ORIGINAL RESEARCH PAPER

Anatomy

KEY WORDS: Omental bursa, Superior and inferior recesses of omental bursa, Foramen bursa omenti majoris, Right and left gastropancreatic folds

AN APPROACH TO DEMONSTRATE THE FORAMEN BURSA OMENTI MAJORIS AND THE GUARDING PERITONEAL FOLDS AND THE RECESSES OF OMENTAL BURSA

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ABSTRACT

Background: Development of high-resolution computed tomographic imaging has substantially improved the radiologic examination of the omental bursa or lesser sac. However, dissection procedure to demonstrate the omental bursa and it two recesses in cadaver did not receive adequate attention in past decades. **Methods:** This was a cross-sectional, observational study on 20 cadavers. Relatively disease-free fresh adult cadavers of both sexes were selected randomly. Omental bursa was exposed through transgastric approach. Photographs taken after proper exposure. **Results:** In every dissection, omental bursa, superior and inferior recesses, foramen bursa omenti majoris, right and left gastropancreatic folds were clearly understood. **Conclusion:** In our study, an effort was made to establish a cadaveric dissection procedure to delineate omental bursa which may add to existing knowledge in medical education technology as well as help the surgoens particularly who are performing minimally invasive surgery (MIS)

INTRODUCTION

The peritoneal cavity contains various compartmentalized potential spaces, knowledge of which is important to understand pathological processes involving the peritoneal cavity. One such potential space is the lesser peritoneal sac. Disease process producing generalized ascites or those involving the pancreas, transverse colon, posterior wall of the stomach, posterior wall of duodenum and the caudate lobe of the liver can produce pathological changes in the lesser sac [1].

In late somite embryos, the right and left pneumato-enteric recesses, appear on each side of the thick dorsal mesogastrium. The left one is transitory and soon disappears, but the right one establishes continuity with the peritoneal cavity and extends progressively cranially and transversely into the mesentery. Eventually this right recess forms a large irregular space with a narrow opening into the peritoneal cavity. Upper portion of the cranial extension of the right pneumato-enteric recess becomes separated from the more caudal portion, the primitive lesser sac, and forms a small closed supra-diaphragmatic mesothelial cavity, the infracardiac bursa [2].

In the later stages the primitive lesser sac undergoes extensive changes, intimately related to the developmental changes in the portion of the stomach, which largely determine its definitive shape. These changes and associated ones in the duodenum result in a large part of the lesser sac cavity coming to lie dorsal to the stomach and in the left half of the upper part of the abdominal coelomic cavity [2]

In summary, during the embryologic development of the alimentary tract, the stomach and duodenum rotate to the right to form a peritoneal space between the stomach and pancreas, known as the omental bursa or definitive lesser sac [3]. The sac varies in size according to the size of the viscera making up its walls. It has posterior and anterior walls as well as superior, inferior, right and left borders [4].

The anterior wall is made up of the posterior peritoneal layer of the lesser omentum, the peritoneum over the posterior wall of the stomach and first part of the duodenum, and the uppermost part of the anterior layer of greater omentum. The posterior wall is formed mainly by the peritoneum covering the posterior abdominal wall in this area. In the lower part, the posterior wall is made up of the anterior layer of the posterior sheet of the greater omentum as it lies on the transverse mesocolon [4].

The right border of the lesser sac is formed by the reflection of the peritoneum from the pancreatic neck and head onto the inferior aspect of the first part of the duodenum. Near the upper duodenal margin the right border joins with the floor of the epiploic foramen round the hepatic artery proper. Above the epiploic foramen the right border is formed by the reflection of peritoneum from the diaphragm to the right margin of the caudate lobe of liver and along the left side of the inferior vena cava, enclosing the hepatic artery [4].

The lesser sac is narrowed by two crescentic peritoneal folds produced by the hepatic and left gastric arteries. The left gastropancreatic fold overlies the left gastric artery as it runs from the posterior abdominal wall to the lesser curvature of stomach. The right gastropancreatic fold overlies the hepatic artery as it runs from the posterior abdominal wall to the lesser omentum [4]. Both gastropancreatic folds meet at their ends and form an aperture known as the foramen bursa omenti majoris.

The lesser sac is divided into two major recesses by a diagonal fold of peritoneum reflecting posteriorly over the left gastric and hepatic arteries [5]. The smaller superior recess is situated above the foramen bursa omenti majoris. It completely encloses the medial surface of the caudate lobe [6]. The larger inferior recess is located to the left of the midline and it lies between the stomach and the pancreas [7].

It is bounded inferiorly by the transverse colon and its mesentery, but can extend for a variable distance between the anterior and posterior reflections of the greater omentum [8]. On the left the bursa extends to the hilum of the spleen and the gastrosplenic and lieno-renal ligaments known as the splenic recess [8].

Keeping the anatomical knowledge in limelight, an effort was made to formulate a cadaveric dissection procedure to expose the abovementioned structures and spaces which

may help in Anatomy demonstration classes as well as relevant clinical training programmes.

