

THE ANATOMY OF PELVIC CORONA MORTIS VESSELS IN BLACK AFRICANS: A CADAVERIC STUDY

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ABSTRACT

Objective: To study prevalence and variant anatomy of the corona mortis vessels in a black African population in relation to side and gender.

Methodology: Forty embalmed hemipelvices obtained from the Department of Human Anatomy at Moi University were used for this descriptive cross sectional study. The cadavers were dissected at the pre-peritoneal area of the abdominal wall from inside to look for corona mortis. Chi-Square test was used to compare the incidence of the corona mortis between males and females. The level of significant difference used was $p < 0.05$. The unpaired t-test was used to compare mean of incidences of corona mortis in males and females.

Results: Corona mortis was present in 38% (15 of 40). Of these, 47% were in men and 53% in women. The mean distance from the pubic symphysis to the point where the corona mortis traverses the pubic ramus was 53.2mm (arterial) and 54.3mm (venous). The mean distance from the pubic ramus to the point of anastomosis with the external iliac systems were 16.4mm and 11.5mm for the artery and vein respectively. Regarding the nature of connection, 2(13.4%) were purely arterial, 5(33.3%) were purely venous while 8(53.3%) had both. From the chi-square results it showed that there was no significant relationship between the gender and nature of connections or side of the pelvis; ($\chi^2=0.134$, $df=2$; $p>0.05$).

Conclusion: In pelvic and acetabular surgery, the corona mortis must be ligated or clipped to advance the dissection further along the pelvic brim and quadrilateral surface during the modified Stoppa approach which enables access to the anterior wall, anterior column, and associated anterior column and posterior hemitransverse fractures, as well as certain both-column, T-shaped, and transverse fractures.

INTRODUCTION

Corona mortis represents anastomotic connection between the obturator and external iliac vascular systems. The name “corona mortis” or crown of death testifies to the importance of this feature, as significant haemorrhage may occur if accidentally cut and it is difficult to achieve subsequent haemostasis. The corona mortis has been said to cause massive uncontrolled bleeding (1), significant bleeding (2), profuse bleeding (3), persistent pelvic bleeding (4), or life-threatening haemorrhage (5). The surgical relevance of the vascular relations of the superior branch of pubis (in trauma, orthopaedic approaches, hernia repair, embolizations and intra-arterial infusions) recommends a detailed knowledge of the morphological and topographical possibilities of the crown of death and the individual evaluation of this risky anatomical structure (6). Prevalence of these vascular connections displays ethnic and regional differences. Anastomoses between the obturator and external iliac systems occurred

in 83% of English (7), 80% of Romania (6), 77% in Thais (8), 72% of Chinese (3), 61% of Turkish (9) of the studied specimens. Venous connections are more probable than an arterial ones (5). The surgeon must appreciate the importance of the venous connections because of the possibility of massive uncontrolled bleeding. Presence of both arterial and venous connections have been found in 20% of specimens (10).

Accessory branches of the obturator artery were observed in 8%, 14.81%, 19% and 34%, (11-15) of the different ethnic populations. In classical anatomy textbooks, a description of the veins that form corona mortis is found less often than descriptions of the arteries. This vein coursed vertically to the inferior border of the superior pubic ramus and connected to the obturator vein (12). Venous anastomosis on the superior pubic ramus are a finding in 96% (12), 70% (13), 40% (16), 20.37% (14) of cases. The mean distance from the symphysis to the anastomotic vessels averaged 6.2 cm (13). The mean distance between the anastomotic

arteries and the symphysis pubis was 64 (45-90) mm, and 56 (37-80) mm for the communicating veins (11).

Corona mortis is at risk during surgical treatment of acetabular fractures, which was treated with the modified medial Stoppa approach (7, 15). This vascular anastomosis is also at risk during ilioinguinal approach to the acetabulum (7). A medial approach for pelvic osteotomies for acetabular dysplasia though technically easier than a lateral approach puts several structures such as the corona mortis at risk (16). General surgeons who repair direct, indirect, femoral, or obturator hernias need to be aware of these anastomoses and their close proximity to the femoral ring (12). Attention needs to be paid to these anastomoses between the arterial and the venous system located over the superior pubic ramus during laparoscopic procedures as in totally extraperitoneal laparoscopic hernioplasty (17).

MATERIALS AND METHODS

Study area: Department of Human Anatomy laboratory, Moi University, School of Medicine.

Study population: The study included adult male and female cadaveric specimen in the Moi University School of Medicine Human Anatomy Laboratories. All 40 intact cadavers whose anatomy on the pelvic region was intact were used.

Study design: A descriptive cross sectional study.

Eligibility criteria: Black African cadavers of either sex from the Human Anatomy Laboratories of Moi University.

Sampling procedure: All adult black African cadaveric non-mutilated, non-decomposed cadavers whose anatomy on the pelvic region was intact from the human anatomy laboratories.

Data collection and management: The measurements performed following dissection were analyzed using the SPSS 11.5.0 (SPSS Inc., Chicago, III). Bar graphs and pie charts were drawn to represent the data. Means, frequencies and ranges were applied to the various measured parameters. The student t-test was used to compare variables on the various measured distances in relation to side and sex at 95% confidence interval.

