

Anatomic study of arcus tendineus fasciae pelvis

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Abstract

Objective: To describe the anatomy of the arcus tendineus fasciae pelvis. **Material and methods:** Two fixed female cadaver pelvises (88 and 66 years old) were dissected. **Results:** The arcus tendineus fasciae pelvis is a 10-cm-long fibrous thickening of the pelvic fascia which is medial to the obturator internus muscle and lateral to the peritoneum. It is inserted on the ischiatic spine and courses downward and anteriorly to the pubovesical ligament. The posterior third of the arcus tendineus fasciae pelvis is fused with the posterior third of the arcus tendineus musculus levatoris ani, forming a curve with upward and anterior concavity. This portion of the arcus tendineus is thick and easy to recognise upon palpation. It is located 1 cm slightly above and anterior to the ischiatic spine and 2 cm from of the pudendal vessels, which course around the posterior inferior margin of the ischiatic spine. The superior margin of the median part of the arcus tendineus fasciae pelvis is crossed laterally by vessels for the obturator internus muscle arising from the internal iliac vessels. **Conclusion:** In genital prolapse cure, sutures must be placed through the anterior or median parts of the arcus tendineus fasciae pelvis. In any case, they must remain anterior to the posterior part of the arcus tendineus fasciae pelvis to avoid injury to the pudendal vessels. © 2001 Elsevier Science Ireland Ltd. All rights reserved.

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1. Introduction

Cystocele (Fig. 1) may be due to disrupted anatomic relations between the anterior vaginal part of the pelvis and the arcus tendineus fasciae pelvis [1–4]. White [1] mimicked a complete cystocele on a cadaver by sectioning the fascia adhering to both arcus tendineus fasciae pelvis. He therefore suggested a surgical technique to restore the paravaginal attachment that consisted in suturing the anterior vagina to the arcus tendineus fasciae pelvis [1]. This technique relies mainly on the surgeon's tactile ability to recognise the anatomic element, as it is extremely difficult to actually see the arcus tendineus fasciae pelvis [5].

Our goal was therefore to provide details on the anatomic relations of the arcus tendineus fasciae pelvis.

2. Material and methods

Dissections were performed in the Laboratory of Anatomy of Professor JP Francke at the Faculty of Medicine of

Lille (research pole), on two fixed female cadavers aged 66 and 88 years.

The first stage consisted in isolating the pelvis by sectioning cadavers 1 cm above the promontory and at the level of the upper third of the femur.

We then resected the anterior abdominal wall and subsequently the uterus and upper third of the vagina, the rectum (except for its caudal end), and the upper part of the bladder down to its neck.

We then proceeded to resect the peritoneum and excise the subperitoneal fatty tissue. The lateral vesical, lateral rectal ligaments and the paracervix were also resected. The iliac vessels were resected after the bifurcation of the common iliac artery. The pelvic fascia having thus been made visible, we were able to study its intimate relations with the arcus tendineus fasciae pelvis. In order to describe the arch's deeper anatomic relations, we secondarily resected the pelvic fascia to reach the obturator internus and levator ani muscles.

Finally, we sectioned a frozen pelvis along a median sagittal plane to obtain yet a better view of the arcus tendineus fasciae pelvis. Photographs were taken under a cold light with a 55 mm lens and a 1.5 diaphragm. The speed was set at 125. The slide film was 64 ASA.

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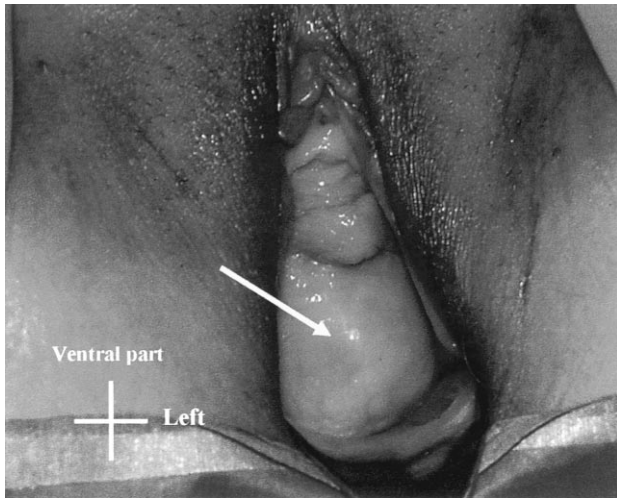


