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Intra-Abdominal Tumor in an Undescended Testis with Acute Abdominal Pain and Histopathological Features Suggestive of Alveolar Rhabdomyosarcoma: A Case Report

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Abstract: Intra-abdominal tumors associated with undescended testis are rare and may present with nonspecific symptoms resembling acute abdominal conditions. In adults, untreated undescended testis can delay diagnosis because the affected testis is not located in the scrotum and may only become clinically evident after tumor enlargement or abdominal symptoms. **Objective:** This case report aims to describe an intra-abdominal tumor in a 27-year-old male with untreated undescended testis who presented with acute right lower abdominal pain and a mass in the right iliac region. **Methodology:** This study used a descriptive case report design. Data were collected retrospectively from patient history, physical examination, operative findings, macroscopic tissue documentation, and histopathological examination. The data were analyzed using a descriptive-narrative approach supported by relevant literature. **Findings:** The patient presented with persistent right lower abdominal pain, progressive abdominal mass, weight loss, decreased appetite, and a history of untreated undescended testis since birth. Physical examination revealed an asymmetrical scrotum, absence of the right testis in the scrotum and inguinal canal, and a solid immobile mass in the right iliac region. Orchidectomy was performed, and macroscopic examination showed a grayish-brown mass measuring 11 × 10 × 7 cm. Histopathological examination revealed a malignant lesion suggestive of alveolar rhabdomyosarcoma. **Research Implications:** This case emphasizes the importance of genital examination in male patients with unexplained acute abdominal pain. Intra-abdominal testicular or paratesticular tumors should be considered when an empty hemiscrotum or cryptorchidism history is present. **Originality:** This report presents an unusual case of untreated undescended testis associated with an intra-abdominal tumor and histopathological features suggestive of alveolar rhabdomyosarcoma.

Keywords: Undescended Testis; Intra-Abdominal Tumor; Alveolar Rhabdomyosarcoma; Acute Abdominal Pain; Case Report.

INTRODUCTION

Testicular malignancy remains an important clinical issue in young and adult men because it may affect survival, fertility, hormonal function, and long-term quality of life. Although testicular cancer is relatively uncommon compared with other male malignancies, its occurrence in productive-age men makes early recognition clinically significant. One important predisposing condition is undescended testis, or cryptorchidism, particularly when the testis remains outside the scrotum until adulthood. Cryptorchidism has been consistently associated with an increased risk of testicular germ cell tumors, and the risk may be influenced by

laterality, tumor location, timing of correction, and histological subtype (Banks et al., 2013; Lip et al., 2013). In adult patients with untreated cryptorchidism, the abnormal testicular location may delay recognition because the disease does not always present with the typical finding of a painless scrotal mass. Instead, it may become clinically apparent only after the development of an intra-abdominal mass, systemic symptoms, or acute abdominal pain (Gupta et al., 2021; Nkembe et al., 2019)

From a practical clinical perspective, intra-abdominal tumors arising from undescended testes may create diagnostic confusion because their symptoms can resemble gastrointestinal or surgical emergencies. Patients may present with right lower abdominal pain, abdominal enlargement, palpable mass, or nonspecific abdominal discomfort, leading clinicians to initially consider appendicitis, abscess, hernia, torsion, hemorrhage, or other causes of acute abdomen. Several reports have shown that intra-abdominal seminoma in an undescended testis may present as acute abdomen, torsion, rupture, hemorrhagic shock, or an abdominal mass discovered during evaluation for non-urological complaints (Gonda et al., 2021; Mohamed et al., 2022; Rajasimman et al., 2022; Rourke et al., 2018). Therefore, in male patients presenting with unexplained acute abdominal pain or an intra-abdominal mass, examination of the external genitalia and identification of an empty hemiscrotum are essential clinical steps to avoid delayed diagnosis.

Previous studies can be grouped into three major categories. The first category includes epidemiological and risk-factor studies examining the relationship between cryptorchidism and testicular cancer. Lip demonstrated through meta-analysis that boys with isolated cryptorchidism have a higher risk of developing testicular cancer later in life (Lip et al., 2013). Banks also reported that cryptorchidism is associated with an increased risk of testicular germ cell tumors, particularly in cases involving delayed correction, ipsilateral tumor development, bilateral cryptorchidism, and seminoma histology (Banks et al., 2013). Ferguson and Agoulnik further emphasized that cryptorchidism and testicular cancer may share developmental and molecular mechanisms, suggesting that undescended testis should not be viewed only as an anatomical abnormality but also as a long-term oncological risk factor (Ferguson & Agoulnik, 2013). However, these studies mainly describe the epidemiological association and do not specifically explain rare adult cases presenting as intra-abdominal tumors with atypical histopathology.

The second category consists of case reports and case series describing intra-abdominal testicular tumors in adult patients with untreated or inadequately managed undescended testes.

Nkembe reported an intra-abdominal testicular seminoma presenting as a lower abdominal mass in an adult man, emphasizing the importance of routine scrotal examination in men with abdominal masses (Nkembe et al., 2019). Rourke described a large intra-abdominal seminoma complicated by torsion (Rourke et al., 2018), while Gonda reported ruptured intra-abdominal seminoma with hemorrhagic shock after previous inadequate exploration for undescended testis (Gonda et al., 2021). Mohamed also described an adult patient with an intra-abdominal mass and empty scrotum that was later identified as testicular seminoma (Mohamed et al., 2022). Although these studies are clinically relevant, most reported cases focus on seminoma or other germ cell tumors, leaving limited discussion on non-germ cell malignancies arising in relation to undescended testis.

