CASE REPORT

Bilateral recurrent pyosalpinx in a sexually inactive 12-year-old girl secondary to rare variant of Mullerian duct anomaly

Tareq Maraqa, Mohamed Mohamed, Daniel Coffey, Gul R Sachwani-Daswani, Crystal Alvarez, Leo Mercer

Department of Trauma, Hurley Medical Center, Flint, Michigan, USA

Correspondence to

Tareq Maraqa,
tmaraqa1@hurleymc.com

Accepted 24 May 2017

SUMMARY

Pyosalpinx is a severe sequel of chronic pelvic inflammatory disease, whereby the fallopian tubes become filled with pus.^{1,2} Pyosalpinx often affects sexually active women and rarely is seen in celibate adolescent girls.³ We report a case of a 12-year-old girl with no prior sexual history who presented to our emergency department with complaints of severe right lower quadrant pain of 1-day duration. Ultrasonography and CT scan of the abdomen and pelvis revealed free fluid collections in the pelvis without visualisation of the appendix. A preoperative diagnosis of acute ruptured appendicitis was given and she was taken to the operating room. Peroperative findings included bilaterally distended, pus-filled pyosalpinges. A definitive diagnosis of bilateral pyosalpinx was then made. Two-week antibiotic therapy was successful but the patient returned with recurrent pyosalpinx and a pelvic abscess 9 weeks later.

BACKGROUND

Pelvic inflammatory disease (PID) in sexually inactive girls is rare, even rarer to have salpingitis leading to pyosalpinx. This pathology is usually unilateral and bilateral pyosalpinx is rare.

The complications of such infection can lead to various long-term reproductive and gynaecological complications. Early diagnosis and treatment is the key to reduce lifelong complications. The wide range of the presenting symptoms of PID makes it easily missed, high index of suspicion should be maintained for early diagnosis.

CASE PRESENTATION

A 12-year-old sexually inactive girl with past histories of recurrent irritable bowel syndrome, urinary tract infections (UTI) and tonsillectomy presented to our emergency service on day 1 into her menses with severe right lower quadrant (RLQ) pain of 1-day duration. This pain was of gradual onset, rapidly became severe in intensity (rated at 10/10 on numerical pain scale) and generalised over the abdomen; associated with fever and nausea. She denied vomiting, diarrhoea, urinary symptoms, vaginal discharge or sexual abuse. She was administered acetaminophen and ibuprofen for her pain at

home by her mother without a significant improvement.

INVESTIGATIONS

On examination, she appeared distressed secondary to the pain. Vital signs revealed a temperature of 38.6°C; heart rate of 143 bpm; blood pressure 105/67 mm Hg; respiratory rate 24 breaths/min; oxygen saturation on pulse oximetry (SpO₂) 98%; and a body mass index of 39.5 kg/m². Abdominal examination revealed guarding, rigidity and tenderness in the RLQ of the abdomen. Bowel sounds were normal. Laboratory investigations revealed leukocytes at 11 100 cell/μL, haemoglobin (Hb) of 11.6 g/dL, C-reactive protein >20 mg/dL, random blood sugar of 118 mg/dL and Hb-A1c of 6.3%. Urine pregnancy test was negative. Urine analysis revealed a red blood cell (RBC) count of 70–90/hpf, white blood cell count of 70–90/hpf, 1+ bacteria, 2+ ketones and protein, and 3+ for leucocyte esterase. PCR was negative for gonococcal infection and *Chlamydia trachomatis*. Abdominal and pelvic ultrasonography revealed mild free fluid in the cul-de-sac but was otherwise unremarkable. CT scan of the abdomen and pelvis with contrast revealed thickening of multiple small bowel loops in the pelvis, likely involving the distal ileum, with extensive surrounding fat stranding; minimal free fluid in the perihepatic region and bilateral paracolic gutters; a peripherally enhancing fluid collection measuring 5.3×4.8×4.4 cm in the cul-de-sac suspicious for an abscess; and numerous enlarged mesenteric lymph nodes (figure 1A,B). The appendix was not visualised on the CT.

