

Improving Maternal and Neonatal Outcomes by Employing AI-Ultrasound and Cervical Cerclage with a Newly Designed Vaginal Speculum

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Objectives

- **Demonstrate** how AI-Assisted point-of-care ultrasound and a novel speculum can prevent pre-term births
- **Encourage** continuous professional growth for physicians
- **Improve** current standard of care for maternal and neonatal health

Introduction

The CDC and WHO define preterm birth (PTB) as delivery of an infant prior to 37 weeks of gestation.^{1,2} In 2022, **14.0% of infant deaths were attributed to PTB's**.¹ Additionally, complications of prematurity can lead to long-term morbidity.³ Currently, PTB's are screened using fetal fibronectin (fFN) levels and/or cervical length (CL) measurements using transvaginal ultrasound. Cervical cerclage, a stitch in cervical tissue, is often used to prevent preterm dilation. This procedure is difficult to perform with 2-bladed speculums due to limited visibility of the cervix. We propose additional tools to overcome these challenges that easily fit into any physicians' current practice. AI-assisted point of care ultrasound (POCUS) can predict delivery timing and identify women at risk for PTB.⁴ The Bouquet vaginal speculum improves visibility of the cervix.⁵ This opinion piece suggests that the Bouquet speculum used with AI-assisted POCUS can improve maternal and neonatal outcomes, especially in resource constrained communities. This would be an asset to internal medicine residency programs with limited training in women's health due to lack of clinical exposure.

