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ORIGINAL STUDY Fungal Peritonitis in Peritoneal Dialysis Patient

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Abstract

Fungal peritonitis is uncommon complication of peritoneal dialysis, when present carry high risk of morbidity and mortality, the current study aim to study occurrence of FP in a random sample of peritoneal dialysis patient and the outcome.

Material and method: cross sectional study included 80 patients on peritoneal dialysis in Baghdad teaching hospital, from the duration of January 2021 to march 2021, sample was collected from each patient cultured and smeared.

Result: 45 male and 35 female with range of age 35-70 with mean of 45 ± 9.05 , 22 case of infection was found (12 FP and 20 BP). *C. parapsilosis* was the common isolated fungi, a statistical significant association was found between immune suppression use and previous antibiotic use with infection, the mean effluent WBC is statistically higher in FP than BP.

Conclusion: Despite being FP is uncommon condition, 12 case was detected in the study. 75 % of patient were on dialysis due to DM, the most common organism was *C. parapsilosis*. The FP patient show worse prognosis than BP.

Keywords: Fungi, Fungal, Dialysis, Hemodialysis

1. Introduction

D eterioration of renal function in chronic kidney disease (stage V) or patient with a glomerular filtration rate <15 mL/min/1.73 m² needed to replace their renal function in order to continue their live. Different types of replacing renal function option as kidney transplantation or dialysis modalities that include: hemodialysis (HD) or peritoneal dialysis (PD). Both forms are designed to replace renal function through withdraw solutes and water, restore the electrolyte balance and correcting the acidosis [1].

Peritoneal dialysis involves the exchange of solutes and water in the peritoneal cavity by a catheter, and using the peritoneal membrane (serous membrane with a surface area about 1-2 m²) as the dialyzing surface. The dialysis solution is packaged in clear flexible plastic bags which is connect to the dialysis catheter by the care giver or nursing staff using a sterile technique [2], the method is applicable and can be done at home, the contraindication of the method include Uncorrected abdominal wall hernia, Pleura-peritoneal shunt and Abdominal adhesions.

Despite the fact that PD is an easy and comfortable method to patients, its carry some complication, the infection of the peritoneal cavity is the most important complication. In fact that all types of dialysis treatments carry risk for infection due to impairment in immune defenses of patients as well as increase the risk of pathogens contamination and colonization by the dialysis techniques, especially the peritoneal dialysis (PD) [3].

2. Peritonitis

Peritonitis is inflammation of the peritoneal cavity that is either due to primary or secondary caused, the inflammation can be localized or extended. Depending on the presence of infectious agents its can be classified into (septic or non-septic). Primary peritonitis is a spontaneous inflammatory condition with absence of underlying intra-abdominal pathology or injury to the peritoneum. Hematogenous

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https://doi.org/10.29350/2411-3514.1285 2411-3514/© 2024 College of Science University of Al-Qadisiyah. This is an open access article under the CC-BY-NC-ND 4.0 license (http://creativecommons.org/licenses/by-nc-nd/4.0/). dissemination of infectious agents is suggested to be the mechanism of primary peritonitis development.

Secondary peritonitis is more common, Several organisms are involved including peritonitis, exitsite infection (ESI) and tunnel infection which are the most common infection that has been notice in PD patient that carry considerable morbidity and mortality reach to 3.5–10.0 % [4], as the catheter provides a portal entry for organisms to the sterile peritoneum.

The most common pathogens are coagulasenegative staphylococcal which found on human skin and hands, and *Staphylococcus aureus*, which together are responsible for 50 % or more of infections in most series.2–4 Exit-site and tunnel infections may also lead to peritonitis. Less commonly, the abdomen itself may be the source. Diverticulitis, appendicitis, cholecystitis, or a perforated viscus may be the source, as well as intra-abdominal surgery, colonoscopy, hysteroscopy, and transmigration of bowel flora from constipation. In cases with an intraabdominal source, the infecting organisms are usually Gram-negative enteric bacteria, streptococci and anaerobic bacteria. Bacteremia from another source may also seed the peritoneum [5].

3. Fungal peritonitis

A serious complication of peritoneal dialysis with view reports on the case, however, fungal exit-site infections are more common to occur than peritonitis [6]. Fungal infections caused by opportunistic fungal organisms as Candida species due to the locally or systemic weakened immune system. The most common isolated species that cause fungal peritonitis are *Candida parapsilosis* (67 %), followed by *Candida glabrata* (10 %), *Candida famata* (7 %), and *Candida zeylanoides* (7 %) [7].

