นิพนธ์ต้นฉบับ • Original Article

การศึกษารายละเอียดความยาวของหลอดเลือดแดง iliac ในสภาวหลอดเลือดปกติและผิดปกติของหลอดเลือดแดง Aortoiliac จากการบิดเบี้ยว คดงอ และโป่งพอง (Tortuosity, Kinking and Aneurysm)

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Morphometric Analysis of the Iliac Arterial Lengths in Normal and Abnormal Aortoiliac Arteries (Tortuosity, Kinking and Aneurysm) Conditions

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หลักการและวัตถุประสงค์ : หลอดเลือดแดง aorta และ iliac เป็นหลอดเลือดที่สำคัญในช่องท้องและช่องเชิงกรานยังมีข้อมูลในการศึกษาไม่เพียงพอเกี่ยวกับหลอดเลือดนี้เพื่อช่วยในการผ่าตัดและสอดสายสวนหลอดเลือดของช่องเชิงกรานและช่องท้อง การศึกษาครั้งนี้จึงมีวัตถุประสงค์เพื่อศึกษารายละเอียดความยาวของหลอดเลือดแดง iliac ในสภาวะที่หลอดเลือดปกติและผิดปกติจากการบิดเบี้ยว คดงอ และโป่งพอง (tortousity,kinking and aneurysm) ของหลอดเลือดแดง aortoiliac ในศพดองคนไทยมองโกลอยด์

วิธีการศึกษา: ผ่าศึกษาเชิงกรานจำนวน 85 ข้างในศพดองคนไทยมองโกลอยด์ แบ่งกลุ่มตามลักษณะหลอดเลือดแดง aorta และ iliac ที่ปกติและผิดปกติจากการบิดเบี้ยว คดงอ และโป่งพอง ทำการวัดความยาวของหลอดเลือดแดง common iliac, external iliac และ internal iliac ในทั้งสองกลุ่มทำการบันทึกข้อมูล ถ่ายรูป และวิเคราะห์ข้อมูลหาความสัมพันธ์ในความแตกต่างของความยาวหลอดเลือดดังกล่าวในระหว่างเพศหญิงและชาย และความแตกต่างในระหว่างทั้งสองกลุ่มโดยใช้ student t-test ที่ระดับความเชื่อมั่น 5% ($p<0.05$)

ผลการศึกษา: พบหลอดเลือดแดง aortoiliac ที่ปกติจำนวน 41 ข้าง (ร้อยละ 48.2) และผิดปกติจำนวน 44 ข้าง (ร้อยละ 51.76) จากเชิงกราน 85 ข้างในศพดองคนไทยมองโกลอยด์ ในกลุ่มหลอดเลือดแดงปกติค่าเฉลี่ยความยาวของหลอดเลือดแดง common iliac, external iliac และ internal iliac คือ 5.19 $\pm$ 1.75 ซ.ม , 8.05 $\pm$ 1.23 ซ.ม และ 4.84 $\pm$ 1.36 ซ.ม ตามลำดับ ส่วนในกลุ่มหลอดเลือดแดงผิดปกติค่าเฉลี่ยความยาว คือ และ 4.83 $\pm$ 1.41 ซ.ม , 8.75 $\pm$ 1.37 ซ.ม และ 5.13 $\pm$ 1.34 ซ.ม

Background and Objectives: The aorta and iliac arteries were the important artery in the abdomen and pelvis. The reports of abnormal (tortousity,kinking and aneurysm) aortoiliac artery in embalmed cadaveric study were still limited. The present study was aimed to measure the lengths of the iliac arteries in normal and abnormal aortoiliac arteries conditions.

Methods: Eighty five pelvises of Thai Mongoloids embalmed cadavers were dissected. The cadavers were classified into normal and abnormal aortoiliac arteries. The lengths of the common, external and internal iliac arteries were measured in both groups. All variants data were recorded, photographed and analyzed. The student t- test with significant level of 5 % ($p<0.05$) was performed to verify the relationship between gender and both groups of arteries in Thai mongoloid embalmed cadavers.

