

Evaluation of Prophylactic Antibiotic Use for History- and Ultrasound- Indicated Transvaginal Cerclage

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Abstract

Objective.

To evaluate whether prophylactic antibiotic administration at the time of history- or ultrasound-indicated transvaginal cerclage placement improves gestational age at delivery, and secondarily to assess associated neonatal and maternal outcomes.

Methods.

Retrospective cohort study of singleton pregnancies undergoing history- or ultrasound-indicated cervical cerclage at multiple hospitals within a large US hospital system between 2020 and 2023. Patients were identified through the electronic medical record and included if they had a singleton pregnancy, met criteria for cerclage placement, and had maternal and neonatal outcomes available. Within each indication, patients receiving antibiotics at the time of cerclage were compared with those who did not. The primary outcome was gestational age at delivery. Secondary outcomes were preterm delivery at less than 37, 32, 28, and 24 weeks; cesarean delivery; neonatal intensive care unit (NICU) admission; and a composite of neonatal morbidity. Groups were compared using the Student t, chi-square, and Fisher exact tests, and multivariable logistic regression adjusting for potential confounders.

Results.

Of 405 transvaginal cerclages performed during the study period, 201 history-indicated and 78 ultrasound-indicated cerclages met inclusion criteria. Prophylactic antibiotics were administered in 60 (29.9%) of history-indicated and 50 (64.1%) of ultrasound-indicated cases; cefazolin was the agent in nearly all treated patients. Mean gestational age at delivery did not differ by antibiotic exposure in either cohort (history-indicated, 36.2 ± 4.9 vs 35.9 ± 4.7 weeks, $p = 0.68$; ultrasound-indicated, 35.9 ± 4.3 vs 36.0 ± 4.5 weeks, $p = 0.95$). Rates of preterm delivery at all thresholds, cesarean delivery, NICU admission, and neonatal morbidity were similar between groups in both cohorts and persisted after adjustment. Approximately one-third of neonates in the ultrasound-indicated cohort required NICU admission regardless of antibiotic exposure.

Conclusion.

Prophylactic antibiotic administration at the time of history- or ultrasound-indicated transvaginal cerclage placement was not associated with improved gestational age at delivery or with differences in neonatal or maternal outcomes.

1. Introduction

Preterm birth remains a leading cause of neonatal morbidity and mortality. Cervical insufficiency—painless cervical dilation and shortening in the second trimester—is an important and potentially modifiable contributor to spontaneous preterm birth and second-trimester loss. Transvaginal cervical cerclage, in which suture or tape is used to reinforce the cervix, is performed to reduce these adverse perinatal outcomes and may be indicated on the basis of obstetric history, sonographic cervical shortening, or physical-examination findings (1, 2, 3).

Prophylactic antibiotics are administered at the time of cerclage to reduce the risk of intra-amniotic infection and ascending colonization (4, 5, 6). Their use is most established for exam-indicated cerclage, in which exposed membranes or cervical dilation confer the highest infectious risk. In contrast, the role of prophylactic antibiotics for history- and ultrasound-indicated cerclage—elective procedures typically performed without cervical dilation—is far less clear. A recent retrospective cohort study by Boelig et al suggested a possible reduction in spontaneous preterm birth before 37 weeks with perioperative antibiotics for ultrasound-indicated cerclage; however, the American College of Obstetricians and Gynecologists and other bodies have not issued a strong recommendation for or against prophylactic antibiotics in this setting, citing limited evidence (7, 9, 18). Given this gap, we sought to determine whether prophylactic antibiotic administration at the time of history- or ultrasound-indicated transvaginal cerclage is associated with an improvement in gestational age at delivery and, secondarily, with neonatal and maternal outcomes.

2. Materials and Methods

Study design and population

This retrospective cohort study included singleton pregnancies undergoing history- or ultrasound-indicated transvaginal cervical cerclage at multiple hospitals within a large US hospital system between 2020 and 2023. The study was approved by the Wake Forest University/Advocate Health Institutional Review Board/ Ethics Committee (approval number IRB 00109024) and was conducted in accordance with the Declaration of Helsinki. A waiver of informed consent was granted by the review board given the retrospective, minimal-risk nature of the study.

