# Hysterectomy in Morbidly Obese Women: A Retrospective Comparative Analysis of Routes Vaginal Versus Abdominal in Benha University Hospital

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## Abstract

**Objective:** To compare perioperative surgical, medical, and financial outcomes in morbidly obese women who underwent non-descent vaginal hysterectomy (NDVH) compared to total abdominal hysterectomy (TAH) for non-prolapse indications. **Patients and methods:** A retrospective analysis included 117 women who underwent hysterectomies performed between January 2015 and March 2023 in Benha University Hospital. The NDVH group included 55 women. The TAH group included 62 women. **Results:** Both NDVH and TAH groups participants had statistically indifferent pre-operative mean hemoglobin levels, age, parity, associated comorbidities, previous pelvic and abdominal surgery involving cesarean sections, and comparable indications for hysterectomy($p>0.05$), but statistically higher BMI, HBA1c preoperative serum level, and shorter preoperative hospital admission (days), all these items favoring the superiority NDVH group over the TAH group($p=0.0001$). There were no statistical differences between groups as regrades operative room time, operative blood loss, intra-operative complications, removed uterine weight in grams, and the need for blood transfusion ($p>0.05$). While there were high statistical differences ($p<0.0001$) favoring outcomes of NDVH over TAH including the need for general anesthesia, wound complications percentage (1% vs 72%), shorter postoperative hospital stays, less consumption of analgesic and shorter duration needs for postoperative venous thromboembolic prophylaxis, earlier ambulation, earlier to pass flatus. Approximate charges of both procedures were encouraging the NDVH over TAH ($p<0.0001$). **Conclusion:** In morbidly obese women with non-prolapsed uteri, the NDVH should be the primary route for hysterectomy, as the NDVH results is better than the TAH results in all perioperative outcomes items.

**Keywords:** non-descent vaginal hysterectomy; vaginal hysterectomy; morbidly obese; total abdominal hysterectomy; retrospective study

# Introduction:

Morbid obesity defined as Body Mass Index (BMI) $\geq 40kg/m^2$ is an increasing healthcare problem in the USA as well as worldwide (1,2,3). Centers for Disease Control and Prevention reported that the actual number may be underrated (3). Present estimations propose that 48.9% of the US population will be obese by 2030 and one in four adults will be severely obese (7.7% in 2013-2014 to 24.2% by 2030) (4,5). In Canada, recent guidelines of the Society of Obstetrics and Gynecology of Canada (SOGC) regarding hysterectomy in obese women reported that one in five women are obese (6), while the magnitude of the obesity problem is indeterminate in Egypt, despite that there was a declaration at a political level to be a significant economic problem.

Simultaneous with the rise in worldwide obesity rates, the number of women who underwent hysterectomy rises, reported in the USA to be 600 000 annually (1,7,8). The rate of hysterectomies in Egypt is unknown, however, it is generally higher than expected, secondary to messy unregulated health policies. In Egypt, many surgical specialties could operate hysterectomies even in governmental health institutes, not merely obstetric and gynecologic generalists rather than expert vaginal gynecologists.

In the United States, 66% of hysterectomies are executed abdominally, and 22% are executed vaginally (7), while in Egypt there is underutilization of the vaginal route and nearly gynecologic surgeon in charge deliberated morbid obesity as a contraindication for vaginal hysterectomies and only a few gynecologists nationwide who practiced non-descent vaginal hysterectomy as a trial based routine gynecologic practice (10-13).

The vaginal route for hysterectomy is excellent to other procedures of hysterectomy in terms of patient's safety, security, economics, cosmesis, perioperative morbidity and supported over other routes by policy statements from the American College of Obstetricians and Gynecologists (ACOG), the American Association of Gynecologic Laparoscopists (AAGL), SOGC and International Society for Gynecologic Endoscopy (ISGE)(6,8,14-16) as well as the medical literature (17-22).

