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Anatomical and Histological Characterization of the Putative Pancreatocolic Attachment: A Pilot Cadaveric Study

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Research Article

Keywords: Transverse colon, Colonic neoplasm, Peritoneum, Anatomy, Colorectal surgery

Posted Date: November 27th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11658378/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

The splenic flexure of the colon (SFC) is one of the most technically challenging regions in colorectal surgery due to its multiple peritoneal attachments and double vascularization system. Currently, there is a lack of anatomical and histological consensus regarding the nomenclature of the medial attachments connecting the SFC to the pancreatic tail. The primary aim of this study was to provide macroscopic and histological characterization of an anatomical attachment between the transverse mesocolon and the pancreas, referred to here as the putative pancreatocolic ligament.

Methods

We conducted a descriptive anatomical and histological pilot study on 10 cadaveric specimens (seven embalmed and three cryopreserved). A complete block dissection of the "Splenic Flexure Box" was performed, preserving all ligamentous attachments intact. We histologically evaluated samples using Hematoxylin-Eosin and Masson’s trichrome stains to identify collagen-rich connective layers.

Results

Macroscopically, a distinct medial attachment between the transverse mesocolon and the pancreatic body and tail was identified in all 10 cadavers, alongside the other recognized attachments of the splenic flexure. Microscopically, Collagen-rich connective tissue was identified on the anterior and posterior surfaces of the attachment. A four-layer connective-tissue pattern was observed in six specimens (60%), whereas two layers were identified in three specimens (30%). In one specimen (10%), tissue degradation precluded reliable assessment.

Conclusions

The attachment described in this study represents a recognizable collagen-rich tissue plane between the transverse mesocolon and the pancreas. Its identification may help surgeons understand the medial anatomy encountered during splenic flexure mobilization. Further anatomical and clinical studies are needed to establish its histological nature and potential surgical relevance.

Introduction

The splenic flexure, the junction between the midgut and hindgut, receives blood from both the SMA (Superior Mesenteric Artery) and IMA (Inferior Mesenteric

Artery). Several ligaments hold this area in place, including the gastrocolic, splenocolic, and phrenicocolic ligaments [1]. Despite this well-known embryological framework, the specific coalescence between the transverse colon and the pancreas remains poorly defined in current anatomical literature. The extent of

attachment between the pancreatic body and tail and the adjacent transverse mesocolon varies due to different rotational movements during embryological development. Their nomenclature remains inconsistent and is not widely standardized. Nevertheless, several names have been published for mesocolic attachments to the pancreatic tail, including the Pancreatocolic ligament or pancreatomesocolic ligament, but without widespread use [2–4].

Splenic flexure is considered one of the most technically challenging regions in colorectal surgery due to its anatomical complexity and multiple peritoneal attachments [5,6]. Splenic flexure mobilization (SFM) is a fundamental maneuver in procedures such as total or partial colectomies and rectal resections to achieve a tension-free anastomosis. Splenic injury during SFM is rare, but when it occurs, the risk of morbidity and mortality increases, whether the problem has been solved conservatively or through a splenectomy [7]. The exact location of the SFC with respect to the spleen has been described by Saber et al. (2016) in a work based on tomography, where they show the situation above the splenic hilum in 67.86%, at the level of the hilum in 7.88%, between the hilum and the lower pole of the spleen in 8.57%, at the level of the lower pole in 10.7%, and below the spleen in 5% of the cases [8]. Anatomical differences in the position of the flexure have been described according to sex, which can make release more difficult, since in men it is located higher (lower half of vertebra T11 versus lower half of T12) and more lateral (160.8mm versus 138.2mm from the midline) than in women [9].

Following the success of Total Mesorectal Excision (TME) in rectal cancer, the concept of Complete Mesocolic Excision (CME) with central vascular ligation (CVL) has been introduced for colon cancer by Hohenberger et al. [10]. This surgical approach involves sharp and blunt dissection along embryological planes, preserving the mesocolic envelope and performing central vascular ligation at the root of the supplying vessels to improve oncological outcomes [11]. CME with CVL aims to remove the tumour-bearing mesocolon intact, preserving its envelope and associated lymphovascular structures, while achieving central ligation of the supplying vessels. Disruption of the visceral peritoneal envelope may compromise the integrity of the mesocolic specimen and potentially leave tumour-bearing tissue behind. However, the relationship between mesocolic plane integrity and oncological outcomes should be interpreted in the context of the available clinical evidence. Finally, CVL ensures the maximum number of resected regional nodes, which has been associated with better survival rates. However, tumors of the splenic flexure are particularly challenging due to their dual lymphatic drainage toward both SMA and IMA territories. Consequently, no clear consensus exists regarding the optimal surgical procedure, with segmental resection, extended hemicolectomy, or subtotal colectomy as possible options [12,13].

The primary outcome was the macroscopic identification and histological characterization of a putative pancreatocolic attachment between the transverse mesocolon and the pancreas. The broader aim was to describe this attachment and explore its potential relevance to the surgical anatomy of splenic flexure mobilization.

MATERIAL AND METHODS

- Dissection and anatomical-surgical study

Given the lack of consensus regarding the nomenclature and histological composition of the medial colonic attachments, this research was designed as an anatomical and histological pilot study to establish a baseline for future standardized classifications. This phase was developed in collaboration with the Department of Anatomy and Human Embryology of the University of Valencia. All cadavers were obtained in accordance with the regulations in force regarding the donation of bodies for study according to Spanish legislation, within the Program of Donation of Bodies for Research and Teaching of the University of Valencia during the period between May 2019 and July 2020. Ethical approval was obtained from the relevant institutional review board. Of the 10 cadavers examined, seven were embalmed by common carotid artery infusion using the solution described by Dr. Cabanes Vila (30% demineralized water, 30% 37-40% formalin, 30.75% propylene glycol, 2.75% ammonium nitrate, 2.75% potassium nitrate, 2.75% sodium sulfite, and 1% Tween 20) [14] and stored at 4ºC. The remaining three cadavers were cryopreserved. We used a standardized dissection protocol to remove the splenic flexure en bloc with its surrounding structures, preserving the peritoneal attachments for subsequent anatomical and histological examination.

