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Salmonella Prostatitis: A Review and Update

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Abstract

Salmonella prostatitis is an extremely rare bacterial infection that has tended to be reported sporadically. There are many sub-types of Salmonella bacteria. Salmonella infection is a common infection that tends to affect the gastrointestinal tract but on rare occasions Salmonella infection does affect other organs. Some of the Salmonella species that had been isolated in some cases of Salmonella prostatitis have included: Salmonella typhimurium, Salmonella St Paul, Salmonella enteritidis, Salmonella panama, and Salmonella para-typhoid. Nevertheless, the common organisms that tend to be cultured in majority of cases of bacterial prostatitis tend to include: Escherichia coli, Klebsiella spp, Proteus spp, Enterococci spp, and Pseudomonas. Manifestations of Salmonella prostatitis tend to be non-specific that could include: fever. perineal pain / discomfort, suprapubic discomfort / pain, voiding difficulties, symptoms and signs suggestive of urinary tract infection. There may or may not be a history of recent diarrhoea, homosexuality, or immunodeficiency or spinal cord injury with voiding dysfunction and undertaking of clean intermittent self-urethral catheterisation. Clinical examination does tend to demonstrate tenderness in the prostate upon digital rectal examination but in cases of spinal cord injury there may be no evidence of tenderness upon rectal examination but only symptoms of urinary tract infections. Apart from the history and clinical signs, bacteriology examination tends to be the cornerstone of establishing a diagnosis of Salmonella prostatitis. The most often utilized way of establishing the diagnosis of Salmonella prostatitis does entail obtaining urine specimens before and pursuant to prostatic massage for microbiology examination (two-glass test). Nevertheless the undertaking of prostate massage is usually contraindicated in cases of acute prostatitis in view of the risk of causing severe pain as well as bacterial dissemination / bacteraemia. These risks could be avoided by examination of an ejaculate sample of semen instead of a post-prostatic massage specimen. The alternative two-glass test has been documented to be more sensitive in comparison with the standard one. In some cases the serum PSA levels would tend to be raised, nevertheless, the serum PSA levels are neither positive or specific to confirm a diagnosis of Salmonella prostatitis. Radiology imaging including contrast-enhanced (a) ultrasound scan, (b) computed tomography (CT) scan, and (c) magnetic resonance imaging (MRI) scan would tend to show contrast-enhancing areas within the prostate but these would not be specific to diagnose Salmonella prostatitis but if the radiology imaging does show that, the prostatitis has been complicated by the development of prostatic abscess then the undertaking of radiology image-guided aspiration of the abscess would lead to confirmation of the diagnosis based upon the bacteriological culture of Salmonella from the specimen of the pus as well as the aspiration of the pus would form part of the treatment. Following early diagnosis and utilization of appropriate antibiotic treatment, the outcome of Salmonella prostatitis tends to be good; nevertheless, a high index of suspicion is required in order to undertake a two-glass test or to obtain post-ejaculate semen specimen for bacteriology culture which would enable early diagnosis of Salmonella prostatitis. Some patients who had Salmonella prostatitis had been treated in the past with trimethoprim-sulfamethoxazole or nalidixic acid successfully for 3 to 7 weeks and they became asymptomatic without any subsequent development of recurrences but it is worth noting that Salmonella organisms have developed resistance to some antibiotics with time. The addition of an alpha-blocker (tamsulosin / alfuzosin) to the antibiotic treatment for prostatitis has been documented to significantly ameliorate the clinical and microbiological outcomes as well as lower the incidence of recurrence. The assessment of the successfulness of the treatment tends to be based upon the subsidence of the symptoms in view of the fact that there is no globally accepted validated test of cure for bacterial prostatitis and resolution of symptoms and negative bacterial culture of seminal ejaculate tends to provide evidence of resolution of the infection.