Non-Descent Vaginal Hysterectomy (NDVH) in the morbidly obese woman is complexed by redundant vaginal tissue especially in parous obese patients rather than nulliparous obese patients, prominent buttocks, and lack of descent. To overcome such problems in morbidly obese women undergoing NDVH, gynecologic surgeon should be patient, confident, knowing how to implement available multiple techniques for peritoneal access, has the accessibility to execute the NDVH procedures with aids of new tools for vessel sealing, vaginal surgery visualization instruments and patients should be in a position for optimal visualization, (17-27).

Morbid obesity is falsely perceived as a contraindication to NDVH. TVH was the procedure of choice by Heaney and Bonney in generalas well as in obese women. Some gynecologists go so far as to say there is no absolute contraindication to vaginal hysterectomy includes large sizes and positional limits, The FIGO prior president states that once gynecologic surgeon could visualize cervix vaginally, he should trial hysterectomy vaginally (17-27).

Morbidly obese women are associated with an elevated risk of death and general morbid conditions (1-8).
A specific adverse effect after gynecologic surgery, such as surgical site infection, venous thromboembolism, and wound complications, are more frequent in obese

women than in normal-weight women (8,9,28-43). Preoperative consultation with an anesthesiologist should be considered for obese patient in whom the possibility of obstructive sleep apnea is suspected on clinical grounds or who is at risk of coronary artery disease, has a difficult airway, or has poorly controlled hypertension (1,6,7,8). Gynecologic surgeons should know how to support obese women on the threats specific to this group (6,7). As with all patients, evidence demonstrates that, in general, vaginal hysterectomy is associated with better outcomes and fewer complications than laparoscopic or abdominal hysterectomy (9,28-43). Postoperative care of the obese patient is like postoperative care of a normal-weight patient and comorbid conditions should be taken into consideration (28-43). In obese women, the incidence of wound complications including poor healing, dehiscence either partial or total, and infections after open surgery were significantly increased (35-43). Wound complications have been one of the major anxieties in obese women who undergo abdominal hysterectomy as well (30-35,39). Because vaginal hysterectomy by default abolishes the need for abdominal wounds, and sequentially wound complications, entirely, it is intuitive to suggest that the vaginal approach may be more favorable for obese women (17-27).

Our intentions were to measure perioperative outcomes of TAH and NDVH in morbidly obese women in Benha University hospitals, to add evidence to what is already known in literature about the superiority of the vaginal route for hysterectomy and to convince Egyptian gynecologic surgeon to follow recommendations by gynecological societies, namely ACOG, AAGL, SOGC, SGS, RCOG and ISGE.

# Patients and Methods:

A retrospective analysis included 117 women who underwent hysterectomies performed between January 2015 and March 2023 in Benha University Hospital. The NDVH group included 55 women. The TAH group included 62 women.

This is a retrospective study in which, all available of charts morbid obese women with BMI $\geq$ 40 kg/m$^2$ who underwent either TAH or NDVH between January 2015 and March 2023 at the Obstetrics and Gynecology Department of Benha University Hospital, Benha, Egypt were examined and relevant data were extracted and tabulated. Ethical approval was granted from the Benha Faculty of Medicine ethical committee (NO: 39.5.2023). Written consent from participants was unneeded according to the default nature of the retrospective study. All NDVH cases were operated by the first author, while TAH cases were operated by experienced gynecologists. Women were included if their BMI was$\geq$40 kg/m$^2$, underwent hysterectomy for benign uterine diseases, the procedure was performed either vaginally or abdominally, anesthetized either generally or spinally, older than 18 years and their clinical follow-up data until completely cured or$\geq$ 30 days postoperatively were available as well as their uteri weren't prolapsed $\geq$ second-degree uterine descent even under anesthesia. We excluded women if they had one of the following criteria :(1) women with suspected malignancy, (2) women found to be second-degree uterine decent or more after execution of the anesthesia, (3) women in whom a major surgical intervention other than hysterectomy was performed, (4) cases with incomplete medical records or who failed to be followed for 30 days postoperatively.Pre-operative collected parameters included age, BMI, comorbid conditions such as

diabetes mellitus, hypertensive disorders, liver diseases, renal disorders, orthopedics problems, airway obstructive disorders, indications for hysterectomy, parity, hemoglobin concentration (CBC), previous abdominal or vaginal surgery and length of preoperative hospital entrance(LOPA) to control the comorbid status as uncontrolled diabetes mellitus (LOPA) as well as percentage of glycated hemoglobin A1C (HBA1C).