Methods/Results

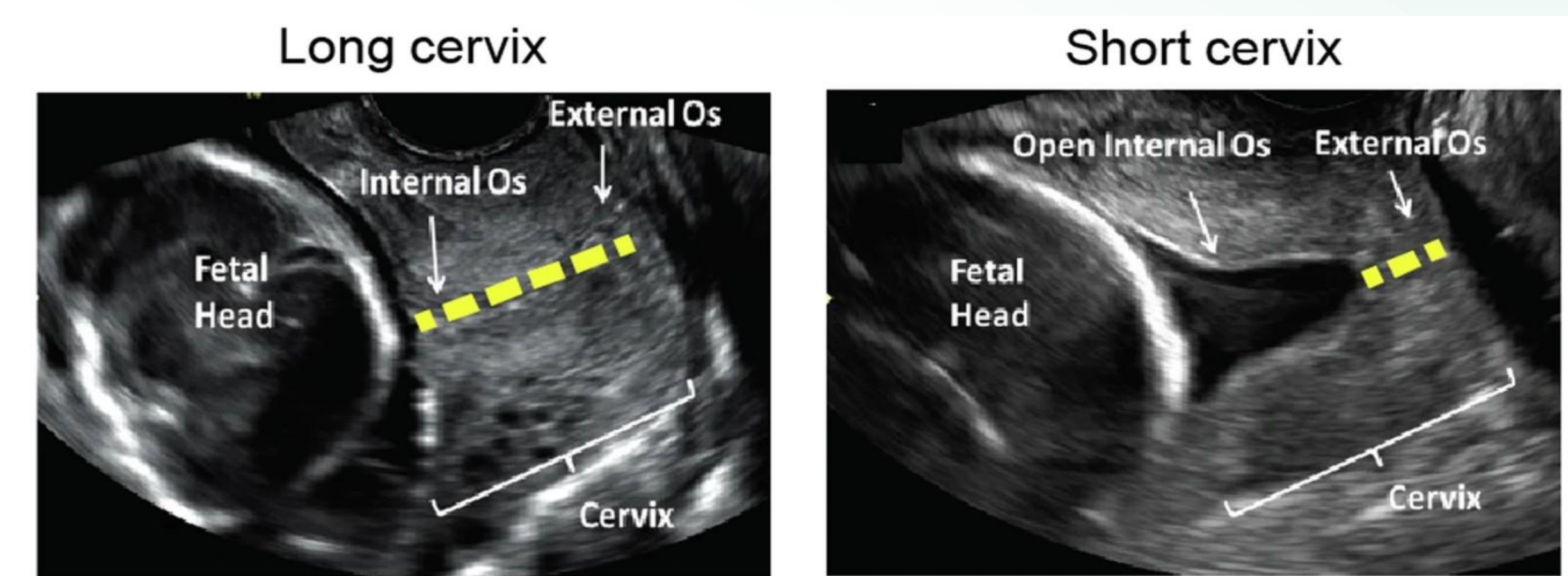


Figure 1

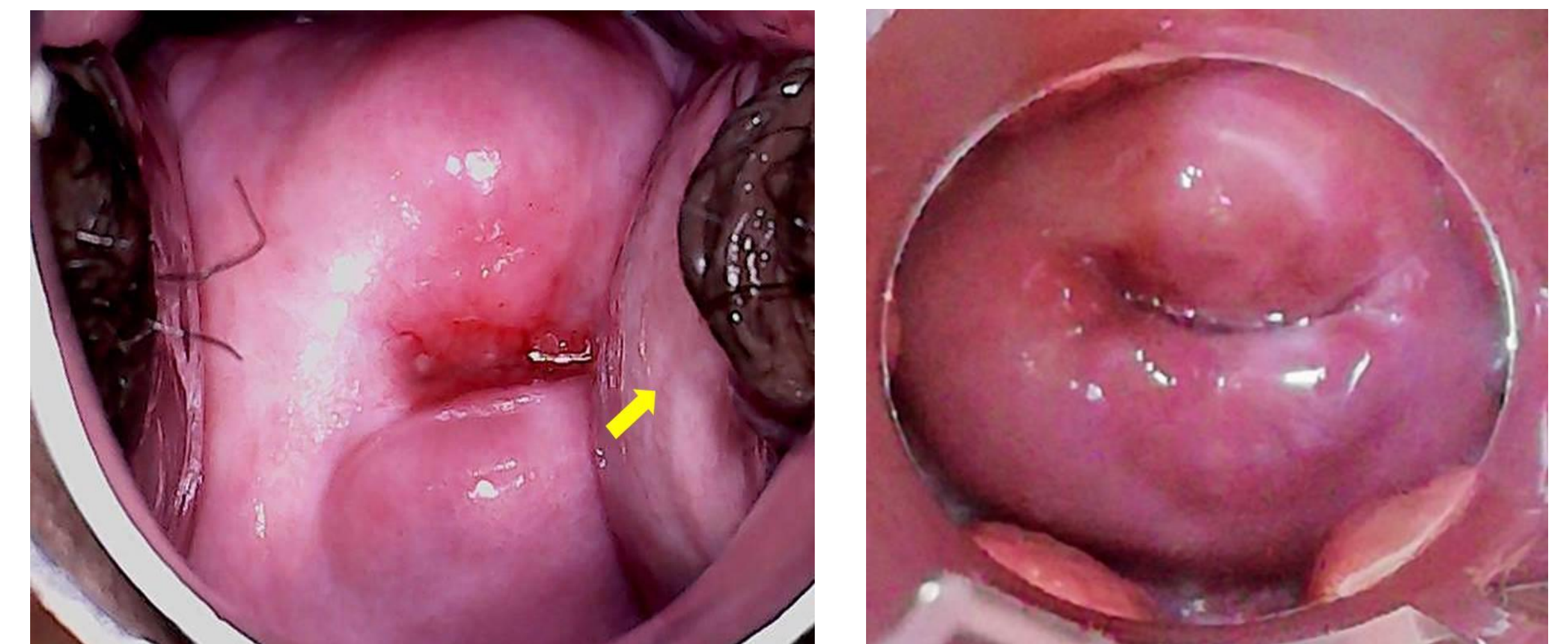


Figure 2

Figure 3

Figure 1: Image showing how AI-assisted Ultrasound assists in predicting delivery dates and PTB⁸
Figure 2: Cervix with a 2-bladed speculum showing right lateral vaginal wall collapse.
Figure 3: Cervix with a Bouquet Speculum showing a complete view of the cervix⁹

We briefly reviewed the literature on the implications of ultrasound artificial intelligence (AI) for predicting PTB. One AI-ultrasound model has a specificity of 95% and a sensitivity of 40%.⁴ The most refined model had a PPV of 90% with pregnancies <37 weeks and within 30 days of delivery date.⁴ PTBs were reduced by 50% in women who had undergone cerclage compared to not performing one (15% vs 32%).⁶ In a survey of internal medicine residents, 89% reported a low comfort level of managing medical complications of pregnancy with 96% reporting limited learning opportunities related to complications of pregnancy.⁷ Topics that residents received more training opportunities for and/or experienced more often in clinic correlated with a higher comfort level rating.⁷ The Bouquet speculum is FDA-cleared with clearly documented improvements in patient and provider experiences.^{10,11}

"In my clinical experience, the Bouquet Speculum is viable for McDonald cervical cerclage. In a limited number of cases, its radial opening has provided a stable, circumferential exposure of the cervix — especially in an anterior cervix or in narrow vaginal canals— allowing antisepsis, clamping, and needle passage without changing speculums or adding retractors. The learning curve is short, and I have not observed any adverse events attributable to the device." - Dr. Rodrigo Orozco Fernández

