Gross morphology of major and minor duodenal papilla: a cadaveric study

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Abstract

Background: Anatomical location of the duodenal papilla is of vital importance while performing retrograde cannulation of the ampulla, trans-duodenal exploration of the common bile duct or sphincterotomy. This study was carried out to review the gross morphology of major and minor duodenal papillae in South Indians. Material and methods: One hundred specimens of duodenum and pancreas enblock, procured from cadavers and autopsy cases from Thanjavur medical college, Thanjavur, were carefully studied and the data obtained was compared with similar reports available in the literature. Results: Major duodenal papilla was present in all the specimens and was located in the II part of the duodenum in 94 specimens, at the junction of I and II part of the duodenum in five specimens and at the junction of the II & III part in one specimen. Minor papilla was absent in nine specimens. Size of the major papilla and minor papilla were 7.6 ± 0.29 mm and 04 ± 0.52 mm respectively. The average distance between the pylorus and minor papilla was 6.2±1.24 cm and between the pylorus and major papilla was 8.2±1.27 cm. The average distance between the major and minor papilla was 1.97± 0.57 cm . Conclusion: The constant introduction of newer and modified techniques in the diagnosis and management of the diseases has increased the importance of normal and variant anatomy. The present study highlights the variations in the gross morphology of the major and minor duodenal papilla in South Indians.

Key words: ampulla of Vater, dimensions, anatomical location, pancreatitis, orifice.

Introduction

Anatomical location of the duodenal papilla is of vital importance while performing retrograde cannulation of the ampulla, trans-duodenal exploration of the common bile duct or sphincterotomy. Duodenoscopy is mandatory in the investigation of acute recurrent pancreatitis (ARP), and to assess duodenal lesions, involving the major and minor papilla. Endoscopic retrograde cholangiopancreatography is the diagnostic tool in the management of mechanical causes of ARP. A swollen major duodenal papilla is a characteristic finding in sclerosing pancreatitis. The histological and immuno histochemical findings of biopsy specimens of the major duodenal papilla, is a method helpful in diagnosing autoimmune pancreatitis. For the endoscopist to perform the dilation, stenting, or papillotomy, it is mandatory to know the surgical anatomy of major and minor duodenal papillae. Moreover, awareness of the gross features of the duodenal papilla, as well as of regional variation in structure and function greatly facilitates the understanding of pathophysiology, evaluation and management of the duodeno-pancreatic diseases, with the help of the modern diagnostic techniques. Thus, this study on the gross morphology of major and minor duodenal papilla was conducted in the Department of Anatomy, Thanjavur Medical College.

Material and methods

One hundred specimens of duodenum and pancreas enblock from 90 adult male and ten female subjects, in the age group of 25 to 63 years, procured from the Department of Anatomy and Forensic medicine, Thanjavur medical college, Thanjavur were utilized to study the anatomy of duodenal papillae by manual dissection method. The specimens of duodenum and pancreas enblock were removed, serially numbered, and preserved in 10% formalin. The duodenum was opened along the convex margin and the following gross morphological features of the duodenal papillae were studied: size, location and shape of major duodenal
papilla, the size and location of the minor duodenal papilla, the distance between the major and minor duodenal papilla, and their distance from pylorus. Dimensions were measured with the help of a caliper. The results obtained were compared with those reported previously.

**Results**

Major duodenal papilla was located in the II part of the duodenum in 94 specimens, at the junction of I and II part of the duodenum in five specimens and at the junction of the II & III part in one specimen. In 79 specimens, it was seen on the posteromedial wall of the duodenum and in 21 specimens, on the medial wall. In 96 specimens, the shape of the major duodenal papilla was found to be papillary and in four specimens, the shape was flat. Shape of the orifice of major duodenal papilla was slit-like in five specimens and was round or oval in 95 specimens. (Fig. 1, 2 & 3)

Size of the major papilla was found to vary from 3mm - 17 mm, with a mean of 7.6 ± 0.29 mm. In 11 specimens, the size was found be more than 10 mm. In 73 specimens, the size of the major duodenal papilla was found to be in the range of 5mm to 10mm. In 12 specimens, the size of the papilla varied from 3mm to 5 mm.

Minor duodenal papilla was absent in nine specimens. In the rest of the 91 specimens, it was located on the anterior wall of the duodenum. The size of the minor duodenal papilla was found to vary from 2-12mm, with the mean size of 4 ± 0.52 mm. In 86 specimens, the size of the minor duodenal papilla was in the range of 2-6 mm. In five specimens, the size of the minor papilla was more than 6 mm.

The distance between the pylorus and minor papilla was found to vary from 2.5 - 9.4 cm, with a mean of 6.2±1.24 cm. In 51 specimens, the distance was greater than 6 cm. In 12 specimens, the distance was less than 5 cm. The distance between the pylorus and major papilla was found to vary from 5-11.6cm, with a mean of 8.2±1.27 cm. In 48 specimens, the distance between the pylorus and major papilla was in the normal range of 8-10 cm. In nine specimens, the distance was found to be in the range of 10-12 cm. In 30 specimens, the distance was found to be in the range of 7 - 8 cm and in 13 specimens, the distance was in the range of 5 - 7 cm (Table - 1).

The distance between the major and minor papilla was found to vary from 0.5 to 3.5cm with the mean distance of 1.97± 0.57 cm. In 65 specimens, the distance between the major and minor papilla was found to be in range of 1.5 to 2.5 cm. In 10 specimens, the distance was in the range of 2.6 to 3.5 cm. In 13 specimens, the distance was less than 1.5 cm.

**Discussion**

The major duodenal papilla is a tubular projection on the posteromedial wall of the duodenum overlain by a hood-like fold and continued below by the tapered longitudinal fold of the duodenum. The average size of the major papilla is 1 cm and the orifice of the major papilla is round or slit-like. The external appearance of the major papilla is flat, papillary or hemispherical. The hemispherical shape of the major duodenal papilla appears to be common, but other shapes like unformed, swollen, villous, cone shaped, nipple-shaped and sharply pointed have also been described. In 76%, the major papilla is visible as a prominence and in 24%, it is depressed, still composed of a solid mass of tissue. Minor papilla is nearly always identifiable in dissected specimens, 1cm to 3.5 cm proximal to major papilla, however, it is never found dorsal or distal to the major papilla. Size of the minor papilla is variable. It may be absent or markedly regressed. Simon et al. observed double papilla of Vater in 0.18% of 1800 patients who underwent ERCP. Double major papilla is very rare and only a very few cases has been reported in literature. In the present study, the shape of the major duodenal papilla was found to be papillary in 96 specimens (96%) whereas, it was flat in four specimens (4%). The shape of the orifice of the major duodenal papilla was round.
or oval in 95 specimens (95%) and slit-like in five specimens (5%). We did not come across a double or triple papillae, however the minor papilla was absent in nine specimens (9%). The ampulla of Vater can be seen in about two-thirds of patients during routine double-contrast barium examination and the minor papilla in about one quarter⁹. In a double-contrast examination, the ampulla is recognized by its hood and a distal longitudinal fold, which lies on the medial wall and the minor duodenal papilla is identified on the anterior wall one cm proximal to the ampulla¹⁰. Endoscopically major papilla appears on the ridge of the duodenal longitudinal fold approximately 8cm from the pyloric ring as a round or oval protrusion of 3mm diameter (range 1.5 to 4.5mm)¹¹. Poppel et al¹² have reported a diameter of major papilla as large as 3 cm. Endoscopically, the minor papilla may be seen as large as major papilla or as a rudimentary elevation, with the size of 3.8 to 6.8mm in length and 2.8 to 5.4 mm in width¹². Similarly, Kamisawa et al¹⁴ reported the size of the minor duodenal papilla to vary from 3 to 6 mm endoscopically. In 50% of patients with chronic pancreatitis, the minor papilla was larger than 6mm. In the present study, the average size of the major duodenal papilla was 7.6 mm, with extremes from 3 mm to 17 mm. In 11 specimens, the size was found to be more than 10 mm. The average size of the minor duodenal papilla was 4 mm, with extremes from 2 mm to 12 mm, and only in five specimens, it was more than 6 mm.

Major papilla usually lies on the posterior or posteromedial wall of the second part of duodenum about 8 cm from the pylorus¹. Shiner¹⁵ describes the major papilla as a mucosal projection situated approximately at the middle of the descending limb of the duodenum, on its medial aspect. The minor duodenal papilla lies in the anteromedial wall at the junction of the superior and middle thirds of the second part of the duodenum¹. Redel et al¹⁶ reported that the major papilla is seen inferior to the midpoint of second part of the duodenum on the posteromedial wall and minor duodenal papilla 2 cm proximal to it on the same wall. In the present study, the major duodenal papilla was seen on the posteromedial wall in 79 specimens whereas it opened medially in 21 specimens. The minor papilla was located on the anterior wall of the duodenum in all the 91 specimens.