Intra-operative collected data were the type of surgical methods either conventional suturing or vessel sealing-based procedures as well as additional actions such as bilateral oophorectomy BS, bilateral salpingo-oophorectomy BSO, cystectomy, added techniques like morcellation as in NDVH, operative time, type of anesthesia either general or spinal, estimated blood loss (EBL), Intra-operative complications included major blood vessel or organ injury (including bowel, bladder, and ureter) and need for blood transfusion.

Post-operative collected data were length of inpatient stay(LOS), hemoglobin concentration(CBC), hospital readmission; return to theatre; vault or pelvic vault hematoma, vault dehiscence, vault abscess, vault cellulitis, abdominal wound status in the TAH group including seroma collection, cellulitis, wound dehiscence, need to reoperate on wound sequels, length of wound care, pelvic infection, urinary tract infection, thromboembolic disease prophylaxis needs and duration of consumption as well as other medical status deterioration. The collected data of all included women in this analysis were summarized and anonymized.

We categorized total expenses, according to nearby private centers prices in deeming expenses estimation at time of writing this manuscript, into three divides: admission expense, anesthesia charge, and operation cost. Admission expenses included ward

fee, pre-and postoperative administration expenses, and extra fees for postsurgical troubles. Anesthesia cost only involved prices of anesthetic drugs during procedure. Operation charge included operative material prices but omitted elective practice fees as private fees and governmental salaries.

Outcome measures were: 1) Operative time(OT),2) EBL, 3) Decline in hemoglobin($\Delta$HB) value (the alteration between preoperative and postoperative, 4) Operative complications as blood transfusion, conversion in case of NDVH or relaparotomy in TAH, bowel or visceral injuries, 5) Early postoperative follow up including (a) postoperative pain either no pain, mild pain, moderate pain, severe pain, and very severe pain, (b)length of hospital stay(LOS), (c) Febrile morbidity (body temperatures $> 38C°$ in two consecutive measurements $> 4$ hours apart), (d) requisite for analgesia, (e) time to pass stool or gas from end of the procedures, f) time to get out of bed activity (hours),7) remote postoperative follow up includes recuperation time and postoperative vaginal length, 8) approximate total expenses of both procedures.

Statistical analysis was executed by Medcalc easy-to-use statistical software for Windows desktop (www. medcalc.org) 2016. Continuous variables were given as mean $\pm$ 2 standard deviations and range, independent samples student's t-test was used to compare continuous variables. Categorical variables were given as numbers and percentages and were assisted using either Fisher's exact test or Pearson's Chi-square test as analysis methods to identify differences between the NDVH and TAH groups. Statistical significance was deemed if p was<0.05.

## Results:

In this retrospective analysis, 55 women were undergoing NDVH while 62 women underwent

TAH between January 2015 and March 2023 in Benha University hospitals.

In table (1) the clinical and demographic characteristics of morbidly obese women were exhibited. women in both groups were parallel about age, parity, clinical uterine extent (weeks), ultrasound uterine volume (Cm$^3$), nonexistent prior vaginal birth, postoperative uterine weightiness (grams), preoperative hemoglobin (gm/dl), the linked preoperative medical comorbidities as well as the cause for hysterectomy. Table (1) also shows significant difference regarding the BMI (kg/m$^2$) (p<0.0001), higher percent of women with uncontrolled diabetes mellitus (DM) (p<0.0001) in the NDVH group, briefer LOPA to control the medical comorbidities (p<0.0001) in the NDVH group and higher HBA1C% (p<0.0001) in the NDVH group. All these parameters supported the preeminence of NDVH over the TAH, as women with greater BMI and with higher preoperative HBA1C (an indicator for uncontrolled diabetes mellitus) were operated vaginally and also admitted for briefer preoperative period as there were no expected abdominal wound so no requirement to wait for lowering HBA1C which takes very longer preoperative admission in TAH group.