Cases were identified using the electronic medical record (Epic SlicerDicer) by querying for cerclage procedures performed during pregnancy within the study period. Because case ascertainment relied on procedural documentation and coding, a small number of cerclages that were not coded as such may not have been captured (see Limitations). Patients were included if they had a singleton pregnancy, met established criteria for cerclage placement, and had maternal and neonatal delivery outcomes available. Patients were excluded for multiple gestation, abdominal cerclage, a non-established indication for cerclage, or missing maternal or neonatal outcome data. Cerclages performed for physical-examination indications were not included in the present analysis, which focused on the elective history- and ultrasound-indicated procedures for which antibiotic prophylaxis is least well supported.

Once the indication was established, cases were assigned to the history- or ultrasound-indicated group. Patients initially documented as ultrasound-indicated who were found to have cervical dilation of at least 1 cm in the operating room were reclassified as exam-indicated and excluded. Within each indication, cases receiving prophylactic antibiotics at the time of cerclage were compared with those who did not.

Data collection

The specific antibiotic agent administered at the time of cerclage was abstracted from the operative and medication records. Dose, timing, and duration were not consistently documented and are described where available. Neonatal morbidity subtypes (respiratory distress syndrome, necrotizing enterocolitis, intraventricular hemorrhage, sepsis, and intrauterine fetal demise or neonatal death) were derived from the recorded clinical complication field.

Outcomes

The primary outcome was gestational age at delivery. Secondary outcomes were preterm delivery at less than 37, 32, 28, and 24 weeks; cesarean delivery; admission to the NICU; and a composite of neonatal morbidity (respiratory distress syndrome, necrotizing enterocolitis, intraventricular hemorrhage grade III/IV, sepsis, and intrauterine fetal demise or neonatal death).

Statistical analysis

Statistical analyses were performed using STATA version 17.0 (StataCorp LLC, College Station, TX). Baseline characteristics and outcomes were compared using the Student t test, chi-square test, and Fisher exact test as appropriate. Multivariable logistic regression was used to evaluate the association between antibiotic administration and each outcome, adjusting for age, body mass index, race and/or ethnicity, gestational age at placement, and indomethacin use. Race and ethnicity were included given the well-documented adverse impact of systemic racism on perinatal outcomes among persons of color. A two-sided p value less than 0.05 was considered statistically significant.

Because this was a retrospective cohort that included all eligible cases during the study period, an a priori sample-size calculation was not performed. Based on the achieved sample, the study had approximately 80% power ($\alpha = 0.05$, two-sided) to detect a difference in mean gestational age at delivery of about 2.0 weeks in the history-indicated cohort and 2.9 weeks in the ultrasound-indicated cohort. Smaller differences, and differences in infrequent neonatal outcomes, cannot be excluded (see Limitations).

3. Results

During the study period, 405 transvaginal cerclages were performed in singleton pregnancies (Fig. 1). Of these, 201 (49.6%) were history-indicated, 132 (32.6%) were documented as ultrasound-indicated, and 72 (17.8%) were exam-indicated. Among the 132 documented ultrasound-indicated cerclages, 54 (40.9%) were found to have cervical dilation of at least 1 cm in the operating room and were reclassified as

exam-indicated. After excluding exam-indicated cases—both those documented as such and those reclassified—the final cohort comprised 201 history-indicated and 78 ultrasound-indicated cerclages. Prophylactic antibiotics were administered in 60 (29.9%) of history-indicated and 50 (64.1%) of ultrasound-indicated cases (overall, 110 of 279 [39.4%]). Among treated patients, cefazolin was the agent in nearly all cases (59 of 60 history-indicated and 48 of 50 ultrasound-indicated), with isolated use of clindamycin or an alternative agent. Because infectious risk and antibiotic practice differ substantially by indication, comparisons were stratified by indication rather than pooled.

History-indicated cohort

Antibiotic and no-antibiotic groups were similar in age, parity, body mass index, insurance, marital status, tobacco use, and obstetric history (Table 1). Patients receiving antibiotics were more likely to be non-Hispanic White ($p = 0.008$) and to receive indomethacin (73.3% vs 50.4%, $p = 0.003$). Mean gestational age at delivery was 36.2 ± 4.9 weeks with antibiotics and 35.9 ± 4.7 weeks without ($p = 0.68$). Rates of preterm delivery at less than 37, 32, 28, and 24 weeks, cesarean delivery, NICU admission, and neonatal morbidity did not differ between groups, and these findings persisted after adjustment (Table 2).

