

Appendix 1. Search Strategy: Enabling Technologies for Gynecologic Vaginal Surgery

PubMed

```
(  
"Gynecologic Surgical Procedures"[Mesh] OR  
"Vagina"[Mesh] OR  
Vagina[tiab] OR  
"Hysterectomy, Vaginal"[Mesh] OR  
(Vagina* AND hysterectomy) OR  
"Fallopian Tubes"[Mesh] OR  
Fallopian tube[tiab] OR  
"Salpingectomy"[Mesh] OR  
Salpingectom* OR  
"Ovariectomy"[Mesh] OR  
Ovariectom* OR  
Oophorectom* OR  
(Adnexa* AND surg*) OR  
"Uterine Myomectomy"[Mesh] OR  
Myomectom* OR  
Pelvic reconstruction OR  
Uterosacral ligament suspension OR  
Sacrospinous ligament fixation OR  
Sacrospinous ligament suspension OR  
Sacrocolpopex* OR  
Colporrhaph* OR  
Plicat* OR  
"Vesicovaginal Fistula"[Mesh] OR  
"Vaginal Fistula"[Mesh] OR  
"Rectovaginal Fistula"[Mesh] OR  
(Fistula[tiab] AND (Vesicovagina* OR Vagina* OR Rectovagina* OR Urethrovagina*))  
)
```

AND

```
(  
"Robotic Surgical Procedures"[Mesh] OR
```

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Robot*[tiab] OR
 Video Telescopic Operating Monitor OR
 "Video-Assisted Surgery"[Mesh] OR
 "Video-Assisted Techniques and Procedures"[Mesh] OR
 VITOM OR
 Transvaginal Natural Orifice Transluminal Endoscopic Surgery OR
 "Natural Orifice Endoscopic Surgery"[Mesh] OR
 vNOTES OR
 VANH OR
 Vaginal access minimally invasive surgery OR
 VAMIS OR
 TVNH OR
 Glove port OR
 Single port OR
 Natural orifice OR
 Retractor[tiab] OR
 (Bookwalter NOT Bookwalter[author]) OR
 (Alexis NOT Alexis[author]) OR
 Martin's arm OR
 Lone star OR
 Ligasure OR
 Bipolar clamp OR
 "Electrosurgery"[Mesh] OR
 Electrosurger* OR
 Vessel seal* OR
 EBVS OR
 Biclamp OR
 (Gyrus NOT "Brain"[Mesh]) OR
 Enseal OR
 (Hominis NOT "Bacteria"[Mesh]) OR
 Endoloop OR
 Camera[tiab] OR
 NOTES[tiab] OR
 Harmonic[tiab] OR
 Capiro OR
 Anchor-Based Device OR
 Suture-capturing device OR
 "Suture Anchors"[Mesh] OR "

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143.
 The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Suture Techniques"[Mesh] OR
 "Sutures"[Mesh] OR
 "Blood Loss, Surgical/prevention and control"[Mesh] OR "Electrocoagulation/instrumentation"[Mesh] OR
 "Hemostasis, Surgical/instrumentation"[Mesh] OR
 "Ligation/instrumentation"[Mesh]
)

AND

("Random Allocation"[Mesh] OR "Clinical Trial" [Publication Type] OR "Double-Blind Method"[Mesh] OR "Single-Blind Method"[Mesh] OR random* OR "Placebos"[Mesh] OR placebo OR ((clinical OR controlled) AND trial*) OR ((singl* OR doub* OR trebl* OR tripl*) AND (blind* OR mask*)) OR rct OR crossover OR cross-over OR cross-over OR "treatment switching" OR "Treatment Switching"[Mesh] OR RCT OR "Randomized Controlled Trial" [Publication Type] OR "Cohort Studies"[Mesh] OR cohort OR "Clinical Trial" [Publication Type] OR "Clinical Trials as Topic"[Mesh] OR follow-up OR followup OR longitudinal OR "Placebos"[Mesh] OR placebo* OR "Research Design"[Mesh] OR "Evaluation Studies" [Publication Type] OR "Evaluation Studies as Topic"[Mesh] OR "Comparative Study" [Publication Type] OR ((comparative OR Intervention) AND study) OR pretest* OR pre test* OR posttest* OR post test* OR prepost* OR pre post* OR "before and after" OR interrupted time* OR time serie* OR intervention* OR ((quasi-experiment* OR quasiexperiment* OR quasi experiment*) AND (method OR study OR trial OR design*)) OR "Case-Control Studies"[Mesh] OR (case AND control) OR "Clinical Study" [Publication Type] OR "Clinical Studies as Topic"[Mesh] OR Observational Study [Publication Type] OR "Epidemiologic Studies"[Mesh] OR "Case-Control Studies"[Mesh] OR "Cohort Studies"[Mesh] OR "Case control" OR cohort OR (observational AND (study OR studies)) OR Longitudinal OR Retrospective OR "Prospective Studies"[Mesh] OR "Longitudinal Studies"[Mesh] OR "Follow-Up Studies"[Mesh] OR ((follow-up OR followup OR "follow up") AND (study OR studies)) OR "Registries"[Mesh] OR register[tiab] OR registry[tiab] OR database[tiab] OR "Evaluation Study" [Publication Type] OR "Evaluation Studies as Topic"[Mesh] OR "Validation Study" [Publication Type] OR "Validation Studies as Topic"[Mesh] OR systematic[sb] OR "Meta-Analysis" [Publication Type] OR "Meta-Analysis as Topic"[Mesh] OR "Systematic Review" [Publication Type] OR "Systematic Reviews as Topic"[Mesh] OR "Review Literature as Topic"[Mesh] OR medline[tiab] OR pubmed[tiab] OR cochrane[tiab] OR embase[tiab] OR psychlit[tiab] OR psyclit[tiab] OR psychinfo[tiab] OR psycinfo[tiab] OR cinahl[tiab] OR cinhal[tiab] OR science citation index[tiab] OR bids[tiab] OR cancerlit[tiab] OR reference list*[tiab] OR bibliograph*[tiab] OR hand-search*[tiab] OR relevant journals[tiab] OR manual search*[tiab] OR selection criteria[tiab] OR data extraction[tiab]) NOT ("Address" [Publication Type] OR "autobiography" [publication type] OR "bibliography" [publication type] OR "biography" [publication type] OR "case reports" [publication type] OR "comment" [publication type] OR "congress" [publication type] OR "Congresses as Topic"[Mesh] OR "dictionary" [publication type] OR "directory" [publication type] OR "editorial" [publication type] OR "festschrift" [publication type] OR "Government Publication" [Publication Type] OR "Government Publications as Topic"[Mesh] OR "historical article" [publication type] OR "interview" [publication type] OR "lecture" [publication type] OR "legal case" [publication type] OR "legislation" [publication type] OR "letter" [publication type] OR "news" [publication type] OR "newspaper article" [publication type] OR "patient education handout" [publication type] OR "periodical index" [publication type] OR "comment on" OR ("Animals"[Mesh] NOT "Humans"[Mesh]) OR rats[tw] OR cow[tw] OR cows[tw] OR chicken*[tw] OR horse[tw] OR horses[tw] OR mice[tw] OR mouse[tw] OR bovine[tw] OR sheep OR ovine OR murinae)

Appendix 2. Study Eligibility Criteria

Population	Women undergoing vaginal gynecological surgery for any benign indication Exclude: • TAH, LAVH, laparoscopic hysterectomy, any exclusively laparoscopic/robotic/abdominal procedures • Vulvar, non-gynecologic, or obstetric surgery • Malignancy • Age <18 years • Procedures that are exclusively vaginal that cannot be performed by another approach (e.g. midurethral sling, vaginal mesh procedures, cervical excision, vaginal cyst excision, hysteroscopy, D&C, urethral diverticulectomy) • Office procedures (e.g.colposcopy) • Transgender procedures/Neovagina creation • Reproductive Endocrinology procedures
Intervention	A contemporary tool or technology that facilitates or enables intraoperative performance of a gynecologic vaginal surgical procedure
Comparator	Another alternative tool or technology, including no intervention, that aims to accomplish the same goal at a similar point in the procedure
Outcomes	<u>Intraoperative:</u> Blood loss, Operative time, Complications, Transfusion, Surgeon/Assistant ergonomic strain, Procedure success/conversion to another route, Educational outcomes <u>Postoperative:</u> Hemoglobin, Transfusion, Reoperation, Length of Hospital Stay, Complications, Postoperative pain, GI Function, Dyspareunia, Quality of life, Patient satisfaction, Cost, Fertility/future pregnancy
Study Designs	Comparative studies: • RCTs or intervention studies • Prospective or retrospective NRCS • Vaginal surgery arms of comparative studies as single group cohort Single arm studies: • Prospective or retrospective • Video case series Systematic Reviews

TAH – total abdominal hysterectomy; LAVH – laparoscopic-assisted vaginal hysterectomy; D&C – dilation and curettage; GI – gastrointestinal; RCT – randomized controlled trial; NRCS – non-randomized comparative studies

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.
The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Appendix 3. Studies Included by Technology Domain

Technology Domain	Devices (Total no. studies)	Surgical Procedures (No. studies)	Comparative Studies	Single Arm Studies	Total No. Participants	Evidence for Meta-analysis
Pedicle Sealers	Ligasure™ (13), BiClamp® (14), Ligasure™ or BiClamp® (2), Ultrasonic shears (1), Thermostapler® (1), Plasmakinetic™ device (1)	Vaginal hysterectomy (32)	12 RCTs 8 NRCS	12	6,057	Sufficient
Nonrobotic vNOTES	Vaginal access port (56)	Vaginal hysterectomy (30), ovarian cystectomy (5), salpingo-oophorectomy (5), cystectomy or salpingo-oophorectomy (1) salpingectomy (4), uterosacral ligament suspension (4), sacrocolpopexy (3), myomectomy (1), multiple surgeries (3)	3 NRCS	53	4,773	Insufficient
Robotic vNOTES	DaVinci™ (6), Hominis® (2)	Vaginal hysterectomy (6), salpingo-oophorectomy (1), endometriosis resection (1)	1 NRCS	7	306	Insufficient
Suture Capture Devices	Capio™ (10), Anchorsure® (1), Miya hook (1), Shutt® suture punch (1), Veronikis ligature carrier™ (3), NeuGuide™ (1), Endo Stitch™ (2),	Sacrospinous colpopexy (16), vaginal paravaginal defect repair (1)	2 RCTs 5 NRCS	10	1,499	Insufficient
Loop Ligatures	Plaingut (1), polydioxanone (1)	Oophorectomy (1), myomectomy (1)	0	2	31	Insufficient
Cameras	VITOM® – Video Telescopic Operating Monitor (1)	Urogynecologic procedures (1)	1 RCT	0	92	Insufficient

RCT – randomized controlled trial; NRCS – non-randomized controlled study; vNOTES – vaginal natural orifice transluminal endoscopic surgery

Appendix 4. Risk of Bias Assessment Rating for Comparative Studies

Study and Design	Study Quality	Clarity: Discrepancies	Clarity: Population	Clarity: Intervention/Comparator	Clarity: Outcomes	Clarity: Setting	Random Sequence Generation	Allocation Concealment	Blinding of participants and personnel	Blinding of outcome assessor	Incomplete outcome data	Selective reporting	Intention to treat analysis	Representativeness of cases	Selection of controls	Other bias
Plair et al 2022 ¹¹⁹ USA RCT	A	Low	Low	Low	Low	Low	Low	Low	High	High	Low	Low	Low	Low	Low	Low
Hobson et al 2021 ¹³⁸ USA RCT	A	Low	Low	Low	Low	Low	Low	Low	High	Low	Low	Low	Low	Low	Low	High
Fitzgerald et al 2013 ²³ Australia RCT	A	Low	Low	Low	Low	Low	Low	High	High	Low	Low	Low	Low	Low	Low	Low
Lakeman et al 2012 ²⁴ Netherlands RCT	A	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Elhao et al 2009 ²⁶ Egypt RCT	A	Low	Low	Low	Low	Low	Low	Low	High	High	Low	Low	Low	Low	Low	Low
Silva-Filho et al 2009 ²⁷ Brazil RCT	A	Low	Low	Low	Low	Low	Low	Unclear	Unclear	Unclear	High	Low	Unclear	Unclear	Low	Low
Zubke et al 2009 ²⁵ Germany RCT	A	Low	Low	Low	Low	Low	Low	Low	High	Unclear	Low	Low	Low	Low	Low	Low
Levy et al 2003 ²⁸	A	Low	High	Low	Low	Low	Low	Low	Unclear	Unclear	Low	Unclear	Low	Low	Low	Low

Balgorin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

USA RCT																
McKenzie et al 2022 ¹²⁰ USA RCT	B	Low	Low	Low	Low	Low	Low	Low	Unclear	Unclear	Low	Low	Low	Low	Low	Low
Lee et al 2019 ²⁹ Taiwan RCT	B	Low	High	Low	Low	Low	Unclear	Unclear	Unclear	Unclear	Unclear	Low	Low	Unclear	Low	Low
Leo et al 2012 ³⁰ Italy RCT	B	Low	Low	High	Low	High	Unclear	Unclear	High	Unclear	Low	High	Low	Low	Low	High
Hefni et al 2005 ³¹ UK RCT	B	High	Low	Low	High	Low	Low	Low	Low	High	Low	Low	Unclear	Low	Low	Low
Samulak et al 2011 ³⁷ Poland RCT	C	Low	High	Low	Low	Low	High	High	High	High	Low	Low	Low	Low	Low	High
Cronje et al 2005 ³² South Africa RCT	C	High	High	Low	Low	Low	High	Low	High	High	Low	Low	Low	Low	Low	High
Clave et al 2003 ³⁴ France RCT	C	High	High	Low	High	Low	High	High	Unclear	High	Low	High	High	Low	Unclear	High
Aharoni et al 2021 ¹⁰⁰ Israel NRCS	B	Low	Low	Low	Low	Low	NA	NA	NA	NA	Low	Low	NA	Low	Low	High
Koythong et al 2021 ¹¹¹ USA	B	Low	High	Low	Low	Low	NA	NA	NA	NA	Low	Low	NA	Low	Low	High