Results: We found 41 normal cases (48.2 %) and 44 abnormal cases (51.76%) aortoiliac arteries from 85 pelvis of Thai Mongoloids embalmed cadavers. The average lengths of the common iliac, external iliac and internal iliac arteries in normal groups were 5.19฿1.75 cm, 8.05 $\pm$ 1.23 cm. and 4.84 $\pm$ 1.36 cm., respectively. The average lengths of those arteries in abnormal groups were 4.83 $\pm$ 1.41 cm., 8.75 $\pm$ 1.37 cm and 5.13 $\pm$ 1.34 cm., respectively. There was statistically significant

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ตามลำดับ มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ ($p<0.05$) เฉพาะในเพศชายของความยาวของหลอดเลือดแดง common iliac และ internal iliac ในระหว่างสองกลุ่ม

สรุป: ผลการศึกษาทำให้ได้ข้อมูลและค่าความยาวของหลอดเลือดแดงในช่องท้องและช่องเชิงกรานที่เป็นประโยชน์ ในการพัฒนาสายสวนหลอดเลือดหรือหลอดเลือดเทียมให้เหมาะสม เพื่อลดผลแทรกซ้อนในการผ่าตัดรักษาบริเวณนี้โดยเฉพาะในผู้ป่วยที่มีปัญหาหลอดเลือดผิดปกติดังกล่าวที่แพทย์จะได้พิจารณาความยาวของหลอดเลือดในแต่ละบุคคลเพื่อใช้เครื่องมือในการรักษาให้เหมาะสม

คำสำคัญ: หลอดเลือดแดง Aortoiliac, Common iliac, External iliac, Internal iliac

differences of male common iliac and internal iliac arterial lengths between both groups ($p<0.05$).

Conclusion: Our results may have the accuracy to develope the appropriate arterial stent grafts or catheters devices for abdomen and pelvis arteries. Therefore, the complication in abdominopelvic surgery would be decreased if the surgeon have considered the typical lengths of invidual aortoiliac arteries especially in abnormality arterial cases.

Keywords: Aortoiliac artery, Common iliac artery, External iliac artery, Internal iliac artery

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Introduction

Anatomical factors of abdominal aorta and its branches are important for surgeons to consider the patients before endovascular repair and pelvic surgery. Previous studies,the resarchers have observed the aortoiliac variations in Caucasoid (American and Europe) patients by radiology technique [1,2], but there were many reports for aortoiliac artery lengths in mongoloid (Asian) population[3-8]. The reports of abnormal (tortousity,kinking and aneurysm) aortoiliac artery in embalmed cadaveric study were still limited. Therefore, the present study was aimed to measure the iliac arterial lengths of normal and abnormal aortoiliac arteries conditions in Thai mongoloid embalmed cadavers.

Materials and Methods

Eighty five pelvis of Thai mongoloid embalmed cadavers (Mean ages = 67.19 $\pm$ 15.11 years) in the Northeastern part of Thailand were dissected. The cadavers were classified into normal and abnormal aortoiliac arteries (tortuosity, kinking and aneurysm) as shown in figures 1 and 2. The A, B, C, D and F points were marked along the aortoiliac arteries and the lengths were measured between two points (figure 1). When it had abnormal arteries the A1 and A2… points of the A point or C1and C2 …points of the C point were added as shown in figure 2. Therefore,the total arterial lengths were the summation of each lengths between two points. The measurement was performed by Mitutoyo vernier calipers 1/128"530-104, protractor and tape. The measurements were performed for three times in three different days. All variant data were recorded, photographed and analyzed. The student t- test with significant level of 5 % ($p<0.05$) was performed to verify the relation between gender and both groups of arteries.

Description of marked points

Point A was the midpoint of the line which was drawn vertically from aortic bifurcation to the lateral boder of the common iliac artery.

Point A1 or A2… was the midlength of anterior surface of the common iliac arteries at the highest point or the deepest point when the arteries had kinking or aneurysm.

Point B was the common iliac bifurcation becoming external iliac and the internal iliac arteries.

