

## Prostatic Artery Originating from Inferior Mesenteric Artery: A Very Rare Variation Observed in Computed Tomography Angiography

Emre Can ÇELEBİOĞLU<sup>a</sup>,  
Sinem AKKAŞOĞLU<sup>b</sup>,  
Selma ÇALIŞKAN<sup>b</sup>,  
Ceren GÜNENÇ BEŞER<sup>c</sup>

<sup>a</sup>Department of Radiology,  
TOBB University Faculty of Medicine,

<sup>b</sup>Department of Anatomy,  
Ankara Yıldırım Beyazıt University  
Faculty of Medicine,

<sup>c</sup>Department of Anatomy,  
Hacettepe University Faculty of Medicine,  
Ankara, TURKEY

Received: 02 May 2019

Received in revised form: 10 Jul 2019

Accepted: 11 Jul 2019

Available online: 18 Jul 2019

Correspondence:

Ceren GÜNENÇ BEŞER  
Hacettepe University Faculty of Medicine,  
Department of Anatomy,  
Ankara, TURKEY  
cmgnc5er@gmail.com

**ABSTRACT** The knowledge of detailed anatomy of the pelvic arterial system is essential to prevent the postoperative morbidity of prostate surgery. Prostatic artery embolization has an increasing importance in treatment of benign prostatic hyperplasia. Studies concerned with prostatic arterial supply are predominantly based on cadaveric studies and there are a few radiologic studies. Various variations and presence of collateral shunts causing complications in prostatic artery embolization were reported in the literature. However; to our knowledge, the prostatic arteries originating from the branches of abdominal arteries have not been described. In the present study, we described a 36 year-old male patient with three prostatic arteries via computed tomography angiography (CTA). From these three arteries; the dominant vessel was originating from inferior mesenteric artery. Arterial variations of the region may be well defined due to the increasing popularity of minimally invasive nonsurgical treatments and widespread use of CTA as a diagnostic method.

**Keywords:** Prostatic artery; prostatic artery embolization; computed tomography angiography; inferior mesenteric artery; variation

Detailed anatomical description of the pelvic arterial system is crucial to prevent the intraoperative bleeding and postoperative morbidity of prostate surgery.<sup>1,2</sup> In recent years, prostatic artery embolization (PAE) has an increasing importance in treatment of benign prostatic hyperplasia (BPH) due to the popularity of minimally invasive procedures as a treatment modality of prostate diseases.<sup>3</sup> Prostatic artery embolization is becoming an effective treatment modality in the management of lower urinary tract symptoms (nocturia, intermittency, urgency, incomplete bladder emptying) in patients with BPH who refuse surgery or have contraindications for surgery.<sup>4</sup> Short, intermediate and long-term outcomes of PAE suggest that it promises a safe and an effective alternative to traditional surgery. Correct identification of anatomical pattern of the prostate artery is essential.<sup>4,5</sup> Because of the close relationship of the arterial supply of rectum, prostate and bladder; the risk of non-target embolization should be kept in mind to prevent complications.<sup>4</sup> In the literature, prostatic artery arises from; internal pudendal, inferior vesical or obturator, umbilical, inferior gluteal or internal iliac arteries.<sup>6-12</sup> In some cases, the prostatic artery arises from a common trunk such as anterior gluteal-pudendal or prostate-vesical trunk.<sup>7</sup> Considerable anastomoses were found between the prostatic branches and surrounding arteries such as the internal pudendal artery, con-

tralateral and ipsilateral prostatic branches, to the rectal and vesical arteries.<sup>7</sup> Although it is suggested in the literature that there are anastomoses in between prostatic artery and middle rectal artery; to our knowledge there is no artery giving rise to prostatic artery except the vessels given above.<sup>2,7,11</sup>

In the present study we described a 36 year-old male patient with three prostatic arteries. From these three arteries; the dominant vessel was originating from the inferior mesenteric artery (IMA).