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

NRCS																
Lee et al 2019 ⁵⁶ Taiwan NRCS	B	Low	Low	Low	Low	Low	NA	NA	NA	NA	Low	Low	NA	Low	Low	High
Campbell et al 2018 ¹²⁵ Sweden NRCS	B	Low	Low	Low	Low	Low	NA	NA	NA	NA	High	Low	NA	Low	Low	Low
Pandeva et al 2018 ¹²¹ UK NRCS	B	Low	Low	Low	Low	Low	NA	NA	NA	NA	Low	Low	NA	Low	High	Low
Giraudet et al 2017 ³⁵ France NRCS	B	Low	Low	Low	Low	Low	NA	NA	NA	NA	Low	Low	NA	High	Low	High
Karacan et al 2017 ³⁸ Turkey NRCS	B	Low	Low	Low	Low	Low	NA	NA	NA	NA	Unclear	Unclear	NA	Low	Low	Low
Leone-Roberti et al 2013 ¹²⁴ Italy NRCS	B	Low	Low	Low	Low	Low	NA	NA	NA	NA	Low	Low	NA	Low	Low	High
Malinow-ski et al 2008 ³⁹ Poland NRCS	B	Low	High	Low	Low	Low	NA	NA	NA	NA	Low	Low	NA	Low	Low	High
Merlier et al 2022 ⁵⁵ France NRCS	C	Low	High	High	High	High	NA	NA	NA	NA	Low	High	NA	High	High	High
Gizzo et al 2013 ³⁶ Italy	C	Low	Low	Low	High	Low	NA	NA	NA	NA	Low	Unclear	NA	High	High	Low

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

NRCS																
Dubuisson et al 2008 ⁴⁰ France NRCS	C	Low	Low	Low	Low	Low	NA	NA	NA	NA	High	Low	NA	Unclear	Unclear	High
Marcickiewicz 2008 ¹²² Sweden NRCS	C	High	High	Low	Low	Low	NA	NA	NA	NA	Low	High	NA	Unclear	Low	High
Chia et al 2007 ⁴¹ UK NRCS	C	Low	High	Low	Low	High	NA	NA	NA	NA	Low	Low	NA	High	Unclear	High
Douay et al 2007 ⁴² France NRCS	C	Low	Low	Low	Low	High	NA	NA	NA	NA	Low	Low	NA	Unclear	Unclear	High
Chang et al 2006 ¹²³ Taiwan NRCS	C	High	Low	Low	Low	Low	NA	NA	NA	NA	Unclear	Unclear	NA	High	High	High
Ding et al 2005 ³³ Australia NRCS	C	High	High	Low	High	Low	NA	NA	NA	NA	Unclear	Unclear	NA	High	High	High

RCT – randomized controlled trial; nRCS – non-randomized comparative study; NA – not applicable

Appendix 5. Main Study Characteristics of Comparative Pedicle Sealer Studies

Study	Design (Quality)	Study Population (n)	Age (y)	BMI (kg/m ²)	Parity	Uterine weight (g)	Outcomes
Fitzgerald et al 2013 ²³ Australia	RCT (A)	Women undergoing vaginal hysterectomy for benign disease with ultrasonic shears (n=21) or suture (n=19)	Shears: 57.2±2.7 Suture: 58.3±2.6	NR	Shears: 3.1±0.5 Suture: 2.7±0.2	Shears: 104.8±16.5 Suture: 74.7±10.9	Operative time, blood loss, length of stay, narcotic use, cost, complications
Lakeman et al 2012 ²⁴ Netherlands	RCT (A)	Women undergoing vaginal hysterectomy benign conditions excluding pelvic organ prolapse with Ligasure™ (n=49) or suture (n=51)	Device: 44.0±6.3 Suture: 48.1±10.0*	Device: 26.5±5.4 Suture: 27.9±5.0	Device: 2.0 (0-6) [†] Suture: 2.0 (1-5) [†]	NR	Operative time, blood loss, length of stay, pain, complications
Zubke et al 2009 ²⁵ Germany	RCT (A)	Women undergoing vaginal hysterectomy for benign uterine disease with BiClamp® (n=88) or suture (n=87)	Device: 45.5±7.1 Suture: 45.1±6.0	NR	NR	NR	Operative time, blood loss, length of stay, pain, cost, complications
Elhao et al 2009 ²⁶ Egypt	RCT (A)	Women undergoing vaginal hysterectomy for benign conditions with Ligasure™ (n=50) or suture (n=53)	Total group: 56.5 (38-75) [†]	Total group: 32.7 (29.1-35.5) [†]	NR	NR	Operative time, blood loss, conversion, prolonged hospital stay, complications
Silva-Filho et al 2009 ²⁷ Brazil	RCT (A)	Women undergoing vaginal hysterectomy for uterine myoma with Ligasure™ (n=45) or suture (n=45)	Device: 44.6±0.5 [§] Suture: 44.7±0.7 [§]	NR	Device: 2.7±0.2 [§] Suture: 2.4±0.2 [§]	Device: 247.2±10.4 [§] Suture: 270.6±11.1 [§]	Operative time, blood loss conversion, length of stay, pain, complications
Levy et al 2003 ²⁸ USA	RCT (A)	Women undergoing vaginal hysterectomy for benign disease with Ligasure™ (n=30) or suture (n=30)	Device: 46.2±8.6 Suture: 47.5±9.4	Device: 26.2±4.6 Suture: 26.1±6.0	Device: 1.7±1.1 Suture: 1.6±1.0	Device: 247.2± 06.3 Suture: 250.8±221.7	Operative time, blood loss, length of stay, complications
Lee et al 2019 ²⁹ Taiwan	RCT (B)	Women undergoing vNOTES vaginal hysterectomy with Ligasure™ (n=36) or conventional bipolar (CB) (n=35)	Device: 46.3±4.0 CB: 46.3±5.0	Device: 24.5±3.4 CB: 24.7±4.4	NR	Device: 465.1±296.4 CB: 444.3±202.7	Operative time, blood loss, length of stay, pain, complications
Leo et al 2012 ³⁰ Italy	RCT (B)	Women undergoing vaginal hysterectomy with BiClamp® and multimodal anesthesia (n=30) or suture and spinal anesthesia (n=30)	Device: 54.1 (41-77) [†] Suture: 60.7 (40-77) [†]	Device: 22.8 (18-27) [†] Suture: 23.1 (18-27) [†]	Device: 1.7 (1-3) [†] Suture: 1.9 (1-4) [†]	90 (NR) [†]	Operative time, blood loss, length of stay, cost, conversion, complications

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Hefni et al 2005 ³¹ UK	RCT (B)	Women undergoing vaginal hysterectomy with Ligasure™ (n=57) or suture (n=59)	Device: 51±11.4 Suture: 52±11.6	NR	NR	NR	Operative time, blood loss, conversion, length of stay, pain, narcotic use, complications
Cronje et al 2010 ³² South Africa	RCT (C)	Vaginal hysterectomy with Ligasure™ (n=37) or suture (n=32)	Device: 38(19-73) [†] Suture: 41(25-59) [†]	NR	NR	NR	Operative time, blood loss, length of stay, cost, pain
Ding et al 2005 ³³ Australia	RCT (C)	Women undergoing vaginal hysterectomy for benign disease with Ligasure™ (n=32) or suture (n=12)	Device: 55(44-66) [†] Suture: 49(37-70) [†]	NR	NR	NR	Operative time, blood loss, length of stay, complications
Clave et al 2003 ³⁴ France	RCT (C)	Vaginal hysterectomy with BiClamp® (n=25) or suture (n=25)	NR	NR	NR	Device: 170 (36-450) [†] Suture: 190 (42-520) [†]	Operative time, same-day discharge, pain narcotic use, complications
Giraudet et al 2017 ³⁵ France	Prospective NRCS (B)	Women undergoing vaginal hysterectomy with BiClamp® (n=16) or suture (n=16)	Device: 49.3±5.1 Suture: 48.2±7.1	Device: 25.9±6.1 Suture: 26.8±5.9	NR	Device: 236.1±176.8 Suture: 207.4±154.7	Operative time, blood loss, pain, narcotic use, complications
Gizzo et al 2013 ³⁶ Italy	Prospective NRCS (C)	Women undergoing vaginal hysterectomy for benign uterine pathology with Ligasure™ (n=21) or suture (n=21)	Device: 68.5±7.0 Suture: 71.3±6.8	Device: 24.9±2.1 Suture: 25.6±2.7	Device: 2.9±1.1 Suture: 3.0±1.2	NR	Operative time, blood loss, conversion, pain, complications, cost
Samulak et al 2011 ³⁷ Poland	Prospective NRCS (C)	Women undergoing vaginal hysterectomy for benign uterine pathology with BiClamp® (n=30) or suture (n=30)	45 (38-58) [†] total group	NR	NR	NR	Operative time, blood loss, length of stay, cost, conversion, complications
Karacan et al 2017 ³⁸ Turkey	Retrospective NRCS (B)	Morbidly obese women undergoing vaginal hysterectomy due to benign pathology with Ligasure™ (n=41) or suture (n=64)	Device: 51.2±11.5 Suture: 49.3±12.9	Device: 44.4±2.7 Suture: 46.2±5.1	Device: 3.3±1.2 Suture: 3.5±1.4	Device: 111±49.3 Suture: 102±70.2	Operative time, conversion, length of stay, complications
Malinowski et al 2008 ³⁹ Poland	Retrospective NRCS (B)	Women undergoing vaginal hysterectomy with Thermostapler® (n=60) or suture (n=60)	Device: 51.1 (37-67) [†] Suture: 50.6 (37-68) [†]	Device: 27.1 (18.0-46.1) [†] Suture: 27.5 (17.6-55.8) [†]	NR	Device: 187 (40-560) [†] Suture: 192 (42-800) [†]	Operative time, length of stay, complications

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Dubuisson et al 2008 ⁴⁰ France	Retrospective NRCS (C)	Vaginal hysterectomy with BiClamp® (n=54) or suture (n=42)	Device: 50.0±9.4 Suture: 48.4±7.4	NR	Device: 2.0±1.2 Suture: 2.0±1.2	Device: 194.2±116.5 Suture: 167.5±84.5	Operative time, length of stay, pain, narcotic use, conversion, complications
Chia et al 2007 ⁴¹ UK	Retrospective NRCS (C)	Women undergoing vaginal hysterectomy with BiClamp® (n=100) or suture (n=100)	NR	NR	NR	Device: 233.3(38-1238) [‡] Suture: 110 (26-349) ^{‡*}	Length of stay, narcotic use, complications
Douay et al 2007 ⁴² France	Retrospective NRCS (C)	Women undergoing vaginal hysterectomy for benign pathology with BiClamp® (n=28) or suture (n=32)	Device: 49.2±6.4 Suture: 48.7±6.4	Device: 26.4±5.9 Suture: 27.3±6.2	Device: 2.8±1.5 Suture: 2.4±1.4	Device: 211±128 Suture: 190±123	Pain, narcotic use, complications

BMI – body-mass index; RCT – randomized controlled trial; NR – not reported; vNOTES – vaginal natural orifice transluminal endoscopic surgery; CB – conventional bipolar; NRCS – non-randomized comparative study

Data are mean±standard deviation or n (%), unless otherwise noted

*p≤0.05

[‡]Median (range)

^{*}Mean (range)

[§]Mean ± SEM

Appendix 6. Study Characteristics and Outcomes of Single-Arm Pedicle Sealer Studies

Study/ Directionality	Study Population (n)	Age (y)	BMI (kg/m ²)	Parity	Operative time (min)	Blood Loss (ml)	Length of stay (d)	Complications (n)	Other Outcomes
Cassis et al 2018 ⁴³ UK Prospective	Women undergoing vaginal hysterectomy for benign conditions with BiClamp® (n=75)	31 (31-70)*	29.4 (18.5-3.3) [†]	NR	108 (46-300) [†]	NR	NR	UTI (1) Vault hematoma (2) Reoperation (2) Bladder injury (1)	Same day discharge: 32 (43) Uterine weight (g): 249(75–833) [†]
Allam et al 2015 ⁴⁴ Egypt Prospective	Women undergoing vaginal hysterectomy with Ligasure™ (n=30)	54 (47-60) [‡]	27.1±2.5	2(0-10) [‡]	100.4±35.8	675 (500-1000)*	36 (36-48)* hours	Conversion/laparotomy (1) Transfusion (6) Ureteric injury (1) Vault hematoma (2)	Postoperative pain (VAS): 3(3-4)* Need for analgesia(d): 2(0-10) [‡]
Pizzoferato et al 2014 ⁴⁵ France Prospective	Women undergoing outpatient vaginal hysterectomy for benign pathology with BiClamp® (n=30)	46.6±5.3	NR	2.1±0.8	59.2 (25-110) [†]	123±115.7	NR	None	Treatment satisfaction: Very satisfied: 11 (36.7) Satisfied: 16 (53.3) Unsatisfied: 3(10) Not satisfied: 0 Uterine weight (g): 170.2(60-710) [†] Pain VAS: Discharge: 2.4±1.9 Day 1: 4.5±2.1 Day 2: 4.4±2.1
Alaniz et al 2009 ⁴⁶ Mexico Prospective	Women undergoing vaginal hysterectomy for benign uterine disease with BiClamp® (n =380)	43.4 (26-69) [†]	NR	NR	45 (18-195) [†]	150 (NR) [§]	48 (24-36) [†]	Conversion/laparotomy (1) Bladder injury (3) Thermal bladder injury (2) VVF (2) Abscess (7) Hemorrhage (4) Vaginal bleeding (2) Vault hematoma (1) Reoperation (4)	Uterine weight (g): 215(45-960) [†]