Table 1

Baseline characteristics of the history- and ultrasound-indicated cerclage cohorts, by antibiotic exposure

Characteristic	History No Abx (N = 141)	History Abx (N = 60)	p	Ultrasound No Abx (N = 28)	Ultrasound Abx (N = 50)	p
Age (years)	32.6 ± 5.2	32.9 ± 5.0	0.74	31.8 ± 4.6	30.1 ± 5.4	0.18
Nulliparity	12 (8.5)	5 (8.3)	0.97	8 (28.6)	15 (30.0)	0.89
Body mass index (kg/m ²)	31.8 ± 7.0	33.3 ± 7.9	0.18	29.0 ± 5.0	32.6 ± 7.8	0.03
Race/ethnicity	0.008			0.16		
Hispanic	38 (27.0)	9 (15.0)		9 (32.1)	7 (14.0)	
Non-Hispanic Black	54 (38.3)	15 (25.0)		6 (21.4)	17 (34.0)	
Non-Hispanic White	38 (27.0)	25 (41.7)		9 (32.1)	22 (44.0)	
Other	11 (7.8)	11 (18.3)		4 (14.3)	4 (8.0)	
Public insurance	72 (51.1)	34 (56.7)	0.47	10 (35.7)	22 (44.0)	0.48
Marital status	0.92			0.48		
Married	98 (69.5)	40 (66.7)		17 (60.7)	26 (52.0)	
Single	41 (29.1)	19 (31.7)		11 (39.3)	22 (44.0)	
Divorced	2 (1.4)	1 (1.7)		0	2 (4.0)	
Tobacco use	4 (13.8)	0	0.28	0	2 (20.0)	1.00
Chronic hypertension	20 (14.2)	7 (11.7)	0.63	0	2 (4.0)	0.53
Pre-gestational diabetes	2 (1.5)	2 (3.6)	0.58	1 (3.7)	2 (4.3)	1.00
History of preterm delivery	102 (72.3)	45 (75.0)	0.70	16 (57.1)	23 (46.0)	0.35
Gestational age at placement (weeks)	14.3 ± 1.4	14.1 ± 1.4	0.32	19.9 ± 2.9	20.4 ± 2.4	0.42
Indomethacin	71 (50.4)	44 (73.3)	0.003	26 (92.9)	43 (86.0)	0.48
<i>Data are presented as n (%) or mean ± SD. Abx, antibiotics. p values from Student t, chi-square, or Fisher exact tests.</i>						

Table 2

Delivery and neonatal outcomes of the history- and ultrasound-indicated cerclage cohorts, by antibiotic exposure

Outcome	History-indicated				Ultrasound-indicated			
	No Abx (N = 141)	Abx (N = 60)	p	aOR / β (95% CI)	No Abx (N = 28)	Abx (N = 50)	p	aOR / β (95% CI)
Gestational age at delivery (weeks)	35.9 $\pm$ 4.7	36.2 $\pm$ 4.9	0.68	0.09 (–1.46, 1.64)	36.0 $\pm$ 4.5	35.9 $\pm$ 4.3	0.95	0.11 (–2.14, 2.37)
Preterm delivery < 37 weeks	55 (39.0)	18 (30.0)	0.22	0.65 (0.32–1.32)	10 (35.7)	19 (38.0)	0.84	1.04 (0.36–2.99)
Preterm delivery < 32 weeks	18 (12.8)	8 (13.3)	0.91	1.38 (0.51–3.75)	4 (14.3)	8 (16.0)	1.00	0.91 (0.21–4.00)
Preterm delivery < 28 weeks	14 (9.9)	5 (8.3)	0.72	0.97 (0.29–3.18)	2 (7.1)	5 (10.0)	1.00	1.20 (0.16–9.05)
Preterm delivery < 24 weeks	7 (5.0)	3 (5.0)	1.00	1.25 (0.27–5.87)	1 (3.6)	2 (4.0)	1.00	—
Cesarean delivery	68 (48.2)	24 (40.0)	0.28	0.75 (0.39–1.47)	9 (32.1)	23 (46.0)	0.23	1.68 (0.56–4.99)
NICU admission	40 (28.4)	11 (18.3)	0.14	0.60 (0.27–1.33)	8 (28.6)	17 (34.0)	0.62	1.54 (0.51–4.60)
Composite neonatal morbidity	50 (35.5)	18 (30.0)	0.45	0.88 (0.44–1.76)	9 (32.1)	18 (36.0)	0.73	1.21 (0.42–3.52)
Respiratory distress syndrome	23 (16.3)	5 (8.3)	0.14	0.57 (0.19–1.65)	6 (21.4)	8 (16.0)	0.55	0.68 (0.19–2.46)
IUFD or neonatal demise	8 (5.7)	4 (6.7)	0.75	1.52 (0.37–6.18)	1 (3.6)	1 (2.0)	1.00	—

