Discussion of 2021-1723

IMPACT OF ENDOVASCULAR STENTING ON OUTCOMES IN PATIENTS WITH TRAUMATIC SUBCLAVIAN ARTERY INJURY

**DR THOMAS M SCALEA** (Baltimore, MD): Almost exactly 3 years ago, I stood in this spot and presented our work on traumatic aortic injury that demonstrated that open repair was simply no longer done. Dr J Wayne Meredith, one of our discussants, began his comments with, “This excellent paper from Dr Scalea and the group at the Shock Trauma Center sounds the death knell for the best trauma operation ever performed: open aortic repair.” This year, I stand here as a discussant and say that this excellent paper from Martin Croce, Lou Magnotti, and the group from Memphis sounds the death knell from my personal favorite operation and perhaps the second-best trauma operation ever performed: open subclavian artery repair. Open repair is technically demanding– more challenging on the left side than on the right– but challenging on both sides.

When done well, it is as elegant an exposure as one has to separate the vessels from the brachial plexus. For patients in shock, one must move rapidly, but failure to recognize the important anatomic relations risks iatrogenic injury to nerve, vessels, or the thoracic duct. In this study, 70 percent of patients with blunt subclavian injury and 40 percent of those with penetrating injury were treated with endovascular repair. Endovascular repair was associated with significantly lower morbidity and mortality compared with open repair in patients with penetrating injury. The usual parameters, Glasgow Coma Scale score and overall injury severity, were associated with mortality. Endovascular repair use was the only modifiable factor associated with the better results seen in penetrating injury, and I would guess that associated effects of the brain injury that often comes with blunt trauma may explain why the authors saw no difference in the patients with blunt trauma. The authors analyzed the TQIP data from 2014 to 2018. I would guess that if they looked at current practice, the trends they observed would be even more striking. At the Shock Trauma Center, we have not performed a primary open subclavian artery repair in over 5 years. We completely drank the Kool‑Aid.

Now, I will acknowledge that we have a special setup. We control the dedicated trauma hybrid operating room. We have 4 dual-trained trauma and vascular surgeons. We can be in the hybrid room at least as quickly as we can be in a regular room, and this makes endovascular care attractive, even in patients in shock. We even stent complete transections now, first getting proximal control with a balloon, then cutting down on the brachial artery and deploying the stent using a retrograde rendezvous approach. So, help me here. Help all of us. How should we manage these patients? How does your group in Memphis do it? Who is treated with open repair or endovascular repair? What are your endovascular capabilities? How quickly can you mobilize the resources needed for endovascular repair? Does that vary by on‑call surgeon? The debate as to how we will train surgeons to care for vascular injury has been contentious and very loud. Some have suggested the answer is to simply train more vascular surgeons. I am not sure that is the answer. Trauma surgeons are the people in-house when these patients present. Time matters here. A few of us senior trauma surgeons still feel comfortable approaching the mediastinal great vessel, particularly the subclavian, using an open technique. As these cases are shrinking in volume, will we be able to provide sufficient experience that trauma surgeons will be able to perform this operation 10 years from now? Maybe not. This manuscript suggests this may not be an issue, as open subclavian artery repair is being used less and less.

I would ask the authors to look into the future. How will we solve this issue? How will we guarantee that we always have the necessary expertise available? This manuscript provides great insight into the current state-of-the-art of management of subclavian artery injury. I am certain that the management of these relatively rare but complex injuries will continue to evolve. I look forward to more work from our colleagues in Memphis and elsewhere as we try to navigate these waters.

**DR DAVID V FELICIANO** (Baltimore, MD): It was interesting that in a paper on 425 endovascular procedures, you did not report in‑hospital or early post‑discharge intervention, a real problem in many previous reports on endovascular repair.

One‑half of the 22% morbidity in the open penetrating group was due to deep vein thrombosis or pulmonary embolism, a figure 3 times that in the endovascular group. I am unaware of any data in the literature over the past 40 years that state that open repair of an injury to the subclavian artery predisposes patients to either of these complications. Therefore, was there some major difference in the use of heparin in the open vs endovascular groups?