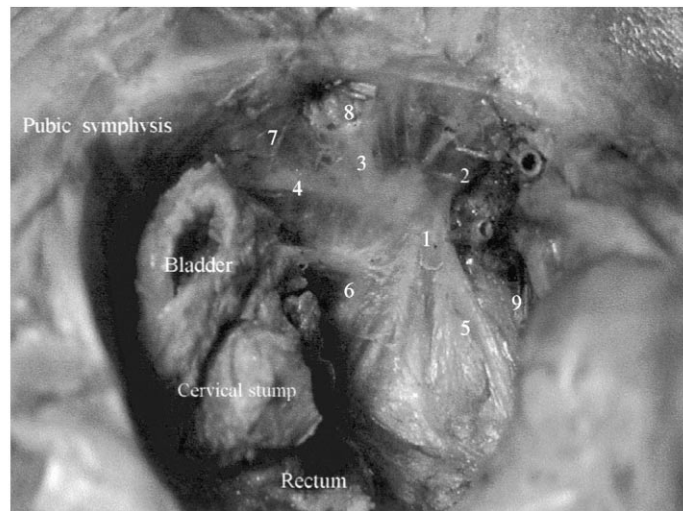
Fig. 1. Cystocele.

3. Results

The arcus tendineus fascia pelvis is a thickening of the pelvic fascia that partially constitutes Roggie's star [6] (Fig. 2).

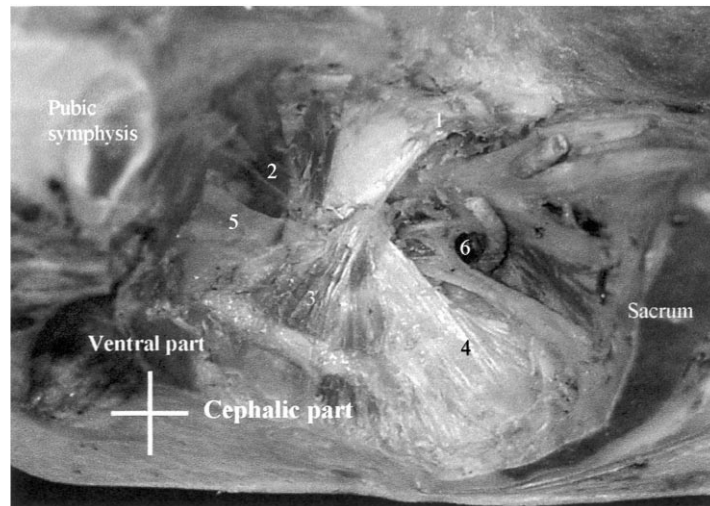
Roggie's star is actually the lateral limit of the paravesical space. It is difficult to differentiate from the rest of the pelvic fascia on account of its branches being formed by tendinous thickenings that are much easier felt than seen. The centre of the star is related to the ischiatic spine laterally. Tendinous thickenings are arranged in the shape of a star.

- The cephalic tendinous thickening, mainly visible in its posterior part, courses upward and becomes impossible to distinguish amidst the fasciae of the piriformis and obturator internus muscles. Medially, it is bordered by the pelvic peritoneum and laterally by the obturator internus muscle (Fig. 3). This is the plica ischiadica [7,8].
- The sacro-spinal ligament extends backwards and medially to the last two sacral and the first two coccygeal vertebrae. It is triangular with a lateral apex. Its anterior aspect is in relation with the pelvic peritoneum while its posterior aspect is in relation with the lower margin and anterior aspect of the coccygeus muscle. The sacro-spinal ligament and coccygeus muscle are in such close relation that they are virtually impossible to separate. The ligament's lower and upper boundaries are the iliococcygeus and the piriformis muscles, respectively (Fig. 4).
- The arcus tendineus musculus levatoris ani courses laterally and frontward to its insertion about 2 cm from the anterior margin of the obturator canal. Its posterior third is fused with the posterior third of the arcus tendineus fasciae pelvis located immediately under and behind it. It is related laterally to the obturator internus muscle and medially to the pelvic peritoneum (Fig. 5).
- The arcus tendineus fasciae pelvis courses downward and frontward to its insertion on the posterior inferior aspect of the pubic symphysis at the level of the pubovesical ligament. The posterior third of this arch is fused with the posterior third of the arcus tendineus musculus levatoris ani. It is related laterally to the obturator internus muscle and medially to the pelvic peritoneum (Figs. 6 and 7).