The third category concerns rare testicular, paratesticular, and genitourinary soft tissue tumors, particularly rhabdomyosarcoma. Primary intratesticular rhabdomyosarcoma is rare and has mostly been reported as isolated case reports, requiring histopathological confirmation and careful differentiation from germ cell tumors and other malignant small round cell tumors (Ihssan et al., 2022; Yahaya & Mremi, 2021). Alveolar paratesticular rhabdomyosarcoma in adults is also uncommon and may mimic inflammatory conditions such as epididymo-orchitis, making diagnosis difficult without adequate pathological and immunohistochemical evaluation (Al Ghamdi et al., 2022; Liang et al., 2022) In suspected alveolar rhabdomyosarcoma, immunohistochemical and molecular evaluation is important because markers of myogenic differentiation and molecular alterations such as PAX3/7–FOXO1 fusion can support diagnostic classification and prognostic assessment (Azorsa et al., 2021; Chen et al., 2022). Therefore, a gap remains in the literature regarding adult intra-abdominal tumors associated with undescended testis when the histopathological impression is not a typical germ cell tumor but instead suggests alveolar rhabdomyosarcoma.

Based on this gap, this case report aims to describe an adult male patient with untreated undescended testis who presented with acute right lower abdominal pain and an intra-abdominal mass. This report specifically discusses the clinical presentation, physical examination findings, operative management through orchidectomy, and histopathological findings suggestive of alveolar rhabdomyosarcoma. By presenting this case, the report seeks to contribute to clinical awareness that acute abdominal pain in men with an empty hemiscrotum should prompt consideration of an intra-abdominal testicular or paratesticular malignancy, including rare non-germ cell tumors.

The main argument of this case report is that untreated intra-abdominal undescended testis in adulthood may present not only as a typical germ cell tumor but also as a rare malignant lesion with atypical histopathological features. Therefore, acute abdominal pain in a male patient with a history of cryptorchidism should not be interpreted solely as a gastrointestinal emergency. Instead, the diagnostic approach should integrate genital examination, abdominal imaging, tumor marker assessment, surgical exploration when indicated, and histopathological confirmation. In this case, the histopathological impression suggesting alveolar rhabdomyosarcoma supports the argument that rare non-germ cell malignancies should remain part of the differential diagnosis when an intra-abdominal mass is found in association with an undescended testis.

RESEARCH METHOD

The unit of analysis in this study was one adult male patient with a history of *undescended testis* (UDT) who presented with acute abdominal pain and was found to have an intra-abdominal mass. The focus of this case report was directed toward the patient's clinical characteristics, including medical history, chief complaint, physical examination findings, operative findings, and histopathological results. This case was selected because intra-abdominal tumors associated with UDT are rarely encountered, particularly when the initial clinical manifestation resembles an acute abdominal condition such as appendicitis or other gastrointestinal disorders.

This study used a case report design with a descriptive approach. This design was chosen because it is appropriate for presenting a rare clinical condition in detail and for highlighting its diagnostic and therapeutic significance. The descriptive approach was applied because this study did not aim to test statistical relationships between variables, but rather to describe the diagnostic process, operative management, and histopathological interpretation in a patient with intra-abdominal UDT. Through this design, the clinical course of the case could be presented systematically, starting from the initial complaint to the establishment of the diagnosis.

The data sources consisted of primary and secondary data. Primary data were obtained through patient history taking, physical examination, and direct clinical observation during patient care. Secondary data were obtained from medical records, clinical notes, operative reports, macroscopic documentation of the tumor tissue, and histopathological examination results. In addition, relevant scientific literature was used as supporting information to compare the findings of this case with previously published reports and theoretical concepts, particularly

those related to UDT, intra-abdominal testicular tumors, and malignancies that may mimic an acute abdominal presentation.

Data collection was conducted retrospectively by systematically reviewing the patient's clinical information. The collected data included the patient's clinical profile, chief complaint, history of UDT since birth, location and characteristics of abdominal pain, presence of an intra-abdominal mass, external genital examination findings, intraoperative findings, and macroscopic and microscopic features of the tumor tissue. All data were then arranged chronologically to describe the patient's clinical course from admission to operative intervention and histopathological confirmation.

Data analysis was performed using a descriptive-narrative approach by integrating the patient's history, physical examination findings, operative findings, and histopathological results. The clinical findings were analyzed by comparing them with relevant scientific literature to strengthen the interpretation of the diagnosis and management. Data validity was maintained through source triangulation by confirming the consistency of information obtained from history taking, physical examination, operative reports, tissue documentation, and histopathological findings. Through this approach, the case report is expected to provide a comprehensive description of an intra-abdominal tumor in a patient with UDT and to emphasize the importance of genitourinary evaluation in male patients presenting with acute abdominal pain.

Ethical consideration: This case report was prepared with attention to patient confidentiality. Identifiable patient information was removed, and patient consent for publication should be obtained before manuscript submission, particularly if clinical images or operative documentation are included.

RESULT

A 27-year-old male patient presented to the Emergency Department with a chief complaint of pain in the right lower abdomen. The pain had been felt for several days before hospital admission, was persistent, and gradually became more severe. The patient also complained of a lump in the right lower abdomen that had progressively increased in size. The lump was not accompanied by redness or a previous history of trauma. The patient did not complain of scrotal pain but admitted that, since birth, one of his testes had never been palpable in the scrotal sac. The history of undescended testis had never been treated until adulthood. In addition, the patient complained of weight loss in the recent period and decreased appetite. Other complaints, such as nausea, vomiting, bowel disturbances, and urinary disturbances, were denied. The past

medical history showed no history of testicular infection, such as orchitis or epididymitis, and the patient had never undergone surgery in the genital area. A previous history of malignancy was also denied. Family history revealed no family members with testicular cancer or other malignancies. Habitual history, such as smoking and chemical exposure, did not provide significant information.