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

								Rectal injury (1) Thrombophlebitis (1) Sepsis/death (1)	
El-Shawarby et al 2006 ⁴⁷ UK Prospective	Women undergoing vaginal hysterectomy Plasmakinetic™ Gyrus (n=51)	44.2±8.4	26.3±3.8	1 (0-4)*	45.6±10.4	100 (20-400)*	2.4±0.8	Ureteric injury (1) UTI (2) Reoperation (1)	Uterine weight (g): 127.7 ± 54.5
Clave et al 2005 ⁴⁸ France Prospective	Women undergoing vaginal hysterectomy with BiClamp® (n=152)	NR	NR	NR	NR	NR	NR	Vulvar/vaginal burns (3) Readmission (4) Reoperation (2) Pelvic hematoma (1) Pyelonephritis (1)	NR
Blayney et al 2017 ⁴⁹ Northern Ireland Retrospective	Women undergoing vaginal hysterectomy with BiClamp® (n=200)	51 (24-83)*	28.5 (9.75) [†]	2 (2) [†]	49.7±15	NR	2.1±1.3	Conversion to abdominal approach (4) Bladder injury (5) Ureteric injury (1) Reoperation (5) Vault hematoma (5) Blood transfusion (2) Readmission (4)	Hb drop (pre to post-operative, g/dL): 1.1±0.8
Clave et al 2017 ⁵⁰ France Retrospective	Women undergoing vaginal hysterectomy for benign conditions with BiClamp® (n=1000)	51.4±8.9	25.8±4.2	NR	40.6±19.5	NR	NR	Bladder injury (10) VVF (1) Hemorrhage (5) Hematoma (15) Vaginal cuff bleeding (10) Bowel injury (1) Bowel obstruction (1) Peritonitis (4) Thromboembolic events (1) Transfusion (2) Readmission (22) Reoperation (19)	Uterine weight(g): 239.6±202.3
Bonino et al 2016 ⁵¹ Italy Retrospective	Women undergoing vaginal hysterectomy for enlarged uteri >	49.1±2.9	25.1±0.6	NR	74.7±34	478.1±627.4	1.5±1.1	Conversion/laparotomy (3) Transfusion (3) Ureterovaginal fistula (1) Bladder injury (1)	NR

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

	500 g with Ligasure™ (n=203)							Rectal perforation (1) Ureteral stenosis (3)	
Graham et al 2016 ⁵² UK Retrospective	Women undergoing vaginal hysterectomy for normal (<280 g; n=43) or large (> 280 g; n=24) uterus with BiClamp®	<280 g: 43.4±7.0 >280 g: 46.4±5.1	NR	NR	<280g: 49.2±20 >280 g: 66.3±22 [§]	<280 g: 189.3±263 >280 g: 333±222 [§]	<280g: 35.2±26 hours >280 g: 32.2±12 hours	Conversion/laparotomy (1) Bladder laceration (1)	NR
Ghirardini et al 2013 ⁵³ Italy Retrospective	Women undergoing vaginal hysterectomy for benign indications with BiClamp® (n=500)	49.2±9.8	28.6±5.6	2 (0-4)*	48.9±15.3	NR	3.2±1.2	Conversion/laparotomy (3) Hemoperitoneum (1) Transfusion (1) Reoperation (1) Vaginal burn (1)	Hb change (pre to post-operative, g/dL): 1.4±1.8
Mistrangelo et al 2008 ⁵⁴ UK Retrospective	Women undergoing vaginal hysterectomy for enlarged fibroid uteri > 250 g with Ligasure™ (n=102)	47.5 (37-78)*	24.8±3.1	2(0-5)*	50 (25-200)*	NR	NR	Conversion/laparotomy (3) Ovarian vessel injury (1)	NR

BMI – body-mass index; NR – not reported; UTI – urinary tract infection; VAS – visual analog scale; VVF – vesico-vaginal fistula; Hb – hemoglobin;.

Data are mean±standard deviation or n(%), unless otherwise specified

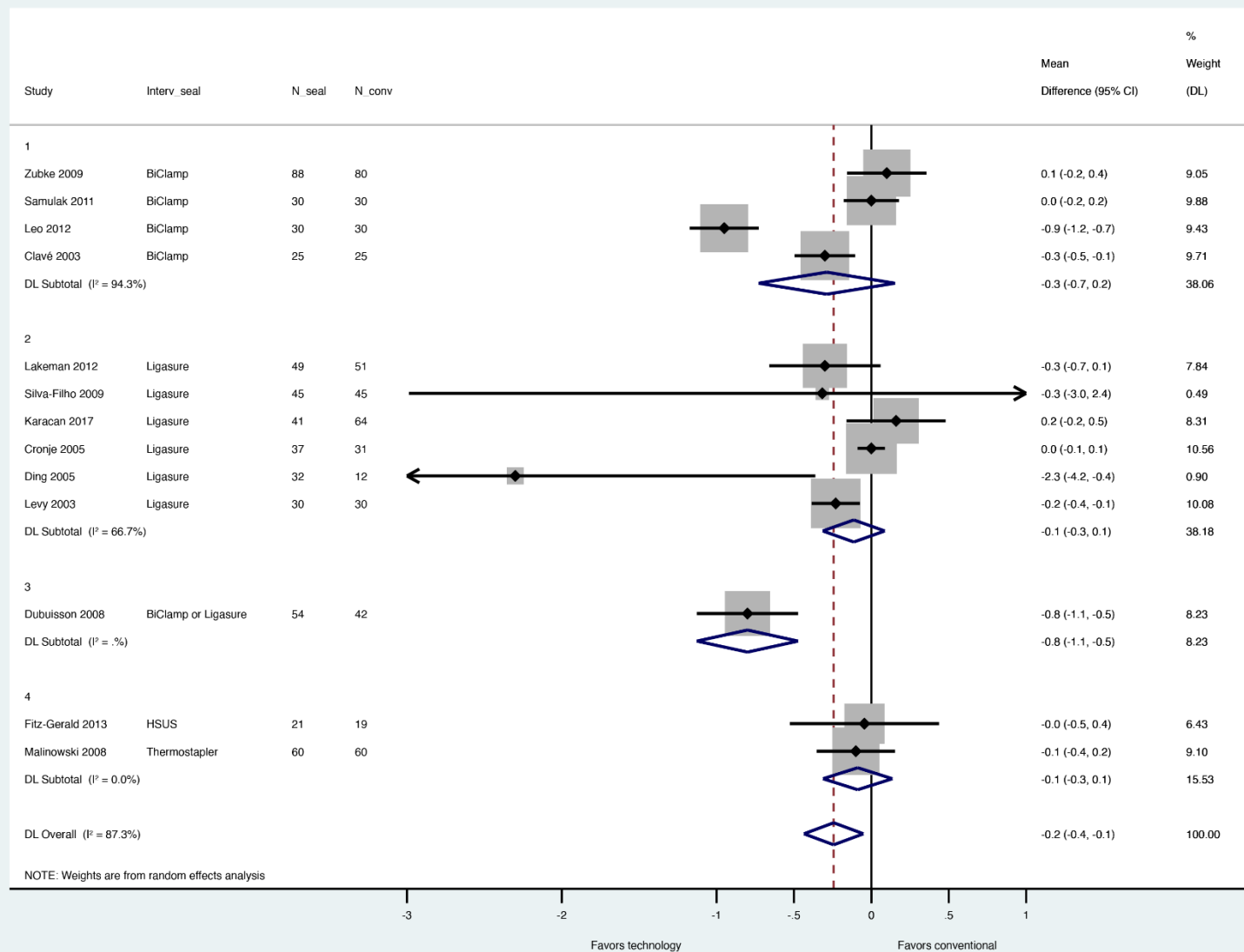
*Median (range)

†Mean (range)

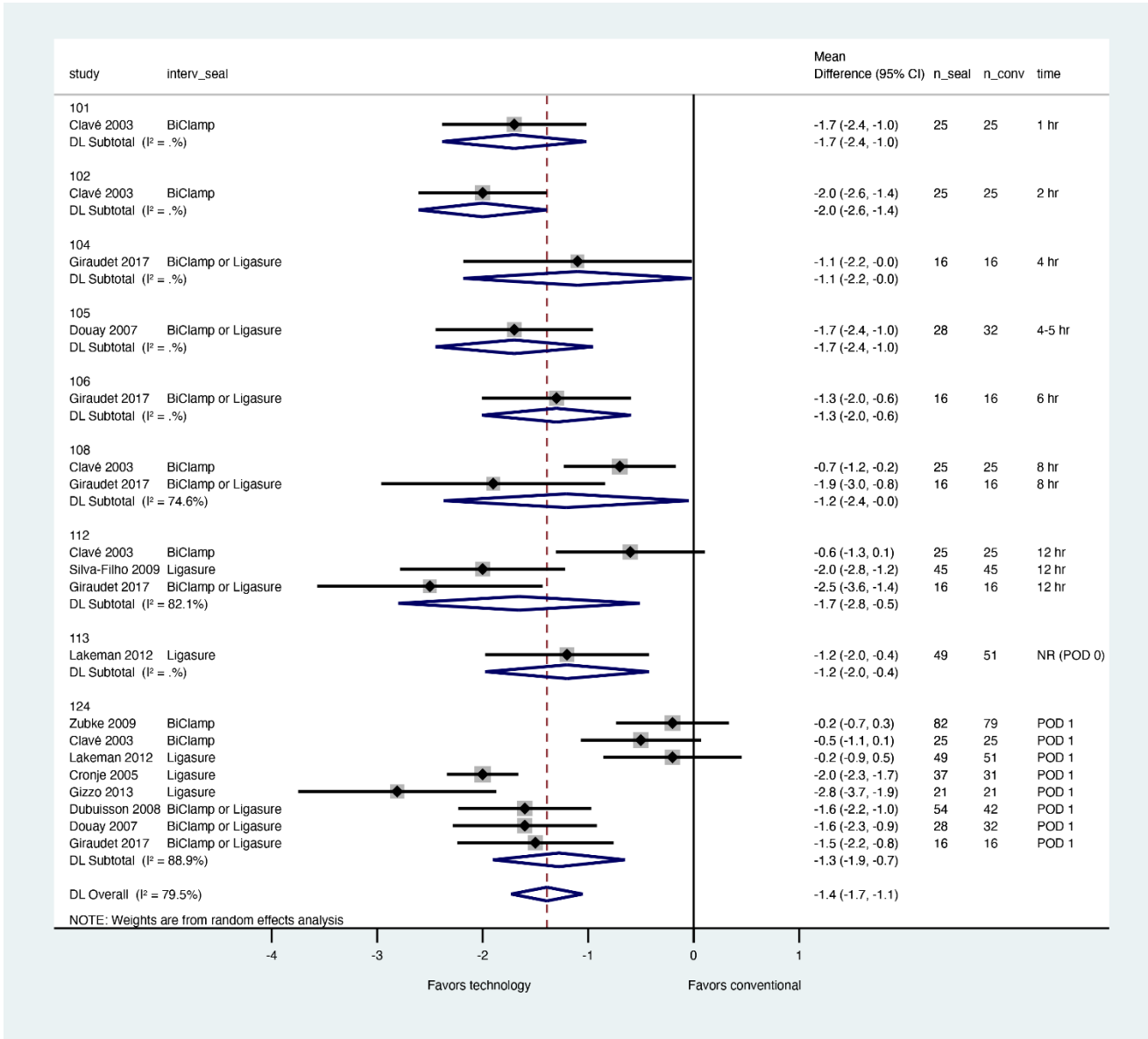
‡Median (IQR)

§p≤0.05

Appendix 7. Meta-analysis of vaginal hysterectomy length of hospital stay (d) in studies comparing pedicle sealers to traditional suture ligation

