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A Comparison of Surgical Outcomes Following TAVI, Robotic or Minimally Invasive AVR and Open Surgical AVR in The ACS NSQIP

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Abstract

Comparative outcomes among Transcatheter aortic valve implantation (TAVI), Conventional open surgical AVR (sAVR) and Robotic/video-assisted thoracoscopic minimally invasive AVR (robotic/MiAVR) remain unclear in contemporary practice.

Methods:
Adult patients undergoing isolated AVR in the ACS NSQIP Participant Use Files (2022–2023) were included in this retrospective cohort study. Patients undergoing concomitant procedures, non-femoral TAVI access, or unplanned conversion to open surgery were excluded. The primary outcomes were 30-day postoperative stroke and 30-day mortality. Multivariable analyses were adjusted using continuous NSQIP-predicted risk scores to account for baseline preoperative patient risk profiles.

Results:
30-day postoperative stroke *(p=0.4047)* and 30-day mortality *(p=0.39)* did not differ significantly across the three surgical approaches. For secondary outcomes that did not reach statistical significance, Robotic/MiAVR demonstrated higher rates of myocardial infarction but lower rates of deep vein thrombosis, pulmonary embolism, urinary tract infections, and sepsis. These findings may suggest variability in perioperative risk profiles across surgical approaches, which may help inform clinical decision-making and patient selection.

Background

- Stroke is a significant complication of aortic valve replacement (AVR) associated with prolonged hospitalization, increased cost, and mortality.[1]
- While transcatheter aortic valve implantation (TAVI) and conventional open surgical AVR (sAVR) are well studied, comparative analyses including Robotic/video-assisted thoracoscopic minimally invasive AVR (robotic/MiAVR) remain limited.[2,3]
- Perioperative outcomes across all three approaches were investigated.

Materials and Methods

- A retrospective cohort study was performed using the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) Participant Use Files from 2022–2023. All adult patients who underwent isolated AVR were included.
- Prior years were excluded as robotic-assisted procedures were not yet captured via CPT codes.
- Patients undergoing concomitant cardiac procedures, Ross procedures, Konno procedures, tandem operations, non-femoral TAVI access, or unplanned conversion to open surgery were excluded.
- The primary outcomes were 30-day postoperative stroke and 30-day mortality, using NSQIP-predicted mortality and morbidity risk scores.

Results

A total of 1,377 patients were included: 326 (23.7%) TAVI, 39 (2.8%) Robotic/MiAVR, and 1,012 (73.5%) sAVR.

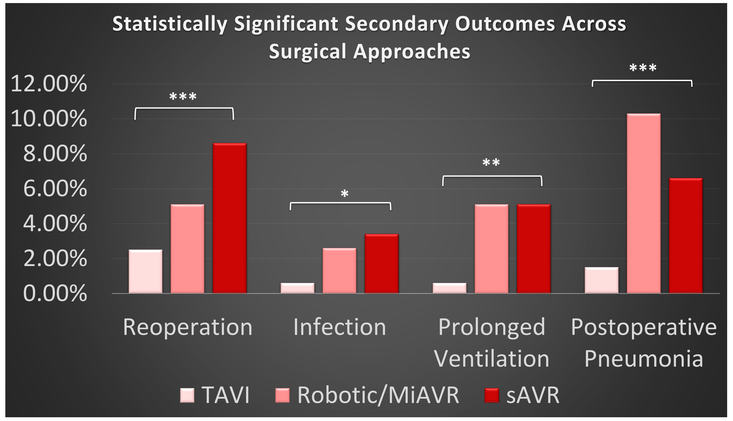
Primary Outcome

30-day postoperative stroke and 30-day mortality did **not differ significantly** across the three surgical approaches.

30-day Postoperative Stroke Rates				Statistics
TAVI	Robotic/MiAVR	sAVR	Total	
8 (2.5%)	0 (0%)	16 (1.6%)	24 (1.7%)	χ^2=1.80, p=0.4047

30-day Mortality Rates				Statistics
TAVI	Robotic/MiAVR	sAVR	Total	
4 (1.2%)	1 (2.6%)	25 (2.5%)	30 (2.2%)	χ^2=1.87, p=0.39

Adjusting for baseline patient risk scores did not affect the associations with stroke and mortality.



Conclusion

In this national sample, 30-day postoperative stroke and 30-day mortality were comparable across TAVI, Robotic/MiAVR, and sAVR. Robotic/MiAVR showed mixed perioperative outcomes suggesting it may be a reasonable option in selected patients; however further comparative studies are needed to clarify its role.

Future Direction

There remains limited comparative evidence guiding the selection among aortic valve replacement strategies, particularly between Robotic/MiAVR, sAVR, and TAVI. This limits clarity on optimal patient selection and contributes to variability in clinical practice.

Future studies should expand sample size, incorporate pairwise comparative analyses, and refine procedural identification within the ACS NSQIP database to improve classification accuracy and enhance the validity of outcome comparisons among different AVR techniques.

References

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