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# Abdominal surgery in autoimmune and autoimmune-related diseases: A review

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ABSTRACT

Autoimmune diseases can have a widespread effect throughout the system and can cause high mortality and morbidity, depending on their involvement in the abdominal organs and systems. Most of the abdominal organs are damaged as a result of the direct or/ and indirect effects of autoimmune diseases. Therefore, abdominal surgeries should be performed to eliminate any complications related to these effects. There could be a significant relationship between abdominal surgery and autoimmune and autoimmune-related diseases. The aim of this study was to reveal the possible relationship between autoimmune and autoimmune-related diseases that cause significant mortality and morbidity. In this way, we further aimed at increasing the awareness of clinicians on this subject, along with providing them with the related publications on autoimmune and autoimmune-related diseases and abdominal surgery. Taking all these into consideration, autoimmune and autoimmune-related diseases can also influence the abdominal organs. The influence may be directly related to the involvement of the organ and system as a result of the autoimmune disease or indirectly related to the influence of the organs and systems. Such influence leading to complications may require urgent or elective abdominal surgery, which can further cause high mortality and morbidity. Therefore, it is significant for all clinicians, especially surgeons, to be aware of the relationship between autoimmune diseases and abdominal surgery. The early detection and treatment of the complications related to the abdominal involvement of autoimmune and autoimmune-related diseases could decrease mortality and morbidity.

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## Introduction

Autoimmune diseases are considered clinical conditions, which are the result of the immune reactions occurring atypically in the organism. While its etiology is still not clearly known, in some cases, genetic, infectious or environmental factors are among the triggering factors. The prevalence of autoimmunity has been reported ranging from 3 to 5% in the general population, based on several epidemiological studies [1,2].

Although autoimmune diseases are not relatively common, their impact resulting in mortality and morbidity are vital [3,4]. Autoimmune diseases can have a widespread effect throughout the system and can cause high mortality and morbidity, depending on their involvement in the abdominal organs and systems [5]. Most of the abdominal organs are damaged as a result of the direct or/and indirect effects of autoimmune diseases. Therefore, abdominal surgeries should be performed to eliminate any complications related to these effects. Gastrointestinal perforation, bleeding, mesenteric ischemia, intestinal necrosis, solid organ ruptures, intra-abdominal bleeding and aortic dissection are among the examples of the high mortality clinical conditions requiring emergency abdominal surgeries [6-8]. In the existence of isolated organ involvement and medical treatment refractory disease, further elective abdominal surgical procedures (e.g. splenectomy, cholecystectomy, transplantation and aortic aneurysm repair) can be necessary [9-11]. All these indicate that there could be a significant relationship between abdominal surgery and autoimmune and autoimmune-related diseases. In our preliminary questionnaire, among the surgeons who usually perform abdominal surgery, the results suggested that surgeons have the highest awareness of the surgical indication and clinical approaches of inflammatory bowel

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diseases and autoimmune hematological diseases. Yet, they were not able to clearly indicate the exact relationship between many autoimmune and autoimmune-related diseases and abdominal surgery. For this reason, if the clinicians, especially surgeons, are aware of the subject, this could provide the opportunity for an early diagnosis and treatment of such complications caused by autoimmune and autoimmune-related diseases, thus reducing the mortality and morbidity rates.

To the best of our knowledge, there has not been any study published on the relationship between autoimmune and autoimmune-related diseases and abdominal surgery in a single study. Generally, in the literature, there are published studies revealing the relationship between a single autoimmune disease and abdominal surgery. Some of these studies include the case reports on rare diseases.

The aim of this study was to reveal the possible relationship between autoimmune and autoimmune-related diseases that cause significant mortality and morbidity rates. In this way, we further aimed at increasing the awareness of clinicians on this subject along with providing them with the related publications on autoimmune and autoimmune-related diseases and abdominal surgery.

## Discussion

The data of this study were obtained through the search conducted on the Thomson Reuters Web of Science (WOS) (Clarivate Analytics, Philadelphia, Pennsylvania, United States) and PubMed (US National Library of Medicine-National Institutes of Health). WOS covers more than 8,500 notable and major journals encompassing 150 disciplines from the 1900s up to the present moment [12]. In addition to WOS, we conducted further search via PubMed database (U.S. National Library of Medicine), which is affiliated to the National Center for Biotechnology Information, since it covers the widely preferred top medical journals.