- | | |
|--------------------------------------|----------------------------------|
| 1=ischiatic spine | 2=plica ischiadica |
| 3=arcus tendineus musculus levatoris | 4=arcus tendineus fasciae pelvis |
| 5=sacro-spinal ligament | 6=ileococcygeus |
| 7=obturator internus | 8=obturator canal |
| 9=piriformis | |

Fig. 2. Roggie star (right, superior, lateral vision).

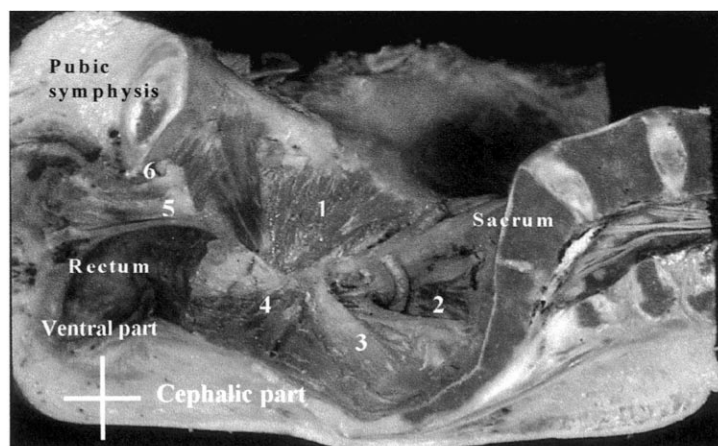


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|---|---------------------------|
| 1=plica ischiadica | 2=obturator internus |
| 3=ileococcygeus | 4=sacro-spinal ligament |
| 5=arcus tendineus musculus fasciae pelvis | 6=arteria pudenda interna |

Fig. 3. Plica ischiadica of Roggio star (right lateral vision).

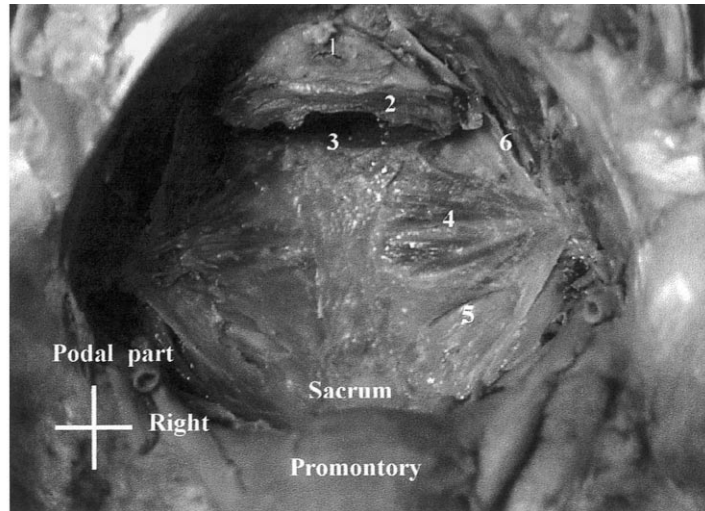
The arcus tendineus fasciae pelvis is 10 cm long. It is most visible in its posterior portion common with the arcus tendineus musculus levatoris ani. It is curved with an upper and anterior concavity. It sends out fibers that run upward and posteriorly to the posterior third of the cephalic tendinous thickening of Roggio star; it is the cephalic tendinous extension of arcus tendineus fasciae pelvis. These fibers constitute a very thick arch with anterior concavity, recognisable when felt, and located about 1 cm above and anterior to the ischiatic spine and 2 cm away from the pudendal vessels that curve around the posterior inferior margin of the spine (Fig. 8).

The middle third of the upper margin of the arcus tendineus fasciae pelvis is related to the vascular pedicle for the obturator internus muscle arising from the internal iliac arteries. The arteries travel between the arcus tendineus fasciae pelvis medially and the fascia of the obturator internus muscle laterally. They cross the upper margin of the arcus tendineus fasciae pelvis about 2 cm anterior to the tendinous extension the latter sends to the cephalic tendinous thickening in Roggio's star, i.e. 3 cm anterior to the ischiatic spine. Branches of the arteries for the obturator internus muscle supply the elevating group of the levator ani muscle, i.e. the pubovaginal and puborectal muscles (Fig. 9).



