AI-Based Automated Extraction of Manufacturer-Specific Stent-Graft Codes for EVAR Planning

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ABSTRACT

This study evaluates an AI model designed to automate the retrieval of manufacturer-specific EVAR stent-graft codes from preoperative CTA scans to standardize device selection across different vendors.

Preoperative CTA datasets from twenty AAA patients were processed using an AI tool that automatically segmented proximal and distal sealing zones to extract key vessel diameters and lengths. The algorithm evaluated all feasible main body and iliac limb component combinations to generate complete identification codes, which were compared against the selections of two experienced vascular surgeons.

The AI tool demonstrated high concordance for both manufacturers, showing no significant differences when compared to surgeon-surgeon agreement distributions (p = 0.67 and p = 0.38).

This tool successfully converts patient-specific anatomy into standardized device codes, eliminating tedious planning tasks while maintaining expert-level accuracy and compliance.

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INTRODUCTION

The objective of this study was to assess whether an **Artificial Intelligence (AI) model** can automate the retrieval of Endovascular Aneurysm Repair (EVAR) related **device codes used to identify specific stent-grafts** from preoperative computed tomography angiography (CTA) imaging studies, with the goal of standardizing device selection across two different manufacturers

The key innovation of this work is the automated generation of complete EVAR stent-graft identification codes, a step that traditionally **requires expert interpretation** of anatomical measurements and **manual cross-referencing** of manufacturer instructions for use.

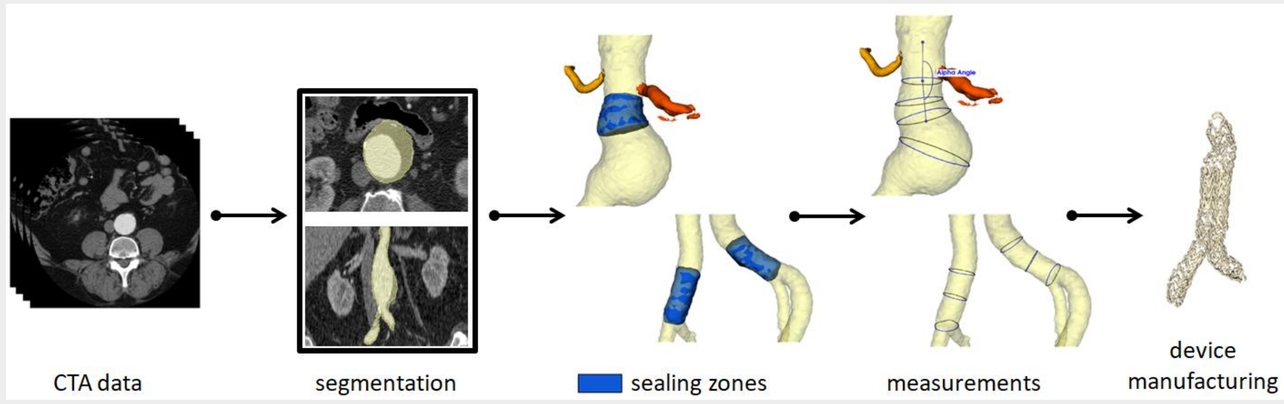

Figure 1. AI-based identification of proximal and distal sealing zones used to drive automated stent-graft code generation.

By linking AI-based sealing zone segmentation to device selection, the proposed approach reduces subjectivity and enables reproducible, anatomy-driven EVAR planning (Figure 1).

METHODS AND MATERIALS

Twenty preoperative CTA scans from patients with infrarenal abdominal aortic aneurysm, were analyzed to asses an AI tool [1] that automatically segmented the aorto-iliac proximal and distal sealing zones, and extracted key anatomical measurements (i.e., vessel diameters and lengths).

The AI algorithm used these parameters to evaluate **all feasible main body and iliac limb stent-graft component combinations** and generate complete identification codes according to the instructions of **two manufacturers**. AI-generated codes were then compared with selections of two experienced vascular surgeons.

Agreement was categorized as **Exact Match, Near Match** (minor differences due to measurements near dimensional thresholds, e.g. 1 mm variation in diameter or length resulting in adjacent codes), or **Mismatch**. Fisher's Exact test was used to compare AI-Surgeon code agreement to Inter-Surgeon Code agreement.

RESULTS

High concordance was observed between the AI-generated stent-graft codes and those selected by the surgeon for each manufacturer.

