ISSN 2607-9917 www.bdd.rdplf.org Volume 7, n° 4, Dec. 2024 https://doi.org/10.25796/bdd.v7i4.84623

Bulletin de la Dialyse à Domicile

Home Dialysis Bulletin (BDD)

International bilingual journal for the exchange of knowledge and experience in home dialysis

(English edition) (version française disponible à la même adresse)

Prevention of infections in peritoneal dialysis: a survey of young tunisian nephrologists

(Prévention des infections en dialyse péritonéale : Une enquête auprès de jeunes néphrologues tunisiens)

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Pour citer : Khadhar M, Gaied H, Jerbi M, Haddad S, Bettaieb A, Aoudia R, Goucha R. Prevention of Infections in Peritoneal Dialysis: Survey Among Young Tunisian Nephrologists. Bull Dial Domic [Internet]. 2024 Sep. 28 [cited 2024 Sep. 28];7(4). Available from DOI: https://doi.org/10.25796/bdd.v7i4.84623

Summary

Peritonitis is a severe complication in peritoneal dialysis (PD) patients, contributing to technique failure and patient mortality. Tunisia lacks a national dialysis registry, making the incidence of peritonitis unclear. The International Society for Peritoneal Dialysis (ISPD) published guidelines from 2016 to 2022, outlining effective strategies for preventing infections in PD patients. This study was conducted between June and July 2022 to assess Tunisian nephrologists' knowledge and practices for preventing infections. Using an online questionnaire, 44 participants (67.69% response rate) provided insights. Findings revealed an average score of 4.45 out of 7, indicating significant confusion among respondents. Many incorrectly believe that protecting the catheter under the skin until renal replacement therapy is initiated reduces infections. Questions also addressed nasal *Staphylococcus aureus* screening, antibiotic prophylaxis, surgical techniques, timing of dressing changes, and local antibiotic use. Responses varied, with 59.1% supporting systematic nasal screening but differing concerning eradication strategies. The study highlights discrepancies between current practices and ISPD guidelines among young Tunisian nephrologists. Recommendations include establishing a national dialysis registry to enhance surveillance and developing tailored national guidelines. A working group from the Tunisian Society of Nephrology, Dialysis, and Transplantation is already developing protocols to address identified gaps and improve PD patient outcomes.

Keywords : Peritoneal dialysis (PD), Peritonitis, Infection prevention, Practice evaluation, Antibiotic prophylaxis

Résumé

La péritonite est une complication grave chez les patients en dialyse péritonéale (DP), contribuant à l'échec de la technique et à la mortalité des patients. La Tunisie ne dispose pas d'un registre national de dialyse, ce qui rend l'incidence de la péritonite incertaine. La Société internationale de dialyse péritonéale (ISPD) a publié des lignes directrices de 2016 à 2022, décrivant des stratégies efficaces pour prévenir les infections chez les patients en dialyse péritonéale. Notre étude a été menée entre juin et juillet 2022 pour évaluer les connaissances et les pratiques des néphrologues tunisiens en matière de prévention des infections. À l'aide d'un questionnaire en ligne, 44 participants (taux de réponse de 67,69 %) ont fourni des informations. Les résultats ont révélé un score moyen de 4,45 sur 7, indiquant une confusion importante parmi les répondants. Beaucoup pensent à tort que la protection du cathéter sous la peau jusqu'à l'instauration d'une thérapie de remplacement rénal réduit les infections. Les questions portaient également sur le dépistage nasal de *Staphylococcus aureus*, l'antibioprophylaxie, les techniques chirurgicales, le moment du changement de pansement et l'utilisation locale d'antibiotiques. Les réponses ont été variées, 59,1 % d'entre elles étant favorables à un dépistage nasal systématique, mais divergentes en ce qui concerne les stratégies d'éradication. L'étude met en évidence les divergences entre les pratiques actuelles et les lignes directrices de l'ISPD chez les jeunes néphrologues tunisiens. Les recommandations comprennent la création d'un registre national de dialyse pour améliorer la surveillance et l'élaboration de lignes directrices nationales adaptées. Un groupe de travail de la Société tunisienne de néphrologie, de dialyse et de transplantation élabore déjà des protocoles pour combler les lacunes identifiées et améliorer les résultats pour les patients en DP.