Based on the anamnesis, the history of undescended testis persisting until adulthood, accompanied by an intra-abdominal mass and systemic symptoms, raised a strong suspicion of possible intra-abdominal testicular malignancy, requiring further evaluation to establish the diagnosis.

On vital sign examination, the patient appeared moderately ill with compos mentis consciousness. Vital signs showed a blood pressure of 120/80 mmHg, pulse rate of 96 beats per minute, respiratory rate of 20 breaths per minute, and body temperature of 37.5°C. On general examination, no jaundice or cyanosis was found. The conjunctiva appeared non-anemic. Examination of the head and neck was within normal limits, with no cervical lymph node enlargement. Thoracic examination showed symmetrical chest wall shape and movement, with normal vesicular breath sounds without rales or wheezing. Heart sounds were regular without murmurs. On abdominal examination, enlargement was observed in the right lower region. On palpation, a mass was palpable in the right iliac region, measuring approximately ±8 cm, with indistinct borders, solid consistency, irregular surface, and mild tenderness. The mass appeared immobile. No signs of peritonitis were found. Bowel sounds were within normal limits. On examination of the external genitalia, the scrotum appeared asymmetrical, with the left testis palpable in the scrotum with normal size and consistency. The right testis was not palpable in the scrotum or in the inguinal canal, consistent with the history of undescended testis. No signs of scrotal inflammation were found. Examination of the extremities was within normal limits, with no edema or signs of thrombosis.

Based on the results of anamnesis and physical examination, orchidectomy was performed to remove the mass located in the right lower abdomen. Histopathological examination was then carried out. On macroscopic examination, tissue from the right lower abdominal region measuring 11 × 10 × 7 cm was obtained, appearing as a grayish-brown mass with a rubbery consistency. The specimen was then processed and stained with hematoxylin-eosin (HE). On microscopic examination, fibrous connective tissue was seen covering the tumor mass. The tumor structure was arranged in nests, cords, sheets, papillary, and trabecular patterns separated by fibrovascular septa. The tumor cells appeared discohesive, with pale round cell morphology,

enlarged round nuclei with coarse and vesicular chromatin, and eosinophilic cytoplasm, accompanied by mitotic activity. In addition, blood vessels showed dilatation and congestion. Based on these histopathological findings, the lesion was concluded to be malignant, with an impression suggestive of alveolar rhabdomyosarcoma.

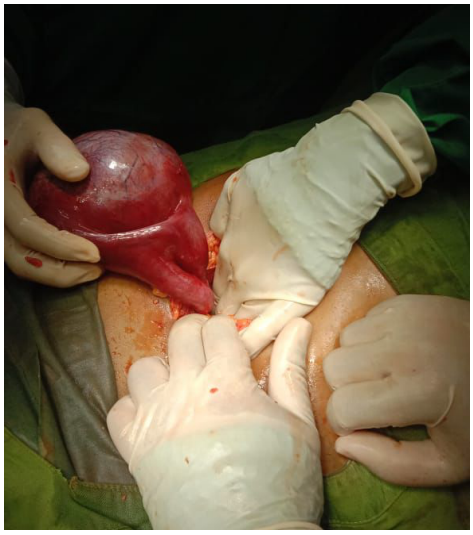

Figure 2.1. Orchidectomy

Figure 2.2. Macroscopic Appearance of the Testis

In this case, the patient presented with right lower abdominal pain accompanied by an intra-abdominal mass, which clinically could initially suggest an acute abdominal diagnosis such as appendicitis. However, based on current literature, these symptoms require further evaluation, especially in male patients with a history of undescended testis, because this condition has a strong association with testicular malignancy, particularly in an intra-abdominal location. Undescended testis is one of the major risk factors for testicular cancer, with a significantly increased risk of malignancy, even reported to be several times higher than that of testes located in the scrotum.4 In addition, testes located intra-abdominally have a higher risk of malignant

transformation compared with other locations and most commonly develop into germ cell tumors, particularly seminoma. In adult patients, this malignancy is often diagnosed late because the abnormal location of the testis causes nonspecific symptoms.

Clinically, intra-abdominal testicular tumors may manifest as an abdominal mass accompanied by pain, either due to tumor growth, compression of surrounding organs, or complications such as torsion, hemorrhage, or necrosis. These manifestations often resemble acute abdominal conditions, including appendicitis, which may lead to an initial misdiagnosis.6 Several case reports have even shown that patients with intra-abdominal testicular tumors presented with right lower quadrant pain and were initially diagnosed with appendicitis before the intra-abdominal testicular mass was finally identified during surgery or imaging.7 In addition, other conditions such as torsion of an intra-abdominal testis may also cause acute symptoms resembling appendicitis, with severe right lower abdominal pain, nausea, and inflammatory signs, making diagnosis even more difficult.8 Therefore, it is important to consider genitourinary etiologies in male patients presenting with acute abdominal pain, especially when an empty scrotum or a history of undescended testis is found.

Testicular cancer develops as a result of interactions between genetic and environmental factors. Epidemiological risk factors include cryptorchidism, impaired spermatogenesis such as subfertility or infertility, disorders of sexual development, family history, tumors in the contralateral testis, and germ cell neoplasia in situ (GCNIS). Cryptorchidism increases the risk approximately two to four times, whereas family history may increase the risk up to six to ten times. Other contributing factors include viral infections such as HPV, EBV, CMV, and HIV, testicular trauma, high maternal estrogen levels, and a previous history of testicular cancer. Genetically, characteristic abnormalities commonly found include isochromosome 12p (i12p), p53 gene mutations, and alterations in tumor suppressor genes such as PTEN. In addition, germ cell regulatory disturbances and genetic variations such as single nucleotide polymorphisms (SNPs) also contribute to risk. However, to date, no single major gene with high penetrance has been identified as directly causing testicular cancer.