Data are presented as n (%) or mean $\pm$ SD. Adjusted models controlled for age, body mass index, race/ethnicity, gestational age at placement, and indomethacin use. For gestational age at delivery, the adjusted effect is the mean difference (β) in weeks; for binary outcomes, the adjusted odds ratio (aOR). CI, confidence interval; IUFD, intrauterine fetal demise; IVH, intraventricular hemorrhage; NICU, neonatal intensive care unit. Neonatal morbidity subtypes were derived from the recorded clinical complication field. Cells reported as “—” were not estimable owing to zero or sparse events.

Outcome	History-indicated				Ultrasound-indicated			
	No Abx (N = 141)	Abx (N = 60)	p	aOR / β (95% CI)	No Abx (N = 28)	Abx (N = 50)	p	aOR / β (95% CI)
IVH grade III/IV	2 (1.4)	0	1.00	—	1 (3.6)	1 (2.0)	1.00	—
Necrotizing enterocolitis	1 (0.7)	0	1.00	—	1 (3.6)	0	0.36	—
Sepsis	0	0	1.00	—	0	0	1.00	—
Data are presented as n (%) or mean $\pm$ SD. Adjusted models controlled for age, body mass index, race/ethnicity, gestational age at placement, and indomethacin use. For gestational age at delivery, the adjusted effect is the mean difference (β) in weeks; for binary outcomes, the adjusted odds ratio (aOR). CI, confidence interval; IUFD, intrauterine fetal demise; IVH, intraventricular hemorrhage; NICU, neonatal intensive care unit. Neonatal morbidity subtypes were derived from the recorded clinical complication field. Cells reported as “—” were not estimable owing to zero or sparse events.								

Ultrasound-indicated cohort

The mean gestational age at cerclage placement was approximately 20 weeks in both groups. Baseline characteristics were similar between groups except for body mass index, which was higher in the antibiotic group (32.6 vs 29.0 kg/m²; p = 0.03) (Table 1); most patients in both groups received indomethacin. Mean gestational age at delivery did not differ (35.9 $\pm$ 4.3 weeks with antibiotics vs 36.0 $\pm$ 4.5 weeks without, p = 0.95), and rates of preterm delivery, cesarean delivery, NICU admission, and neonatal morbidity were similar and unchanged after adjustment (Table 2). Approximately one-third of neonates in both groups required NICU admission.

4. Discussion

In this multihospital retrospective cohort, prophylactic antibiotic administration at the time of history- or ultrasound-indicated transvaginal cerclage was not associated with an improvement in gestational age at delivery or with differences in preterm birth, neonatal, or maternal outcomes. These findings add to a limited body of evidence and support continued attention to antibiotic stewardship in this elective surgical setting (11, 12, 13, 15). Antibiotic prophylaxis at cerclage is best supported for exam-indicated procedures, based largely on a small randomized trial by Miller et al, in which examination-indicated McDonald cerclage between 16 0/7 and 23 6/7 weeks with indomethacin and cefazolin prophylaxis (n = 27) was compared with no perioperative prophylaxis (n = 26). Although gestational latency beyond 28 days was more common in the intervention group (p = 0.01), there were no differences in gestational age at delivery, preterm prelabor rupture of membranes, chorioamnionitis, or neonatal morbidity, and the trial was underpowered for these secondary outcomes (14). Systematic reviews of adjunctive therapies at cerclage, including a Cochrane review, have similarly concluded that the evidence is insufficient to recommend routine perioperative antibiotics regardless of indication (8, 10). Our findings for history- and

ultrasound-indicated cerclage are consistent with this uncertainty and contrast with the possible benefit reported by Boelig et al, a difference that may in part reflect differences in cohort classification, discussed below.