Mots-clés : Dialyse péritonéale (DP), péritonite, prévention des infections, évaluation des pratiques, prophylaxie antibiotique

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journal officiel du Registre de Dialyse Péritonéale de Langue Française **RDPLF** www.rdplf.org

www.bdd.rdplf.org Volume 7, n° 4, Dec. 2024
https://doi.org/10.25796/bdd.v7i4.84623
ISSN 2607-9917

Introduction

Peritoneal dialysis (PD) is one of the modalities of renal replacement therapy for patients with end-stage renal disease. In 2015, estimates suggested that 272,000 individuals globally were undergoing PD, accounting for approximately 11% of the dialysis population [1]. PD is an ambulatory technique, but patients need to receive training and education from specialized nurses beforehand to minimize the risk of bacterial contamination during the connection maneuvers of the catheter to dialysate bags. Infectious complications are the most feared complications of this technique. There are two main types of infections: exit-site infections and infections of the dialysis fluid (peritonitis). In Tunisia, at a center in Sousse, the authors report a rate of 0.44 peritonitis episodes per patient [2]. However, in France, according to the French Language Peritoneal Dialysis Registry (RDPLF), the incidence of peritonitis is one episode in every 32 patient–months (i.e., 0.37 episodes per year) [3,4]. Despite the existence of international guidelines for diagnosis, prevention, and treatment issued by the International Society of Peritoneal Dialysis (ISPD) [5], the incidence of infectious complications remains high and varies from one country to another. Prevention in its various forms remains the central focus of management. Nevertheless, we did not find any articles in the literature that evaluate the knowledge of young nephrologists regarding preventive measures against PD infection complications.

This work aims to assess the theoretical knowledge and practical approaches of young Tunisian nephrologists concerning the prevention of infectious complications, identify and address the difficulties encountered, and, subsequently, review the preventive measures for PD-related infections.

Materials and Methods

Participants:

This is a descriptive cross-sectional observational study conducted between June and July 2022, targeting young nephrologists. These nephrologists were required to complete an anonymous online questionnaire. A total of 65 questionnaires were sent to various physicians (residents-in-training and hospital–university assistants). Forty-four physicians (67.69%) responded to the questionnaire.

Inclusion Criteria:

• Young nephrologists who are residents and hospital–university assistants

Non-Inclusion Criteria:

• Nephrologists who were not practicing at the time of the study
• Nephrologists practicing abroad
• Associate professors and full professors

Exclusion Criteria:

• There were no exclusion criteria, as the online platform receiving the responses only accepted fully completed questionnaires

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www.bdd.rdplf.org Volume 7, n° 4, Dec. 2024
https://doi.org/10.25796/bdd.v7i4.84623
ISSN 2607-9917

Methods

The Questionnaire:

The questionnaire consisted of 11 questions: four regarding the physicians' status and the training they received concerning PD, and seven on the prevention of infections in PD. There were 10 single-choice questions and one multiple-choice question.

The questionnaire focused on the following themes:

- Prophylactic antibiotic therapy and infections
- Technical procedures and infections
- Screening for nasal carriage of *Staphylococcus aureus* and its eradication
- Timing of the first dressing change
- Systematic local antibiotic therapy and infections

The seven questions assessing the theoretical and practical knowledge of young nephrologists (residents and hospital–university assistants) regarding the prevention of infections in PD were scored on a scale of 0 to 7. Each question was scored as either correct (1 point) or incorrect (0 points). There was no partial credit: 0 points for an incorrect response and 1 point for a correct response. The total score ranged from 0 to 7.

The questionnaire was distributed to young nephrologists via email and through social media platforms. Responses were collected using the Google Forms interface and through email for analysis.

Statistical Analysis: We computed simple frequencies and relative frequencies (percentages) for qualitative variables. For quantitative variables, we calculated means, medians, and standard deviations and identified extreme values.

Ethical Considerations: Anonymity was strictly maintained throughout the study. No information about the participants' identities was requested.

Results

Forty-four questionnaires were completed and validated. The maximum score was 7 out of 7, and the minimum score was 1 out of 7. Four physicians achieved a score of seven.

Characteristics of the study population

Question 1: Are you a resident?

Thirty-four physicians (77.27%) who responded to the questionnaire are residents. The distribution of residents according to residency year is shown in *Figure 1*.

Question 2: Are you a hospital–university assistant?

Ten physicians (22.73%) are hospital–university assistants . The distribution of physicians according to assistantship year is shown in *Figure 2*.

