Review paper

Imaging findings of congenital anomalies of seminal vesicles

Osman Ocal\textsuperscript{B,E,F}, Ali Devrim Karaosmanoglu\textsuperscript{A,D,E}, Musturay Karcaaltincaba\textsuperscript{A,D,E}, Deniz Akata\textsuperscript{A,D,E}, Mustafa Ozmen\textsuperscript{A,D,E,F}

Department of Radiology, Hacettepe University, Ankara, Turkey

Abstract

The seminal vesicles are paired organs of the male reproductive tract, which produce and secrete seminal fluid. Although congenital anomalies of seminal vesicles are usually asymptomatic, they may lead to various urogenital symptoms, including infertility. Due to their embryologic relationship with other urogenital organs, congenital anomalies of seminal vesicles may accompany other urinary or genital anomalies. Congenital anomalies of seminal vesicles include agenesis, hypoplasia, duplication, fusion, and cyst. These anomalies can be diagnosed with various imaging techniques. The main purpose of this article is to summarise imaging findings and clinical importance of congenital anomalies of seminal vesicles with images of some rare and previously unreported anomalies.

Key words: seminal vesicles, congenital anomalies, computed tomography (CT), magnetic resonance imaging, ultrasound (US).

Introduction

Congenital anomalies of seminal vesicle are rare but well recognised in the literature. It is important to be familiar with the imaging findings of seminal vesicle anomalies so as not to misinterpret them with other conditions. Congenital anomalies of seminal vesicles are classified in three categories: number (agena...
form of cystic fibrosis. It is associated with mutations in the cystic fibrosis transmembrane conductance regulator gene, and agenesis may be seen as a consequence of luminal obstruction with thick secretions [11]. These patients usually have bilateral vas deferens agenesis but normal urinary tract.

Unilateral seminal vesicle agenesis is seen if embryologic insult occurs before the seventh week; thus, it is usually associated with other anomalies, most commonly ipsilateral renal agenesis. But fewer than 10% of the cases can have normal kidneys [12].

Although patients are generally asymptomatic, it may result in infertility [13]. It can be diagnosed with all imaging modalities. It is characterised by non-visualisation of seminal vesicles posterior to the prostate (Figure 1). It is essential to check for any abnormality in kidneys when seminal vesicle agenesis is encountered (Figure 2). It may also be associated with other genitourinary anomalies such as ectopic ureter opening (Figure 3).

Agenesis

Seminal vesicle agenesis is a rare anomaly with a reported incidence of 0.08% in a robotic laparoscopic radical prostatectomy series [10]. It can be unilateral or bilateral. Bilateral SV agenesis is mostly seen as a primarily genital anomalies, while kidneys develop normally if the defect occurs after the seventh week [4].

In the case of complete failure of the mesonephric duct, ipsilateral kidney, hemitrigone, and seminal vesicle will not develop [5]. Seminal vesicle will develop normally while ipsilateral kidney is agenetic or dysplastic if the ureteral bud fails to meet the metanephric blastema [6]. Maldevelopment of the distal mesonephric duct causes absence of the ureteral bud; thus, this results in ejaculatory duct obstruction with seminal vesicle cyst and ipsilateral renal agenesis or dysplasia [7]. If the ureteral bud meets with the mesonephric duct in a more cranial position, absorption of caudal mesonephric duct will be delayed, and this results in the distal ureteral bud emptying into mesonephric duct derivatives such as the vas deferens, seminal vesicle, or ejaculatory duct [8]. There is no known common embryological process between the seminal vesicle and contralateral kidney [9].

Fusion and duplication

There are few reported cases of seminal vesicle fusion in the literature [4,14]. Diagnoses were based on surgical
exploration or vasography, but in one report in which they retrospectively evaluated the preoperative sonographic images, they realised that the seminal vesicles were fused in the midline by an isthmus [4]. This anomaly causes modification of the surgical technique if radical prostatectomy was planned; thus, it is important to diagnose preoperatively.

Seminal vesicle duplication is another very rare anomaly with only two reported cases, and none of them described imaging features of this anomaly [15,16].