Finally, you did not list the cause of death in the 42 patients in the penetrating group. How many deaths in the open group were due to the incision, management of the clavicle, or inadvertent injury to surrounding structures, all concerns that you and Dr Scalea have raised? Like most experienced trauma vascular surgeons, I have never had a postoperative infection in the sternum or clavicle repairing these injuries and have only had 1 clamp injury to the brachial plexus over 40 years.

I congratulate the authors on their excellent results and on this interesting state‑of‑the‑art paper. Like all Level I and II trauma centers, I encourage them to do a cadaver lab annually to teach subclavian and axillary exposures. This operation is not going away.   
**DR OMAIDA VELAZQUEZ** (Miami, FL): I congratulate the Memphis group for a wonderful paper that, in my opinion, should change clinical practice. When you look at these data, it is evident that endovascular repair for subclavian artery injury performs better than open repair. This is similar to what we saw with aortic injury. And it took randomized, prospective trials to finally change practice patterns on how best to reconstruct disrupted aortas due to blunt traumatic injury (from open to endovascular approaches). My question to this group is simple: Do you feel that this data is sufficient for all of us to go home and change our standard‑of‑care clinical practice, or has some of what has been mentioned by discussants lead us to continue revisiting this topic and await additional prospective trials?

Speaking as a vascular surgeon, I have no doubt in my mind that endovascular repair is superior, better for patients. As elegant an exposure and as beautiful an operation it is to perform open, the endovascular patients have much less of a physiologic insult.

**DR RICHARD A LYNN** (Palm Beach, FL): Not every place is the Maryland Shock Trauma Center. This goes on all over the country and in less sophisticated places. Who performs them? The trauma team? Vascular surgeons? Or interventional radiology? Are they performed in the operating room? Are they performed in a hybrid suite or in an interventional radiology suite? Past president LD Britt commented 10 years ago on a paper about stenting in young trauma patients for thoracic injury, and he, in his eloquent way, was concerned about long‑term follow‑up in this patient population who may not be compliant. So, what is, indeed, your follow‑up?

**DR BENJAMIN R ZAMBETTI** (Memphis, TN): In terms of how we manage subclavian artery injury in Memphis, we have transitioned to primarily performing these operations using an endovascular technique. We do not have access to a trauma hybrid room, so patients who present in an extremist or variable degrees of shock still usually require open procedures. How quickly can we mobilize it? It is somewhat dependent on the on‑call surgeon and on what time of day it is, as you alluded to. As the trauma surgeons are in-house, most of our stenting work is performed by the vascular staff who would have to be called in and our team mobilized. In terms of what the future trending paradigm should be, as Dr Feliciano alluded to, I think it will be some degree of anatomy labs and cadavers, and an increase in teaching endovascular techniques across specialties. Dr Feliciano asked about early intervention for patients who underwent endovascular repair. Unfortunately, due to limitations in the TQIP equipment database, we cannot really separate that out. Any intervention performed after discharge is not captured. Similarly, while the deep venous thrombosis rate was different in the blank group, that did not hold in the penetrating group. The use of heparin (procedure heparin) is not reported through TQIP, nor is the cause of death.

Dr Velazquez asked whether this data is sufficient to change practice, I think it should definitely change practice for patients who are stable on presentation. People who can be treated endovascularly should be, though I do not think there will be a time when open operation is not needed.

Dr Lynn asked who should be performing this operation. I think whoever feels comfortable and qualified to do so should perform it. If, at a certain center, the trauma surgeon does endovascular care and feels comfortable taking care of it, I think whoever is present and ready to do so, should.

There is no information in the TQIP database about the location of the procedure, whether it is performed in the operating room, hybrid room, or interventional radiology. At our institution, it varies based on staff preference.

In terms of long‑term outcomes and stent patency, I agree that it is an ongoing issue that will have to be addressed over time, and these patients will need routine surveillance, as well as antiplatelet therapy, which they may or not be compliant with. So that will be an ongoing issue that will probably need to be addressed at an institutional level.