## CASE REPORT

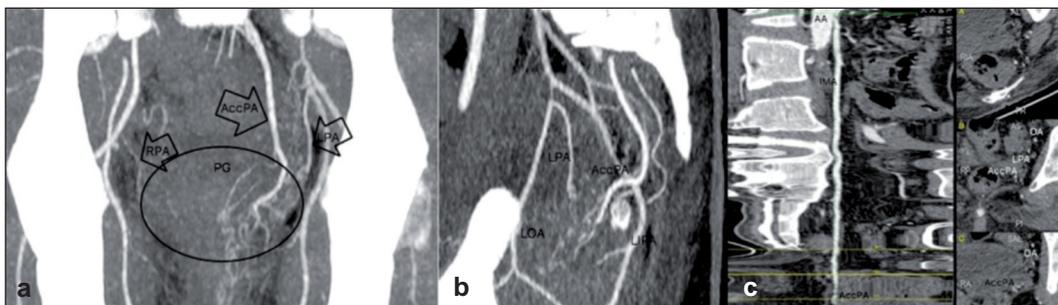
Ethics committee approval was obtained from TOBB ETU Faculty of Medicine Clinical Research Ethics Committee, (Number: KA EK 118/031, Date: February 20, 2019). The written informed consent was obtained from the patient. Thirty-six years old male patient underwent Computed Tomography Angiography (CTA) for imaging the abdominal aorta and arteries of lower extremities. Minimal atherosclerotic changes were detected. There were no other pathological findings. Arteries of the pelvic region were examined, and it was detected that the right internal iliac artery gave rise to vesical (superior and inferior), obturator, internal pudendal and inferior gluteal arteries. Additionally; the left internal iliac artery gave rise to vesical, obturator, internal pudendal and inferior gluteal arteries. This branching pattern was similar with the basic branching pattern of the internal iliac artery according to Yamaki.<sup>6</sup> Both of the right and the left

prostatic arteries were arising from obturator arteries (Type III pattern according to Yamaki). In our case; the right prostatic artery with 1.5 mm largest transverse diameter and left prostatic artery with 2.2 mm largest transverse diameter were detected. During the assessment of prostatic arterial supply, a third prostatic artery (accessory prostatic artery) with the widest diameter of 2.7 mm was demonstrated on the left side. This artery seemed to have a tortuous course in prostate, and it was originated from IMA (Figure 1, Figure 2).

## DISCUSSION

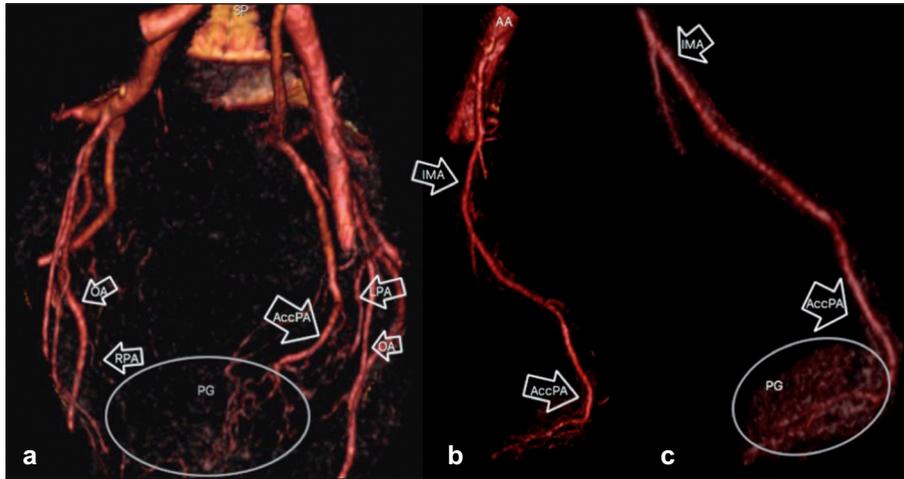
Studies concerned with prostatic arterial supply are predominantly based on cadaveric series. In 1998, Yamaki et al. classified the branches of internal iliac artery based on the data of dissections of 645 pelvic halves of Japanese cadavers.<sup>6</sup> Besides cadaveric studies; prostatic arterial anatomy is also evaluated in radiologic studies.<sup>7</sup> Bilhim et al. suggested that CTA which is a noninvasive vascular imaging technique provides a detailed anatomical knowledge of variations of prostatic artery when planning PAE.<sup>8</sup>

Our literature review showed that arteries from which prostatic artery arises include; internal pudendal, vesical, obturator, umbilical, inferior gluteal and internal iliac arteries.<sup>6-12</sup> In some cases, the prostatic artery arises from a common trunk such as anterior gluteal-pudendal or prostate-vesical trunk.<sup>7</sup> In the literature, anastomoses were found between the prostatic branches and sur-



**FIGURE 1:** Computed tomography angiography (CTA) images of the right, left and accessory prostatic arteries; **a)** coronal section; **b)** sagittal section; **c)** curved planar tracking image.

