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Case Report

Splenogonadal fusion: a radiologic-pathologic correlation and review of the literature ☆

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ABSTRACT

We present the case of a 29-year-old male who presented to his General Practitioner with a left testicular lump. Scrotal ultrasound examination revealed 4 well-defined, homogenous, mildly hypoechoic extratesticular mass lesions. He was referred for an urgent urological opinion and underwent local excision. Histologic analysis revealed splenic tissue resulting in the diagnosis of splenogonadal fusion.

Introduction

Splenogonadal fusion (SGF) is a rare congenital abnormality in which splenic tissue is found in close proximity to gonadal tissue. The presentation can mimic a testicular tumor in males and may result in unnecessary orchidectomy.

Case presentation

A 29-year-old male presented to his General Practitioner (GP) with a left testicular lump that he had noticed a few weeks earlier. There was no past medical or family history of testicular disease. Clinical examination revealed palpable masses in the left hemiscrotum which were felt to represent epididymal cysts but there was no palpable swelling of the left testicle itself. He was referred for an ultrasound of the testes.

Ultrasound demonstrated 4 well-defined, homogenous, mildly hypoechoic masses located superior to the left testes measuring between 6 mm and 30 mm (Figs. 1-3). The largest

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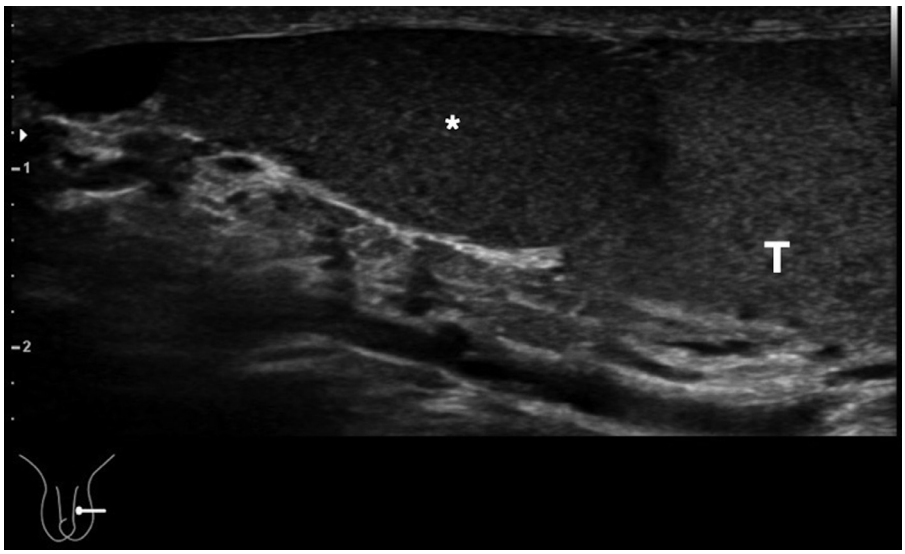

Fig. 1 – Transverse ultrasound image of the left scrotum in a 29-year-old male. A homogenous, hypoechoic, intrascrotal extratesticular mass lesion (*) is visualized adjacent to the left testis (T). Four masses were identified in total (not present on this image).

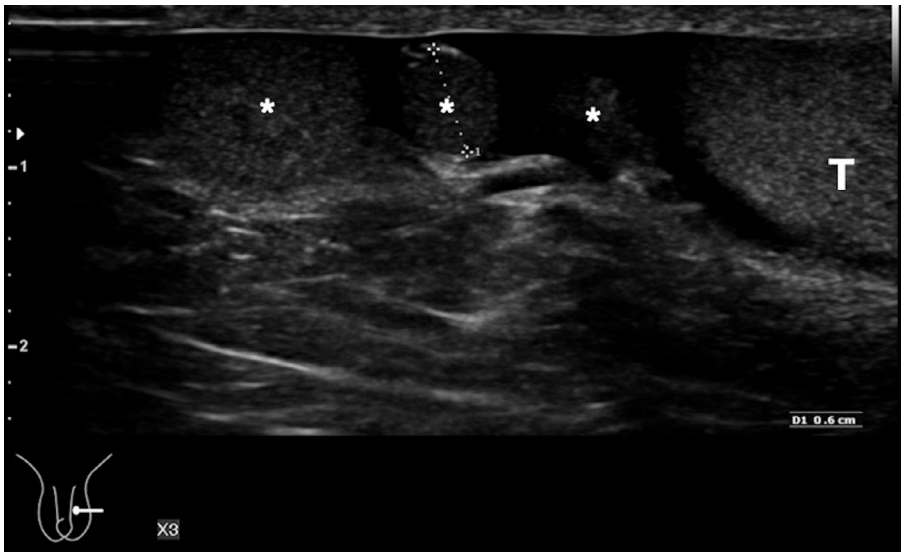

Fig. 2 – Transverse ultrasound image of the left scrotum in a 29-year-old male. Three homogenous, hypoechoic, intrascrotal extratesticular mass lesions (*) are visualized adjacent to the left testis (T). The second of these lesions measured 6 mm (dotted line between the calipers).