Table (2) shows no significant differences between groups regarding total OT, EBL, intraoperative complications including visceral injuries, blood transfusion, conversion to laparotomy. In the NDVH group there was one case due to inability to access the vesico-uterine pouch secondary to large solitary uterine leiomyoma. There were significant differences between groups regarding the percent of women who underwent conventional suturing were more in the TAH group (p<0.0006) while women who underwent vessel sealing were more in the NDVH group. This could be attributed to the adoption of the concept of energy-based surgery earlier in TVH and this is well known in gynecological practice.
 As regards type of anesthesia, there was more general anesthesia in the TAH group (p<0.0001) while most NDVH were

significantly competed under initial spinal anesthesia (p=0.0001). In all cases of the NDVH group morcellations techniques were applied while in the TAH group, such procedures were very infrequent (p<0.0001). In the NDVH group more women significantly underwent BS (p<0.0001), while in the TAH group, significantly excess women underwent BSO(p<0.0001), all these differences could be attributed to differences in mindsets of vaginally motivated gynecologist whom always challenging themselves. Incidentally, the percent of women with postoperative uterine weight less than 100 grams was more in the NDVH group (p=0.03). This could be explained on basis of electing for definitive treatment by NDVH operator once the patient choice it. Approximate expenses of admission, anesthetic drugs, operative materials were significantly lesser in the NDVH group (p<0.0001)

The early and late postoperative outcomes data in this retrospective analysis were displayed in table 3. The percent of women in the NDVH group that showed a severe pain status at 6h and 24 h postoperative was significantly lesser (p < 0.0001) while the consumption of analgesia both narcotic and NSAID was significantly lower  (p = 0.0002 and p < 0.0001 respectively) in the NDVH group. The decline in 24-hour hemoglobin was not significant between both groups (p= 0.6). Also, no significant differences between groups regarding febrile morbidity, vaginal spotting, pelvic cellulitis, and cystitis (p>0.5). While there were significant differences between NDVH and TAH groups regarding the time to move out of bed (p<0.0001), time to outflow flatus (p<0.0001), LOS (p<0.0001), resuming usual activity time (p<0.0001), wound complications(p<0.0001), reoperation for the wound (p=0.003), requirement for venous thromboembolism (VTE) prophylaxis (p<0.0001) and time of VTE prophylaxis (p<0.0001) which were superior in the NDVH group.

**Table (1):** Demographic and clinical characteristics of morbidly obese women with BMI ≥40kg/m2 underwent NDVH and TAH.

