Journal of Morphological Sciences
J Morphol Sci
Brazilian Society of Anatomy

Original Article
J Morphol Sci 2022;39:494-497

Cholecysto-colic Ligament – Anatomical, Physiological and Clinical Prospect

Chetan Sahni[1], Rajesh Kumar[2]

[1]Assistant Professor, Department of Anatomy, Institute of Medical Sciences, Banaras Hindu University, Varanasi
[2]Senior Resident, Department of Anatomy, All India Institute of Medical Sciences, New Delhi

Disclose and conflicts of interest: none to be declared by all authors

ABSTRACT

Introduction: anomalous arrangement of visceral peritoneum around different viscera can result in formation of variable peritoneal folds and recesses around these folds. These can act as a challenging factor during any diagnostic or therapeutic surgical approach to abdomen. It is thus important to know different forms of anomalous peritoneal folds, bands or ligaments during surgical approach to abdomen for acute or chronic conditions. During routine dissection of cadaver for the undergraduate students at Institute of Medical Sciences, Banaras Hindu University, Varanasi, a rare uncommon accessory peritoneal ligament was found. It was extending from inferior surface of gall bladder to transverse colon measuring 2.5 and 3.5 centimeters in length and breadth respectively. Information regarding variation in such type of accessory peritoneal reflections is necessary for anatomists, surgeons, and radiologists. Knowledge of such variation is imperative during gallbladder surgeries, liver transplantation surgeries and any diagnostic or therapeutic interventions in right hypochondrium region of abdomen.
Keywords: Peritoneum; Mesogastrium; Cholecysto-colic Ligament; Peritoneal Adhesions.

Introduction

The peritoneum is a largest and highly complex serous cavity in the abdomen which is filled with serous peritoneal fluid. Various abdominal organs are partially or completely covered by various folds and project into peritoneal cavity during various stages of development. Various peritoneal folds have been named differently as lesser or greater omentum, ligaments (like falciform ligament, ligamentum venosum), mesentery, mesocolon depending upon relationship to different viscera. Peritoneum covers the viscera as visceral layer and inner part of body wall as parietal layer. These layers also project as double layer in different part of abdominal cavity to suspend or hold the viscera at places[1]. Peritoneum and its different folds develop from pericardioperitoneal canal and also from lateral plate mesoderm (somatopleuric and splanchnopleuric layers) associated with the gut. Complexity of peritoneum can be related to differential development of different viscera and different parts of peritoneal folds[2]. Peritoneal folds not only suspend or holds the viscera at its place but it also acts as a gateway for neurovascular structures (arteries, veins, nerves and lymphatics) to concerned viscera[3]. In some pathological states, peritoneal folds also act as a pathway to spread of infections. It also forms some recesses and limiting spaces, which act as a site for hidden infection/abscess[4,5]. Peritoneal folds acting as boundaries for different spaces or recesses and may become dominant sites for fluid collection or abscess formation[6,7]. Normally, there is no peritoneal connection between the gallbladder, duodenum, and large intestine. In some unusual cases where such a peritoneal connection occurs, it has been named the Cholecysto-duodeno-colic Ligament. This ligament is a double-layered peritoneal structure. Due to its location, it may sometimes act as a window to the entry of a lesser sac[8]. Formation of abnormal peritoneal folds occurs due to abnormal development and rotation of viscera. These may also be found as a part of any pathological process involving peritoneum. These accessory peritoneal folds may cause internal rotation with subsequent pain and strangulation[8]. Many of these peritoneal folds or ligaments have been described previously in literature (Table 1). A very rare type of anomalous peritoneal fold was found and described in this report. Anatomical, physiological, embryological and clinical implications have been discussed in details with review of literature. Knowledge about these variations will be important to clinician, radiologists and surgeons during any diagnostic or therapeutic surgical interventions. Also. It will be imperative to academicians like anatomists for teaching purpose and making the medical students aware of these variations early in the curriculum.

DOI: 10.51929/jms.39.494.2022
ISSN 2177-0298

Table 1. Accessory peritoneal folds found by different authors.

