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RESEARCH ARTICLE

Inferior epigastric artery arising from the obturator artery as a terminal branch of the internal iliac artery and consideration of its rare occurrence

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Summary

The origins of the inferior epigastric and obturator arteries and the relationship between these arteries have been determined macroscopically in examinations of 706 body-halves of Japanese subjects. Three very rare inferior epigastric arteries were found to arise from the obturator artery leaving the internal iliac artery. The intimate relationship between these arteries has been documented by the obturator artery arising from the inferior epigastric artery and the anastomosis between them. It is generally interpreted that such anomalies occur as remnant or partial disappearance of the connection between the pubic branches of the inferior epigastric and obturator arteries. The inferior epigastric artery arising from the obturator artery is also thought to be a similar anomaly. Since the obturator artery from the inferior epigastric artery represents one form of extreme anomaly, and the inferior epigastric artery from the obturator artery represents another form, it would seem that these two forms of extreme anomaly should occur at similar frequencies. However, in our research, the incidence of the former was 10.5% while that of the latter was a very low 0.4%. During normal development, the inferior epigastric artery is established at an earlier stage than the obturator artery as a channel for blood supply. We suppose that the difference of blood flow resulting from

Abbreviations: AA, abdominal aorta; ARL, artery of the round ligament; Cr, cremasteric artery; DD, ductus deferens; DIR, deep inguinal ring; EI, external iliac artery; Fe, femoral nerve; IE, inferior epigastric artery; IG, inferior gluteal artery; II, internal iliac artery; IL, inguinal ligament; IP, internal pudendal artery; IV, inferior vesical artery; IVC, inferior vena cava; LA, levator ani; MS, median sacral artery; Ob, obturator artery; OE, obturator externus; OI, obturator internus; PB, pubic branch; Pb, pubis; Pr, prostate; QL, quadratus lumborum; RA, rectus abdominis; S1–S3, ventral rami of the sacral spinal nerves; SG, superior gluteal artery; SV, superior vesical artery; TA, transversus abdominis; Te, testicular artery; UB, urinary bladder; Ur, ureter.

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this time lag is one of the reasons why the inferior epigastric artery from the obturator artery is very rare in comparison to the obturator artery from the inferior epigastric artery.

Introduction

We came across three very rare instances of the inferior epigastric artery arising from the obturator artery as a terminal branch of the internal iliac artery in the course of our research on the origins of the inferior epigastric and obturator arteries, and the relationship between these arteries. According to general anatomy textbooks (Henle, 1876; Gegenbaur, 1903; Kopsch, 1951; Hollinshead, 1974; Walls, 1981; Woodburne and Burkel, 1988; Williams et al., 1989), the inferior epigastric artery is a branch of the external iliac artery. It arises from the ventral side of the external iliac artery just proximal to the inguinal ligament and ascends obliquely towards the umbilicus along the medial margin of the deep inguinal ring. After it gives off a cremasteric artery which accompanies the spermatic cord in the male (or an artery of the round ligament in the female) and the pubic branch which runs medially and downward to reach the back of the pubis, passing close to the femoral ring, it pierces the transversalis fascia below the arcuate line and enters the rectus sheath to reach the deep surface of the rectus abdominis muscle. It provides numerous branches to the rectus abdominis muscle which eventually anastomose with those of the superior epigastric and lower posterior intercostal arteries. In fact, although the inferior epigastric artery sometimes originates from the femoral artery (Adachi, 1928; Pick et al., 1942; Jakubowicz and Czarniawska-Crzesinska, 1996; Sarikcioglu and Sindel, 2002; Sarikcioglu et al., 2003), the profunda femoris artery (Delitzin, 1896; Adachi, 1928), and the medial circumflex femoral artery (Adachi, 1928; Sañudo et al., 1993; Shanahan and Jordan, 1997), it is consistently reported to originate from the external iliac system or its branch. Cruveilhier (1841) also said that it was worthy of remark that the obturator was often observed to arise from the epigastric, whilst there was, perhaps, no example of the epigastric being derived from the obturator. In this light our instances of the inferior epigastric artery arising from the obturator artery as a terminal branch of the internal iliac artery are very rare indeed. In the literature, we did not find any similar report with the exception of that of Quain (1844), who introduced an instance cited from an essay of Hesselbach, Adachi (1928) and Ishizeki et al. (1982) who reported another example. On the other hand, regarding the relationship between the inferior epigastric and obturator arteries, it is well known that an anastomosis, referred as the corona mortis, often exists between both arteries, and that the obturator artery frequently originates from the inferior epigastric artery arising from the external iliac artery (Gegenbaur, 1903; Kopsch, 1951; Lang and Wachsmuth, 1972). The unexpected presence of these anomalous arteries is a matter of great concern to the orthopaedist, urologist, gynaecologist, and general surgeon, because they may be injured during surgical procedures in this area. Although the inferior epigastric artery in question, which arises from the obturator artery as a terminal branch of the internal iliac artery, is extremely rare, it is thought that this anomaly is related to the anomalous obturator arteries mentioned above and shares similar clinical importance. The purpose of this research is to discuss the morphological significance of the various anomalies related to the inferior epigastric and obturator arteries, as well as to observe and report in detail the gross anatomical findings of this very rare anomaly for future reference. In addition, we would like to consider the rare occurrence of the inferior epigastric artery arising from the obturator artery.

Material and methods

The origins of the inferior epigastric and obturator arteries were observed macroscopically in a total of 353 bodies or 706 body-halves of Japanese subjects, bequeathed for student dissection at Kumamoto University from 1994 to 2006. In addition, the origins of their pubic branches, their developmental degrees and the origins of the cremasteric artery (or the artery of the round ligament) were also observed macroscopically. In the course of this research, we came across three anomalous inferior epigastric arteries arising from the obturator artery in a 66-year-old male cadaver in 1998 and in an 88-year-old female cadaver in 2000. These three anomalous instances were observed carefully and sketched in detail, and three-dimensional photographs were made.