

Aneurysm, Tortuosity and Kinking of Abdominal Aorta and Iliac Arteries in Thai Cadavers

Aneurisma, Tortuosidad y Torsión de la Parte Abdominal de la Aorta y de las Arterias Iílicas en Cadáveres Tailandeses

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SUMMARY: The prevalence of the aneurysm, tortuosity, and kinking of abdominal aorta and iliac arteries is important for primary consideration in operative planning. The present study was undertaken to investigate the prevalence of abnormality of abdominal aorta and iliac arteries and demonstrate the patterns of kinking external iliac arteries in Thai cadavers. Eighty-five Thai embalmed cadavers (58 males and 27 females) were observed and measured the diameter of abdominal aorta and iliac arteries using a vernier caliper for assessment of aortic aneurysm (AAA). To investigate the tortuosity and kinking of iliac arteries, a standard goniometer was applied to measure the individual angle of iliac artery. In addition, the kinking patterns of external iliac artery were classified. The prevalence of AAA was 4.71% and the aneurysms of common and internal iliac arteries were 4.12 and 0.59%. The tortuosity of common and external iliac arteries were 1.76 and 20%. No tortuosity of internal iliac artery was observed. In addition, the kinking of common, external, and internal iliac arteries were 4.71, 16.47, and 1.18%, respectively. Moreover, the patterns of external iliac aortic kinking were classified into 4 major types (S-shape; reversed –C shape; low grade shape; and V-shape). We have observed the prevalence of the aneurysm, tortuosity, and kinking of abdominal aorta and iliac arteries in Thai cadavers. Currently, the 4 kinking variations of external iliac arteries were also first demonstrated.

KEY WORDS: Aneurysm; Tortuosity; Kinking; Abdominal aorta; Iliac arteries.

INTRODUCTION

In general, the dilation of the infrarenal abdominal aorta that exceeds 1.5 times or greater than 3 cm in diameter as compared to the normal aortic segment is called abdominal aortic aneurysm (AAA) (Prisant & Mondy, 2004). Of iliac arterial aneurysm, it has been reported that the diameter of the common iliac artery exceeds 2 cm, while of external or internal iliac artery approximately exceeded 0.8 cm (Walker *et al.*, 2010; Uberoi *et al.*, 2011). In addition, the assessments of the tortuosity and kinking of arteries have also been described by magnetic resonance angiography (Del Corso *et al.*, 1998; Schep *et al.*, 2001; Kristmundson *et al.*, 2012). The knowledge of prevalence, appropriate detection and surgical management of aortic aneurysm including the tortuosity and kinking of iliac arteries may be useful to decrease the rate of death from the ruptured aorta (Lederle *et al.*, 1995). Some recognitions of these phenomenons are important for treating consideration in the optimizing radiation doses, endovascular stent grafting or traditional

surgery (Marin *et al.*, 1995; Quinn *et al.*, 1997; Zarins *et al.*, 1999; Derom & Nout, 2005; Majewska *et al.*, 2011). The objective of present study was to investigate the prevalence of the aortoiliac aneurysm including tortuosity and kinking of iliac arteries in Thai embalmed cadavers. In addition, we attempted to classify the kinking types of the external iliac artery observed.

MATERIAL AND METHOD

This study was carried out in 85 Thai embalmed cadavers (58 males and 27 females) with no vascular disease history, approximately aged between 29 to 95 years (averaged 67.19±15.11 years), during the period from June 2011 to May 2013, at the Department of Anatomy, Faculty of Medicine, Khon Kaen University.

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Assessment of aortic aneurysm. After opening the abdominopelvic wall, the internal organs underneath diaphragm were carefully removed from the posterior abdominal wall to observe and measure the diameter of abdominal aorta and iliac arteries using a vernier caliper. The measurements were performed three times on three different days. As described in a previous study, the abdominal aorta that exceeded 3 cm in diameter was considered as AAA (Prisant & Mondy). In addition, the aneurysm of common iliac artery was considered when its diameter exceeded 2 cm, while of external or internal iliac artery was considered if its diameter exceeded 0.8 cm (Walker *et al.*; Uberoi *et al.*).

