of the vagina, and the effect on the sexual life of the women by preserving the neurovascular supply at the cervicovaginal junction and the pubovesicocervical fascia (3). The dilemma regarding the ability to nominate surgical expertise is whether training hospitals can refine the trainee's surgical skills in mastering a new surgical procedure and, if yes, how?' Nevertheless, each operation can be practiced by many methods, but the best approach is the one mastered by the surgeon himself.

Surgical Technique

After induction of general anesthesia and intubation, the abdominal hysterectomy begins with properly positioning the patient in a dorsal position. Catheterization of the bladder is done, and the catheter is connected to a continuous drainage system. The patient is examined under anesthesia with particular attention to the size of the uterus, contour, and width; uterine mobility; cervical size and location; ovarian size; and any evidence of masses or signs of adhesions. The preceding guides as to the type and size of the skin incision. Subsequently, a single dose of intravenous antibiotic is routinely given. The ' 'patient's abdomen and upper thighs are prepared with povidone-iodine and then draped. A laparotomy incision is made based on the plan procedure, patient body habitus, and any presence of previous surgical scar. Once the laparotomy is accomplished, peritoneal fluid or washing for cytology is obtained if warranted, followed by an examination of the abdominal cavity systemically. The bowel is gently packed cephalad with three moistened laparotomy sponges. A self-retaining retractor with blades of an appropriate length is applied with due care to avoid iatrogenic nerve injury. The pelvic anatomy is examined.

Restoration of normal anatomy is achieved with adhesiolysis, if necessary. The uterus is grasped at each cornua with a long curved Kocher clamp and elevated toward the incision. The clamp must incorporate the cornua, round ligament, and fallopian tube. The uterus is shifted to the patient's left side; then, a vicryl one suture is placed directly below the round ligament through the mesosalpinx approximately 3-4 cm from the cornua, then another suture is applied laterally 2 cm away from the first one. Electrocautery is used to desiccate and transect the round ligament between the two stitches. The suture is tagged and laced laterally over the retractor, thereby holding the peritoneum opens laterally. The posterior leaflet of the broad ligament is opened down to the level of bifurcation of the common iliac artery. Then a narrow deaver was applied, moving the ligament in a craniocaudal fashion to identify the ureter. A vessel loop is used to keep the ureter visible throughout the procedure. The anterior leaflet of the broad ligament is opened inferiorly to the level of the uterine vessel and then medially along the vesicouterine peritoneal fold separating the bladder peritoneum from the lower uterine segment preparation for bladder flap development. Once the ureter is identified, either the infundibulopelvic ligament or the utero-ovarian ligament is clamped and transected, depending on whether a salpingo-oophorectomy is planned or otherwise. When an oophorectomy is designed, a defect is created in the broad posterior ligament inferior to the ovary with the ureter insight. This defect is extended toward the infundibulopelvic ligament.

Typically, two clamps are passed from lateral to medial through this defect lateral to the ovary, thus ensuring that the entire ovary is included in the surgical specimen. Two Robert clamps are applied, and then electrocautery is dissection done. A free tie of No. 1 polyglycine is then used to tightly secure both the area behind and the proximal clamp and the most distal on if an ovary-sparing procedure is planned, a defect is created in the broad posterior ligament lateral to the uterus and inferior to the utero-ovarian ligament. Two Robert clamps have applied this defect, and the corneal clamp is advanced to prevent back-bleeding. The utero-ovarian ligament is then ligated with a free tie of No. 1 polyglycine. The uterus is elevated cephalad, and the bladder dissection is performed. The vesicouterine peritoneum is elevated, and sharp dissection is performed with tips of the scissors pointing toward the uterus. An avascular plane exists between the lower uterine segment and bladder, which allows for its mobilization. With caution, the bladder is taken down past the cervix via blunt dissection with a wet abdominal sponge.