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ISSN 2607-9917

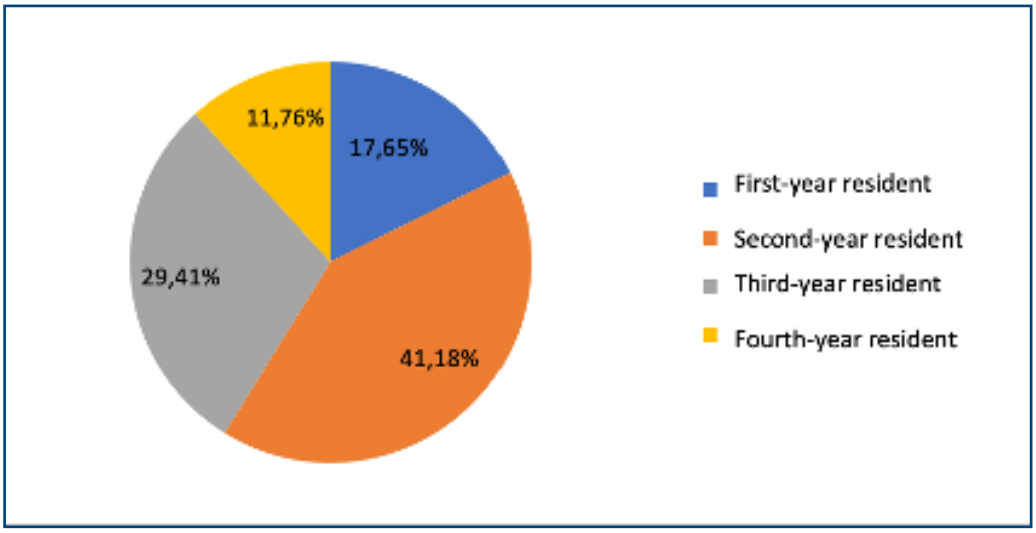

Figure 1. Distribution of respondents by year of residency

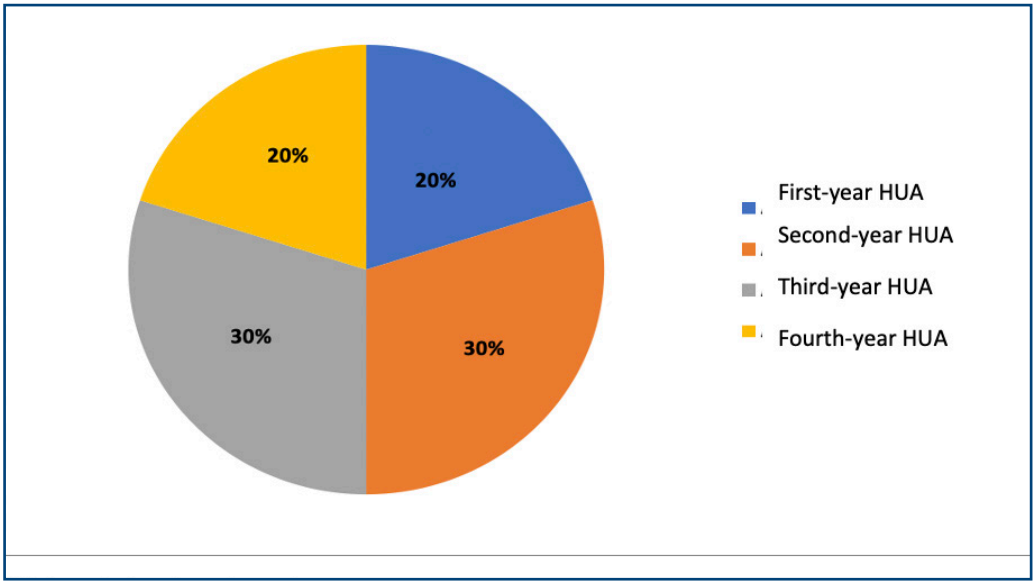

Figure 2. Distribution of respondents by year of assistantship. HUA= hospital university assistant

Question 3: Did you receive specialized training in peritoneal dialysis?
In response to this question, 50% of the respondents answered that they did not receive specialized training. Moreover, 22 physicians had received training from Baxter in PD, and one physician obtained a university diploma in PD. Only one physician received two types of specialized training (university diploma in PD and Baxter training in PD).

Question 4: Have you undergone training in peritoneal dialysis during your practice?
Among the respondents, 40.9% said that they had not undergone training in PD for a period lasting at least 3 months.