DIFFERENTIAL DIAGNOSIS

Based on the history and CT findings, the patient was provisionally diagnosed with peritonitis secondary to ruptured appendicitis.

TREATMENT

The patient underwent a diagnostic laparoscopy where a significant intra-abdominal purulence, interloop abscesses and adhesions involving the small and large bowels and distal omentum were found. Because of these findings the procedure was converted to a celiotomy. The appendix was located and despite a normal gross appearance, a clinical decision was made to perform an appendectomy.

CrossMark

To cite: Maraqa T, Mohamed M, Coffey D, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2016-218924

Figure 1 (A) CT scan image showing fluid in the pelvis. The arrow points to a fluid-filled structure, later identified as the left fallopian tube. (B) Coronal CT scan image showing (hollow arrow) a fluid-filled structure later identified as the fallopian tube and (solid arrow) fluid in the pelvis.

Both fallopian tubes were identified with observation of bilateral hyperaemia and distention suggestive of an inflammatory process, with the left tube appearing more hyperaemic and distended than the right fallopian tube (figure 2). Both ovaries were grossly normal. Intraoperative gynaecological consultation was sought confirming the diagnosis of bilateral pyosalpinx. Cultures were obtained and the abdomen was copiously irrigated with warm sterile saline. Postoperatively, culture and sensitivity results were positive for *Peptostreptococcus anaerobius*, *Prevotella bivia* (formerly *Bacteroides bivius*) and *Streptococcus anginosus*. Histopathological examination of the appendix revealed microscopic inflammation. According to the recommendations of the gynaecologist, the patient was placed on intravenous (IV) antibiotics immediately after the surgery. She was on doxycycline 100 mg IV every 12 hours for 6 days and cefoxitin 2 g IV every 12 hours for 3 days then altered to cefoxitin 2 g IV every 6 hours for another 3 days. Then she was on oral course of doxycycline capsules 100 mg every 12 hours for 4 days and metronidazole tablet 500 mg every 8 hours for 5 days. On discharge, doxycycline capsules 100 mg every 12 hours were prescribed for 1 week.

OUTCOME AND FOLLOW-UP

She was discharged on postoperative day 9 in stable condition. She continued to follow-up in the surgical clinic for 3 weeks after

Figure 2 Intraoperative photo showing the left and right fallopian tubes measuring approximately 6 cm in length, inflamed and filled with purulence.

Figure 3 Coronal CT scan image showing (orange arrow) fluid collection in the pelvic with 5.5×12.5×8.1 cm and (blue arrow) a dilated fallopian tube filled with fluid.

the discharge and she was doing well. The patient returned to our emergency department 9 weeks after her discharge with RLQ pain, loss of appetite, nausea and fever for 1-day duration. Her last menstrual period was 6 days before presentation and lasted for 4 days. She denied using tampons, douching or ever having anything in her vagina. Her mother gave her acetaminophen for fever. Her vital signs revealed a temperature of 37.6°C; heart rate of 152 bpm; blood pressure 90/64 mm Hg; respiratory rate 21 breaths/min; and SpO₂ of 98%. A CT scan of the abdomen and pelvis revealed a focal collection within the pelvis measuring 5.5×12.5×8.1 cm situated in the midline just cephalad to the uterus, a tubular structure visualised within the right and left lower abdomen and pelvis ends blindly with peripheral enhancing wall with a maximum diameter of about 3.8 cm most consistent with a dilated fallopian tube, abnormal appearance of the vagina which is distended and fluid filled, and there was also a focal multiloculated collection visualised within the pelvis in cul-de-sac measuring about 7×6 cm (figure 3). Her leukocytes were 30 700 cell/μL and Hb was 12.1 g/dL. She was diagnosed with tubo-ovarian abscess (TOA) and pelvic abscesses with septic shock. She was transferred to another hospital by ambulance because of the absence of paediatric surgeon in our facility. She was given 3 L of normal saline (N/S) 0.9% during transfer. On arrival to the referred hospital, her vitals revealed a temperature of 38.1°C; heart rate of 125 bpm; blood pressure 92/54 mm Hg; respiratory rate 34 breaths/min; and SpO₂ of 98%. She was admitted to the paediatric intensive care unit. She received 1 unit of packed RBCs as her Hb dropped to 8.4 g/dL, N/S and epinephrine and norepinephrine infusion for 3 days and then weaned off. She was also on piperacillin/tazobactam (Zosyn) 4.5 g IV every 8 hours for 1 day then the dose was adjusted to 2.25 g for another 7 days, vancomycin 1500 mg IV every 6 hours for 1 day then adjusted to 1000 mg every 8 hours for another 2 days, and doxycycline 100 mg IV every 12 hours for 8 days. The patient was intubated in the same day of admission because of respiratory failure. She was on mechanical ventilation for 2 days then extubated and continued on oxygen via

