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## Introduction

- Patients undergoing limb salvage or amputation often have complex comorbidities such as peripheral vascular disease, diabetes, and neuropathy.
- These comorbidities increase perioperative risk and complicate anesthetic management.
- Patients frequently exhibit altered gait, balance, and proprioception, impacting perioperative planning.
- Impaired mobility can lead to falls, delayed ambulation, and prolonged recovery, especially after neuraxial or regional anesthesia.
- Understanding functional limitations by amputation level is critical for anesthesiologists in tailoring perioperative care, including block selection, hemodynamic support, and coordination of postoperative physical therapy.
- Transmetatarsal amputation (TMA) is generally preferred over below-knee amputation (BKA) to preserve mobility, but limited evidence exists comparing functional outcomes between levels.
- This study aims to quantify gait and balance differences across amputation levels to guide anesthetic risk stratification and individualized perioperative planning.

## Methods & Materials

- Retrospective cohort study conducted from June 2021 to July 2024 at a tertiary wound care center.
- Included adults  $\geq 18$  years old who could ambulate unassisted and had no pain, wounds, or lower extremity surgery in the past 90 days.
- Patients stratified into three groups: no amputation, TMA, or BKA
- Gait data collected using Opal wearable sensors during a 120-sec walk and 30 sec Romberg sway test.
- Extracted parameters: gait speed, cadence, step duration, mid-swing elevation, limb support times, stride length, RMS sway.
- Recorded patient demographics and comorbidities, including peripheral vascular disease, neuropathy, and chronic kidney disease.
- Gait differences analyzed using t-tests and multivariate regression controlling for age, sex, and Charlson Comorbidity Index.
- Anesthesia-relevant outcomes: RMS sway for balance and mid-swing elevation for fall risk stratification.

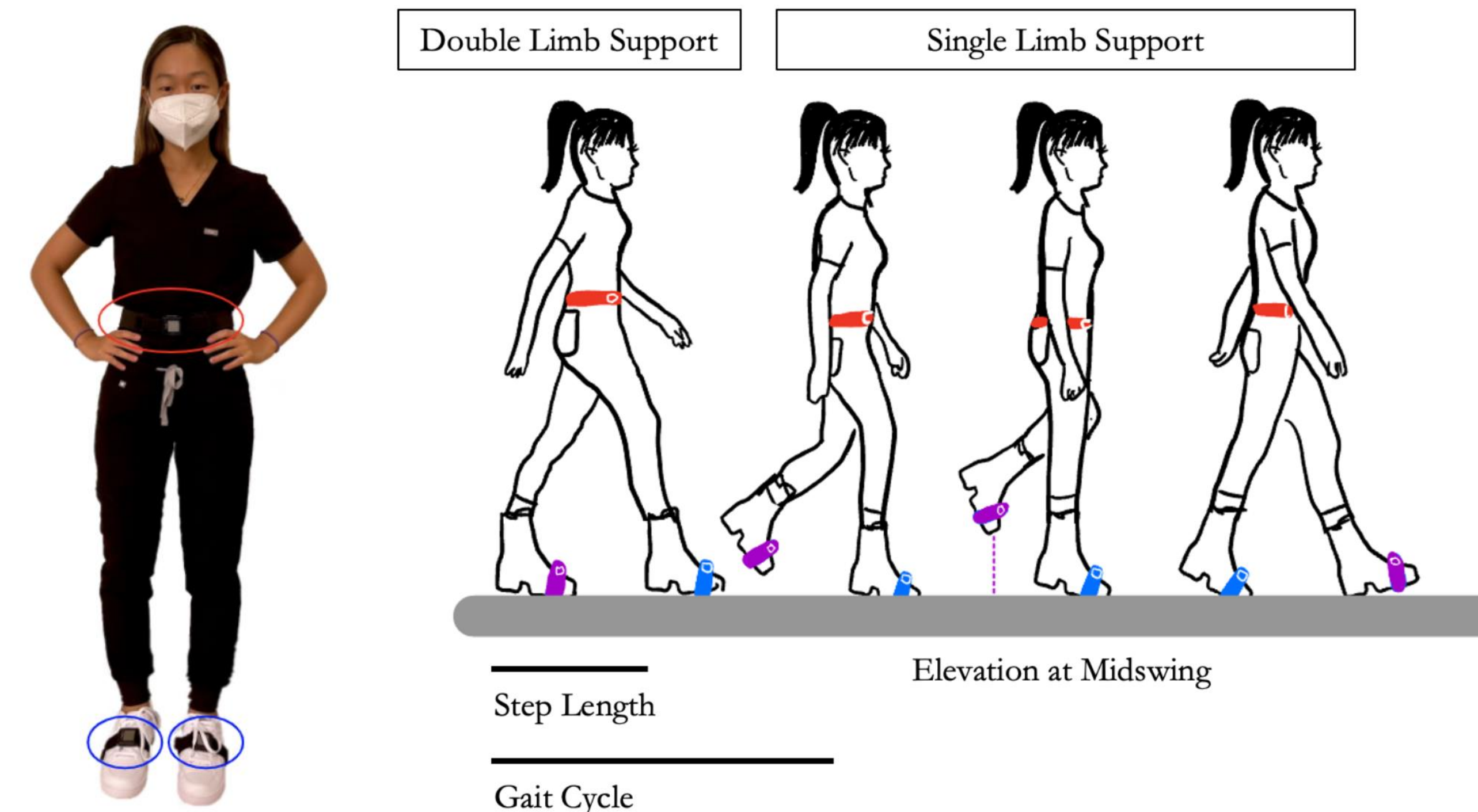


**Fig 1.** Sensor placement and Romberg test position. G-Sensor placed across abdomen in lumbar position (red); Opal sensors attached to each foot by velcro straps (blue).