Keywords: Salmonella Prostatitis, Perineal Pain, Dysuria, Frequency, Ejaculate, Semen, Prostatic Massage, Bacteriology Culture, Ciprofloxacin, Levofloxacin

Introduction

Prostatitis is a terminology that is utilized for inflammation of the prostate gland which is a common urological disorder which urologists encounter. The prevalence of prostatitis has been documented to range between 2% and 10% [1,2]. It has been iterated that bacterial infections of the prostate gland do tend to amount to only about 10% of all cases of prostatitis [1,3]. It has additionally been documented that with regard men to who have been afflicted with spinal cord injury (SCI), the rate of bacterial infection of the prostate gland does seem to be much higher with an infection rate of 33.3% [1,4]. It has additionally been

iterated that there are so far no epidemiological reports related to the incidence or prevalence of bacterial prostatitis in men who are affected by spinal cord injury (SCI) [1]. It has been iterated that the bacteria that have been most commonly isolated with regard to cases of acute prostatitis and chronic prostatitis do include: Escherichia coli, Klebsiella spp., Enterococci spp., and pseudomonas aeruginosa [1, 5-7]. The manifestations of cases of prostatitis tend to be similar therefore, there is no way a clinician would be initially aware based upon the clinical features of a case of prostatitis which organism is causing the symptoms and the diagnosis tends to be ascertained based upon the microbiology culture results of specimens of ejaculated sperm/semen, urine specimen, and specimen of aspirated prostatic abscess have been obtained. Salmonella prostatitis is a very uncommon type of prostatitis which could be associated with a history of prior diarrhoeal / gastro-enteritis type symptoms in the recent past or contemporaneously, and in other occasions there would tend not to be any history of diarrhoea or gastro-enteritis type symptoms. A high index of suspicion would be required in order to suspect a diagnosis of Salmonella prostatitis.

Aim

To review and update the literature on Salmonella prostatitis.

Method

Internet data bases were search including Google; Google Scholar; Yahoo; Bing; and PUBMED. The search words that were used included: Salmonella prostatitis, Salmonella infection of prostate, Prostate infection by Salmonella. Thirty two references were identified which were used to write the article that has been divided into two parts: (A) Overview, and (B) Miscellaneous narrations and discussions from some case reports, case series and some studies related to Salmonella infections of the prostate gland.

Review and Update of Literature

[A] Overview

Definition / General Comments

- Prostatitis is a terminology that is utilized for inflammation of the prostate gland and prostatitis could be acute prostatitis or chronic prostatitis
- Prostatitis does include acute bacterial prostatitis, chronic bacterial prostatitis, chronic prostatitis / chronic pelvic syndrome, and granulomatous prostatitis [8].
- Different types of bacteria have been cultured in cases of acute prostatitis.

Essential Features

- It has been advised that prostatitis should not be diagnosed based upon needle biopsy of the prostate gland alone [8].
- It has been iterated that clinical diagnosis of prostatitis is based upon quantitative bacterial cultures as well as microscopic examination of fractionated urine specimens including the first 10 millilitres of urine which is urethral urine, mid-stream specimen of urine which is urinary bladder urine, and expressed prostatic secretions. [8]

Epidemiology

- It has been documented that chronic pelvic pain syndrome (CPPS), which does include prostatodynia, category III, or abacterial prostatitis, tends to be the commonest urological diagnosis related to men who are older than 50 years of age [8].
- It has also been stated that current evidence does indicate an inverse relationship between inflammatory cells and cancer [8]. It has been iterated that clinically diagnosed prostatitis could increase the risk of carcinoma of the prostate gland which could be race dependent [8] [9]. It has been stated that histological evidence of inflammation of the prostate gland does decrease the likelihood of carcinoma of the prostate gland [8,10].

Clinical features

- It has been stated that in prostatitis, there tends to be elevated serum levels of prostate-specific antigen (PSA), especially in cases of acute prostatitis [8].
- Individuals whose sensations are normal who develop acute prostatitis tend to develop symptoms including: perineal pain / discomfort, dysuria, urinary urgency, urinary frequency,
- The clinical features of acute prostatitis or chronic prostatitis tend to be similar irrespective of the organism that is causing the infection and it is only the bacteriology culture of specimens of expressed prostatic secretions, and seminal fluid that tend to confirm the bacteria that is responsible for the prostatitis so it is the bacterial culture of Salmonella that would establish the diagnosis of Salmonella prostatitis.