**Hypoplasia**

Hypoplasia refers to congenital underdevelopment of the seminal vesicles. Hypoplasia was defined as a maximum diameter smaller than 50% of normal or < 5 mm [17]. This condition usually is associated with other genitourinary anomalies such as absence of the vas deferens [1]. It is mostly seen in patients with azoospermia. It can be diagnosed with transrectal ultrasonography (TRUS), but computed tomography (CT) and magnetic resonance imaging (MRI) provide more repeatable measurements and delineated images (Figure 4).

**Cyst**

The seminal vesicle cyst is a rare entity, which can be acquired or congenital. The incidence of seminal vesicle cyst is 0.005%, and it is associated with an ipsilateral renal anomaly in two-thirds of cases [18]. A study revealed up to 0.46% incidence of seminal vesicle cyst in patients with ipsilateral renal agenesis [19]. It is rarely associated with autosomal dominant polycystic kidney disease [20]. Seminal vesicle cysts can be accompanied with other congenital genitourinary abnormalities (Figure 5). Zinner syndrome is a rare condition, which is characterised by a triad of unilateral renal agenesis or dysplasia, ipsilateral seminal vesicle cyst, and ejaculatory duct obstruction. It is related to the common embryologic origin of the mesonephric duct and ureteral bud, which are associated with the development of genital and urinary tracts. A few variants of this syndrome were reported including renal agenesis with contralateral seminal vesicle cyst, renal agenesis with contralateral seminal vesicle hypoplasia, renal agenesis with ipsilateral seminal vesicle cyst and contralateral seminal vesicle hypoplasia (Figure 6), and renal agenesis with bilateral seminal vesicle cyst [9,18,21-26]. Dysplastic kidney with bilateral seminal vesicle abnormality or dysplastic kidney with ectopic ureter draining into ipsilateral seminal vesicle cyst can be seen (Figures 7, 8).

Seminal vesicles enlarge with the accumulation of secretions due to atresia of the ejaculatory duct after puberty, and this leads to the formation of a cyst. The clinical presentation is related to the size and location of the cyst. Seminal vesicle cysts less than 5 cm are usually asymptomatic. When symptomatic it can cause dysuria, frequency, recurrent infections, painful ejaculation, perineal pain, or infertility [27]. Giant cysts (larger than 12 cm) can even cause bladder or colonic obstruction [28].

---

**Figure 4.** 72-year-old male with increased alkaline phosphatase levels. Axial contrast-enhanced computed tomography images shows seminal vesicle hypoplasia on the right (arrow)

**Figure 5.** 62-year-old male with elevated prostate specific antigen (PSA) levels. A) Axial T1 and B) T2 images show cystic dilatation of the left seminal vesicle. C) Coronal T2 images show ectopic opening of the dilated ureter into the seminal vesicle cyst. D) Axial subtracted magnetic resonance image shows no enhancement of the cyst except the walls
Differential diagnosis of seminal vesicle cysts includes prostatic, urticarial or Müllerian cysts, abscesses, ureteroceles, benign or malignant tumours of the bladder, rectum, sacrum, or lymph nodes [27]. Accompanying renal abnormalities are diagnostic clues of Zinner syndrome. Also, seminal vesicle cysts are paramedian to the bladder while Müllerian duct cysts or ejaculatory duct cysts have midline and ectopic ureteroceles have a more lateral location.

Different imaging studies may be helpful in diagnostic work-up. Abdominal or transrectal ultrasonography may reveal an anechoic mass in the seminal vesicle region while showing agenetic or dysplastic kidney. CT also offers a noninvasive diagnosis of pelvic cysts. Seminal vesicle cysts can be seen as a low attenuated retrovesicular mass superior to the prostate gland or cystic pelvic mass with thick irregular walls on CT. But MRI is the ideal imaging study to assess seminal vesicles due to high resolution, superior soft tissue contrast, multiplanar imaging capabilities, and no use of ionising radiation. Seminal vesicle cysts appear hypointense on T1-weighted images and hyperintense on T2-weighted images. Cysts can contain debris seen as increased intensity on T1-weighted images secondary to previous bleeding or infection. No contrast enhancement is seen except the walls of the cyst. Subtraction images can be used to control enhancement in cases of T1 hyperintense cyst content (Figure 5). MRI can also aid surgical planning with excellent delineation of anatomic structures. No FDG uptake is seen inside the cyst in positron emission tomography (PET) images. Vasography and percutaneous fine-needle aspiration are no longer used unless for therapeutic intentions. Only a seminal vesicle cyst will contain spermatozoa, which differentiates it from other cystic pathologies.

Treatment options are aspiration or surgical excision, which depends on the size and location of the cyst and whether it is symptomatic or not. Patients without any symptoms should not be treated, and surgical excision should be preferred in symptomatic cases because aspi-
Imaging findings of congenital anomalies of seminal vesicles

Figure 7. 31-year-old male patient with left orchiectomy secondary to testicular tumour. A) Contrast-enhanced computed tomography scan of abdomen shows left dysplastic kidney and left paraaortic metastatic lymphadenopathy. B) No seminal vesicle is seen on the right. A soft tissue density extending to the left side of bladder, is continuous with left seminal vesicle. C) Axial T2-weighted magnetic resonance imaging of the abdomen: No seminal vesicle is seen on the right (arrowhead). Dilated cystic structure (black arrow) is continuous with the stump of the left vas deferens (white arrow).

Figure 8. 51-year-old male with perforated cholecystitis. A) Axial contrast enhanced fat-sat T1 image shows right seminal vesicle cyst. B) Oblique coronal computed tomography image reveals calcified dysplastic right kidney with dilated ureter, which drains into the right seminal vesicle cyst, and increased density in mesenteric fat due to cholecystitis (not shown).
Osman Ocal, Ali Devrim Karaosmanoglu, Musturay Karcaaltincaba et al.

Figure 9. 34-year-old male with intermittent pelvic pain and history of left seminal vesicle cyst aspiration 2 years ago. (A) Coronal-contrast enhanced computed tomography (CT) image shows left renal agenesis, and (B) axial CT image shows left seminal vesicle cyst displacing bladder anteriorly.

ration is associated with high risk of recurrence (Figure 9) [27]. Imaging follow-up is preferred in asymptomatic cases.

Conclusions

Seminal vesicles are a part of the male genitourinary system and are critical for male fertility. Congenital anomalies of SV often seen with other defects in the genitourinary system due to their common embryological origin. Although they rarely cause symptoms, surgical correction may be needed. SV anomalies can be accurately diagnosed with all imaging modalities, but MRI is superior to other modalities, with excellent soft tissue resolution, and it plays a critical role in surgical planning.

Conflict of interest

The authors report no conflict of interest.

References

1. Vohra S, Morgentaler A. Congenital anomalies of the vas deferens, epididymis, and seminal vesicles. Urology 1997; 49: 313-321.
2. Dagur G, Warren K, Suh Y, et al. Detecting diseases of neglected seminal vesicles using imaging modalities: A review of current literature. Int J Reprod Biomed (Yazd) 2016; 14: 293-302.
3. Pace G, Galatiioto GP, Gulia L, et al. Ejaculatory duct obstruction caused by a right giant seminal vesicle with an ipsilateral upper urinary tract agenesis: an embryologic malformation. Fertil Steril 2008; 89: 390-394.
4. Mendez-Probst CE, Pautler SE. Fusion of the seminal vesicles discovered at the time of robot-assisted laparoscopic radical prostatectomy. J Robot Surg 2010; 4: 45-47.
5. Sloufi A, Ergragui S, Lasri A, et al. Zinner’s syndrome: report of two cases and review of the literature. Basic Clin Androl 2016; 26: 10.
6. Mehra S, Ranjan R, Garga UC. Zinner syndrome—a rare developmental anomaly of the mesonephric duct diagnosed on magnetic resonance imaging. Radiol Case Rep 2016; 11: 313-317.
7. Naval-Baudin P, Carreno Garcia E, Sanchez Marquez A, et al. Multicystic seminal vesicle with ipsilateral renal agenesis: two cases of Zinner syndrome. Scand J Urol 2017; 51: 81-84.
8. Shariat SF, Naderi AS, Miles B, Slawin KM. Anomalies of the wolffian duct derivatives encountered at radical prostatectomy. Rev Urol 2005; 7: 75-80.
9. Resorlu M, Adam G, Uysal F, et al. Seminal vesicle hypoplasia with contralateral renal agenesis. Urology 2014; 84: e7.
10. Acharya SS, Gundeti MS, Zagaja GP, et al. Wolffian duct derivative anomalies: technical considerations when encountered during robot-assisted radical prostatectomy. Can J Urol 2009; 16: 4601-4606.
11. Dayangac D, Erdem H, Yilmaz E, et al. Mutations of the CFTR gene in Turkish patients with congenital bilateral absence of the vas deferens. Hum Reprod 2004; 19: 1094-1100.
12. Donohue RE, Fauver HE. Unilateral absence of the vas deferens. A useful clinical sign. JAMA 1989; 261: 1180-1182.
13. Simpson WL, Jr., Rausch DR. Imaging of male infertility: pictorial review. AJR Am J Roentgenol 2009; 192: S98-S107 (Quiz S108-S111).
14. Malatinsky E, Labady F, Lepies P, et al. Congenital anomalies of the seminal ducts. Int Urol Nephrol 1987; 19: 189-194.
15. Christiano AP, Palmer JS, Chekmareva MA, Brendler CB. Duplicated seminal vesicle. Urology 1999; 54: 162.
16. Hublet D, Kaekenbeeck B, De Backer E, Schmitz. Dysgenetic prostatic cyst and bilateral duplication of seminal vesicles with unilateral duplication of vas deferens, epididymis and renal dysplasia. One case and review of the literature. Acta Urol Belg 1980; 48: 424-429.
17. Raviv G, Mor Y, Levron J, et al. Role of transrectal ultrasonography in the evaluation of azoospermic men with low-volume ejaculate. J Ultrasound Med 2006; 25: 825-829.
18. Logigan H, Manea C, Crisan N, et al. Zinner syndrome: a case report and literature review. Romanian Journal of Urology 2014; 13: 44.
19. Sheih CP, Hung CS, Wei CF, Lin CY. Cystic dilatations within the pelvis in patients with ipsilateral renal agenesis or dysplasia. J Urol 1990; 144: 324-327.
20. Reig B, Blumenfeld J, Donahue S, Prince MR. Seminal megavesicle in autosomal dominant polycystic kidney disease. Clin Imaging 2015; 39: 289-292.
21. Kosan M, Tul M, Inal G, et al. A large seminal vesicle cyst with contralateral renal agenesis. Int Urol Nephrol 2006; 38: 591-592.
22. Shimamura M, Koizumi H, Hisazumi H. Seminal vesicle cyst associated with contralateral renal agenesis: a case report]. Hinyokika Kiyo 1984; 30: 1263-1267.
23. El-Assmy A, Abou-El-Ghar ME. Giant seminal vesicle cyst causing ipsilateral hydronephrosis with contralateral renal agenesis. Urology 2012; 79: e17-18.
24. Khanduri S, Katyal G, Sharma H, et al. Unique association of multiple seminal vesicle cysts with contralateral renal agenesis: a rare variant of Zinner syndrome. Cureus 2017; 9: e1415.
25. Linhares Furtado AL. Three cases of cystic seminal vesicle associated with unilateral renal agenesis. Br J Urol 1973; 45: 536-540.
26. Kardoust Parizi M, Shahkssalim N. Management of Zinner’s syndrome associated with contralateral seminal vesicle hypoplasia: a case report. Case reports in urology 2013.
27. van den Ouden D, Blom JH, Bangma C, de Spiegeleer AH. Diagnosis and management of seminal vesicle cysts associated with ipsilateral renal agenesis: a pooled analysis of 52 cases. Eur Urol 1998; 33: 433-440.
28. Kenney PJ, Leeson MD. Congenital anomalies of the seminal vesicles: spectrum of computed tomographic findings. Radiology 1983; 149: 247-251.