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Endovascular branch fenestration and/or stenting may be a viable treatment option for lower limb malperfusion due to acute type B aortic dissection

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ABSTRACT A clinical decision report appraising Norton EL, Williams DM, Kim KM, et al. Management of acute type B aortic dissection with malperfusion via endovascular fenestration/stenting [published online September 30, 2019]. *J Thorac Cardiovasc Surg.* 2019. https://doi.org/10.1016/j.jtcvs.2019.09.065

Keywords: *acute limb ischemia, lower limb malperfusion, acute type B aortic dissection, endovascular, fenestration, stenting*

Clinical Context

Hank Brown (pseudonym), a 51-year-old male with a past medical history metastatic colon cancer, was transferred from an outside hospital due to hypertensive emergency (210/130) and a Stanford type B aortic dissection extending from just distal to the left subclavian artery to the left external iliac artery. The dissection also propagated into the celiac trunk, and the left kidney was perfused by the false lumen. Upon arrival to the Surgical Intensive Care Unit (SICU), Mr. Brown did not have dopplerable pulses in his left leg, which also felt cooler to touch than the contralateral limb. At this time, he also complained of paresthesias in his left foot. The patient's blood pressure was subsequently controlled with esmolol and nifedipine.

After speaking with the patient and his family, Mr. Brown confided that he was working to control his hypertension in order to receive a chemotherapy medication – that was known to cause hypertension – for his colon cancer. However, insurance and monetary barriers impeded his success. Additionally, Mr. Brown played in a recreational soccer league and wanted definitive treatment without undergoing a major operation for his acute limb malperfusion. His preference provoked a discussion among the treating physicians. After discussion and counselling the patient and family, the patient was scheduled for an endovascular fenestration and stent later that day. Following his procedure, Mr. Brown had a resolution of his symptoms; and his blood pressure was well controlled on the new regimen.

Clinical Question

Is endovascular fenestration and stenting a viable treatment option for patients with lower limb malperfusion secondary to acute type B aortic dissection?

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Research Article

Norton EL, Williams DM, Kim KM, et al. Management of acute type B aortic dissection with malperfusion via endovascular fenestration/stenting [published online September 30, 2019]. *J Thorac Cardiovasc Surg.* 2019. https://doi.org/10.1016/j.jtcvs.2019.09.065.

Related Literature

A search of the MEDLINE database via PubMed was conducted with the following search terms: type B aortic dissection[All Fields] AND acute limb ischemia[All Fields] OR lower limb malperfusion[All Fields] NOT type A[Title/Abstract] AND endovascular fenestration[All Fields]. Using these variables yielded 15 results that were screened to determine their relevance to Mr. Brown's case. Three of the articles discussed open fenestration,[1–3] and four articles were case reports.[4–7] While case reports are useful to report unique or challenging cases, they are not beneficial in evaluating treatment options for patients.

In 2014, Gargiulo et al. published a systemic review on lower limb malperfusion in the setting of type B aortic dissection. Lower limb malperfusion is the only clinically detected malperfusion in about 50% of patients – as was observed with Mr. Brown. Lower limb malperfusion is also commonly associated with renal and visceral malperfusion. Endovascular, surgical, and medical treatment options were employed with 47%, 37%, and 16% of patients, respectively. Of patients who had an endovascular intervention, the most common was percutaneous fenestration – occurring in over half of the patients. This technique was used for Mr. Brown. Additionally, aortic and/or iliac stent-grafting and thoracic endovascular aortic repair were concomitantly performed with percutaneous fenestration. In this meta-analysis, endovascular technical success was observed in close to 90% of patients.[8]

Other studies reviewed included two single-center retrospective studies published, both of which had small sample sizes of 32 and 11 patients.[9,10] A similar study, published by Sfyroeras et al., included 85 patients undergoing endovascular repair for type B aortic dissections. However, only six patients had evidence of lower limb ischemia.[11] A retrospective study that included patients with aortic dissections and subsequent peripheral vascular complications over the course of a decade had a larger sample size 187. Of these patients, only five underwent endovascular procedures.[12] Given these limitations, these articles were not the best available to answer the clinical question.