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|-------------------------|----------------------------|
| 1=obturator internus | 2= arteria pudenda interna |
| 3=sacro-spinal ligament | 4= ileococcygeus |
| 5=vagina | 6=urethra |

Fig. 4. Sacro-spinal ligament (right lateral vision).



- | | |
|-------------------------|-----------------------------------|
| 1=bladder | 2=vagina |
| 3=rectum | 4=ileococcygeus |
| 5=sacro-spinal ligament | 6= arcus tendineus fasciae pelvis |

Fig. 5. Arcus tendineus fasciae pelvis (right anterior, superior and lateral vision).

The arcus tendineus fasciae pelvis is a fibrous thickening of the pelvic fascia. When we attempted to dissect it, it was impossible to separate from the fascia. Its lower part is composed of fibers stemming from the fascia of levator ani muscle, its upper posterior third of fibers from the arcus tendineus musculus levatoris ani, along its entire length, its superior part and lateral part it receives fibers from the fascia of the obturator internus muscle, and its lower and lateral part, fibers from the superior fascia of pelvic diaphragm.

4. Discussion

According to White, the difficulty in surgically treating cystocele using the arcus tendineus fasciae pelvis lies first in that the area in which the procedure takes place is deep (at the level of the paravesical space) and difficult to reach, and second, in that surgeons must rely on touch more than on vision for this technique [5]. The arcus tendineus fasciae pelvis is difficult to differentiate from the other organic elements for several reasons. Whether the procedure be

Arcus tendineus musculus levatoris ani (ATMLA) (right lateral vision)

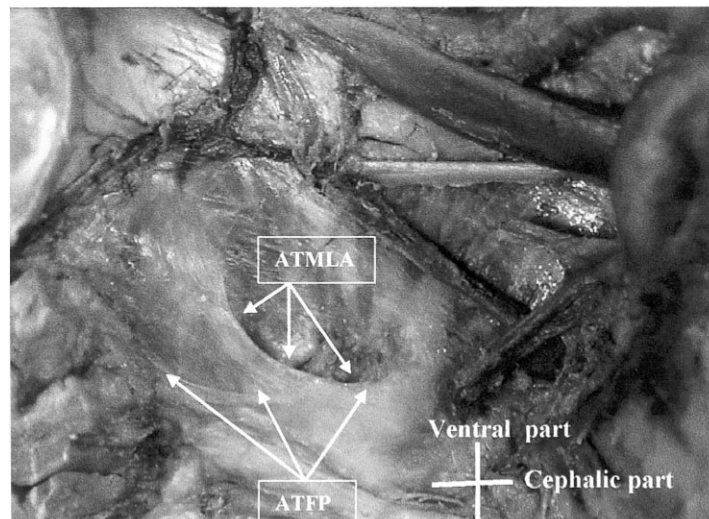


Fig. 6. Arcus tendineus fasciae pelvis (ATFP). Arcus tendineus musculus levatoris ani (ATMLA) (right lateral vision).