Diagnosis

Chronic abacterial prostatitis / chronic pelvic pain syndrome: [8]

- does include prostatodynia, category III or abacterial prostatitis.
- Chronic abacterial prostatitis / chronic pelvic pain syndrome is defined by the International Prostatitis Collaborative Network under the National Institute of Health and diagnosis and does follow clinical, microbiological, as well as laboratory criteria [11,12].
- Histopathology examination diagnosis of chronic abacterial prostatitis / chronic pelvic syndrome is less crucial or might not be required to establish the diagnosis [8].
- The disease tends to manifest clinically similar to bacterial prostatitis, with evidence of persistent pain, especially pursuant to ejaculation but no bacteria tend to be cultured from specimens of expressed prostatic secretions (EPS) [8].
- Excessive amounts of white blood cells (WBCs) could be present or absent [8].
- The white blood cell (WBC) number does vary within the same individual patient and it does tend not to correlate with the severity of the symptom of the patient [8].
- The disease tends not to be curable essentially

Acute bacterial prostatitis [8]

- The types of bacteria that cause acute bacterial prostatitis tend to be similar to the bacteria that usually cause urinary tract infections including Escherichia Coli (E coli), gram negative rods, enterococci, staphylococci as a result of reflux, as well as ensuing surgical manipulation, or sexually transmitted diseases.
- It has been stated that acute bacterial prostatitis usually tends to be localized and it could cause obstruction, urinary retention, or an abscess of the prostate gland.
- It has been iterated that chronic bacterial prostatitis does manifest with low back pain, dysuria, perineal pain / discomfort, supra-pubic pain / discomfort [8].
- It has been stated that chronic bacterial prostatitis tends to be associated with a history of urinary tract infection by the same organism [8].
- It has been iterated that chronic bacterial prostatitis may not be associated with any symptoms [8].

Granulomatous prostatitis [8].

- It has been iterated that with granulomatous prostatitis, necrotizing or non-necrotizing granulomas could be visualized in individuals who have undergone Bacillus Calmette Guerin (BCG) for high grade non-muscle invasive

urothelial carcinoma / CIS.

- Granulomatous prostatitis has also been documented to develop post trans-urethral resection.
- Apart from the aforementioned, majority of cases of granulomatous prostatitis tend to be idiopathic, and they tend not to require acid-fast staining.
- The clinical features of acute prostatitis or chronic prostatitis tend to be similar irrespective of the organism that is causing the infection and it is only the bacteriology culture of specimens of expressed prostatic secretions, and seminal fluid that tend to confirm the bacteria that is responsible for the prostatitis so it is the bacterial culture of Salmonella that would establish the diagnosis of Salmonella prostatitis.
- The microscopy examination features of prostatitis would demonstrate features of inflammation but these features would tend not to be specific to diagnose Salmonella prostatitis.

Laboratory tests

- It has been iterated that in cases of bacterial prostatitis, the prostatic secretion cultures should demonstrate bacterial counts that are ten times that of the bacterial counts of urethral and urinary bladder urine cultures [8].
- It has been stated that with regard to cases of non-bacterial prostatitis, there should be greater than 10 white blood cells (WBCs) per high power field within prostatic secretions without pyuria [8].

Treatment

- It has been iterated that the treatment of prostatitis tends to be difficult, in view of the fact antibiotics generally tend to penetrate poorly into the prostate gland [8].
- Treatment of prostatitis should be based upon utilization of an antibiotic of choice based upon the antibiotic sensitivity pattern of the cultured organism. Within Europe, utilization of fluoroquinolones especially, ciprofloxacin or levofloxacin have tended to be the first line of treatment but it is important to treat all patients based upon the antibiotic sensitivity pattern of the cultured organism and the choice of an antibiotic that can permeate into the prostatic tissue as well as the allergic status of the individual patient. An average treatment period of 20 days may be required and in some cases of chronic infection, six weeks of antibiotic treatment may be required.
- Salmonella prostatitis is rare and when it is diagnosed, the treatment should be based upon utilization of an antibiotic which has been shown upon the sensitivity pattern of the cultured Salmonella organism knowing that some Salmonella organisms have tended to be resistant to some of the previously utilized antibiotics for the treatment of Salmonella.

Microscopy pathology examination features

The ensuing summating iterations have been made regarding the microscopy examination features of specimens of the prostate gland in cases of prostatitis: [8]

- Microscopy examination of specimens of the prostate in cases of prostatitis tend to show macrophages within the stroma, and neutrophils within the lumen spaces which are specific for the diagnosis of acute prostatitis and usually lymphoid aggregates tend not to be specific for prostatitis. [8]
- The amount of white blood cells (WBCs) that are visualized in biopsied specimens of prostatic tissue do not correlate with the degree of pain in cases of chronic pelvic pain syndrome (CPPS). [8]
- The density of lymphocytes within the prostate gland is said to be remarkably constant across the age groups as well as across the races [8,13].

[B] Miscellaneous narrations and discussions from some case reports, case series, and studies undertaken on Salmonella infections generally and Salmonella prostatitis.

Krebs et al. reported a 57-year-old man with a known neurogenic lower urinary tract dysfunction as s sequel of post-traumatic complete spinal cord injury at the level of the 6th thoracic spine (T6) 40 years earlier, who had attended for a routine urological check-up assessment. He did report a history of having been experiencing recurrent urinary tract infections (UTIs) since he had commenced the undertaking of intermittent self-urethral catheterization to empty his urinary bladder 6 years prior to his presentation [1]. He stated that he had had disinfection of his glans penis, utilized a pre-hydrated hydrophilic catheter, and he had had oral vaccination with Escherichia Coli (E Coli) extract but these efforts had not been successful in the prevention of him having recurrent urinary tract infections (UTIs) of 2 to 3 episodes of urinary tract infection (UTI) each year. Two years preceding his presentation, he was diagnosed as having symptomatic as well as febrile urinary tract infections (UTIs) which had been caused by Enterococcus and Streptococcus viridans as well as prostatitis that was caused by Escherichia Coli based upon culture results of his ejaculate. He was treated by means of ciprofloxacin for 6 weeks. In addition, he had been commenced on the use of an alpha-1 antagonist Tamsulosin. He did report that he had been undertaking clean intermittent self-catheterization five times each day pursuant to the washing of his hands and disinfection of his glans penis with utilization of a single-use hydrophilic urinary catheter. He did not report any incontinence of urine or any recent episodes of diarrhoea. His bowel was managed by means of per digital evacuation of faeces from his rectum two to three times each week. His general and systematic examination findings were normal with no signs of an infection. He had a digital rectal examination which demonstrated that his prostate gland was unremarkable, apart from the fact that the prostate was adjudged to be age-appropriately enlarged. He had ultrasound scan of the renal tract and pelvis which showed that the prostate gland, the urinary bladder, the urethra, and kidneys did appear normal. He had video-urodynamic studies which showed an increased capacity of his urinary bladder that was associated with neurogenic detrusor a-contractility as well as a reduced sensation of his urinary bladder. The study did not demonstrate any prostatic influx. The result of his urinalysis was normal and no pathogenic bacteria were detected upon examination of his urine. His serum prostate-specific antigen (PSA) level was 2.56 ng / ML that was within the normal range of 0.27 to 3.42 ng / ML. He was HIV seronegative. Microbiology analysis of his ejaculate demonstrated a growth of monophasic Salmonella enterica spp. enterica serotype 4,12:i:-. He received six weeks of ciprofloxacin 500 mg twice per day based upon the antibiotic sensitivity of the cultured Salmonella organism. During his follow-up it was observed that he had not had any recurrent symptomatic urinary tract infections (UTIs).

Krebs et al. [1] made the ensuing iterations

- Their reported case was the first case of Salmonella prostatitis to be reported in a man who had been afflicted by spinal cord injury (SCI).
- Salmonella prostatitis is very rare.
- Saphra and Winter did report 49 cases of urinary tract infections (UTIs) that had amounted to 0.5% out of 9,284 clinical and sub-clinical human Salmonella infections that had been diagnosed within the New York Salmonella Centre

from 1939 through 1955 [14]. It was stated that the prostate gland was involved with regard to only "some" of the cases.

- Additionally, a few case reports of Salmonella prostatitis had been published [15-20].
- Furthermore, the potential of Salmonella infections of the prostate gland in men who have HIV infection had been referred to within the literature without documentations of reports of any confirmed cases [21,22].
- The route of infection related to Salmonella infection of the prostate gland is not clear. Generally, Salmonella urinary tract infection (UTI) could be an emanation of haematogenous spread of infection or an ascending Salmonella infection from contaminated areas of the perineum of Salmonella carriers [23, 24].
- Additionally, it has been iterated that some types of coital practices or catheterization of the urinary bladder per urethra, could facilitate the development of Salmonella urinary tract infection (UTI) by the introduction of the pathogen directly into the urinary tract [10, 24,25].
- It has been stated that haematogenous transmission of Salmonella infection tends to be most likely with regard to patients who have predisposing conditions, some of which do include: chronic disease or immunosuppression [23,26-28].
- Their reported patient did not manifest with any predisposing condition. It has been iterated that the development of bacteraemia in the absence of symptoms of gastroenteritis is not very common with regard to Salmonella typhimurium [29].
- It has been documented that an ascending infection from a contaminated area of the perineum is not likely with regard to adults. In addition, their reported patient did not report any recent episodes of having had diarrhoea [16,30].
- A direct venereal introduction of Salmonella into the urogenital tract had been documented in a homosexual [16].
- Their reported patient had sexual dysfunction as a sequel of spinal cord injury (SCI) and he had not indulged in sexual intercourse. Nevertheless, he did undertake intermittent self-urethral catheterization of his urinary bladder for evacuation of urine. Based upon this, they would postulate that Salmonellae had been introduced into the urinary tract through the urinary catheter.

Lessons that can be learnt from this case report include:

- Even though Salmonella urinary tract infection and Salmonella prostatitis is rare, patients who have spinal cord injury (SCI) and voiding as well as sexual dysfunction could develop urinary tract infection and or Salmonella prostatitis on rare occasions for which the clinician needs to have a high index of suspicion for.
- Salmonella prostatitis in individuals who have spinal cord injury (SCI) and sexual dysfunction and voiding dysfunction do have neurological problems with a non-sensitive urinary bladder and prostate and when they develop Salmonella prostatitis they may not have typical symptoms of prostatitis including perineal pain and their ordinary urine specimen upon microscopy and culture may not show evidence of Salmonella infection; however, culture of sperm ejaculate may demonstrate evidence of Salmonella infection. For those who can void spontaneously pre-and post-prostate massage specimens of their urine would be useful in the diagnosis of Salmonella prostatitis.
- Because of reduced sensitivity within the prostate gland region in patients who have spinal cord injury (SCI), digital rectal examination may not demonstrate any evidence of tenderness within the prostate upon palpation of the prostate gland but if the prostatitis is associated with a prostatic abscess, then digital rectal examination upon palpation of the prostate gland could demonstrate a soft cystic area within the prostate. With regard to individuals who do not have spinal cord injury and neurogenic bladder, digital rectal examination would most often reveal tenderness within the prostate gland which may make it difficult for a thorough / full examination of the prostate gland by means of digital examination.

Seo et al. reported a 57-year-old man who had presented with symptoms that he had recently developed including: fever, lower abdominal pain, dysuria, urinary frequency, as well as pain within his perineum. He denied having any clinical histories of drug abuse, previous sexually transmitted diseases, diabetes mellitus, as well as hypertension. His general and systematic examinations were normal except for the fact that he was febrile with a temperature of 38.5 degrees centigrade. The results of his haematology and biochemistry blood tests were as follows: Full blood count (FBC/CBC) 19,390/µl of white blood cells (WBCs), 15.2 g / dl of haemoglobin, and 173,000 /µl of platelets, serum creatinine 0.93 mg/dl, glucose 100 mg/dl, HbA1c 5.4%, serum prostate-specific acid (PSA) 28.82 ng/ng/ml, C-reactive protein (CRP) 23.51 mg/dl. The result of his enzyme-linked immune-absorbent assay (ELISA) test for immunodeficiency virus was negative. The results of his midstream specimen of urine was reported to have shown: nitrite (-), WBC in urine dipstick (+3), WBC > 100 / high power field (HPF), and red blood cell (RBC) 1- 4 per HPF. He had computed tomography (CT) scan of abdomen and pelvis which demonstrated a normal urinary tract and a mildly swollen prostate gland which exhibited diffuse contrast-enhancement that was suggestive of acute prostatitis (see figure 1). Based upon a provisional diagnosis of acute prostatitis, he was commenced on ciprofloxacin 0.8 grams per plus tamsulosin 0.2 mg per day for 10 days. The results of his urine culture showed 30,000 colony forming units /ml serotype of C Salmonella species which was sensitive to ampicillin, cefotaxime, ceftazidime, ciprofloxacin, as well as trimethoprim/ sulfamethoxazole. There was no pathogen demonstrated from her initial stool and blood sample. His symptoms improved after three days of his admission. The results of his laboratory tests did improve in his follow-up tests as follows: Urinalysis 9,430 / µl of WBC in CBC, 4.1 mg / dl CRP, and red blood cells (RBC) < /HPF, and WBC 30 – 99/ HPF in urinalysis. Examination of his prostate gland showed a soft swollen prostate with no evidence of any palpable nodule. His expressed prostatic secretion (EPS) was yellowish-turbid and it did demonstrate many WBCs/ HPF. The EPS culture did demonstrate moderately growing Salmonella species. He was re-assessed 10 days later and he was found to be healthy, and the results of his CBC, CRP, and urine samples were all within normal ranges. He was discharged from hospital with a prescription for oral ciprofloxacin to take for 4 weeks. Four weeks later, he had one urine culture and one expressed prostate secretion (EPS) culture and both cultures did not grow any Salmonella organism from the culture plates. Seo et al.[31] did pick one colony in Salmonella positive EPS culture plate and they did extract Salmonella DNA from the sample. Polymerase chain reactions (PCRs) were undertaken from the genomic DNA and they read 1,423 base pairs of DNA sequence which were completely matched with Salmonella enteric serovar infantis (LN649235.1) and para-typhi C strain C3 (EU118092.1). A lesson learnt from this case report is that EPS is a useful way of of obtaining specimen that would lead to the diagnosis of Salmonella prostatitis as well as utilization of EPS post-treatment of prostatitis for culture would establish if the Salmonella prostatitis has been completely treated apart from resolution of the symptoms of the patient and improvement