nasal cannula, 1.5 L/min for another day. Also on the same day of admission, she underwent percutaneous abscess drainage by interventional radiologist. The radiologist used an abdominal catheter which drained about 300 mL of purulent fluid and transrectal catheter to drain the cul-de-sac which drained about 100 mL. The fluid was sent for culture and sensitivity, the pelvic fluid revealed *Citrobacter* 'sensitive to piperacillin/tazobactam' and *Bacteroides ovatus* and *uniformis*. Vaginal culture revealed *S. anginosus*. The drained abdominal fluid did not show any organisms in the Gram stain or culture. Chlamydia, gonorrhoea and trichomonas tests were negative. Blood and urine cultures were negative. Day 2 of admission was complicated by an acute kidney injury (AKI), with an elevated serum creatinine of 1.9 mg/dL, and an acute haemodialysis catheter was inserted in the left femoral vein. She was on continuous renal replacement therapy for less than 1 day to treat AKI, fluid overload and vancomycin toxicity. With regard to the aetiology of her recurrent PID and TOA, the gynaecologist suggested that obstructed hemivagina due to Mullerian duct anomaly 'based on a distended vagina measuring about 6 cm in diameter filled with fluid on the CT scan done on her presentation' can be the cause of retrograde menstruation. The gynaecologist initiated continuous oral contraceptive pills for hormonal suppression. She was discharged after 8 days in a good condition.

DISCUSSION

Pyosalpinx in non-sexually active adolescent girls is very rare.³ The term PID includes a spectrum of inflammatory disorders of the upper female genital tract. This spectrum includes endometritis, salpingitis, TOA and pelvic peritonitis.⁴ PID represents the most common gynaecological disorder necessitating hospitalisation in female patients of reproductive age in the USA.⁴

Infection may include either part of, or the entire genital tract.⁵ Specifically, salpingitis may occur as a result of ascending vaginal infection, haematogenous and lymphatic spread, or transmural migration of bacteria from the gut.⁶ The resulting purulent material may spill from the fallopian tubes into the uterus or nearby peritoneum, and ultimately adhesion formation develops occluding the fallopian tubes and resulting in pus-filled salpinges (pyosalpinx).⁷ As such, pyosalpinx represents a severe sequel of salpingitis. It is apparent that pyosalpinx may further progress into a TOA, thus pyosalpinx may be considered as an intermediary stage, being a more severe form of salpingitis and a less severe form of TOA. This was highlighted in a recent study by Kim *et al* comparing pyosalpinx and TOA. This study also showed pyosalpinx is likely to occur with a decreased C-reactive protein level, mass size, hospital stay duration and frequency of invasive procedures when compared with TOA.⁷ In our case, the patient had a complicated pyosalpinx. The spillage of pus from the fallopian tubes into the abdomen led to peritonitis and pelvic abscess formation.

Polymicrobial infection with mixed aerobic and anaerobic organisms is usually the culprit in PID.^{8,9} In sexually active women, *Neisseria gonorrhoea* and *C. trachomatis* are considered the two most common causative organisms, and are involved in one half to two-thirds of patients with PID.² Because of the rarity of PID in sexually inactive women, there is no specific information about the causative organisms. Based on our literature review, the most commonly encountered bacteria in such patients and younger than 18 years of age appear to be *Escherichia coli* and *Streptococcus pneumoniae*, followed by *Pseudomonas aeruginosa*, *S. pyogenes*, *Fusobacterium nucleatum* and other various non-specified organisms (table 1).