**Fig 2.** Depiction of spatiotemporal gait parameters.

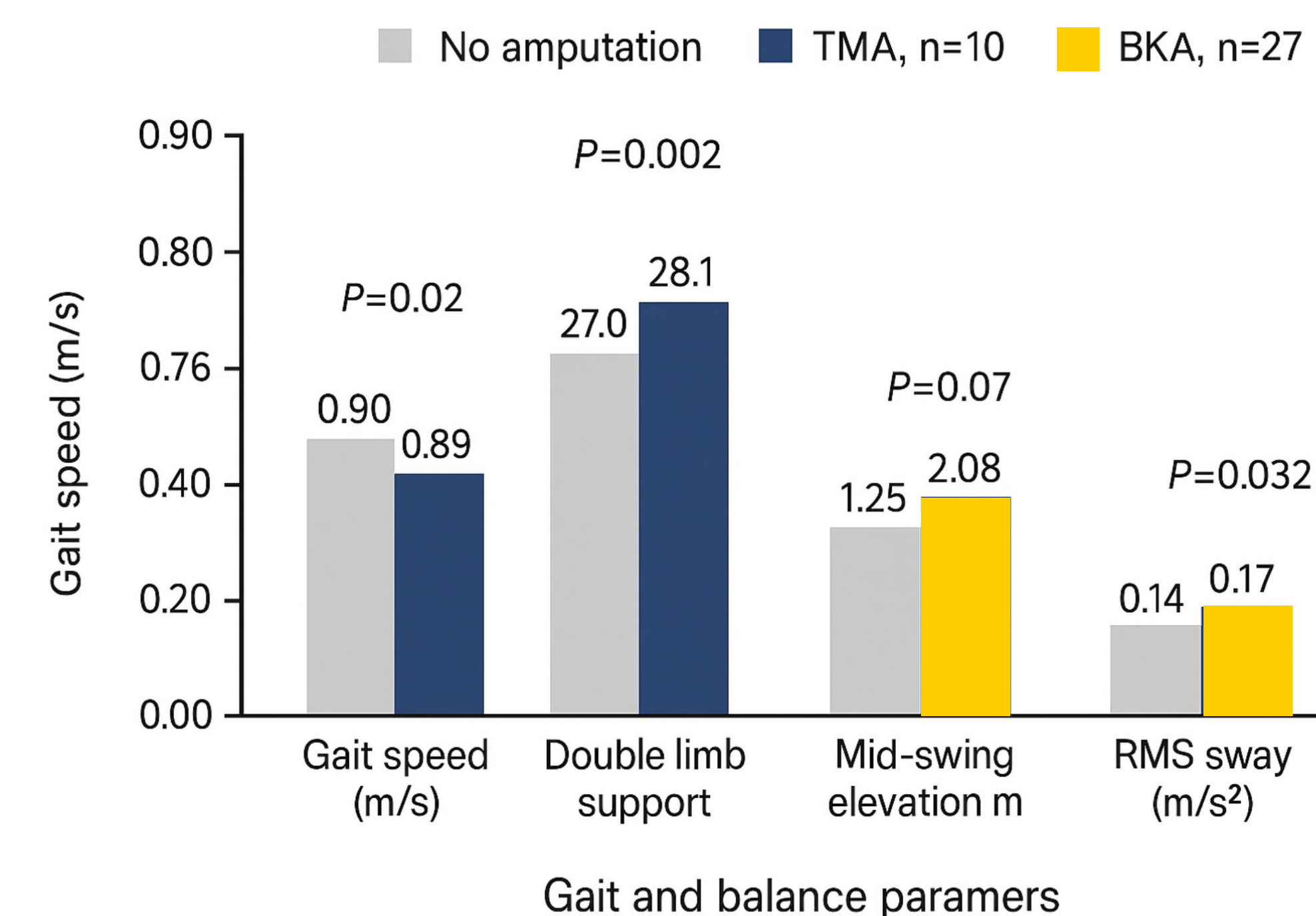


**Fig 3.** Comparison of Gait and Balance Metrics Among No Amputation, TMA, and BKA Patients

## Results

Among 303 eligible patients, 267 had no amputation, 10 underwent TMA, and 27 had BKA. Compared to controls, BKA patients demonstrated significantly reduced gait speed (0.76 m/s vs. 0.90 m/s,  $p=0.002$ ) and increased double limb support (28.1% vs. 25.7%,  $p=0.001$ ). TMA patients exhibited greater mid-swing elevation (2.08 cm vs. 1.25 cm,  $p=0.007$ ) and RMS sway (0.27 vs. 0.14 m/s<sup>2</sup>,  $p=0.032$ ). Multivariate analysis identified level of amputation as an independent predictor for gait impairment.

## Discussion

- Gait disturbances and balance variability post-amputation impact preoperative risk stratification and postoperative planning.
- TMA patients retained more distal limb function but showed higher RMS sway, indicating impaired proprioception and postural instability.
- BKA patients exhibited impaired gait propulsion and reduced cadence, reflecting compromised motor coordination and endurance.
- Functional changes can influence decisions on regional versus general anesthesia, block selection, and timing of physical therapy.
- Preoperative awareness of these impairments may guide fall prevention, promote safer ambulation, and reduce perioperative complications.
- Findings highlight the value of incorporating gait analysis into perioperative assessment to personalize anesthesia care for patients with lower extremity amputation.

## References

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