



Case Report

# Intra-Abdominal Hemorrhage Due to Spontaneous Urinary Bladder Diverticulum Rupture in a Female: An Autopsy Case Report and Brief Review of the Literature

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**Abstract:** Urinary bladder diverticula are formed by the herniation of the mucosa into the muscle layer of the bladder wall, often ending with a narrow neck that communicates with the bladder lumen. They may be congenital or acquired, and they most often affect males. Urinary bladder diverticula discovery during autopsy incidence described in the literature is approximately 5–10%. Various causative factors have been described, including urinary tract obstruction (e.g., benign prostate hyperplasia) and neurogenic and iatrogenic causes. The most described site of occurrence is adjacent to the ureteral orifice. Their clinical presentation does not often facilitate diagnosis, as most are small and asymptomatic. Complications of urinary bladder diverticulosis include infections, lithiasis, neoplasia, pressure on adjacent tissues, obstruction, and rupture. Indeed, urinary bladder diverticula may lead to spontaneous bladder rupture in extremely rare cases. This paper presents the case of an 87-year-old female suffering from atrial fibrillation and under anticoagulant therapy who was pronounced dead in a hospital and was subsequently referred to our department for medico-legal examination. Upon macroscopic examination of the body, intra-abdominal hemorrhage was observed in the vicinity of the urinary bladder, extraperitoneally. A meticulous examination excluded the possibility of injury as the cause of this finding, and tissue samples were collected for histopathological examination. A ruptured urinary diverticulum was discovered and confirmed histopathologically. Death was attributed to intra-abdominal hemorrhage after rupture of urinary bladder diverticulum. A forensic pathologist should be aware of this diagnosis, as although extremely rare, such pathology may lead to death, especially when the patient is under anticoagulant therapy.

**Keywords:** forensic medicine; forensic pathology; autopsy; urinary bladder diverticulum; abdominal hemorrhage



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## 1. Introduction

Urinary bladder diverticula (UBDs) are quite rare findings. The first relevant reports date back to the eleventh century, while their clinical incidence is not clear [1,2]. In autopsy studies, they are found in approximately 5–10% of the relevant population [3]. UBDs are described as herniation of the mucosa into the muscle layer of the bladder wall, often ending with a narrow neck that communicates with the bladder lumen [4–8]. They may be congenital or acquired [1,3,4,9] and most often occur in males with urinary tract obstruction history. Increased pressure within the bladder with an obstructed outlet is a common cause of bladder diverticula formation [2,10,11]. It should be noted that the most common cause of such an obstruction is benign prostatic hyperplasia. Less often, UBDs may be formed due to neurogenic causes or even due to iatrogenic causes [1]. Cases in which UBDs are formed after surgical procedures or long-term catheterization have been recorded in the literature [12].

The most probable UBD formation site is the area adjacent to the ureteral orifice, where the longitudinal detrusor muscle fibers are defective or absent and thus the outpouching is facilitated [7]. The UBD's clinical presentation is not precise, and it does not always facilitate the diagnosis, as most of them are small and asymptomatic [7,10]. On the other hand, when the bladder diverticula are accompanied by symptoms, these mainly result from complications such as infections, lithiasis, neoplasms, obstructive phenomena, pressure phenomena in the adjacent structures, and even acute abdomen due to rupture of the bladder at the site of the diverticulum [1,3,4,6,7,13,14].

In most cases, UBDs are asymptomatic [8]. Persistent urinary tract infections are described to be associated with UBDs in 13–73% of cases [3]. Lithiasis has also been reported within a UBD [6]. UBDs are also described to rarely cause urinary bladder outlet obstruction [15]. UBD herniation has been described to be extremely rare both for inguinal (0.05% of 1910 cases) [5] and for femoral hernias (merely two cases) [10]. It should be noted that spontaneous UBD rupture is considered to be an extremely rare condition [16]. Development of urothelial carcinoma within a UBD has been reported to involve 0.8–10% of cases [4,14]. Pulmonary embolism secondary to thrombosis of the deep inguinal and pelvic veins due to a UBD's mechanical compression has also been reported [13].

Imaging modalities remain the most reliable diagnostic method in all cases [10]. Atrial fibrillation (AF), on the other hand, is known to pose a significant burden to both the patients and the healthcare systems globally. It is estimated that AF accounts for approximately 20–30% of all ischemic strokes, thus rendering AF-associated thromboembolic events a preventable complication. According to the European Society of Cardiology 2020 Guidelines, naturally, after proper bleeding risk assessment is performed, anticoagulant therapy is indicated for patients with AF. The few absolute contraindications to oral anticoagulants include active serious bleeding, associated comorbidities, or a recent high-risk bleeding event such as intracranial hemorrhage [17]. On the other hand, oral anticoagulants are known to be associated with increased bleeding risk [18–20].