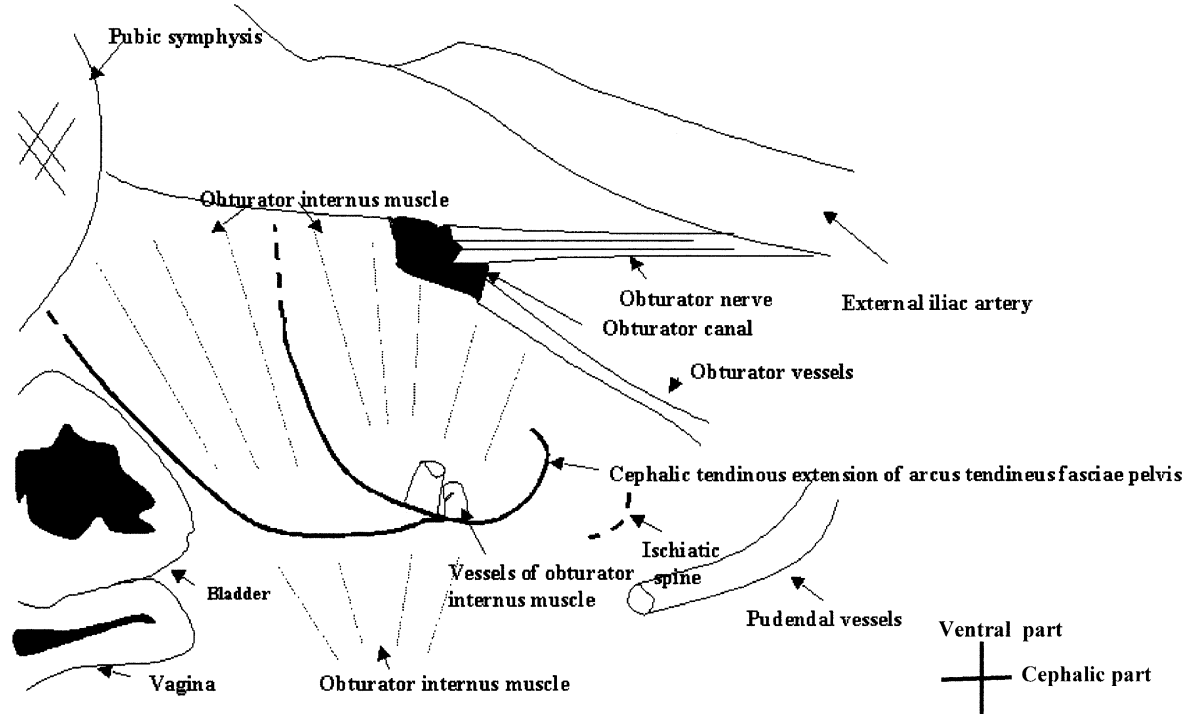
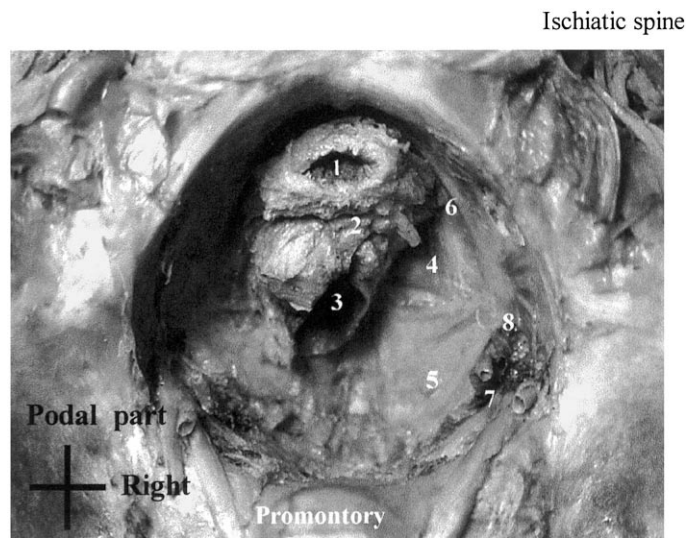


Fig. 7. Right lateral vision of arcus tendineus fasciae pelvis.

abdominal or vaginal, the arcus tendineus fasciae pelvis is located very laterally, as it belongs to the pelvic wall and constitutes a lateral boundary for the paravesical space.

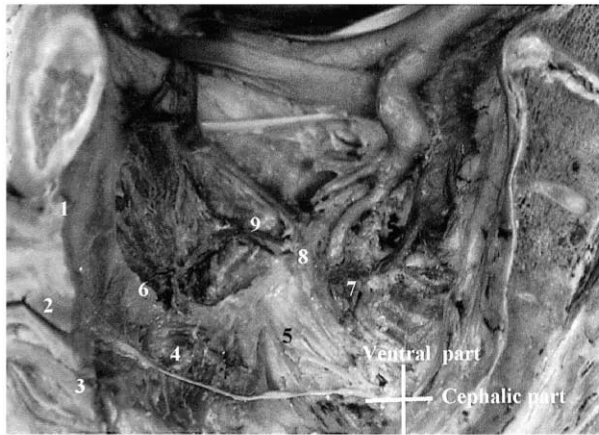
The object of our study was to help surgeons identify the arcus tendineus fasciae pelvis by providing a detailed description of its relations.