mass abutted the upper pole of, but was separate from, the left testis with no ultrasound evidence of testicular invasion. All masses demonstrated vascular flow on Doppler interrogation. The ultrasound appearances of the remainder of the scrotal contents were normal. The left extratesticular tissue was reported as indeterminate and urology referral was advised. Carcinoembryonic antigen (0.6 μg/L, normal range 0-5) and alpha-fetoprotein (<1 kU/L, normal range 0-10) levels were within normal limits.

Following discussion at the urology multidisciplinary meeting, the patient underwent an uncomplicated surgical exploration of the left scrotum. This revealed an apparent multilobulated cystic formation connected to the upper pole of the left testis. This had the appearance of testicular tissue, and was excised and sent for histologic analysis.

Macroscopic evaluation revealed a 58 mm length piece of tissue comprised of 4 well-defined encapsulated grayish rounded masses joined together by fibrous tissue. These were hemorrhagic and uniform in appearance on sectioning (Fig. 4). Microscopic examination demonstrated that all 4 nodules had a fibrous capsule connected together by a small amount of fibroadipose tissue. They were all composed of splenic tissue and contained a normal proportion of white pulp and red pulp (Figs. 5 and 6) consistent with the diagnosis of SGF.

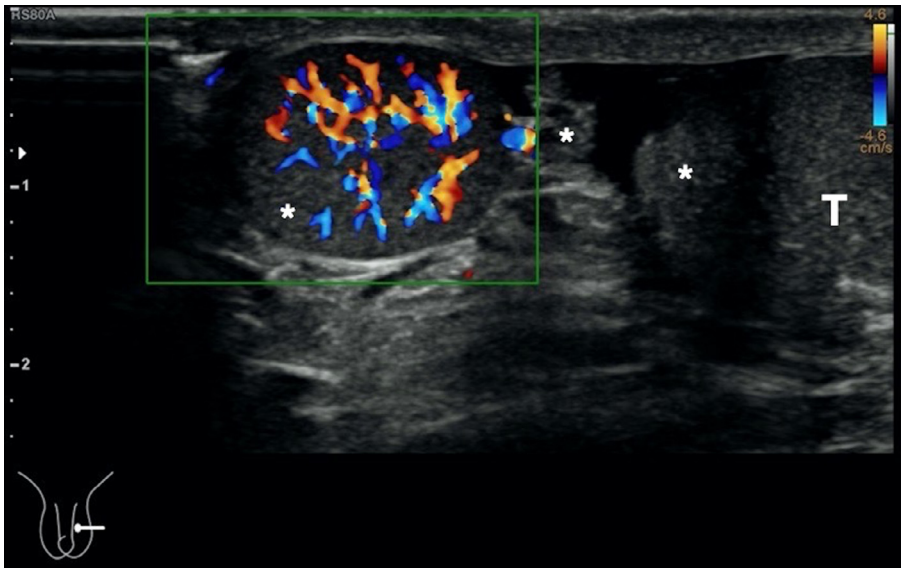

Fig. 3 – Transverse ultrasound image of the left scrotum in a 29-year-old male. Three homogenous, hypoechoic, intrascrotal extratesticular mass lesions (*) are visualized adjacent to the left testis (T). The largest of these masses (far left) demonstrated central vascularity with a branching pattern on Doppler interrogation.

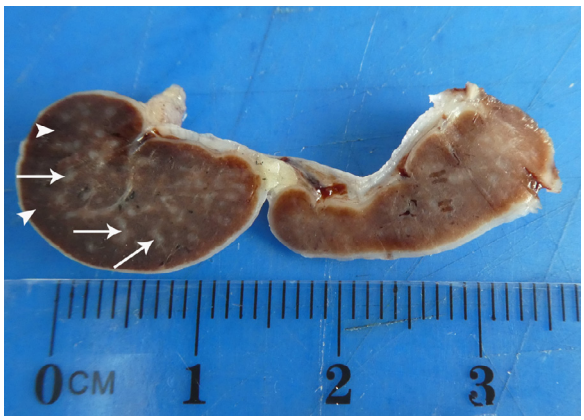

Fig. 4 – Macroscopic image of the 2 largest nodules of excised splenic tissue. The white pulp (arrows) and red pulp (arrowheads) are visible.