1: Complete extraction of the “splenic box”.

Dissections were performed by two senior surgeons (VPR, JSM) and one anatomist to ensure consistency. Standard surgical instruments were used for dissection. Silk ligatures or vascular clips were used for ligation of the blood vessels. For the division of the digestive tract, sharp dissection (scalpel/scissors) and endostaplers were used interchangeably. The different maneuvers necessary to extract the box were as follows:

1. Section of the transverse proximal colon and mesocolon: at the level of the hepatic flexure.

B- Section of the hepatic hilum and lesser omentum, freeing the upper right part of the stomach.

C- Dissection and esophageal section. At the distal esophagus.

D- Mattox maneuver: lateral block mobilization of the left colon, splenic flexure, left kidney, and lower lateral portion of the diaphragm (which is sectioned to keep the phrenicocolic ligament intact).

E- Distal section of the descending colon, sectioning the left colic vessels and the retroperitoneal vessels that will come *en bloc* (left gonadal vessels and left ureter).

F- Complete mobilization of the spleen, keeping its connections with the colon intact.

G- Release of the dorsal face of the *box*:

G.1- Section of the gastroepiploic vein and the middle colic vessels.

G.2- Dissection of the pancreatic uncinate process.

G.3- Division at the level of the first duodenal portion.

G.4- Right gastroepiploic artery section.

G.5- Section of the body of the pancreas.

G.6- Division of the inferior mesenteric vein (IMV) at its confluence.

G.7- Dissection and division of the splenic vein.

G.8- Division of the splenic artery and the right gastric vessels.

H- Section of the left renal pedicle, including the left kidney in the piece under study. Complete mobilization of the *box* and extraction.

2: Ligament sample section and storage.

Subsequently, histological processing was performed to prepare the samples for the microscopic study. Thin sections of each ligament (1- 3 mm) were made for fixation and inclusion in paraffin for subsequent staining with hematoxylin-eosin and Masson's trichrome. Each ligament was sectioned at 3 different points: in the middle, at its junction with the colon, and at its junction with the adjacent viscera.

3: Codification and storage

Ligaments were numerically coded in a clockwise fashion, following the physiological direction of peristalsis. The different sections of the ligament for microscopic study are referenced:

.1: Junction of the colon with the ligament.

.2: The ligament itself

.3: Junction of the ligament with the other structure that is not the colon.

Code	Ligament	**Subcode**	**Section of the ligament**
1	**Gastrocolic ligament**	1.1	Colon-gastrocolic junction
		1.2	Gastrocolic ligament
		1.3	Stomach-gastrocolic ligament junction
2	**Putative pancreatocolic ligament**	2.1	Colon-pancreatocolic attachment junction
		2.2	Pancreatocolic attachment
		2.3	Pancreas–pancreatocolic attachment junction
3	**Splenocolic ligament**	3.1	Colon-splenocolic ligament junction
		3.2	Splenocolic ligament
		3.3	Spleen-Splenocolic ligament junction
4	**Phrenicocolic ligament**	4.1	Colon-phrenicocolic ligament junction
		4.2	Phrenicocolic ligament
		4.3	Phrenicocolic ligament-diaphragm junction

Table 1. Sampling locations for the four splenic flexure attachments.

4: Storage of samples

The same samples for the microscopic study were marked with a letter corresponding to the specimen, following the alphabetical order. Once the samples were obtained, they were placed into the blocks stored individually by ligament. Each ligament, with its 3 samples, went into a sample jar (red lid), marked with the corresponding code of the specimen and ligament. Each jar was filled with formaldehyde at 4% for further processing.

5: Treatment and sample fixation

The samples were fixed with formaldehyde (4% solution), dehydrated in different alcohols, and embedded in paraffin. Sections of 4 µm thickness were obtained using a microtome to subsequently perform hematoxylin-eosin (H&E) and Masson's trichrome histochemical staining (which makes it possible to clearly differentiate the presence of collagen bundles in a bluish coloration, as well as cell nuclei and cytoplasm). These stainings were performed according to the instructions of the manufacturer (Agilent®).

- Histology study of the fixing elements of the splenic flexure of the colon.

Description of the putative pancreatocolic ligament:

- Histological study

Histological sections were reviewed jointly by a pathologist and a colorectal surgeon (FGS and VPR) using a Leica® DM 2500 light microscope. Images were captured at different magnifications for subsequent review using Aperio ImageScope®. The number of collagen-rich connective-tissue layers was assessed by counting the distinct layers identified according to their continuity throughout the histological section. Layer identification was based on the ability to trace each collagen-rich layer along the examined section. The number of identifiable connective-tissue layers was recorded for each evaluable histological section. For the purpose of the comparison presented in Table 2, only the central portion of each attachment (sampling point .2) was considered.

DATA ANALYSIS

Macroscopic evaluation identified the different ligaments that fix the SFC. Histological sections were examined to characterize the collagen-rich connective tissue associated with each attachment. The number of identifiable connective-tissue layers was recorded for each evaluable histological section. When tissue preservation or section quality did not permit a reliable assessment, the result was classified as not assessable. These layers were not considered direct evidence of the number of mesothelial layers, which could not be definitively established using the stains employed in this study.

STATISTICAL ANALYSIS

This descriptive anatomical study used Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) for data recording and analysis. Categorical data are presented as absolute frequencies and percentages. No

inferential statistical analyses were performed.

USE OF ARTIFICIAL INTELLIGENCE TOOLS

Artificial intelligence tools (Gemini and ChatGPT) were used to assist with language editing and grammatical refinement. The authors reviewed and approved all changes and take full responsibility for the final content of the manuscript.