Literature discloses very little on this subject. According to Rouvière, the arcus tendineus fasciae pelvis is a thickening of the fascia of levator ani extending from the internal end of the pubic insertion of the levator ani to the internal aspect of the ischiatic spine [6]. DeLancey [9] described the intimate relations between the structures supporting the



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|------------------------------|-----------------------------------|
| 1=bladder | 2=vagina |
| 3=rectum | 4=ileococcygeus |
| 5=sacro-spinal ligament | 6= arcus tendineus fasciae pelvis |
| 7=pudendal vessels and nerve | 8=ischiatic spine |

Fig. 8. Pudendal vessels and nerve. Ischiatic spine.



- | | |
|--|----------------------------------|
| 1=bladder | 2=vagina |
| 3=rectum | 4=ileococcygeus |
| 5=sacro-spinal ligament | 6=arcus tendineus fasciae pelvis |
| 7=pudendal vessels and nerve | 8=ischiatric spine |
| 9=vessels and nerve of obturator internus muscle | |
| 10= arcus tendineus musculus levatoris ani | |

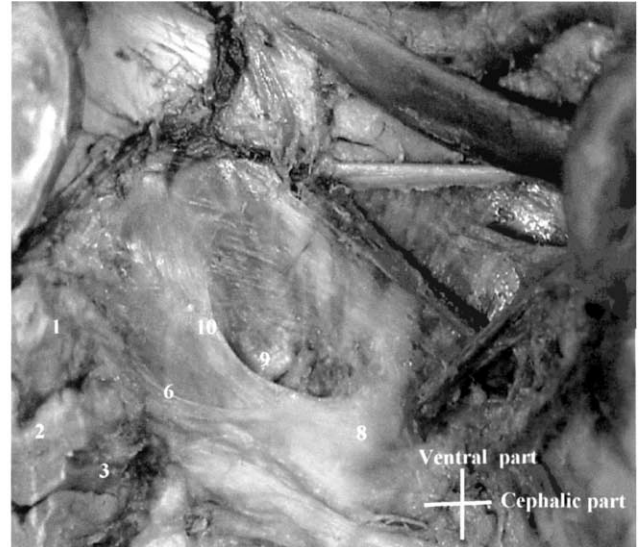


Fig. 9. Vessels and nerve of obturator internus muscle (right lateral vision).

urethra and the arcus tendineus fasciae pelvis: the neck of the bladder is connected to the anterior and middle portions of the arcus tendineus fasciae pelvis by means of the pubovesical ligaments, which, according to DeLancey, may be muscular based on cytological findings, possibly originating from an extension of the detrusor muscle. The arcus tendineus fasciae pelvis's insertion on the ventral aspect of the pubis covers about 1 cm, and approximately the same surface on the inferior margin of the pubic symphysis. DeLancey also noted the fusion between the arcus tendineus fasciae pelvis and arcus tendineus musculus levatoris ani in their posterior parts [9].

Our study offers practical details to establish whether the arcus tendineus fasciae pelvis can be used as an anchor in the pelvis. It is reinforced by the arcus tendineus musculus levatoris ani in its dorsal part, where it appears thicker. The sturdiness of the arcus tendineus fasciae pelvis is conferred by its intimate relation with the anterior and lateral margins of the levator ani muscle and with the superior fascia of the pelvic diaphragm. However, some parts of the arch may be dangerous to use, such as its middle third, where the arteries for the obturator internus muscle cross it laterally, and its cephalic tendinous extension to the cephalic tendinous thickening of Roggie star because of its proximity to the pudendal arteries (2 cm). The arteries for the obturator internus muscle may be injured but according to White, hemostasis may be achieved by compression [5]. The pudendal arteries are not injured as long as sutures are

placed anterior to the extension of the arcus tendineus fasciae pelvis to cephalic tendinous thickening of Roggie star.

5. Conclusion

The arcus tendineus fasciae pelvis does exist and can be identified. It is a thickening of the anterior and lateral margins of the levator ani muscle and of the superior fascia of the pelvic diaphragm.

The anterior and middle parts of the arcus tendineus fasciae pelvis, located anterior to its cephalic tendinous extension to the cephalic tendinous thickening of Roggie star can be used as an anchor in cystocele cure if care is taken to stay at a distance from the pudendal arteries.

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