Assessment of the tortuosity and kinking of iliac arteries. Based on the idea of Schep *et al.*, that detected the tortuosity and kinking of iliac artery by magnetic resonance angiography, this study was performed in cadavers by applying a standard goniometer to measure the individual angle of iliac artery. To consider the tortuosity, the angle of the artery was greater than 130 degrees whereas kinking angle was lesser than 130 degrees. Additionally, kinking variations of external iliac artery were classified.

RESULTS

In this study, AAA was found in 4 (4.71%) cases (two males and two females) of in 85 specimens. The diameters of AAA were 5.74, 4.02, 3.67, and 3.27 cm respectively (Fig. 1A–D). Additionally, the aneurysms of iliac arteries were observed (Table I). From 170 sides of common iliac arteries observed, the aneurysm was found in 7 (4.12%) sides. Only internal but not external iliac artery was considered as aneurysm. It was found only on 1 side (0.59%) of 170 sides (Table I). Its diameter was approximately 1.4 cm.

Moreover, the tortuosity and kinking of iliac arteries were observed (Table I). In 170 sides of common or external iliac artery, the tortuosities were observed in 3 (1.76%, of common iliac artery) sides and in 34 (20%, of external iliac artery). However, no tortuosity of internal iliac artery was found (Table I). In kinking assessments, these were found in common iliac artery (8 sides [4.71%]), external iliac artery (28 sides [16.47%]), and internal iliac artery (2 sides [1.18%]), respectively (Table I).

Furthermore, the patterns of external iliac aortic kinking observed in this study (Fig. 2) were also recorded and could be classified into 4 major types (S-shape; reversed –C shape; low grade shape; and V-shape). Of 170 sides, there were found in the S-shape (14 sides [8.24 %]), the reversed –C shape (2 sides [1.18 %]), the low grade shape (9 sides [5.29 %]) and the V-shape (3 sides [1.76 %]), respectively (Fig. 2).