Point C was the midpoint of the line which drawn vertically from common iliac bifurcation to the lateral boder of the external iliac artery

Point C1 or C2 was the midlength of anterior surface of the external iliac arteries at the highest point or the deepest point when the arteries had kinking or aneurysm

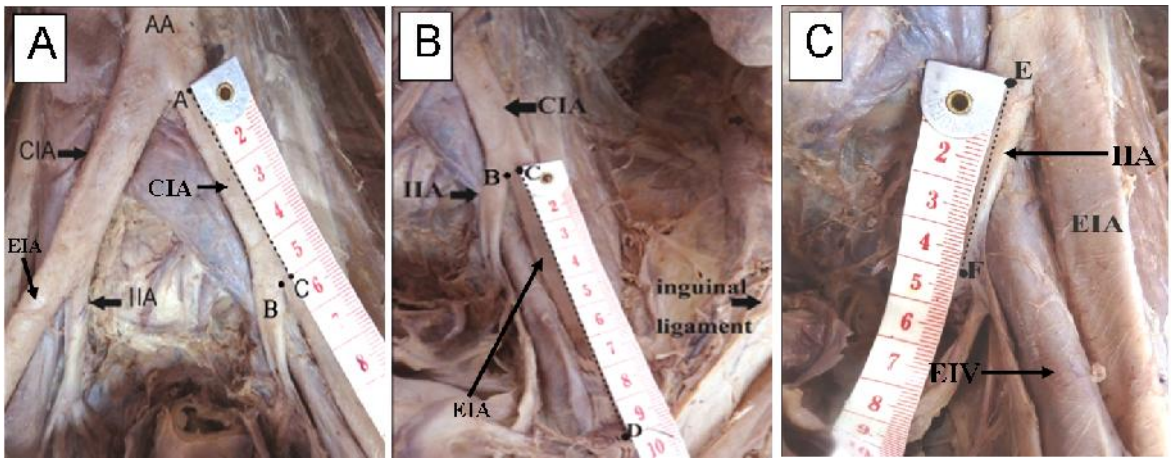

Figure 1 Demonstrating of the marked points of the iliac arteries in normal aortoiliac arteries
A. Demonstrating the common iliac length (AC**) B.** Showing the external iliac length (CD)
C. Showing the internal iliac length (EF) (AA=Abdominal aorta, CIA=Common iliac artery, EIA=External iliac artery, IIA=Internal iliac artery, EIV= External iliac vein)

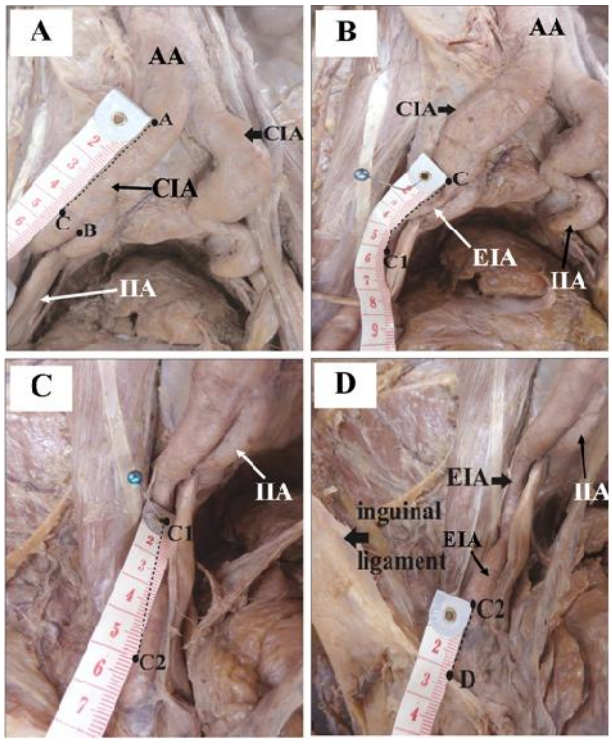

Figure 2 Demonstrating of the marked points of the iliac arteries in abnormal aortoiliac arteries (AA=Abdominal aorta, CIA=Common iliac artery, EIA=External iliac artery, IIA=Internal iliac artery)

Point D was the midpoint of anterior length of the external iliac artery before traversing under inguinal ligament

Point E was the midpoint of the line which drawn vertically from common iliac bifurcation to the medial boder of the internal iliac artery

Point F was the internal iliac bifurcation for the anterior division and posterior division

Results

We found 41 normal cases (48.2 %) and 44 abnormal (tortuosity, kinking and aneurysm) cases (51.76%) aortoiliac arteries from 85 embalmed cadavers. In normal groups, the average lengths in male and female common iliac, external iliac and internal iliac arteries of the right and left were shown in Table 1. In abnormal groups,the average lengths in male and female common iliac, external iliac and internal iliac arteries of the right and left were shown in Table 2.

