

# A human case of hypoplastic external iliac artery and its collateral pathways

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*During a student dissection course held at the Tokyo Women's Medical University, in a 91-year-old human female cadaver we encountered a very rare case of a hypoplastic right external iliac artery. It continued into the normal femoral artery by anastomoses formed with the enlarged obturator and deep circumflex iliac arteries. While the obturator artery originated from the anterior branch of the internal iliac artery, the deep circumflex iliac artery was supplied by the iliolumbar artery, which in turn formed a common stem to arise from the lateral sacral artery*

*Whether the hypoplastic external iliac artery arose developmentally or secondarily could not be discerned, but the case nevertheless provides important information regarding the arterial anlage between the pelvis and lower extremity. The case is also clinically significant in that it indicates a possible collateral pathway if the external iliac artery is occluded or ischaemia.*

**Key words:** external iliac artery, human, anatomical variation, obturator artery

## INTRODUCTION

The human obturator and inferior epigastric arteries usually arise from the internal and external iliac arteries respectively. However, variations in which the obturator artery arises from the external iliac artery [1–4, 7, 10, 11] or the inferior epigastric artery arises from the internal iliac artery [1, 2, 5, 6, 10] are known to occur with a relatively high frequency.

During the gross anatomy dissection course for medical students at Tokyo Women's Medical University we encountered a hypoplastic external iliac artery in a 91-year-old Japanese female cadaver (cause of death: cerebellar infarction). In this case, instead of the hypoplastic external iliac artery, the blood supply of the right leg was taken over by several other pelvic arteries, namely the obturator, iliolumbar and deep circumflex iliac arteries.

Lipshutz [5] described anastomosis between the obturator and the inferior epigastric arteries but there are only a few cases similar to ours [1, 9]. Therefore, we report this very rare iliac arterial anomaly in detail.

The present rare case provides important information regarding the morphogenesis of the arteries at the boundary between the trunk and the lower extremity.

## CASE REPORT

At the level of the fifth lumbar vertebra, the abdominal aorta bifurcated into the right and left common iliac arteries. Although the left common iliac artery gave rise to internal and external iliac arteries of almost same size, the right external iliac artery was found to be extremely reduced in diameter (Fig. 1A). It was found that the obturator and iliolumbar arteries were enlarged in order to compensate for the reduced arterial supply to the right extremity relative to the left.

The obturator artery joined the femoral artery at two different sites. At the level of the inguinal ligament, the pubic branches of the obturator and inferior epigastric arteries anastomosed (Fig. 1B, 2).

The iliolumbar artery arose from the internal iliac artery, forming a common trunk with the lateral sacral artery. It passed between the fourth and fifth lumbar nerves, supplied the iliopsoas muscle and supplied the femoral artery via its anastomosis with the deep circumflex iliac artery. Owing to the formation of these extensive supplementary anastomosis channels, the diameters of the right and left femoral arteries were found to be equal.

The right superior gluteal artery and the common trunk of the inferior gluteal and internal pudendal arteries penetrated L5-S1/S2-3 and left the pelvis through the suprapiriform foramen and the infrapiriform foramen respectively.

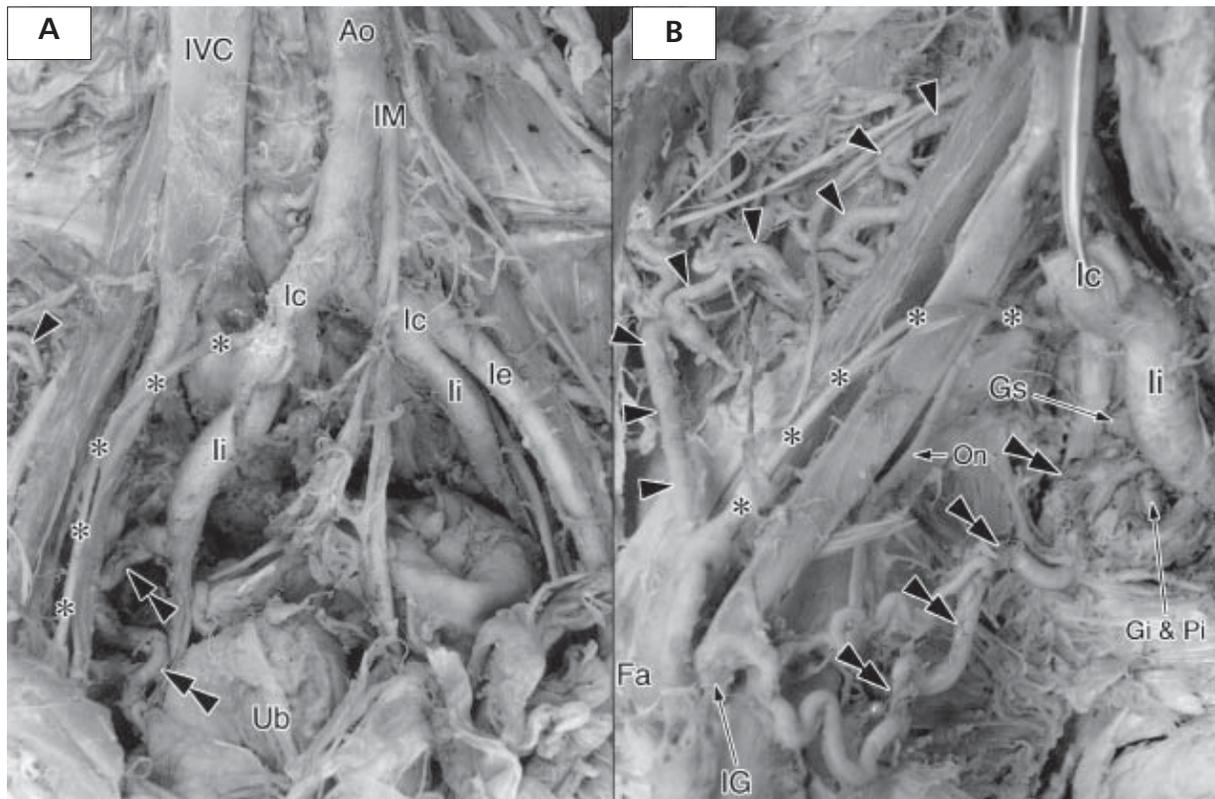
No anomalies were observed in the other branches of the right iliac arteries or in the branches on the left side.

## DISCUSSION

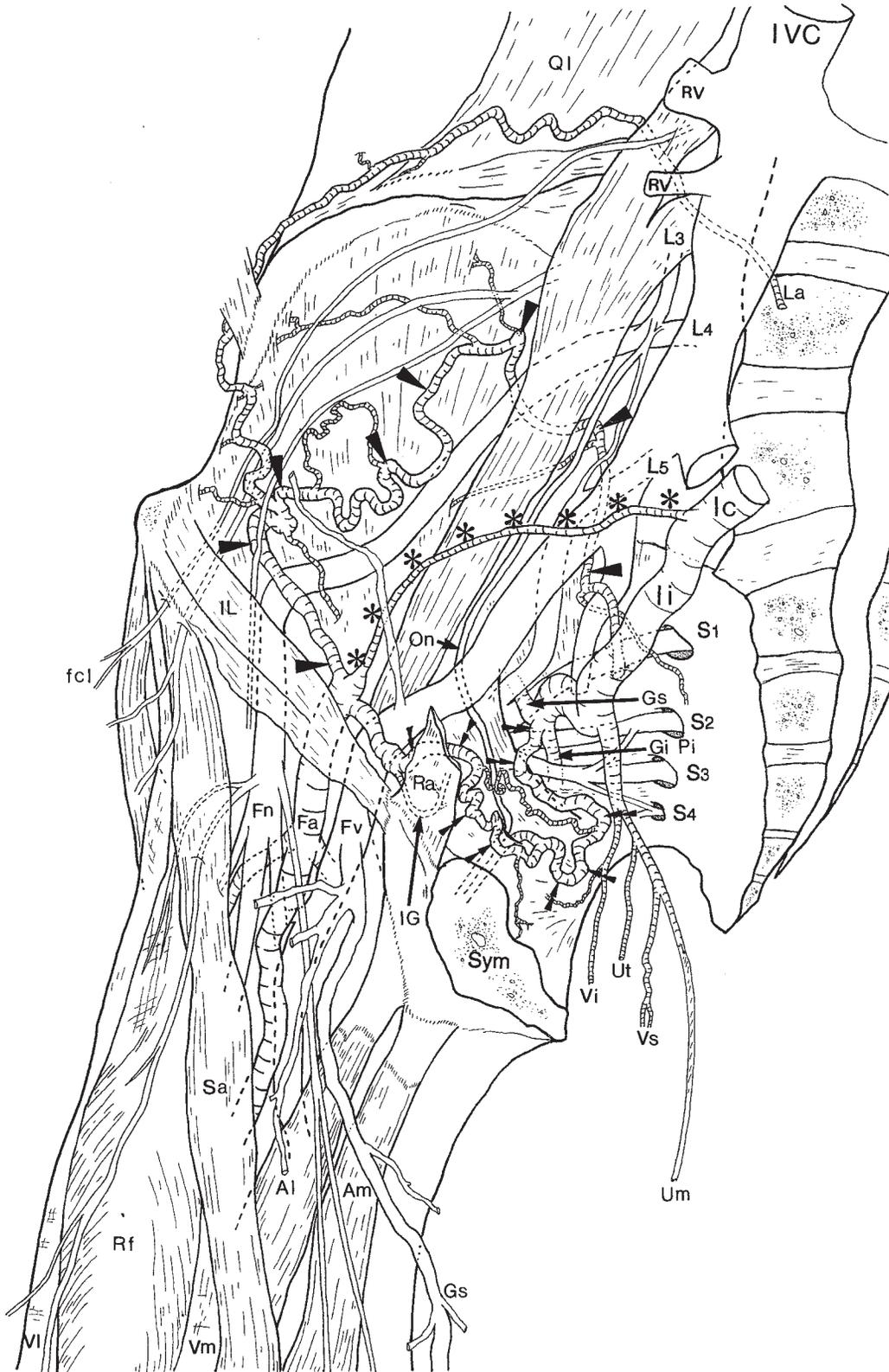
Previous reports have described a relatively high percentage of arterial anomalies involving the branching pattern of the obturator artery from the external iliac artery [1–4, 7, 10, 11] or the inferior epigastric artery from the internal iliac artery [1, 2, 5, 6, 10]. Recently Okamoto et al. [8] have reported a peculiar anomalous left common iliac artery which entered into the small pelvis without branching to the external iliac artery, passed behind to the sacral nerves and continued to the femoral artery. Consequently, they concluded that their case might have exhibited a communication between the median sacral and superior gluteal arteries. This case also was extremely rare.

