

# Case Report: Investigating the Middle Rectal Artery and its Clinical Significance



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## ABSTRACT

**Introduction:** The middle rectal artery is a vital artery supplying the rectum, along with the superior and inferior rectal arteries. We explored the middle rectal artery due to its importance in rectal carcinoma surgeries.

**Methods:** In total, 40 pelvises were obtained from the Department of Anatomy of Dr. D. Y. Patil Medical College in Pune City, India.

**Results:** Variations were found in the origin of the middle rectal artery, including arising from the internal pudendal artery in 9 cases. In 2 cases, it was arising from the common stem of internal pudendal and inferior gluteal arteries. Arising from the inferior vesical artery was observed in 1 case; while in 2 cases, middle rectal artery was arising from the obturator artery. This is the artery that penetrates the fascia of rectum, which is essential in mesorectal excision in rectal carcinoma cases. It forms anastomosis with superior rectal artery.

**Conclusion:** In the low anterior resection of the rectum, the middle rectal artery is always exposed.

## 1. Introduction

Various body arteries commonly show variations in their origin. Thus, we investigated the middle rectal artery due to its high importance in rectal carcinoma surgeries. Arterial supply to the rectum is sourced from the superior, middle, and inferior rectal arteries. Superior rectal artery, as the continuation of the inferior mesenteric artery, enters into the pelvis through sigmoid mesocolon. Then, it crosses the left common iliac vessels and passes over sacral promontory. Next, it passes anterior to the sacral vertebrae and enters the upper mesorectum.

Then, it divides into two branches in front of the third sacral vertebra. These branches enter the rectum wall and reach the rectal submucosa. In the rectum wall, it forms anastomoses with the branches of middle and inferior rectal arteries.

Middle rectal arteries directly arise from the anterior division of the internal iliac artery or the inferior vesical artery (vaginal artery in females). They enter the mesorectum anterolaterally in the lateral rectal ligaments, and are frequently absent or maybe very small in caliber. When present, they provide arterial supply to the muscles of the mid and lower rectum; however, form only

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poor anastomoses with the superior and inferior rectal arteries. Rectum also receives blood supply from inferior rectal arteries, which are the terminal branches of internal pudendal arteries. The ascending branches of inferior rectal arteries form anastomoses with the branches of superior rectal arteries (Figure 1) [1].

The middle rectal artery usually arises from the anterior division of internal iliac artery, descends in the pelvis, and supplies the inferior part of rectum, seminal glands, prostate, and vagina [2]. This is the only vessel that penetrates the fascia of the rectum and is highly important in mesorectal excision in rectal carcinoma cases. Additionally, middle rectal artery forms anastomosis with superior rectal artery. In the low anterior resection of rectum, middle rectal artery is always removed, and the rectal stump is not well-vascularised; thus, we investigated the anatomy and variations of middle rectal artery.

## 2. Materials and Methods

Pelvises from 40 cadavers embalmed with 10% formalin was obtained from the Department of Anatomy of Dr. D. Y. Patil Medical College in Pune City, India. These cadavers were labelled from 1-40, and by left and right sides. Dissection was carried out according to the Cunningham's manual of practical anatomy, volume 2 [3].

The steps of the dissection procedure were as follows: dissected cadavers were cut at the level of 12<sup>th</sup> thoracic vertebra. A sagittal section of the pelvis was taken. The specimens were labelled with numbers and side. External and internal iliac arteries were exposed by removing the fascia over them. The branches of internal iliac artery, such as superior vesical, inferior vesical, middle rectal, obturator, uterine, and vaginal arteries were traced and identified with all these organs in situ. All these arteries were identified and confirmed after the removal of organs. Variations in the origin of middle rectal artery were noted according to the side of the specimen and gender and, eventually, the photographs of variations were taken.

## 3. Results

Four different types of variations were found in the origin of the middle rectal artery (Table 1).

## 4. Discussion

Ronald Bergman investigated the middle rectal artery and found the different origins of middle rectal artery. It was found arising from inferior vesicle artery and in some cases, from obturator artery [4].