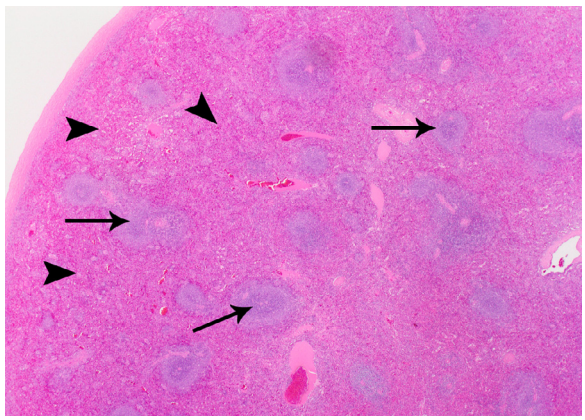

Fig. 5 – Microscopy of the excised splenic parenchyma from Fig. 4 (12× magnification). The capsule is identified at the top left of the image. The white pulp (arrows) and red pulp (arrowheads) are visible.

The red pulp showed diffuse foci of acute inflammatory cells, mainly beneath the capsule but also within the sinuses of the deep splenic parenchyma (Fig. 7), consistent with mild acute splenitis.

The patient was followed up as an outpatient and reassured that the excised extratesticular tissue was benign. The incision had healed well, and the patient was discharged back to the care of his GP.

Discussion

SGF is a rare congenital abnormality in which splenic tissue is found in close proximity to gonadal tissue. This malformation was first described in 1883 by Bostroem [1] and only 184 cases have been reported [2]. SGF overwhelmingly affects males (95%) and is left sided (98%) [3]. The noted higher incidence in males likely reflects the ease with which the external male gonad can be palpated/examined.

SGF can be an incidental finding: of all known cases, 17% were diagnosed on postmortem examination [4]. SGF may also be discovered during surgery for inguinal hernia repair or cryptorchidism. Congenital anomalies are noted to be present in 26% of cases of SGF [2]. Cryptorchidism is the most commonly associated abnormality and is present in 31% of all cases [3,5]. It has been reported that over 70% of cases occur in males less than 20 years of age, with 50% of these under the age of 10 [6]; however, there have been cases reported at the extremes of age [7,8].

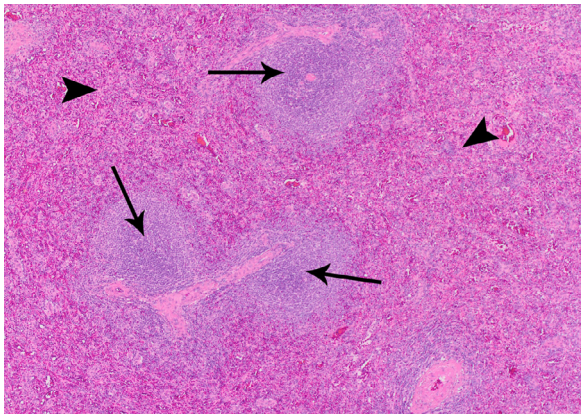

Fig. 6 – Microscopy of the excised splenic parenchyma from Fig. 4 (40× magnification). The lymphoid tissue of the white pulp (arrows), and the red pulp cords and sinuses (arrowheads) are visible.

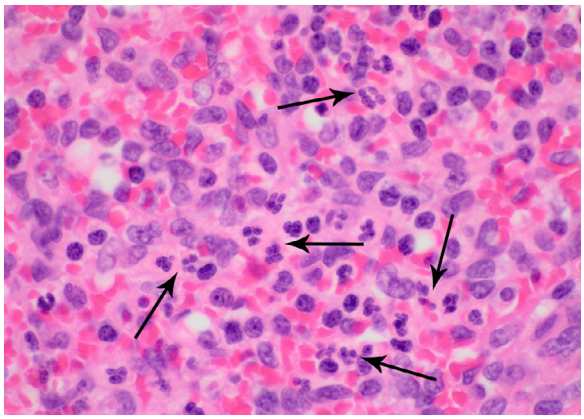

Fig. 7 – Microscopy of the excised splenic parenchyma from Fig. 4 (600× magnification). Neutrophils with characteristic polylobated nuclei (arrows) are visible within the red pulp sinuses.

