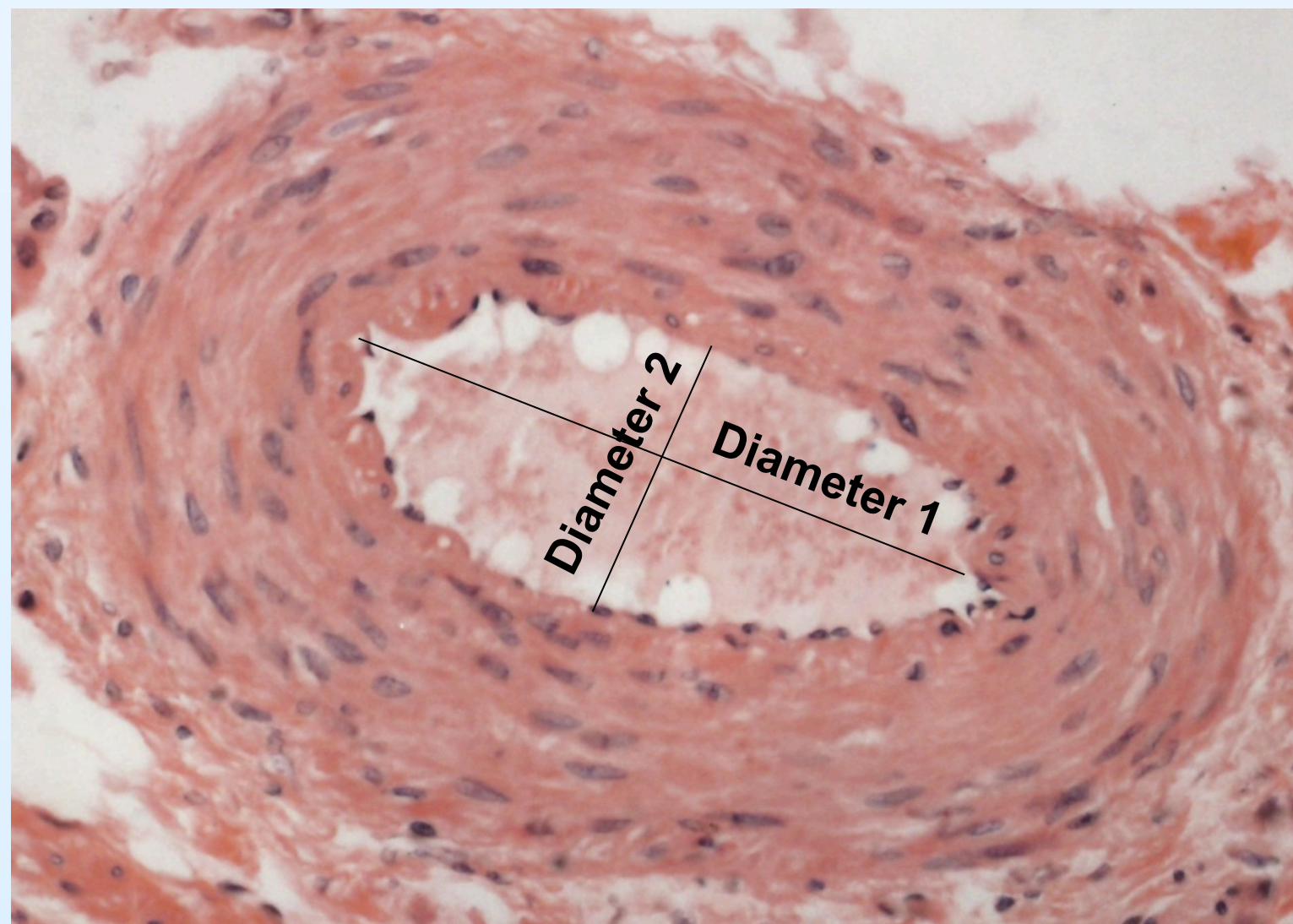


## Introduction

- The utilization of free flaps has become an integral part of head and neck reconstruction over the last 30 years<sup>1</sup>
- Free flap success relies on a multitude of factors, but none are likely more important than a healthy anastomosis between the donor and recipient vasculature<sup>2</sup>
- Despite surgical progress resulting in high rates of transferred tissue survival, the risk of pedicle vessels thrombosis still remains a significant problem<sup>3</sup>
- Peripheral vascular disease, which causes vessel narrowing, has been shown to decrease success of free flap reconstruction in various portions of the body<sup>4</sup>
- No previous study has looked at vessel size and health during free flap reconstruction of the head and neck
- In this study we prospectively gathered small segments of arteries from donor and recipient sites for 68 consecutive cases at Pennsylvania Hospital, a tertiary academic hospital apart of the University of Pennsylvania Health Network
- The goal of the pathologist was to measure the luminal and wall thickness of each artery, as well as the presence of intimal hyperplasia and plaque formation, and the presence of calcifications



**Figure 1.** Cross section of thick-walled artery showing an approximation of how the intraluminal area was calculated.

## Methods

First, IRB approval was obtained for this prospective cohort study designed to collect intraoperative human tissue for histopathologic sampling. Plan for collection of donor and recipient artery segments for each head and neck free flap reconstructive cases between December 2020 and November 2021. A total of 68 patients were enrolled in the study in this time period. No patients declined to enroll in the study, however 17 cases had vessels that were not collected due to lack of consent prior to anesthesia or forgetting to send specimens to pathology. Arterial intraluminal dimensions were measured under a microscope. This was done by measuring the diameter at the largest dimension and then also at a complete perpendicular dimension. These numbers were each divided by 2 to get radius measurements and then multiplied by each other and 3.14159 to estimate and area calculation.