When compared between two groups, there was significantly differences ($p<0.05$) between the average lengths of male common iliac and internal iliac arteries. It was noted that the abnormal group was longer than that in the normal group.

Table 1. The average lengths of the common iliac, external iliac and internal iliac arteries in normal aortoiliac arteries

Gender	N (Cases)	CIA length(cm.) (Mean± SD)		EIA length (cm.) (Mean± SD)		IIA length (cm.) (Mean± SD)	
		Side of pelvis		Side of pelvis		Side of pelvis	
		Right	Left	Right	Left	Right	Left
Male	23	4.34 ± 1.16 (R=2.53-7.17)	4.53 ± 1.58 (R=1.33-8.20)	8.30 ± 1.40 (R=5.50-11.43)	8.49 ± 1.36 (R=6.13-11.23)	5.34 ± 1.06 (R=3.23-7.18)	5.47 ± 1.35 (R=3.10-8.23)
Average lengths		4.43 ± 1.37 (R=1.33-8.20)[a]		8.40 ± 1.37 (R=5.50-11.43)		5. 41 ± 1.20 (R=3.10-8.23) b	
Female	18	4.81 ± 1.80 (R=1.47-7.23)	5.56 ± 1.68 (R=2.37-8.93)	8.49 ± 1.12 (R=6.61-10.33)	7.60 ± 1.20 (R=5.33-9.80)	4.92 ± 1.47 (R=1.70-7.93)	4.76 ± 1.26 (R=2.50-7.10)
Average lengths		5.19 ± 1.75 (R=1.47-8.93)[a]		8.05 ± 1.23 (R=5.33-10.33)[c]		4.84 ± 1.36 (R=1.70-7.93) b	

(CIA=Common iliac artery, EIA=External iliac artery, IIA=Internal iliac artery)

a = There was statistically significant differences ($p<0.05$) between the average lengths of female and male common iliac arteries that female arteries were longer than male arteries.

b = There was statistically significant differences ($p<0.05$) between the average lengths of male and female internal iliac arteries that male arteries were longer than female arteries.

C= There was no statistically significant differences ($p>0.05$) of the average lengths of the external iliac arteries between male and female.

Discussion

In normal aortoiliac arteries, we found that there was statistically significant differences ($p<0.05$) between the average lengths of female and male common iliac and internal arteries. In addition, the female common iliac arteries were longer than male arteries whereas for the male internal iliac arteries were longer than female arteries. There was no statistically significant differences ($p>0.05$) of the average lengths of the external iliac arteries between male and female as shown in Table 1.

In abnormal aortoiliac arteries, there was no statistically significant differences ($p>0.05$) of the average lengths of the common iliac, external iliac and internal iliac arteries between male and female as shown in Table 2.

In this stdut, the common iliac artery lengths in embalmed cadavers were longer than the reports of Cheng et al [8] and Midorikawa et al [9] which have studied the aneurysm in Hongong and Japanese patients, but shorter than that reported by Nanayakkara et al [10] which have studied in embalmed Srilanka patients. In Table 3, when compared the common iliac artery, lengths of our study were similar to those lengths that were investigated in Thai mongoloid embalmed cadavers[11-13]. Although it was different when compared between Asian mongoloid races, it could be explained that because of the individual differences in each race. There was no statistically significant differences ($p>0.05$) of these arteries between Asian mongoloid which correlated to our hypothesis that the arterial lengths had no difference between the same races. When compared the common iliac arterial lengths (Thai mongoloid embalmed cadavers) in our study to a report of Bleich et al [5] which studied in American caucasoid unembalmed cadavers, our results were longer than their results. Because the differences among races affected the differences to the body structure, it may correlated to our hypothesis that the arterial lengths of American or Europe caucasoid races were longer than that of Asian mongoloid races.