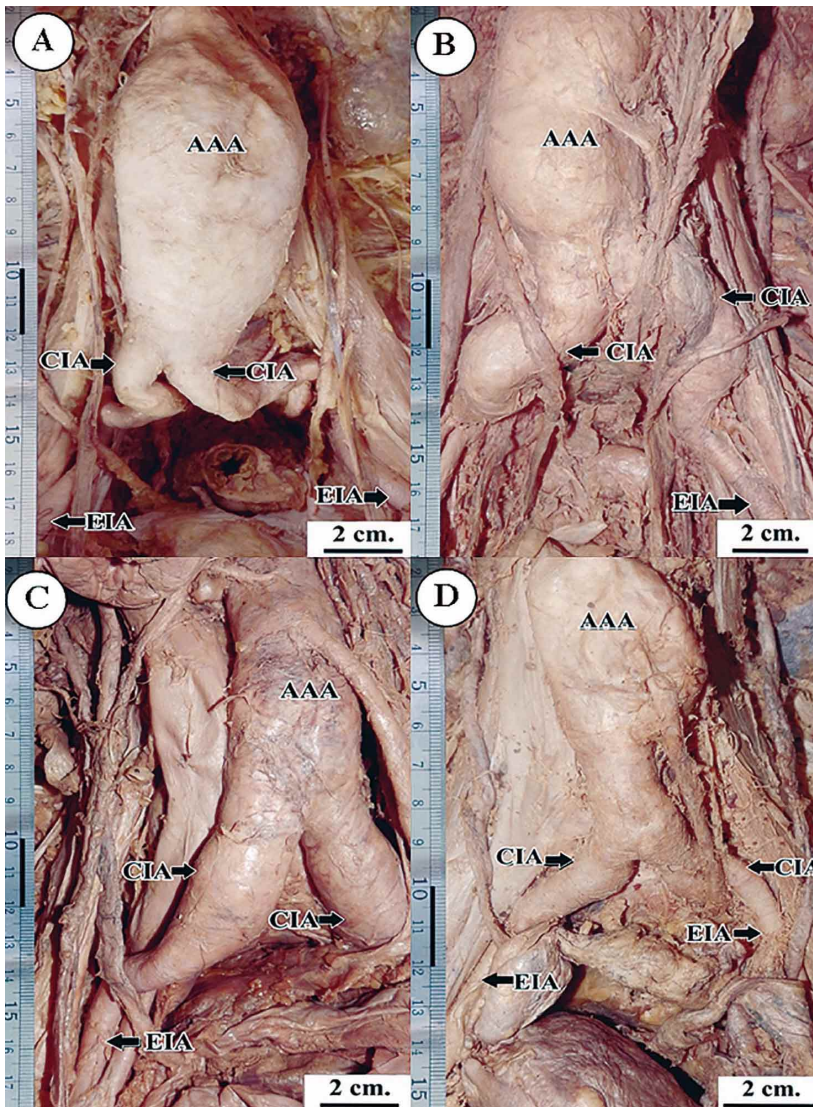


Fig. 1. Photographs showing the abdominal aortic aneurysm found in 4 of 85 Thai cadaveric specimens. The most width of aneurysm was measured; A) 5.74 cm, B) 4.02 cm, C) 3.67 cm, and D) 3.27 cm. AAA, abdominal aortic aneurysm; CIA, common iliac artery; EIA, external iliac artery; IIA, internal iliac artery.

Table I. Showing prevalence of aortic aneurysm and tortuosity and kinking of iliac artery in 85 Thai cadavers.

Arteries	Sided number (%)		
	Aneurysm	Tortuosity	Kinking
Abdominal aorta	4 (4.71%)	–	–
Common iliac artery	7 (4.12%)	3 (1.76%)	8 (4.71%)
External iliac artery	–	34 (20%)	28 (16.47%)
Internal iliac artery	1 (0.59%)	–	2 (1.18%)

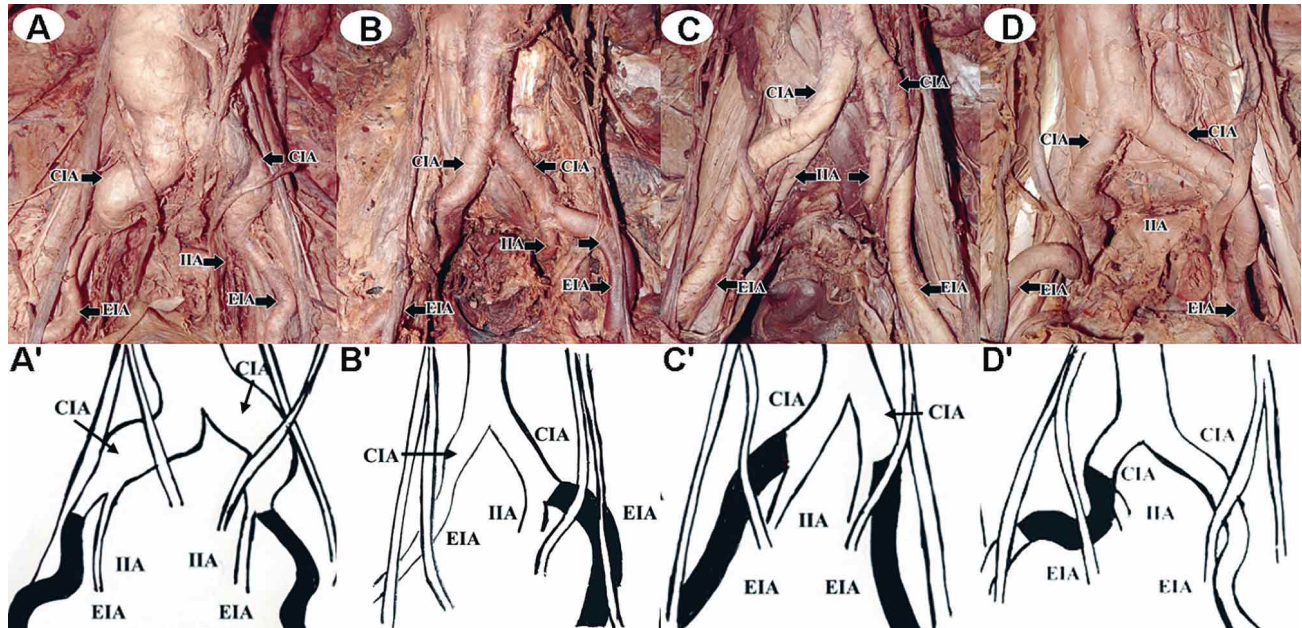


Fig. 2. Photographs (A-D) and schematics (A'-D') showing the 4 types of the external iliac aortic kinking observed in 85 Thai cadaveric specimens. A, A') S-shape; B, B') reversed –C shape; C, C') low grade shape; D, D'), V-shape. CIA, common iliac artery; EIA, external iliac artery; IIA, internal iliac artery.