Germ cell tumors are known to develop as a result of tumorigenic events occurring during intrauterine life, which then trigger the formation of intratubular germ cell neoplasia (GCNIS).8 This lesion originates from gonocytes that fail to differentiate into spermatogonia. Initially, these cells do not yet possess invasive capacity, but after hormonal changes occur during puberty, they may develop into malignant cells.9 Seminoma is formed from germ cells that undergo transformation but are arrested in the differentiation process.10 Meanwhile, embryonal

carcinoma has characteristics resembling undifferentiated stem cells, with gene expression patterns similar to stem cells and GCNIS.11 Other types, such as choriocarcinoma and yolk sac tumor, show extraembryonic differentiation, whereas teratoma undergoes somatic differentiation.

Various genetic loci have been identified as playing a role in increasing susceptibility to testicular cancer.13 One of the most significant is variation on chromosome 12q21, which is associated with the KITLG–KIT signaling pathway.14 Abnormal activation of this pathway during fetal life is thought to cause arrested germ cell maturation at the gonocyte stage. Subsequently, increased expression of embryonic transcription factors such as NANOG, SOX17, and OCT3/4 plays a role in inhibiting apoptosis, increasing cell proliferation, and triggering the accumulation of mutations that ultimately lead to the formation of GCNIS.

In addition, several other genes are involved in the pathogenesis of testicular cancer and are distributed across various chromosomes, including UCK1 on chromosome 1; HPGDS and CENPE on chromosome 4; TERT, TERT/CLPTM1L, and SPRY4 on chromosome 5; BAK-1 on chromosome 6; MAD1L1 on chromosome 7; DMRT1 on chromosome 9; AFT7IP and KITLG on chromosome 12; RFWD3 on chromosome 16; and TEX14 and PPM1E on chromosome 17. Variations in gene expression influenced by epigenetic mechanisms, including DNA methylation, also play a role in determining the development of various histological subtypes of germ cell tumors.

Undescended testis (UDT) is an abnormality found in approximately 1 in 500 men and may cause complications such as malignancy, vascular disorders, and infertility. This condition is closely associated with an increased risk of testicular cancer, with the likelihood of malignancy reported to be approximately 3.7 to 7.5 times higher than in testes located in the scrotum. Approximately 5–10% of testicular cancer cases are reported to have a history of cryptorchidism. Malignant transformation generally occurs in young adulthood, particularly in the third to fourth decade of life. The location of the testis outside the scrotum, especially intra-abdominally, causes symptoms to appear late, so patients often present at an advanced stage.

Histologically, most tumors in UDT are seminomas, accounting for approximately 50–60% of cases, whereas the remainder are nonseminomas. Clinical manifestations may vary, ranging from asymptomatic conditions to acute complaints due to complications such as torsion or hemorrhage. Abdominal pain is the most common complaint, followed by abdominal mass and other symptoms such as urinary disturbances and constipation. Diagnosis is often difficult because many patients are unaware of their cryptorchidism or have an unclear history of

previous surgery. As a result, cases are not infrequently initially suspected to be retroperitoneal tumors before finally being identified as intra-abdominal testicular tumors.

The mechanism of malignancy in UDT is explained by two main theories. The first theory states that the higher temperature in the ectopic location plays a role in carcinogenesis because it may inhibit germ cell maturation and disturb apoptosis, allowing abnormal cells to survive and develop into premalignant lesions with the potential to become malignant after puberty. The second theory emphasizes the role of hormonal disturbances during intrauterine and perinatal development, which contribute both to the occurrence of cryptorchidism and malignant transformation. Based on this theory, early orchidopexy does not completely prevent cancer, although it remains important to facilitate early detection.

The risk of malignancy after corrective surgery for UDT has been reported to range from 2.23% to 5.4%, depending on the age at which surgery is performed, with correction generally recommended before the age of 2 years. However, several studies have not found a significant relationship between the timing of correction and cancer risk. The risk is also increased in bilateral UDT, intra-abdominal location, testicular atrophy, disorders of sexual development, and chromosomal abnormalities. In addition, gonadoblastoma is more commonly found in cases with gonadal dysgenesis.

Histopathologically, testicular germ cell tumors are divided into five main subtypes: seminoma, embryonal carcinoma, teratoma, yolk sac tumor, and choriocarcinoma. Tumors composed entirely of seminoma components are classified as pure seminoma. Conversely, all tumors containing nonseminomatous components, either pure or mixed with seminoma, are categorized as nonseminomas and managed according to that group. Most nonseminomatous tumors have mixed compositions of various germ cell tumor subtypes. In addition, tumors that histologically appear like seminoma but are accompanied by elevated serum alpha-fetoprotein (AFP) levels must be considered nonseminoma because seminoma does not produce AFP.

Testicular cancer may manifest in various forms, most commonly as a painless scrotal mass, an incidental finding on radiological examination, complaints following trauma, or scrotal pain. In rarer cases, the initial symptoms may reflect disease spread, such as metastasis or enlargement of retroperitoneal lymph nodes. Changes in the testis may be noticed by the patient or by a partner. One important differential diagnosis of a scrotal mass is epididymitis. In this condition, if symptoms such as pain, swelling, or abnormalities on physical examination do not improve after antibiotic therapy, further evaluation is required. Establishing an

alternative diagnosis is very important to rule out the possibility of testicular cancer in every patient presenting with a scrotal mass.