Buranintu et al[12] reported that the average lengths of the external iliac arteries in Thai mongoloid embalmed cadavers (501 sides) from central part of Thailand was 9.7 cm. (R=7.0-13.4) which was longer than our study of 85 cases (8.40 ± 1.37 cm.,R=5.50-11.43) in Northeastern part of Thailand whereas average lengths of the internal iliac artery in our study (4.84 ± 1.36 cm.,R=1.70-7.93) was longer than a report of Buranintu et al [13] (average= 4.1cm.) which study in Thai mongoloid embalmed

Table 2 The average lengths of the common iliac, external iliac and internal iliac arteries in abnormal aortoiliac arteries

Gender	N (Cases)	CIA length(cm.) (Mean± SD) Side of pelvis		EIA length (cm.) (Mean± SD) Side of pelvis		IIA length (cm.) (Mean± SD) Side of pelvis	
		Right	Left	Right	Left	Right	Left
Male	35	5.05 ± 1.40 (R=3.17-9.27)	5.10 ± 1.15 (R=1.97-6.87)	8.48 ± 1.47 (R=5.57-11.67)	8.15 ± 1.58 (R=5.47-11.97)	4.95 ± 1.25 (R=1.61-7.53)	4.93 ± 1.22 (R=2.80-7.93)
Average lengths		*5.07 ± 1.28 (R=1.97-9.27)		*8.32 ± 1.52 (R=5.47-11.97)		*4.94 ± 1.22 (R=1.61-7.93)	
Female	19	4.93 ± 1.43 (R=3.30-6.90)	4.73 ± 1.48 (R=2.03-6.30)	8.64 ± 1.27 (R=6.05-9.83)	8.86 ± 1.54 (R=6.43-11.23)	4.88 ± 1.35 (R=1.95 ± 6.10-)	5.39 ± 1.36 (R=2.88-6.90)
Average lengths		*4.83 ± 1.41 (R=2.03-6.90)		*8.75 ± 1.37 (R=6.05-11.23)		*5.13 ± 1.34 (R=1.95-6.90)	

(CIA=Common iliac artery, EIA=External iliac artery, IIA=Internal iliac artery)
*=There was no statistically significant differences (p>0.05) of the average lengths of the common iliac, external iliac and internal iliac arteries between male and female.

Table 3 Comparision of the present data and the previous studies carried out in other populations for common iliac artery lengths

Authors	Race (no. of cases/pelvis) Type of subject	CIA lengths(cm.) (normal group) Rt/Lt	CIA lengths(cm.) (abnormal group or pateint) Rt/Lt
Present study	Thai (85 pelvis)	Rt=4.55±1.47	Rt=5.02±1.40
Boonruangsri P, et al. 2013	Embalmed cadavers (North eastern part)	Lt=4.98±1.68	Lt=5.02±1.22
Buranintu D, et al. 1992	Thai (327 cases) Embalmed cadavers (Central part)	Rt= 4.6 Lt= 4.9	-
Nanayakkara BG, et al. 2007	Srilangka (11 cases) Embalmed patients	Rt=54.0±2.38 mm. (5.40±0.238 cm.) Lt.= 57.5±1.36 mm. (5.75±0.136 cm.)	-
Cheng SW, et al. 2004	Hongong (65 cases) Patients	-	Rt.=29.9 mm. (2.99 cm.) Lt=34.2 mm. (3.42 cm.)
Midorikawa H, et al. 2006	Japanese (65 cases) Patients	-	Rt=40.0±10.1 mm. (4.00±1.01 cm.) Lt=39.7±9.6 mm. (3.97±0.96 cm..)
Bleich AT, et al. 2007	American (37cases) (Unembalmed cadavers)	Rt= 57.1 mm. (5.71 cm.) Lt.= 55.2 mm.. (5.52 cm.)	-

(CIA=Common iliac artery, Rt= Right side, Lt= Left side)

cadavers (322 sides) from central part of Thailand. Therefore, the subjects from differences part of the country could affect the arterial lengths.

Conclusion

Our results may have the accuracy to develope the appropriate arterial stent grafts or catheters devices for abdomen and pelvis arteries. Therefore the complication in abdominopelvic surgery would be decreased if the surgeon have considered the typical lengths of invidual aortoiliac arteries especially in abnormality artery cases.

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