Authors	Year	Variations/Clinical Presentation
Mamata Sar *et al*	2021	Peritoneal band extended from the upper end of ascending colon to the inferior surface of the right lobe of liver along with hepatoduodenal ligament and cysto-duodenal ligament
S B Nayak *et al*	2021	Gall bladder totally enclosed in the right free margin of the lesser omentum
Nayak SB *et al.*,	2017	cysto-duodenocolic ligament compression to both duodenum and colon
Erginel B *et al.*,	2016	Congenital peritoneal bands causing intestinal obstruction
Vishwajit Ravindra Deshmukh *et al*	2016	Cysto-duodeno-colic ligament
Nayak SB *et al*	2013	Peritoneal fold from the right end of the greater omentum to the gallbladder
Sharma NA *et al*	2013	cysto-duodenal and hepato-duodeno-colic ligaments
Narendra Padmini *et al*	2012	Anomalous peritoneal fold suspending gallbladder from undersurface of liver extending upto transverse colon, mesocolon and second part of duodenum
Somayagi Nagabhooshana & Venkata Ramana Vollala	2011	Peritoneal fold connecting pyloric part of stomach, right colic flexure and gall bladder
Ashaolu JO *et al.*,	2011	Cysto-duodenal ligament in 35% of cadavers
Tal Raphaeli *et al*	2009	Ladd's band- A single, thick adhesive band from the lateral abdominal sidewall to the hepatic flexure of the colon resulted in a complete colonic obstruction
Padmini N *et al*	2008	Cystogastrocolic fold with atrophy of gallbladder
Pinedo-Onofre JA & Guevara-Torres L	2007	0.37% incidence of omental torsion in cases presenting with acute abdomen
Mongardini M *et al*	2005	Ladd's band

Case report

During routine dissection of cadavers in practical classes of first-year undergraduate students, a rare uncommon peritoneal fold extending from the gallbladder to the transverse colon was observed. This was found in a 50-year-old male embalmed cadaver in the Department of Anatomy, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India. No pathological or traumatic lesions or surgical marks were observed in the abdominal region. The abdominal cavity was carefully dissected and the supracolic compartment was meticulously exposed (Fig. 1A). After reflecting the visceral surface of the left lobe of the liver, the supracolic compartment was

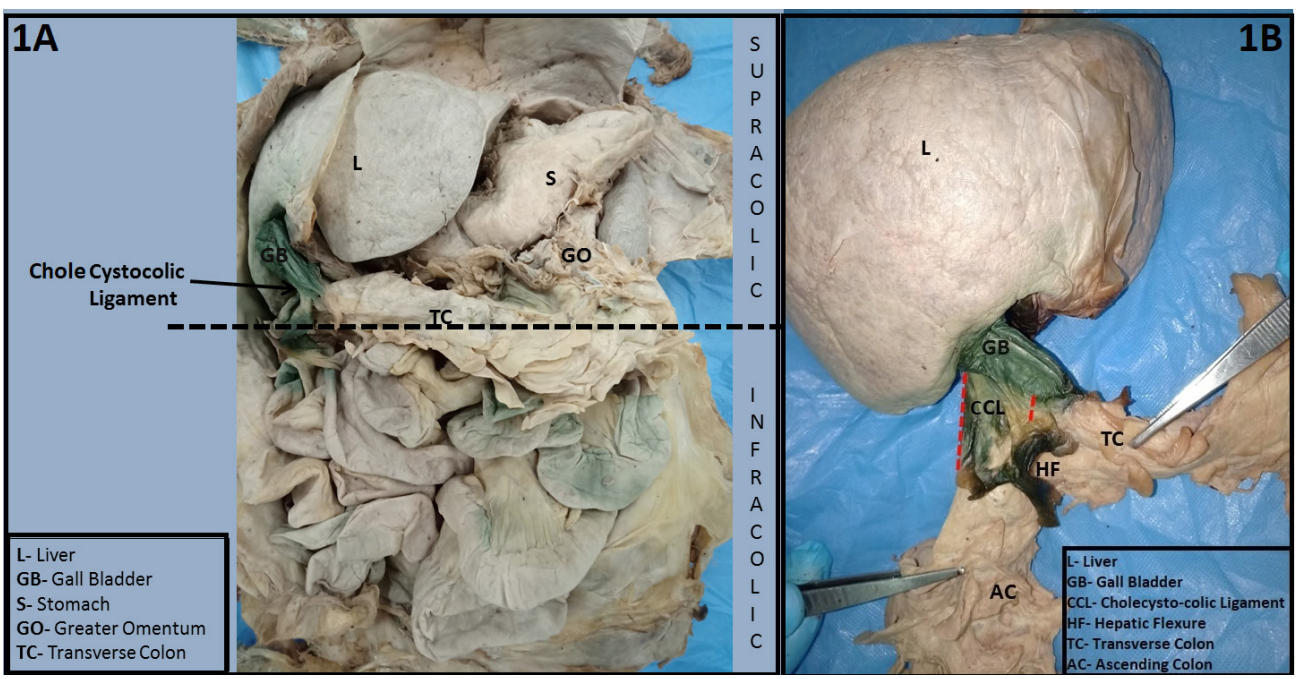

Figure 1. A: Dissected abdominal cavity showing supra-colic and infra-colic compartment. In the supra-colic compartment, a peritoneal fold connecting the gallbladder and the transverse colon named as Cholecysto-colic Ligament. B: Showing clear demarcation of Cholecysto-colic Ligamen

properly visualized. The Lesser omentum was found to be thin and was attached from the lesser curvature of the stomach to the porta hepatis. The gallbladder was situated along the inferior surface of the right lobe of the liver. An accessory peritoneal fold was observed in relation to the gallbladder and transverse colon, which extended approximately from half of the body of the gallbladder to the hepatic flexure of the transverse colon. This accessory fold of the peritoneum is termed the Cholecysto-colic ligament, which measured 2.5 cm in length and 3.5 cm in breadth in the present case (Fig. 1B). Measurements were taken by digital vernier's caliper. No neurovascular structures were observed within the ligament. This accessory peritoneal fold was differentiated from the peritoneal adhesions by tracing the two layers around the gallbladder and transverse colon. The continuity of the two layers confirmed its identity as the Cholecysto-colic ligament, thus differentiating it from other peritoneal adhesions. No other anomalous peritoneal fold was found in cadaver.

Discussion

Anomalous peritoneal folds have been documented by various authors. Generally, these anomalous folds are common in supracolic as compared to infracolic compartment. It has been seen more commonly in relation to lesser omentum, gall bladder, duodenum and colon. These are tabulated with actual findings and associated anomalies (Table 1). Cysto-duodenocolic ligament has been found to be associated with compression to both duodenum and colon[9]. Anomalous peritoneal fold suspending gallbladder from under surface of liver extending to transverse colon, mesocolon and second part of duodenum was also found[9]. Anomalous peritoneal folds involving gall bladder is generally associated with more than one viscus like colon and duodenum. In present case, fold was found only between gall bladder and transverse colon, which makes it a unique finding.

Embryologically, a single gut tube is attached initially to body wall by ventral and dorsal mesogastrium. During further development, most of the ventral mesogastrium undergoes regression and persists only in the region of stomach and initial part of duodenum. With differential growth and rotation of different viscera and parts of gut, peritoneal folds become more complex. The developing liver divides this ventral fold into the Falciform ligament, which connects the liver with the ventral body wall, and the Lesser omentum which connects the porta hepatis of the liver with the stomach and first part of the duodenum.[2] Persistent ventral peritoneal fold in other sites of the gut tube due to abnormal development present as accessory peritoneal folds such as the Cholecysto-duodeno-colic ligament. Ashaolu *et al.* classified the peritoneal folds/ligaments into two types: Type I are those with partial attachment to the surface of the gall bladder and Type II are those which are attached to the whole gall bladder[11]. Type I, the partial type is common and usually associated with abnormal development of gall bladder and inefficient emptying of bile with other gastrointestinal disturbances[12]. Meilstrup *et al.* reported that persistence of such connections in developing gall bladder with the duodenum and transverse colon may cause different developmental anomalies in gall bladder like Phrygian cap, polyploid cholesterolosis, and anomalies of the valve of Heister situated in the neck of gall bladder[13]. If the Cholecysto-colic fold extends to the liver and duodenum, then it is termed the Cholecysto-duodeno-colic ligament which is commonly related to developmental anomalies of the liver[7]. It is also reported in some cases that the thickness of the gall bladder wall increases at such sites of accessory peritoneal fold attachment. The plausible reason behind this may be the resistance offered by these folds during gall bladder distension[12]. In a case report, Cholecysto-colic ligament was found to be associated with other accessory peritoneal folds which blocked the epiploic foramen of winslow[14]. In the present case, no other accessory peritoneal folds were found. However, the gall bladder wall thickness was evident at the site of the Cholecysto-colic ligament attachment. In the present case the gallbladder was situated in the gallbladder fossa, but there are reports on floating gallbladders with mesenteries. In one of the studies performed on 27 patients, there were 13 lumbar, nine pelvic and five iliac gallbladders, with poor function in 20 of them[7]. When gallbladder floats in a mesentery or any abnormal fold like the one being reported here, there is a high chance of volvulus formation[8]. Knowledge of this type of anomalous fold is useful in differentiating pathological constrictions due to ulcerations from anatomical constrictions due to peritoneal folds.

Most of the abnormal folds are asymptomatic and go unnoticed throughout life. Some of them might be involved in physiological change in activity of gall bladder and colon. It may be involved in harbouring disease processes or serve as channels for the spread of malignancies. Sometimes, it also causes compression and obstruction of the hollow viscera. Peritoneal fold compressing duodenum was found in a radiological observation[15]. Liu *et al.* reported a congenital band compressing jejunum[16]. When the peritoneal folds enclosing the gall bladder are very long, they might result in a condition known as "Floating gallbladder" and result in torsion or volvulus formation. This fold of peritoneum might cause adverse effects in the normal functioning of the gallbladder and the gut. These peritoneal folds, in addition to affecting the liver and gall bladder, may also cause constrictions in the large intestine and create resistance to normal peristaltic movements[17].

Knowledge of such developmental variations is very crucial for surgeons while performing surgeries on

the gallbladder, liver and intestines. Such accessory peritoneal folds may obstruct the laparoscopic field and access during surgery[13]. The presence of such variations may hinder visualization of the Calot's triangle in laparoscopic cholecystectomy, adding difficulties to the surgical procedure[18].

Conclusion

Awareness about possibility of accessory peritoneal folds is extremely important as it alters the conventional surgical and radiological filed of interest. It can also form recesses which can harbour exudates of inflammatory processes. These folds often go unnoticed and reported rarely in literature as compared to actual statistics because these are often observed in an emergency procedure for an acute abdomen. Therefore, knowledge and healthy suspicion of such variation is imperative during gallbladder surgeries, liver transplantation surgeries and any diagnostic or therapeutic interventions in right hypochondrium region of abdomen.

Acknowledgment

The authors wish to sincerely thank those who donated their bodies to science so that anatomical research could be performed. Results from such research can potentially improve patient care and increase mankind's overall knowledge. Therefore, these donors and their families deserve our highest gratitude.

Funding decla

IoE Seed grant (Banaras Hindu University) No. "R/DEV/D/IOE/Seed Grant-II/2021-22/39976", is gratefully acknowledged.

References

1. Gray H, Standring S. Gray's anatomy: the anatomical basis of clinical practice. Churchill Livingstone; 2008.
2. Sadler TW. Langman's medical embryology. Lippincott Williams & Wilkins; 2018 Sep 6.
3. Tirkes T, Sandrasegaran K, Patel AA, Hollar MA, Tejada JG, Tann M, Akisik FM, Lappas JC. Peritoneal and retroperitoneal anatomy and its relevance for cross-sectional imaging. Radiographics. 2012 Mar;32(2):437-51. https://doi.org/10.1148/rg.322115032
4. Kim S, Kim TU, Lee JW, Lee TH, Lee SH, Jeon TY, Kim KH. The perihepatic space: comprehensive anatomy and CT features of pathologic conditions. Radiographics. 2007 Jan;27(1):129-43. https://doi.org/10.1148/rg.271065050
5. Le O. Patterns of peritoneal spread of tumor in the abdomen and pelvis. World journal of radiology. 2013 Mar 28;5(3):106. https://dx.doi.org/10.4329%2Fwjr.v5.i3.106
6. Auh YH, Lim JH, Kim KW, Lee DH, Lee MG, Cho KS. Loculated fluid collections in hepatic fissures and recesses: CT appearance and potential pitfalls. Radiographics. 1994 May;14(3):529-40. https://doi.org/10.1148/radiographics.14.3.8066268
7. Deshmukh VR, Singh S, Sehgal R. Cysto-duodeno-colic ligament and its clinical relevance. biomedical journal. 2016 Dec 1;39(6):414-6. https://doi.org/10.1016/j.bj.2016.10.002
8. Ashaolu JO, Ukwenya VO, Adenowo TK. Cystoduodenal ligament as an abnormal fold and the accompanying anatomical and clinical implications. Surgical and radiologic anatomy. 2011 Mar;33(2):171-4. http://dx.doi.org/10.1007/s00276-010-0736-z
9. Nayak SB, George BM, Mishra S, Shetty SD, Sirasanagandla SR, Padavinangadi A. Surgical and radiological importance of a rare cysto-duodeno-colic peritoneal fold. Anatomy & Cell Biology. 2017 Jun 1;50(2):159-61. https://doi.org/10.5115/acb.2017.50.2.159
10. Pamidi N, Rao Sirasanagandla S, Nayak BS, Jetti R. Variant position of the gallbladder associated with abnormal peritoneal fold around it. Rev Arg de Anat Clin. 2012 Jul 5;4(2). https://revistas.unc.edu.ar/index.php/anatclinar/article/view/14024
11. Ashaolu JO, Olayinka J, Ukwenya VO. The prevalence and classification of the cystoduodenal ligament. Anatomy Research International. 2015;2015. http://dx.doi.org/10.1155/2015/742621
12. Nayak SB. Abnormal peritoneal fold connecting the greater omentum with the liver, gallbladder, right kidney and lesser omentum. Bratisl Lek Listy. 2009 Aug;110(11):736-. http://www.ncbi.nlm.nih.gov/pubmed/20120448
13. Meilstrup JW, Hopper KD, Thieme GA. Imaging of gallbladder variants. AJR. American journal of roentgenology. 1991 Dec;157(6):1205-8. https://doi.org/10.2214/ajr.157.6.1950867
14. Sharma NA, Sharma A, Garud RS. Rare peritoneal bands and recesses: incidental findings in a cadaveric dissection. Surgical and Radiologic Anatomy. 2013 May;35(4):359-63. https://doi.org/10.1007/s00276-012-1033-9
15. Low VH, Davis SJ, Yoong MF. Anomalous Peritoneal Folds of the Duodenum A Normal Variant Simulating Disease. Australasian radiology. 1992 May;36(2):135-6. https://doi.org/10.1111/j.1440-1673.1992.tb03100.x
16. Liu C, Wu TC, Tsai HL, Chin T, Wei C. Obstruction of the proximal jejunum by an anomalous congenital band—a case report. Journal of pediatric surgery. 2005 Mar 1;40(3):E27-9. https://doi.org/10.1016/j.jpedsurg.2004.11.008
17. Alicioglu B. An incidental case of triple gallbladder. World journal of gastroenterology: WJG. 2007 Apr 7;13(13):2004. https://dx.doi.org/10.3748%2Fwjg.v13.i13.2004
18. Akgür FM, Tanyel FC, Büyükpamukçu N, Hiçsönmez A. Anomalous congenital bands causing intestinal obstruction in children. Journal of pediatric surgery. 1992 Apr 1;27(4):471-3. https://doi.org/10.1016/0022-3468(92)90340-d

Mini Curriculum and Author's Contribution

1. Chetan Sahni – MBBS, MD; Contribution- Dissection and making Prosected Specimen for Case Report, Writing the Manuscript. ORCID- 0000-0002-4301-4643

2. Rajesh Kumar – MBBS, MD; Contribution- Writing manuscript, Collecting References & Editing the manuscript. ORCID- 0000-0002-8743-7541

Received: August 1, 2022
Accepted: August 10, 2022

Corresponding author
Chetan Sahni
E-mail: chetansahni@bhu.ac.in