We did not encounter any reports of young girls with salpingitis and with *S. anginosus* involved; a normal flora of the mouth, gastrointestinal and genitourinary tract which can cause severe invasive and purulent infections.¹⁰ To the best of our knowledge, this makes our case the first to be reported involving *S. anginosus*.

The genital tract of the prepubescent child is different from that of a woman of reproductive age. Unlike the normal acidic pH of the adult female vagina, the pH of the premenarchal vagina is neutral.¹¹ This creates an environment that may facilitate overgrowth of the normal vaginal flora (*E. coli*, *Gardnerella vaginalis*, *Staphylococci*, *Streptococci*, and so on). In addition, it lacks the vaginal antibodies that may appear later in life.¹¹ These two factors may increase the susceptibility for vaginal infection in children.

Risk factors for PID and hence salpingitis include obesity, poor hygiene, diabetes, bacterial vaginosis, cervical surgical instrumentation, sexual abuse, multiple sexual partners, previous history of PID and appendicitis.^{2,12} Moreover, urogenital malformations and Hirschsprung's disease have been reported to be present in association with pyosalpinx.^{3,5} Based on our literatures review, it appears that sexual activity represents the most important risk factor for salpingitis. Further, a sexually active 15-year-old girl has 10 times more likelihood of developing salpingitis compared with a 25-year-old woman.¹¹ We suggest that although the premenarchal vagina is relatively more susceptible to infection, PID is rarely seen in children due to the overall decreased exposure to risk factors, mainly sexual activity, when compared with adults. As mentioned earlier, salpingitis may occur as a result of ascending vaginal infection. We believe that our patient had recurrent pyosalpinx due to ascending vaginal infection as the second CT scan revealed a collection of fluid in the dilated vagina and the vaginal culture revealed *S. anginosus* which was cultured from the abdominal fluid of the first pyosalpinx attack. Obesity is another contributing factor, as it physically constrains the person making personal hygiene and cleanliness difficult.¹³

In general, the clinical presentation of PID widely varies. Many women experience non-specific symptoms or may be asymptomatic.⁸ The most common symptom in PID is lower abdominal pain which is usually bilateral. Other symptoms include abnormal vaginal discharge, irregular bleeding, fever, nausea and vomiting.² The presentation may mimic acute appendicitis, UTI, irritable bowel syndrome, gastroenteritis, functional abdominal pain of unknown origin or a plethora of gynaecological conditions.² In adolescents, symptoms are usually similar to adults, and frequently occur at the end of menses.¹² Specifically, patients with pyosalpinx usually present with pelvic pain, fever and a palpable pelvic mass on bimanual examination. When the right-sided fallopian tube is affected, many of the signs mimic those of acute appendicitis.¹ In our case, recurrent attacks of lower abdominal pain were present, with history of irritable bowel syndrome and recurrent UTIs. Further, the patient presented with acute appendicitis. It is tempting to hypothesise that one or more of her prior attacks could have resulted from undiagnosed milder forms of PID which eventually may have resulted in chronicity and development of pyosalpinx later on. This is however unproven.

Because of the variations in presentation, diagnosis of PID is difficult and often easily missed.⁸ Further, the diagnosis is more challenging in children due to rarity of the condition, which is usually delayed until the time of surgical exploration for presumed appendicitis.^{9,12} Laparoscopy represents the gold standard for the diagnosis of salpingitis, pyosalpinx and TOA.^{2,11} A recent study demonstrated the ability of abdominal ultrasound

Table 1 Documented cases of pyosalpinx that occurred in girls under 18 years old without history of sexual activity or abuse. The culture result in the first case in the table may represent *Neisseria gonococci*