Aims and Objectives

To establish a definite dissection procedure in cadavers to observe and demonstrate the omental bursa, superior and inferior recesses of omental bursa, foramen bursa omenti majoris, right and left gastropancreatic folds.

MATERIALS AND METHODS

Study setting:

The present study was conducted on 20 cadavers in the Department of Anatomy, Medical College, Kolkata, Department of Anatomy, College of Medicine & Sagore Dutta Hospital, Kamarhati and Department of Anatomy, Shri Ramakrishna Institute of Sciences, Durgapur over a span of two years after acceptance of the research proposal by respective Institutional Ethics Committees.

Type of study:

It was a cross-sectional observational study.

Sampling methods:

A total number of 20 cadavers (10 adult males and 10 adult females) were selected by random sampling.

Inclusion criteria:

(a) relatively disease-free fresh cadavers (b) both sexes aged between 20 and 60 years.

Exclusion criteria:

(a) Deformed and mutilated cadavers (b) age of cadavers less than 20 years and more than 60 years (c) History of abdominal surgery elicited by documentation or incision mark.

Dissection:

Cadaver was placed supine on the dissection table. A midline vertical skin incision was made extending from the xiphoid process to the pubic symphysis around the umbilicus. Further incisions were made following the costal margins, from the xiphoid process to the corresponding mid-axillary lines. Finally, bilateral incisions were given from the symphysis pubis to the respective anterior superior iliac spines. The skin was dissected from the midline and was reflected laterally. anterior abdominal wall muscles and rectus sheath was exposed.

A midline vertical incision was made at the linea alba. Attachments of the rectus abdominis and other muscles of anterior abdominal wall were cut along the lower costal margins of both sides. Muscles flaps were reflected inferolaterally and thus the greater sac of peritoneal cavity was exposed. Lesser sac of peritoneal cavity passes between the stomach and the posterior abdominal wall. This omental bursa arises as an extension of the peritoneal cavity into the right side of the mesentery of the stomach [9].

A circular window of about 10 cm in diameter was made in the anterior wall of the stomach and in the posterior wall of the stomach maintaining the alignment. Both the walls of the stomach were stitched close to the margins of the windows.

The whole stomach was lifted by applying some stay sutures. With the proper illumination and labeling the superior and inferior recesses of the omental bursa, right and left gastropancreatic folds, foramen bursa omenti majoris could be demonstrated.

RESULTS

Following the same procedure, omental bursa, superior and inferior recesses of omental bursa, foramen bursa omenti majoris, right and left gastropancreatic folds were clearly visible and could be demonstrated to the undergraduate and postgraduate medical students.

Figure-A

Figure-B

Figures A and B show (1) Stomach (2) Window in the stomach (3) Liver (4) The diaphragm (5) Greater omentum (6) Transverse colon (7) Descending colon (8) Small intestine (9) Lesser sac peritoneum on pancreas

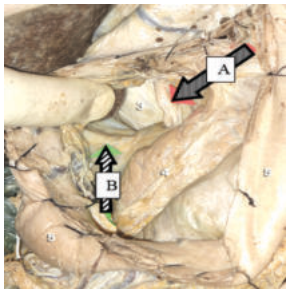

Figure-C

Figure-D

Figures C and D show (1) Right gastropancreatic fold- **arrowB** (2) Left gastropancreatic fold-**arrowA** (3) Superior recess of omental bursa (4) Lesser sac peritoneum on the pancreas (5) Stomach (6) Abdominal aorta (7) Coeliac trunk (8) Left gastric artery (9) Common hepatic artery (10) Splenic artery (11) Pancreas.

DISCUSSION

As a result of rotation and growth of the stomach, liver and associated mesenteries, the cephalic part of the peritoneal cavity is divided into an anteriorly positioned greater peritoneal cavity, that communicates with the common peritoneal cavity and a smaller posterior peritoneal cavity called the lesser peritoneal sac or omental bursa [10]. At term, the only communication between these two peritoneal cavities is via a small orifice, called the foramen of Winslow or epiploic foramen.

On peritneography, some contrast medium injected into the abdomen generally appears in the lesser peritoneal sac [11]. With advanced age or intraperitoneal inflammation, however the foramen of Winslow narrows and seals so as to segregate the lesser peritoneal sac from the greater peritoneal cavity [12]. Although sonography does not delineate lesser sac anatomy as well as CT, it may demonstrate an lesser peritoneal sac fluid collection, pseudocyst or mass [13]. The development of high-resolution computed tomographic imaging has substantially improved the radiologic examination of the lesser peritoneal sac [3].

Abnormalities involving lesser sac include fluid collections (ascetic transudate, inflammatory exudates, blood or bile), a discrete mass (pseudocyst, abscess, benign neoplasm or malignancy) and internal herniation of the gallbladder or intestine.

Benign or malignant neoplasms that involve the lesser peritoneal sac include those arising from the pancreas, stomach, transverse colon, proximal jejunum, left kidney and left adrenal gland. Rare primary neoplasms such as liposarcoma may occupy the lesser sac, peticularly in lateral compartment [8].

