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Commentary: Robotic surgery increases global warming

Craig R. Smith, MD

First, I applaud Momin and colleagues¹ for daring to do this experiment. Some readers may quibble over a few methodologic imperfections, but as a first pass, the results are too striking to be dismissed. Myocardial protection is clearly an important issue when crossclamp times are 41% longer in the robotic group, even in the hands of surgeons as proficient as these.

I always measure temperature with a needle thermistor in the interventricular septum, except in “minimally invasive” thoracotomies or when adhesions obscure epicardial landmarks. Therefore, in any routine mitral procedure with normal coronaries, I know that septal temperature falls below 15°C in about 1 minute after 400 to 600 mL of antegrade del Nido cardioplegia. In this study 2 to 3 times as much antegrade cardioplegia (20 mL/kg) was required to reach 18°C in right atrial (RA) fat. Crudely extrapolating from my experience compared to that data, it appears that a topical thermistor placed on RA fat is somewhat more insulated from convective intravascular cooling than a needle thermistor inserted into septal muscle. That is not surprising. Whether strictly comparable to septal muscle cooling or not, however, the results in the sternotomy group reported here prove that RA fat does cool quite well when cardioplegia is delivered. What is alarming, and must be explained, is why there was almost no cooling in the robotic group. The most likely explanation by far is that there was much less cardioplegia delivered. It seems very unlikely that the insulation provided by a closed chest, radiant heating from the camera, room air carbon dioxide, or any other nonconductive ambient heating sources could

Radiation and convection beat conduction here, but not in the heart.

CENTRAL MESSAGE

Antegrade cardioplegia delivery in robotic operations may be inadequate or unpredictable.

overcome the initial cooling that we know is reliably and rapidly achieved with antegrade cold cardioplegia. Conductive cooling at the capillary level is very effective! Various ambient heat sources do contribute to rewarming, which might also be more dramatic in the robotic group, although it is hard to see here, since that group was barely cooled. The authors don't mention whether cardiac arrest was achieved in the robotic patients. The fact that the robotic patients tolerated an hour of ischemia without at least a few stone hearts suggests that some cardioplegia was delivered. If not into the coronaries, where was most of it going? Was aortic occlusion secure?

Even though Momin and colleagues¹ have not explained the absence of cooling in the robotic group, I commend them for concluding that “meticulous care” should be taken to ensure adequate cardioplegia delivery. They also appropriately emphasize the importance of excellent venous return to minimize convective rewarming by venous blood. My more limited personal experience with robotic and other “minimally invasive” approaches suggests that inconsistent decompression of the heart is vexing and very common. This report raises many tantalizing questions that could be addressed much more precisely in large animal models, which I hope someone will pursue.

Reference

1. Momin A, Chemtob R, Lopez D, Gillinov AM, Wierup P, Mick SL. Open sternum, cooler heart: the effect of surgical approach on myocardial temperature. *J Thorac Cardiovasc Surg Tech.* 2020;1:41-2.

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