A notable observation was that 54 of 132 patients (41%) initially documented as ultrasound-indicated met criteria for exam-indicated cerclage—cervical dilation of at least 1 cm—at the time of surgery. In our system, ultrasound-indicated cerclage is typically performed within 1–2 days of diagnosis, and a cervical examination at the time of the sonographic diagnosis of short cervix was not consistently documented; thus it is unclear whether dilation was present at diagnosis or developed in the interval before surgery. Among the reclassified patients with a documented preoperative cervical length, the median was 1.0 cm (interquartile range 0.5–1.8 cm), and 55% had a cervical length of 1.0 cm or less, confirming that these were extremely short cervixes. Patients with an extremely short cervical length are more likely to have dilation on examination, and this overlap has important implications: in the cohort reported by Boelig et al, patients with documented cervical dilation (29%) and without a documented examination (42%) were retained in the ultrasound-indicated group, which may bias outcomes and blur the surgical indication. Our approach of reclassifying such patients—although it reduced the ultrasound-indicated sample size—was intended to characterize outcomes according to the true clinical presentation at surgery and underscores the value of a cervical examination at the time of short-cervix diagnosis and of timely cerclage placement thereafter.

Despite limited supporting evidence, prophylactic antibiotics were administered in 29.9% of history-indicated and 64.1% of ultrasound-indicated cerclages in our system, in the absence of cervical dilation. This practice may reflect the absence of a strong societal recommendation and a general assumption that surgical antibiotic prophylaxis is low-risk and potentially beneficial. However, the intended benefit—reducing maternal and fetal infection—must be weighed against the potential for inadequate antimicrobial coverage. Intra-amniotic infection is frequently polymicrobial, commonly involving *Ureaplasma urealyticum*, *Mycoplasma hominis*, streptococcal and staphylococcal species, and enteric gram-negative and anaerobic organisms, several of which are not reliably covered by antibiotics typically used at cerclage (16, 17). When antibiotics are used, agent selection should reflect this microbiology within the framework of antimicrobial stewardship.

Although the mean gestational age at delivery was approximately 36 weeks across groups, nearly one-third of neonates in the ultrasound-indicated cohort required NICU evaluation or admission, underscoring that the need for an ultrasound-indicated cerclage is itself a marker of substantial preterm-birth risk irrespective of antibiotic exposure.

Strengths and limitations

Strengths include the detailed chart review and careful classification of cases by their true indication at the time of surgery, including exclusion of patients who met exam-indicated criteria. Several limitations warrant consideration. First, the retrospective design and modest sample size limit statistical power; the study was powered to detect only relatively large differences in gestational age at delivery

(approximately 1.9 and 3.0 weeks in the history- and ultrasound-indicated cohorts, respectively), and smaller but clinically meaningful effects—as well as differences in infrequent neonatal outcomes—cannot be excluded (type II error). A definitive evaluation of antibiotic efficacy in this setting would require a randomized controlled trial. Second, case ascertainment relied on procedural documentation and coding, and cerclages not appropriately coded may have been missed. Third, a cervical examination and cervical length at the time of short-cervix diagnosis were not consistently available. Fourth, exam-indicated cerclages were deliberately excluded so as to focus on the elective indications for which prophylaxis is least supported; a dedicated evaluation of the exam-indicated population, for which some randomized and cohort data already exist, is a reasonable direction for future work. Fifth, the specific antibiotic agent was recorded, but dose, timing, and duration were not consistently documented, limiting characterization of the regimens. Sixth, data on vaginal progesterone use were not available in this cohort; because vaginal progesterone reduces preterm birth in patients with a short cervix, unmeasured differences in its use could have influenced outcomes, and future studies should capture and adjust for it. Finally, the study reflects practice within a single US health system and relied in part on clinical documentation for neonatal morbidity, which may limit generalizability and completeness.

5. Conclusion

Prophylactic antibiotic administration at the time of history- or ultrasound-indicated transvaginal cerclage was not associated with a reduction in preterm birth or neonatal NICU admission, or with improved gestational age at delivery. In the absence of demonstrated benefit, these findings support judicious, stewardship-guided use of antibiotics for elective cerclage and highlight the need for adequately powered randomized trials.

Declarations

Ethics approval and consent to participate

This study was approved by the Wake Forest University IRB (approval number IRB 00109024) and was conducted in accordance with the Declaration of Helsinki. A waiver of informed consent was granted by the review board given the retrospective, minimal-risk nature of the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Availability of data and materials

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

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Authors' information

Not applicable.

