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CASE REPORT

A Dilated, Tortuous Uterine Artery: Gross Anatomical Variant and Clinical Significance

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Abstract

The dissection of a left hemisected pelvis of a 43-year-old embalmed female cadaver revealed a dilated, tortuous ascending branch of the uterine artery. It contains a total of eighteen direction changes in a ~2cm span. Dilated tortuous uterine arteries are associated with multipara, and the resultant decreased blood flow can lead to a multitude of pre- and post-partum complications. Research focuses on developing a reproducible, credible identification method for uterine artery variants in women presenting with associated symptoms in order to prevent these dangerous clinical manifestations. The purpose of this paper is to report the anatomical variant, provide retrospective discussion, and advocate future research.

Keywords: Dilated, Tortuous, Uterine Artery, Pregnancy, Parity, Preeclampsia, PrE

Introduction:

The first step in any disease management strategy is identification of the underlying problem. Often, a significant fundamental factor to disease states is an anatomical variant. For example, dilated tortuous uterine arteries are closely linked to clinical presentations such as preeclampsia (PrE), uterine artery pseudoaneurysm (UAP) treatment difficulties, severe vaginal bleeding, dysmenorrhea, miscarriages, and lower abdominal pain. Complex monitoring and screening are required to prevent these manifestations and the identification of a uterine artery variant is an important factor. No reproducible identification strategy currently exists. In this article, we report a dilated, tortuous uterine artery identified in a 43-year-old female cadaver and discuss its clinical significance to emphasize the importance of effective identification methods.

Materials and Methods

The dilated, tortuous uterine artery was initially identified by a second-year medical student while dissecting the vesicouterine pouch of a previously hemisected left pelvis. The student's professor confirmed the uniqueness of the artery and the student was instructed to continue the dissection to its deepest point, while preserving the integrity of the artery in question. The ascending branch of the uterine artery was dissected to the level of supply seen in Figure 1. Orientation of the uterine artery on gross inspection begins with a gentle inferomedial curve followed by the dilated tortuous segment (ascending branch). This segment begins at the level of the internal os with an anterior- inferior (AI) direction and continues for 6.88cm in a 2.03cm space with 18 direction changes: AI→ superior-posterior (SP) → superolateral (SL) → inferior (I) → medial (M) → SP → M → L → I → M → L → S → L → M → L → I → SP→ P. The dilated segment ends at the attachment point of the round ligament of the uterus.

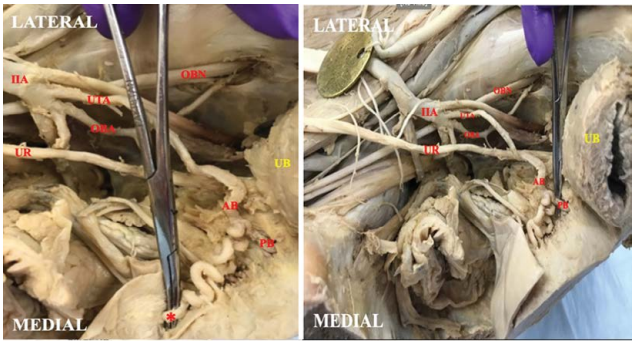

Figure 1: 2 AP views of L hemisected pelvis internal iliac artery and branches
ILA = internal iliac a. OBA = obturator a. UTA = uterine a. AB = start of uterine a. ascending br. PB = uterine a. posterior br. UR = ureter OBN = obturator n. UB = urinary bladder
* = level of supply

Digital imaging measurement software (Image J NIH, Bethesda MD) was used to measure the uterine artery in its anatomical position (Figure 2) and isolated outside of the pelvis (Figure 3). A ruler in each image scales the software as pixels/cm and

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Figure 2: Uterine a. in anatomical position. 1 straight segment (red line) measured after the anteroinferior curve to focus on the dilated tortuous segment length = 2.03cm.