Most commonly, the major papilla usually opens 8.5 to 10 cm from the pylorus whereas the papilla minor is calculated as being situated about 7 cm below the pylorus and 2 cm above the papilla major¹⁷. Milbourn¹⁸ found that the distance between the minor papilla and pylorus to vary from 5.5 to 9 cm, the average being 8 cm, whereas Keyl¹⁹ reported the distance to be 3.5 to 12 cm, with an average of 7 cm. Letulle et al²⁰ found the distance of major papilla from pylorus to be 52 to 98 mm, the average being 7 - 8 cm, whereas in a study by Maeda²¹, the distances vary, as a rule, from 70 to 79 mm, with extremes from 40 to 159 mm. In the present study, the distance between the pylorus and minor papilla was found to vary from 2.5 to 9.4 cm, with the average of 6.2 cm while the distance between the pylorus and major papilla was found to vary from 5 to 11.6 cm, with the average of 8.2 cm (Table-1).

Given that, the major papilla may be as close as 5 cm or as far away as 15 cm from pylorus, it can be located at any point from the junction of I & II part of the duodenum to within the III part²²,²³. In 75% of the population, major duodenal papilla lies in the second part of the duodenum, in 15%, at the angle between the second and the third parts and in 9%, in the horizontal third part of the duodenum²³ which is almost similar to the results of the study done by Schwartz et al²⁴ (Table-2). In 67.8% of patients with congenital biliary dilatation, the papilla of Vater was distal to the descending portion of the duodenum.²⁵

Keddie et al.²⁶, in a series of 120 operative cholangiograms, found that the papilla was located at the junction of the second and third parts of the duodenum in 13 patients (11%) and in the third part in
Table - 1: Distance between pylorus and duodenal papillae.

<table>
<thead>
<tr>
<th>Landmark</th>
<th>Author / Year</th>
<th>Range (cm)</th>
<th>Mean ± SD (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between pylorus and minor papilla</td>
<td>Milbourn 1950</td>
<td>5.5 - 9</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Keyl 1955</td>
<td>3.5 - 12</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>Present study</td>
<td>2.5 - 9.4</td>
<td>6.2 ± 1.24</td>
</tr>
<tr>
<td>Between pylorus and major papilla</td>
<td>Letulle et al 1898</td>
<td>5.2 - 9.8</td>
<td>7.0 - 8.0</td>
</tr>
<tr>
<td></td>
<td>Maeda 1955</td>
<td>4 - 15.9</td>
<td>7.0 - 7.9</td>
</tr>
<tr>
<td></td>
<td>Present study</td>
<td>5 - 11.6</td>
<td>8.2 ± 1.27</td>
</tr>
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14 patients (in 13 patients (11%), at the proximal 2 cm and in 1 patient(0.83%), at the distal end of the third part). Abnormal location of the papilla of Vater in the third part of the duodenum has also been described in association with a congenital duodenal diaphragm[27]. In a series of 194 cadavers, Lurje[32] found that the common bile duct entered the upper surface of the beginning of the 3rd portion of the duodenum 16 times (8.25%), whereas, Pereira-Lima et al[28], in a review of 3,000 operative cholangiograms, found this anomaly in three patients (0.1%). In a study by Kantor et al[29], major duodenal papilla was present at the junction of II and III part in 3% and in the III part in 1% of cases. In the present study, the major duodenal papilla was located at the junction of the 1st and 2nd part of the duodenum in five specimens (5%), in the 2nd part of the duodenum in 94 specimens (94%), and it was located at the junction of the 2nd and 3rd part in one specimen (1%). Abnormal location of major papilla by various studies is shown in Table - 2.

Baldwin[30] (1911), in his study on 100 specimens, showed that the major and minor duodenal papilla is present in all cases and the distance between them varies from 0.9 to 3.5cm, average being 2cm, which correlates with the range of 10mm to 35mm in a study by Letulle et al[20] (1898), but with an average of 18mm. Maeda[31] (1924), in 62 specimens found the distance between the both the papilla to vary from 20 to 29mm, with extremes of 10-59 mm, whereas Hughes et al[11] (1954) found it to be an average of 2.1cm. Distance between minor and major papilla from various studies is shown in table - 3. In the present study, the distance between the major and minor papilla was found to vary from 0.5 to 3.5cm with the average distance of 1.97 cm. In 65 specimens, the distance between the major and minor papilla was in range of 1.5 to 2.5 cm, whereas in 13 specimens, the distance was less than 1.5cm.

Conclusion

The constant introduction of newer and modified techniques in the diagnosis and management of the diseases has increased the importance of normal and
variant anatomy. Awareness of the anatomical variations in the location of the duodenal papilla is of vital importance since meticulous examination of major duodenal papilla during endoscopy and endoscopy guided biopsies helps in early detection of papillary lesions and in diagnosing autoimmune pancreatitis. Thus, the present study highlights the variations in the gross morphology of the major and minor duodenal papilla in South Indians.

References


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