Surgical Importance of Middle Rectal Artery

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Abstract

Background  Middle rectal artery is one of the important arteries supplying the rectum, along with the superior and inferior rectal arteries. Study of middle rectal artery was undertaken as it is important in surgeries of rectal carcinoma.

Materials and Methods  For the present study, 40 pelvises, fixed in 10% formalin, were procured from the Department of Anatomy of Dr. D. Y. Patil Medical College, Pune, Maharashtra, India. Sagittal section of pelvis was taken and dissection was performed following the steps according to the Cunningham’s manual.

Results  Variations were found in the origin of middle rectal artery such as those arising from the internal pudendal artery in nine cases. In two cases, it was arising from the common stem of internal pudendal and inferior gluteal arteries. It was seen arising from the inferior vesical artery in one case, while in two cases the middle rectal artery was arising from the obturator artery.

Conclusion  This is the artery that penetrates the fascia of the rectum which is important in mesorectal excision in cases of rectal carcinoma. It forms anastomosis with superior rectal artery. In low anterior resection of rectum, the middle rectal artery is always exposed.

Keywords  ► middle rectal artery
► variations
► rectal carcinoma
► mesorectal excision

Introduction

Arteries generally show variations in their origin in human body, and in relation to this, study of middle rectal artery (MRA) was undertaken as it is a very important artery in surgeries of rectal carcinoma.

Arterial supply to the rectum is from the superior, middle, and inferior rectal arteries. Superior rectal artery being as continuation of inferior mesenteric artery enters into the pelvis through sigmoid mesocolon, then it crosses the left common iliac vessels and passes over the sacral promontory, 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 wall of the rectum and reach the rectal submucosa. In the wall of the rectum it anastomoses with the branches of the middle and inferior rectal arteries. This arterial anastomoses gives a very rich arterial supply to the rectum.

MRA arises directly from the anterior division of the internal iliac artery (IIA) or from the inferior vesical artery (vaginal artery in females). They enter the mesorectum anterolaterally in the lateral rectal ligaments, and are frequently absent or may be very small in caliber. When present, they provide an arterial supply to the muscles of the mid and lower rectum, but form only poor anastomoses with the superior and inferior rectal arteries.

Rectum also receives blood supply from the inferior rectal arteries, which are the terminal branches of the internal pudendal arteries. Ascending branches of the inferior rectal arteries form anastomoses with branches of the superior rectal arteries.1

MRA usually arises from the anterior division of the IIA, descends in the pelvis, and supplies the inferior part of the rectum, seminal glands, prostate, and vagina in females.2

This is the only vessel that penetrates the fascia of the rectum, so it is important in mesorectal excision in cases of rectal carcinoma. Also, MRA forms anastomosis with superior rectal artery. In low anterior resection of rectum, the MRA is always removed and the rectal stump is not well

DOI https://doi.org/10.1055/s-0039-3401901
ISSN 2277-4025.
vascularized. Hence, study of anatomy and variations of the MRA was undertaken.

Materials and Methods

Pelvis from 40 cadavers embalmed with 10% formalin was procured from the Department of Anatomy of Dr. D. Y. Patil Medical College, Pune, Maharashtra, India. These cadavers were labeled from 1 to 40, from left and right side. Dissection was performed according to the Cunningham's Manual of Practical Anatomy—Volume 2.²

The steps of dissection were as follows:

• Dissected cadavers were cut at the level of twelfth thoracic vertebra.
• Sagittal section of the pelvis was taken.
• The specimen was labeled with number and side.
• External and internal iliac arteries were exposed by removing the fascia over them.
• Branches of IIA like superior vesical, inferior vesical, middle rectal, obturator, uterine, and vaginal arteries in females were traced and identified with all these organs in situ.
• All these arteries were identified and confirmed after removal of organs.
• Variations in origin of MRA were noted according to the side of the specimen and sex.
• Photographs of the variations were taken.

Observations

Four different types of variations were found in the origin of MRA. The artery was seen arising from different branches of IIA as shown in ►Table 1 (see also ►Figs. 1–4).

Discussion

MRA is the visceral branch of the anterior division of the IIA which is frequently absent. The MRA may also arise from the inferior gluteal artery (IGA) and/or inferior vesicle artery with the common trunk from the anterior division of the IIA. As the muscle of the middle and lower part of the rectum receives arterial supply from the MRA and the extensive rectal anastomosis, thus MRA is significant for the provision of collateral blood flow during intestinal embolization.³

Parsons and Keith⁴ also studied the MRA and reported that the MRA may be present in the form of multiple vessels. When there is more than one vessel, they arise from the IIA, or the inferior vesical artery, or the internal pudendal artery (IPA). In the present study, MRA was seen arising from common stem of the internal pudendal and inferior vesical arteries.

Hentati et al⁷ in their study on MRA found its origin from the posterior division of the IIA as well as from the IPA. Absence of MRA was also reported in approximately 60% of cases by Lin et al.⁸ No such case was found in the present study.

The MRA may arise from the IPA, IGA, or obturator artery. It may also arise from the posterior division of the IIA.

MRA penetrates the fascia of the rectum and then passes to the rectum posterolaterally. It is important in mesorectal excision in cases of rectal carcinoma as the MRA is usually removed in these cases.⁹

Table 1 Variable origins of middle rectal artery

<table>
<thead>
<tr>
<th>Origin of middle rectal artery from</th>
<th>Side</th>
<th>Percentage of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Internal pudendal artery (►Fig. 1)</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>The common stem of internal pudendal and inferior gluteal arteries (►Fig. 2)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Inferior vesical artery (►Fig. 3)</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Obturator artery (►Fig. 4)</td>
<td>–</td>
<td>2</td>
</tr>
</tbody>
</table>

Fig. 1 Origin of middle rectal artery from the internal pudendal artery. AD, anterior division; CIA, common iliac artery; EIA, external iliac artery; IIA, internal iliac artery; IPA, internal pudendal artery; MRA, middle rectal artery; PD, posterior division.
DiDio et al reported that the MRA originated from the IPA in 40% of the studied cases, IGA in 26.7%, and IIA in 16.8%. In addition, it was found in 56.7% of the cases, bilaterally in 36.7% and unilaterally in 20%. At the same time with advances in endoscopic surgery, the knowledge of precise anatomy of the MRA is becoming more crucial for optimal rectal cancer surgery.\(^\text{10}\)

In low anterior resection surgeries for rectal carcinoma where the MRA is always removed, knowledge of the MRA and its variations play an important role.\(^\text{11}\)

Havaldar et al in his study described the various origins of MRA as follows: from anterior division (4%), IPA (64%), inferior vesicle artery (6%), obturator artery (2%), and IGA (8%). MRA was absent in 16% of cases.\(^\text{12}\)

Naidoo et al reported that though MRA was not the principal arterial supply for the proximal rectum, it can assist to preserve the rectal arterial supply in surgical procedures.\(^\text{13}\)

**Embryological explanation**: During development of blood vessels, initially numerous primary capillary channels are formed but in later stages few primary channels persist while the others regress or disappear, which result in the final arterial pattern formation.

Unusual selection of channels from the primary capillaries is thought to account for the anatomical variations affecting the different arterial patterns.\(^\text{14}\)
Conclusion

Variant origins of MRA, like a branch from any of the branches of the anterior division of the IIA or from the posterior division of the IIA, are commonly seen which makes this artery surgically important vessel in cases of rectal carcinoma excision procedures.

Conflict of Interest

None.

References