RESULTS

Dissection and anatomical-surgical study

A total of 10 cadavers were studied (7 embalmed and 3 cryopreserved specimens), in which the "*splenic box*" was extracted in a protocolized manner according to the previously explained methodology. Complete extraction of the lesser sac of the omentum with the adjacent viscera (transverse colon and splenic flexure, stomach, pancreas, spleen, diaphragm, and kidney) was achieved in all specimens.

Results by ligaments:

- Macroscopic: The gastrocolic, splenocolic, and phrenicocolic ligaments were identified in all 10 cadavers. A medial attachment between the transverse mesocolon and the pancreas was also identified in all specimens:

-Gastrocolic ligament: formed by the greater omentum that connects the stomach to the arch of the gastroepiploic vessels, until it contacts the antimesenteric serosa of the transverse colon with its posterior leaf, after covering without adhering to the mesenteric intestinal bundle.

-Splenocolic ligament: Portion of the greater omentum that extends from the spleen to the antimesenteric serosa of the splenic flexure of the colon.

-Phrenicocolic ligament: attachment of the splenic flexure of the colon to the left diaphragmatic parietal peritoneum. It continues distally with the parietocolic ligament, without a clear anatomical separation between the two structures.

-Putative Pancreatocolic ligament: a peritoneal fold containing adipose tissue that connects the transverse colon with the root of the middle colic vessels along the pancreas body and tail.

-Histological study of the splenic flexure of the colon attachments:

-Gastrocolic ligament: In the sections studied, the presence of honeycomb-shaped adipocytes together with blood vessels was observed. Collagen-rich connective tissue was readily identified by its blue staining with Masson's trichrome. Two layers of underlying connective stroma tissue were identified in eight of the ten specimens (80%) examined. Four layers were identified in one specimen (10%), whereas the tissue could not be reliably assessed due to degradation in another (10%).

- Splenocolic ligament: The collagen-rich connective tissue was easily identifiable in Masson's trichrome stain. In 100% (10/10) of the samples studied, the presence of two connective-tissue layers that form the ligament was observed. The continuity of these collagen fibers with the splenic capsule is noteworthy.

- Phrenicocolic ligament: 2 collagen-rich connective sheets were observed, with the presence of adipocytes forming a reticular network by collagen septa. In the 10 specimens studied, two connective-tissue layers were observed (100%).

- Putative pancreatocolic ligament: the presence of honeycomb-shaped adipocytes was identified by the collagen fibers that form the cells, and occasionally, blood vessels or capillaries. Collagen-rich connective tissue was identified on both the anterior and posterior surfaces of the attachment. Two connective-tissue layers were identified in three cadavers (30%), whereas four layers were identified in six (60%). In one cadaver (10%), tissue degradation precluded reliable assessment. The preservation process may have contributed to architectural distortion and limited the assessment of tissue-layer organization. These findings describe the observed connective-tissue architecture and do not, by themselves, establish the number of mesothelial layers.

SPECIMEN	PRESERVATION	SEX	NUMBER OF IDENTIFIABLE CONNECTIVE-TISSUE LAYERS			
			Gastrocolic attachment	Putative pancreatocolic attachment	Splenocolic attachment	Phrenicocolic attachment
A	Embalmed	female	2	4	2	2
B	Embalmed	male	Not assessable	4	2	2
C	Embalmed	male	2	2	2	2
D	cryopreserved	female	2	4	2	2
E	Embalmed	female	2	Not assessable	2	2
F	cryopreserved	male	4	4	2	2
G	cryopreserved	male	2	4	2	2
H	Embalmed	male	2	2	2	2
I	Embalmed	male	2	2	2	2
J	Embalmed	male	2	4	2	2

Table 2. Connective-tissue layer patterns identified in the examined attachments. Not assessable (tissue preservation or section quality did not permit a reliable assessment)

DISCUSSION

Detailed cadaveric dissection of this anatomical region allowed us to formulate a new hypothesis regarding a medial attachment that has historically lacked consensus in major anatomical textbooks. Between the part of the transverse colon that forms the splenic flexure of the colon (SFC) and the pancreas, there are attachments, which some authors name as “pancreatocolic or pancreatomesocolic fixation elements” [2–4,15]. While anterior splenic flexure mobilization involves sectioning the gastrocolic ligament and lateral release involves

the splenocolic ligament, the medial approach requires division of the pancreatocolic attachments. We hypothesized that the medial attachment between the transverse mesocolon and the pancreas could be characterized histologically and considered within the existing nomenclature of peritoneal attachments. The histological findings showed differences in the connective-tissue architecture of the attachments examined. Although these patterns may be compatible with the apposition or fusion of peritoneal tissues during development, the present study was not designed to establish their embryological origin. Thus, our microscopic findings suggest that the gastrocolic ligament may result from the embryological adhesion between the visceral peritoneum of the transverse colon and the mesothelial layers of the greater omentum, and that, depending on the sampling point, it can present 4 layers (in the area where the 2 anterior mesothelial layers merge with the 2 posterior mesogastria) or 2 layers (if the sampling was closer to the stomach). The splenocolic ligament is compatible with the fusion between the visceral peritoneum of the transverse colon and the mesothelial layers of the greater omentum located between the spleen and the colon. The phrenicocolic ligament may result from the fusion of the visceral peritoneum of the SFC and the diaphragmatic parietal peritoneum. The observed attachment may reflect the developmental apposition or fusion of peritoneal tissues associated with the dorsal mesogastrium and the transverse mesocolon. However, this embryological interpretation remains a hypothesis and cannot be confirmed by the present cadaveric and histological findings alone.

Several approaches to splenic flexure mobilization have been described, including anterior, medial, and lateral approaches [5,15,16]. The choice of approach depends on the operative context and the surgeon's assessment of the anatomy. A clearer description of the medial attachments may contribute to the anatomical understanding of this region, although the present study does not compare surgical approaches or their clinical outcomes.

In a survey of colorectal surgeons on different techniques and surgical maneuvers, SFM was listed as a technically difficult maneuver [6]. The great surgical difficulty involved in SFM is a consequence of its embryological development, where there are fusions and adhesions among different structures. The greater omentum is formed by the dorsal mesogastrium derived from the 4th mesodermal sheet and presents a fascial fusion with the ventral mesoderm of the transverse colon. A thorough understanding of embryological development is essential to guarantee a safe surgical model. To simplify this complex regional anatomy, our group previously proposed a conceptual visual model termed the 'Splenic Flexure Box' (SF Box). During laparoscopic or robotic surgery, the pneumoperitoneum expands the virtual space of the lesser sac into a real volume, anatomically resembling a box anchored to the parietal peritoneum by the phrenicocolic ligament (SF box) [5]. The first ligament sectioned, which allows the pneumoperitoneum to enter the lesser sac, should determine the name of the approach. After the section of this first ligament, the SFM must be completed by the section of the rest of the attachments of the "box".

In our research, the presence of an anatomical structure that connects the transverse colon to the body and tail of the pancreas was identified, which, from a macro- and microscopic point of view, is comparable to the rest of the classically described SFC attachments. We provisionally use the term "pancreatocolic attachment" to describe the structure examined in this study. Related terms, including "pancreatocolic ligament" and "pancreatomesocolic attachment," have appeared in previous publications [2,4,5]. Further anatomical studies are needed to determine whether a single standardized term adequately reflects the morphology and

histological organization of this attachment. Regarding the nomenclature of the different unions and fusions of the peritoneal mesothelial layers, in recent years, different studies have been conducted to standardize it. Mike et al. (2015) proposed abandoning the terms parietal and visceral peritoneum, replacing them with fusion fascia and deep subperitoneal fascia, respectively [17]. While the group of Coffey et al. (2014) proposed using the nomenclature of "fascia" for Toldt's and "coalescences" for the rest [18]. In our research group, for example, we suggest that the coalescences of Fredet and Treitz have the same anatomical characteristics as the "fascia of Toldt", and therefore they should be called the same [19]. When focusing on the splenic flexure of the colon, different fascial fusions between parietal and visceral peritoneum or between two layers of visceral peritoneum are present, which have classically been called ligaments. From a purely histological perspective, the attachment elements of the SFC macroscopically and microscopically resemble fusion fascias (or coalescences) rather than typical musculoskeletal articular ligaments. Peritoneal attachments have traditionally been described as ligaments, although their microscopic organization may differ from that of typical musculoskeletal ligaments [20]. Nevertheless, the term 'ligament' remains deeply rooted in surgical and anatomical literature for these embryological intestinal attachments. A four-layered connective-tissue pattern was observed in six of the ten cadavers. One possible explanation is the apposition of tissues associated with the transverse mesocolon and the dorsal mesogastrium. However, the present findings do not establish that the four observed layers correspond to four mesothelial layers or confirm this proposed developmental mechanism. The fact that the same histological distribution of the pancreatocolic attachment was not found in all the cadavers could be explained by anatomical differences that would involve the involution of the dorsal mesogastrium, by variations in the sampling, or by the different state of preservation of the cadavers. This study has several limitations. First, the small sample size limits the generalizability of the findings. Second, the use of different preservation methods may have affected tissue architecture and comparability between specimens. Third, haematoxylin and eosin and Masson’s trichrome staining did not allow definitive identification or quantification of mesothelial layers. Finally, no clinical or intraoperative outcomes were assessed; therefore, the potential value of the attachment as a surgical landmark remains to be established.

In summary, this study provides a macroscopic description and preliminary histological characterization of the main attachments encountered during splenic flexure mobilization. A medial attachment between the transverse mesocolon and the pancreas was identified in all ten cadavers. Further studies are needed to clarify its histological organization, establish consistent nomenclature, and determine its practical relevance during surgery.

CONCLUSION

This pilot cadaveric study identified a medial attachment between the transverse mesocolon and the pancreas in all 10 specimens and described its collagen-rich connective-tissue architecture. These findings support further investigation of the attachment as a potential anatomical landmark during splenic flexure mobilization. Larger anatomical studies and clinical evaluation are required to clarify its histological classification and establish its surgical relevance.

Declarations

Acknowledgements: The authors would like to express their sincere gratitude to the surgical residents of the General Surgery Department at Hospital Universitari i Politècnic La Fe for their invaluable technical assistance and commitment during the anatomical dissections. Furthermore, the authors state that this study is part of the doctoral thesis of V. Primo-Romaguera, titled "Cinc tipus d'alliberament laparoscòpic de l'angle esplènic. Lligament pancreatocòlic, un nou lligament en cirurgia colorrectal. Estudi anatomo-quirúrgic", which was defended at the University of Valencia in 2023 and received the highest academic distinction (Excellent Cum Laude).

Funding Declaration: The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Consent to Publish: Consent to Publish declaration: not applicable.

Consent to Participate: Consent to Participate declaration: not applicable.

Data Availability: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics approval: The study was conducted in accordance with the applicable regulations governing human body donation and anatomical research. The study was approved by the Ethics Committee of Research in Humans of the Ethics Commission in Experimental Research of the University of Valencia. All cadavers were obtained through the body donation programme of the University of Valencia.

Author Contribution: A.G-G. conceived the original idea and the conceptual framework of the study. V.P-R. designed the study, performed the anatomical dissections, collected the data, and drafted the manuscript. A.G-G., F.G., and A.A.V-N. served as doctoral thesis supervisors, providing critical guidance and academic oversight. A.B-S., F.M-S., and A.A.V-N. participated in the anatomical methodology and validation. B.F-L., J.S-M., E.A-S., M. F. and H.C. provided essential surgical and clinical expertise, contributing to the interpretation of the findings and their practical application. V.P-R and F.G. performed the histological analysis and interpretation. All authors revised the manuscript for important intellectual content and approved the final version for submission.

Conflict of Interest: The authors declare that they have no conflict of interest.

References

1. García-Armengol J, García-Granero A, García-Gausí M. Anatomía quirúrgica aplicada, ¿Qué debe conocer el coloproctólogo? Pistas y trucos para orientarse en la práctica operativa. In: Practicum en coloproctología de la AECP. 1st ed. 2021. p. 25–40.
2. Gezen C, Altuntas YE, Kement M, Vural S, Civil O, Okkabaz N, et al. Complete Versus Partial Mobilization of Splenic Flexure During Laparoscopic Low Anterior Resection for Rectal Tumors: A Comparative Study. J Laparoendosc Adv Surg Tech. 2012 May;22(4):392–6. doi:10.1089/lap.2011.0409
3. Skandalakis PN, Colborn GL, Skandalakis LJ, Richardson DD, Mitchell WE, Skandalakis JE. The Surgical Anatomy of the Spleen. Surg Clin North Am. 1993 Aug;73(4):747–68. doi:10.1016/S0039-6109(16)46083-

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4. Merchea A, Dozois EJ, Wang JK, Larson DW. Anatomic mechanisms for splenic injury during colorectal surgery. Clin Anat. 2012 Mar;25(2):212–7. doi:10.1002/ca.21221
5. Garcia-Granero A, Primo Romaguera V, Millan M, Pellino G, Fletcher-Sanfeliu D, Frasson M, et al. A video guide of five access methods to the splenic flexure: the concept of the splenic flexure box. Surg Endosc. 2020 Feb 21. doi:10.1007/s00464-020-07423-9
6. Jamali FR. Evaluating the Degree of Difficulty of Laparoscopic Colorectal Surgery. Arch Surg. 2008 Aug 18;143(8):762. doi:10.1001/archsurg.143.8.762
7. Holubar SD, Wang JK, Wolff BG, Nagorney DM, Dozois EJ, Cima RR, et al. Splenic Salvage After Intraoperative Splenic Injury During Colectomy. ARCH SURG. 2009;144(11):6.
8. Saber AA, Dervishaj O, Aida SS, Christos PJ, Dakhel M. CT Scan Mapping of Splenic Flexure in Relation to Spleen and its Clinical Implications. Am Surg. 2016 May;82(5):416–9. doi:10.1177/000313481608200516
9. Brookes A, Macano C, Stone T, Cheetham M, Meecham L. Sex differences in the splenic flexure. Ann R Coll Surg Engl. 2017 Jul;99(6):456–8. doi:10.1308/rcsann.2017.0054
10. Hohenberger W, Weber K, Matzel K, Papadopoulos T, Merkel S. Standardized surgery for colonic cancer: complete mesocolic excision and central ligation - technical notes and outcome. Colorectal Dis. 2009 May;11(4):354–64. doi:10.1111/j.1463-1318.2008.01735.x
11. West NP, Hohenberger W, Weber K, Perrakis A, Finan PJ, Quirke P. Complete Mesocolic Excision With Central Vascular Ligation Produces an Oncologically Superior Specimen Compared With Standard Surgery for Carcinoma of the Colon. J Clin Oncol. 2010 Jan 10;28(2):272–8. doi:10.1200/JCO.2009.24.1448
12. Manceau G, d'Annunzio E, Karoui M, Breton S, Rousseau G, Blanchet AS, et al. Elective subtotal colectomy with ileosigmoid anastomosis for colon cancer preserves bowel function and quality of life. Colorectal Dis. 2013 Apr; 1078-1085. doi:10.1111/codi.12237
13. Wang X, Zheng Z, Chen M, Lu X, Huang S, Huang Y, et al. Subtotal colectomy, extended right hemicolectomy, left hemicolectomy, or splenic flexure colectomy for splenic flexure tumors: a network meta-analysis. Int J Colorectal Dis. 2021 Feb;36(2):311–22. doi:10.1007/s00384-020-03763-z
14. Cabanes Vila J. ENSAYO EXPERIMENTAL DE UN NUEVO MÉTODO DE EMBALSAMAMIENTO Y CONSERVACIÓN PARA CADÁVERES HUMANOS ENTEROS. Universitat de València (Estudi General); 2010.
15. Kim HJ, Kim CH, Lim SW, Huh JW, Kim YJ, Kim HR. An extended medial to lateral approach to mobilize the splenic flexure during laparoscopic low anterior resection. Colorectal Dis. 2013 Feb;15(2):e93–8. doi:10.1111/codi.12056
16. Benseler V, Hornung M, Iesalnieks I, von Breitenbuch P, Glockzin G, Schlitt HJ, et al. Different approaches for complete mobilization of the splenic flexure during laparoscopic rectal cancer resection. Int J Colorectal Dis. 2012 Nov;27(11):1521–9. doi:10.1007/s00384-012-1495-6
17. Mike, M., Kano, N. Laparoscopic surgery for colon cancer: a review of the fascial composition of the abdominal cavity. Surg Today 45, 129–139 (2015). doi:10.1007/s00595-014-0857-9
18. Coffey JC, Sehgal R, Culligan K, Dunne C, McGrath D, Lawes N, et al. Terminology and nomenclature in colonic surgery: universal application of a rule-based approach derived from updates on mesenteric anatomy. Tech Coloproctol. 2014 Sep;18(9):789–94. doi:10.1007/s10151-014-1184-2

19. Garcia-Granero A, Pellino G, Frasson M, Fletcher-Sanfeliu D, Bonilla F, Sánchez-Guillén L, et al. The fusion fascia of Fredet: an important embryological landmark for complete mesocolic excision and D3-lymphadenectomy in right colon cancer. Surg Endosc. 2019 Nov;33(11):3842–50. doi:10.1007/s00464-019-06869-w
20. Saló i Orla JM. Estructura de los ligamentos. Características de su cicatrización . Mon Act Soc Esp Med Cir Pie Tobillo. 2016;8:1-6.