Author (publication year)	Patient age (years)	Symptoms	Comorbidities	Imaging	Culture results	Inflamed Fallopian tubes
Burke (1926) ¹⁶	5	Right-sided abdominal pain, vaginal discharge, fever, constipation	Measles 2 months prior	None	Unspecified Gram-negative diplococci	Bilateral
Claireaux and Farquhar (1949) ¹⁷	Newborn	Abdominal distension, vaginal discharge	Mother had infectious hepatitis during pregnancy	None	Haemolytic streptococcus non-group A	Right
Fisher (1967) ¹⁸	3	Acute abdomen	Virilising adrenocortical hyperplasia, under steroid therapy, varicella 2 weeks prior	None	<i>Pseudomonas aeruginosa</i>	Left
Touloukian (1974) ¹⁹	6	Lower abdominal pain, fever, bile-stained vomiting and vaginal discharge	Cerebral palsy, urine and stool incontinence	None	<i>Escherichia coli</i>	Right
Meis <i>et al</i> (1993) ²⁰	4	Upper abdominal pain, nausea, vomiting.	Laparotomy and ileal resection and anastomosis (trauma)	Abdominal X-ray	<i>Streptococcus pneumoniae</i>	Right
Brown-Harrison <i>et al</i> (1995) ²¹	3.5	Emesis, diarrhoea, fever, tender abdomen	None	Abdominal ultrasound	<i>Streptococcus pyogenes</i>	Bilateral
Sirotnak <i>et al</i> (1996) ²²	8	Abdominal pain, nausea, emesis, fever	None	Abdominal ultrasound	<i>S. pneumoniae</i>	Right
	12	RLQ abdominal pain, emesis	None	Abdominal ultrasound	<i>S. pneumoniae</i>	Right
	12	Bilateral lower abdominal pain, difficulty breathing, menstruation	None	None	<i>S. pneumoniae</i>	Bilateral
Habek <i>et al</i> (2002) ¹¹	9	Lower abdominal pain, diarrhoea, nausea, vaginal discharge	None	None	<i>E. coli</i>	Right
Algren and Strickland (2005) ¹²	14	Lower abdominal pain, fever, dysuria, night sweats, nausea, vomiting, diarrhoea	None	Abdominal ultrasound, abdominal CT	Streptococcus group F, <i>Fusobacterium nucleatum</i>	Right
Lerand and Jay (2007) ²³	12	General abdominal pain, fever	Obesity (BMI 31.9), type II diabetes, UTIs, constipation	Abdominal CT	<i>E. coli</i>	Bilateral
	16	RLQ abdominal pain, suprapubic pain, fever, chills, anorexia	<i>Candida vaginitis</i> , Crohn's disease	Abdominal CT	<i>E. coli</i>	Bilateral
van der Putten <i>et al</i> (2008) ⁶	11	Abdominal pain, nausea, fever	None	None	<i>S. pneumoniae</i>	Right
Singh-Ranger <i>et al</i> (2008) ¹⁴	17	Lower abdominal pain, back pain, appetite loss, rigours	Appendectomy	Abdominal CT	<i>E. coli</i>	Bilateral
Homemann <i>et al</i> (2009) ²⁴	13	RLQ pain, fever	None	Abdominal ultrasound	<i>E. coli</i>	Right
Desai and Ward (2011) ²⁵	12	Bilateral and suprapubic abdominal pain, fever, emesis, vaginal discharge	Hirschsprung's disease (colectomy), appendectomy, tonsillectomy	Abdominal CT	NA	Bilateral
Moralioğlu <i>et al</i> (2013) ³	14	Abdominal pain, vomiting, fever	Anal atresia with rectovestibular fistula, sigmoidectomy, uterus bicornis unicollis, septate vagina	Abdominal ultrasound, abdominal CT	<i>E. coli</i>	Right
Kielly and Jamieson (2014) ⁴	11	RLQ abdominal pain radiating throughout abdomen, nausea, emesis	Constipation, encopresis	Abdominal ultrasound	Unspecified	Right
	15	General malaise, RLQ abdominal pain	None	Abdominal radiography, ultrasound and CT	Unspecified	Unspecified
Schmiege <i>et al</i> (2014) ⁵	12	Lower abdominal pain, nausea, vomiting.	Appendectomy	Abdominal ultrasound, abdominal MRI	<i>E. coli</i>	Bilateral
Maraqa <i>et al</i> (2017)	12	Lower abdominal pain, fever, nausea	Obesity (BMI 39.5), UTIs, IBS, dilated vagina (Mullerian duct anomaly)	Abdominal ultrasound, abdominal CT	<i>Streptococcus anginosus</i> , <i>Peptostreptococcus anaerobius</i> , <i>Prevotella bivia</i>	Bilateral