Patel et al. published a single institution retrospective study exploring the long-term results of percutaneous intervention for malperfusion secondary to acute type B dissection. In their study, 68% of patients had affected limb vasculature on angiography, but only about 38% presented with symptoms of limb ischemia. While this study concluded percutaneous intervention to be a viable option, they only included patients with pathology confined to the thoracoabdominal aorta.[13] As Mr. Brown had his dissection extend into the left external iliac artery, the studied patient population did not represent our patient.

Utilizing both a national and single institution database, both Henke et al. and Norton et al. analyzed type B aortic dissections leading to malperfusion with both a national and single institution database. Henke et al. examined acute limb ischemia specifically, where they concluded that endovascular therapy was more commonly employed than surgical therapy. However, if the patients received fenestration, it was an aortic as opposed to a branch fenestration like our patient Mr. Brown.[14]

On the contrary, Norton et al. published an article in 2019 where 59% of the 182 patients had a branch vessel fenestration and/or stenting. Of this cohort, 58 patients had iliac fenestration and/or stenting.[15] This paper is best suited to answer his clinical question for two reasons. First, the patient population was diverse and from a national database. Given there are no randomized controlled trials on the subject matter, a retrospective study with a patient population from many separate institutions provides the best data available. Second, Mr. Brown underwent an iliac fenestration and stent, and is thus best represented by the patient population studied. Given the above discussed literature, this body of evidence would be a Grade-C Strength of Recommendation based on the Strength of Recommendation Taxonomy (SORT) criteria.

Critical Appraisal

The study by Norton et al. is a retrospective study utilizing data from both a single institution and a national database. Using the SORT guidelines, this study is Level 3. Preferably, research studies are randomized controlled trials. There are often logistic and

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ethical issues with subject enrollment for surgical research studies such as blinding surgical procedures from patients. Because this study utilized a national cohort, it provides the best available evidence. It benefits from a clear definition of acute type B dissection and 5- and 10-year follow-up data, with over 93% of subject's following up.

However, there are a few flaws with the study due to its retrospective nature. First, a cause and effect relationship cannot be concluded with retrospective data. Additionally, Norton et al. did not have a control group. This presents challenges when interpreting the data and prevents the calculation and interpretation of an effect size. Although it is clear that endovascular stenting and fenestration is a viable treatment modality, this study did not compare how it performs relative to other options, say surgical, medical, or other endovascular techniques.

A strength of the study is inclusion and exclusion criteria: patients with type B dissection resulting in malperfusion were excluded only if the initial insult was trauma or if the symptoms were effectively addressed with thoracic endovascular aortic repair. With these criteria, very few patients were removed from analysis, facilitating more generalizability of the conclusions. While Mr. Brown met these criteria, his profile has some stark differences from the demographics of the subjects. Over two thirds of the patients in this study were current or former smokers, whereas Mr. Brown never used tobacco products. Additionally, he had a history of strokes, compared to mere 7% of patients in this study. Mr. Brown's presenting symptom was back pain, while over 60% of patients presented with abdominal pain. Additionally, less than 40% of patients had extremity malperfusion suspected, resulting in only 58 iliac artery stenting or fenestrations.

Time from presentation to intervention is an absent variable in the analysis of Norton et al. Similar to other ischemic conditions such as acute coronary syndrome or stroke, prompt treatment is imperative to achieve adequate outcomes. Because this variable was not addressed, it could confound the results. For example, maybe endovascular fenestration and/or stenting result in great outcomes not because of the intervention's effectiveness, but rather how quickly the intervention occurred. To appropriately understand our clinical question, it is imperative this is addressed in future studies.

