J Assist Reprod Genet (2008) 25:567–569
DOI 10.1007/s10815-008-9267-5

PHYSIOLOGY

Septate uterus with left fallopian tube hypoplasia and ipsilateral ovarian agenesis

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Received: 4 August 2008 / Accepted: 9 October 2008 / Published online: 25 October 2008

Abstract
Objective To report a combined genital tract anomaly of septate uterus, unilateral fallopian tube hypoplasia, and ipsilateral ovarian agenesis.
Design Case report.
Setting Academic tertiary care center.
Patient A 24-year-old female.
Intervention(s) History and physical, pelvic sonogram, hysterosalpingogram, intravenous pyelogram, abdominal and pelvic magnetic resonance imaging, diagnostic laparoscopy, exploratory laparotomy, cuff neosalpingostomy, and uterine septum resection.
Main Outcome Measure(s) Recognition of three independent and rare reproductive tract anomalies in the same patient.
Result(s) Restoration of anatomy and subsequent fertility.
Conclusion(s) A careful clinical evaluation with consideration of embryologic origin is essential to the identification and treatment of rare reproductive tract malformations.

Capsule Report of a septate uterus in conjunction with unilateral fallopian tube hypoplasia and ovarian agenesis in an infertility patient.

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Keywords Mullerian anomaly · Ovarian agenesis · Fallopian tube hypoplasia · Fimbrioplasty

Introduction

Developmental abnormalities have been observed at all points along the female reproductive tract, including the external genitalia, vagina, cervix, uterus, oviducts, and ovaries. Most commonly, abnormalities include organs which originate from the Mullerian ducts. These occur in 0.1–3.8% of women [1] and include septate, unicornuate, bicornuate and didelphic uteri [2]. Complex anomalies involving the urinary system, fallopian tubes, ovaries and vagina have also been described [3] but occur less frequently.

Normal female reproductive tract development begins in the sixth week of gestation when the bilateral Mullerian ducts begin to migrate towards the midline. By the seventh week, the caudal aspects of these ducts meet and form a double lumen structure. The septum separating the two lumens resorbs by the ninth week forming the uterus. Inferiorly, the uterus comes into contact with the urogenital sinus to create the vagina. Rostrally, the Mullerian ducts form fallopian tubes. Any disturbance in the migration, fusion or resorption of these ducts can cause a Mullerian anomaly [4].

Whereas anomalies of Mullerian duct derived organs are relatively common, congenital defects or absence of an ovary is quite rare. Gonadal development depends on accurate germ cell migration as well as appropriate formation of the urogenital ridge, the site of the future gonad.

Germ cells migrate from an embryo's outer ectoderm, through the primitive streak and the base of the allantois, along the wall of the hindgut and eventually to the urogenital ridge. During this migration, the urogenital ridge develops from the intermediate mesoderm under the

influence of multiple proposed genes including Lim-1, GATA4 and Lim Homeobox 9 [5]. In the absence of testes determining factor, which is coded by the sex-determining region of the Y chromosome (SRY), sertoli cells fail to form. The germ cells become primordial follicles, granulosa cells proliferate and an ovary develops [6]. A unilateral defect at any point in this process could potentially prevent ovarian formation [3].

In this paper, we present a patient with Mullerian anomalies consisting of a uterine septum and a hypoplastic fallopian tube in addition to ipsilateral ovarian agenesis. To the best of our knowledge, this is the first report of such a confluence of anomalies. IRB approval was obtained prior to submission of this case report.

Case report

A 24-year-old nulligravida presented at the Infertility Clinic, King/Drew Medical Center, Los Angeles, California, with a 3-year history of primary infertility. Her medical history was significant for a Chlamydia infection treated 3 years prior to presentation, she had no past surgical history, regular monthly menses and no complaints of dysmenorrhea or dysparunia. The patient was born to unrelated parents and was the product of a full-term uneventful pregnancy. Her growth pattern during childhood and adolescence was unremarkable. She denied history of maternal drug use, exposure to toxic materials in utero or any unusual childhood illness. A general physical examination was non-extraordinary. On pelvic exam, a single, grossly normal cervix, a small anteverted uterus, and no adnexal masses were noted. Transvaginal ultrasound demonstrated an 8 cm uterus with two distinct endometrial linings and one uterine body. A normal right ovary was identified, the left ovary was not visualized. Hysterosalpingography also illustrated two endometrial cavities as well as a hydrosalpinx on the right and non-opacification of the left tube. Intravenous pyelography confirmed normal bilateral kidneys and ureters. Lastly, magnetic resonance imaging demonstrated a septum within the uterus extending down to the cervix, an external fundal indentation, and a normal right ovary. The left ovary was not visualized.