Testicular malignancy generally appears as a unilateral lump or painless enlargement of the testis and is often found incidentally. In some cases, patients may complain of dull pain, which is reported to occur in approximately one-third of patients, whereas acute pain is found in only about 10% of cases. Although testicular cancer is not directly associated with trauma, a previous history of trauma often prompts further examination and thus helps establish the diagnosis.

Evaluation of patients with suspected testicular cancer should begin with complete history taking regarding the chief complaint and assessment of risk factors. Physical examination should be performed thoroughly, including comparison of the affected testis with the contralateral side.18 Careful physical examination is very important, as a hard intratesticular mass is usually found. Each testis should be gently palpated to distinguish intratesticular from extratesticular lesions. Examination of the contralateral testis should also be performed thoroughly because a small proportion of patients may have tumors on both sides simultaneously. A normal testis is generally about 3.5–5 cm in length, with a smooth surface, homogeneous consistency, mobility, and separation from the epididymis. The presence of a hard, solid, or fixed area on or around the testis is an abnormal finding requiring further evaluation.18 In certain conditions, such as the presence of hydrocele, palpation of the testis may be difficult, so ultrasonography is needed as an adjunct to confirm the presence of a lesion.1 In addition, examination should include assessment of inguinal and supraclavicular lymph nodes, the abdomen, and the chest to detect gynecomastia, which may be associated with hormone production by the tumor.

Symptoms due to metastasis are rarely the initial complaint but may be found in some cases. Systemic manifestations include decreased appetite, weakness, and weight loss. Pulmonary metastasis may cause cough or shortness of breath, whereas lymph node spread may cause lymph node enlargement in the cervical or supraclavicular region. Retroperitoneal involvement may cause back pain or varicocele due to vascular compression. In addition, edema of the lower extremities may occur due to vascular obstruction or thrombosis, and gastrointestinal symptoms such as nausea, vomiting, or bleeding may occur due to metastasis in the retroduodenal region. Involvement of the central or peripheral nervous system may also cause neurological symptoms.

During anamnesis, it is important to explore clinical symptoms and risk factors, including a history of cryptorchidism, orchidopexy, or inguinal hernia surgery during infancy. A family history of testicular cancer, especially in the father or brother, should also be asked. On physical examination, every solid intratesticular mass should be considered malignant until proven otherwise. In addition, signs suggestive of metastasis should also be evaluated.

The initial supporting examination recommended in suspected testicular cancer is scrotal ultrasonography because it can confirm the presence of a mass, determine whether the lesion is intratesticular or extratesticular, and evaluate the contralateral testis. This modality has high sensitivity, ranging from 92–98%, with specificity reaching 95–99.8%. Although magnetic resonance imaging (MRI) has good specificity, its use is relatively limited due to higher cost. The combination of physical examination and ultrasonography can even achieve nearly 100% sensitivity in detecting testicular cancer. Suspicious lesions generally appear as solid intratesticular masses that are hypoechoic and show vascularity. If ultrasonography reveals a solid intratesticular mass, the patient should be immediately referred for radical inguinal orchiectomy, which serves as both a diagnostic procedure and the main therapy. Before this procedure is performed, it is important to measure serum tumor markers, such as alpha-fetoprotein (AFP), beta-human chorionic gonadotropin (β-hCG), and lactate dehydrogenase (LDH). In addition, patients should be educated regarding the potential risk of fertility impairment due to the disease or its therapy, as well as the option of testicular prosthesis placement. In certain conditions, especially when bilateral involvement is present, sperm banking should be considered as a preventive measure against future infertility.

Before orchiectomy, the initial evaluation includes laboratory tests such as blood chemistry, liver function tests, and serum tumor markers including beta-human chorionic gonadotropin (β-hCG), lactate dehydrogenase (LDH), and alpha-fetoprotein (AFP). These tumor markers are important to re-evaluate after surgery because staging is based on post-orchiectomy values. To assess possible metastasis, radiological examinations such as chest X-ray and CT scan of the abdomen and pelvis are performed. If abnormalities are found, chest CT scan may be added. Further examinations such as brain MRI or bone scan are considered if metastasis is suspected based on history and physical examination. Testicular cancer staging is performed using the TNMS system, which includes tumor, nodes, metastasis, and serum markers.

Radical inguinal orchiectomy is the main therapy and also functions as a diagnostic procedure because it allows histopathological examination of the tissue. Biopsy through a

scrotal approach is not recommended because of the risk of local tumor spread due to disruption of lymphatic pathways and because it has been shown to increase local recurrence rates compared with orchiectomy. The spread of testicular germ cell tumors follows a characteristic and predictable lymphatic pattern. In right testicular tumors, metastasis generally first occurs in the infrarenal interaortocaval lymph nodes, followed by the paracaval and para-aortic nodes. In contrast, left testicular tumors more commonly spread to the para-aortic lymph nodes, followed by the interaortocaval nodes. Spread from the right side to the left in the retroperitoneum can occur, whereas the reverse is rarely found except in cases with a large tumor burden. Therefore, abdominal and pelvic imaging plays an important role in detecting retroperitoneal lymph node involvement and in planning therapy.

All patients with testicular germ cell tumors are recommended to undergo CT scan of the abdomen and pelvis as part of staging evaluation. In patients with elevated tumor markers, the examination is continued with chest CT scan to detect metastasis. Conversely, if tumor markers are within normal limits, the risk of metastasis outside the retroperitoneum is relatively low, so chest X-ray is generally sufficient when combined with CT scan of the abdomen and pelvis. In cases with high β-hCG levels, particularly those suggestive of choriocarcinoma, brain imaging should be considered because of the tendency for hematogenous spread to the central nervous system.