## Results

The mean intraluminal dimensions and luminal area for the donor (free flap donor site) arteries was larger than that of the overall average luminal area of the recipient arteries within the neck ( $0.913\text{mm}^3$  vs  $0.679\text{mm}^3$ ,  $p=0.45$ ). The average luminal area of all arteries in successful free flaps was  $0.788\text{mm}^3$ , while the average luminal area of all arteries used in cases where there was either partial or complete free flap failure was  $0.576\text{mm}^3$ ,  $p=0.39$ ). The difference in vessel luminal area between recipient and donor vessels was greater in cases where there was free flap failure,  $0.914\text{mm}^3$ , versus the difference in luminal area between recipient and donor vessels in successful free flap cases,  $0.147\text{mm}^3$ ,  $p=0.38$ ). While none of these measurements reached statistical significance, it should be noted that in cases of free flap failure (partial or complete) the arteries utilized for microvascular anastomosis were smaller and showed a greater disparity between donor and recipient artery sizes.

## Discussion & Conclusions

- It is intuitive that successful free flaps are more likely to have larger recipient and donor arteries. The larger luminal size should theoretically make it more difficult for a completely occlusive thrombus to form and cause ischemic injury. It also seems logical that the anastomosis between donor and recipient arteries would ideally include two similarly sized arteries. Unfortunately, our study hinted at these points, but was not powered well enough to show statistical significance
- Our study had multiple limitations. First, the sample size was not large enough to draw any definitive conclusions. As previously shown, the data displays some interesting results, however the sample size would have to be much larger to show a statistically significant difference. Second, there are many variables that go into free flap success. To properly show correlation, a multivariate analysis taking in many different demographic and clinical factors would have to be included. Also, multiple different people were involved in the tissue fixation and paraffin embedding process for sample analysis. If the vessels were prepared differently or cut at slightly oblique angles, that would affect the final measurements. Lastly, other findings by the reading pathologist were deemed too subjective to include in the final study (presence of significant calcifications, intimal hyperplasia, plaque formation, inflammation).
- While we understand this study displays many limitations, the authors feel we presented a thought provoking and novel concept, as well as some interesting data

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