Figures

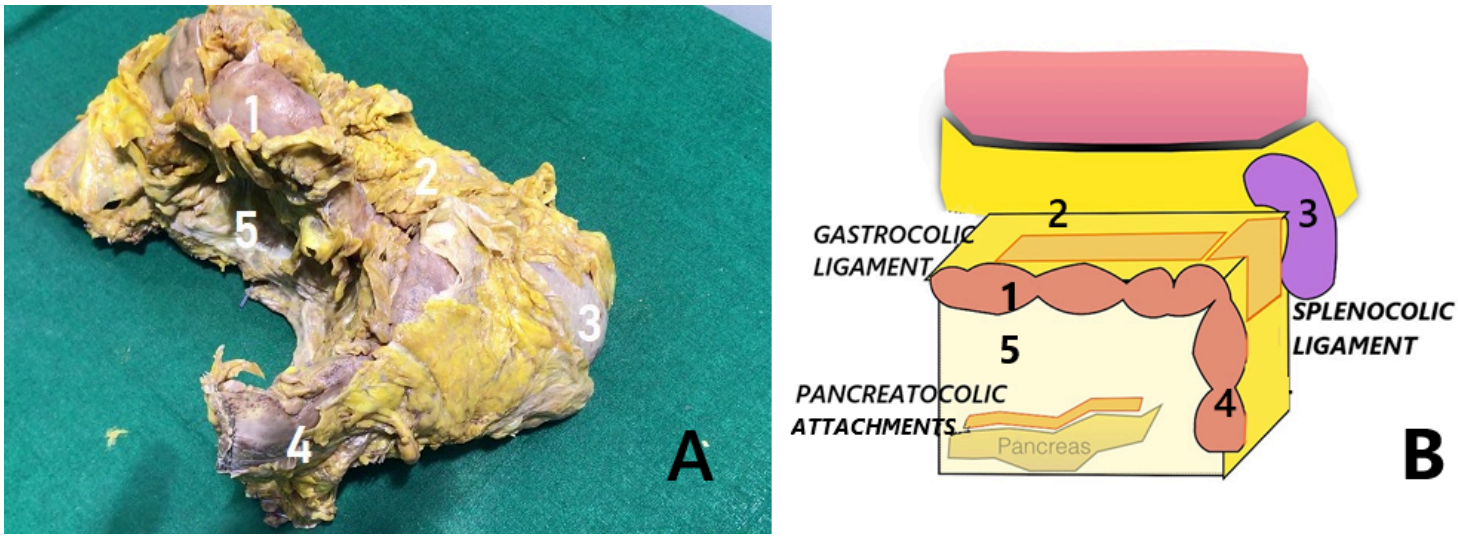


Figure 1

A: En bloc extraction of the "*Splenic Flexure Box*". B: Schematic representation of the "Splenic Flexure Box" and the attaching ligaments. 1: transverse colon, 2: greater omentum, 3: spleen, 4: descending colon, 5: transverse mesocolon.