in CRP and white blood cell count level in the blood test results.

Figure 1: Abdominal computed tomography scan revealed a structurally normal urinary tract, but a mildly swollen prostate with diffuse enhancement with contrast (arrows), which suggested acute prostatitis. Reproduced from: [31] Seo Y M, Seo P W, Lee G. Acute Bacterial Prostatitis by Salmonella infection [31]. Urogenit Tract Infec 2016; 11(2): 69 – 72. http://dx.doi.org/10.14777/uti.2016.11.2.69 https://synapse.koreamed.org/upload/SynapseData/PDFData/1216uti/uti-11-69.pdf

Sumii et al. reported a 38-year-old man who was a recipient of a living kidney transplantation 12 years earlier who had presented with terminal haematuria [19]. Sumii et al. [19] reported that Salmonella typhimurium was isolated from the patient's expressed prostatic secretion and from his seminal fluid. The patient was diagnosed as having chronic bacterial prostatitis and he was commenced on nalidixic acid, 2 grams orally four times each day for one month. Nevertheless, three days after his medication was stopped, Salmonella typhimurium was again isolated from his seminal fluid and for this reason it was necessary for his treatment to be continued for 2 months to ensure that the Salmonella typhimurium had been completely destroyed from the prostate gland. A lesson learnt from this case summation is the fact that with regard to cases of chronic Salmonella prostatitis, a longer period of treatment could be required to ensure eradication of the Salmonella organism from the prostate gland.

Greene et al. [16] reported a homosexual man who had developed haemorrhagic cystitis, prostatitis, as well as bilateral epididymo-orchitis that was caused by Salmonella enteritidis. Greene et al. [16] stated that evidence did suggest that the infection did arise from local inoculation of Salmonella during genital-anal intercourse. An important lesson that was learnt from this summation is the fact that Salmonella prostatitis could be contemporaneously associated with Salmonella cystitis and Salmonella bilateral epididymo-orchitis.

Mellon et al. undertook a retrospective study of non-typhi salmonella enterica strains that had been isolated from urine cyto-bacterial examination (UCBE) between 1st January 1996 and 30th October 2014 and which were analysed by the microbiology laboratories of the University hospitals of Western part of Ice-de-France and of Paris France. Mellon et al. [32] summated the results as follows:

- Twenty UCBEs that were positive for non-typhi Salmonella enterica were analysed.
- The sex ratio was 0.53 and the average age of the patients was 57 years.
- The manifestations included:
  . acute pyelonephritis
  . acute cystitis
  . and prostatitis.
- Eight (8) cases of bacteraemia were noted.
- Diarrhoea was noted in half of the patients which had either preceded the urinary tract infection (UTI) or was contemporaneously associated with the urinary tract infection (UTI).
- Immunodeficiency and diabetes mellitus was diagnosed in 8 of the patients.
- Three (3) of the patients had manifested with uropathy.
- The patients were treated with utilization of antibiotics which were cephalosporins and fluoroquinolones.
- The average duration of the treatment was 20 days.
- A spondylitis and a purulent pleurisy had been observed which were adjudged to be related to the urinary tract infections (UTIs).
- The patient outcome was always favourable pursuant to treatment with antibiotics.

Lessons that have been learnt from this study include:

- The fact that when a diagnosis of Salmonella urinary tract infection is established and appropriate antibiotics are provided for an average treatment time of 20 days the outcome generally tends to be good.
- Salmonella infections of the urinary tract including Salmonella prostatitis could be associated with immunodeficiency and diabetes mellitus.

Conclusions

- Salmonella prostatitis is a rare infection of the prostate gland which has been reported sporadically either alone, or in association with urinary tract infection in the form of cystitis or / and pyelonephritis or cystitis plus epididymo-orchitis, and at times in association with spinal cord injury, immunosuppression, diabetes mellitus, homosexuality, and utilization of clean intermittent self-urethral catheterization to empty a dysfunctional urinary bladder.
- Diagnosis of Salmonella prostatitis has tended to be based upon the clinical manifestations of the disease in combination with microbiology bacteriological examination of urine samples that have been obtained prior to and pursuant to prostatic massage which is called the two-glass test in which the urine specimens have been examined by microscopy, culture, and antibiotic sensitivity testing of the cultured organism. Nevertheless, because of tenderness that tends to be associated with digital rectal examination of the prostate gland in cases of prostatitis and the possibility of inducing

bacteraemia during prostatic massage, examination of an ejaculated semen which is considered to be an alternative two-glass test has generally been utilised with examination of (a) voided urine and (b) ejaculated semen.

- Although serum prostate-specific antigen (PSA) levels tend to be raised in some cases of prostatitis, the elevation of serum PSA levels are not diagnostic or specific for the confirmation of the diagnosis of prostatitis even though if the raised serum PSA level is because of the prostatitis if the patient is responding to antibiotic treatment, the serum PSA level may decrease and thus provide an indirect monitoring of the response to treatment.
- Contrast-radiology imaging of the prostate and pelvis does show some contrast-enhanced areas of the prostate gland in prostatitis but the radiology imaging features would not establish a definite diagnosis of prostatitis as well as illustrate the organism that is responsible for the prostatitis. Nevertheless, radiology imaging of the prostate gland would ascertain if an individual who has Salmonella prostatitis has developed a prostatic abscess and if there is evidence of a prostatic abscess, then radiology image-guided aspiration / drainage of the abscess can be undertaken and the culture of the pus would tend to yield Salmonella bacteria.
- Treatment of Salmonella prostatitis does entail utilization of antibiotics based upon the antibiotic sensitivity pattern of the cultured Salmonella organism and frequency the first line antibiotic of choice in some parts of the world has been based upon the utilization of fluoroquinolone ciprofloxacin or levofloxacin for up to 20 days or longer depending upon the response but other antibiotics have been used in other parts of the world.
- A high index of suspicion is required to establish early diagnosis of Salmonella prostatitis based upon the undertaking of the modified two-glass test.