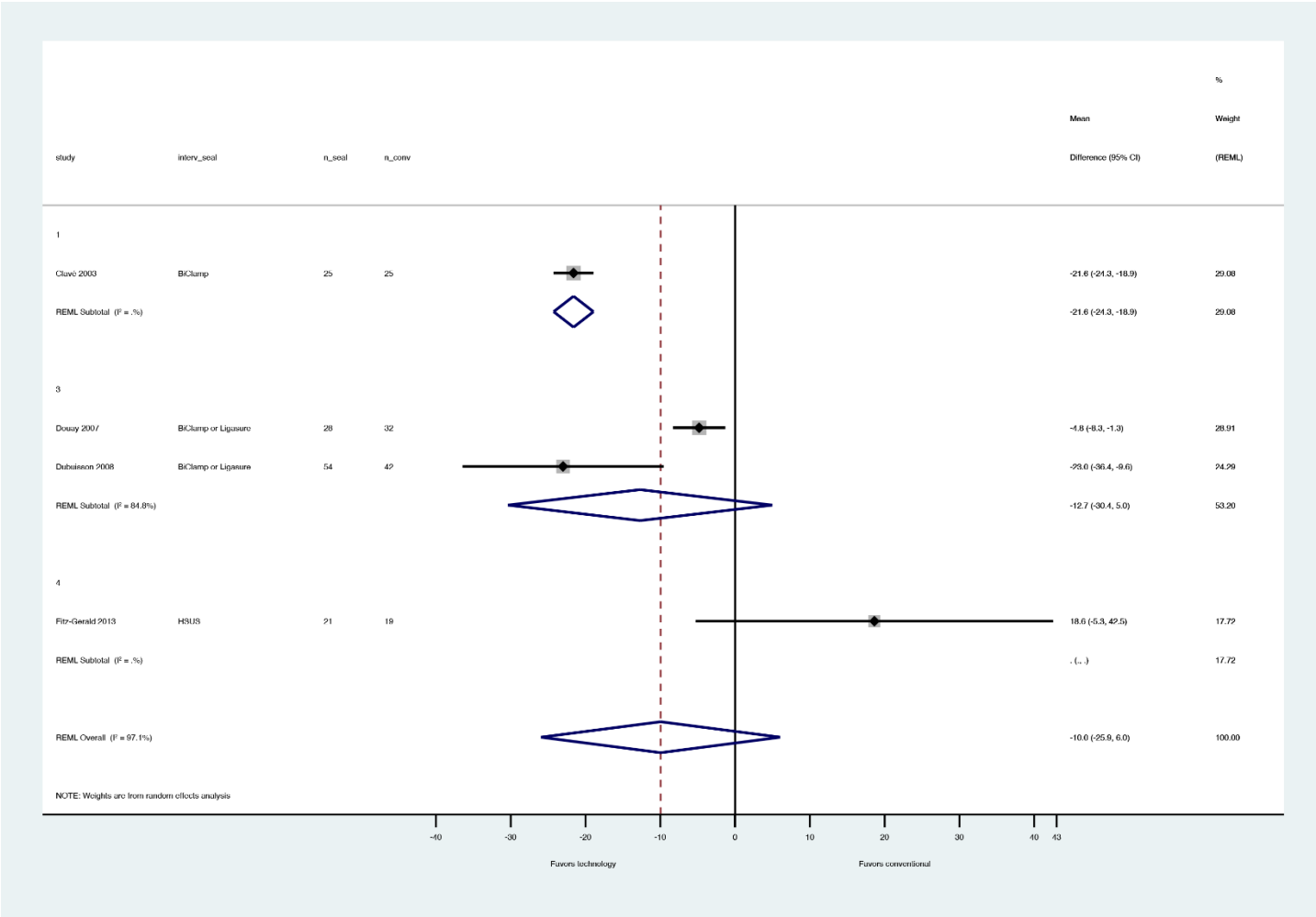


Appendix 8. Meta-analysis of vaginal hysterectomy visual analog scale pain scores in studies comparing pedicle sealers to traditional suture ligation. POD,postoperative day



Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143. The authors provided this information as a supplement to their article.
©2024 American College of Obstetricians and Gynecologists.

Appendix 9-. Meta-analysis of vaginal hysterectomy narcotic use (morphine milligram equivalents) in studies comparing pedicle sealers to traditional suture ligation



Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143. The authors provided this information as a supplement to their article.
©2024 American College of Obstetricians and Gynecologists.

Appendix 10. Evidence Profile for Pedicle Sealer Compared With Traditional Suture

Outcome*	Studies (Total n); Design	Methodologic Limitations	Indirectness	Imprecision	Inconsistency	Other Issues	Certainty of evidence	Summary of findings MD (95% CI)
Surgical time (min)	15 (1201) RCT NRCS	No limitations	Direct	Precise	Consistent	None	High	-15.9 (-23.3, -8.5)
Blood loss (mL)	12 (815) RCT NRCS	No limitations	Direct	Precise	Consistent	None	Moderate	-36.9 (-56.9, -17.0)
Length of hospital stay (d)	14 (1268) RCT NRCS	Serious [†]	Direct	Precise	Consistent	None	Moderate	-0.2 (-0.4, -0.1)
Postoperative pain (VAS)	9 (713) RCT NRCS	Serious [‡]	Direct	Precise	Consistent	None	Moderate	-1.4 (-1.7, -1.1)
Postoperative narcotic use (MME)	4 (246) RCT NRCS	Very serious [§]	Direct	Imprecise	Consistent	None	Fair	-10.0 (-25.9, 6.0)

MD – mean difference; CI – confidence interval; RCT – randomized controlled trial; NRCS – non-randomized comparative study; VAS – visual analog scale; MME – morphine milligram equivalents

Balance of benefits and harms: comparing pedicle sealers (Ligasure, BiClamp, Harmonic Scalpel, Thermostapler) to traditional clamping, cutting, and suture ligation in a population of women undergoing vaginal hysterectomy, pedicle sealers reduced surgical time (high quality evidence) with less reported blood loss (moderate quality evidence). Given overall effect sizes, there does not appear to be any net benefits for one method over the other with regards to length of hospital stay (moderate quality evidence), post-operative pain (moderate quality evidence), or analgesic use (fair quality evidence).

*All outcomes were of high importance

[†]Risk of bias from randomization, allocation concealment, blinding, selective reporting, and other biases

[‡]Risk of bias from randomization, allocation concealment, blinding, representativeness of cases, and other biases

[§]Risk of bias from article discrepancy, allocation concealment, blinding, representativeness of cases, and other biases

Appendix 11. Study Characteristics and Outcomes of Comparative and Single-Arm, Nonrobotic vNOTES Hysterectomy Studies

Study/Design	Study Population (n)	Age (y)	BMI (kg/m ²)	Parity	Operative Time (min)	Blood Loss (mL)	Length of Stay (d)	Complications (n)	Uterine weight (g)
Merlier et al 2022 ⁵⁵ France Retrospective NRCS	Women undergoing vNOTES (n=50) or conventional (n=50) vaginal hysterectomy (VH)	vNOTES: 48.6±7.4 VH: 49.5±8.5	vNOTES: 27.5±6.4 VH: 25.6±5.2	vNOTES: 2.0(0-5)* VH: 2.0(0-5)*	vNOTES: 81(33-229)* VH: 70.5(32-158)*	vNOTES: 10(10-600)* VH: 10(10-900)*	vNOTES: 0(0-3)* VH: 1(0-4)*	vNOTES: Conversion to laparoscopy (1) Laparoscopic gas pain (1) VH: UTI (2) Readmission (2) Vaginal hematoma (1)	vNOTES: 156 (36-1428)* VH: 154 (24-743)*
Lee et al 2019 ⁵⁶ Taiwan Retrospective NRCS	Female-to-male transsexuals undergoing vNOTES (n=14) or conventional (n=42) vaginal hysterectomy (VH)	vNOTES: 28.8±7.3 VH: 29.3±6.4	vNOTES: 24.3±5.0 VH: 23.7±4.4	vNOTES: 0 (0) VH: 0 (0)	vNOTES: 144.3±51.7 VH: 149.2±47.1	vNOTES: 200 (100-388) [†] VH: 150 (100-150) [†]	vNOTES: 7.7±2.4 VH: 7.1±3.1	vNOTES: Postoperative vaginal bleeding (1) Reoperation (1) Readmission (1) VH: Postoperative internal bleeding (2) Postoperative vaginal bleeding (2) Pelvic abscess (2) Bacteremia (1) Reoperation (2) Readmission (1)	NR
Kim et al 2021 ⁵⁷ South Korea Prospective Single Arm	Patients undergoing vNOTES hysterectomy (n=34)	47.5 (38-73)*	22.5 (18.2-30)*	NR	85.5 (43-132)*	100 (20-500)*	3(2-8)*	Conversion to laparoscopy (2) Bladder injury (2) Postoperative bleeding (1) Postoperative infection (1)	180 (50-670)*

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143. The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

								Readmission (1)	
Zhang 2021 ⁵⁸ China Prospective Single Arm	Patients with benign uterine disease, atypical hyperplasia of endometrium or cervical intraepithelial neoplasia undergoing transvaginal NOTES hysterectomy (n=30)	51.4±4.6	23.4±1.5	1.17±0.38	95.9±14.6	52.5±19.2	3.1±1.4	None	80±35.5
Park et al 2021 ⁵⁹ South Korea Prospective Single Arm	Women who required hysterectomy for benign uterine disease or abnormal uterine bleeding (n=13)	54 (35-77)*	23.8 (21.3-27.6)*	P0:1(7.7) P1:3(23.1) P2:6(46.2) ≥P3:3(23.1)	55 (25-105)*	100 (0-650)*	4(4-4)*	Bleeding (1) Surgical site infection (1) Vaginal laceration (4)	238 (40.8-940)*
Karkia et al 2019 ⁶⁰ UK Prospective Single Arm	All women with benign uterine pathology or grade one stage one endometrial cancer suitable for hysterectomy (n=33)	50 (35-75) [‡]	30.0 (20.0-53.0) [‡]	NR	68.5(43-110) [‡]	269 (50-1200) [‡]	1.4 (1.0-2.0) [‡]	Readmission (2)	NR
Baeklandt et al 2019 ⁶¹ Belgium Prospective Single Arm	Women scheduled to undergo hysterectomy for benign disease (n=35)	46(24-65)*	26(18-44)*	NR	41±22	NR	0.8±0.77	Bladder injury (1) Postoperative infection (1) Readmission (1)	206 (44-788)*
Baeklandt et al 2015 ⁶² Belgium Prospective Single Arm	Patients undergoing total vaginal NOTES hysterectomy for benign gynecologic disease (n=10: 5 nulliparous and 5 parous women)	48.4 (34-61) [‡]	25.1 (19.7-33.3) [‡]	NA	97 (60-120) [‡]	NA	NA	Cystitis (1) Hematoma (1)	132.3 (51-353) [‡]
Lee et al 2014 ⁶³ China Prospective Single Arm	Patients scheduled for laparoscopic hysterectomy undergoing transvaginal NOTES hysterectomy (n=137)	46.0±0.4 [§]	24.7±0.4 [§]	P0: 8(5.8) >P1:129 (94.2)	88.2±4.1 [§]	257.7±23.9 [§]	2.8±0.1 [§]	Conversion to laparoscopy (7) Bladder injury (1) Hemorrhage (1) UTI (1) Readmission (1) Transfusion (10)	450±24.1 [§]

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Kaya et al 2022 ⁶⁴ Turkey Unclear Single Arm	Obese (BMI>30) undergoing vaginal hysterectomy for benign gynecological conditions (n=48)	52(40-74) [‡]	31.9 (30-54.6) [‡]	3 (0-9) [‡]	67.5 (35-170) [‡]	NR	NR	Transfusion (7)	230 (100-815) [‡]
Kaya et al 2022 ⁶⁵ Turkey Retrospective Single Arm	Women with enlarged (>280 g) and undescended uteri undergoing vNOTES hysterectomy (n=30)	47.5 (40-55) [*]	28.2 (21.1-48) [*]	2(1-7) [*]	45 (35-120) [*]	NR	NR	Transfusion (2)	365 (280-815) [*]
Badiglian-Filho 2021 ⁶⁶ Brazil Retrospective Single Arm	Patients undergoing hysterectomy with adnexectomy for benign disease (n=21)	47.2±11.1	27.2±4.4	P0: 10(47.6) P1: 5 (23.8) P2: 3 (14.3) P3: 2 (9.5) P4: 1 (4.8)	111.9 (80-180) [§]	NR	1 (all patients)	None	129.1±88.0
Basol et al 2021 ⁶⁷ Turkey Retrospective Single Arm	Patients undergoing vNOTES hysterectomy (n=20)	49.9±5.3	27±4.4	2.9±1.1.	58.5±14.2	NR	NR	Conversion to vaginal hysterectomy (1)	NR
Nulens et al 2021 ⁶⁸ Belgium Retrospective Single Arm	Patients undergoing vNOTES hysterectomy for benign gynecologic disease with uterine weight > 280 g (n= 114)	50.7±3.5	26.5±5.5	NA	63±34	NR	NR	Conversion to laparotomy (1) Hemorrhage (2) Vaginal bleeding (1) Reoperation (1)	560±426
Nulens et al 2021 ⁶⁹ Belgium Retrospective Single Arm	Patients undergoing vNOTES hysterectomy after prior vNOTES adnexectomy or cystectomy (n=11)	49 (44-65) [*]	23.4 (17.5-31.6) [*]	2 (0-2) [*]	42 (31-100) [*]	NA	2 (1-4) [*]	Cystitis (2)	99
Kaya et al 2021 ⁷⁰ Turkey	Patients undergoing vNOTES hysterectomy for various gynecological indications (n=30)	51.6±7.3	31.4±8.2	2.57±1.7	79.6±32.5	NR	44±16.5	Transfusion (2)	NR