The data were initially searched as follows, we typed the term using the keyword “Autoimmune diseases abdominal surgery” into the search box of WOS and Pubmed basic research, along with the selection of all the years. There were no restrictions on the journals. Then, we further categorized the results using over 100 autoimmune and autoimmune-related disease names obtained through the U.S. National Library of Medicine, the U.S. National Institute of Allergy and Infectious Diseases, the American Autoimmune Related Diseases Association (AARDA) (https://www.aarda.org/diseaselist/). We typed each name of the disease into the search box of WOS and Pubmed basic research. Finally, the articles on the subject were evaluated separately, classified, and tabulated.

Since the abdominal involvement of autoimmune and autoimmune-related diseases can result in serious mortality and morbidity rates, urgent and elective abdominal surgical interventions are necessary to reduce mortality and morbidity [13]. In autoimmune diseases, through the direct involvement of the organs and the systems, the side effects of medical treatments cause complications that require abdominal surgery. In some cases, the organ involvement of autoimmune diseases mimics a tumor which leads to the need for abdominal surgery in diagnosis and treatment. Whist the digestive system is the mostly affected system in the abdomen, vascular structures, connective tissues and lymphoid organs are also among the commonly affected systems [14,15]. The most common complications include gastrointestinal perforation, bleeding, mesenteric ischemia, acute cholecystitis, ileus, intra-abdominal abscess and organ ruptures. Aortic aneurysm, aortic dissection and other visceral aneurysms are also the clinical conditions requiring abdominal surgery because of the vascular involvement.

The end-stage organ failure may occur due to the organ involvement of autoimmune disease whose treatment can be provided through organ transplantation. Autoimmune hepatitis, especially sclerotic cholangitis and primary biliary cirrhosis, are among the most common cholestatic diseases requiring liver transplantation [16]. Renal transplantation is considered as a decent choice in the treatment of end-stage renal disease associated with the complication of Systemic lupus erythematosus caused by lupus nephritis [17]. Intestinal transplantation could be required for the treatment of Churg-Strauss syndrome and Crohn's disease extensive bowel resection which lead to a short bowel syndrome [18].

Inflammatory bowel diseases are also included in the autoimmune disease group. Even though ulcerative colitis and Crohn's disease primarily involve the colon and the small intestine, they can further influence other systems through their extraintestinal involvement. Ulcerative colitis is an autoimmune disease which is characterized by T-cells infiltrating in the colon [19]. Total proctocolectomy with permenent ileostomy or proctocolectomy with ileal pouch-anal anastomosis formation, and diverting ileostomy can be treatment of choice in case of medically refractory ulcerative colitis [20]. Abdominal surgery may be required in case of complications due to ulcerative colitis such as toxic megacolon, colon perforation, intestinal hemorrhage, colon obstruction and colon-rectum fistulas (vaginal, bladder, cutaneous) [21,22]. There is a higher risk of colon cancer in patients with ulcerative colitis. Furthermore, this risk is more noticeable, especially in the patients with total or extensive colitis for more than 8-10 years [23]. Abdominal surgery could be essential for the patients with a precancerous lesion detected by colonoscopy and the patients diagnosed and confirmed with colon cancer [24]. Hepatobiliary and pancreatic manifestations (e.g. cholelithiasis, acute pancreatitis, the association with primary sclerotic cholangitis and the

association with cholangiocarcinoma) can be seen in ulcerative colitis [25,26]. Abdominal surgery could be required to treat these manifestations.

Crohn's disease also causes clinical conditions similar to ulcerative colitis. Abdominal surgery is needed to provide the remission of the disease and to treat complications such as toxic megacolon, intestinal perforation, intestinal hemorrhage, intestinal obstruction and fistulas (vaginal, bladder, cutaneous, bowel) [27]. Moreover, surgical interventions might be required because of the increased risk of small bowel and colon cancer [28]. As it can be seen in ulcerative colitis, hepatobiliary and pancreatic manifestations such as the increased risk of gallstones, acute pancreatitis, the association with primary sclerotic cholangitis are observed [29]. Abdominal surgery may also be required in the treatment of such manifestations. Crohn's disease can recur in healthy small intestine following small bowel resection. Reconstructed small bowel resections due to obstructions, strictures and recurrences lead to short bowel syndromes in time. Therefore, intestinal transplantation may be needed in such cases [30].