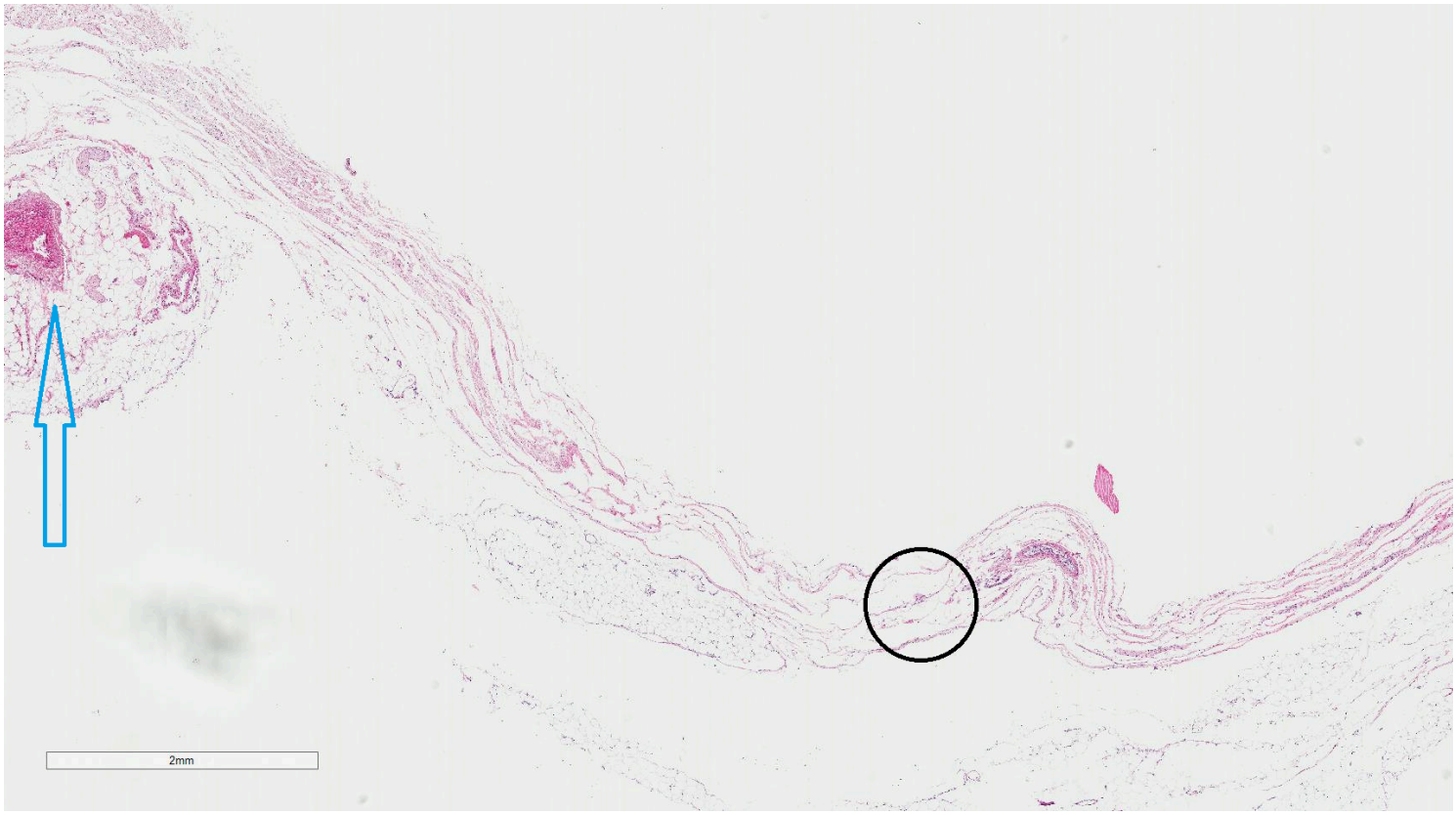


Figure 2

Histological section of the pancreatocolic attachment at its colonic insertion (sample 2.1), stained with haematoxylin and eosin (H&E). Four distinguishable connective-tissue layers are visible. The black circle highlights the layers, and the blue arrow indicates the transverse colon.

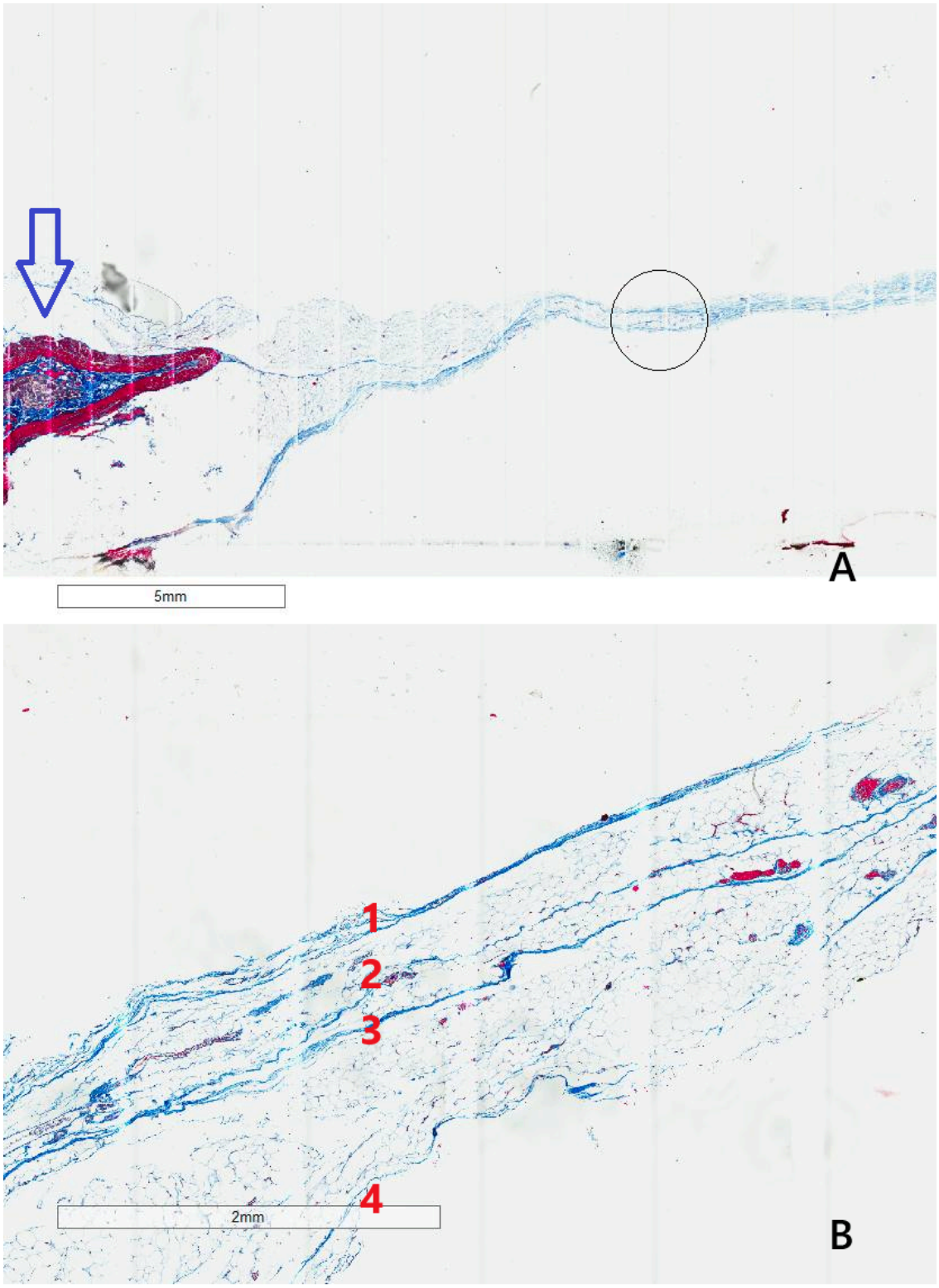


Figure 3

A: Pancreatocolic attachment at its insertion in the colon (2.1) with Masson's trichrome stain. The presence of several connective-tissue layers that join at the central level of the ligament was observed. Black circle: junction area of the different connective-tissue layers. Blue arrow: transverse colon. B: Putative Pancreatocolic ligament in the central area (2.2) with Masson's trichrome stain. Four distinguishable connective-tissue layers were observed in more detail (1-4 red numbers).