The uterine vessels are then skeletonized, removing excess tissue so that the ureter drops even further and so that the pedicle contains only vascular structures. The excess connective tissue is picked up with forceps and separated from the vascular systems using sharp dissection or electrocautery; a heavy Kocher clamp is placed parallel to the lower uterine segment and cervix, transecting the pedicle with a scalpel to cut the tissues medial to the clamp, suturing the pedicle with Vicryl No. 1 stitch. Additional clamps are placed on each side, with each clamp placed medial to the previous pedicle, close to the cervix, thus

further avoiding the ureter. These bites incorporate the cardinal ligaments and uterosacral ligaments. A series of pedicles may be required depending on uterine size. Care must be taken to slide off the uterine corpus and cervix with each bite. As one progresses, it is always vital check to ensure that the bladder has been dissected sufficiently and the rectum is not closed. Once external cervical os location is confirmed via palpation, the cervix is pushed up with fingers from the backside. The vaginal lumen is opened by scalpel sliding from upwards, being held with 4 Kocher's, one in each direction, with the cutting being close to the cervix. The surgical specimen is checked to ascertain that the entire cervix has been removed. The specimen and the scissors are passed off the table and considered contaminated.

For closure of the vaginal cuff, typically, the last usually used attached stitch thread from the corner of one side with continuous locking and running sutures to approximate the anterior and posterior cuff sides, ensuring that there are no spaces between bites, and the suture is tied with the short end of the other corner. Another continuous closure layer starts from the other corner side to assure proper secure closure and is tied with the other suture end. The cuff is inspected for hemostasis, and additional sutures are placed if necessary. Both ureters are inspected for their peristaltic movements to assure the proper function and confirm our procedure's safety. The operative pedicles are observed; once hemostasis is assured, the retractor and laparotomy sponges are removed, and the incision is closed in layers by the routine fashion.

Materials and Methods

In this retrospective study, the records of women underwent an abdominal hysterectomy in Jordan University hospital, Amman, Jordan by the one surgeon from January 2017 to January 2019 were reviewed.

All women underwent vaginal hysterectomy and had another surgical procedure at the time of hysterectomy were excluded.

An entire detailed history was taken after reviewing the indication of hysterectomy and its circumstances, stressing the necessary work performed before surgery, mainly the endometrial biopsy result. All women admitted to Jordan University hospital underwent complete physical examination, followed by proper workup including complete blood count, kidney function test, chest X-ray, tumor marker CA-125, and cardiac, respiratory, and anesthetic evaluation. Information about each participant including; gravidity, parity, age, weight, body mass index, indication for hysterectomy, approach and type of the hysterectomy performed, duration of surgery, need to blood transfusion, estimated blood loss, duration of hospital stay, intraoperative and postoperative complications, and the histopathology results was collected.

Statistical Analysis

The data were collected from women's medical files and filled in a designed datasheet. Statistical Package for the Social Sciences (SPSS) software version 25 was used for statistical analyses.

Results

A total of 245 hysterectomy cases carried out during the period of the study were analyzed for: indications, type of hysterectomy performed, duration of surgery, need to blood transfusion, duration of hospital stays, and factors affecting the operative time, including the surgical technique. The mean age of women undergoing hysterectomy was 50.1 ± 8.8 years. The mean body mass index of women was 30.1 ± 1 6.5 kg/m^2, as illustrated in Table 1. The most common indication for hysterectomy was abnormal vaginal bleeding, followed by malignancy. In comparison, the least common indications were adenomyosis and pelvic organ prolapse, while the most common type of surgery performed was simple extra fascial total abdominal hysterectomy without salpingo-oophorectomy, followed by radical hysterectomies, but modified radical hysterectomy was performed the least, while simple extra fascial abdominal hysterectomy with both ovaries and fallopian tubes or pelvic lymphadenectomy or both was performed on the rest of the participants (Table 2). For the duration of surgery according to indication and type of hysterectomy, it was found that the minimum time consumed was 30 minutes, mainly being a simple hysterectomy case, longest

Table 1. Demographic Characteristics of Study Participants by Year

Variables	2017 (n=68)	2018 (n=85)	2019 (n=92)
Age (y)	51.47 ± 9.48	49.09 ± 9.20	50.10 ± 7.85
Weight (kg)	76.95 ± 17	77.28 ±15.1	78.82 ± 15.9
Height (cm)	161.10 ± 7	160.16 ± 7	161.38 ± 5
Body mass index (kg/m^2)	29.69 ± 6.3	30.33 ± 7.3	30.30 ± 5.1
Gravidity	5.60 ± 4.3	5.52 ± 3.1	5.25 ± 2.8
Parity	4.5 ± 2.9	4.5 ± 2.6	4.1 ± 2.1
Abortion	0.9 ± 2.1	0.9 ± 1.3	1.09 ± 1.8

Data presented as mean ± standard deviation (SD).

time required was 2:30 hours which was in a morbid adherent placenta case, the average time of surgery for all cases was 1.12 hours (Table 3), which revealed also the presence of a significant difference in the operative time needed according to the indication of hysterectomy. There was also a significant difference in the duration of surgery consumed according to the type of hysterectomy performed. Radical hysterectomy was reported the longest, followed by modified radical hysterectomy. A total of 63 women (25.6%) received packed red blood cells. The main indication was preoperative anemia, followed by intraoperative bleeding and low postoperative hemoglobin respectively (Table 4). The most frequent histopathological finding was benign etiologies, followed by endometrial cancer, then by ovarian and cervical cancers respectively (Table 5). In so far as postoperative complications, 87.3% of all cases had no postoperative complication. In contrast, the most common postoperative complication was wound infection, followed by incisional hernia. Fever and venous thrombus embolism were the third and fourth common complications respectively as illustrated in Table 6.

Discussion

This study focused on abdominal hysterectomy cases performed using the gained surgical skills to the well-known traditional one. In our study, the mean age of participants undergoing hysterectomy was 50.1 ± 1 8.8 years. Hysterectomy was most commonly performed for abnormal vaginal bleeding (44.5%) followed by malignancy (22%), and hysterectomies were performed for fibroids in 14.3% of cases. Aarts et al (11) found that hysterectomy for benign gynecological disease, mostly abnormal uterine bleeding, prolapse, or fibroids, is one of the most frequent gynecological procedures (30% of women by the age of 60-year-old). Neis and colleagues (12) found that hysterectomies were performed to treat uterine fibroids. Garry et al (13) stated that the main indications for hysterectomy were dysfunctional uterine

Table 2. Indications/ Types of Hysterectomy by Year

Indication n (%)	2017 (n=78)	2018 (n=85)	2019 (n= 82)
Abnormal vaginal bleeding	37 (47.4%)	41 (48.2%)	41 (50%)
Fibroids	12 (15.4%)	11 (12.9%)	12 (14.6%)
Malignancy	15 (19.3%)	18 (21.2%)	21 (22.8%)
Abdominal pain	5 (6.4%)	0 (0%)	4 (4.8%)
Postmenopausal bleeding	2 (2.5%)	5 (5.8%)	3 (3.6%
Adenomyosis	0 (0%)	1 (1.1%)	2 (2.4%)
Prolapse	2 (2.5%)	1 (1.1%)	1 (1.2%)
Morbidly adherent placenta	5 (6.4%)	8 (9.4%)	8 (9.7%)
Type of hysterectomy			
Simple	40 (51.2%)	49 (57.6%)	51 (62.2%)
Radical	14 (17.9%)	18 (21.2%)	13 (15.8%)
Modified radical	2 (2.5%)	2 (2.3%)	0 (0.0%)
Simple with Bilateral salpingo-oophorectomy	12 (15.3%)	6 (7.0%)	13 (15.8%)
Simple with pelvic lymphadenectomy	2 (2.5%)	5 (5.8%)	1 (1.2%)
Simple with bilateral salpingo-oophorectomy + pelvic lymphadenectomy	8 (10.2%)	5 (5.8%)	4 (4.8%)

Table 3. Duration of Surgery According to Indication and Type of Hysterectomy

Variables	Number	Mean ±SD	Minimum	Maximum
Indication				
Mean time of Abnormal vaginal bleeding (h:min)	109	1:02 ± 0:12	0:45	1:30
Fibroids	35	1:13 ± 0:17	0:50	2:00
Malignancy	54	1:27 ± 0:18	1:00	2:00
Abdominal pain	9	1:05 ± 0:15	0:45	1:30
Postmenopausal bleeding	10	1:03 ± 0:16	0:45	1:30
Adenomyosis	3	1:20 ± 0:17	1:00	1:30
Prolapse	4	1:03 ± 0:30	0:30	1:45
Morbidly adherent placenta	21	1:35 ± 0:28	1:00	2:30
Hysterectomy Type				
Simple	130	1:07 ± 0:19	0:30	2:30
Radical	59	1:26 ± 0:20	1:00	2:00
Modified	4	1:23 ± 0:13	1:10	1:40
Simple with Bilateral salpingo-oophorectomy	31	1:09 ± 0:15	0:50	1:50
Simple with pelvic lymphadenectomy	8	1:03 ± 0:13	0:45	1:30
Simple with bilateral salpingo-oophorectomy + pelvic lymphadenectomy	13	1:15 ± 0:22	0:45	2:00