Ethical consideration: Permission and clearance to conduct the study was sought from Institutional Research and Ethics committee of Moi University and the Department of Human Anatomy, Moi University, School of Medicine. Data collection tools were shredded upon completion of the study and disposed off in the most appropriate way.

RESULTS

The findings of the study showed that of the 40 dissected hemipelvices, the corona mortis was present in 15 (37.5%) while 25(62.5%) did not have either venous or arterial anastomosis between the obturator and the external iliac systems. Corona mortise was present in 8(53%) female specimens compared to 7(47%) in the male hemipelvices. Of the 15 hemipelvices with corona mortise, 8(53%) were on the left while 7(47%) were on the right side. Regarding the nature of connection, 2(13.4%) were purely arterial, 5(33.3%) were purely venous while 8(53.3%) had both venous and arterial communication/corona mortis. A majority of the hemipelvices had both mixed and venous communication.

Table 1
Nature of connection based on gender

Gender		Nature of connection			Total
		Arterial	Venous	Both	
Male	Count	1	2	4	7
	% of Total	6.7%	13.3%	26.7%	46.7%
Female	Count	1	3	4	8
	% of Total	6.7%	20.0%	26.7%	53.3%
Total	Count	2	5	8	15
	% of Total	13.4%	33.3%	53.3%	100%

Nature of connections: Cross tabulation was used to compare the relationship between gender and nature of connections as summarized in Table 1. From the chi-square results it showed that there was no significant relationship between the gender and nature of connections; ($\chi^2=0.134$, $df=2$; $p>0.05$), Table 2. These results are based on a small sample size due to limited number of specimens that were in good condition at the time of study.

Table 2
Chi- square test on nature of connection

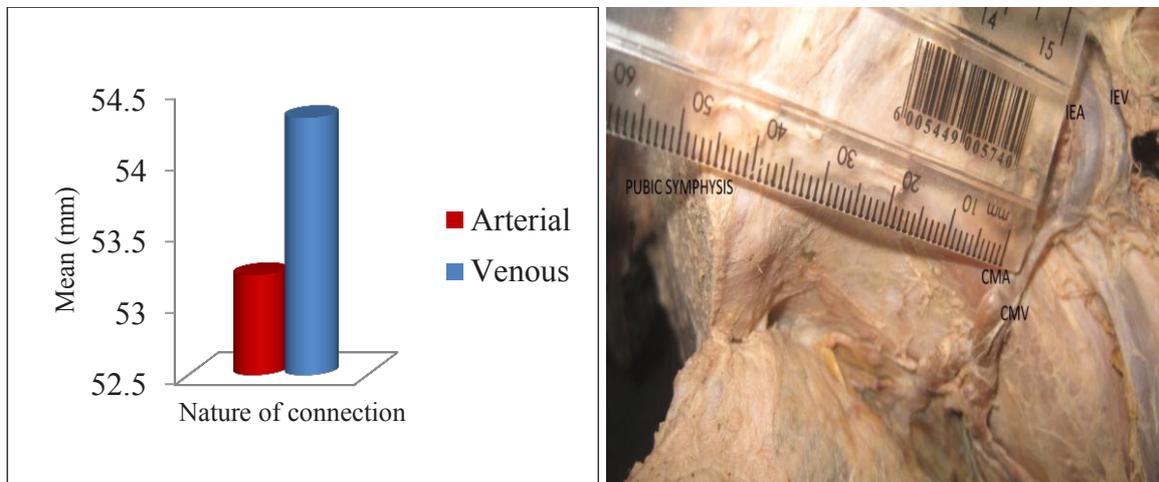
	Value	Df	Asymp. Sig. (2-sided)
Pearson chi-square	0.134 ^a	2	0.935
Likelihood ratio	0.135	2	0.935
Linear-by-linear association	0.020	1	0.888
No. of valid cases	15		

The mean distance from pubic symphysis to corona mortis: The mean distance from pubic symphysis to corona mortis was computed during the study as shown in Table 3 and Figure 1. The mean venous distance (54.27mm) to corona mortis was slightly longer compared to arterial (53.17mm).

