Aortoiliac Allograft Outer Diameter Measurement: Why Pressurization Matters

ORIGINAL RESEARCH ARTICLE

INTRODUCTION

Aortic grafts are used in clinical cases necessitating aortic reconstruction, repair, or replacement due to primary infection of a previously implanted vascular graft, mycotic aneurysm, or aortic graft-enteric erosion [1]. Aortic graft infections occur in 0.2 - 5.0% of open aortic reconstruction surgeries [2]. These rare infections are difficult to treat and are linked to significant morbidity and mortality [2]. The treatments, such as extra-anatomic bypass and neo-aortoiliac system procedure (NAIS) with the femoral vein also have substantial risk of complications including recurrent infections, aortic stump blowout, and major limb amputation [2-4]. Replacement grafts may be autograft, synthetic, construct, singular vein or artery allograft, or aortoiliac allograft, each with potential advantages and limitations. The main advantage of an autograft is that it eliminates the possibility of immune-derived rejection; however, an autograft requires a second surgery site in an already critically ill patient and also may not be available due to poor vascular quality. Synthetic grafts avoid a second surgery site, but are more prone to infection than autograft or allograft [5]. Singular vein or artery allografts avoid a second surgery site, but may need to be altered using surgical modifications such as beveled anastomosis, fish mouth, and tapering. These modifications are necessary to make the graft fit the patient's anatomy, but the process consumes valuable operating room time during a critical procedure. Cryopreserved aortoiliac allografts are another alternative that similarly avoid a second surgery site while also having the options to be custom size-matched and to include branch vessels that may help reduce ischemia [2].

While autograft and singular allograft veins or arteries are altered to fit a patient's aortic diameter and anatomic specifications, a cryopreserved aortoiliac allograft can be size-selected for a specific patient to minimize preparation time. Given the severity of these cases, clinicians may need to intervene quickly. Having an allograft option that saves valuable operating room time in these critical procedures not only benefits the patient, but also the surgeon and hospital.

Size-matching for the patient can be difficult to determine depending on how the grafts were measured. Aortoiliac allografts distend when exposed to arterial pressures. However, the amount of distension varies by individual donor, which may lead to a graft-to-patient mismatch that requires modification if the graft is measured only in its flaccid state. For example, in a study of 25 aortic grafts, the difference between pressurized grafts of the same flaccid inner diameter measurement revealed variances of up to 5mm (Fig. 1A-B). To measure the inner diameter of a flaccid aorta, a hegar dilator was wetted and inserted into the aorta without adding any pressure inside the vessel, without leaving gaps, and without dilating of the arterial wall. To measure the pressurized diameter, the graft was filled with isotonic solution to a pressure of ~125 mmHg. The pressurized outer diameter was measured with a ruler. Measuring under physiological arterial pressures reduces the possibility of a mismatch because the distended measurement is the one that will match the patient's anatomy. If only the flaccid measurement is used to order grafts, and an assumption is made regarding distension under pressure; it can lead to increased risk of a mismatch resulting in increased OR time, or graft modifications (Fig. 2).

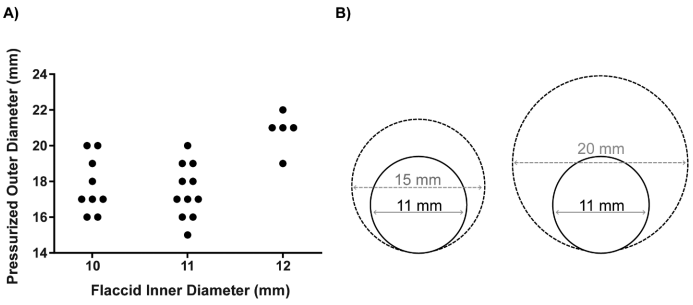

Figure 1. Pressurized diameter variability. Panel A shows that aortoiliac arteries from different donors with the same flaccid inner diameter (ID) measurement can have different outer diameter measurements when pressurized. Each point represents an individual donor: ID of 10mm (n = 9), ID 11m (n = 11), and ID 12mm (n=5). Panel B illustrates the smallest and largest diameters for the 11 mm flaccid inner diameter group. Solid lines indicate flaccid inner diameter while dashed lines indicate pressurized outer diameter. Illustration is to scale.

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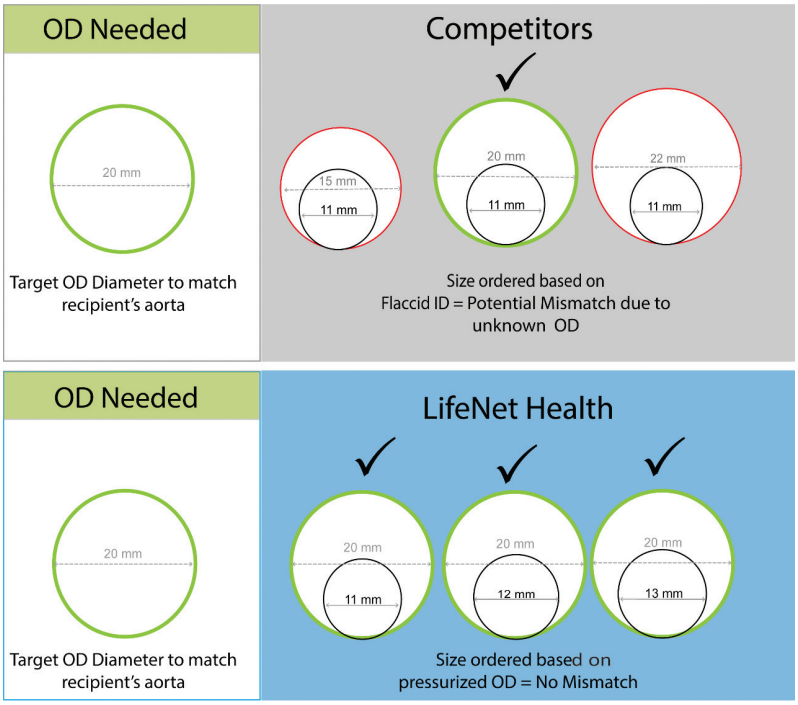

Figure 2. Comparison of sizing methods. The top panel shows aortoiliac sizing based on flaccid inner diameter (ID) without knowing the pressurized outer diameter (OD). This method has the potential for a mismatch. For example, three grafts with a flaccid inner diameter of 11mm could each have a different OD when pressurized due to variability between donors. The bottom panel shows that sizing based on pressured OD leads to precise matching regardless of flaccid ID size.

CONCLUSIONS

Patients that need aortic reconstruction, repair, or replacement experience high levels of morbidity and mortality. These critically ill patients need every possible advantage that medicine can offer to help them survive and heal. Measuring pressurized outer diameter for aortoiliac allografts can lead to a better fit for the patient and save valuable operating room time by avoiding the need for modifications. During these critical, and often life-saving procedures, every second counts. Minimizing graft preparation time is of vital importance, and having the best possible for the patient as well as the surgeon.

REFERENCES

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