BMI, body mass index; IBS, irritable bowel syndrome; NA, not applicable; RLQ, right lower quadrant; UTI, urinary tract infection.

and CT scan to confirm the diagnosis of pyosalpinx. Ultrasound confirms the diagnosis when a tubular structure filled with debris and fluid layerings are observed. CT scan usually reveals a tubular juxtauterine mass with complex internal fluid and thick enhancing walls.⁷ There are no specific indications for using transvaginal sonography or MRI techniques; however, utilisation of such modalities may also reveal thickened, fluid-filled tubes in cases of pyosalpinx.⁸

Treatment of pyosalpinx varies from conservative management with IV antibiotic to laparoscopic aspiration, image-guided aspiration or drainage, laparoscopic salpingostomy with saline irrigation, or salpingectomy.¹ In more than 75% of patients, antibiotics may solely be sufficient for treating pyosalpinx.⁹ In our case, despite the surgery encountered for the initially presumed appendicitis in the first attack, irrigation and drainage of the abdomen and pelvis in addition to IV and oral antibiotics were sufficient for complete resolution without the need for salpingostomy or salpingectomy. A randomised clinical trial in 2008 demonstrated that vaginal sonographic drainage with IV antibiotics resolved symptoms quicker than IV antibiotics alone, and also resulted in a decreased length of hospital stay.¹⁴ Pyosalpinx is less likely to require surgical intervention in comparison with TOA. In premenopausal women, salpingectomy is only reserved in cases of severe tube damage and gangrene.¹

Salpingitis in adolescents may lead to long-term consequences. Formed pelvic adhesions may cause chronic pelvic pain, infertility (from distorted fallopian tubes) and increase risk of ectopic pregnancy. Further, complication rates are usually higher when infection occurs at younger ages.^{4 6 14} One episode of salpingitis may lead to infertility in up to 15% of cases which may increase to 50% after the third episode.⁶ The tubal function may be assessed by salpingography and/or salpingoscopy. A 'cobblestone' appearance of the tubal mucosa suggests patchy loss and damage to ciliated mucosa.¹⁴ Our patient experienced TOA after her recurrent attack of PID, which was further complicated by septic shock and AKI. Up to one-third of hospitalised patients with PID develop TOA, which represents the most serious form of PID.¹⁵ Rupture of the abscess can be fatal as high as 5%–10% of cases even with advanced treatment and surgical intervention.¹⁵ Immediate and aggressive treatment can lead to the favourable outcome.

Learning points

- A low threshold for suspicion of pelvic inflammatory disease is required to avoid such drastic complications, especially in non-sexually active younger women.
- Imaging modalities such as ultrasound and CT can aid in making the diagnosis of pyosalpinx.
- Early pyosalpinx can be treated successfully with adequate antibiotic coverage.
- Pyosalpinx when associated with an adjacent abscess usually requires percutaneous or surgical intervention.

Contributors TM, DC, MM and GRS-D provided critical input on the conception, design and revision of the manuscript. MM and GRS-D are contributed in writing the manuscript. LM and CA were the operating surgeons and also provided critical revisions for the submission of the manuscript.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

© BMJ Publishing Group Ltd (unless otherwise stated in the text of the article) 2017. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES

- 1 Agbor VN, Njim T, Aminde LN. Pyosalpinx causing acute appendicitis in a 32-year-old cameroonian female: a case report. *BMC Res Notes* 2016;9:368.
- 2 Khan ZE, Rizvi JH. Pelvic inflammatory disease and pelvic abscesses. *Reviews in Gynaecological and Perinatal Practice* 2006;6:185–91.
- 3 Moralioglu S, Ozen IO, Demirogullari B, et al. Pyosalpinx and Hydrosalpinx in vaginal adolescents: report of two cases. *J Pediatr Surg* 2014;49:257–9.
- 4 Kielly M, Jamieson MA. Pelvic inflammatory disease in vaginal adolescent females without tubo-ovarian abscess. *J Pediatr Adolesc Gynecol* 2014;27:e5–e7.
- 5 Schmieg C, Ebert M, Reingruber B, et al. Bilateral pyosalpinx as a rare cause of pelvic cystic lesions in a 12-year old girl- abstract. *J Pediatr Surg* 2014;49:34–8.
- 6 van der Putten ME, Engel M, van Well GT. Salpingitis. A rare cause of acute abdomen in a sexually inactive girl: a case report. *Cases J* 2008;1:326.
- 7 Kim HY, Yang JI, Moon C. Comparison of severe pelvic inflammatory disease, pyosalpinx and tubo-ovarian abscess. *J Obstet Gynaecol Res* 2015;41:742–6.
- 8 Pelvic inflammatory disease [Internet]. 2015 <http://www.cdc.gov/std/tg2015/pid.htm>
- 9 Ashrafganjooei T, Hariri I, Iravanlo G. Tubo-ovarian abscess in a virgin girl. *Iran J Reprod Med* 2011;9:247–50.
- 10 Junckerstorff RK, Robinson JO, Murray RJ. Invasive *Streptococcus anginosus* group infection-does the species predict the outcome? *Int J Infect Dis* 2014;18:38–40.
- 11 Habek D, Vranko Nagy N, Sklebar I, et al. Rupture of coliform pyosalpinx in a nine-year old girl. *Zentralbl Gynakol* 2002;124:220–2.
- 12 Algren SD, Strickland JL. Beta hemolytic *Streptococcus* group f causing pelvic inflammatory disease in a 14-year-old girl. *J Pediatr Adolesc Gynecol* 2005;18:117–9.
- 13 Dixon JB. The effect of obesity on health outcomes. *Mol Cell Endocrinol* 2010;316:104–8.
- 14 Singh-Ranger D, Sanusi A, Hamo I. Coliform pyosalpinx as a rare complication of appendicectomy: a case report and review of the literature on best practice. *J Med Case Rep* 2008;2:97.
- 15 Sordia-Hernández LH, Serrano Castro LG, Sordia-Piñeyro MO, et al. Comparative study of the clinical features of patients with a tubo-ovarian abscess and patients with severe pelvic inflammatory disease. *Int J Gynaecol Obstet* 2016;132:17–19.
- 16 Burke GR. Double pyosalpinx in a child, aged five years. *JAMA* 1926;87:31.
- 17 Claireaux AE, Farquhar JW. A case of pyosalpinx in a newborn infant. *Arch Dis Child* 1949;24:62–6.
- 18 Cloud DT. *Pseudomonas* pyosalpinx: report of its occurrence in a child with adrenogenital syndrome who recently recovered from varicella. *J Pediatr Surg* 1967;2:599.
- 19 Touloukian RJ. Acute coliform salpingitis in a premenstrual child with severe vulvovaginitis. *J Pediatr* 1974;85:281.
- 20 Meis JF, Festen C, Hoogkamp-Korstanje JA. Pyosalpinx caused by *Streptococcus pneumoniae* in a young girl. *Pediatr Infect Dis J* 1993;12:539–40.
- 21 Brown-Harrison MC, Christenson JC, Harrison AM, et al. Group A streptococcal salpingitis in a prepubertal girl. *Clin Pediatr* 1995;34:556–8.
- 22 Sirotak AP, Eppes SC, Klein JD. Tuboovarian abscess and peritonitis caused by *Streptococcus pneumoniae* serotype 1 in young girls. *Clin Infect Dis* 1996;22:993–6.
- 23 Lerand SJ, Jay MS. Tubo-Ovarian abscess in vaginal adolescents: look for underlying etiology. *J Pediatr Adolesc Gynecol* 2007;20:S127.
- 24 Hornemann A, von Koschitzky H, Bohlmann MK, et al. Isolated pyosalpinx in a 13-year-old virgin. *Fertil Steril* 2009;91:2732.e9–2732.e10.
- 25 Desai B, Ward T. Bilateral pyosalpinx in a peripubescent female with Hirschsprung's disease: a case report. *Int J Emerg Med* 2011;4:64.

Copyright 2017 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow