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Original Research Article

Variation in the origin of obturator artery

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ABSTRACT

Introduction: An ideal method of exploring the surgical anatomy and the variations and anomalies is the human cadaver. The anatomical region of pelvic cavity consists of a large number of organs and structures. The clear knowledge of vascular pattern and its variations is significant. The laparoscopic surgical procedures for herniorrhaphy and hernio plasty makes the study of the pelvic vascular structures very important. The obturator artery which is normally a branch of anterior division of internal iliac artery has high frequency of variations which brings attention of many anatomists and surgeons to its origin and course.

Materials and Methods: The present study was conducted on 24 hemi pelvises of 12 adult cadavers, independent of age and sex dissected in the department of Anatomy, AIIMS, Rishikesh, India. During the dissection, origin and course of the obturator artery were traced. The handy instruction booklet of Anatomy by Cunningham was referred as the standard for all the dissections.

Observation and Result: In 22 specimens out of the 24 pelvic halves, the obturator artery originated from the anterior division of the internal iliac artery (IIA). The variations were noted in 2 hemi pelvises. In the right and left pelvis of a cadaver, obturator artery was coming from the posterior trunk of IIA. In 91.66% specimen normal origin of the obturator artery was noted i.e. from the anterior trunk of the IIA and in 8.3% specimens it originated from the posterior trunk of IIA.

Conclusion: The present study indicates that the obturator artery is frequent in showing disparity in its origin and course. It is usually described as a branch of anterior division of IIA. It can also take origin from posterior division of IIA. The surgeons who deal with the direct, indirect, femoral and obturator hernias need to have a clear knowledge about its variations and relation to the femoral ring.

1. Introduction

The common iliac arteries originate from the bifurcation of abdominal aorta at the level of fourth lumbar vertebra. They are two in number. In front of the sacroiliac joint, it further bifurcates into external and internal iliac arteries on either of the side. The common iliac artery basically supplies the pelvis and the lower limb of the corresponding side. [1]

Obturator artery (OA), is a medium- sized muscular artery. It is one of the branches of the internal iliac artery formerly known as the hypogastric artery usually originating from its anterior division. It courses antero-inferiory i.e. downwards and forwards on the lateral wall of the pelvis. It then reaches the upper part of the obturator foramen, exiting the pelvic cavity through the obturator canal. It gives off iliac, vesical and pubic branches within the pelvis. It supplies the medial compartment of the thigh by its anterior and posterior branches. The a cetabular branch, which enters the hip joint is originated from the posterior branch of the obturator artery. [2]

According to Bergman et al, the obturator artery has been documented to show disparity in its origin. In 41.4% of cases, it may take its origin from the common iliac or from the anterior trunk of IIA. In 10% of cases it may arise

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from the superior gluteal, in 25% cases from the inferior epigastric artery. It may also originate from the internal pudendal or inferior gluteal trunk in 10% of cases being 3.8% and 4.7% respectively.[3]

The study of vascular patterns and their variations in the pelvic region are of much importance. The pelvis contains large number of organs concentrated in the limited space of the cavity.[4] The surgeons dealing in the field of obstetrics and gynecology, orthopedics, urology and general surgery should be well aware of the variations of these arteries as they play a pivotal role. The anomaly in the origin of obturator artery may be beneficial for ligating the IIA. Arterial bleeding can be a fatal complication in injuries of the pelvic region including internal iliac artery and others. The variability in the origins of the branches of the IIA from different regions, if not provided attention, may result in improper therapeutic embolization.[5] This study emphasizes on the variation in origin and course of the obturator artery.

2. Materials and Methods

The present study was conducted in the Department of Anatomy at AIIMS, Rishikesh, India during a routine gross anatomy class of dissection for undergraduate students. All the dissections were carried out with the reference of Cunningham handy instruction booklet of Anatomy. A total of 24 pelvic halves of 12 cadavers preserved in formaldehyde were studied. Both halves of the same pelvis were completely examined irrespective of sex and age. The routine dissection instruments to dissect the pelvis were used. The dissection was carried out from superficial to deep underlying structures. The pelvic viscera which occupied left and right iliac fossa was reflected to reach the posterior abdominal wall where the common iliac artery was exposed. The division of external and internal iliac artery was noted and the branches of internal iliac artery was traced. The origin of obturator artery was traced and careful recording of data was done. Photographs were taken after displaying the origin of the obturator artery by using the canon camera with zoom lens.