Although harvesting data from subjects dating back to 1996 provides the authors with a large subject population, it also introduces a potential bias. There is a drastic improvement in the technology and techniques over two decades. The authors conclude as much, as there is an overall in-hospital mortality of 7.7% and none in the most recent eight years. Mr. Brown survived his life-threatening condition despite having risk factors according to this article's data. Using a multivariable logistical regression to calculate the odds ratio (OR) and confidence interval of risk factors for in-hospital mortality, age (OR: 1.15; 95% CI: (1.06-1.25); p-value=.0009), acute myocardial infarction (OR:8.59; 95% CI: (1.35-54.42); p-value=.020), and found extremity malperfusion (OR:8.83; 95% CI: (1.43-54.78); p-value=.02) were statistically significant.

The results of this study suggest that endovascular fenestration and/or stenting may be a viable treatment option for patients with malperfusion syndrome secondary to acute type B aortic dissection. Due to the methodology, the results should be interpreted with caution, and more robust research is required.

Clinical Application

Mr. Brown expressed concerns about the long-term outcomes of his disease and the interventions, because he wished to quickly return to the soccer field. The article by Norton et al. suggests that endovascular stenting and/or fenestration is a treatment option with acceptable outcomes. Utilizing a minimally invasive approach may sacrifice definitive treatment. This study reported a 5- and 10-year cumulative incidence of reintervention of 21% and 31%, respectively. Furthermore, the 5- and 10- year survivals were 72% and 49%, respectively. Had Mr. Brown wanted a one-time treatment invention, other available options such as open surgery would have been considered. Another factor discussed was the distance from the hospital that Mr. Brown and his family lived. While they did live far away, it was within acceptable driving distance should he require another intervention. Had Mr. Brown lived in a remote location, a more definitive treatment option again would have been more seriously considered.

Despite the limitations of the study, their conclusions seem appropriate. Norton et al. utilized acceptable definitions of acute type B aortic dissections and malperfusion. They also analyzed data from a national registry in

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addition to their institution's database. Doing so allows the results to be more generalizable. Consequently, the demographics of the subjects adequately represented Mr. Brown and apply to his case.

Before these results are applied widely, stronger evidence is necessary. Studies with a control group, prospective data, and or a randomized controlled trial would provide stronger evidence to support this treatment modality. These studies should explore the time from presentation to intervention and also reintervention rate. It is important to consider these variables in order to help physicians advise patients on the best intervention for their wants and needs.

New Knowledge Related to Clinical Decision Science

While retrospective studies can provide useful information and provided us with some guidance to care for Mr. Brown, a definitive answer to is his problem is hard to solve. Clinical Decision Science tells us that it is important to take into the considerations of the patient when physicians examine and use evidence-based medicine to guide treatment. For the case of Mr. Brown, we applied treatment that while effective, had limited support from randomized clinical trials or prospective cohort studies. Clinical Decision Science guided management and was made with the patient's stated preference for minimally invasive surgery. Given his co-morbid condition of metastatic cancer and his relatively young age, his desire to play soccer looms large in the clinical decision. When patients face multiple medical conditions that have associated high mortality, priorities for remaining life experiences change. Playing soccer may seem trivial to others, but for Mr. Brown, it had an important effect on the clinical decision. In this case, the evidence needed merely meet the criteria for "reasonable care." Although the evidence is scant, in this clinical setting it seemed appropriate. The treatment ended up being successful, showing that treatment modality should be tailored to the patient and concern for whether data is from a randomized controlled trial, while important, should not be the only focus when discussing treatment. Clinical Decision Science also has to consider the possibility of Mr. Brown dying from treatment complications. Would that have been an acceptable outcome for the family, patient, and treating doctors?