Parsons and Keith also studied the middle rectal artery and reported that the middle rectal artery might be present in the form of multiple vessels. When there is more than one

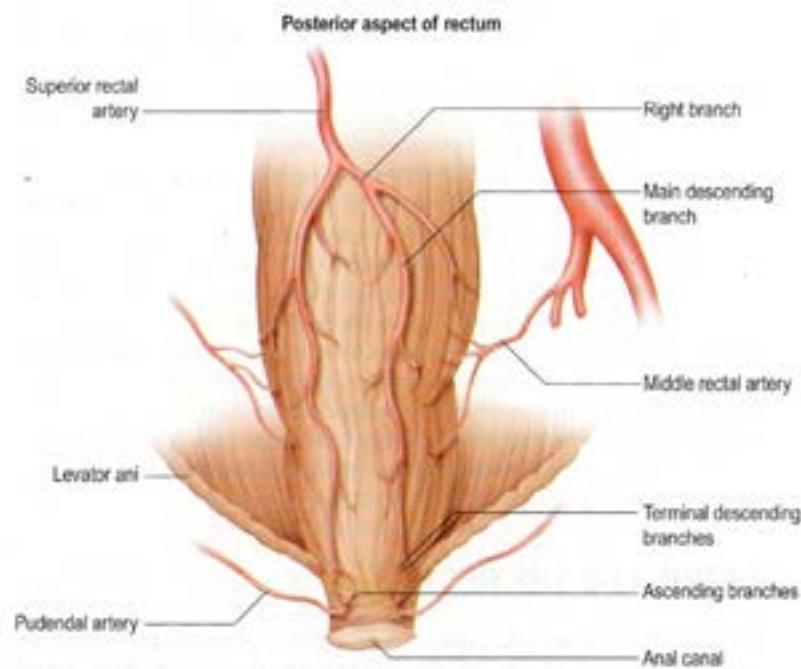


Figure 1. Blood supply of rectum

**Table 1.** Middle rectal artery

Origin of Middle Rectal Artery	Side		%
	Right	Left	
Internal pudendal artery (Figure 2)	4	5	22.5
Common stem of internal pudendal and inferior gluteal arteries (Figure 3)	1	1	5
Inferior vesical artery (Figure 4)	1	-	2.5
Obturator artery (Figure 5)	-	2	5

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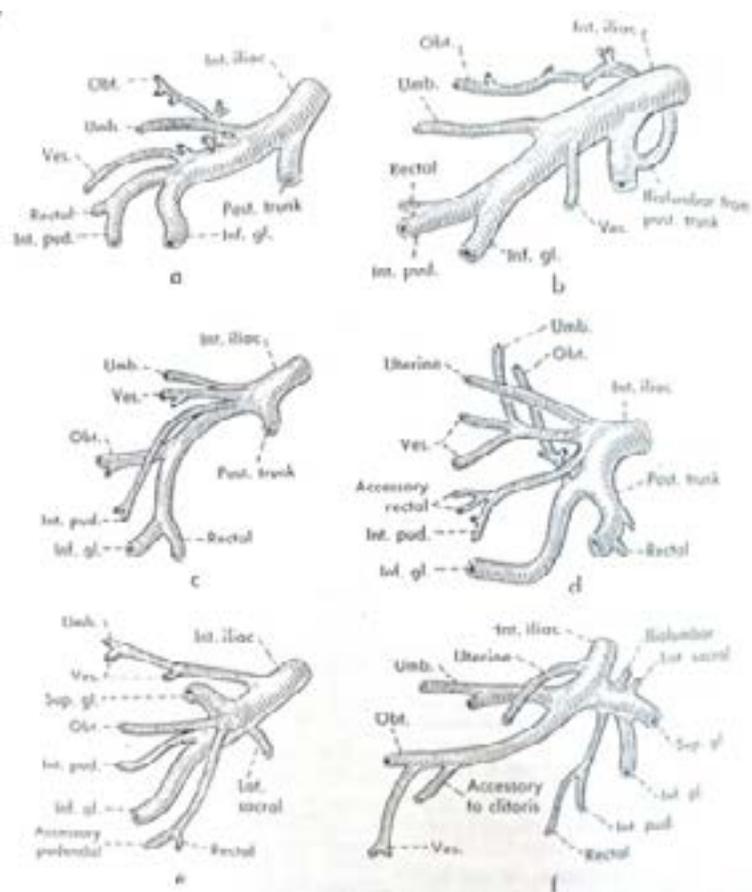
vessel, they arise from the internal iliac artery, the inferior vesical artery, or the internal pudendal artery [5].

Hassen et al. explored the middle rectal artery. They found its origins from the posterior division of the internal iliac artery or internal pudendal artery [6].

The lack of a middle rectal artery was also reported in about 60% of cases by Lin M and associates [7]. In the present study, middle rectal artery existed in all cases.