3.1. Risk factors

The Fungal peritonitis is uncommon complication. The fungal infection form 4-10 % of all causes of peritonitis in pediatrics and 1-23 % of in adults according to the series [8] with the worse prognosis than bacterial infection, the mortality rate can reach 5-53 %.

The presence of high bacterial peritonitis increase the risk of fungal peritonitis development [9] due to the fact that peritoneal inflammation can raise patients susceptibility to a fungal invasion. Its notice that the fungal infection appears mostly after gram-negative bacilli infection [10] other risk factor is the use of wide-spectrum antibiotics for bacterial peritonitis treatment, however, absence of antimicrobial therapy does not exclude the possibility of infection [11].

Other risk factors include prolonged duration of peritoneal dialysis. Keeping use the catheter even after detecting the fungal infection, old age, immunosuppressant agent administration, immunocompromising or debilitating diseases as systemic lupus erythematosus or HIV [12].

4. Etiological agent

The etiological agent of fungal peritonitis are many including most of yeast species and human pathogenic fungal filaments, with environmental yeasts and fungi that are uncommon in practice.

4.1. Yeasts

Are widely distributed pathogens that can survive in an extraordinary environmental conditions. About 25-30 out of 500 known strain are considered to be a pathogenic. The genus Candida are consider to have the highest incidence rate of fungal peritonitis that form 60-90 % of cases [13]. Candida albicans are the predominant species to cause infection and associated with a poor prognosis and the need for aggressive treatment [14]. However, recent studies state that C. parapsilosis which colonies the skin becoming the most common pathogen to cause fungal peritonitis in peritoneal dialysis patient mainly due to the ability to adherence to synthetic materials [15], most common candida pathogen cause peritonitis are Candida parapsilosis (67 %), followed by Candida glabrata (10 %), Candida famata (7 %), and Candida zeylanoides (7 %).

Other peritonitis-causing yeasts are reported in few episodes as *Cryptococcus neoformans, C. laurentii.*

4.2. Filamentous fungi

Widely distributed in nature that cause peritonitis in lower extent than yeasts, form about 40 % of cases [16]. The filamentous fungi are more resistance to AB, *Aspergillus* genus is commonly seen in clinical practices, however few case of peritoneal infection are reported by this genus.

Some are known as opportunistic pathogens: Alternaria, Bipolaris, Aureobasidium pullulans, Scedosporium apiospermum, Scopulariopsis sp, Cladosporium sp. and Madurella mycetomatis.

4.3. Clinical manifestations

Fungal peritonitis has the same sign and symptom of bacterial peritonitis that include abdominal pain,

fever (in some cases) nausea, vomiting, diarrhea, and deterioration in the general state. Biochemical analysis to the peritoneal liquid is done to diagnose the condition if leukocytes count is 100 or higher per microliter with at least 50 % of WBC are polymorph nuclear cell type with no systemic leukocytosis due to absence of fungemia [17].

Fungal peritonitis is expected in patient with recurrent episodes of bacterial peritonitis and absence of response to antibiotic treatment. Biochemically patients show Hypoalbuminaemia due to lack of ultrafiltration occurring in peritonitis episode, which consider as a poorer prognostic factor [18].

The outcome of FP is prolonged hospitalization, peritoneal membrane failure and shifting to hemodialysis or even death.

5. Material and method

Cross sectional study include 80 patient of peritoneal dialysis for different cause, data was collect for the duration of March 2021 to May 2021, from Baghdad teaching hospital including male and female with age range from 35 to 70 yrs.

A Sample from patient's peritoneal effluent samples were collected and tested for white blood cell count, beside the patient age, gender, smoking habits, presence of previous peritonitis episodes. Peritonitis identified according to guidelines and confirmed with a positive culture for fungi and a negative Gram stain.

6. Identification of isolates

Sabouraud's Dextrose Agar (SDA) used to isolate all yeast from PD. The SDA is a ground powder has been used as cultivate, isolate, identify media to maintain saprophytes and pathogenic fungi, especially *Candida albicans*, in non-sterile specimens.

7. Result

The study is cross sectional that included 45 male and 35 female with range of age 35-70 with mean of 45 ± 9.05 . All patient are on peritoneal dialysis for different causes that include 75 % of them due to DM, 12.5 % due to ischemic nephropathy, 6.25 % due to Glomerulonephritis and 6.25 % of then due to other causes.

Regarding the smoking status 68.75 % are smokers where as 31.25 % are non-smokers. Previous episode of peritonitis increase the risk of FP, in the current study 93.75 % have previous episode.