Surgical acute abdomen can emerge because of the complications associated with autoimmune and autoimmune related diseases. But, a surgical intervention is not needed for in the acute abdomen encountered in Addison's disease, which can manifest through non-specific symptoms of adrenal failure. However, acute abdominal signs may be observed in some patients suffering from Addison's disease due to rhabdomyolysis. The treatment with cortisone is the best option for these patients. Thus, acute adrenal failure should be always considered in patients with Addison's disease along with the acute abdominal findings, in order to prevent unnecessary surgery [31]. Autoimmune pancreatitis may mimic the peritonitis acute surgical abdomen caused by systemic lupus erythematosus [32]. Patients with acute abdominal findings who do not require surgery have also been reported in celiac disease. Thus, the improvement of symptoms can be achieved by choosing the medical treatment and thus avoiding unnecessary surgery [33].

Gastrointestinal perforations are among the most common complications associated with autoimmune and autoimmune-related diseases. Vasculitis, embolism, thrombosis, circulating immune complexes and amyloid deposits play a critical role in pathogenesis [34]. Previously, perforations requiring urgent abdominal surgery in the stomach, duodenum, small intestine and colon because of autoimmune diseases have been reported (Table 1) [35,36].

**Table 1.** Cases requiring abdominal surgery in autoimmune and autoimmune related diseases

| **Achalasia** | **Amyloidosis** | **Autoimmune hemolytic anemia (IHA)** |
|---|---|---|
| Esophageal surgery (myotomy) | Gastric Outlet Obstruction<br>Ischemic colitis<br>Intestinal hemorrhage<br>Intestinal pseudo-obstruction<br>Massive intraperitoneal hemorrhage<br>Massive ischemia of the small intestine<br>Mechanical bowel obstruction<br>Mesenteric mass<br>Mimicking colon cancer<br>Mimicking gallbladder cancer<br>Perforation of the sigmoid colon<br>Pneumatosis intestinalis<br>Spontaneous hepatic rupture<br>Spontaneous rupture of the spleen<br>Stenosis of ureter | Benign pelvic neoplasms<br>Mesenteric teratoma<br>Ovarian teratoma<br>Renal urotepithelial cancer<br>Gallbladder perforation<br>Splenectomy |
| **Addison's disease** | **Ankylosing spondylitis** | **Autoimmune hepatitis** |
| Acute abdomen | Abdominal aortic aneurysm | Liver transplantation<br>Splenic abscesses |
| **Adult-onset Still's disease** | **Antiphospholipid Antibody Syndrome** | **Autoimmune pancreatitis** |
| Acute appendicitis | Acute acalculous cholecystitis<br>Acute pancreatitis<br>Giant gastric ulceration<br>Hepatic artery aneurysm rupture<br>Massive gangrene of the stomach<br>Mesenteric ischemia<br>Multiple visceral aneurysms<br>Recurrent ischemic colitis<br>Splenic thrombosis | Bowel obstruction<br>Cholangitis<br>Choledochal cyst<br>Gastric outlet obstruction<br>Inflammatory abdominal aortic aneurysm<br>Masses in the gallbladder<br>Mimicking Cholangiocarcinoma |