For **Manufacturer 1,** 65% of AI selections were exact matches, and 30% were near matches, while **5% were mismatches**.

For **Manufacturer 2**, 83% of AI selections were exact matches, and 15% were near matches, with only **2% being mismatches**.

No significant differences were found between AI-surgeon and surgeon-surgeon agreement distributions for either manufacturer (p = 0.67 and p = 0.38).

Automated stent-graft codes closely matched expert surgeon selections across two manufacturers, with **agreement levels comparable to inter-surgeon variability** and only a small number of mismatches.

These results demonstrate that **AI can replicate expert-level device selection decisions** while maintaining consistency across users and vendors, as summarized in Figure 2.

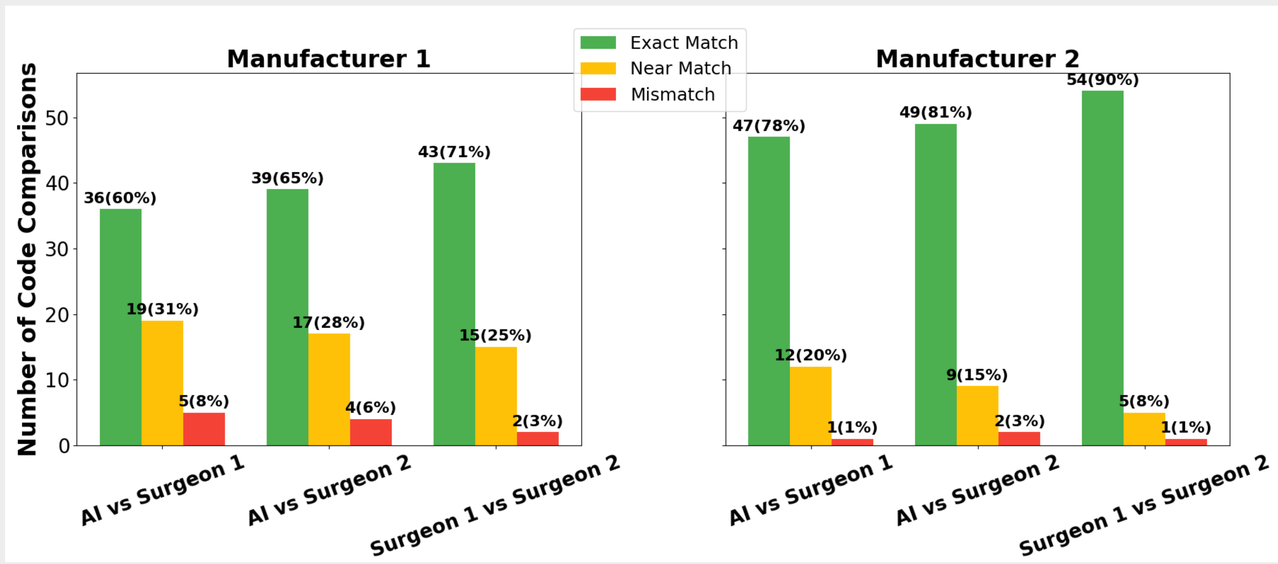

Figure 2. Summary of agreement between AI-generated and expert-selected stent-graft codes across two manufacturers.

DISCUSSION

The clinical value of this automation lies in its ability to bridge the operational gap between complex patient anatomy and rigid vendor-specific inventory guidelines.

By directly linking AI-based segmentation of sealing zones to device code generation, this framework effectively **removes the inherent subjectivity and human variation** traditionally associated with preoperative planning.

Mapping precise anatomical measurements to exact main body and iliac limb combinations normally demands meticulous expert interpretation and manual cross-referencing of manufacturer instructions, a tedious task highly susceptible to observer differences.

The finding that AI-driven selections achieve statistical parity with experienced vascular surgeons indicates that automated code extraction can serve as a **reliable decision-support tool** in clinical environments

CONCLUSIONS

AI-based automated extraction of EVAR stent-graft codes demonstrates **expert-level agreement** with vascular surgeons across the two manufacturers..

The AI tool automates converting patient-specific anatomy into manufacturer-specific device codes, **eliminating tedious EVAR planning tasks**, while maintaining standardisation and compliance with manufacturer device restrictions.

REFERENCES

1. Robbi E, Ravanelli D, Allievi S, et al. Automatic CTA analysis for blood vessels and aneurysm features extraction in EVAR planning. Sci Rep. 2025;15(1):16431.