During the analysis of the aspirated materials 15 % are have peritonitis due to fungal cause where as 40 % have peritonitis due to bacterial cause. Regarding the isolated pathogens, bacterial cause included 3 specific isolated which *S. epidermidis* (50 %), *Staphylococcus aureus* (16 %), and *Enterococcus* (9 %) (see Table 1). The fungal pathogens include *C. parapsilosis* (60 %), *C. albicans* (30 %), and *C. famata* (10 %), as presented in Table 2.

A comparism was made between the parameter of each patient in both groups, it's found that 11 out of 20 patient who have bacterial peritonitis are diabetic patient and 6 out of 12 patient who have fungal peritonitis are diabetic patient, no statistical significant difference was found between being a diabetic patient and developing bacterial or fungal peritonitis, p = 0.73.

The mean duration of Bacterial peritonitis BP patient on peritoneal dialysis was 35 ± 3 months while the mean duration for fungal peritonitis FB patient on peritoneal dialysis was 24 ± 12 months with no statistical significant differences between two mean, p-value 0.79.

Using immunosuppressive drug increase the risk for peritonitis, 58.3 % of FP patients were under immunosuppressive therapy, 75 % of BP patients were under immunosuppressive therapy, with statistical significant association between immunosuppressive use and development of peritonitis, pvalue 0.01.

5.4 % of FP patients were using AB, while 50 % of BP patients were using ab, a statistical significant association between AB use and development of peritonitis, p-value 0.004.

Table 1. Distribution of studied variables.

Variable		Percentage
Gender	Male	45 (65.25 %)
	Female	35 (43.75 %)
Cause of dialysis	DM	60 (75 %)
	Ischemic nephropathy	10 (12.5 %)
	Glomerulonephritis	5 (6.25 %)
	Others	5 (6.25 %)
Smoking state	Yes	55 (68.75 %)
	No	25 (31.25 %)
Pervious episode	Yes	75 (93.75 %)
of peritonitis	No	5 (6.25 %)
Etiological factor	Fungal	12 (15 %)
	Bacterial	20 (40 %)

Table 2. Percentage of isolated fungal pathogens.

Pathogen		Percentage
Bacterial	S. epidermidis	50 %
N = 50	Staphylococcus aureus	16 %
	Enterococcus	9 %
Fungal	C. parapsilosis	60 %
N = 30	C. albicans	30 %
	C. famata	10 %

Serum creatinine and blood urea in FP patients were 609.90 ± 149.96 , 16.71 ± 3.4 while in BP patients was 746.52 ± 104.59 , 16.08 ± 4.7 , respectively. No statistical significant differences in mean between two groups, p-value 0.2, 0.65.

Mean of Serum albumin was statically higher in BP patient (32.00 \pm 1.7) in compare to FP patient (24.90 \pm 0.98), with p-value 0.01.

No statistical significant difference was found between mean of WBC count in blood in FP patient (9.95 \pm 0.55) and BP (7.66 \pm 1.03), p-value 0.201, however, the mea peritoneal effluent WBC count in FP patient was statically higher (2680 \pm 5195) than BP (923 \pm 123), p-value 0.002.

7 out of 30 of FP patients have been transferred to hemodialysis while only 3 out of 50 patients have been transferred to hemodialysis. Unfortunately 6 patients of those who have FP are died while 4 of BP patients are died. skin increase the risk and few reports about *C. parapsilosis*.

In the study of [21] included 4675 patient on PD to investigate the occurrence of FP in those patients. 162 episodes of FP occur in 158 patient of all participant. The rates of fungal peritonitis was 0.03. The isolated organisms were *Candida albicans* (41) followed by other Candida species (72), and other fungi (52). The cause of BP included staphylococci (10), *S. aureus* (5), streptococci (3), enterococci (5), and others. The result are agreed with current study result that found BP is caused by *S. epidermidis*, *Staphylococcus aureus*, and Enterococcus while FP causes were *C. parapsilosis*, *C. albicans*, and *C. famata* in similar order.

In a study done by Ref. [22] to estimate risk factor, clinical presentation and outcome of FP in children on PD. The study included 194 child on PD, 55 of them show peritonitis symptom (11 fungal, 44 bac-

Variable	Fungal peritonitis $n = 12$	Bacterial peritonitis $n = 20$	P-value
Diabetes	6 (50 %)	11 (55 %)	0.73
PD duration (months)	24 ± 12	35 ± 3	0.795
Under immunosuppressive therapy	7 (58.3 %)	15 (75 %)	0.01*
Previous antibiotic use	13 (5.45 %)	25 (50 %)	0.004*
Serum creatine (µmol/L)	609.90 ± 149.96	746.52 ± 104.59	0.200
Blood urea nitrogen (mmol/L)	16.71 ± 3.4	16.08 ± 4.7	0.65
Serum albumin (g/L)	24.90 ± 0.98	32.00 ± 1.7	0.010*
Blood WBC (10 ⁹ /L)	9.95 ± 0.55	7.66 ± 1.03	0.201
Effluent WBC (10 ⁶ /L)	2680 ± 5195	923 ± 123	0.002*
Transfer to hemodialysis	7 (58.3 %)	3 (15 %)	1
Mortality	6 (50 %)	4 (20 %)	1

*p-value is significant if \leq 0.05.