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ISSN 2607-9917

Question 5: Do you believe that burying a catheter (Moncrief method) reduces the incidence of exit-site infections?
Regarding this question, 63.6% of physicians incorrectly answered yes, stating that burying the catheter under the skin until the need to initiate renal replacement therapy reduces the incidence of exit-site infections.

Question 6: Do you believe that a preoperative antibiotic injection is recommended to reduce the risk of infection?
Among the participants, 90.9% (n = 40) answered this question correctly.

Question 7: Do you believe that screening for nasal carriage of *Staphylococcus aureus* should be performed systematically after catheter placement?
Responses were divided: 59.1% answered affirmatively, suggesting systematic screening for nasal carriage of *S. aureus* should be done.

Question 8: Do you believe that eradication of nasal carriage of *Staphylococcus aureus* should be systematically performed in a peritoneal dialysis patient?
Responses were also divided: Slightly more than half of the participants (54.5%; n = 24) answered no to this question.

Question 9: According to you, is intermittent systemic treatment the best solution to eradicate nasal carriage?
Seventy-one physicians (81.80%) answered this question correctly.

Question 10: In your opinion, is it common practice to change the first dressing seven days after catheter placement to avoid cuff mobilization and promote healing?
According to 68.2% of the surveyed physicians (n = 30), it is necessary to change the first dressing sometime after placement, typically approximately 7 days after.

Question 11: Do you recommend applying a local antibiotic following the disinfection process to lower the risk of infection?
To this question, 72.7% responded affirmatively that adding a local antibiotic reduces the risk of infection.

Discussion

Preoperative antibiotic prophylaxis

Preoperative antibiotic prophylaxis is recommended to reduce the risk of infections, particularly early peritoneal infections. A clinical trial by Gadallah et al. [6] demonstrated that antibiotic prophylaxis significantly reduces peritoneal infection rates though it does not affect exit-site infections. Recent guidelines from the Indian Society of Peritoneal Dialysis [7] and ISPD [5], supported by randomized trials [8], also recommend systemic antibiotic administration before catheter insertion. Antibiotic prophylaxis should be brief, typically lasting less than 24 h, and

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www.bdd.rdplf.org Volume 7, n° 4, Dec. 2024
https://doi.org/10.25796/bdd.v7i4.84623
ISSN 2607-9917

should be tailored to local ecology covering enterobacteria and common Gram-positive skin flora. Notably, the majority of organisms cultured from catheter exit-site swabs are Gram-positive bacteria commonly found on the skin, such as *S. aureus*, coagulase-negative Staphylococcus spp., and Streptococcus spp. [9,10,11].

Moncrief Method (Buried Catheter)

In 1991, Moncrief and Popovich introduced a new technique for implanting PD catheters. The technique involves a coiled tip, two cuffs, and an arched bend to prevent fluid leakage. Further, the external segment of the catheter is buried in a subcutaneous tunnel for 4 to 6 weeks before exteriorizing it. This method aims to promote tissue growth around cuffs, reducing bacterial colonization and peri-catheter infections [12]. Despite its benefits in extending catheter lifespan and reducing some infections, burying the catheter is not recommended by ISPD for preventing exit-site infections or peritonitis [5,7]. Furthermore, opinions are divided on the Moncrief method for catheter implantation. Some studies suggest it may increase catheter lifespan and reduce peri-catheter infections [13]. However, Osako et al. reported a 3.3% incidence of exit-site and tunnel infections within 2 weeks of using this technique, with an incidence of catheter malfunction of 1.9% due to occlusion [14]. ISPD has found insufficient evidence supporting reduced peritonitis rates due to the use of buried catheters [15].

First Dressing Change after the Placement of a PD Catheter

The first dressing change after the placement of a PD catheter marks a crucial moment in a patient's care. This change is typically done 5 to 7 days post-surgery, allowing time for initial healing to begin. It is important to perform the dressing change in a sterile environment to minimize the risk of infection, which could lead to complications such as peritonitis. The change process involves careful removal of the old dressing, inspection of the catheter site for any signs of infection or poor healing, and the application of a new sterile dressing. This step is essential in ensuring the long-term success of PD treatment.