RPA: right prostatic artery; LPA: left prostatic artery; PG: prostate gland; Acc PA: accessory prostatic artery; LOA: left obturator artery; AA: abdominal aorta; IMA: inferior mesenteric artery; LIPA: left internal pudendal artery.



**FIGURE 2:** Three- dimensional computed tomography angiography (CTA) images of the right, left and accessory prostatic arteries with; **a)** coronal section; **b,c)** sagittal section.

RPA: Right prostatic artery; LPA: Left prostatic artery; PG: Prostate gland; Acc PA: Accessory prostatic artery; OA: Obturator artery; IMA: Inferior mesenteric artery.

rounding arteries such as the internal pudendal artery, contralateral and ipsilateral prostatic branches, to the rectal and vesical arteries.<sup>7</sup> Although it was suggested that there are anastomoses in between prostatic artery and middle rectal artery; to our knowledge there is no artery giving rise to prostatic artery except the vessels given above.<sup>2,7,11</sup> In our case, the right and left prostatic arteries were arising from obturator arteries and there was a third prostatic artery that was originated from IMA. To our knowledge, in the literature, prostatic artery originating from the branches of abdominal arteries has not been described before.

Radiological presentation of vascular anatomy of pelvic region is gaining importance because of the widespread use of the PAE as a minimally invasive treatment. Computed tomography angiography is a valuable diagnostic technique in identifying the vascular anatomy due to its high-resolution capacity. Inadequate treatment and/or complications secondary to non-target embolization can be minimized by this technique.

The common branching patterns of prostatic artery were identified and demonstrated by angiography in recent studies.<sup>10</sup> Various variations and presence of collateral shunts causing complications in PAE procedure were also reported in the literature.<sup>8,12</sup> Some of the reported complications associated with these variations are bladder ischemia,

transient ischemic proctitis, pubic avascular necrosis and penile ischemia.<sup>4</sup> Collateral connections that cannot be demonstrated by imaging methods and retrograde reflux were reported to lead these complications.<sup>12</sup> Besides, it must be kept in mind that insufficient selective catheterization of accessory prostatic artery during angiography procedure may also lead complications.

Prostatic arteries are small-sized arteries with diameters between about 1-2 mm. The diameters of the prostatic arteries do not depend on prostate volume, but on the number of independent prostatic arteries. If there is only one prostatic artery, the diameter is larger, but if there are more than one prostatic artery, the diameters are smaller. It is hard to identify and catheterize these arteries due to their small size.<sup>7</sup>

In the literature, PA arising from various branches of the internal iliac artery has been reported.<sup>7-12</sup> However; to our knowledge, the PA originating from the branches of abdominal arteries has not been described. Arterial variations of the region may be well defined due to the increasing popularity of minimally invasive nonsurgical treatments and widespread use of CTA as a diagnostic method. Prostatic artery navigation variations should be studied in larger CTA series. As a result; the PAE will become a widespread treatment modality in the next decades and will likely

become the first treatment option of BPH. Surgeons and interventional radiologists dealing with prostate surgery/minimally invasive treatment should be well known with the arterial variations that may be encountered in this area to reduce the risk of complications.

### Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

### Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or

members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

### Authorship Contributions

**Idea/Concept:** Emre Can Çelebioğlu, Sinem Akkaşoğlu, Selma Çalışkan, Ceren Güneç Beşer; **Design:** Emre Can Çelebioğlu, Sinem Akkaşoğlu; **Control/Supervision:** Selma Çalışkan, Ceren Güneç Beşer; **Data Collection and/or Processing:** Emre Can Çelebioğlu, Sinem Akkaşoğlu; **Analysis and/or Interpretation:** Emre Can Çelebioğlu, Sinem Akkaşoğlu, Selma Çalışkan, Ceren Güneç Beşer; **Literature Review:** Selma Çalışkan, Ceren Güneç Beşer; **Writing the Article:** Emre Can Çelebioğlu, Sinem Akkaşoğlu, Selma Çalışkan, Ceren Güneç Beşer; **Critical Review:** Emre Can Çelebioğlu, Sinem Akkaşoğlu, Selma Çalışkan, Ceren Güneç Beşer; **References and Findings:** Emre Can Çelebioğlu, Sinem Akkaşoğlu, Selma Çalışkan, Ceren Güneç Beşer; **Materials:** Emre Can Çelebioğlu.