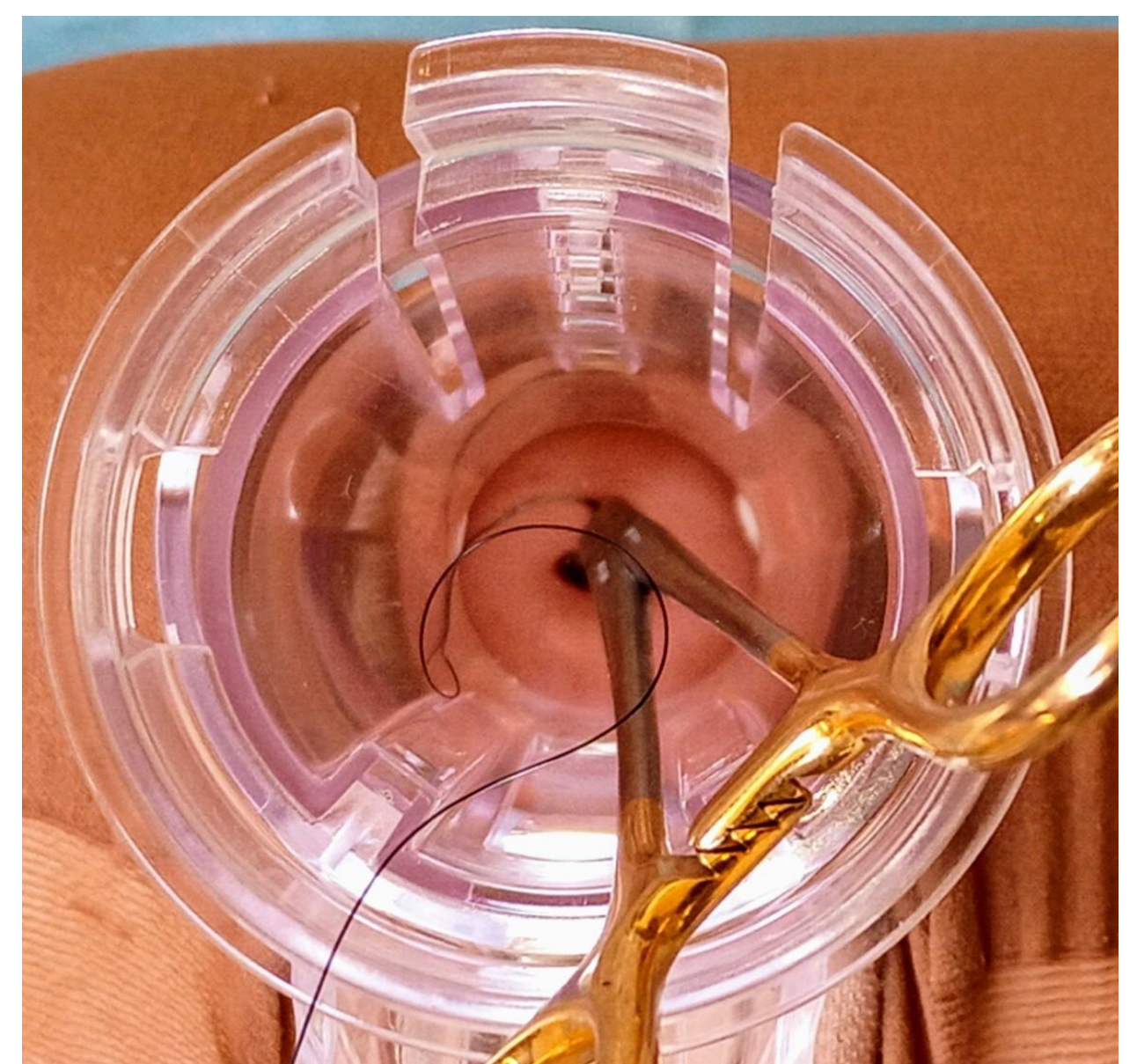


Figure 4

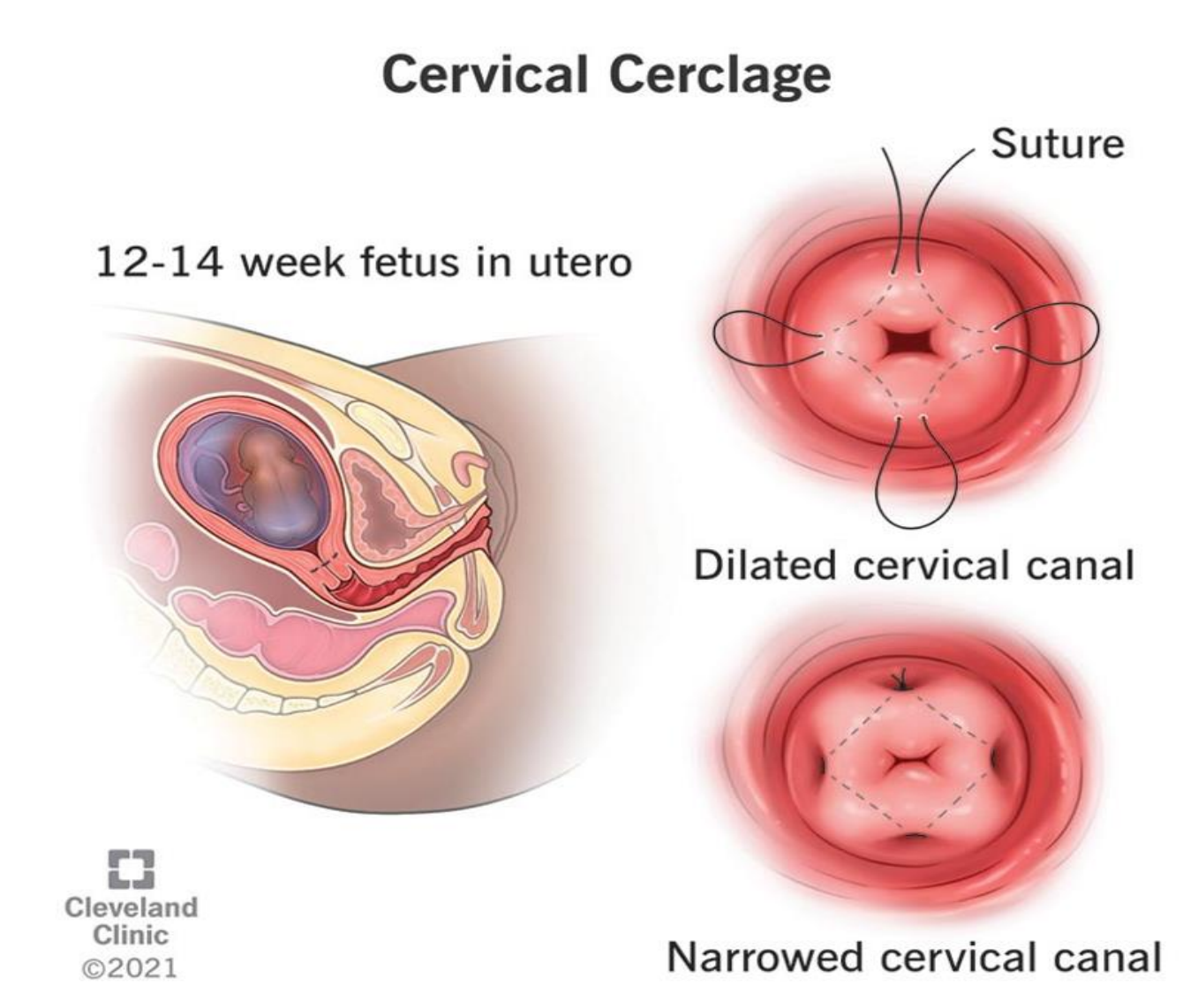


Figure 5

Figure 4: Image of a cervix with a long-handled needle driver for cervical cerclage (McDonald suture) inside of the Bouquet Speculum. **Figure 5:** McDonald stitch for cervical cerclage (Cleveland Clinic)⁷

Discussion

This perspective piece demonstrates how the Bouquet speculum provides better visualization of the cervix by preventing lateral collapse of the vaginal wall. AI detection progressively improves as more training and data (e.g., images) are collected, leading to increasingly accurate estimates of delivery timing. Testimony from physicians like Dr. Fernández demonstrate the utility of the Bouquet speculum during procedures, such as cervical cerclage.

Conclusion

AI-assisted POCUS combined with the Bouquet speculum improves visualization and efficacy of cervical cerclage; offers a safe, cost-effective, and practical approach to reducing preterm birth complications; highlights preventable causes of preterm birth; underscores the need for better maternal health outcomes, especially in resource-limited settings; and supports early adoption of new technologies and practices within internal medicine to advance the field and improve patient care.

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