DISCUSSION

Clinically, the detailed anatomic assessments of the aneurysm, tortuosity, and kinking of abdominal aorta and iliac arteries are required in consideration for endovascular aortic repair, such as endografting, at abdominopelvic region. For AAA, these anatomic features may include aortic neck length, diameter, and bifurcations (Sprouse *et al.*, 2004). In particular, the data on three dimensions of aortoiliac tortuosity are very important for planning of endovascular repairs (Wolf *et al.*, 2011; Kristmundson *et al.*). Together with computed tomography assessments, accumulated-anatomic data of abdomino-iliac artery features observed in cadaveric samples could be a primary source to determine as appropriate approach in endovascular repairs.

In this study, we found all abnormal types of abdomino-iliac arteries observed in Thai cadavers (Figs. 1 and 2, Table I). However, the aneurysm, tortuosity, and

kinking of abdomino-iliac arteries (except external arteries) were less than 10 percent (Table I). It is possible that all cadavers investigated in this study had no history of vascular diseases (data not shown). Interestingly, only tortuosity (20%), and kinking (16.4%) of the external iliac artery was found to have high evidence as compared to those of other arteries (Table I). Assumed from this study, aging Thais may have a tendency of tortuosity and kinking of the external iliac artery. Moreover, we first demonstrated and classified the patterns of external iliac aortic kinking observed in Thai cadavers into 4 major types: S-shape, reversed, C shape, low grade shape, and V-shape, respectively (Fig. 2). Unfortunately, the computed tomography assessments of the aneurysm, tortuosity, and kinking of abdominal aorta and iliac arteries in Thai patients are limited to co-analyze with our results to elucidate particular prevalence.

In conclusion, this study showed prevalence of the aneurysm, tortuosity, and kinking of abdominal aorta and iliac arteries and demonstrated 4 major kinking variations of external iliac arteries observed in Thai cadavers.

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RESUMEN: La prevalencia de aneurisma, tortuosidad y torsión de la parte abdominal de la aorta y arterias ilíacas es relevante para la consideración primaria en la planificación quirúrgica. Se realizó un estudio para investigar la prevalencia de alteraciones en las parte abdominal de la aorta y arterias ilíacas y demostrar los patrones de torsión en las arterias ilíacas externas de cadáveres tailandeses. Se observaron 85 cadáveres tailandeses embalsamados (58 hombres y 27 mujeres); se midió el diámetro de la parte abdominal de la aorta y arterias ilíacas utilizando un pie de metro para la evaluación de aneurisma aórtico. Para investigar la tortuosidad y torsión de las arterias ilíacas, se utilizó un goniómetro estándar para medir el ángulo individual de la arteria ilíaca. Además, se clasificaron los patrones de torsión de las arterias ilíacas externas. La prevalencia de aneurisma aórtico fue 4,71% y los aneurismas de las arterias ilíacas comunes e internas fueron 4,12% y 0,59%. La tortuosidad de las arterias ilíacas comunes y externas fueron 1,76% y 20%. No se observó tortuosidad de la arteria ilíaca interna. Además, la torsión de las arterias ilíacas comunes, externas e internas fueron 4,71%, 16,47% y 1,18%, respectivamente. Por otra parte, los patrones de torsión fueron clasificados en 4 tipos principales (formas de S, de C invertida; de bajo grado y en V). Observamos la presencia de aneurisma, tortuosidad y torsión de la parte abdominal de la aorta y arterias ilíacas en cadáveres tailandeses. Demostramos también por primera vez, las 4 variaciones de torsión de las arterias ilíacas externas.

PALABRAS CLAVE: Aneurisma; Tortuosidad; Torsión; Aorta abdominal; Arterias ilíacas.

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