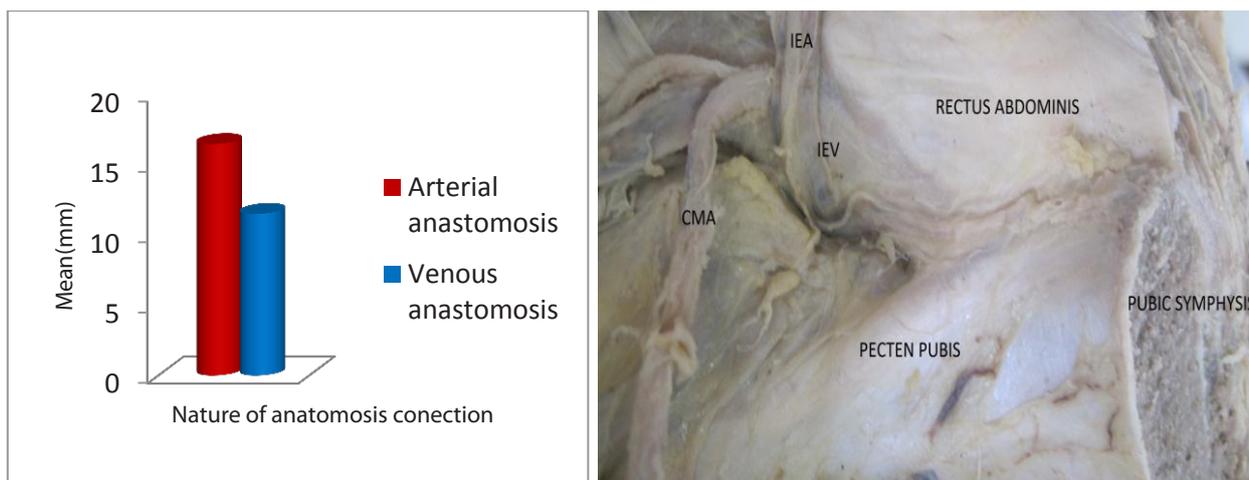
Table 3
Mean distance from pubic symphysis to corona mortis

Distance from pubic symphysis to	Gender	N	Mean	Std. Dev	Std. Error Mean	T	df	Sig. (2-tailed)
Artery	Male	7	56.14	7.034	2.658	1.93	10	0.083
	Female	5	49.00	5.099	2.280	2.04	9.98	0.069
Vein	Male	4	56.00	10.708	5.354	0.561	9	0.588
	Female	7	53.29	5.648	2.135	0.471	3.98	0.662

Figure 1
Mean distance from pubic symphysis to corona mortis



The mean distance from pubic ramus to corona mortis anastomosis with the external iliac vessels: The mean distance from pubic ramus to corona mortis anastomosis varied during the study as shown in Figure 2. The mean of arterial anastomosis distance was 16.42mm, while that of the venous anastomosis was 11.45mm.

Figure 2*Mean distance from pubic ramus to corona mortis anastomosis*

Independent samples t-test: The independent samples t-test showed that there was no significant difference in gender and mean distances from pubic symphysis to corona mortis. The findings also showed that there was no significant difference between the male and female distance from corona mortis (artery and vein) to pubic symphysis ($p > 0.05$). Independent samples t-test of the mean distance from pubic symphysis to corona mortis ($p > 0.05$; $n = 40$).

DISCUSSION

Vascular connections between the external iliac network of vessels and obturator systems are called the corona mortis. These connections may be arterial, venous or both (17). With the increase in surgery of the anterior pelvic ring, many investigators have started to study the detailed anatomy of the retro-pubic vascular system (2). Various other authors have noted the variations in the corona mortis, and estimated the incidence and location.

This study evaluated the incidence and location of communicating vascular channels running over the superior pubic ramus and the determination of the gender and occurrence in either the left or the right hemipelvises among black African cadavers. The corona mortis originates from the obturator vessels and then crosses over the superior pubic ramus to anastomose with external iliac vessels. The distance from the superior pubic ramus to the communication of the corona mortis with the external iliac vessels was also measured.

The findings of the study showed that of the 40 dissected hemipelvises, the corona mortis was present in 15 (37.5%) while 25 (62.5%) did not have either venous or arterial anastomosis between the obturator and the external iliac vascular systems.

Studies have reported the incidence of communicating vascular channels to be as high as 96% in a study by Berberoglu *et al.* (10), 73% by Teague *et al.* (2), and

84% by Tornetta *et al.* (11). Berberoglu *et al.* (10) reported an incidence of arterial corona mortis of 8% in 50 retro-inguinal dissections, while Teague *et al.* (2) found one of 43% in 79 cadaveric hemipelvises. To our knowledge, only one study has reported the incidence of the arterial corona mortis in males as compared to females (19). Karakurt *et al.* (15), in their angiographic study, noted an arterial incidence of 29%. According to Letournel *et al.* (18), the incidence was 10%–15%, but clinically, they encountered only one very large vessel out of more than 150 ilioinguinal exposures. They also noted that the type of fracture in that single clinical case probably affected the anastomoses, by lacerating the vascular connections at the time of injury (18). Teague *et al.* (2), in their clinical report, were of the same opinion.

In this study, the nature of connections was characterized which showed that 2 (13.4%) were purely arterial, 5 (33.3%) were purely venous while 8 (53.3%) had both venous and arterial communication. A majority of the hemipelvises had both mixed and venous communication.

CONCLUSION

With the increase in surgery of the anterior pelvic ring, more research has to be done to study the detailed anatomy of the retro-pubic region. Bleeding is a major complication in pelvic surgery both from an orthopaedic and a general surgery point of view. It is a complication that can however be prevented by having a detailed understanding of the pelvic anatomy in the population. Understanding this anatomy should aid the surgeon in avoiding vascular complications and catastrophic haemorrhage.

Surgeons who repair with direct, indirect, femoral, or obturator hernias need to be aware of these anastomoses and their close proximity to the femoral ring.

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