| Variable | NDVH (no =55) | TAH (no = 62) | Δ (95% CI) | P value |
|---|---|---|---|---|
| - Age (year) | 49.6 ±5.2 (41 – 62) | 49.8 ± 4.8 (40 – 65) | 0.2 (-1.63 to 2.03) | 0.8 |
| - Parity | 2.4± 1.5 (0 - 5) | 2.5± 1.6(0 – 6) | 0.1 (-0.47 to 0.67) | 0.7 |
| - BMI (kg/m2) | 51.6 ± 4.6 (41.5 – 60.5) | 46.3 ± 5.8 (40.5 – 58.6) | -5.3 (-7.23 to -3.36) | 0.0001 |
| - Clinical uterine size (weeks) | 11.3 ± 3.1 (6 – 20) | 11.6 ± 2.8 (6 – 20) | 0.3 (-0.78 to 1.38) | 0.5 |
| - Ultrasound uterine volume Cm$^3$ | 145 ± 66 (55 – 700) | 155 ± 87 (60 – 900) | 10 (-18,56 to 38.56) | 0.4 |
| -Absent of previous vaginal birth | 10(18%) | 12(19%) | 1% (-13.4% to 14.9%) | 0.8 |
| -preoperative HB (g/dl) | 12.1±1.1(10.5-13.5) | 11.9±0.9(10.8-12.9) | -2 (-0.56 to 0.16) | 0.2 |
| **- Previous pelvic surgery:** | | | | |
| - Cesarean section | 18 (32%) | 22(35%) | 3% (-13.9% to 19.4%) | 0.7 |
| - other | 8 (14%) | 12(19%) | 5% (-8.9% to 18.3%) | 0.4 |
| -virgin lower abdomen | 31(56%) | 32(51%) | 5% (-12.7% to 22.2%) | 0.6 |
| **- Comorbidity:** | | | | |
| - HTN | 46(83%) | 54(87%) | 4% (-9.1% to 17.5%) | 0.5 |
| - DM | 49(89%) | 52(83%) | 6% (-7.1% to 18.6%) | 0.3 |
| - uncontrolled DM | 45(81%) | 49(79%) | 2% (-12.7% to 16.2%) | 0.7 |
| -PHBA1C (%) | 14.1±3.5(5.1%-18.4%) | 10.3±4.6(4.9%-17.8%) | -3.69 (-5.2 to 2.1) | 0.0001 |
| -LOPA (days) | 3.5± 1.5(2-7) | 30.5± 10.5(20-40) | 27 (24.1 to 29.8) | 0.0001 |
| **- Indication for hysterectomy:** | | | | |
| - PMB | 45(81%) | 52(83%) | 2% (-11.88% to 16.28%) | 0.7 |
| - EH | 35(63%) | 39(62%) | 1% (-16.22% to 17.95%) | 0.9 |
| -CIN | 5(9%) | 8(12%) | 3% (-9.03% to 14.56%) | 0.6 |
| - Adenomyosis | 6(10%) | 9(14%) | 4% (-8.54% to 16.06%) | 0.5 |
| - Fibroid | 8 (14%) | 13(20%) | 6% (-8.06% to 19.43%) | 0.3 |

**NDVH:** Non-Descent Vaginal Hysterectomy; **TAH:** Total Abdominal Hysterectomy; **BMI:** Body Mass Index; **HTN:** Hypertension; **DM:** Diabetes Mellitus; **PMB:** Perimenopausal Bleeding; **EH:** Endometrial Hyperplasia; **CIN:** Cervical Intraepithelial Neoplasia; **PHBA1C:** Pre-Operative Glycated Hemoglobin A1C; **LOPA:** Length of Preoperative Admittance; p<0.05: statistically significant, Values were given as mean ± 2 standard deviation (range) or number (percent).

**Table (2):** Comparison of intra-operative outcome measures and expenses between morbidly obese women with BMI $\geq 40kg/m^2$ who underwent NDVH and TAH.