Authors' contributions

D.E. and C.H. conceived and designed the study. D.E., S.M., and R.H. contributed to data acquisition. R.H. and C.H. performed the statistical analysis and interpretation. All members worked to draft the manuscript. All authors critically revised the manuscript for important intellectual content and approved the final version for submission.

Use of generative artificial intelligence

During the revision of this manuscript, the authors used a generative artificial intelligence tool, Claude (Anthropic PBC; model claude-opus-4-8), accessed through the Claude desktop application (August 2026), to assist with copy-editing and reorganization of the manuscript text in response to peer-review comments, preparation of the cohort selection flow diagram (Figure 1), and drafting of the point-by-point response to reviewers. All statistical analyses reported in the manuscript were performed and verified by the authors using STATA (version 17.0; StataCorp LLC, College Station, TX). The authors reviewed and edited all artificial-intelligence-assisted content, take full responsibility for the integrity and accuracy of the work, and confirm that the tool was not used to generate or fabricate data or results and is not listed as an author.

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Figures

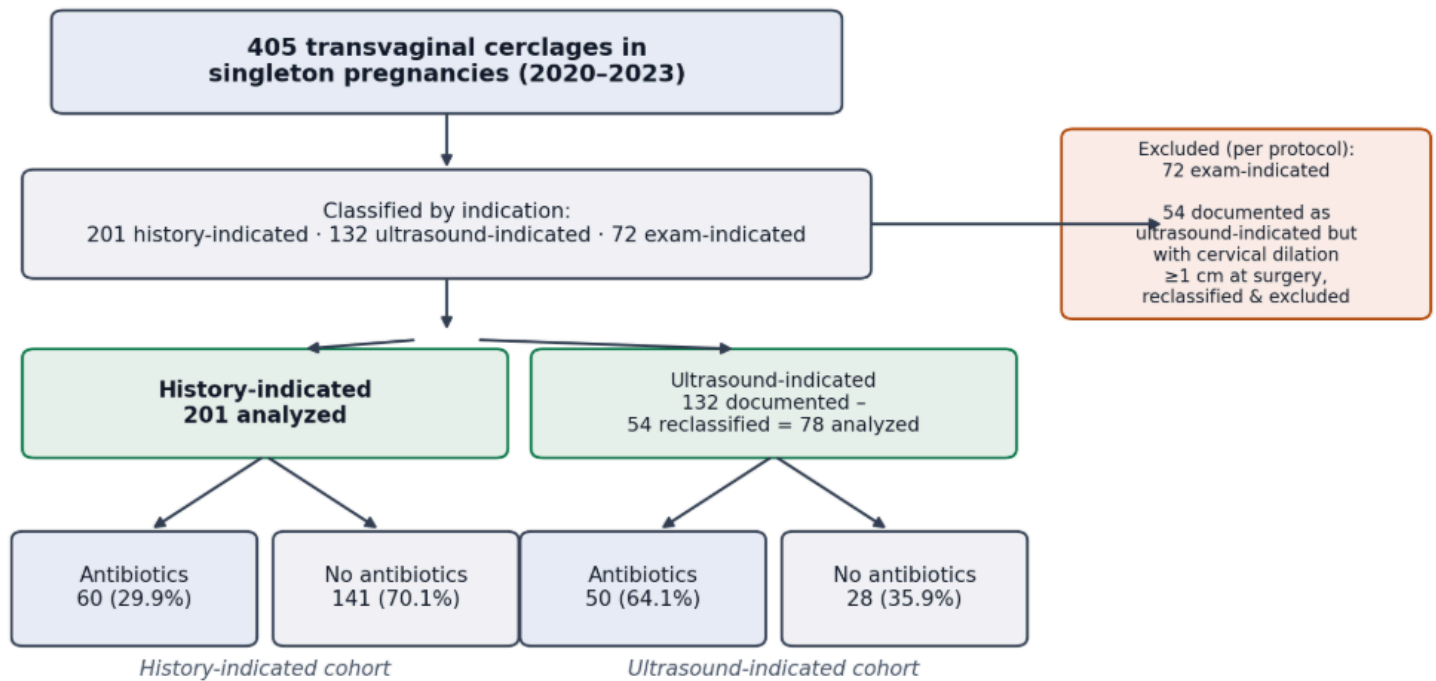


Figure 1

Flow of cerclage cases through classification, exclusion, and antibiotic exposure.