PD Initiation Timing After Catheter Placement

There is ongoing debate over the ideal time to start peritoneal dialysis (PD) following catheter insertion. The Timely study found higher rates of peritoneal fluid leaks when PD began one week post-insertion compared to waiting two to three weeks [16, 17]. Further, Leblanc et al. (2001) associated these leaks with exit-site infections and peritonitis [17]. Currently, we wait three weeks before using the PD catheter. If renal replacement therapy is needed sooner, we opt for intermittent hemodialysis. Delaying the first dressing change to seven days in routine practice has reduced catheter mobilization, minimizing leaks and peritonitis cases. Although guidelines are lacking, 68.2% of young nephrologists advocate for a seven-day delay, which may be considered acceptable given the absence of guidelines in this regard.

Nasal Carriage of *S. aureus* (Screening–Eradication–Treatment)

Systematic screening for nasal carriage of *S. aureus* after catheter placement is not recommended by medical societies [5-7]. Nasal carriage of *S. aureus* is frequent but intermittent, and a negative sample does not rule out a diagnosis.

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www.bdd.rdplf.org Volume 7, n° 4, Dec. 2024
https://doi.org/10.25796/bdd.v7i4.84623
ISSN 2607-9917

The systematic eradication of nasal carriage of *S. aureus* is also not recommended for patients undergoing PD. The mupirocin group study, which included 1144 PD patients across 9 European centers, found that nasal mupirocin did not reduce tunnel infections or peritonitis incidence. ISPD recommends screening before PD catheter insertion (Grade 2D) and suggests nasal mupirocin application (Grade 1B) if carriage is detected to reduce exit-site infection risk though the insertion does not affect peritonitis risk [19].

Care of the Exit Site (Eradication–Treatment)

Amato et al. demonstrated identical genotypic *S. aureus* at both exit sites and in peritonitis [20]. Eradicating catheter exit site carriage prevents tunnel infections and peritonitis [7]. The administration of oral rifampicin, 600 mg daily for 5 days every 3 months, reduces exit site infections but not peritonitis and has high adverse effects [21]. Moreover, meta-analysis shows mupirocin reduces *S. aureus* infections by 72% and peritonitis by 40% [22]. Local mupirocin has equivalent efficacy to systemic rifampicin but with fewer adverse effects [23]. Notably, resistance to mupirocin has been reported in recent years, primarily with intermittent use rather than daily application [24,25]. Piraino found high numbers of Pseudomonas with mupirocin [26]. Gentamicin cream is comparable to mupirocin: gentamicin also reduces infection incidence [27].

ISPD recommends daily topical application of mupirocin or gentamicin at the catheter exit site (Grade 1B) [15]. Application of mupirocin at the catheter exit site reduces the incidence of *S. aureus* peritonitis, while gentamicin application reduces infections caused by gram-negative bacilli and *S. aureus*, providing a viable alternative to mupirocin cream [7]. However, in Tunisia, mupirocin cream is not available. In current practice, Tunisian nephrologists disinfect the exit site using povidone-iodine but do not apply local antibiotics.

Enhanced Education Reduces Infections

Education for patients and healthcare professionals is crucial, and at least 3 sessions per patient are recommended. Moreover, ISPD and the Indian Society of Peritoneal Dialysis recommend qualified nursing staff (grade 1C) administer PD [5-7]. Additionally, emphasis is placed on connection learning during education and post-infection re-education. “Flush before fill” reduces peritoneal infections (grade 1A) [15].

In Tunisia, there is a lack of dedicated videos or brochures for patient education, hindering program adherence.

Conclusion

Peritonitis poses a significant threat to PD, impacting treatment outcomes and patient survival. In Tunisia, the incidence of peritonitis remains unknown due to the absence of a national registry. Preventing infections relies on ISPD guidelines from various updates, including those from 2016 to 2017 and 2022. However, misconceptions persist among some physicians, such as the notion of screening and eradicating nasal carriage to mitigate peritonitis risk in PD patients. Given the confusion among young nephrologists regarding the application of ISPD guidelines to current practices in PD units, establishing national recommendations is crucial. A Tunisian Society of Nephrology, Dialysis, and Transplantation working group is finalizing protocols for PD patient

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management. Dedicated training sessions on PD preventive measures for young nephrologists and nurses will enhance their proficiency. Additionally, practical workshops using simulations will provide hands-on experience, especially for those with limited access to PD units during training.

Conflicts of interest

All authors have no conflicts of interest to declare.

Authors' contributions

Conception and participation in study design: MK, HG. Data collection: MK. Manuscript drafting: MK, RA. Manuscript revision: RG, MJ, HG, AB, SH. All the authors have read and agreed to the final manuscript.

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