However, the hypoplastic external iliac artery with its collateral pathways seen in the present case is very seldom encountered and few cases have been reported [1, 9] and so a detailed report may well be of use to morphologists and clinicians.

In our case the right superior gluteal artery and the common trunk of the inferior gluteal and internal



**Figure 1.** Photographs showing the aberrant external iliac artery (indicated by asterisks) viewed from the ventral (A) and medioventral (B) aspects. The collateral branches, the obturator (double arrow heads) and iliolumbar (single arrow heads) arteries, are visible in addition to the faint external iliac artery. Ao — aorta; Fa — femoral artery; Gi — inferior gluteal artery; Gs — superior gluteal artery; lc — common iliac artery; le, external iliac artery; li — internal iliac artery; IM — inferior mesenteric artery; IVC — inferior vena cava; On — obturator nerve; Pi — internal pudendal artery; Ub — urinary bladder; IG — inferior epigastric artery.



**Figure 2.** Drawing of the weak external iliac artery and two collateral pathways, viewed from a medioventral aspect. The asterisks show the hypoplastic external iliac artery. Al — adductor longus muscle; Am — adductor magnus muscle; Fa — femoral artery; fcl — lateral femoral cutaneous nerve; Fn — femoral nerve; Fv — femoral vein; Gs — great saphenous vein; IG — inferior epigastric artery; IL — inguinal ligament; La — lumbar artery; Pi — internal pudendal artery; Ql — quadratus lumborum muscle; Ra — rectus abdominis muscle; Rf — rectus femoris muscle; RV — renal vein; Sa — sartorius muscle; Sym — symphyseal surface; Um — umbilical artery; Ut — uterine artery; Vi — inferior vesical artery; VI — vastus lateralis muscle; Vm — vastus medialis muscle; Vs — superior vesical artery; IVC — inferior vena cava; L3, L4, L5 — 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> lumbar nerves; Ic — common iliac artery; li — internal iliac artery; On — obturator nerve; Gi — inferior gluteal artery; S1, S2, S3, S4 — 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> sacral nerves.

pubdental arteries penetrated L5-S1/S2-3 and left the pelvis through the suprapiriform foramen and the infrapiriform foramen respectively.

The penetrating position of the sacral plexus contrasts with the majority of normal cases. However, normal cases have sometimes also displayed positional changes in the penetration of the sacral plexus and so we have not adduced any connection between the existence of the hypoplastic external iliac artery and positional change in the penetration of the sacral plexus.

Although we could not determine whether the hypoplastic external iliac artery was an inborn or secondary anomaly, the collateral pathways clearly represent the arterial anlage of the boundary between the pelvis and the lower extremity. Senior [12, 13] described normal and abnormal arterial developments and suggested that their final morphologies resulted from inter-arterial communications and disappearances. In the light of this, our case could be also explained by this theory. The present case is also clinically significant with regard to the presence of a collateral pathway in the event of the occlusion or ischaemia of the external iliac artery.

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