Table 4. Blood Transfusion and Its Indication in Hysterectomy Cases by Year

Indication/Year	2017	2018	2019	Total
Pre-operative anemia	6 (8.8%)	15 (17.7)	22 (23.9%)	43 (17.5%)
Intraoperative	2 (2.9%)	3 (3.5%)	1 (1.1%)	6 (2.4%)
Postoperative	8 (11.8%)	2 (2.4%)	4 (4.3%)	14 (5.7%)

Table 5. Histopathology Results for Hysterectomy Cases by Year

Indication/Year	2017	2018	2019	Total
Benign	47 (69.1%)	65 (76.5%)	70 (76.1%)	182 (74.3%)
Endometrial cancer	12 (17.6%)	11 (12.9%)	8 (8.7%)	31 (12.7%)
Ovarian cancer	2 (2.9%)	5 (5.9%)	8 (8.7%)	15 (6.1%)
Cervical cancer	2 (2.5%)	2 (2.5%)	2 (2.5%)	6 (2.5%)
Others	5 (7.4%)	2 (2.5%)	4 (4.3%)	11 (4.5%)

Table 6. Post-operative Complications Required Admission by Year

Complications/Year	2017	2018	2019	Total
None	58 (85.5%)	75 (88.2%)	81 (88%)	214 (87.3%)
Wound Infection	3 (4.4%)	3 (3.5%)	6 (6.5%)	12 (4.9%)
Venous thrombus embolism	1 (1.5%)	0 (0%)	2 (2.2%)	3 (1.2%)
Bleeding	1 (1.5%)	0 (0%)	0 (0%)	1 (0.4%)
Fever	1 (1.5%)	2 (2.5%)	2 (2.5%)	5 (2%)
Incisional hernia	4 (5.9%)	3 (3.5%)	0 (0%)	7 (2.9%)
Others	0 (0%)	2 (2.5%)	1 (1.2%)	3 (1.2%)

bleeding (63%), fibroids (17%), pelvic pain (11%), endometriosis (9%), and failed ablation (8%). In our study, the most common type of surgery performed was simple total abdominal hysterectomy without salpingo-oophorectomy (53.1%) followed by radical hysterectomy (24.1%). Modified radical hysterectomy was performed for only four cases (1.6%), the least performed type. Simple abdominal hysterectomy with bilateral salpingo-oophorectomy or pelvic lymphadenectomy or both were performed on the rest of the patients.

Data analysis in this study revealed that the minimum time disbursed was 30 minutes which was mainly in simple hysterectomy cases, and the maximum time requisite was 2:30 hours which was in morbidly adherent placenta cases, the average duration of surgery for all cases was 1.12 hours, and the median was 1 hour. Muzii and colleagues (14) found that the median operative time for abdominal hysterectomy cases was 58 minutes with a range of 45 to 75 minutes, while Falcone and colleagues (15) reported a median operative duration of 130 minutes with a range of 97 to 155 minutes. On one hand, Persson et al (16) documented a median operative time of 64 min with a range of 35 to 150 minutes; on the other hand, Yuen and colleagues (17) documented a median operative time of 105 minutes with a range of 86 to 120 minutes. Another study found a median operative time of 132 minutes with a range of 121 to 145 minutes. There was a noteworthy difference in the operative time used up according to the indication of hysterectomy (18). In our study, the mean operative time in morbidly adherent placenta cases was 1:35 hours, with the maximum time needed 2:30 hours. Malignancy cases were the second in time consumption as the mean operative time consumed was 1:27 hours.