| | | |
|---|---|---|
| | | Mimicking Intraductal papillary-mucinous carcinoma<br>Mimicking other pancreatic cancers<br>Obstructive jaundice<br>Splenomegaly<br>Pancreatic pseudocyst |
| **Autoimmune polyglandular disease type I** | **Chagas' disease** | **Evans syndrome** |
| Cholelithiasis | Toxic megacolon | Intra-abdominal abscess<br>Splenectomy for thrombocytopenia |
| **Behcet's Disease** | **Cogan's syndrome** | **Giant cell arteritis** |
| Abdominal Aortic Pseudoaneurysm and Aneursym<br>Aortic pseudoaneurysm rupture into the Sigmoid colon<br>Caecal necrosis<br>Superior Mesenteric and Celiac Arteries Occlusion | Thoracoabdominal aortic aneurysm | Small bowel infarction<br>Colon infarction<br>Involving the female genital tract |
| **Castleman's Disease** | **Crohn's disease** | **Granulomatosis with Polyangiitis (Churg-Strauss)** |
| Adnexial Mass<br>Leiomyosarcoma<br>Intraabdominal mass | Acute pancreatitis<br>Cholelithiasis<br>Fistulas (vaginal, bladder, cutaneus, bowel)<br>Increased risk of colorectal cancer<br>Increased risk of gallstones<br>Increased risk of small intestinal cancer<br>Intestinal hemorrhage<br>Intestinal obstruction<br>Intestinal perforation<br>Intraabdominal abscesses<br>Multiple liver abscesses<br>Primary sclerosing cholangitis<br>Short bowel syndrome (intestinal transplant surgery)<br>Strictures of intestine<br>Toxic megacolon | Appendiceal perforation<br>Gastrointestinal tract hemorrhage<br>Intestinal transplantation<br>Intraabdominal bleeding<br>Liver infarction<br>Multiple large-bowel perforations<br>Pelvic mass leading to total hysterectomy<br>Small intestine perforations<br>Ureteral stenosis |
| **Celiac disease** | **Dermatomyositis** | **Graves' disease** |
| Acute abdominal pain<br>Small bowel adenocarcinoma<br>Small bowel intussusception<br>Pneumatosis cystoides intestinalis | Gastrointestinal perforations<br>Ischemic duodenal perforated ulcers<br>Colonic vasculopathy and perforation<br>Malignant pheochromocytoma<br>Mimicking ovarian teratoma<br>Ovarian carcinoma<br>Primary jejunal neuroendocrine carcinoma<br>Spontaneous abdominal hematoma | Benign ovarian mass<br>Malignant struma ovarii |
| **Guillain-Barré syndrome** | **IgG4-related autoimmune disease** | **Myasthenia Gravis** |
| Adynamic ileus | Aortic aneurism ruptures<br>Cholangitis<br>Liver abscess and mass<br>Mimicking Carcinomatosis<br>Mimicking Klatskin tumour<br>Mimicking Lymphoma | Abdominal Aortic Aneurysm<br>Intestinal pseudo-obstruction |

| | | |
|---|---|---|
| | Mimicking Periampullary cancer<br>Multifocal gastrointestinal varices (bleeding)<br>Necrotizing mesenteric arteritis<br>Retroperitoneal fibrosis<br>Solid pseudopapillary neoplasm of the Pancreas<br>Small bowel obstruction | |
| **Henoch-Schönlein purpura (HSP)** | **Lambert-Eaton myasthenic syndrome** | **Paraneoplastic cerebellar degeneration** |
| Acalculous cholecystitis<br>Acute appendicitis<br>Bowel ischaemia and infarction<br>Gastrointestinal haemorrhage<br>Intestinal perforation<br>Intussusception<br>Pancreatitis<br>Terminal ileitis | Abdominal neuroblastoma | Ovarian carcinoma |
| **Idiopathic thrombocytopenic purpura (ITP)** | **Microscopic Polyangiitis** | **Paroxysmal nocturnal hemoglobinuria** |
| Ovarian carcinoma<br>Duodenal obstruction (intamıural hematoma)<br>Gastrointestinal hemorrhage<br>Hemoperitoneum caused by a ruptured corpus luteum<br>Intra-abdominal bleeding<br>Splenectomy<br>Splenic abscess<br>Splenic tuberculosis | Gallbladder hemorrhage<br>Intestinal ischemia | Abdominal aortic aneurysm<br>Duodenal obstruction<br>Intestinal infarction<br>Small bowel perforation<br>Splenic infarction |
| **Pemphigus** | **Primary sclerosing cholangitis** | **Sarcoidosis** |
| Retroperitoneal inflammatory myofibroblastic tumor<br>Sigmoid diverticular perforation | Intraductal papillary neoplasm of the bile duct<br>Idiopathic fibrosing pancreatitis<br>Liver transplantation<br>Mimicking cholangiocarcinom | Splenectomy for isolated splenic sarcoidosis |
| **Pernicious anaemia** | **Pyoderma gangrenosum** | **Scleroderma** |
| Gastric carcinoma and carcinoid tumours | Colonic diverticulitis | Spontaneous bowel perforation<br>Pneumoperitoneum |
| **Polymyalgia rheumatica** | **Relapsing polychondritis** | **Sclerosing mesenteritis** |
| Abdominal aortic aneurysm | Abdominal aortic dissection or rupture<br>Splenic abscess<br>Surgery for ileocecal ulcers | Intestinal obstruction<br>Mesenteric ischemia<br>Mimicking intestinal malignant neoplasm<br>Obstructive uropathy<br>Retroperitoneal tumor |
| **Polymyositis** | **Retroperitoneal fibrosis** | **Sjögren's syndrome** |
| Ovarian carcinoma<br>Pancreatic cancer<br>Sigmoid colon perforation<br>Simulating primary hyperaldosteronism | Duodenal and intestinal obstruction<br>Huge splenomegaly<br>Inflammatory abdominal aortic aneurysm<br>Urethral obstruction | Idiopathic fibrosing pancreatitis<br>Idiopathic retroperitoneal fibrosis<br>Intra-abdominal hemorrhage<br>Mesenteric acute panniculitis<br>Pancreatic pseudotumor<br>Splenic abscess |