8. Discussion

Fungal peritonitis is uncommon condition seen in daily practice, however its carry high risk morbidity and worse outcome [19]. The current take a 80 random sample from peritoneal dialysis patients who show sign and symptom of peritonitis. Male to female ratio is 1.28, about 75 % of patient are on dialysis due to DM disease, the majority are smokers (68.75 %) and had previous episode of bacterial peritonitis (93.75 %).

The study of [20] included the data of 21 patients who develop FP, 12 of them were females 9 were males that is the opposite to current study gender distribution, mean of age 46 \pm 13 which is nearly constant with current study mean of age 45 \pm 9.05. The most common isolated fungal pathogen was *Candida albicans* that is inconstant with current study finding in which *C. parapsilosis* is the commonest, due to the colonization of *C. albicans* on the skin and the cross of dialysis catheter through terial) the distribution of infection cause approach current study distribution (12 fugal, 20 bacterial), as the FP is very uncommon condition and it's more likely to see BP more.

The WBC in peritoneal effluent was more $100/\mu$ L in all FP patient while 84.1 of BP have WBC count more than $100/\mu$ L with p-value 0.32, while in the current study took the mean of peritoneal effluent, which was statically higher in FP patient in compare BP patients. Regarding the fate of patient 1 out of 11 in FP patients is dead with no death recorded in BP while in current study 6 out of 12 in FP and 4 out of 20 death were recorded. The analysis of peritoneal effluent is important diagnostic tool, mostly the WBC count is more than 100 cell/mm³ [23]

In [18] the study identify all the FP case in one dialysis center from 2012 to 2017. The ration of FP to BP was 1:5, the most common species was *C. albicans and C. parapsilosis* that is constant with current study finding.

It's included 730 cases, 11 of them are FP and 5 are BP. 4 of all FP are diabetic while 24 of BP are diabetic that approach current study finding 6 of FP are diabetic and 11 of BP are diabetic, as diabetic is an important risk factor for both type of infection. Mean of dialysis duration in FP was 43 months and in BP 35, p-value 0.7, in the current study mean dialysis duration in FP was 24 ± 12 and in BP was 35 ± 3 and p-value 0.795, no association was found between duration of dialysis and risk for infection.

The use of immune suppression therapy increase the risk of infection, however in Hu study no association was found between usage and development of infection that is inconstant with current study result in which a statistical significant association was found between usage of immune suppression therapy and development of infection. However, both studies found an association between AB use and infection development.

Both studies found no statistical significant differences in mean level of B. urea S.cr and blood WBC in both FP and BP. A statistical significant differences in mean level of serum albumin and effluent WBC that is statically higher in FP than BP, p-value 0.01 and 0.002 respectively which is an expected result in FP case and important diagnostic sign.

FP patient has the worst prognosis as 6 of them are transferred to HD and 4 are passed that constant with current study (7 transferred and 6 passed).

9. Conclusion

Despite being FP is uncommon condition, 12 case was detected in the study. 75 % of patient were on dialysis due to DM, the most common organism was *C. parapsilosis*. The FP patient show worse prognosis than BP.

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References

- Blake PG, Jain AK. Urgent start peritoneal dialysis: defining what it is and why it matters. Clin J Am Soc Nephrol 2018; 13(8):1278-9.
- [2] Crabtree JH, Shrestha BM, Chow KM, Figueiredo AE, Povlsen JV, Wilkie M, et al. Creating and maintaining optimal peritoneal dialysis access in the adult patient: 2019 update. Perit Dial Int 2019;39(5):414–36.
- [3] Akoh JA. Peritoneal dialysis associated infections: an update on diagnosis and management. World J Nephrol 2012;1(4): 106–22.
- [4] Mujais S. Microbiology and outcomes of peritonitis in North America. Kidney Int 2006;70:S55–62.
- [5] Song DS. The Korean journal of gastroenterology. Taehan Sohwagi Hakhoe chi 2018;72(2):56–63.