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Retrospective Single Arm									
Chen et al 2020 ⁷¹ China Retrospective Single Arm	Women with benign uterine conditions undergoing vNOTES hysterectomy (n=30)	49.4±5.1	24.3±3.9	NA	150±41	54±15	3.2±0.8	Total (5)	165±36
Puisungnoen et al 2020 ⁷² Thailand Retrospective Single Arm	Patients undergoing NOTES-assisted vaginal hysterectomy for nonprolapsed uterus and benign gynecological disease (n=50)	47.3±6.7	24.7±4.4	17(34)	146.0±57.9	300(450) [†]	2.5±0.8	Transfusion (3)	150(138) [†]
Wang et al 2020 ⁷³ China Retrospective Single Arm	Women undergoing vNOTES hysterectomy for benign indications with uterus ≥1 kg (n=39)	48(42-66) [‡]	24 (18.4-38) [‡]	NR	123.3 (40-400) [‡]	206.7 (10-1300) [‡]	2.4(1-11) [§]	Conversion to laparoscopy (3) Transfusion (2) Ureteral injury (1)	1141.8 (1000-1720) [‡]
Yang et al 2020 ⁷⁴ Taiwan Retrospective Single Arm	Patients undergoing vNOTES hysterectomy for nonprolapsed and benign uterine disease (n=20)	45.6±4.4	22.5±2.4	P0: 0(0) P1: 4(20) P2: 11(55) ≥P3: 5(25)	129.3±39	53.5±74.9	4.05±0.5	None	219.9±148.4
Lauterbach et al 2020 ⁷⁵ Israel Retrospective Single Arm	First 25 patients undergoing vNOTES hysterectomy due to menorrhagia and endometrial hyperplasia (n=25)	64.5 (35-74) [*]	27.5 (21-38.5) [*]	4 (1-6) [*]	38 (30-49) [*]	55(20-200) [*]	2 (all patients)	Readmission (1)	NR
Wang et al 2019 ⁷⁶ Taiwan Retrospective Single Arm	Women undergoing vNOTES hysterectomy (n=240)	46.6±4.9	24.2±3.8	2.3±0.9	76.5±22.4	167.1±144.5	2.1±0.4	Conversion to laparoscopy (1) Transfusion (13) Hemorrhage (2) Bladder injury (1)	409.9±195
Yantapant et al 2019 ⁷⁷ Thailand Retrospective	Patients fulfilling indications for hysterectomy (n=1)2	44.6±6.1	24.6±5.0	NR	147.9±62.4	291.7±214.9	2 (2-3) [*]	Transfusion (1) Stump infection (1) Readmission (1)	238.8±169.7

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Single Arm									
Su et al 2018 ⁷⁸ Taiwan Retrospective Single Arm	Women undergoing NOTES subtotal hysterectomy for benign uterine conditions (n=10)	44.5±3.6	28.9±7.1	1.5±1.0	106.7±40	250±120.2	2.2±0.5	Transfusion (1)	452.2±227.8
Temtana-kitpaisan et al 2018 ⁷⁹ Taiwan Retrospective Single Arm	Patients undergoing vNOTES hysterectomy (n=275) Uterine weight <500g (n=191), 500-999 g (n=67), ≥1000 g (n=17)	<500 g: 48.7±6.6 500-999g: 47.2±3.8 ≥1000 g: 46.5±3.0	<500 g: 23.5 (21.1, 26.4) [†] 500-999g: 24.6 (22.8, 27.0) [†] ≥ 1000 g: 32.1 (22.1, 28.5) [†]	<500 g: 2 (2,3) [†] 500-999g: 2 (2,3) [†] ≥1000 g: 2 (2,2) [†]	<500 g: 76.7±0.68 [§] 500-999g: 99.9±1.1 [§] ≥1000 g: 152.9±3.4 [§]	<500 g: 180.9±4.6 [§] 500-999g: 342.6±7.0 [§] ≥1000 g: 532.4±11.9 [§]	<500 g: 1.3±0.01 [§] 500-999g: 1.4±0.01 [§] ≥1000g: 1.5±0.02 [§]	Bleeding (4) Pelvic infection (3) Bladder injury (2)	NR
Kim et al 2018 ⁸⁰ South Korea Retrospective Single Arm	Patients undergoing NOTES-assisted vaginal hysterectomy (n=40)	47.3±6.1	24.3±2.6	2 (0-3) [*]	75.4±25.1	NR	5.3(4-7) [*]	Conversion to another route (1)	278.3±168.9
Wang et al 2015 ⁸¹ Taiwan Retrospective Single Arm	Women undergoing transvaginal natural orifice transluminal endoscopic hysterectomy (n=147). Uterine weight ≤ 350 g (n=62), 351-500 g (n=45), >500 g (n=40)	46.1±4.7	24.5±3.8	NA	≤ 350 g: 68.4±24.7 351-500 g: 79±23.3 >500 g: 87±23.5	≤ 350 g: 136.9±123.3 351-500 g: 221.3±285.5 >500 g: 243.8±165.7	≤ 350 g: 2.1±0.5 351-500g: 2.1±0.4 >500 g: 2.1±0.5	Reoperation (1) Bladder injury (1) Transfusion (9)	397.2±182.3
Yang et al 2014 ⁸² South Korea Retrospective Single Arm	Women undergoing NOTES-assisted vaginal hysterectomy for benign uterine disease (n=16)	47.3±4.6	23.8±2.3	2 (0-3) [*]	70.6±12.8	201.8±127	3.5(3-5) [*]	None	299.4±186
Lee et al 2012 ⁸³ Taiwan Unclear	Patients eligible for laparoscopic hysterectomy for benign uterine disease (n=10)	47.4±4.3	23.7±3.5	2.4±0.7	93.4±6.3	245±54.0	2.7±0.3	None	440.1±76.5

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Single Arm									
Su et al 2012 ⁸⁴ Taiwan Retrospective Single Arm	Women with benign uterine disease undergoing transvaginal NOTES hysterectomy (n=16)	47.8±1.2	24.9±4.7	1.9±0.9	122.7±17.6	379.4±95.4	2.8±0.2	Transfusion (4)	538.8±102.9

vNOTES – vaginal natural orifice transluminal endoscopic surgery; BMI – Body-Mass Index; NRCS – non-randomized comparative study; VH – vaginal hysterectomy; UTI – urinary tract infection; NR- Not Reported

Data are mean±standard deviation or n (%), unless otherwise noted

*Median (range)

†Median (IQR)

‡Mean (range)

§Mean ± SEM

|| p≤0.05

Appendix 12. Study Characteristics and Outcomes of Single Arm Nonrobotic vNOTES Adnexal Surgery Studies

Study/Design	Study Population (n)	Age (y)	BMI (kg/m ²)	Parity	Operative Time (min)	Blood Loss (mL)	Length of Stay (d)	Complications (n)	Mass Diameter (cm)
Huang et al 2021 ⁸⁵ China Retrospective	Patients undergoing unilateral vNOTES ovarian cystectomy (n=86)	30.6±7.3	21.9±3.2	NR	78.7±23.8	25.8±18.9	3.4±0.7	None	NR
Baeklandt 2018 ⁸⁶ Belgium Unclear	Patients undergoing transvaginal ovarian cystectomy (n=14)	38 (20-49)*	24.7 (19-33)*	2 (0-3)*	37 (20-60)*	NR	NR	None	4.5 (1.5-7.0)*
Jung 2021 ⁸⁷ South Korea Prospective	Patients undergoing vNOTES ovarian cystectomy (n=20)	34.2 (24-51)*	22.8 (17.7-34.3)*	NR	58.7 (32-96)*	NR	0.5 (0.1-1)*	Hematoma (1) Readmission (1)	6 (1.5-11.9)*
Su et al 2021 ⁸⁸ Taiwan Retrospective	Patients with non-endometriotic ovarian tumors undergoing transvaginal natural orifice ovarian cystectomy with fibrin glue (n=71) or suture (n=54) for hemostasis and defect repair	Glue: 32.5 (18-44) [†] Suture: 34 (20-48) [†]	Glue: 20.9 (15.7-36.8) [†] Suture: 21.2 (16.3-40.3) [†]	NR	Glue: 43.5 (29-180) [†] Suture: 40 (25-105) [†]	Glue: 20 (2-100) [†] Suture: 20 (5-300) [†]	Glue: 1(1-2) [†] Suture: 1 (1-3) [†]	None	Glue: 8(5-17) [†] Suture: 7 (5-19) [†]
Wang et al 2016 ⁸⁹ Taiwan Retrospective	Women with ovarian masses undergoing vNOTES ovarian cystectomy (n=34)	33.6±6.4	21.8 ±3.0	NR	38.1±10.2	31.6±24.1	1.4±0.6	None	7.6±1.8
Huang et al 2020 ⁹⁰ Taiwan Retrospective	Patients with adnexal tumors undergoing vNOTES ovarian cystectomy or salpingo-oophorectomy (n=136)	41.6±12.7	23.1±4.3	NR	40.8±11.7	22.8±23.6	1.5±0.7	None	7.9±2.3
Baeklandt et al 2021 ⁹¹ Belgium	Women with intact uterus with adnexal mass presumed to be benign	52±8.5	27±5.8	NR	24±8	NR	NR	Bleeding complications (4) Reoperation (1)	4.7±2.0

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143. The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Prospective	undergoing salpingo-oophorectomy (n=34)								
Li et al 2017 ⁹² Taiwan Retrospective	Women with ovarian masses undergoing vNOTES adnexectomy (n=33)	56±8.3	23.9±.9	NR	39.2±18.5	14±11.5	1.4±0.5	None	7.6±2.1
Liu et al 2020 ⁹³ China Retrospective	Patients undergoing transvaginal salpingo-oophorectomy with gasless laparoscopy (n=10)	61.7 (49-72)*	NR	NR	22.2 (11-40)*	NR	2.5 (2-4)*	None	NR
Reynders et al 2015 ⁹⁴ Belgium Retrospective	Patients undergoing adnexectomy for benign gynecologic disease (n=20)	51 (31-75)*	24 (17.2-28.7)*	NR	32 (20-50)*	NR	NR	Cystitis (1)	5.2 (3.5-11)*
Ozceltik et al 2022 ⁹⁵ Turkey Retrospective	Transgender men undergoing vaginal hysterectomy and vNOTES BSO (n=45)	27 (20-41) [†]	24.2 (17-32.5) [†]	NR	60 (30-120) [†]	NR	2 (1-7) [†]	Late-onset intra-abdominal bleeding (1) Reoperation (1)	NR
Chen 2019 ⁹⁶ China Unclear	Patients with ectopic pregnancy undergoing salpingectomy (n=12)	33 (28-42) [†]	23.47 (20.6-27.7) [†]	NR	47.5 (40-70) [†]	7.5 (2-20) [†]	NR	None	3.0 (2.1-5) [†]
Xu 2014 ⁹⁷ China Prospective	Patients undergoing salpingectomy for tubal ectopic pregnancy (n=18)	31.7±3.7	NR	NR	53.3±7.3	0	2.2±0.4	None	NR
Ozceltik et al 2022 ⁹⁸ Turkey Retrospective	Patients undergoing vNOTES salpingectomy for ectopic pregnancy (n=21)	34 (20-43) [†]	23.1 (18.9-35.4) [†]	NR	42 (22-68) [†]	25 (15-50) [†]	1(1-2) [†]	None	5 (1.7-7.5) [†]
Yassa et al 2022 ⁹⁹ Turkey Prospective	Women with nonprolapsed uteri undergoing vNOTES opportunistic bilateral	36.3±4.1	27.4±4.5	NR	17 (14.7-21.1) [†]	NR	1(1-1) [‡]	None	NR

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

	salpingectomy for sterilization (n=32)								
--	--	--	--	--	--	--	--	--	--

Abbreviations: vNOTES – vaginal natural orifice transluminal endoscopic surgery; BMI – Body-Mass Index; NR- Not Reported; BSO – bilateral salpingo-oophorectomy

Data are mean ± standard deviation, unless otherwise noted

* Mean (range)

†Median (range)

Appendix 13. Characteristics and Perioperative Outcomes of Comparative and Single Arm vNOTES Pelvic Reconstruction Studies

Study/ Design	Study Population (n)	Age (years)	BMI (kg/m ²)	Parity	Operative Time (min)	Blood Loss (mL)	Length of stay (d)	Complications	Other Outcomes
Aharoni et al 2021 ¹⁰⁰ Israel Retrospective NRCS	Women undergoing vNOTES (n=65) or conventional (n=70) uterosacral ligament suspension (CUSLS)	vNOTES: 59.9±12.0 CUSLS: 59.5±7.7	vNOTES: 29.4±5.9 CUSLS: 29.3±3.6	vNOTES: 3.4±1.7 CUSLS: 3.8±1.8	vNOTES: 101.4±22.3 CUSLS: 125.5±27.6*	NA	vNOTES: 3(2-4) [†] CUSLS: 2(2-4) ^{†*}	vNOTES: Intraoperative hemorrhage (1) Cystotomy (1) Wound complication (1) Pelvis hematoma or abscess (1) CUSLS: Ureteral obstruction (6)* Intraoperative hemorrhage (4) Cystotomy (1) Wound complication (1) UTI (3) Pelvic hematoma or abscess (1)	Uterine weight (g): vNOTES: 58±68 CUSLS: 143±87*
Liu et al 2019 ¹⁰¹ China Retrospective Single Arm	Women undergoing sacrocolpopexy for pelvic organ prolapse (n=23)	62.6±7.3	22±2.5	P1: 7(30.4) P2: 6(26.1) P3: 4(17.4) P4: 3(13) ≥P5: 3(13)	189.7±45.1	30.9±20.8	4±1.6	0	
Li et al 2022 ¹⁰² China Retrospective Single Arm	Patients with advanced apical prolapse undergoing transvaginal single-port laparoscopic sacrocolpopexy (n=46)	55±6.6	23.7±2.4	1.4±0.5	134.5±32.2	95.4±54.6	6±2.1	Readmission (1) Mesh exposure (3) Denovo SUI (1) Constipation (2) Dyspareunia (2) UTI (2) Reoperation (2) Recurrence (1)	VAS pain score: 2.4±0.9 VAS cosmetic score: 9.0±0.8
Li et al 2021 ¹⁰³ China Retrospective Single Arm	Patients with severe multi-compartment pelvic organ prolapse undergoing	62.3±6.8	24.7±2.6	1.8±0.9	132.7±28	110.7±56.3	5.64±3.01	Persistent pelvic pain (1) De novo SUI (5) Constipation (6) Dyspareunia (2)	VAS pain score: 2.9±1.2