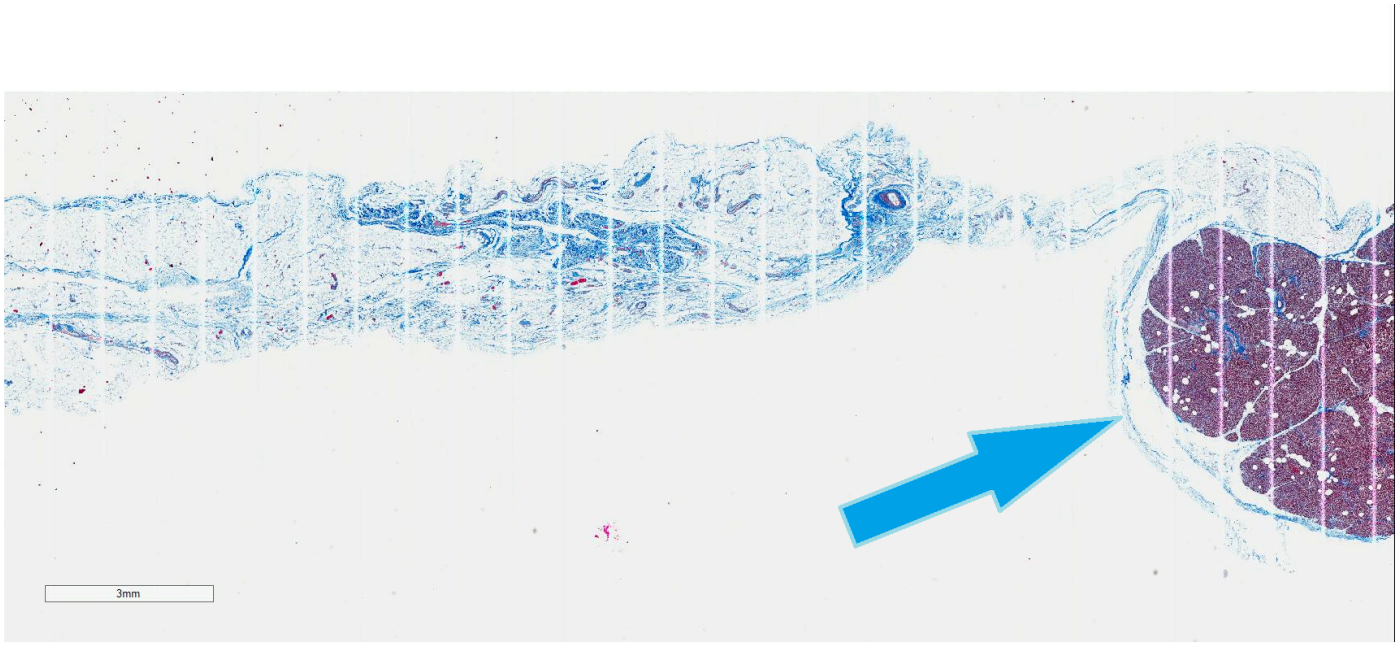


Figure 4

Putative Pancreatocolic ligament at its insertion into the pancreas (2.3). The close relationship between the pancreatic capsule and the collagen-rich connective sheets of the attachment is observed. Blue arrow: pancreas.

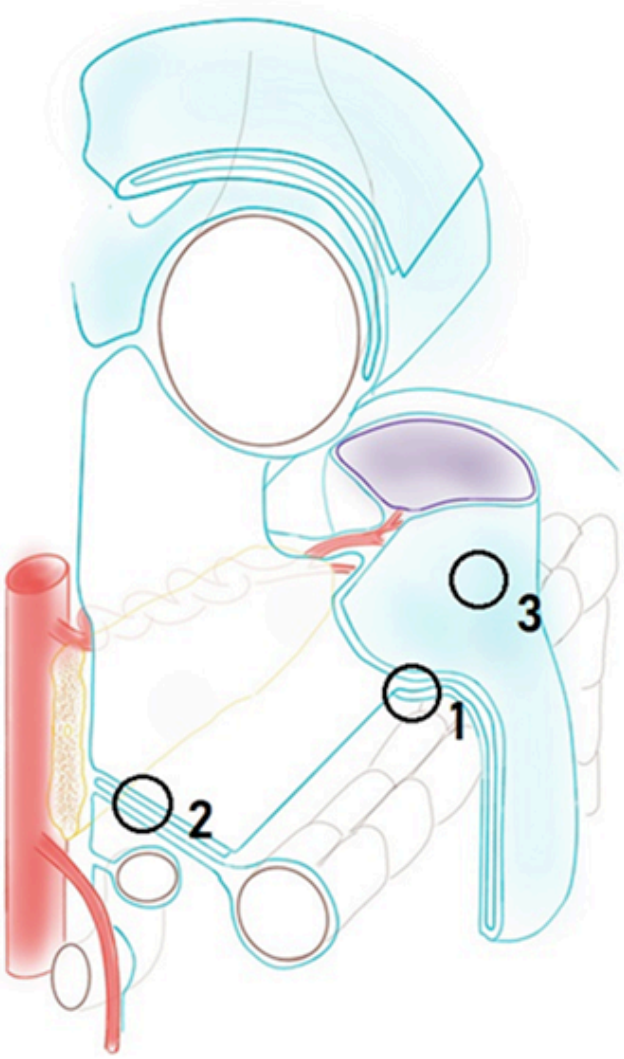


Figure 5

Schematic representation of the connective-tissue layer patterns observed in selected splenic flexure attachments. The diagram summarizes the proposed interpretation of the histological findings and does not establish the number of mesothelial layers. Applied Surgical Anatomy Unit of the University of Valencia. *Álvarez-Sarrado E.*