Intra-abdominal bleeding as an autopsy finding has been associated with various causes, including injury (e.g., accidental, physical abuse [21], etc.), iatrogenic causes (e.g., after surgery [22], or after delivery [23]), neoplasia [24,25], and aortic pathology [26]. Therefore, a forensic pathologist must be aware of the above-mentioned differential diagnosis to be able to search for, identify, and exclude it.

## 2. Materials and Methods

A case of an 87-year-old female referred to our department for full medico-legal investigation is presented. The deceased was submitted to post-mortem examination, and samples were collected for toxicological and histopathological examination.

A detailed list of all macroscopical and histopathological findings is presented, along with the results of the toxicological examination.

A brief review of the literature was performed. Published studies were found using a thorough search strategy of the PubMed Database. There were neither time nor regional constrictions in our search, and all the included papers were written in English. The terms used in the search were URINARY BLADDER DIVERTICULUM RUPTURE. Studies citing the included articles were searched through the PubMed Database, and their corresponding abstracts and full articles were also accessed if relevant.

## 3. Case Presentation

An 87-year-old female was transferred by ambulance to a hospital due to loss of consciousness. Upon arrival at the emergency department, the patient was without spontaneous breathing and was pulseless. Advanced cardiovascular life support was initiated; however, the resuscitation attempt was without success, and the patient was pronounced deceased. As no cause of death was diagnosed, the case was classified as sudden, unexpected death, thus necessitating an autopsy.

Subsequently, an order was issued to perform a post-mortem examination to ascertain the cause of death. Relatives of the deceased reported that she suffered from atrial fibrillation, for which she was receiving anticoagulant therapy.

The body of the deceased was referred to the Department of Forensic Medicine and Toxicology of the Medical School of the National Kapodistrian University of Athens for full medico-legal post-mortem examination.

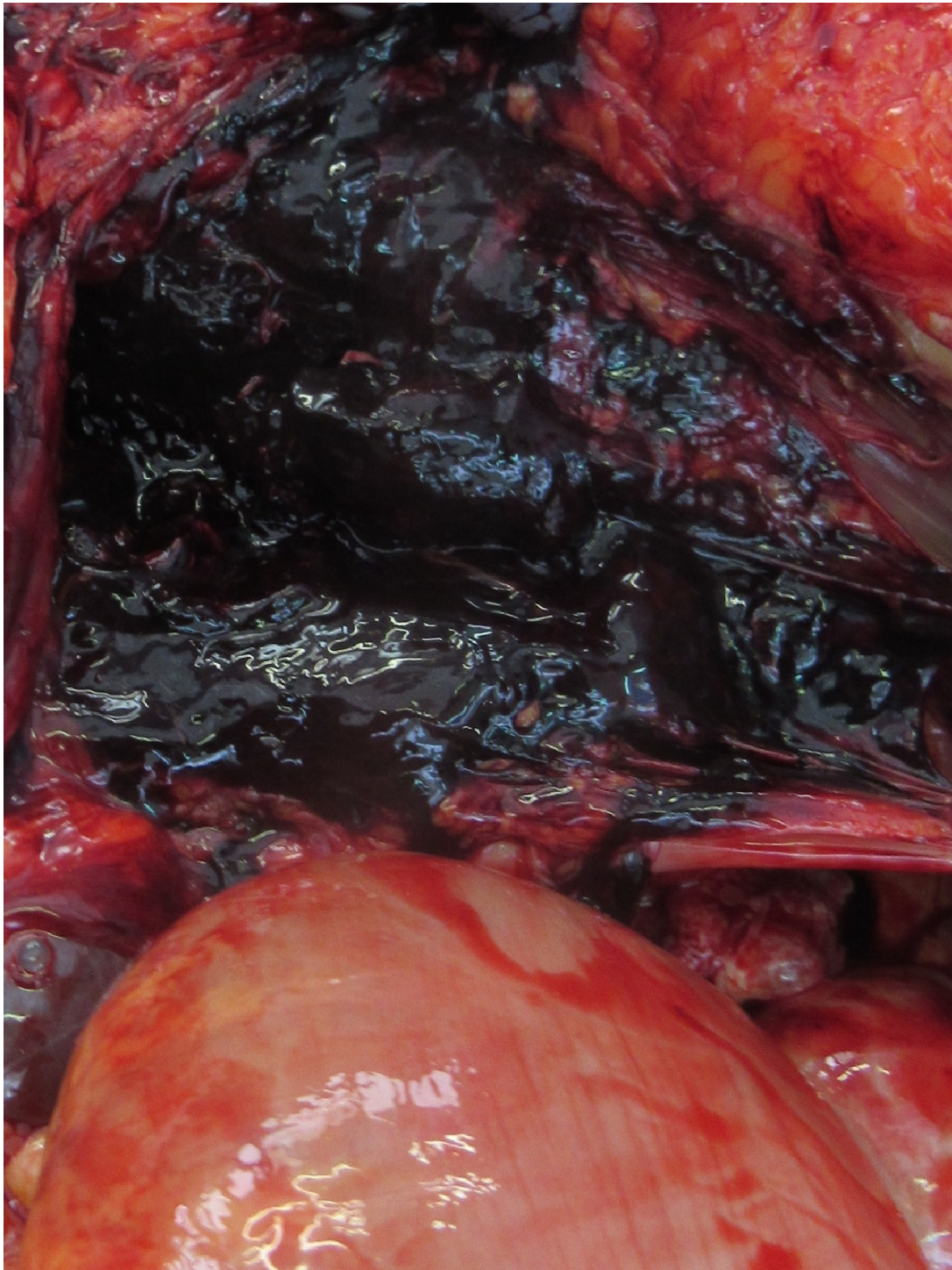
Upon external examination of the body, obesity was noted, along with medical manipulations performed during the cardiopulmonary resuscitation attempt at the hospital. An old surgical scar measuring approximately 12 cm in length was also noted in the subumbilical region. No external injuries were observed.