- [6] Kleinpeter MA. Successful treatment of Candida infections in peritoneal dialysis patients: case reports and review of the literature. In: Advances in peritoneal dialysis. Conference on Peritoneal Dialysis, 20; 2004, January. p. 58–61.
- [7] Coelho S, Beco A, Oliveira A, Santos C, Pestana M. Exit-site fungal infections: experience of a peritoneal dialysis unit. Portuguese J Nephrol Hyperten 2016;30(4):285–90.
- [8] Ram Ř, Swarnalatha G, Neela P, Murty KD. Fungal peritonitis in patients on continuous ambulatory peritoneal dialysis: a single-centre experience in India. Nephron Clin Pract 2008;110(4):c207–12.
- [9] Indhumathi E, Chandrasekaran V, Jagadeswaran D, Varadarajan M, Abraham G, Soundararajan P. The risk factors and outcome of fungal peritonitis in continuous ambulatory peritoneal dialysis patients. Indian J Med Microbiol 2009;27(1):59.
- [10] Gravito-Soares M, Gravito-Soares E, Lopes S, Ribeiro G, Figueiredo P. Spontaneous fungal peritonitis: a rare but severe complication of liver cirrhosis. Eur J Gastroenterol Hepatol 2017;29(9):1010-6.
- [11] Elwood NR, Guidry CA, Duane TM, Cuschieri J, Cook CH, O'Neill PJ, et al. Short-course antimicrobial therapy does not increase treatment failure rate in patients with intraabdominal infection involving fungal organisms. Surg Infect 2018;19(4):376–81.
- [12] Huang CH, Pang L, Chen Z. Risk factors, clinical features, and short-term prognosis of spontaneous fungal peritonitis in cirrhosis: a matched case-control study. World J Clinic Cases 2019;7(17):2438.
- [13] Pagès A, Iriart X, Molinier L, Georges B, Berry A, Massip P, et al. Cost effectiveness of candida polymerase chain reaction detection and empirical antifungal treatment among patients with suspected fungal peritonitis in the intensive care unit. Value Health 2017;20(10):1319–28.
- [14] Liang CC, Fang JT, Chen KH, Hung CC, Hwang TL, Huang JY. Candida parapsilosis peritonitis complicated with infected pancreatic pseudocysts in a peritoneal dialysis patient: a challenge for nephrologists. Clin Nephrol 2008;69(6): 461–3.
- [15] García-Agudo R, García-Martos P. Clinical and microbiological aspects of fungal peritonitis in peritoneal dialysis. Nefrologia 2009;29(6).
- [16] Verma A, Mothu PN, Kalawat U, Vishnubhotla SK. Fungal peritonitis in continuous ambulatory peritoneal dialysis (CAPD) patients. J Clin Diagn Res 2018;12(8).
- [17] Rosa NG, Silva S, Lopes JA, Branco P, de Almeida E, Ribeiro C, et al. Fungal peritonitis in peritoneal dialysis patients: is previous antibiotic therapy an essential condition? Mycoses 2007 Jan;50(1):79–81. https://doi.org/10.1111/j.1439-0507.2006.01323.x. PMID: 17302754.
- [18] Hu S, Tong R, Bo Y, Ming P, Yang H. Fungal peritonitis in peritoneal dialysis: 5-year review from a North China center. Infection 2019 Feb;47(1):35–43. https://doi.org/10.1007/ s15010-018-1204-7. Epub 2018 Aug 25. PMID: 30145773.
- [19] Prasad N, Gupta A. Fungal peritonitis in peritoneal dialysis patients. Perit Dial Int 2005;25(3):207–22.
- [20] Unal A, Kocyigit I, Sipahioglu MH, Tokgoz B, Oymak O, Utas C. Fungal peritonitis in peritoneal dialysis: an analysis of 21 cases. Int Urol Nephrol 2011 Mar;43(1):211–3. https:// doi.org/10.1007/s11255-010-9763-2. Epub 2010 Jun 6. PMID: 20526810.
- [21] Miles R, Hawley CM, McDonald SP, Brown FG, Rosman JB, Wiggins KJ, et al. Predictors and outcomes of fungal peritonitis in peritoneal dialysis patients. Kidney Int 2009 Sep;76(6): 622–8. https://doi.org/10.1038/ki.2009.202. Epub 2009 Jun 10. PMID: 19516241.
- [22] Alsuhaibani M, Aldosari E, Rahim KA, Alzabli S, Alshahrani D. Fungal peritonitis in children on peritoneal dialysis at a tertiary care Centre. BMC Nephrol 2020;21(1):1–6.
- [23] Nadeau-Fredette AC, Bargman JM. Characteristics and outcomes of fungal peritonitis in a modern North American cohort. Perit Dial Int 2015;35(1):78–84.