Surgical procedures may alter the lesser sac significantly. With splenectomy, the lesser sac floor and left side wall are

resected, leaving the lesser sac open to the geater peritoneal cavity. A similar result follows partial gastrectomy or resection of the transverse colon.

Minimally Invasive Surgery (MIS) is a well known procedure for intra-abdominal surgery. Regular trials are making it more accurate. Robot-assisted MIS is the future of surgery improving ergonomy and 3-dimensional vision. Particularly in oncosurgeries and in complicated reconstructive surgeries MIS is very helpful (14).

Magnification and its optimal visualization are the key points in favour of MIS. But by being dependant on technology, we are loosing the tactile feel of the inta abdominal organs an this feeling are very important to avoid complecations in surgery. This deficiency we could make up by having a good anatomical knowledge of the peritoneal cavities specially this omental Bursa. [15]

In spite of the profound clinical importance of the omental bursa, dissection procedure to demonstrate the omental bursa and it two recesses in cadaver did not receive adequate attention in past decades. During dissection, in most of the times, we are focused on exposing branches of coeliac trunk and damage the peritoneum. Although an understanding of the embryologic development of the omental bursa makes it intelligible, the anatomy remains complex and difficult to envision in three dimensions. For this reason, we propose a simple method of dissection in cadavers which is needed for visual conception about omental bursa and relevant structures and spaces.

CONCLUSION

The lesser sac is a cavity lined with peritoneum and connected to the larger general peritoneal cavity (greater sac) by epiploic foramen. It is considered part of the right supramesocolic space because embryologically the liver grows into the right peritoneal space and stretches the dorsal mesentery to form the lesser sac behind the stomach [4]

What this study adds to existing knowledge:

Keeping in view the clinical importance of the lesser sac, the present work was undertaken. It included the dissection of cadavers to demonstrate the omental bursa with its superior and inferior recesses, right and left gastropancreatic folds and foramen bursa omenti majoris. Omental bursa was exposed through transgartric approach which may add to existing knowledge in medical education technology.

This study was conducted after receiving approval from the institutional ethical committee of Medical College, Kolkata. All the authors were involved in collection of data, statistical analysis and manuscript preparation

Funding: Nil,

Conflict of interest: None

REFERENCES

1. Atre AL, Tandon A, Unune N. Depiction of lesser sac anatomy on MDCT by extravasated oral contrast in a case of gastric perforation. Indian J Radiol Imaging 2007; 17:74-76.
2. Hamilton WJ, Mossman HW. Alimentary and respiratory systems, pleural and peritoneal cavities. Hamilton, Boyd and Mossman's Human Embryology, 4th edition. Cambridge. Macmillan; 1972:373.
3. Dodds WJ, Foley WD, Lawson TL, Stewart ET, Taylor A. Anatomy and imaging of lesser peritoneal sac, AJR Am J Roentgenol 1985; 144:567-75.
4. Standring S, Gatzoulis MA, Collins P, Healy JC, Wigley C. Thorax. Gray's Anatomy, 40th edition. Edin. Churchill Livingstone; 2008: 1000-06.
5. Meyers MA, Dynamic radiology of the abdomen: Normal and pathological anatomy, 3rd edition. New York: Springer-Verlag; 1988.
6. Raval B, Hall JT, Jackson H. CT diagnosis of fluid in lesser sac mimicking thrombosis of inferior vena cava. J Comput Assist Tomogr 1985; 9:956-58.
7. Allen KS, Siskind BN, Burrell MI. Perforation of distal esophagus with lesser sac extension: CT demonstration. J Comput Assist Tomogr 1986; 10:612-14.
8. Jeffery RB, Federle MP, Goodman PC. Computed tomography of lesser peritoneal sac. Radiology 1981; 141:117-22.
9. Romanes GJ. The abdomen. Cunningham's Manual of Practical Anatomy, 15th edition. Oxford medical publication; 1986:113-124.
10. Moore KL. The developing human: clinically oriented embryology, 2nd ed. Philadelphia: Saunders, 1977.
11. Dunnick NR, Jones RB, Doppman JL, Speyer J, Myers CE. Intraperitoneal contrast infusion for assessment of intraperitoneal fluid dynamics. AJR 1979; 133:221-223. Meyers MA. Dynamic radiology of the abdomen: normal and pathological anatomy. New York: Springer-Verlag, 1976.
12. Vincent LM, Mauro MA, Mittelstaedt CA. The lesser sac and gastrohepatic recess: sonographic appearance and differentiation of fluid collections. Radiology 1984; 150:515-19.
13. Gore RM, Callen PW, Filly RA. Lesser sac fluid in predicting the etiology of ascites: CT findings. AJR 1982; 139:71-74.
14. Van Hillegersberg R, Seesing MF, Brenkman HJ, et al. Robot-assisted minimally invasive esophagectomy. Chirurg. 2017; 88:7-11.
15. Hylke J. F. Brenkman, Nicole I. van der Wielen, Jelle P. Ruurda, Maarten S. van Leeuwen et al. Surgical anatomy of the omental bursa and the stomach based on a minimally invasive approach: different approaches and technical steps to resection and lymphadenectomy. J Thorac Dis 2017;9(Suppl 8):S809-S816