During internal examination, upon dissection of the abdominal wall, an extraperitoneal hematoma was observed (Figure 1).



**Figure 1.** Upon dissection of the abdominal wall, a hematoma was observed.

During examination of the abdominal cavity, free blood and blood clots were found (approximately 780 mL in total) in the vicinity of the urinary bladder, outside the peritoneal cavity (Figure 2). It should be noted that during macroscopical examination of the urinary bladder, no other obvious pathologic finding was discovered (e.g., diverticulum).



**Figure 2.** Free blood and blood clots were found within the pelvis.

Dense hemorrhagic infiltration of the pelvic cavity was also noted.

A thorough examination of the skeleton excluded any possibility of a skeletal injury being the cause of the hemorrhage found within the abdomen. Other causes of intra-abdominal bleeding, as above described, were not identified.

As to the other autopsy findings, atheromatosis was observed in the vessels of the circle of Willis and in the coronary arteries. Sternal and rib fractures, compatible with cardiopulmonary resuscitation attempts, were found. Macroscopically, the lungs appeared

to present pulmonary oedema. The weight of the heart was 444 g, without any macroscopically evident pathology.

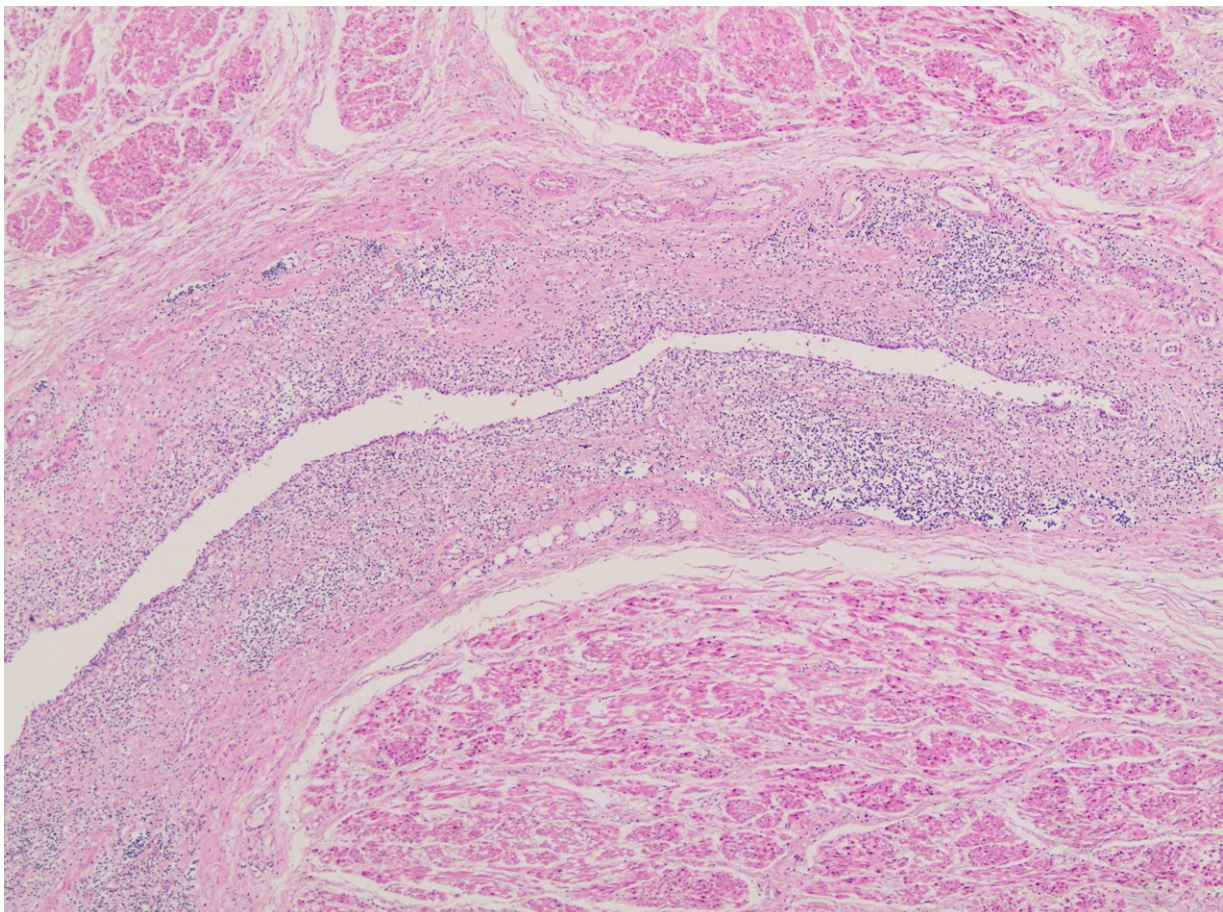
The stomach, the liver, the choledochal cyst, the pancreas, the spleen, both intestines (small and large), the abdominal aorta, and both kidneys were free of any macroscopically evident pathology.

As no cause for the intra-abdominal bleeding was identified macroscopically, it was decided to obtain samples both for toxicological and histopathological examination.

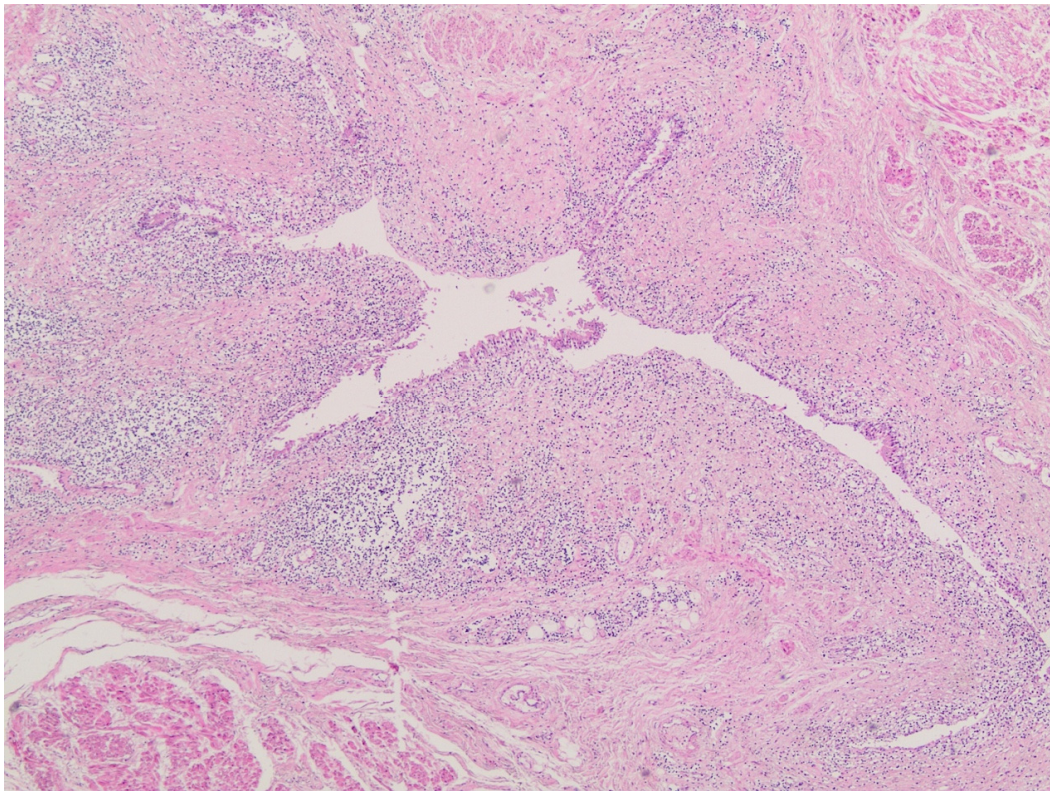
Blood, eye-fluid, and urine samples were collected. The subsequent toxicological examination revealed apixaban and lidocaine in therapeutic concentrations within the blood sample examined. Apixaban was confirmed to be prescribed for the history of atrial fibrillation, and lidocaine was administered during the cardiopulmonary resuscitation attempt at the hospital.