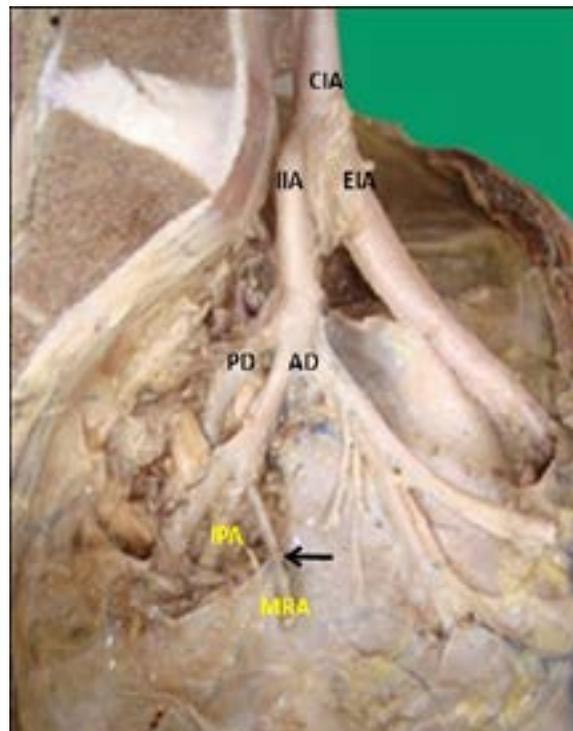
Variable origins of the middle rectal artery given by Henry Hollinshead 2<sup>nd</sup> edition, volume 2 are shown in the following diagram. According to him, middle rectal artery may arise from internal pudendal artery, inferior gluteal artery, or obturator artery. It may also arise from the posterior part of internal iliac artery (Figure 6).

The middle rectal artery penetrates the fascia of rectum and laterally passes to the rectum postero. It is important in mesorectal excision in rectal carcinoma cases; as the



**Figure 2.** Variable origins of the middle rectal artery

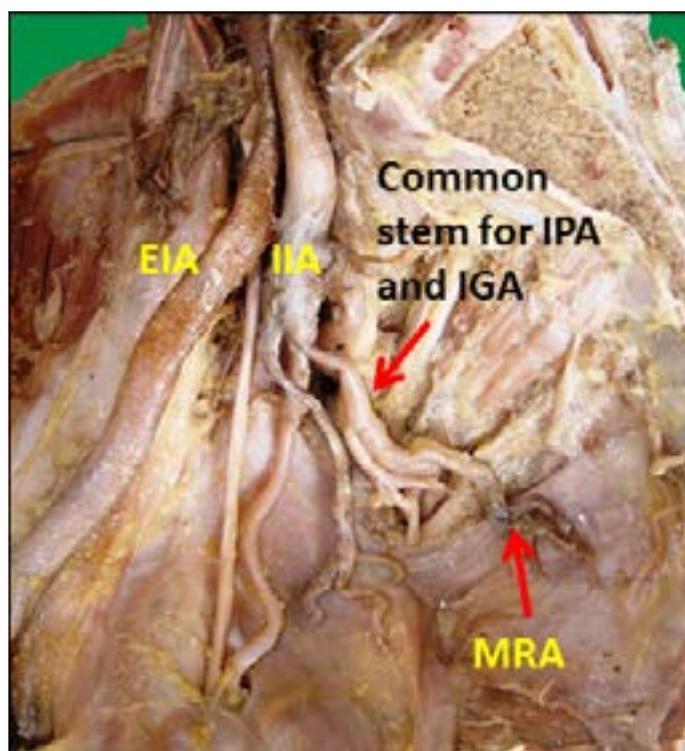
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**Figure 3.** Origin of the middle rectal artery from the internal pudendal artery

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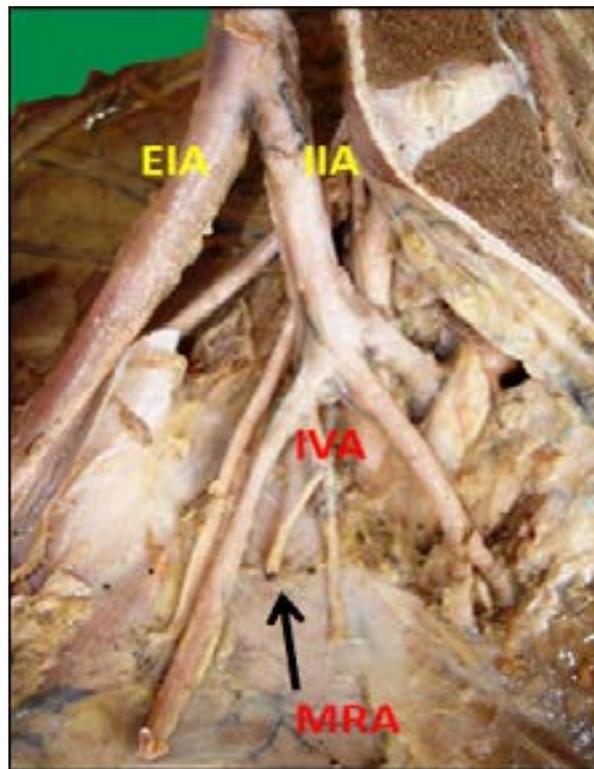
AD: Anterior Division; PD: Posterior Division; CIA: Common Iliac Artery; IIA: Internal Iliac Artery; EIA: External Iliac Artery; IPA: Internal Pudendal Artery; and MRA: Middle Rectal Artery



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**Figure 5.** Middle rectal artery arising from the common stem of the internal pudendal and inferior gluteal artery

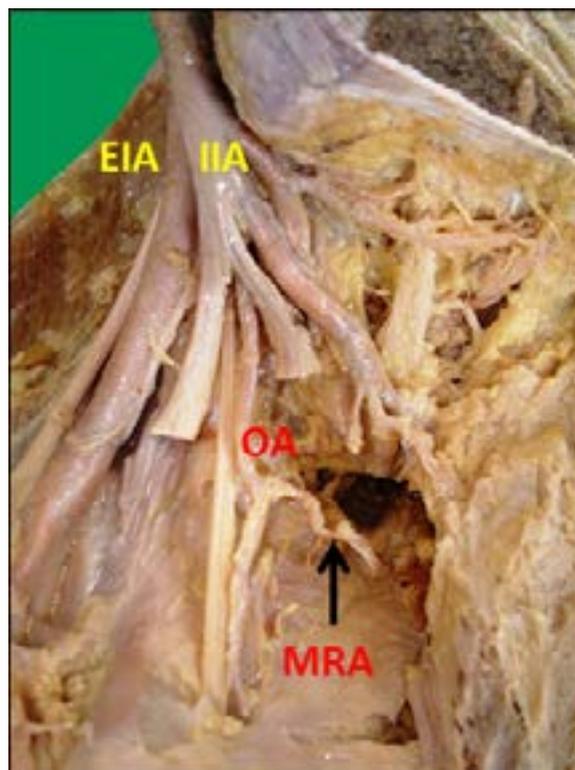
IIA: Internal Iliac Artery; EIA: External Iliac Artery; IPA: Internal Pudendal Artery; IGA: Inferior Gluteal Artery; and MRA: Middle Rectal Artery



**Figure 4.** Middle rectal artery arising from the inferior vesical artery

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IIA: Internal Iliac Artery; EIA: External Iliac Artery; IVA: Inferior Vesical Artery; and MRA: Middle Rectal Artery



**Figure 6.** Middle rectal artery arising from the obturator artery

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IIA: Internal Iliac Artery; EIA: External Iliac Artery; OA: Obturator Artery; and MRA: Middle Rectal Artery

middle rectal artery is usually removed in these cases. [8] Additionally, with advances in endoscopic surgery, the knowledge of precise anatomy of middle rectal artery is becoming more crucial for optimal rectal cancer surgery [9].

The middle rectal artery forms anastomoses with superior rectal artery. In low anterior resection of rectum, for rectal carcinoma, middle rectal artery is always removed. Thus, the knowledge of middle rectal artery and its variations is vital [10].

During the development of blood vessels, numerous primary capillary channels are formed. The most appropriate channels enlarge while the others are retracting or disappearing, which may result in the final arterial pattern. Unusual selection of channels from the primary capillaries might account for the anatomical variations affecting the arterial patterns [11].

## 5. Conclusion

Variant origins of the middle rectal artery, like a branch from any of the branches of anterior division of internal iliac artery or the posterior division of internal iliac artery are commonly observed; thus, this artery is a surgically important vessel in rectal carcinoma excision procedures.

## Ethical considerations

### Compliance with ethical guidelines

All ethical principles were considered in this article.

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### Authors' contributions

All authors contributed in preparing this article.

### Conflict of interest

The authors declared no conflict of interest.

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