| **Primary biliary cirrhosis** | **Rheumatoid arthritis (RA)** | **Systemic sclerosis** |
|---|---|---|
| Hepatocellular carcinoma<br>Idiopathic fibrosing pancreatitis<br>Liver transplantation | Acute cholecystitis<br>Amyloidosis of the small intestine<br>Endometrial cancer<br>Increased frequency of gallbladder Stones<br>Obstructive eosinophilic gastroenteritis<br>Sigmoid colon perforation<br>Small and large intestinal infarction<br>Small bowel stricture<br>Vasculitis of the female genital tract | Female genital tract cancer |
| **Systemic lupus erythematosus (SLE)** | **Wegener's granulomatosis** | **Ulcerative colitis** |
| Acute abdomen<br>Acute acalculous cholecystitis<br>Aortic aneurysm and dissection<br>Aortic occlusion<br>Acute pancreatitis<br>Choledochal cyst<br>End-stage Renal disease (renal transplantation)<br>Hemorrhagic cholecystitis and hemobilia<br>Hepatic artery aneurysm<br>Ileocecal intussusception<br>Intestinal ischemia<br>Intestinal perforation<br>Intestinal pseudo-obstruction<br>Spontaneous perinephric hemorrhage | Acute pancreatitis<br>Aortitis with aneurysm formation<br>Intestinal ischemia<br>Small bowel perforation<br>Splenic abscess<br>Spontaneous splenic hemorrhage | Acute pancreatitis<br>Colon obstruction<br>Colon perforation<br>Cholangiocarcinoma toxic megacolon<br>Cholelithiasis<br>Chronic pancreatitis<br>Fistulas (vaginal, bladder, cutaneus)<br>Fulminant/refractory colitis<br>Hemangioma<br>Increased risk of colorectal cancer<br>Intestinal hemorrhage<br>Mucosal lesions in duodenum<br>Primary sclerosing cholangitis<br>Stricture of colon |
| **Tolosa-Hunt syndrome** | | |
| Mycotic aortic aneurysm | | |

Depending on the gastric involvement of autoimmune and autoimmune-related diseases, complications including gastric ulcer, necrosis and gastric outlet obstruction can be observed. Subtotal or total gastrectomies could be required for the treatment of these complications [37,38]. Paralytic or mechanical ileus is another clinical condition associated with autoimmune and autoimmune-related diseases in which abdominal surgery is not required in the majority of the cases of paralytic pseudo-obstruction, while the surgical treatments are needed in mechanical intestinal obstruction. Therefore, the differential diagnosis of ileus is important to avoid unnecessary surgery. Guillain-Barré syndrome, systemic lupus erythematosus, myasthenia gravis paralytic ileus can be observed [39,40]. Chagas' disease is an endemic disease which is caused by Trypanosoma cruzini, and it particularly affects Latin American countries. However, previous studies have suggested the autoimmunity hypothesis, i.e. the disease may have an autoimmune pathogenesis [41,42]. The disease is also on the list provided by the American Autoimmune Related Diseases Association (AARDA) (https://www.aarda.org/diseaselist/). Although the megacolon, which is a long-term complication of Chagas' disease, has ileus findings, there is no mechanical obstruction. Yet, colon resection may be still required in the treatment [43]. The causes such as intussusception, fibrosis-related stricture, abnormal eosinophilic infiltration of the gastrointestinal tract, amyloid deposition, mesenteric vasculitis and intramural hematoma are related to the etiopathogenesis of autoimmune disease-related mechanical intestinal obstruction [44,45]. Principally in children, intussusceptions causing mechanical intestinal obstruction have been seen in patients with Henoch-Schonlein purpura, celiac disease and systemic lupus erythematosus [46,47].

The gastrointestinal system involvement of autoimmune and autoimmune-related diseases can be the reason of bleeding in the gastrointestinal tract which leads to an increased mortality and morbidity. Surgical interventions are often used besides endoscopic and angiographic procedures for hemostasis. The etiopathogenesis of gastrointestinal bleeding is associated with vasculitis, thrombocytopenia, mucosal ischemia and gastrointestinal varices [48]. Massive gastrointestinal bleeding can be observed especially in idiopathic

thrombocytopenic purpura and Henoch-Schönlein purpura [49,50]. In addition to gastrointestinal bleeding, intraabdominal bleeding, which can develop due to solid organ ruptures and postoperative bleeding, is accompanied by some autoimmune diseases [51]. A case report of spontaneous hepatic rupture causing intraabdominal bleeding due to amloidosis has been previously noted [52].

Thromboembolic complications occurring in solid organs, small intestines, and the colon are an important clinical condition caused by autoimmune and autoimmune-related diseases. Vasculitis, vascular thrombosis of veins and arteries are related to etiopathogenesis [53,54]. Ischemia and necrosis eventually develop in the organs as a result of this complication. Emergency abdominal surgeries may be required in case of ischemia and necrosis. Antiphospholipid Syndrome, giant-cell arteritis, systemic lupus erythematosus and paroxysmal nocturnal hemoglobinuria are the most commonly observed autoimmune diseases [55-57]. Throboembolic complications and organ ischemia have also been reported in Behcet's Disease, Churg-Strauss syndrome, Henoch-Schönlein purpura and Wegener's granulomatosis (Table 1) [58,59].

Acute appendicitis can develop as a complication of autoimmune diseases such as Eosinophilic Granulomatosis with Polyangiitis (Churg-Strauss) and Henoch-Schönlein purpura. Appendectomy is the treatment of choice for acute appendicitis [60]. Systemic lupus erythematosus can also be involved in the Necrotizing vasculitis of the appendix [61]. Mesenteric acute panniculitis and acute appendicitis related clinical findings can be observed in Sjögren's syndrome [62].

Some autoimmune and autoimmune-related diseases can lead to surgical procedures because of spleen-related involvements. Clinical conditions which require splenectomy are often encountered. Splenectomy is performed for both the remission and the treatment of autoimmune hemolytic anemia and idiopathic thrombocytopenic purpura. Splenectomy has been previously performed for splenic abscesses in autoimmune hepatitis, Sjögren syndrome, relapsing polychondritis, and Wegener's granulomatosis [63]. Splenectomy is also performed in the case of isolated splenic involvement in sarcoidosis, splenic necrosis and rupture in Wegener's granulomatosis (Table 1) [9,64]. Autoimmune and autoimmune-related diseases can lead to gallbladder-related pathologies, such as acute acalculous cholecystitis, cholelithiasis, eosinophilic cholecystitis, vasculitis of the gallbladder, hemorrhagic cholecystitis and hemobilia (Table 1). An increased incidence of gallbladder stones was observed in patients with rheumatoid arthritis [65]. Acute acalculous cholecystitis has also been reported as a gastrointestinal manifestation of systemic lupus erythematosus in various case reports. While the majority of the cases were treated by means of cholecystectomy, several cases successfully treated with corticosteroid have also been reported [66]. Few cases of microscopic polyangiitis and systemic lupus erythematosus with hemorrhagic cholecystitis and gallbladder hemorrhage caused by vasculitis have also been reported. Cholecystectomy was performed to these patients [67,68].