Serum tumor markers play an important role not only in diagnosis but also in staging, evaluation of therapeutic response, and detection of recurrence. LDH reflects tumor burden, although it is nonspecific. β-hCG is produced by syncytiotrophoblastic cells and can be found in both seminoma and nonseminoma tumors, particularly choriocarcinoma. AFP originates from yolk sac tumor or embryonal carcinoma components and does not increase in pure seminoma or pure choriocarcinoma. However, elevated AFP and β-hCG may also be found in other conditions, such as liver disease or non-germinal malignancies, whereas LDH may increase in various nonspecific conditions. Recent research has also highlighted the potential use of microRNA, such as miR-371a-3p, as a biomarker in germ cell tumors, although its role in clinical practice still requires further study. In addition, various immunohistochemical markers such as PLAP, OCT3/4, NANOG, and others have been used in histopathological diagnosis to help identify germ cell tumor subtypes more accurately and specifically.

The staging system for testicular cancer is established by the American Joint Committee on Cancer using the TNM classification, which includes tumor size and invasion (T), lymph node involvement (N), and distant metastasis (M). In addition to clinical staging, staging can

also be performed pathologically (pTNM) based on surgical results and histopathological examination of the tissue.

1. Stage 0 is a condition of testicular intraepithelial neoplasia (Chen et al.) or intratubular germ cell neoplasia (ITGCN), equivalent to carcinoma in situ. In most cases, TIN is found after orchiectomy for an invasive germ cell tumor, so the lesion has usually already been removed and does not require additional therapy. More complex cases occur when TIN is found on biopsy of the contralateral testis, although this is rarely performed because the incidence and mortality are low. Therefore, treatment decisions in this stage are rarely encountered, with options including radiotherapy, observation, or orchiectomy.
2. Stage I is characterized by cancer that remains confined to the testis. Invasion into structures such as the epididymis, tunica albuginea, or rete testis does not change the stage, but invasion into the tunica vaginalis or the presence of lymphovascular invasion is categorized as T2, invasion into the spermatic cord as T3, and invasion into the scrotum as T4. Although invasion of the scrotal wall or a history of previous surgery does not change the stage, these conditions increase the risk of spread to the inguinal lymph nodes. A higher T category is associated with the risk of occult metastasis and recurrence. Patients with persistently elevated tumor markers after orchiectomy are classified as stage IS, and in nonseminoma they are treated as stage III. In seminoma, persistent elevation of tumor markers, especially beta-hCG, usually indicates the presence of metastasis.
3. Stage II indicates testicular involvement with spread to retroperitoneal or para-aortic lymph nodes, usually around the kidneys. Further assessment is based on the number and size of involved lymph nodes, where involvement of more than five lymph nodes or a size greater than 2 cm increases the risk of recurrence. Stage IIC describes disease with extensive lymph node enlargement greater than 5 cm, which is associated with a poorer prognosis.
4. Stage III indicates that the cancer has spread beyond the retroperitoneal lymph nodes, based on physical examination, imaging, or laboratory findings. This stage is divided into several subcategories based on the location of metastasis and tumor marker levels. Stage IIIA has a better prognosis, with metastasis limited to lymph nodes and lungs and mild elevation of tumor markers. Stage IIIB is characterized by moderate elevation of tumor markers, whereas stage IIIC shows high elevation of tumor markers and/or

metastasis to other organs such as the liver, bones, or brain. This classification follows the International Germ Cell Consensus system for metastatic germ cell tumors.

Testicular cancer is generally divided into two main groups, namely seminoma and nonseminoma, and this classification is important in treatment planning. Seminoma is known to be more sensitive to radiotherapy and chemotherapy and has a lower tendency for distant metastasis compared with nonseminoma. Conversely, nonseminoma may contain teratoma components that tend to be resistant to chemotherapy, often requiring surgery to achieve cure. By definition, pure seminoma does not contain teratoma elements, so the role of surgery in the management of nonseminoma is generally greater than in seminoma. Nonseminomatous testicular tumors include several types, namely embryonal carcinoma, yolk sac tumor, choriocarcinoma, teratoma, and mixed germ cell tumor.

DISCUSSION

Management of Stage 0 Testicular Cancer

In men diagnosed with invasive testicular germ cell tumors (stages I–III), approximately 0.5% to 1.0% are found to have tumors in both testes simultaneously, and another 1% to 2% will develop an invasive germ cell tumor in the contralateral testis later in life. However, death due to subsequent contralateral metachronous tumors is very rare. A study of 29,515 men in the United States diagnosed between 1973 and 2001 showed that only 287 patients developed contralateral testicular cancer, and only one of them died. Therefore, biopsy to detect testicular intraepithelial neoplasia (Chen et al.) in the contralateral testis is generally not recommended because its benefit is limited.

If biopsy is still performed, approximately 4% to 8% of patients will be found to have TIN in the contralateral testis. Management of this condition generally includes radiotherapy at a dose of 18–20 Gy, surveillance, or orchiectomy. It should be noted that patients undergoing radiotherapy or orchiectomy will experience infertility, and patients undergoing orchiectomy as well as some patients receiving radiotherapy are also at risk of hypogonadism.

Radiotherapy for TIN is known to have a low risk of recurrence. In one study of 122 patients who received external radiotherapy at a dose of 18–20 Gy, only three cases of recurrence were found, approximately 2.5%. In addition, surveillance can be performed with annual transscrotal ultrasonography and monthly self-examination. However, approximately

half of TIN cases may progress to invasive germ cell tumors within a median period of about three years.

In contrast, chemotherapy does not show optimal effectiveness in preventing progression to invasive cancer. Several reports have shown that progression still occurs in patients who have received chemotherapy, either with bleomycin, etoposide, and cisplatin (BEP) or carboplatin regimens. Therefore, chemotherapy is not the main option for preventing TIN progression. In addition, various ongoing clinical trials are available to evaluate new therapeutic approaches for testicular cancer. Clinical trial searches can be adjusted based on location, type of therapy, drugs used, and other criteria.