| Outcome | NDVH (no = 55) | TAH (no = 62) | Δ(95% CI) | pvalue |
|---|---|---|---|---|
| Total operative time (min) | 120±40 (90 – 180) | 110±45 (80-150) | -10(-25.6to5.5) | 0.2 |
| Conventional surgical procedures | 18(33%) | 40(65%) | 32%(13.8%to47.2%) | 0.0006 |
| Vessel-sealing surgical procedures | 37(67%) | 22(35%) | 32%(13.8%to47.2%) | 0.0006 |
| Operative blood loss (ml) | 525 ± 170(300-750) | 550 ± 180(350 -950) | 25(-39.3to89.3) | 0.4 |
| General anesthesia | 5(9%) | 50(80%) | 71%(55.4%to80.5%) | 0.0001 |
| Spinal anesthesia | 50(90%) | 12(19%) | 71% (55.4%to80.5%0 | 0.0001 |
| Additional techniques | 55(100%) | 5(8%) | 92%(80.5%to96.5%) | 0.0001 |
| Intraoperative complications* | | | | |
| - visceral injuries | 2 (vesical) (3%) | 3 (vesical) (4%) | 1%(-6.5%to9.5%) | 0.7 |
| - blood transfusion | 4(7%) | 5(8%) | 1%(-9.8%to11.3%) | 0.8 |
| -conversion to laparotomy | 2(3%) | n.a | | |
| Concomitant procedures | | | | |
| -BS | 31(57%) | 10(16%) | 40%(22.7%to54.2%) | 0.0001 |
| - BSO | 24(43%) | 52(84%) | 40%(22.7%to54.2%) | 0.0001 |
| - others | 6(10%) | 5(8%) | 2%(-8.9%to13.6%) | 0.7 |
| Approximate expenses* | | | | |
| admission expense | 2.18±0.345(1.1-3.7K) | 5.145±0.55(2-8K) | 2.96 (2.78 to 3.13) | <0.0001 |
| anesthesia expense | 0.42±0.085(.19-.9K) | 2.43±0.97(1.5-3.9K) | 2.01 (1.74 to 2.27) | <0.0001 |
| operation expense | 5.15±0.768(4-5.5 K**) | 8.685±1.75(7-9K) | 3.52 (3.02 to 4.03) | <0.0001 |
| -**P. O** uterine weight(gram) | 190 ± 85 (60 – 1050) | 180 ± 85 (65 – 950) | -10 (-41.18 to 21.18) | 0.5 |
| -Uterus weight (category) | | | | |
| -Small (≤100 g) | 4(7.2%) | 0(0%) | 7.2% (0.09%to17.1%) | 0.03 |
| -Standard (101–300 g) | 32(58%) | 43(65%) | 7% (-10.3% to 23.9%) | 0.43 |
| -Large (301–600 g) | 14(25.4%) | 13(20.9%) | 4.5% (10.6%to19.7%) | 0.56 |
| -Very large (>600 g | 5(9%) | 6(9%) | 0% (-11.5% to 10.9%) | 1 |

**NDVH:** Non-Descent Vaginal Hysterectomy; **TAH:** Total Abdominal Hysterectomy; **Δ(95% CI)**: Point estimate difference with 95% confidence interval; **BS:** Bilateral salpingectomy; **BSO:** Bilateral Salpingo-Oophorectomy; **P.O:** postoperative, **\*:** approximate costs were determined in Egyptian currency (LE), **\*\*:** K=1000LE; Values were given as mean ± standard deviation(range) or number (percent); **P<0.05:** Statistically significances

**Table (3):** Comparison of early and late postoperative outcome measures between morbidly obese women with BMI ≥40kg/m$^2$ who underwent NDVH and TAH.