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

	transvaginal single port sacrocolpopexy (n=93)								VAS cosmetic score: 9.2±0.6
Lowenstein et al 2021 ¹⁰⁴ Belgium Prospective Single Arm	Women undergoing vNOTES uterosacral ligament suspension for uterovaginal or vaginal apical prolapse (n=35)	55 (40-81) [†]	27.6 (21-42.6) [†]	4 (1-6) [†]	Total: 113 (89-233) [†] Hysterectomy: 38 (15-55) [†] Apical suspension: 18 (14-26) [†]	30 (20-200) [†]	2 (1-3) [†]	Readmission (1)	VAS pain 24 h: 1 (1-3) [†]
Lu et al 2021 ¹⁰⁵ China Retrospective Single Arm	Patients with severe prolapse undergoing vNOTES uterosacral ligament suspension (n=35)	53.7±11.4	24±3.3	1.6±0.8	111.7±39.4	67.9±35.8	3.7±1.1	UTI (1) Urinary retention (1) Constipation (1) De novo SUI (2) Recurrence (0) Dyspareunia (0)	NR
Lauterbach et al 2021 ¹⁰⁶ Israel Prospective Single Arm	Women undergoing hysterectomy by vNOTES and uterosacral ligament suspension for pelvic organ prolapse (n=23)	56.5±7.7	29.4±4.9	1 (0-3) [†]	NR	NR	NR	NR	NR

vNOTES – vaginal natural orifice transluminal endoscopic surgery; BMI – Body-Mass Index; NRCS – non-randomized comparative study; CUSLS – conventional uterosacral ligament suspension; UTI – urinary tract infection; SUI – stress urinary incontinence; VAS – visual analog scale; NR- Not reported

Data are mean ± standard deviation or n (%), unless otherwise noted

* p<0.05

[†]Median (range)

Appendix 14. Characteristics and Prolapse Outcomes of Comparative and Single-Arm vNOTES Pelvic Reconstruction Studies

Study/ Design	Study population (n)	Follow up (months)	POPQ point Aa (pre- vs post-operative)	POPQ point Ba (pre- vs post-operative)	POPQ point C (pre- vs post-operative)	POPQ point Ap (pre- vs post-operative)	POPQ point TVL (pre- vs post-operative)	Quality of life measures (pre- vs post-operative)	Other Outcomes (pre- vs post-operative)
Aharoni et al 2021 ¹⁰⁰ Israel Retrospective NRCS	Women undergoing vNOTES (n=65) or conventional (n=70) uterosacral ligament suspension (CUSLS)	NR	NR	NR	NR	NR	NR	NR	NR
Liu et al 2019 ¹⁰¹ Chian Retrospective Single Arm	Women undergoing sacrocolpopexy for pelvic organ prolapse (n=23)	1-14	1.4±1.7 vs -1.9±0.6*	NR	2.2±1.9 vs -6.1 ± 0.7*	NR	NR	PFIQ-7: 163.1±46.2 vs 18.4±29.3*	NR
Li et al 2022 ¹⁰² China Retrospective Single Arm	Patients with advanced apical prolapse undergoing transvaginal single-port laparoscopic sacrocolpopexy (n=46)	38.7±7.5	0±1.4 vs -2.9±0.4*	NR	2.2±2 vs -6.8±0.5*	-1.8±1.5 vs -2.9±0.4*	7.3±0.6 vs 7.4±0.6	PFDI-20: 57.8±23.3 vs 22.4±24.7* POPDI-6: 30.1±14.8 vs 8.7 ± 10.5* CRADI-8: 4.4±5 vs 3.9±6.7 UDI-6: 23.3±13.6 vs 9.8±13.9* PISQ-12: 34.1±6.6 vs 35.7±4.4	NR
Li et al 2021 ¹⁰³ China Retrospective Single Arm	Patients with severe multicompartiment pelvic organ prolapse undergoing transvaginal single port sacrocolpopexy (n=93)	8.2±6.6	2.1±1.2 vs -2.9±0.3*	NR	2.6±2.4 vs -6.9±0.7*	-0.3±1.8 vs -3.0±0.2*	7.2±0.7 vs 7.1±0.4	POPDI-6: 37.3±16.1 vs 5.5±7.6* CRADI-8: 7.2±11.1 vs 2.6±6.1* UDI-6:	NR

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143. The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

								32.3±16.0 vs 10.4±12.9* PFDI-20: 76.8±32.1 vs 18.2±20.3* PISQ-12: 34.3 ± 4.2 vs 37.2 ± 2.6*	
Lowenstein et al 2021 ¹⁰⁴ Belgium Prospective Single Arm	Women undergoing vNOTES uterosacral ligament suspension for uterovaginal or vaginal apical prolapse (n=35)	3	NR	NR	NR	NR	NR	PFDI-20: 45(26-54) vs 6(0-34) ^{†*} POP subscale: 53(32-59) vs 2 (0-11) ^{†*}	POPQ stage: Stage 0-1: 0 (0) vs 35 (100) Stage 2: 4(11) vs 0(0) Stage 3: 25(71) vs 0(0) Stage 4: 6(17) vs 0(0)
Lu et al 2021 ¹⁰⁵ China Retrospective Single Arm	Patients with severe prolapse undergoing vNOTES uterosacral ligament suspension (n=35)	3.9±3.8	0.6±1.7 vs -2.9±0.2*	1.9±2.2 vs -2.9±0.3*	1.5±2.2 vs -6.9±0.9*	-1.4±1 vs -3 ±0.1*	7.4±0.5 vs 7.2±0.4	POPDI-6: 9.9±3.5 vs 0.9±1.9* CRADI-8: 2.5±3 vs 0.7±2.1* UDI-6: 7.5±4.4 vs 1.6±2.8* PFDI-20: 19.9±6.7 vs 3.2±5.4* PISQ-12: 24.8±2.3 vs 38.3±4.1*	POPQ point Bp: -1.1 ± 1.4 vs -2.9 ± 0.1*
Lauterbach et al 2021 ¹⁰⁶ Israel Prospective Single Arm	Women undergoing hysterectomy by vNOTES and uterosacral ligament suspension for pelvic organ prolapse	12	NR	NR	NR	NR	NR	FSFI total: 22.2±1.6 vs 28.7±1.5* FSFI desire: 3.9±0.6	POPQ stage: 3(3-4) [†] vs 0(0-1) [†]

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

	(n=23)							5.3±0.5* FSFI arousal: 3.7±0.7 vs 5.5±0.7* FSFI lubrication: 3.9±0.7 vs 4.5±0.6 FSFI orgasm: 3.0±0.7 vs 3.7±0.6 FSFI satisfaction: 3.4±0.8 vs 5.4±0.8* FSFI pain: 4.2±0.3 vs 4.3±0.3	
--	--------	--	--	--	--	--	--	--	--

vNOTES – vaginal natural orifice transluminal endoscopic surgery; POPQ – pelvic organ prolapse quatification; TVL – total vaginal length; NRCS – non-randomized comparative study; CUSLS – conventional uterosacral ligament suspension NR- Not reported; PFIQ-7 – pelvic floor impact questionnaire-7; PFDI-6 – pelvic floor disability index-6; POPDI-6 – pelvic organ prolapse distress inventory-6; CRADI-8 – colorectal-anal distress inventory-8; UDI-6 – urogenital distress inventory-6; PISQ-12 – pelvic organ prolapse-urinary incontinence sexual function questionnaire-12; POP – pelvic organ prolapse; FSFI – female sexual functioning index

Data are mean ± standard deviation or n (%), unless otherwise noted

- *p≤0.05
- †Mean (range)
- *Median (range)

Appendix 15. Characteristics and Outcomes of Single-Arm Miscellaneous vNOTES Studies

Study/ Directonality	Study Population (n)	Age (y)	BMI (kg/m ²)	Parity	Operative Time (min)	Blood Loss (mL)	Length of stay (d)	Complications	Other Outcomes
Huang et al 2021 ¹⁰⁷ China Retrospective	Patients undergoing vNOTES resection of posterior uterine myomas (n=17)	38.7±7.7	22±2.0	0.9±0.5	107.5±34.2	101.2±109	3.2±0.4	Conversion to laparoscopy (1)	Myoma weight (g): 183.9±144.3 Pre- to postoperative hemoglobin change (g/dl): -1.4±0.7 VAS pain 12 h: 2±0.9 VAS pain 24 h: 1.2±0.7
Tavano et al 2021 ¹⁰⁸ Belgium Retrospective	Patients with subsequent pregnancy (n=21) after fertility- preserving vNOTES procedures (myomectomy, salpingectomy, adnexectomy, ovarian cystectomy) (n=125)	31±4.3	NR	NR	NR	NR	NR	NR	Interval to pregnancy (months): 6.1±4.7 No. of pregnancies: 26 No. pregnancies per patient: 1.2±0.4 Vaginal delivery: 15 (57.7) Vacuum delivery: 2 (7.7) TOLAC: 2 (7.7) CD: 6 (23.1)
Baeklandt et al 2021 ¹⁰⁹ Belgium Prospective	Patients undergoing vNOTES hysterectomy (n=750) or other procedures (adnexal surgery, salpingectomy, ovarian cystectomy, myomectomy, appendectomy, omentectomy, adhesiolysis) (n=270)	46 (22-83)* All patients	26 (165-52)* All patients	NR	Hysterectomy: 46 (20-25)* Other: 33 (14-150)*	NR	NR	Hysterectomy: Conversion to laparotomy (1) Cystotomy (9) Transfusion (1) Cystitis (6) Hematoma (5) Wound infection (2) Other: Conversion to laparoscopy (3) Cystitis (1)	Uterine weight (g): 172 (20-3361)*

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Baeklandt et al 2016 ¹¹⁰ Belgium Retrospective	Patients undergoing VANH (n=77) or adnexal surgery (n=33)	VANH: 51 (34-73)* Adnexal surgery: 51 (22-82)*	VANH: 25.4 (18.4-36.7)* Adnexal surgery: 23.8 (17.9-33.6)*	NR	VANH: 56 (40-120)* Adnexal surgery: 25.5 (20-120)*	NR	NR	Cystitis (7)	VANH: Uterine weight (g): 155.9 (25-642)* Pre- to postoperative hemoglobin drop (g/dL): 1.5 (-0.6-4.2)* VAS pain 6h: 2.3(1-6)* VAS pain 24h: 1.8(1-7)* Adnexal surgery: Adnexal mass size (mm): 45.5 (15-110)* VAS pain 6h: 1.8(0-5)* VAS pain 24h: 1.6 (1-2)*
---	---	---	---	----	---	----	----	--------------	--

Abbreviations: vNOTES – vaginal natural orifice transluminal endoscopic surgery; BMI – Body-mass index; VAS – visual analog score; NR – not recorded; VANH – vaginally-assisted NOTES hysterectomy; TOLAC – trial of labor after Cesarean; CD – Cesarean delivery;

Data are mean ± standard deviation or n (%), unless otherwise noted

* Mean (range)

Appendix 16. Characteristics and Outcomes of Comparative and Single-Arm Robotic vNOTES Studies

Study and Design	Study Population (n)	Age (y)	BMI (kg/m ²)	Parity	Operative Time (min)	Blood Loss (mL)	Length of stay (d)	Complications (n)	Uterine weight (g)
Koythong et al 2021 ¹¹¹ USA Retrospective NRCS	Women undergoing RvNOTES (n=35) or conventional vNOTES hysterectomy (n=79) for benign gynecologic conditions	RvNOTES: 41 (38-46)* CV: 44 (39-49)* [†]	RvNOTES: 28 (25-34)* CV: 30 (25-34)*	NR	RvNOTES: 157 (123-180)* CV: 143 (114-181)*	RvNOTES: 50 (30-100)* CV: 50 (25-150)*	RvNOTES: 0 (0-1)* CV: (0 (0-1)*	RvNOTES UTI (3) Cystotomy (1) Surgical site infection (1) Reoperation (1) CV: Conversion to laparoscopy (5) Conversion to laparotomy (1) UTI (4) Urinary retention(2) Transfusion (1) Readmission (3) Pelvic abscess (1) Cystotomy (1) Reoperation (1) Groin pain (1) Stroke (1) Pneumonia (1)	RvNOTES: 100 (79-229)* CV: 175 (92-393)*
Yang et al 2020 ¹¹² South Korea Prospective Single Arm	Patients with benign uterine disease undergoing RvNOTES hysterectomy (n=13)	46.7±4.8	24.1±3.5	2 (0-3) [†]	165 (120-250) [†] Console time: 135 (92-215) [†] Docking time: 15(5-25) [†]	50 (20-450) [†]	3 (3-4) [†]	None	290 (115-892) [†]
Liu et al 2022 ¹¹³ USA Retrospective Single Arm	Patients undergoing RvNOTES hysterectomy for benign gynaecological diseases (n=84)	42 (25-69) [†]	28.16 (17.5-46.9) [†]	2 (0-5) [†]	77.27±2.89 Docking time: 4(2-18) [†]	50 (25-500) [†]	0(0-2) [†]	Conversion to laparoscopy (2) UTI (7) Pneumonia (1) Cuff granulation (1) Cuff cellulitis (1) Bladder injury (1)	136.5 (40-1420) [†]