The heart, the urinary bladder, and the internal genitals, along with tissue samples from the lungs, the liver, and the kidneys, were collected. The histopathological examination of the lungs revealed congestion, oedema, and pulmonary hemorrhage. Heart microscopical examination ascertained cardiomyopathy as myocardial cells were found to be themselves enlarged, with enlarged nuclei that presented irregular contours.

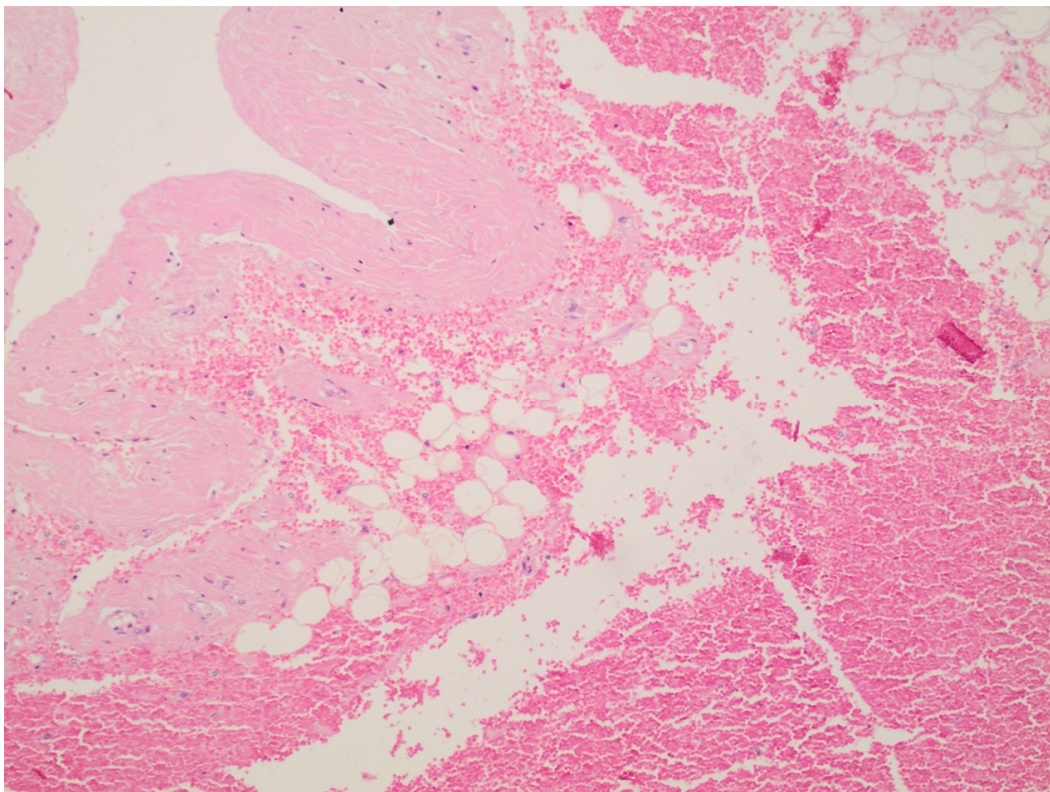
The liver presented microscopically inflammatory infiltrations, while the kidneys showed interstitial nephritis. The microscopical examination of the urinary bladder revealed a ruptured UBD and cystitis (Figures 3–5).