| Outcome | NDVH (no = 55) | TAH (no = 62) | Δ(95% CI) | P value |
|---|---|---|---|---|
| Postoperative pain | | | | |
| - severe at 6h | 25(45%) | 55(88%) | 43%(26.3 to56.7) | 0.0001 |
| - severe at 24 h | 5(9%) | 45(72%) | 63%(46.9 to 73.9) | 0.0001 |
| Analgesic requirements over 24h | | | | |
| -Total narcotic (mg) | 19.8 ± 8.2(10-40) | 38.2 ± 9.8(20-60) | 18(15.1 to 21.73) | 0.0001 |
| -Total parental NSAID (mg) | 150.5 ± 55.5(100-300) | 240.5 ± 120.6(200-500) | 90(54.8 to 125.1) | 0.0001 |
| Time to get out of bed (h) | 5.6 ± 1.7(2-12) | 8.8 ± 5.6(6-24) | 3.2(1.6to4.7) | 0.0001 |
| Time to flatus(h) | 7.2 ± 3.2(3-24) | 18.1 ± 9.2(10-50) | 10.9(8.3 to 13.4) | 0.0001 |
| decline in hemoglobin at (24h) | 1.8 ± 1.1(.8-1.7) | 1.7 ± 1.3(.9-1.9) | -0.1(-0.5 to 0.3) | 0.6 |
| LOS (days) | 1.5 ±0.5(1-10) | 18.5± 8.9(7-70) | 17(14.6 to 19.3) | 0.0001 |
| Return to usual activity time (day) | 9.6 ± 4.6(3-15) | 35.3 ± 11.9(15-90) | 25(22.3 to 29.1) | 0.0001 |
| Febrile morbidity | 28 (9.5%) | 35 (14.2%) | 4.7%(-7.7% to 16.7%) | 0.4 |
| Vaginal spotting | 48 (87%) | 5(8%) | 79%(64.2%to86.9%) | 0.0001 |
| Pelvic cellulitis | 5 (9%) | 3(4%) | 5%(-4.5%to15.8%) | 0.2 |
| Cystitis | 8 (14%) | 4(6%) | 8%(-3.1%to20.1%) | 0.1 |
| Wound complications | 1(1%) | 45(72%) | 71%(56.7%to8o.6%) | 0.0001 |
| Reoperation for wound | 1(1%) | 15(24%) | 23%(11.4%to34.9%) | 0.0003 |
| Need for VTE prophylaxis(days) | 20(36%) | 62(100%) | 64%(49.5%to75.3%) | 0.0001 |
| Duration of VTE prophylaxis(days) | 1.9±1.1 (1-7) | 8.5±3.4 (5-15) | 6.6(5.7to7.5) | 0.0001 |

**NDVH:** Non-descent Vaginal Hysterectomy; **TAH:** Total Abdominal Hysterectomy, **Δ(95% CI)**: Point estimate difference with 95% confidence interval, **NSAID:** Non-steroidal anti-inflammatory drugs, **VTE:** venous thromboembolism**, LOS:** length of postoperative stay in hospital; p<0.05: statistically significant, Values were given as mean ± 2 standard deviation (range) or number (percent).

## Discussion:

This retrospective study concentrated on morbidly obese women with type III obesity with BMI $\geq 40 kg/m^2$ who undergoing major gynecological surgery, specifically TAH and NDVH as such sector of women were understudied both retrospectively as well as prospectively as stated in systematic review on a hysterectomy in morbidly obese (36). Despite, the high expectations for morbid obesity in the United States, Canada, and the rest of the world, including Egypt, in the nearest future (1-6), as well as the high expectations for hysterectomy needs (7–10), we believed that our paper as an Egyptian analysis of NDVH on morbid obese women was a unique research piece that addressed this incredibly difficult problem.

Impact of obesity was investigated on TAH by comparing nonobese versus obese in 1976 and author reported that wound complications were seven times more in obese (29). Also, impact of obesity was investigated on vaginal hysterectomy (VH) by comparing nonobese versus obese in 1977 and author stated that, obesity does not appear to inflict added risks in vaginal hysterectomy, in conflict to abdominal hysterectomy in which the raised morbidity relays to wound infection (30). Studies after 1976 rarely compare TAH to VH in obese, despite the availability of studies comparing TAH to total laparoscopic and robotic hysterectomy (TLH) (6,17 14,32,36,37). Moreover, our prior prospective studies didn't address this sector of women (10-13). A recent retrospective analysis in 2017 investigate VH in morbidly obese comparing conventional suturing technique to vessel sealing technology reported very low conversion rate as well as very low complication rate (23), but it only compared vaginal to vaginal and conducted on morbidly obese women with average BMI.