The exact mechanism of SGF remains unclear but it is thought that fifth to eighth weeks of fetal development are key to its natural history. The spleen begins to develop during the fifth week of embryonic development and originates in the intraembryonic splanchnic mesoderm. During this time, the splenic anlage is rotated to the left and comes into close proximity to the left urogenital fold which contains the gonadal mesoderm [9]. The tissues remain in close proximity to each other until the descent of the gonads during the eighth week of gestation [7]. It is hypothesized that an insult occurs during this time which results in fusion of the 2 organs [7,9]. This notion is given further credence due to the notably high levels of associated limb defects (amelia) and micrognathia which may be associated with SGF given that the limb buds and Meckel's cartilage (the origin of the mandible) both develop at the same time as the splenic anlage and gonadal mesoderm [3,10].

In a series of 30 cases of SGF, the 2 most frequently observed malformations were peromelus (malformation of one of more extremities [34], also known as severe dysmelia [33]; *Gk. pero* = maimed, deformed, malformed; *Gk. mel-* = limb, body extremity or member) and micrognathia [11]. A review of 123 cases of SGF found major congenital abnormalities in 24 patients including: limb defects, micrognathia, cardiac defects, cleft palates, anal canal abnormalities, and spina bifida. Additionally, 1 patient was diagnosed with Moebius syndrome [9], a congenital neurologic disorder of rhombencephalic maldevelopment with nonprogressive abducens and facial nerve palsies which may be also associated craniofacial and limb abnormalities [12–14]. Our patient did not have any associated abnormalities.

A classification of SGF into continuous or discontinuous forms has been proposed. The continuous form is defined by an uninterrupted cord connecting the spleen and gonad. In contrast, the discontinuous form is defined as a splenic-gonadal mesonephric structure which has lost all connection with the primary or native spleen and is stated to be a variant of an accessory spleen [11]. The continuous form of SGF comprises approximately 55% of all reported cases and is associated with a 5 times higher risk of congenital defects compared to the discontinuous form [15].

The diagnosis of SGF is challenging given that the clinical presentation of a scrotal mass can mimic that of a testicular neoplasm [4]. The rarity of the condition alongside its lack of characteristic clinical or imaging features means that, understandably, this diagnosis is overlooked. However, this may result in male patients undergoing unnecessary orchidectomy: a review of 123 cases of SGF found that 37% of patients had undergone orchiectomy [5]. A different review of 61 reported cases from 1990 onwards found that 24% of patients had undergone orchiectomy for a dysplastic or atrophic "appearing" gonad at surgery, or an inability to completely separate the splenic mass/tissue from the testis [2].

SGF alone is not believed to increase the risk of testicular cancer. Cryptorchidism has an established association with testicular malignancy and remains the most common congenital abnormality in newborn males with an incidence of 6%: a meta-analysis found that male children with isolated cryptorchidism were 3 times more likely to develop testicular cancer [16]. Associated cryptorchidism is presumed to be the causative factor for associated malignancy in cases of SGF [17]. The use of the serum protein biomarkers (alpha-fetoprotein, beta-human chorionic gonadotropin (β-hCG), carcinoembryonic antigen, and lactate dehydrogenase) play a role in the diagnosis and management of testicular tumors. However, only 60% of patients with testicular germ cell tumors will have an elevated result which may further cloud the diagnostic picture [18].

Ultrasound is the imaging modality of choice in the investigation of scrotal and testicular masses. It is inexpensive, non-invasive, and widely available alongside high patient acceptability, obviating exposure to ionizing radiation. The evaluation of a scrotal mass includes its location in relation to the testis (intra- or extratesticular) and its nature (solid or cystic). Intratesticular solid masses should be considered malignant until proven otherwise [19]. Extratesticular solid masses are much more likely to be benign with only 3% reported as malignant [20].

The differential diagnosis of an extratesticular intrascrotal mass includes benign (lipoma [most common], leiomyoma,

neurofibroma, granular cell tumor, angiomyofibroblastoma-like tumor, fibrous pseudotumor, and fibrous hamartoma of infancy) and malignant lesions (metastasis, liposarcoma, leiomyosarcoma of the scrotum, malignant fibrous histiocytoma, rhabdomyosarcoma, and primary dermal lesions extending into the deeper layers of scrotum) [21]. However, there is a significant overlap in the ultrasonographic appearances of benign and malignant solid extratesticular masses [19].