## REFERENCES

- Park BJ, Sung DJ, Kim MJ, Cho SB, Kim YH, Chung KB, et al. The incidence and anatomy of accessory pudendal arteries as depicted on multidetector-row CT angiography: clinical implications of preoperative evaluation of laparoscopic and robot-assisted radical prostatectomy. *Korean J Radiol.* 2009;10(6):587-95. [[Crossref](#)] [[PubMed](#)] [[PMC](#)]
- Moya C, Cuesta J, Frieria A, Gil-Vernet Sedó JM, Valderrama-Canales FJ. Cadaveric and radiologic study of the anatomical variations of prostatic arteries: a review of the literature and a new classification proposal with application of prostatectomy. *Clin Anat.* 2017;30(1):71-80. [[Crossref](#)] [[PubMed](#)]
- Carnevale FC, Antunes AA, da Motta Leal Filho JM, de Oliveira Cerri LM, Baroni RH, Marcelino AS, et al. Prostatic artery embolization as a primary treatment for benign prostatic hyperplasia: preliminary results in two patients. *Cardiovasc Intervent Radiol.* 2010;33(2):355-61. [[Crossref](#)] [[PubMed](#)] [[PMC](#)]
- Mirakhor A, McWilliams JP. Prostate artery embolization for benign prostatic hyperplasia: current status. *Can Assoc Radiol J.* 2017;68(1):84-9. [[Crossref](#)] [[PubMed](#)]
- Pisco J, Bilhim T, Pinheiro LC, Fernandes L, Pereira J, Costa NV, et al. Prostate embolization as an alternative to open surgery in patients with large prostate and moderate to severe lower urinary tract symptoms. *J Vasc Interv Radiol.* 2016;27(5):700-8. [[Crossref](#)] [[PubMed](#)]
- Yamaki K, Saga T, Doi Y, Aida K, Yoshizuka M. A statistical study of the branching of the human internal iliac artery. *Kurume Med J.* 1998;45(4):333-40. [[Crossref](#)] [[PubMed](#)]
- Bilhim T, Tinto HR, Fernandes L, Martins Pisco J. Radiological anatomy of prostatic arteries. *Tech Vasc Interv Radiol.* 2012;15(4):276-85. [[Crossref](#)] [[PubMed](#)]
- Bilhim T, Casal D, Furtado A, Pais D, O'Neill JE, Pisco JM. Branching patterns of the male internal iliac artery: imaging findings. *Surg Radiol Anat.* 2011;33(2):151-9. [[Crossref](#)] [[PubMed](#)]
- Kawanishi Y, Muguruma H, Sugiyama H, Kagawa J, Tanimoto S, Yamanaka M, et al. Variations of the internal pudendal artery as a congenital contributing factor to age at onset of erectile dysfunction in Japanese. *BJU Int.* 2008;101(5):581-7. [[Crossref](#)] [[PubMed](#)]
- de Assis AM, Moreira AM, de Paula Rodrigues VC, Harward SH, Antunes AA, Srougi M, et al. Pelvic arterial anatomy relevant to prostatic artery embolisation and proposal for angiographic classification. *Cardiovasc Intervent Radiol.* 2015;38(4):855-61. [[Crossref](#)] [[PubMed](#)]
- Clegg EJ. The arterial supply of the human prostate and seminal vesicles. *J Anat.* 1955;89(2):209-16. [[PubMed](#)]
- Carnevale FC, Soares GR, de Assis AM, Moreira AM, Harward SH, Cerri GG. Anatomical variants in prostate artery embolization: a pictorial essay. *Cardiovasc Intervent Radiol.* 2017;40(9):1321-37. [[Crossref](#)] [[PubMed](#)]