Conflict of interest – None

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References

1. Krebs J, Göcking K, Pannek J (2014) Salmonella prostatitis in a man with spinal cord injury. J Spinal Cord Med 37: 114-116.
2. Krieger J N, Lee S W, Jeon J, Cheah P Y, Liong M L, etal. (2008) Epidemiology of prostatitis. Int. J. Antimicrob Agents 31: S85-S90.
3. de la Rosette JJ, Hubregtse MR, Meuleman EJ, Stolk-Engelaar MV, Debruyne FM (1993) Diagnosis and treatment of 409 patients with prostatitis syndromes. Urology. 41: 301-307.
4. Perrouin-Verbe B, Labat J J, Richard I, Maudtuyt de la Greve I, Buxelin J M, et al. (1995) Clean intermittent catheterisation from the acute period in spinal cord injury patients. Long term evaluation of urethral and genital tolerance. Paraplegia 33: 619 - 624.
5. Cai T, Mazzoli S, Meacci F, Boddi V, Mondaini N, et al. (2011) Epidemiological features and resistance pattern in uropathogens isolated from chronic bacterial prostatitis. J Microbiol 49: 448-454.
6. Etienne M, Chavanet P, Sibert L, Michel F, levesque H, et al. (2008) Acute bacterial prostatitis: heterogeneity in diagnostic criteria and management. Retrospective multicentric analysis of 371 patients diagnosed with acute prostatitis. BMC Infect Dis 8: 1-9.
7. Millan-Rodriguez F, Palou J, Bujons-Tur A, Musquera-Felip M, Sevilla-cecilia C, et al. (2006) Acute bacterial prostatitis: two different sub-categories according to a previous manipulation of lower urinary tract. World J. Urol 24: 45-50.
8. Iczkowskih K A (2016) Prostate gland & seminal vesicles Inflammation Prostatitis. PathologyOutlines.com.
9. Rybicki B gA, Kryvenko O N, Wang Y, Jankowski M, Trudeau S, et al. (2016) Racial differences in the relationship between clinical prostatitis, presence of inflammation in benign prostate and subsequent risk of prostate cancer. Prostate Cancer Prostatic Dis 19: 145-150.
10. Kryvenko O N, Jankowski M, Chitale D A, Tang D, Rundle A, et al. (2012) Inflammation and preneoplastic lesions in benign prostate as risk factors for prostate cancer. Mod Pathol 25:1023-1032.
11. Krieger J N, Nyberg L Jr, Nickel J C (1999) NIH consensus definition and classification of prostatitis. JAMA 282: 236-237.
12. Polackwich A S, Shoskes D A (2016) Chronic prostatitis/chronic pelvic pain syndrome: a review of evaluation and therapy. Prostate Cancer Prostatic Dis 19: 132-138.
13. Bostwick DG, de la Roza G, Dundore P, Corica FA, Iczkowski KA (2003) Intraepithelial and stromal lymphoceytes in the normal human prostate. Prostate 55: 187-193.
14. Saphra I, Winter JW (1957) Clinical manifestations of salmonellosis in man; an evaluation of 7779 human infections identified at the New York Salmonella Center. N Engl J Med 256: 1128-1134.
15. Gerridzen R G, Ooi T C, McKendry J B (1981) Salmonella epididymitis with recurrent septicemia in diabetic patient. Urology 17: 172-174.
16. Greene J B, Adler M, Holzman R S (1982) Salmonella Enteritidis Genitourinary Tract Infection in a Homosexual Man. J Urol 128: 1046-1048.
17. Young DV, Poretz D M (1987) Treatment of Salmonella prostatitis with trimethoprim-sulfamethoxazole. South Med J 71: 742-743.
18. Melzer M, Altmann G, Rakowszczyk M (1963) Urinary tract infections due to Salmonella. Harefuah 65: 395-399.
19. Sumii T, Nakano H, Ohnishi Y, Kanamoto Y, Nishio T (1986) A case of Salmonella prostatitis in a renal transplant patient] Kansenshogaku Zasshi 60: 624-626.
20. Laval E, Frick P (1972) Paratyphoid fever B and prostatitis. Rev med Chile 100: 44-45.
21. Brede CM, Shoskes DA (2011) The etiology and management of acute prostatitis. Nat Rev Urol 8: 207–212.
22. Hyun G, Lowe FC (2003) AIDS and the urologist. Urol Clin North Am 30: 101-109.
23. Tena D, Gonzalez-Praetorius A, Bisquert J (2007) Urinary tract infection due to non-typhoidal Salmonella: report of 19 cases. J Infect 54: 245-249.
24. Mitchell R G (1965) Urinary tract infections caused by Salmonellae. Lancet 1: 1092-1093.
25. Ko MC, Liu CK, Woung LC, Lee WK, Jeng HS, et al. (2008) Species and antimicrobial resistance of uropathogens isolated from patients with urinary catheter. Tohoku J Exp

Med 214: 311-319.
26. Cohen JI, Bartlett JA, Corey GR (1987) Extra-intestinal manifestations of salmonella infections. Medicine (Baltimore) 66: 349-388.
27. Allerberger F J, Dierich M P, Ebner A, Keating M R, Steckelberg J M, et al. (1992) Urinary tract infection caused by nontyphoidal Salmonella: report of 30 cases. Urol. Int 48: 395-400.
28. Ramos JM, Aguado JM, Garcia-Corbeira P, Ales JM, Soriano F (1996) Clinical spectrum of urinary tract infections due on nontyphoidal Salmonella species. Clin Infect Dis 23: 388–390.
29. Goyal A, Sooch N, Gupta MK (1988) Occurrence of unusual manifestations and uncommon serotypes of Salmonella in human infection. J Commun Dis 20: 141-146.
30. R Feldman RA (1979) Salmonella isolates from urine in the United States, 1968–1979. J Infect Dis 146: 293-296.
31. Seo Y M, Seo P W, Lee G (2016) Acute Bacterial Prostatitis by Salmonella infection. Urogenit Tract Infec 11: 69-72.
32. Mellon G, Delanoe C, Roux A L, Heyn B, Dubourg O, et al. (2017) Non-typhi Salmonella enterica urinary tract infections. Infections urinaires à Salmonella enterica serovar non typhi Medicine et Maladies infectieuses 47: 389-393.

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