**Figure 3.** HE  $\times 40$ . Urinary bladder wall. Please note the dense inflammatory infiltration surrounding the diverticulum.



**Figure 4.** HE  $\times 40$ . Urinary bladder wall. Please note the dense inflammatory infiltration that extends through the diverticular wall to the adjacent tissue. Areas of ulceration are also visible.



**Figure 5.** HE  $\times 100$ . Urinary bladder wall. Please note to the upper left the thinned wall of the ruptured diverticulum. Diffuse hemorrhagic material with scanty inflammatory cells is also present.

The endometrium presented microscopically atrophy and focal cystic changes. The rest of the internal organs were free of any evident pathology.

After the conclusion of both toxicological and histopathological examinations, the cause of death was ascertained as intra-abdominal/extraperitoneal hemorrhage following rupture of the urinary bladder diverticulum.

#### 4. Discussion

Rupture of the urinary bladder is classified into extraperitoneal (60–65%) and intraperitoneal (25%) and constitutes a surgical emergency, with a mortality rate reaching up to 47% of relevant cases. These ruptures are usually the result of injuries, while extremely rarely they can also be spontaneous [1,3].

In this paper, a spontaneous UBD rupture is presented. The rarity of this incident lies in the fact that acquired bladder diverticulum occurs more often in older men, while, as mentioned above, non-traumatic bladder ruptures are an extremely rare phenomenon as well [1,3,8,13].

Even though the present diverticulum could also be a congenital, asymptomatic diverticulum, it is worth pointing out that the individual had undergone abdominal surgery (e.g., bladder surgery), thus presented increased probability of an acquired diverticulum as well. Additionally, the urinary bladder presented microscopically cystitis, which is one of the most common complications in patients with UBD [1,3,4,8].

Urinary bladder rupture manifests with a wide clinical picture. Symptoms may be completely atypical and/or associated with painful abdominal distension, voiding complaints, and, in some cases, it can take on the appearance of acute peritonitis with sepsis, oliguria, and acute renal failure due to peritoneal urine reabsorption [1,3,7].

Regardless of the cause of the rupture, once it occurs, immediate surgical treatment is mandated for all cases of intraperitoneal and for complicated extraperitoneal ruptures, due to the high risk of sepsis and peritonitis. To avoid these life-threatening complications, laparotomy or laparoscopic exploration of the abdominal cavity, reconstruction of the cyst, and drainage of fluids from the abdominal cavity are deemed essential. In particularly rare cases, such as the one in question, where the rupture has occurred in the vicinity of a diverticulum, diverticulectomy is deemed necessary [1,2,4,7,10].

However, in this specific case, therapeutic management of the rupture was not possible, as the individual was pronounced dead soon after her arrival at the emergency department of the hospital.

UBDs are particularly rare autopsy findings. Their presence in women is even rarer. The present case demonstrates the presence of a complicated bladder diverticulum, which was ruptured and caused an acute abdomen in an elderly woman. Due to the atypical and broad symptomatology, the identification of these diverticula is usually difficult and requires imaging testing. Management of these cases requires immediate surgical intervention to repair the urinary bladder and excise the diverticulum.

It should be noted that in the case in hand, mainly due to extensive hemorrhagic infiltration of tissues in the pelvis, macroscopic diagnosis of the UBD rupture was not feasible during the post-mortem examination. After excluding any possible injury that might have been the cause of this hemorrhage, the next logical step was to collect samples for histopathological examination. It should be stressed that based on the information received by relatives, the deceased was suffering from atrial fibrillation. Anticoagulant therapy that is used to prevent complications from atrial fibrillation and that was used in the case in question may provide a suitable explanation for the extent of the hemorrhage discovered.

#### 5. Conclusions

A forensic pathologist is regularly called upon to establish diagnosis of the cause of death in cases where other clinical specialties were unable to do so. As already explained, UBDs represent a rare autopsy finding. Moreover, hemorrhage from a ruptured UBD that caused the death of the patient is even more rarely encountered. Nevertheless, a forensic

pathologist should be familiar with such a possibility and should not hesitate to confirm any macroscopical initial diagnosis with histopathological examination. History-taking prior to the examination yet another time proves to be an invaluable help.

## 6. Limitations

Post-mortem imaging is not available in our department and thus was not performed in this case. During macroscopical examination, due to the extensive and dense hemorrhagic infiltration of the tissues surrounding the urinary bladder, in addition to the hemorrhage, no other obvious pathologic finding was discovered (e.g., diverticulum). Both above are limitations of this case.

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