On ultrasound, SGF may appear as a hypoechoic extratesticular mass(es) with no specific sonographic features to distinguish it from a neoplasm [22]. Reported Doppler characteristics are those of central vascularity with a branching pattern which is said to differ from the "criss-cross" pattern typically detected in a neoplastic mass [23]. However, any pattern of internal vascularity in a scrotal mass is potentially suspicious and prompts further investigation. Unfortunately, the infrequency of SGF adds an additional layer of ambiguity to the radiologic diagnosis.

SGF may be detected on other imaging modalities. ^{99m}Tc-sulphur colloid liver spleen scintigraphy demonstrates uptake in splenic tissue. Increased uptake within the scrotum may indicate the diagnosis of SGF if there is a high level of clinical suspicion [24]. However, it is more likely that scrotal uptake would be visualized incidentally on imaging performed for another clinical indication. Planar scintigraphy and single positron emission computed tomography may not be readily available in all centers which, along with computed tomography (CT), expose the patient and gonadal tissue to ionizing radiation making the use of these modalities less acceptable in clinical practice [24,25].

CT has been stated to be helpful in the diagnosis of SGF. Enhancement of homogenous, noncalcified, soft-tissue masses with attenuation values similar to primary splenic tissue may suggest SGF in the appropriate clinical context [25]. That said, investigations which employ ionizing radiation should only be employed in younger radiosensitive patients when it is clinically justified, particularly given the widespread availability and access to ultrasound [26]. Magnetic resonance imaging may also have a role if there is diagnostic uncertainty or in specific clinical contexts [27].

Papparella et al. [28] examined the surgical management of SGF. Direct visualization of the connective band from the inguinal ring to the spleen during laparoscopy can facilitate the diagnosis of continuous SGF. The splenic tissue in SGF is closely attached to the gonad and restricted to within the tunica vaginalis and, much like the native or primary spleen, contains a capsule which enables a distinction between the gonad and the splenic tissue [30]. Splenic tissue removed via an open excision, with careful measures taken to spare the testis (gonad sparing surgery), is advocated in cases where there is sufficient diagnostic and/or intraoperative confidence [29].

As stated above, the splenic tissue in our patient was comprised of 4 well-defined encapsulated grayish rounded masses joined together by fibrous tissue which was separate from the testis. Histologically, the proportions of red and white pulp appeared normal (Figs. 5 and 6) but on high power examination, there were numerous neutrophils present within the splenic sinuses of the red pulp (Fig. 7). To our knowledge, this finding has not been described before in cases of SGF. There was no involvement of the white pulp and no necrosis was present. It was considered that the acute inflammation may have caused tenderness and/or an increase in size of the tissue which may have brought the lump to the patient's attention. Historically, acute inflammation within the spleen or "septic spleen" has been thought to be associated with bacteremia. However, actual evidence for this appears scant. Two published studies on the subject which examined postmortem spleens found no correlation amongst splenic neutrophil counts and deaths associated with sepsis [31], or bacterial cultures from splenic tissue [32]. Therefore, it seems unlikely that the mass came to attention as a result of a generalized subclinical infection, particularly given that there was no evidence of preoperative neutrophilia, and the patient was otherwise clinically well. It is more likely that this acute inflammation may be explained by the effects of pre- and/or perioperative palpation resulting in a minor degree of trauma.

Conclusion

The clinical history of a scrotal mass in concert with the ultrasound findings of well-circumscribed, hypoechoic, homogenous extratesticular focal mass(es) should raise the possibility of SGF. While it is accepted that the sonographic findings in SGF are nonspecific, ultrasound is helpful in excluding more sinister pathologies and in expediting referrals to urology specialists, where appropriate. Where clinically feasible, gonad sparing surgery is the mainstay of management. A multidisciplinary approach to the investigation of SGF is advocated with close liaison between colleagues in clinical radiology, surgery, and pathology.

Author contributions

Guarantor of integrity of the entire study—MP

Study concepts and design—MP

Literature research—AQ, MP

Clinical studies—CQ, KG

Experimental studies/data analysis—n/a

Statistical analysis—n/a

Manuscript preparation—AQ, CQ, MP

Manuscript editing—AQ, CQ, KG, MP

AQ: co-wrote the manuscript text.

CQ: prepared the tissue for histologic analysis; obtained and labeled the microscopic and macroscopic images; wrote the sections relating to pathology; edited the manuscript text.

KG: involved in the clinical care of the patient; extracted the relevant ultrasound images; edited the manuscript text.

MP: co-wrote the manuscript text; reformatted and labeled the ultrasound images; wrote the figure legends; obtained informed signed patient consent.

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