It is well known that pancreatitis is associated with many autoimmune diseases. But, abdominal surgery is not commonly required in the treatment of most cases with pancreatitis [69]. Since acute pancreatitis is also related to the acute abdomen, it should be clearly distinguished from the clinical conditions requiring urgent abdominal surgery. However, in the case of acute pancreatitis, pseudocyst, infected necrosis, abscess and bleeding, abdominal surgeries may still be required [70]. The examples of autoimmune diseases associated with pancreatitis include autoimmune pancreatitis, antiphospholipid syndrome, Wegener's granulomatosis, Henoch-Schönlein purpura, ulcerative colitis, Sjögren's syndrome, primary biliary cirrhosis and primary sclerotic cholangitis [71,72].

Reactions emerged on the topic of autoimmune and autoimmune-related diseases which can cause intraabdominal tumor masses which often mimic malignant tumors, and sometimes result in unnecessary or radical abdominal surgeries. On the other hand, some autoimmune diseases have been found to be associated with malignant tumors. For example, abdominal surgeries have been performed for the paraneoplastic intraabdominal, retroperitoneal tumor masses associated with Castleman's Disease, granulomatosis with polyangiitis, autoimmune pancreatitis, pemphigus, sclerotic mesenteritis and Sjogren's syndrome [73-75]. Moreover, a relationship between some autoimmune diseases and tumor masses has been reported in several studies. For instance, associations between Graves' disease and struma ovarii, between autoimmune hemolytic anemia and ovarian teratoma, between idiopathic thrombocytopenic purpura and ovarian carcinoma, between paraneoplastic cerebellar degeneration and ovarian carcinoma and, between pernicious anemia and gastric cancer have been commonly shown as clinical conditions in the literature [76-79]. Because autoimmune diseases may occasionally mimic malignant tumors, this situation leads to misdiagnosis and treatment as in the example of autoimmune pancreatitis and pancreatic cancer differentiation. The differentiation is particularly difficult due to similar clinical presentations, laboratory results and morphologic imaging [80]. Another example is primary sclerotic cholangitis which mimics cholangiocarcinoma [81]. Similar relationships have been also reported between various autoimmune diseases and malignant tumors (Table 1).

Achalasia is a neurodegenerative disorder that develops because of the dysfunction of the lower esophageal

sphincter in the case of myenteric plexus loss. Myotomy performed with minimally invasive surgery methods in the treatment of achalasia treatment has been reported to have a higher success rate [82].

Many of the autoimmune and autoimmune-related diseases can involve the main vascular and visceral vascular structures, such as the aorta (Table 1). Moreover, an increased incidence in inflammatory aortic aneurysm has been observed in autoimmune and autoimmune-related diseases [83]. Rupture and aortic dissection due to aortic aneurysm requiring emergency abdominal surgery are among the clinical cases with high mortality rates. Hepatic artery aneurysm bleeding, which requires urgent abdominal surgery, has also been previously reported in systemic lupus erythematosus and antiphospholipid syndrome [84].

Complications such as ureter stenosis and ureteric obstruction may also develop depending on the ureter involvement of autoimmune and autoimmune-related diseases. Furthermore, some autoimmune diseases have been found to be associated with renal urothelial cancer. Abdominal surgery is required in the treatment of such clinical conditions [85-87]. Several complications requiring abdominal surgery may also develop as a result of the type of medical treatment of autoimmune and autoimmune-related diseases [88], as in the example of bowel perforations developing in a patient receiving a high-dose steroid treatment due to Churg-Strauss syndrome [89]. In addition, a case of intestinal necrosis in a patient receiving an anti-TNF treatment due to rheumatoid arthritis has also been reported [90].

## Conclusions

Taking all these into consideration, autoimmune and autoimmune-related diseases can also influence the abdominal organs. The influence may be directly related to the involvement of the organ and system as a result of autoimmune disease or indirectly related to the influence of the organs and systems. Such influence leading to complications may require urgent or elective abdominal surgery, which can further cause high mortality and morbidity. Therefore, it is significant for all clinicians, especially surgeons, to be aware of the relationship between autoimmune diseases and abdominal surgery. The early detection and treatment of the complications related to the abdominal involvement of autoimmune and autoimmune-related diseases could decrease mortality and morbidity.

## Conflict of interest disclosure

There are no known conflicts of interest in the publication of this article. The manuscript was read and approved by all authors.

## Compliance with ethical standards

Any aspect of the work covered in this manuscript has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

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