References

1. Szeberin Z, Dósa E, Fehérvári M, Csobay-Novák C, Pintér N, Entz L. Early and long-term outcome after open surgical suprarenal aortic fenestration in patients with complicated acute type B aortic dissection. *Eur J Vasc Endovasc Surg*. 2015;50(1):44-50. https://doi.org/10.1016/j.ejvs.2014.12.028
2. Trimarchi S, Segreti S, Grassi V, et al. Open fenestration for complicated acute aortic B dissection. *Ann Cardiothorac Surg*. 2014;3(4):418-422. https://doi.org/10.3978/j.issn.2225-319X.2014.07.08
3. Trimarchi S, Jonker FHW, Muhs BE, et al. Long-term outcomes of surgical aortic fenestration for complicated acute type B aortic dissections. *J Vasc Surg*. 2010;52(2):261-266. https://doi.org/10.1016/j.jvs.2010.02.292
4. Ikeda A, Kudo Y, Konishi T, Matsuzaki K, Jikuya T. Surgical fenestration for lower limb ischemia developing from chronic type B aortic dissection: a report of 2 cases. *Ann Vasc Surg*. 2016;31:208.e9-208.e14. https://doi.org/10.1016/j.avsg.2015.08.029
5. Narita K, Akutsu K, Yamamoto T, et al. Simultaneous fenestration with stent implantation for acute limb ischemia due to type B acute aortic dissection complicated with both static and dynamic obstructions. *Ann Thorac Cardiovasc Surg*. 2012;18(2):158-161. https://doi.org/10.5761/atcs.cr.11.01712
6. Fujita W, Daitoku K, Taniguchi S, Fukuda I. Endovascular stent placement for acute type-B aortic dissection with malperfusion--an intentional surgical delay and a possible "bridging therapy." *Interact Cardiovasc Thorac Surg*. 2009;8(2):266-268. https://doi.org/10.1510/icvts.2008.191361
7. Yamaguchi M, Sugimoto K, Tsuji Y, et al. Percutaneous balloon fenestration and stent placement for lower limb ischemia complicated with type B aortic dissection. *Radiat Med*. 2006;24(3):233-237. https://doi.org/10.1007/s11604-005-1526-0
8. Gargiulo M, Bianchini Massoni C, Gallitto E, et al. Lower limb malperfusion in type B aortic dissection: a systematic review. *Ann Cardiothorac Surg*. 2014;3(4):351-367. https://doi.org/10.3978/j.issn.2225-319X.2014.07.05
9. Botsios S, Schuermann K, Maatz W, Keck N, Walterbusch G. Complicated acute type B dissections: a single-center experience with endovascular treatment. *Thorac Cardiovasc Surg*. 2010;58(5):280-284. https://doi.org/10.1055/s-0030-1249942
10. Vedantham S, Picus D, Sanchez LA, et al. Percutaneous management of ischemic complications in patients with type-B aortic dissection. *J Vasc Interv Radiol*. 2003;14(2 Pt 1):181-194. https://doi.org/10.1097/01.rvi.0000058320.82956.3f

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https://doi.org/10.22237/crp/1593562080

11. Sfyroeras GS, Rubio V, Pagan P, Diethrich EB, Rodriguez JA. Endovascular management of malperfusion in acute type B aortic dissections. *J Endovasc Ther*. 2011;18(1):78-86. https://doi.org/10.1583/10-3141.1
12. Lauterbach SR, Cambria RP, Brewster DC, et al. Contemporary management of aortic branch compromise resulting from acute aortic dissection. *J Vasc Surg*. 2001;33(6):1185-1192. https://doi.org/10.1067/mva.2001.115377
13. Patel KP, O'Brien TW, Subramony SH, Shuster J, Stacpoole PW. The spectrum of pyruvate dehydrogenase complex deficiency: clinical, biochemical and genetic features in 371 patients. *Mol Genet Metab*. 2012;105(1):34-43. https://doi.org/10.1016/j.ymgme.2011.09.032
14. Henke PK, Williams DM, Upchurch GR, et al. Acute limb ischemia associated with type B aortic dissection: clinical relevance and therapy. *Surgery*. 2006;140(4):532-539; discussion 539-540. https://doi.org/10.1016/j.surg.2006.06.019
15. Norton EL, Williams DM, Kim KM, et al. Management of acute type B aortic dissection with malperfusion via endovascular fenestration/stenting [published online September 30, 2019]. *J Thorac Cardiovasc Surg*. 2019. https://doi.org/10.1016/j.jtcvs.2019.09.065

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