Figure 3: Uterine a. isolated outside of pelvis without stretching. Initial and Final measurements are labeled by left and right red points, respectively. 39 straight segments measured along lower border of artery for total uterine a. length = 13.37cm. Starting at segment 16 (white arrow), 24 straight segments measured along lower border for dilated tortuous segment length = 6.88cm.

the straight segment tool was used to measure multiple points to best follow the artery curvature.

Results

In anatomical position, scale measured as 17.34 pixels / cm; the tortuous ascending branch (post- initial gentle anteroinferior) length measured 2.03cm. Outside of the pelvis, the scale measured 100pixels/cm; 39 separate straight segments were measured along the lower border of the artery, yielding a total length of 13.37cm. 24 segments were measured to focus on the dilated tortuous ascending branch length, which measured 6.88 cm. These results illustrate the substantial compression of uterine artery ascending branch vasculature in the body to less than 1/3 of its true length, ultimately increasing resistance to blood flow.

	anatomical position—AB (Figure 2)	isolated outside of pelvis—AB (Figure 3)	isolated outside of pelvis—total (Figure 3)
Scale (pixels/cm)	17.34	100	100
Number of segments Measured	1	24	39
Length (cm)	2.03	6.88	13.37
Relation	0.295X	X	-

Discussion

Known history of this donor includes one daughter and cause of death (Septicemia, Chron's disease, Malnutrition, Liver Disease, Pulmonary Embolism and Heart failure). A rotated, dilated tortuous uterine artery was identified, which is "almost always" seen in multipara as a response to increased blood flow to the uterus during pregnancy [1]. This anatomical change can paradoxically lead to increased resistance and decreased blood flow to the uterus, leaving pregnant women at risk of developing threatening medical conditions. A common manifestation of decreased uterine artery blood flow is preeclampsia (PrE), a leading cause of mortality and morbidity worldwide: For every one woman who dies from PrE, twenty others suffer from morbidity complications [2]. Prevention of preeclampsia includes standard blood pressure and urine monitoring, but uterine artery pulsatile index (UtA-PI) measurement is important in those requiring further testing. UtA-PI measures flow velocity of the proximal uterine artery, which is an accurate representation of the arcuate arteries' flow velocity [1]. Classically, the uterine artery Doppler (UtAD) ultrasound scan is performed by a certified technician in the suprapubic region [3]. The target measuring location is the internal os, but due to "relatively low interobserver reproducibility" of correct probe placement, many measurements are made distally [4, 5].

Incorrect, distal UtA-PI measurement is reported to lower detection rates of PrE, which can be detrimental, as it is the number one cause of maternity death. Decreasing inaccurate detection rates can lead to a significant decrease in mortality due to PrE prevalence. By understanding spatial arrangement of the uterine artery, as in this donor, we can enhance UtA-PI measurement because it allows the technician to access the target location more easily and reveals tortuous anatomy that contributes to decreased UtA-PI. Technology such as three-dimensional power reconstruction, Spin-echo magnetic resonance imaging (MRI), and magnetic resonance angiography (MRA) have been used in this capacity, and are shown to help in PrE screening [5, 6]. Unfortunately, these imaging options are expensive and, thus, a significant barrier to access and availability exists. Identifying uterine artery spatial arrangement can assist in many other management strategies for vaginal bleeding, dysmenorrhea, UAP, and miscarriage [6-8].

Dilated tortuous uterine artery anatomy is a key factor in multiple disease processes; therefore, we support the recommendation to continue research in reproducible, cost effective spatial arrangement imaging.

Conclusion

Advancements in medicine allow management of many factors influencing disease progression, e.g. vitals, bloodwork, urinalysis, and biopsies. Despite its importance in a multitude of clinical situations an anatomical variant like this is still difficult to detect and monitor. This report of a dilated tortuous uterine artery illustrates an anatomical variant previously correlated to parity and proven to influence multiple complications, most notably preeclampsia. Identifying variants such as this would

provide a better clinical picture for Preeclampsia screening in high-risk patients as an adjunct to current doppler imaging. Current research on uterine artery spatial arrangements should be continued to improve pulsatile index measurements, and an emphasis on anatomical variants in clinical presentations should begin.

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