Imaging results, as well as treatment options including IVF and surgery were discussed with the patient. In consideration of her limited financial resources, desire for multiple future pregnancies and long standing infertility; we decided that the best approach would be to surgically repair her tubal occlusion as well as normalize her anatomy with regards to the uterine septum.

Laparoscopy revealed a single, normal-sized uterus with a small fundal indentation. The right fallopian tube was normal in length, but clubbed and distended at the distal end. This hydrosalpinx was consistent with her history of prior Chyladmial infection. The right ovary appeared normal. The left fallopian tube was normal in origin and diameter, but only 3 cm in length with a tapered, non-fimbriated distal end (Fig. 1). The left ovary was absent. Despite a vigilant search, no ovarian remnant, pedicle or utero-ovarian ligament was identified.

A hysteroscopic metroplasty was attempted. However, due to technical difficulties with the hysteroscopic equipment, the case was converted to laparotomy. A Tompkins metroplasty was performed without incident followed by a cuff neosalpingostomy of the right tube. The laporotomy afforded us the opportunity to palpate the left ovarian fossa and overlying omentum. Still, no ovarian remnant or hint of an ovarian pedicle was identified.

Three months post-operatively, the patient conceived spontaneously. Her prenatal course was uneventful and resulted in the uncomplicated Cesarean delivery of a healthy infant.

Discussion

The anomalies identified in our patient are seen with varying frequency as isolated incidents. Septate uteri occur with a reported incidence of 1:200 to 1:600 [7]. Fallopian tube hypoplasia and unilateral ovarian agenesis appear in the literature mostly as case reports [8–10], thus their incidence is very difficult to estimate; however, Sivanesaratnam has reported an incidence of 1/24,000 in his review of the literature [11]. Suffice it to say, the combination of a septate uterus, unilateral hypoplastic oviduct, and ipsilateral ovarian absence is exceedingly rare and, to the best of our knowledge, has not previously been reported.

We entertained two possible theories to explain our findings. First, adenexal torsion with profound ovarian hypoxia leading to cell death and subsequent adnexal

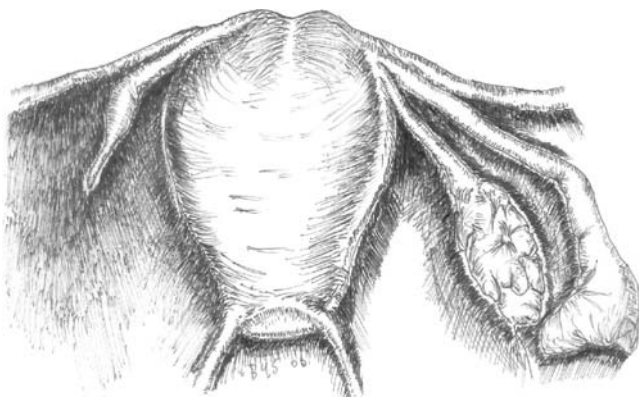

Fig. 1 Posterior view of the uterus demonstrating subtle indentation in the fundus, absence of the left ovary, hypoplasia of the left fallopian tube and a right hydrosalpinx

degeneration [12, 13] could have occurred in this patient with an independent Mullerian anomaly (septate uterus). In fact, torsion has been reported as the cause of many ovarian oddities, including abnormally positioned and parasitic ovaries, which sit above the pelvic brim [14].

While this scenario seems plausible, we have no evidence of its occurrence. The patient denied any history of unexplained abdominal pain, which would be consistent with torsion and had never undergone surgery. While torsion can be asymptomatic or occur at a very young age, even in utero, one would normally expect to find some evidence of the former adnexa during laparotomy. This patient had none.

Our second scenario proposes that the confluence of septate uterus, left fallopian tube hypoplasia, and ipsilateral ovarian agenesis occurred as unique events during genital tract formation in the early weeks of organogenesis. Separately, the events leading to these findings are relatively well understood; however, a unifying theory to explain why they all occurred at the same time is pure speculation. With this in mind, it has been proposed that a unilateral defect in the development of the urogenital ridge could have profound ramifications on the future gonad which would sit upon it. Due to the physical proximity of the distal fallopian tube to that region, one could speculate that the improper development of the urogenital ridge could also affect development of the oviduct in that region. In this patient, we propose that the above occurred in someone who independently developed a septate uterus.

There is no way to know, in this patient, what caused her unique anatomical findings. It is our hope, however, that the reporting of this case along with the existing literature will help to shed some light on female reproductive development and the anomalies which go along with it.

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