Management of Stage I Testicular Cancer

In stage I seminoma, the cure rate is very high, approaching 100%, with or without additional therapy after orchiectomy. The main option is radical inguinal orchiectomy followed by strict surveillance using clinical examination, tumor markers, and periodic imaging. Although approximately 15–20% of patients may experience recurrence, almost all can still be cured with further therapy, so the overall cure rate remains very high. Factors that increase the risk of recurrence include tumor size greater than 4 cm and rete testis invasion. For patients who do not choose surveillance, additional therapy can be given to reduce the risk of recurrence, such as radiotherapy or adjuvant chemotherapy using carboplatin. However, radiotherapy is currently being used less frequently because it is associated with an increased risk of secondary malignancy. As an alternative, one or two cycles of carboplatin chemotherapy are often used because of their good effectiveness with fewer side effects.

In stage I nonseminoma, the prognosis is also very good, with a cure rate of more than 99%. Approximately 70% of patients can be cured with orchiectomy alone, whereas the remainder are at risk of recurrence and require additional therapy. There are three main approaches: surveillance, retroperitoneal lymph node dissection (RPLND), and adjuvant chemotherapy. Surveillance is performed with strict monitoring through clinical examination, tumor markers, and periodic imaging, and becomes the standard option if the patient can undergo regular follow-up. RPLND may be selected for both staging and therapeutic purposes, especially in selected patients, but this procedure has a risk of morbidity and requires special expertise. Meanwhile, adjuvant chemotherapy with cisplatin-based regimens such as BEP for one or two cycles can significantly reduce the risk of recurrence and is often chosen for high-risk patients.

The choice of therapy in stage I nonseminoma remains debated because all three approaches provide nearly similar survival rates. Therefore, risk-based strategies are often used, in which patients with high-risk factors such as lymphovascular invasion or embryonal carcinoma predominance are more likely to be considered for additional therapy, whereas low-risk patients may undergo surveillance to avoid unnecessary treatment-related side effects.

Management of Stage II Testicular Cancer

In stage II seminoma, the disease is divided into bulky and non-bulky categories to determine therapy and prognosis. Bulky tumors are generally larger than 5 cm, whereas non-bulky disease is divided into stage IIA, with lymph nodes ≤2 cm, and stage IIB, with lymph nodes measuring 2–5 cm. In non-bulky stage II disease, radiotherapy at a dose of 30–36 Gy provides a cure rate of approximately 90–95%, and most recurrences can still be cured with chemotherapy. The risk of recurrence increases in patients with multiple enlarged lymph nodes. Conversely, in bulky disease (stage IIC), radiotherapy outcomes are less optimal, so cisplatin-based chemotherapy becomes the main option. After chemotherapy, residual masses are often found and generally shrink over time. The approach may involve close observation or further intervention if the mass enlarges. PET-CT can help distinguish active residual masses from benign ones, thereby determining the need for biopsy or surgery.

Treatment options for stage II seminoma include radical orchiectomy followed by radiotherapy or chemotherapy in non-bulky cases, whereas combination chemotherapy is more recommended in bulky cases. Retroperitoneal lymph node dissection (RPLND) is rarely performed and is only considered in certain conditions.

In stage II nonseminoma, the cure rate is also very high, exceeding 95%. Patients with elevated tumor markers after orchiectomy are generally treated as stage III and receive chemotherapy immediately. In patients with normal tumor markers, management is divided according to stage. In stage IIA, RPLND is often performed to confirm staging because some patients do not actually have metastasis and can therefore avoid unnecessary chemotherapy.

For stage IIB and IIC, systemic chemotherapy becomes the main option because the risk of recurrence is higher if only surgery is performed. Treatment approaches include several options: orchiectomy followed by RPLND with or without chemotherapy, or direct chemotherapy followed by surgical removal of residual masses if needed. Commonly used chemotherapy regimens are cisplatin-based combinations such as BEP (bleomycin, etoposide, cisplatin) or EP (etoposide, cisplatin). In general, all of these approaches provide excellent cure

rates. The choice of therapy is based on stage, tumor marker levels, and risk factors such as lymphovascular invasion and embryonal carcinoma predominance. After chemotherapy, residual masses that remain visible on imaging usually need to be removed because they may contain active tumor tissue, and the histopathological results of the residual mass will determine the need for further therapy.

Management of Stage III Testicular Cancer

In stage III testicular cancer, both seminoma and nonseminoma are generally still curable, although they have different prognostic assessment criteria. In disseminated seminoma, patients are divided into good-risk and intermediate-risk groups based on the presence or absence of non-pulmonary visceral metastasis. Patients in the good-risk group, whose metastases are limited to lymph nodes and/or lungs, have a 5-year progression-free survival (PFS) of approximately 82% and an overall survival (Gonda et al.) of approximately 86%. Meanwhile, patients in the intermediate-risk group have a 5-year PFS of approximately 67% and OS of approximately 72%.

In disseminated nonseminoma, prognostic classification is more detailed, dividing patients into good-, intermediate-, and poor-risk groups. This classification is based on the location of the primary tumor, whether mediastinal or gonadal/retroperitoneal, the presence of non-pulmonary visceral metastasis, and serum tumor marker levels. The poor-risk group includes patients with a primary mediastinal tumor, metastasis to organs other than the lungs, or very high tumor marker levels. The intermediate-risk group consists of patients with moderately elevated tumor markers, whereas the good-risk group includes patients with a primary tumor in the testis or retroperitoneum, metastasis limited to lymph nodes and/or lungs, and tumor marker levels within the good-risk category.