3. Observation and Result

In 22 pelvic halves out of 24, the most common pattern of origin of obturator artery i.e. from the anterior division of internal iliac artery was recorded. In the remaining 2 hemi pelvises variation was observed as the obturator artery was originating from the posterior division of the internal iliac artery(Fig 1). In 91.66% specimen normal origin of the obturator artery was noted i.e. from the anterior trunk of the IIA and in 8.3% specimens it originated from the posterior trunk of IIA.

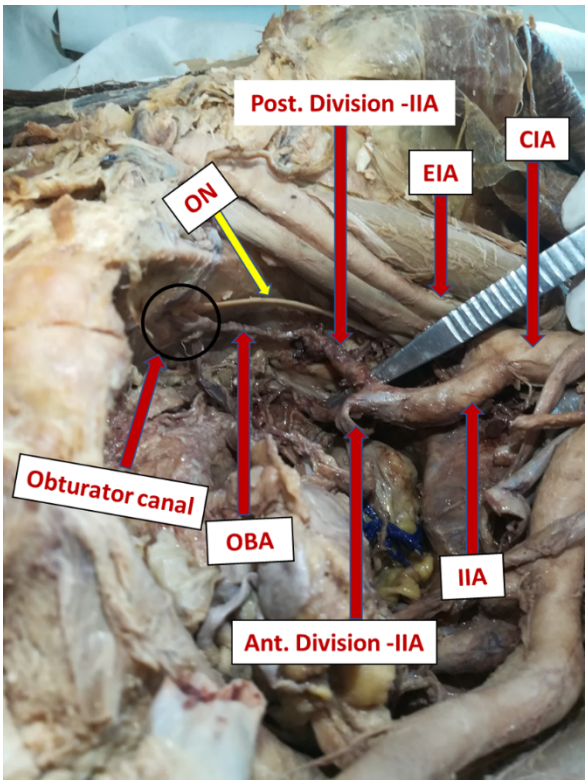

Fig. 1: IIA-Internal iliac artery, Obturatorartery-OBA, Common iliac artery-CIA, External iliac artery-EIA, Obturatornerve-ON

4. Discussion

The knowledge of the anatomy of the obturator vasculature is of immense importance especially for the surgeries related to the pelvic brim, and other compartments of thighs e.g. gluteal and adductor.[6] The obturator artery is mainly concerned with the blood supply of the adductor compartment of thighs and the smaller branches of the pelvis. The anterior trunk of internal iliac artery is the most common site of its origin. The obturator artery shows variation in its origin which needs to be noticed carefully. A study conducted by Jusoh et al, obturator artery was reported to be coming from the posterior division of IIA in 5.8% cases and this further divided to reach the prostate as an inferior vesical branch.[7]

Pavan et al reported a considerable variation in its origin through their study. In 72% of cases, anterior division of IIA was the site of its origin. In 18% of the cases it was observed to be originating from the posterior division of IIA. In 2% cases, it originated from external iliac artery and in 6% from inferior epigastric artery. Absence of the obturator artery was observed in 2%specimens.[8] Another study was conducted by Rajive et al on 50 cadavers. The obturator arteries arising from various locations were reported, 4% being coming from the common trunk of the internal iliac artery, anterior trunk of the internal iliac

arteries gave rise to it in 54% cases. It took origin from the inferior epigastric artery in 22% cases, from superior gluteal artery in 2% cases, from internal pudendal trunk in 2% specimens. Inferior gluteal artery and the external iliac artery gave origin to the obturator artery in 2% and 4% cases respectively.[9]

Kumar D. and Rath G reported the origin of left obturator artery from the posterior division of internal iliac artery at a distance of 8mm, from the point of bifurcation of the left internal iliac artery.[10]

According to Dubreuil-Chambardel there are different types of origins of obturator artery. They are as follows:

1. From the anterior division of internal iliac artery
2. From the posterior division
3. From inferior gluteal artery
4. From the internal pudendal artery.
5. From a common trunk for inferior gluteal artery and internal pudendal artery.
6. From the lateral sacral artery
7. Obturator and iliolumbar as a common stem from the trunk of internal iliac artery.[11]

In a study conducted by Sonje and Vatsalaswamy, in 10% cases the obturator artery was found to be arising from the posterior division of the internal iliac artery. This study also showed the presence of double obturator artery. In one of the cases, a very thin and rudimentary obturator artery was coming from the posterior division of the internal iliac artery and the other was arising from the external iliac artery.[12]

Variations in the branching pattern of obturator artery has also been reported by Parson and Keith. It was seen originating from external iliac or the hypogastric (internal iliac artery), the anterior or posterior division of the later, or a branch of either division within the pelvis.[13]

Benjamin Lipchitz reported the origin of obturator artery from the internal iliac before its division into anterior and posterior divisions in 9.1% cases. It was also found as a common stem with middle rectal in 5.4% of cases. The inferior gluteal artery gave rise to the obturator artery in 2% of cases; and from the internal pudendal in 4% of cases. In few cases it was report ed to be arising from the femoral artery.[14]

The most common origin of the OA in both males and females was from the internal iliac artery, more often from the anterior division and in some of the cases from the posterior division as a separate branch. It can also come with a common origin with the superior gluteal/ ilio lumbar artery. No obturator arteries were found to arise from the common iliac artery. It originated from the external iliac artery in almost 19% of the cases. The percentage of obturator arteries arising directly from the external iliac artery was 21% and 5% in males and females respectively.[15]

Another study conducted by Rao et al, showed the second highest incidence of the origin of obturator artery was from inferior epigastric artery (26.66%).[16]

In women undergoing pelvic surgery, and also in cases of obstruction of the internal iliac artery due to any cause, the ligation of the internal iliac arteries and its b ranches are quite significant. When the obturator artery arises from the external iliac artery, its branches especially the one to the head of femur are spared from being ligated. The existence of a dual origin for the obturator artery is a more unusual anomaly that occurs at a frequency of 1% cases.[17]

An anastomosis between the obturator and the external iliac or inferior epigastric arteries or veins known as the “corona mortis” or crown of death is an important anatomical variant as it is prone to accidental hemorrhage during surgeries especially in the anterior approach to the acetabulum and its hemostasis is difficult. The superior pubic ramus at a variable distance of 40-96 mm from the symphysis pubis marks its location. Darmanis et al state that, the high prevalence of these large retropubic vessels and their anomalous origin and course should not affect the surgical approach for fear of excessive hemorrhage, rather surgeons should exercise caution properly.[18]

The present study shows the variation in the origin of obturator artery in 8.3% specimens studied where it was noted to be originating from the posterior division of the internal iliac artery.

4.1. Embryogenesis

The Obturator artery appears to be comparatively late in development from a plexus. It is then joined by the axial artery of lower limb accompanying the sciatic nerve.[19]

According to Many other studies also, the Obturator artery has been reported to arise late in the development. The anomalies affecting the arterial patterns may be due to the selection of channels from the primary capillaries. Some channels may enlarge and some may constrict and even disappear. This can be responsible for the ultimate arterial patterns. If these channel remain successfully persiste nt near the posterior division and disappear from the anterior division, anomalous origin of the obturator artery from the posterior trunk of internal iliac artery can take place.[7]

The unusual selection of the vascular channels in relation to the external iliac artery and obliteration of the arterial channels in relation to the most common origin i.e. anterior trunk of the internal iliac artery, may give rise to obturator artery originating from external iliac artery.[20] In this study the anomalous origin can be understood with relation to these studies where the final pattern of arterial channels gave origin to the obturator artery from the posterior division of internal iliac artery.

5. Conclusion

The present study described the variation in the origin of the obturator artery where it was noted to be coming from the

posterior division of internal iliac artery in 8.3% specimens studied. These anomalous branching of the vascular pattern is of utmost importance to the surgeons dealing in the region and also for the academic benefits for the anatomists. The clear knowledge of these disparities are helpful to be cautious and avoid any kind of mishap during the surgical interventions.

6. Limitations

Small sample size.

7. Source of funding

None.

8. Conflict of interest

None.

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