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. *Obstet Gynecol* 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Lowenstein et al 2021 ¹¹⁴ Israel Prospective Single Arm	Women undergoing benign hysterectomy with RvNOTES (n=30)	59 (37-79) [‡]	25.4 (17.6-40) [‡]	2(0-10) [‡]	57 (24-88) [‡]	50(20-400) [‡]	3 (2-8) [‡]	UTI (3)	NR
Baeklandt et al 2016 ¹¹⁵ Retrospective Single Arm	Patients undergoing robotic transvaginal vNOTES hysterectomy (10 RTVNH, 10 RVANH)	RTVNH: 49 (40-73) [§] RVANH: 63 (46-84) [§]	RTVNH: 26.4 (20.5-40.2) [§] RVANH: 27.8 (21.2-37.9) [§]	NR	RTVHN: 118 (75-165) [§] RVANH: 90 (56-120) [§]	NR	NR	RVANH: superficial thrombophlebitis (1)	RTVNH: 149 (21-518) [§] RVANH: 213 (70-575) [§]
Lowenstein et al 2020 ¹¹⁶ Israel Prospective Single Arm	Women undergoing BSO by RvNOTES (n=8)	64 (50-70) [‡]	24 (19-30) [‡]	3 (0-5) [‡]	45 (38-91) [‡] Docking time: 5(1-28) [‡]	10 (10-50) [‡]	1 (1-2) [‡]	None	NR
Zhang et al 2021 ¹¹⁷ China Retrospective Single Arm	Patients with endometriosis undergoing RvNOTES total hysterectomy with resection of endometriosis (n=33)	39.3±5.4	27.7±6.5	NR	141.9±40.2 Docking time: 7.1±15.8	52.3±33.8	1.2±0.4	UTI (2) Pneumonia (1)	NR
Yang et al 2021 ¹¹⁸ South Korea Retrospective Single Arm	Patients undergoing RvNOTES hysterectomy (n=14)	47 (30-59) [‡]	22.3 (20.5-29.2) [‡]	2 (1-3) [‡]	160 (110-240) [‡] Docking time: 11.5 (5-20) [‡]	75 (20-600) [‡]	2 (2-4) [‡]	None	259 (115-923.5) [‡]

NRCS – non-randomized comparative study; vNOTES – vaginal natural orifice transluminal endoscopic surgery; RvNOTES – robotic-assisted vaginal natural orifice transluminal endoscopic surgery; CV – conventional; UTI – urinary tract infection; NR – not reported; RTVNH – robotic total vaginal NOTES hysterectomy; RVANH – robotic vaginally assisted NOTES hysterectomy; BSO – bilateral salpingo-oophorectomy

Data are mean±standard deviation, unless otherwise noted

* Median (IQR)

[†]p ≤ 0.05

[‡] Median (range)

[§]Mean (range)

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Appendix 17. Characteristics and Perioperative Outcomes of Comparative and Single-Arm Suture Capture Studies for Pelvic Reconstruction

Study and Design (Quality)	Study Population (n)	Age (y)	BMI (kg/m ²)	Parity	Operative Time (min)	Blood Loss (mL)	Length of stay (d)	Complications (n)
Plair et al 2022 ¹¹⁹ USA RCT (A)	Women undergoing native-tissue pelvic organ prolapse repair with sacrospinous colpopexy with Anchorsure® (AS) (n=24) or Capio™ (n=23)	AS: 71.2±8.4 Capio™: 71.0±10.9	AS: 29.4±6.4 Capio™: 29.7±6.6	AS: 3* Capio™: 3*	NR	NR	NR	Capio™: Surgical site infection (1)
McKenzie et al 2022 ¹²⁰ USA RCT (B)	Women undergoing sacrospinous colpopexy with Anchorsure® (AS) (n=21) or Capio™ (n=22)	AS: 68.7±8.8 Capio™: 70.1±10.7	AS: 29.9±6.6 Capio™: 30.1±6.4	NR	NR	NR	NR	Total complications: UTI (7)
Pandeva et al 2018 ¹²¹ UK Prospective NRCS (B)	Women undergoing sacrospinous colpopexy or hysteropexy with Capio™ (n=40) or Miya Hook (n=63)	Capio™: 67±7 Miya: 66.6±12.1	Capio™: 24.9±3.8 Miya: 29.6±5.3 [†]	Capio™: 2.5±1.0 Miya: 2±1.2	Capio™: 67.7 (26.2) [‡] Miya: 66.48 (22.7) [‡]	NR	Capio™: 1.8±0.39 Miya: 1.9±0.28	NR
Marciekiewicz et al 2008 ¹²² Sweden Retro-spective NRCS (C)	Women undergoing vaginal sacrospinous colpopexy for vaginal vault prolapse with Shutt® (n=20), Deschamps (n=31), or needle holder (n=22)	Shutt®: 68 (43-88) [§] Deschamps: 65 (47-86) [§] Holder: 66 (42-89) [§]	Shutt®: 28(23-36.4) [§] Deschamps: 26.9 (21-35.2) [§] Holder: 26.5 (22.8-30.2) [§]	Shutt®: 2.2 (0-4) [§] Deschamps: 2.4 (0-6) [§] Holder: 2.5 (1-4) [§]	Shutt®: 58.5 (30-123) [§] Deschamps: 64.3 (37-137) [§] Holder: 63.5 (24-88) [§]	Shutt®: 49.8 (0-250) [§] Deschamps: 64.8 (0-400) [§] Holder: 25.7 (0-150) [§]	NR	Shutt®: Reoperation (1) Transfusion (1) Deschamps: Bowel injury (1) Transfusion (1) Holder: Bladder injury (1)
Chang et al 2006 ¹²³ Taiwan Retrospective NRCS (C)	Patients undergoing sacrospinous colpopexy for uterovaginal or posthysterectomy vaginal vault prolapse with Veronikis ligature carrier™ (VLC) (n=20) or needle holder (n=15)	VLC: 71 (42-83) [§] Holder: 66 (48-82) [§]	VLC: 24.4 (21.6-32.9) [§] Holder: 25.5 (18.1-34.2) [§]	VLC: 4.0 (3-7) [§] Holder: 5.0 (2-7) [§]	VLC: 35 (25-40) Holder: 75 (45-128) ^{§†}	VLC: 100(50-100) [§] Holder: 100(40-250) [§]	VLC: 6(5-7) [§] Holder: 7(5-9) [§]	None
Leone-Roberti et al 2013 ¹²⁴ Italy Prospective NRCS (B)	Patients undergoing vaginal vault prolapse repair with Capio™ (n=44) or traditional suture (n=42)	Capio™: 61.4±7.3 Suture: 60.7±84	Capio™: 25±1.1 Suture: 24.4±2.0	Capio™: 2(1-6) Suture: 2(1-5) [§]	Capio™: 71.7±24.5 Suture: 105.5±31.5*	Capio™: 98±40 Suture: 159.8±82.4*	NR	Capio™: UTI (3) Suture: Transfusion (1) Hematoma (2) UTI (4)

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Campbell et al 2018 ¹²⁵ Sweden Retrospective NRCS (B)	Patients undergoing vaginal vault prolapse repair with Capio™ or Fixt™ (n=353) or traditional suture (n=195)	Device: 67.6±11.2 Suture: 65.8±10.1*	Device: 26.2±3.6 Suture: 25.8±3.5	NR	NR	NR	Device: 1.3±0.9 Suture: 2.0±1.3*	Device: Readmission: 17 (5.1) Reoperation for complication or recurrence: 26 (7.4) Suture: Readmission: 6 (3.1) Reoperation for complication or recurrence: 26 7(3.6)
Unger et al 2014 ¹²⁶ USA Retrospective Single Arm	Women undergoing sacrospinous ligament colpopexy for vaginal apex prolapse with Capio™ (n=242)	66±10	28.7±5.4	3 (0-9) [§]	NR	NR	NR	NR
Vaudano et al 2015 ¹²⁷ Italy Retrospective Single Arm	Women undergoing unilateral or bilateral sacrospinous fixation for vaginal vault prolapse with Capio™ (n=47)	74 (50-84) [§]	27 (17.6-34.7) [§]	NR	NR	NR	2.5 (2-11) [§]	Pararectal abscess (1) Bilateral ureteral obstruction (1) Neuropathy (9)
Hamdy et al 2019 ¹²⁸ Egypt Prospective Single Arm	Women undergoing sacrospinous ligament fixation with Capio™ (n=60)	45.7(28-65)	NR	NR	NR	NR	NR	Granulation tissue: 21 (35.0) Bleeding: 9 (15.0) Discharge: 15 (25.0) Deep-seated pain: 9(18.8) Deep dyspareunia: 7 (11.6) Exposed suture/erosion: 8(35.0) Asymptomatic erosion: 6 (12.5)
Mowat et al 2018 ¹²⁹ Australia	Patients undergoing unilateral sacrospinous colpopexy with Capio™ (n=51)	66.1±8.9	27.6±3.9	3 (2-3) [¶]	6.9±2	NR	NR	NR

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Prospective Single Arm								
Weintraub et al 2017 ¹³⁰ Israel Prospective Single Arm	Patients with POPQ stage 3 centro- apical prolapse undergoing transvaginal sacrospinous ligament fixation with NeuGuide™ (n=10)	63.8±12	27.1±3.7	2 (1-3) [§]	NR	NR	NR	Denovo urge urinary incontinence (1)
Rogers et al 2001 ¹³¹ Australia Retrospective Single Arm	Patients undergoing transvaginal sacrospinous colpopexy with Endo Stitch™ (n=168)	NR	NR	NR	NR	NR	NR	Pararectal hematoma (1) Pudendal nerve injury (1)
Rouzier et al 1997 ¹³² France Prospective Single Arm	Patients undergoing vaginal prolapse repair with Endo Stitch™ for bladder neck suspension and/or sacrospinous ligament fixation (n=20)	58 (43-73)	NR	3(1-11)	NR	NR	NR	Cystotomy (2) Hemorrhage (1) Urinary retention (1) Surgical wound infection (1) Recurrent stage 2 cystocele (1) Recurrent prolapse requiring repeat operation: (2)
Veronikis et al 1997 ¹³³ USA Unclear Single Arm	Patients undergoing transvaginal sacrospinous colpopexy with Veronikis ligature carrier™ (n=71)	NR	NR	NR	NR	NR	NR	0
Chou et al 2010 ¹³⁴ Taiwan Retrospective Single Arm	Patients with uterovaginal or post- hysterectomy vaginal vault prolapse undergoing sacrospinous fixation with Veronikis ligature carrier™ (n=76)	63 (40-88) [§]	NR	3 (1-7)	34 (20-55)	79 (50-400)	5 (2-9)	Postoperative gluteal pain (1)
Leone-Roberti et al 2012 ¹³⁵ Italy Prospective Single Arm	Women with paravaginal defects, anterior wall prolapse, and uterine prolapse undergoing vPVR with Capio™ (n=36)	67.5(48-78) [§]	24 (20.3-29.6) [§]	2 (0-6) [§]	12.9 (11-18) [§]	35 (20-65) [§]	3.3±0.5	UTI (2)

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

BMI – body-mass index; RCT – randomized controlled trial; NR – not reported; NRCS – non-randomized comparative study; UTI – urinary tract infection;
Data are mean±standard deviation or n (%), unless otherwise noted

- *Median
- †p≤0.05
- ‡Median (standard deviation)
- §Median (range)
- ||Mean (range)
- ¶Median (IQR)

Appendix 18. Prolapse and Gluteal Pain Outcomes of Comparative and Single-Arm Suture Capture Studies for Pelvic Reconstruction

Study and Design (Quality)	Study Population (n)	Follow-up length (months)	Procedure Success	Prolapse recurrence	Quality of life outcomes	Gluteal/Buttock/Posterior thigh pain	Other Outcomes
Plair et al 2022 ¹¹⁹ USA RCT (A)	Women undergoing native-tissue pelvic organ prolapse repair with sacrospinous colpopexy with Anchorsure® (AS) (n=24) or Capiro™ (n=23)	1.5	NR	Apical failure: AS: 0 Capiro™: 0	NR	Baseline to postoperative day 1 change in gluteal and posterior thigh pain: AS: 2.3±2.7 Capiro™: 2.3±3.0 Baseline to week 1 change in gluteal and posterior thigh pain: AS: 2.7±2.8 Capiro™: 3.1±3.3 Baseline to week 6 change in gluteal and posterior thigh pain: AS: -0.2±1.2 Capiro™: -0.1±1.7	Total MME taken 1 st week after discharge: AS: 10 (0-22.5)* Capiro™: 35 (0-60)* Total MME taken daily 1 st week after discharge: AS: 1.3 (0-8.6)* Capiro™: 5 (0-7.5)*
McKenzie et al 2022 ¹²⁰ USA RCT (B)	Women undergoing sacrospinous colpopexy with Anchorsure® (AS) (n=21) or Capiro™ (n=22)	15.4±4.3	NR	Anatomic failure: AS: 0 Capiro™: 0 Subjective failure: AS: 2 (9.5) Capiro™: 0	PFIQ change pre- to postoperative AS: -40.6±62.4 Capiro™: -26.4±65.7 PFDI-20 change pre- to postoperative AS: -71±45.5 Capiro™: -66.3±64.4	Persistent gluteal and posterior thigh pain from baseline AS: -0.2±0.9 Capiro™: -0.5±1.6	POPQ point C: AS: -7.6±1.3 Capiro™: -7.8±1.3 POPQ TVL: AS: 8.6±0.9 Capiro™: 8.8±1 POPQ stage: AS: 0.9±0.8 Capiro™: 0.8(0.9)
Pandeva et al 2018 ¹²¹ UK Prospective NRCS (B)	Women undergoing sacrospinous colpopexy or hysteropexy with Capiro™ (n=40) or Miya Hook (n=63)	Capiro™: 14±3.1 Miya: 16.9±7.8		Apical failure: Capiro™: 1 (2.5) Miya: 2 (3.0) Reoperation: Capiro™: 3 (7.5) Miya: 6 (9.5)	Postoperative ICIQ-VS Capiro™: 4±7 Miya: 4.9±6 Postoperative ICIQ-SM Capiro™: 5.3±8 Miya: 8.8±11 Postoperative QoL Capiro™: 1.6±3	NR	NR