There are two main theories explaining the occurrence of malignancy in undescended testis (UDT). The first theory states that the higher intra-abdominal temperature is carcinogenic because it can disrupt germ cell differentiation and trigger the formation of premalignant lesions such as carcinoma in situ (CIS), so early orchidopexy is considered capable of reducing the risk of malignancy. Meanwhile, the second theory emphasizes that hormonal disturbances during intrauterine and perinatal development play a role in the occurrence of cryptorchidism as well as in increasing cancer risk, meaning that orchidopexy is not always protective. The risk of malignancy is also higher in certain conditions, such as intra-abdominal testis, bilateral cryptorchidism, testicular atrophy, genital abnormalities, and chromosomal abnormalities.

The risk of malignancy after UDT correction ranges from 2.23% to 5.4%, depending on the age at which the procedure is performed, with a general recommendation before the age of 2 years. However, the relationship between age at correction and cancer risk has not been fully consistent. Orchidopexy remains beneficial in facilitating early detection. In some cases, tumors can occur in both undescended testes and may be accompanied by gonadal developmental disorders, such as gonadoblastoma in patients with gonadal dysgenesis. The risk is also increased in intra-abdominal and bilateral UDT.

Clinically, patients with intra-abdominal testicular malignancy may be asymptomatic or may show complaints that resemble other conditions, such as appendicitis, incarcerated hernia, increased urinary frequency or dysuria due to compression of the bladder by the mass, or acute abdomen due to torsion or rupture accompanied by bleeding. Radiological or preoperative diagnosis of complications such as torsion or rupture is often difficult because a history of cryptorchidism is not always known and imaging findings may be nonspecific.25 Tumors in UDT are generally diagnosed at a more advanced stage compared with tumors in normally descended testes. The principles of therapy are similar to those for testicular germ cell tumors, but the approach must be individualized. In advanced-stage cases (stage II or higher), multimodal therapy should be planned sequentially. Because the intra-abdominal location requires laparotomy, chemotherapy is often administered first, followed by mass excision with or without retroperitoneal lymph node dissection (RPLND) to reduce the need for repeated operations and facilitate surgical management. Staging in nonseminoma is also challenging because tumor markers are often assessed before mass removal, which may lead to overstaging, for example from stage II to stage III due to an increased tumor marker category. In addition, there are no definite guidelines regarding indications for lymph node sampling, either during the initial operation or after chemotherapy. Therefore, the decision to perform RPLND must be individualized based on tumor type, treatment response, and radiological and intraoperative findings.

Orchidectomy can be performed through several approaches, including inguinal, subinguinal, and transscrotal approaches. The inguinal approach is the standard for testicular tumor cases because it allows complete removal of the testis and spermatic cord while reducing the risk of tumor spread. The subinguinal approach is more minimally invasive because it preserves the anatomy of the inguinal canal, thereby reducing the risk of complications such as neuropathic pain and postoperative hernia. Meanwhile, the transscrotal approach is more commonly used in benign cases or as palliative therapy because the technique is simpler, but it

is not recommended in testicular malignancy. The choice of surgical technique is adjusted according to the indication, the patient's condition, and the clinical judgment of the operator.26

The prognosis of testicular tumors is mainly determined by histological type, extent of metastatic spread, and degree of tumor marker elevation. In metastatic seminoma, the main poor prognostic factor is the presence of metastasis to visceral organs other than the lungs. In addition, tumors originating from the mediastinum have a poorer prognosis than those originating from the testis. Nevertheless, even in patients with extensive metastasis at diagnosis, including brain metastasis, the disease still has the potential to be cured if managed optimally. Several studies have shown that larger tumor size, approximately ≥3–4 cm, is associated with a higher risk of recurrence in seminoma. In addition, rete testis invasion and lymphovascular invasion are also known as predictors of recurrence in testicular germ cell tumors. A new biomarker, CXC-chemokine ligand 12 (CXCL12), has also been reported to have potential as an independent predictor of recurrence, particularly in nonseminomatous germ cell tumors.

CONCLUSION

This case highlights that untreated undescended testis (UDT) in adulthood may present as an intra-abdominal tumor with atypical clinical manifestations. The main finding of this case is that a 27-year-old male with a history of untreated UDT presented with acute right lower abdominal pain and a mass in the right iliac region, initially resembling an acute abdominal condition such as appendicitis. Physical examination findings, particularly an asymmetrical scrotum and the absence of the right testis in both the scrotum and inguinal canal, were important clinical clues for considering a genitourinary etiology. Therefore, this case emphasizes the importance of genital examination in male patients presenting with unexplained acute abdominal pain or intra-abdominal masses.

The scientific contribution of this case report lies in its description of a rare presentation of an intra-abdominal tumor associated with untreated UDT, with histopathological findings suggestive of alveolar rhabdomyosarcoma. This finding expands the clinical perspective that malignancy in undescended testis should not only be associated with common germ cell tumors such as seminoma but may also involve rare non-germ cell malignancies. This report contributes to clinical awareness by showing that early recognition of UDT, careful physical examination, surgical intervention, and histopathological evaluation are essential for accurate diagnosis and appropriate management.

This case report has several limitations. The available clinical data did not include detailed imaging findings, serum tumor marker levels, immunohistochemical confirmation, molecular

testing, staging assessment, surgical margin status, or long-term follow-up outcomes. These limitations restrict the ability to establish a definitive diagnosis of alveolar rhabdomyosarcoma and to describe the full extent of disease progression and prognosis. Future reports should include comprehensive radiological evaluation, tumor marker assessment, immunohistochemical and molecular confirmation, oncological staging, postoperative treatment, and follow-up data to provide a more complete understanding of rare intra-abdominal tumors associated with undescended testis.

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