A Cochrane review on surgical approaches to hysterectomy for benign gynecologic diseases states that the vaginal approach must be considered the best choice for uterus removal because of its association with fewer complications, reduced operating time, decreased hospitalization, lower costs, and shorter convalescence compared with AH (9). Despite the demonstrated advantages of VH as a type of natural orifice surgery (17-23), VH accounts for only 23% of hysterectomies performed in the United States (7,8,9,38). The route of hysterectomy is commonly selected fitting to the experience and capability of the surgeon where the vaginal route was discovered to be unsuitable to most of gynecologic surgeon even in the USA (40) and UK (41). So, TVH is seeming omission to evidence-based decision-making. Morbidly obese women had projecting buttocks, redundant vaginal tissue, decreased soft tissue pliability and this was claimed to be challenges to execute NDVH (17-22,40,41). So, several strategies were recommended to facilitate NDVH in morbidly obese women including extended lithotomy position, energy-based vessel sealing (EBVS), different morcellations techniques including cervical amputation after anterior and posterior colpotomies, uterine bisection, myomectomy and uterine coring (24,25,26) as well as gynecologist motivation, patience, training, and experience.

The outcomes of this analysis favoring NDVH over TAH were in parallel with the results of many research articles (27, 28,29,30,32,31,33,34,38,39,40,42), as regards outcomes of TAH and VH in obese women and morbidly obese including intraoperative and postoperative outcomes measures. In France, a study evaluates

impact of obesity on MIH including TVH, TLH, RH, they found that the least performed is TVH (8%) and class 3 obesity associated with highest expenses (43). A Canadian survey reported 4% in their cohort underwent hysterectomy were class 3 obesity and reported that both TAH, TLH, TVH could safely performed in obese when compared to non-obese (44).

An American survey evaluated complications corresponding to BMI in 55,409 hysterectomies for benign indications in the National Surgical Quality Improvement Project in the USA, reported that in TAH, women with BMIs of ≥40 had an odd ratio (OR) aroundfive for wound dehiscence or wound infection and an OR of 1.9 for sepsis and also reported the magnitude of the connotation between wound infection and BMI was slighter after TVH and the recommended that in obese women TVH or TLH should be executed whenever feasible (38).

A prospective comparison of obesity impact on TVH and LAVH for the non-prolapsed uterus reported that both procedures were feasible and safe alternate for obese patients showing comparable perioperative outcome measures as non-obese patients undergoing TVH and LAVH and the authors stated that, TVH should be preferred to LAVH as it is a safe route of hysterectomy, with procedure time being significantly quicker (62.8 ± 9.3 vs. 29.9 ± 6.6 min in non-obese women, and 62.7 ± 9.8 vs 30.0 ± 6,9 min for obese women) (45).

Moreover, this study is the first article showing that women in the NDVH group had significantly higher BMI and PHBA1C while shorter LOPA (Table 1). This could be explained based on referring morbid obese patients to NDVH gynecologist. Also, this study shows that significant shift toward utilizing EBVS during NDVH,

lower need to convert to general anesthesia, higher utilizations of morcellations in the NDVH group as well as more addressing the removal of tubes and ovaries on NDVH group (Table 2), and lower consumption of prophylaxis for VTE (Table3). All these items were secondary to changing the concept towards NDVH and dealing with all hysterectomy as a trialed vaginal by the principal investigator. Such an attitude towards NDVH was recommended by Pioneer of gynecologic surgery( gynecologic surgeons) (17-27,40,41).

This study's strengths were its retrospective nature being low cost and assessing actual status of surgical performances, relatively larger sample size to other studies as well as comparing NDVH to TAH in women with BMI ≥40 kg/m$^2$, addressing surgical outcomes specifically in morbidly obese patients who underwent NDVH, challenging an actual well-known contraindication to TVH as morbid obesity, nulliparity, lack of uterine mobility, prior lower abdominal surgery, and bulky uterine size.

This study's limitations were being a retrospective analysis includes selection biases, reporting biases, confounders such surgical experience of the gynecologists as well as an inability to generalize the outcomes as it is single institute results and the skills of NDVH were limited and underutilized all over the world.

## CONCLUSIONS:

The keynote outcome of our study is that the NDVH rather than TAH should be the preferred procedure specifically for morbidly obese utilizing the vessel sealing rather than conventional suture and adapting the concept of trial vaginal hysterectomy in all cases with benign uterine conditions.

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