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

					Miya: 1.4±2		
Marciekiewicz et al 2008 ¹²² Sweden Retrospective NRCS (C)	Women undergoing vaginal sacrospinous colpopexy for vaginal vault prolapse with Shutt® (n=20), Deschamps (n=31), or needle holder (n=22)	Shutt®: 37.4(13-80) [†] Deschamps: 40.3(7-108) [†] Needle: 38.8(10-94) [†]	NR	NR	Satisfaction with surgery Shutt®: 16 (80.0) Deschamps: 16 (84.0) Needle Holder: 19 (87.0)	NR	NR
Chang et al 2006 ¹²³ Taiwan Retrospective NRCS (C)	Patients undergoing sacrospinous colpopexy for uterovaginal or post-hysterectomy vaginal vault prolapse with Veronikis ligature carrier™ (VLC) (n=20) or needle holder (NH) (n=15)	>24	NR	VLC: Recurrent cystocele (1) NH: Recurrent rectal prolapse (1)	NR	NH: postoperative buttock soreness resolved by 6 weeks (1)	NR
Leone-Roberti et al 2013 ¹²⁴ Italy Prospective NRCS (B)	Patients undergoing vaginal vault prolapse repair with Capiro™ (n=44) or traditional suture (n=42)	36	Objective success rate Capiro™: 38 (86.4) Suture: 37 (88.1) Subjective success rate Capiro™: 44 (100.0) Suture: 39 (92.9)	NR	Capiro™ (pre- vs postoperative): UDI-6: 54.9±10.6 vs 14.7±6.7* IIQ-7: 76.8±11.3 vs 22.5±10.9* PISQ-12: 79.8±13.0 vs 38.8±14.8* Suture (pre- vs postoperative): UDI-6: 54.5±10.5 vs 15.3±6.7* IIQ-7: 79.2±11 vs 21.3±11* PISQ-12: 80.4±12.5 vs 42.3±19.1*	NR	NR
Campbell et al 2018 ¹²⁵	Patients undergoing vaginal vault prolapse repair with Capiro™ or	12	Asymptomatic at 1 year: Device:	NR	Patient satisfaction: Device: 196 (78.1)	NR	Reoperation within 1 year: Device: 26 (7.4)

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Sweden Retrospective NRCS (B)	Fixt™ (n=353) or traditional suture (n=195)		218 (71.5) Suture: 127 (78.7)		Suture: 134 (78.4)		Suture: 7 (3.6)
Unger et al 2014 ¹²⁶ USA Retrospective Single Arm	Women undergoing sacrospinous ligament colpopexy for vaginal apex prolapse with Capio™ (n=242)	1.5	NR	NR	NR	Immediate gluteal or posterior thigh pain: 134 (55.4) 6 week gluteal or posterior thigh pain: 36 (15.3) Intervention for posterior thigh/gluteal pain 5(2.1)	NR
Vaudano et al 2015 ¹²⁷ Italy Retrospective Single Arm	Women undergoing unilateral or bilateral sacrospinous fixation for vaginal vault prolapse with Capio™ (n=47)	18.5 (3-34) [†]	Procedure success: 42 (89.3)	Vault prolapse recurrence: 5 (10.6) Cystocele 15 (31.9)	NR	NR	Postsurgical TVL: 7.1±2.4
Hamdy et al 2019 ¹²⁸ Egypt Prospective Single Arm	Women undergoing sacrospinous ligament fixation with Capio™ (n=60)	24	NR	Apical failure: 3 (5.0) Anterior compartment failure: 15 (25.0)	POPIQ7 (pre- vs postoperative): 55.6±23.2 vs 12.0±21.7 [‡]	Buttock pain 3 months: 44 (73.3) Buttock pain 6 months: 10 (16.6) Suture removal: 15 (25.0)	NR
Mowat et al 2018 ¹²⁹ Australia Prospective Single Arm	Patients undergoing unilateral sacrospinous colpopexy with Capio™ (n=51)	17 (12-30) [§]	Objective success: 41 (80.0) Subjective success: 44 (86.0)	NR	ePAQ-PF (pre- vs postoperative): Vaginal symptoms: 33 (11-73) [†] vs 0(0-11) ^{†‡} Urinary symptoms: 11 (0-44) [†] vs 0(0-11) ^{†‡} Bowel symptoms: 0(0) vs 0(0)	Buttock pain at 1 week: 37 (84.1) Persistent buttock pain 6 weeks: 3 (6.8) Suture removal for buttock pain: 1 (2.3) Persistent buttock pain 12 months: 0	POPQ pre- vs postoperative: Aa: 1(0-2)* vs -1 (-2-0)* [‡] Ba: 1(0-2)* vs -1(-2-0)* [‡] C: -2(-4 to 4)* vs -6 (-7to -5)* [‡]

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

							GH: 2.3 (3.6-5)* vs 3 (2.1 to 3.4)* [‡] PB: 4(3 to 4)* vs 3.5 (3 to 4)* TVL: 9(8 to 10)* vs 8 (8 to 9)* [‡] Ap: 0(-1 to 1)* vs -3 (-3 to -2)* [‡] Bp: 0(-1 to 1)* vs -2 (-3 to -2)* [‡]
Weintraub et al 2017 ¹³⁰ Israel Prospective Single Arm	Patients with POPQ stage 3 centro-apical prolapse undergoing transvaginal sacrospinous ligament fixation with NeuGuide™ (n=10)	6	NR	Recurrent prolapse (0)	UDI-6 domains (pre- vs postoperative): Frequent urination: 70.0% vs 60.0% Urine leakage urgency: 33.0% vs 26.0% [‡] Urine leakage physical activity: 33.0% vs 26.0% Small amount of urine leakage: 33.0% vs 20.0% [‡] Difficulty emptying bladder: 50.0% vs 26.0% Pain/discomfort in lower abdomen/ genitalia: 50.0% vs 30.0%	Postoperative buttock pain (1)	POPQ pre- vs postoperative: C/D: 3 (2-4) [†] vs -5 (-4 to -7) ^{†‡}
Rogers et al 2001 ¹³¹ Australia Retrospective Single Arm	Patients undergoing transvaginal sacrospinous colpopexy with Endo Stitch™ (n=168)	< 6 to >24	Symptom resolution: Vaginal lump 111 (81.0) Dragging feeling in pelvis: 71 (74.0) Pressure down below: 91(79.0)	Recurrent prolapse (3)	NR	NR	Reoperation (8)

Balgobin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.

The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

Rouzier et al 1997 ¹³² France Single Arm	Sacrospinous ligament colpopexy with Endo Stitch™ (n=20)	6-18		Recurrent prolapse (1) Recurrent prolapse requiring repeat operation (2)	NR	NR	NR
Veronikis et al 1997 ¹³³ USA Unclear Single Arm	Patients undergoing transvaginal sacrospinouscolpopexy with Veronikis ligature carrier™ (n=71)	1.5 to 6	Well supported vaginal vault at 6 weeks: 71 (100.0) Continued excellent support at 6 months: 58 (100.0)	NR	NR	0	NR
Chou et al 2010 ¹³⁴ Taiwan Retrospective Single Arm	Patients with uterovaginal or post-hysterectomy vaginal vault prolapse undergoing sacrospinous fixation with Veronikis ligature carrier™ (n=76)	36 (12-60) [†]	NR	Recurrent vault descent (4) Recurrent cystocele (3)	NR	Postoperative gluteal pain resolved within 6 weeks (1)	NR
Leone-Roberti et al 2012 ¹³⁵ Italy Prospective Single Arm	Women with paravaginal defects, anterior wall prolapse, and uterine prolapse undergoing vPVR with Capio™ (n=36)	24	NR	Recurrent anterior vaginal wall (stage >/=2): 3 (8.6)	UDI-6 pre- vs postoperative: 49.4±13.2 vs 14.8 ± 7.7 [‡] IIQ-7 pre- vs postoperative: 77.8 ± 10.6 vs 18.8 ± 11.9 [‡] PISQ-12 pre- vs postoperative: 79.2 ± 11 vs 31.6 ± 5.8 [‡]	NR	NR

RCT – randomized controlled trial; NR – not reported; MME – mean morphine equivalents; PFIQ-7 – pelvic floor impact questionnaire-7; PFDI-20 – pelvic floor disability index-20; POPQ – pelvic organ prolapse quantification; TVL – total vaginal length; NRCS – non-randomized comparative study; ICIQ-VS – International consultation on incontinence questionnaire-vaginal symptoms; ICIQ-SM – International consultation on incontinence questionnaire-sexual matters; QoL – quality of life; UDI-6 – urinary distress inventory-6; IIQ-7 – incontinence impact questionnaire-7; PISQ-12 – pelvic

Balgin S, Balk EM, Porter AE, Misal M, Grisales T, Meriwether KV, et al. Enabling technologies for gynecologic vaginal surgery: a systematic review. Obstet Gynecol 2024;143.
The authors provided this information as a supplement to their article.

©2024 American College of Obstetricians and Gynecologists.

organ prolapse-urinary incontinence sexual function questionnaire-12; POPIQ-7 – pelvic organ prolapse impact questionnaire-7; ePAQ-PF – electronic personal assessment questionnaire-pelvic floor; GH – genital hiatus; PB – perineal body; vPVR – vaginal paravaginal repair
Data are mean ± standard deviation or n (%), unless otherwise noted
*Median (IQR)
†Median (range)
‡p≤0.05
§Mean (range)

Appendix 19. Characteristics and Outcomes of Single-Arm Loop Ligature Studies

Study	Study Population (n)	Age (y)	BMI (kg/m ²)	Parity	Operative Time (min)	Blood Loss (mL)	Length of stay (d)	Complications (n)	Mass Size	Endoloop Success Rate
Hoffman et al 1991 ¹³⁶ USA Prospective	Patients undergoing transvaginal oophorectomy (n=20) by clamp technique or plaingut ligatures	50 (38-72)*	NR	2.8 (0-8)*	18 (15-30)*	0-5 [†]	NR	None	Ovaries: 3.3 x 2 (1.5-6 x 1-4) cm*	10/10 (100)
Ujihira et al 2013 ¹³⁷ Japan Retrospective	Patients undergoing endoloop myomectomy for prolapsed pedunculated submucous uterine myoma with polydioxanone ligatures (n=11)	40.9 (32-54)*	NR	NR	NR	NR	0	Persistent bleeding (1)	Myoma diameter: 30.9 (20-42) mm*	11/11 (100)

Abbreviations: BMI- body-mass index; NR – not reported

Data are n (%) unless otherwise specified

*Mean/range

[†]Range

Appendix 20. Characteristics and Outcomes of the Video Telescopic Operating Monitor (VITOM) Comparative Study

Study/ Design (Quality)	Study Population (n)	Age (years)	Sex	Learners “very satisfied in faculty/ preceptor domain of VA LPS:	Ability to follow procedural steps:	Ability to see what main surgeon was doing	Ability to position themselves well to see the surgery	Ability to position themselves well to help with the surgery	OR set up well to see the surgery	Satisfaction with learning in the OR (VAS satisfaction)
Hobson et al 2021 ¹³⁸ USA RCT (A)	Obstetrics and Gynecology residents and medical students observing vaginal surgery* with VITOM® (n=44) or traditional observation (TO) (n=48)	VITOM®: 20-24: 13 (30.0) 25-29: 2(5.0) 30-34: 3(7.0) 35-30: 1(2.0) ≥40: 1(2.0) TO: 20-24: 10 (21.0) 25-29: 30 (63.0) 30-34: 5 (10.0) 35-30: 2(4.0) ≥40: 1(2.0)	VITOM®: Male: 27 (61.0) Female: 17 (39.0) TO: Male: 21 (44.0) Female: 27 (56.0)	VITOM®: 41 (93.2) TO: 43 (91.5)	VITOM®: 39 (89.0) TO: 39 (81.0)	VITOM®: 41 (93.0) TO: 30 (63.0) [†]	VITOM®: 43 (98.0) TO: 26 (55.0) [†]	VITOM®: 33 (77.0) TO: 26 (55.0) [†]	VITOM®: 44 (100.0) TO: 36 (75.0) [†]	VITOM®: 96(89-100) [‡] TO: 80(57-98) ^{‡†}

VA LPS – veterans affairs learner’s perception survey; OR – operating room; VAS – visual analog scale; RCT – randomized controlled trial; TO – traditional observation

Data are n (%), unless otherwise specified.

* Procedures include vaginal hysterectomy, uterosacral ligament suspension, sacrospinous colpopexy, anterior colporrhaphy, posterior colporrhaphy, midurethral sling, vaginal mesh removal, perineorrhaphy, other vaginal and non-vaginal procedures

[†]p≤0.05

[‡]Median (IQR)