Surgical implications of aortoiliac tortuosity
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Abstract
Introduction
The Variations involving the abdominal aorta, common iliac artery and its branches are very rare. The abdominal aorta bifurcates into the right and left common iliac arteries at the level of fourth lumbar vertebra.

Methods
During routine cadaveric dissection for medical undergraduates, a variation in abdominal aorta and iliac arteries was seen in a 51-year-old male cadaver in Department of Anatomy, Maulana Azad Medical College, New Delhi.

Results
The arteries were unusually tortuous instead of following a straight course. Part of the aorta above the origin of inferior mesenteric artery till its termination at the level of lower border of L4 vertebra was curved. The artery was shifted to the right of midline and inferior vena cava was pushed further right. The distance of shift from midline was 2.3 cm. In addition, iliac arteries were also found to be tortuous.

Discussion
The tortuosity may be attributed to atherosclerosis or hypertension and underlying systemic disease like Ehlers Danlos syndrome, Marfans syndrome or more recently recognized syndrome of arterial tortuosity.

Conclusion
Proper identification of anatomical variations is essential for surgical and radiological interventions in order to avoid dangerous haemorrhage due to perforation in a percutaneous intervention and other troublesome complications during open surgical procedure.

Introduction
The abdominal aorta begins at the aortic hiatus of the diaphragm, anterior to the lower border of the 12th thoracic vertebra. It descends anterior to the lumbar vertebrae to end at the lower border of the fourth lumbar vertebra, slightly left of the midline, by dividing into common iliac arteries with variation in angle of the aortic bifurcation. These arteries diverge as they descend and divide at the level of the sacroiliac joint into external and internal iliac arteries. It has been suggested that the relationship between aortic size and shape is a possible causative factor in the development of abdominal aortic aneurysm. The reflection of transmitted pressure waves due to the column of blood may focally weaken the intimal lining at the origin of the branches of aorta, e.g. at the aortic bifurcation. This could be explained by pressure oscillations and possible turbulence which may be set up as a result of differences in the luminal diameters of the common iliac arteries, producing the reflected waves that may injure the intima of the distal abdominal aorta. The role of the relative calibres of the iliac arteries remains uncertain. Aortoiliac tortuosity is an important factor in the selec-tion, planning, conduct, and outcome of endovascular aortoiliac aneurysm repair. Excessive tortuosity may cause difficulty in gaining access to the aneurysm and in the deployment of the stent graft and may result in unstable fixa-tion. A variation in abdominal aorta and iliac arteries was observed which may be surgically important during endovascular surgery for aneurysm repair, transfemoral angiography or angioplasty.

Case Report
During routine cadaveric dissection for medical undergraduates, a variation in abdominal aorta and iliac arteries was seen in a 51-year-old male cadaver in Department of Anatomy, Maulana Azad Medical College, New Delhi. The cadaver used in this study was fixed by embalming through femoral route using embalming fluid containing 10% formalin. The arteries were unusually tortuous instead of following a straight course (Figure 1). Part of the aorta above the origin of inferior mesenteric artery till its termination at the level of lower border of L4 vertebrae was curved. The artery was shifted to the right of midline and inferior vena cava was pushed further right. The distance of shift from midline was 2.3 cm. No aneurysm formation or localized dilatation was observed in aorta. In addition, iliac arteries were also found to be tortuous. The celiac trunk, superior mesenteric and inferior mesenteric artery appeared to have a normal origin and course. The angle of bifurcation of aorta was 35.18 degrees. The angle between abdominal aorta and common iliac artery was 103.87 degrees on right and 156.02 on left with difference of 52.15 degrees (Figure 2). This work conforms to the values laid down in the Declaration of Helsinki (1964). The protocol of this study has been approved by the relevant ethical committee related to our institution in which it was performed. All subjects gave full informed consent to participate in this study.

Discussion
Endovascular aneurysm repair has been performed since last two decades but factors such as tortuosity angioplasty,
morphology, or calcification have posed difficulties for vascular surgeons\(^5\).

In the elderly, these represent signs of atherosclerosis or hyper-tension whereas in children, they may be a sign of underlying systemic disease like Ehlers Danlos syndrome, Marfan’s syndrome or more recently recognized syndrome of arterial tortuosity\(^6\). The cystic medial degeneration may be underlying predisposing factor for such tortuous arteries. This degenerative process is genetically determined, which is typically seen in connective tissue diseases such as Marfan and Ehlers-Danlos, Turner’s and Noonan’s syndromes. However, in old patients without these disorders varying degrees of degeneration can be seen, with underlying factor such as hypertension and advancing age.

Tortuosity of aorta may cause the narrowing or constriction of vessel, which can cause blockage of blood flow. It can lead to high blood pressure, aortic insufficiency or premature atherosclerosis. Arterial tortuosity is known to increase with age, and indeed higher indices of tortuosity are associated with advanced age. This association may partly explain the higher likelihood of arterial reconstruction and early endoleak in the elderly, although other factors may play a role\(^4\). In younger patients, physical changes in the spine or the wall of the chest may lead to aortic tortuosity. Several factors, such as age, smoking, and BMI, can influence iliac artery tortuosity\(^7\).

Angulation and tortuosity of the iliac arteries makes deployment of the endograft more difficult. Increased angulation and tortuosity can cause embolization and dissection. With methods currently available, it is difficult to describe tortuosity of the iliac arteries since they can be variably tortuous throughout their length. Angulation may change along the length of the iliac arteries and may be particularly different in the common and the external iliac arteries. The proximal iliac angle is an important parameter of aortoiliac tortuosity that may play a role in postoperative clinical outcome.\(^8\)

Endovascular surgery has changed the treatment of abdominal aortic aneurysms remarkably. However, despite iliac tortuosity being a highly relevant factor in access assessment, evaluation of iliac tortuosity is most often done in a subjective manner by the operator and quantitative measurements are rarely performed.\(^7\)

The methods to standardize measurement of aortoiliac tortuosity and the application of computer-aided quantification, could enhance planning, communication, follow-up, and the development of standards and guidelines endovascular aneurysm repair surgery.\(^9\)

Knowledge of such cases of aortoiliac tortuosity has important surgical significance in endovascular aneurysm repair and invasive arterial procedure such as angiography.
and angioplasty, which may help the surgeons in avoiding troublesome dangerous haemorrhage.

References

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