The indications with the least needed time were abnormal vaginal bleeding and pelvic organ prolapse with a mean operative time of 1:02, 1:03 hours respectively. The mean operative time for other indications ranged from 1:05 hours in abdominal pain to 1:20 hours in adenomyosis cases. Ferrari and others (19) found that the median operative time for abdominal hysterectomy cases implemented to treat uterine fibroids was 2 hours with a range of 98 to 123 minutes, while in our study, the median operative time for fibroid cases was 1 hour, mean of 1.13 hours with a range of 50 to 120 minutes. This adapted approach of abdominal hysterectomy applied on our cases reduced the operative time compared to hysterectomies performed with the traditional approach. The number of surgical threads used was less by at least two threads for each case. There was also a significant difference in the total duration consumed according to the type of hysterectomy performed. Radical hysterectomy needed the longest time with an average duration of surgery of 1:26 hours, followed by modified radical hysterectomy with an average duration of surgery of 1:23 hours. For the other types of hysterectomy performed, the mean operative time ranged from 1:07 hours in simple total abdominal hysterectomy to 1:15 hours in simple total abdominal hysterectomy with pelvic lymphadenectomy and bilateral salpingo-oophorectomy cases. Herling and colleagues found that the mean operative time for total abdominal hysterectomy

with bilateral salpingo-oophorectomy was 91 minutes; it was 114 minutes for total abdominal hysterectomy with bilateral salpingo-oophorectomy, omentectomy, and pelvic lymphadenectomy (20). In our study, a total of 63 patients (25.6%) received packed red blood cells; the main indication was preoperative anemia (17.5%) followed by intra and low postoperative hemoglobin in 2.4%, 5,7%, respectively. While Ng reported the transfusion rate was 4.7% intra-operatively (21), but Zitsman and colleagues (22) reported the transfusion rate was 13.3% in the abdominal hysterectomies due to benign disorders.

The most frequent histopathological finding in this study was benign etiologies in 182 participants (74.3%), followed by endometrial cancer in 31 women (12.7%), then by ovarian and cervical cancers in 15 (6.1%) and 6 (2.4%) women, respectively. Ottosen et al (23) showed that 7.5% of abdominal hysterectomy cases had malignancy on histopathology results. In comparison, 52.5% turned out to be fibroids, 20% adenomyosis, and 7.5% normal findings, which are in line with our findings. Qatawneh et al reported a benign etiology in 77% of their participants (24). Acquisition of surgical skills has become an important necessity due to the steadily increasing number of physicians, but not in parallel with the number of patients. Nevertheless, a thorough discussion of the surgical approach regarding benefits and risks should be made. The surgical expertise may influence the decision of the surgical procedure, and the associated benefits and risks may be appraised (25). Ideally, the surgical route for hysterectomy should be a joint decision after a comprehensive discussion between the woman and her surgeon. Surgeons must have a different set of skills and capabilities from that of open surgery, which is the backbone and suitable for any this operation regardless of the indication (26), the surgeon must take into account the clinical factors for each patient, their surgical experience and skills and accordingly settle on the route of choice for a hysterectomy that will most safely facilitate the removal of the uterus and optimize patient outcome (27).

Limitations of the Study

Some women did not adhere to the follow up scheduled appointments as advised, which made it difficult to tract their postoperative status and complications as they may have presented to other clinics or other sub-specialties. As for the staff in the surgical team, Jordan University Hospital is a teaching hospital, so the surgical team with the first author had to be changed multiple times during the research period presenting the challenge to guide and teach a new surgical team every few months.

Conclusions

Recruitment of acquired surgical skills in performing abdominal hysterectomy was expressively concomitant with lessening operative time, equating the time inspired using the traditional slant, as well as reducing the total cost of surgery through the decrease in the number of surgical threads used in each operation by at least two threads coupled with shortening hospital stay.

As evident by comparing intraoperative and postoperative parameters between 2017, 2018, and 2019, surgical skills help improve the outcome of surgery. Thus, increasing the learning curve in teaching hospitals will help patients and be implemented for benign or malignant situations, particularly with the stability of the medical team. Interestingly, the effect of the acquired skills grew by practice and proved to be preferential over previous years.

Authors' Contribution

All authors have the same contribution in the design of the manuscript, reviewing the literature, collecting the data, data analysis, editing, and submitting this manuscript. All authors approved the final manuscript and take responsibility for the integrity of the data.

Conflict of Interests

Authors declare that they have no conflict of interests.

Ethical Issues

The study proposal was approved by the Ethics Committee, the Scientific Research Committee (SRC), and the Institutional Review Board (IRB) of the Jordan University hospital, University of Jordan, School of Medicine, Amman, Jordan (Ref. 662/2020/2021/13/67).

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