

The National Kidney Foundation

NKF



renal
outlook
kidney health for all





Sowing the seeds to advance the growth and vitality of renal care, Renal Outlook passionately echoes the spirit of our 55th anniversary theme, “Kidney Health for All”. By cultivating cutting-edge studies and insights, our renal community comes together to reap benefits for the well-being of kidney patients and the broader community.



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To commemorate the 55th anniversary of NKF's mission of Giving Life & Hope with the theme "Kidney Health for All" this year, our 3rd edition of Renal Outlook holds special significance as we unite within the renal community to advance renal research, clinical practices, and overall care for kidney disease management. The theme takes on heightened importance as all of us must persist in working synergistically to enhance the well-being of our patients and contribute positively to the healthcare ecosystem. It is crucial that we navigate the complex challenges and tailor care plans in renal care – from awareness to prevention to early management. This is especially pertinent as there are some 500,000 people in Singapore suffering from chronic kidney disease and are at higher risk of progressing towards kidney failure.

In today's rapidly advancing technological era, renal innovations, including precision medicine, are crucial for elevating patient care beyond conventional methods. This issue delves into the realm of patient-focused medical technology and intervention, with the aim of enhancing care delivery and empowering individuals to manage their health autonomously. Several articles shed light on holistic well-being and education in renal supportive care, particularly conservative care, underscoring the need for comprehensive understanding and knowledge dissemination in this domain. All these insights align with our broader vision of Future Forward 2030, which emphasises impactful transformations in patient care.

I am happy to share that NKF will contribute \$5.5 million to establish the SGH-NKF Renal Research Partnership, focusing on chronic kidney disease retardation and prevention, innovative renal replacement therapies, and enhancing psychosocial well-being for patients and caregivers.

I wish to express my gratitude to the Editorial Advisory Committee for dedicating your time, providing insightful advice, and contributing your expertise towards the advancement of this publication as a valuable resource. Special thanks are extended to the authors and reviewers for your resolute commitment and significant contributions. Your endeavours have enriched our work, bringing diverse perspectives and creative approaches to renal care. These efforts are vital for developing innovative programmes, reducing kidney disease prevalence, and fostering sustained growth in renal health.

Once again, my deepest appreciation to the renal community, healthcare partners, and kidney health advocates for your unwavering support and partnership. Together, we leverage each other's expertise through knowledge sharing, collaboration and integration. Let's persevere in advancing our collective efforts by immersing ourselves into research, aiming for breakthroughs, and embracing transformative changes to address the ever-evolving challenges in renal care.

Tim Oei
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The Significant Value of Renal Supportive Care and Overcoming its Barriers

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Background and Aims

As Singapore's population ages, prevalence of chronic kidney disease is expected to double from 12.2% in year 2007 to 24.3% by year 2035. The benefits of dialytic therapy in elderly patients with multiple comorbidities are less apparent and this group of patients is likely to benefit from renal supportive care (RSC) which is a patient-centered approach to management of advanced chronic kidney disease, especially in elderly patients¹. Adoption of RSC in Asian countries has been slow. This study aimed to investigate the barriers towards RSC as perceived by physicians in Singapore.

Methods

An online survey was sent out to all practicing and training nephrologists, geriatricians and palliative physicians in Singapore public hospitals between 1 and 30 October 2020. Responses were compiled and analysed.

Results

Out of 365 surveys sent, 75 nephrologists, 43 geriatricians and 28 palliative care physicians responded, accounting for a 40% response rate. Response rates amongst nephrologists was 59%, palliative physicians 48%, and geriatricians 24%. Most of the participants managed 16 to 30 chronic kidney disease patients in a week. Median percentage of patients aged >75 years old managed by nephrologists was 31-40%, and >40% for geriatricians and palliative physicians. Most physicians from all three subspecialties agreed that renal supportive care aims to improve quality of life in chronic kidney disease (97.9%) and can be implemented alongside life-prolonging treatments such as dialysis (83.6%). However, only 51.4% recognised a distinction between renal supportive care and palliative care. Fewer nephrologists compared to geriatricians received prior palliative care training (54.7% vs 93.0%, $p < 0.001$) or were certified advanced care planning facilitators (33.3% vs 67.4%, $p < 0.001$). All respondents agreed that nephrologists should be aware of basic principles of palliative care, and 89.7% felt that palliative care should be incorporated into nephrology training. Most were comfortable holding discussions regarding dialysis withholding and withdrawal (93.8% and 87.7% respectively). However, nephrologists were less likely than geriatricians to be comfortable with managing symptoms of pain (56% vs 90.7%, $p < 0.001$) and dyspnea (78.7% vs 93%, $p = 0.041$). Fewer physicians were comfortable with managing symptoms of pruritus (65.1%) and restless legs syndrome (56.2%). Majority (60%) did not feel confident in providing spiritual support as part of end-of-life care. Main barriers to RSC included inadequate time during clinic consults to address the patients' needs (87%), reliance on family members to make decisions (69.2%), inadequate palliative training during fellowship (67.1%) and inadequate community support services (55.5%). Some cited lack of awareness and acceptability of renal supportive care amongst patients and relatives in Singapore's Asian cultural context. Most felt that encouraging advanced care planning discussions earlier in the course of chronic kidney disease (80.8%), having dedicated renal supportive care services in hospital (78.1%) and including palliative care rotation as part of training (69.2%) could potentially increase uptake of renal supportive care in Singapore. Proposed solutions to overcome the top three barriers to RSC as identified by study respondents are presented in Table 1.

Table 1: Proposed solutions to overcome the top three barriers to renal supportive care as identified by the study respondents

Issue	Specific Barriers Identified in the Survey	Proposed Solutions
Resource limitation	<ul style="list-style-type: none"> Inadequate clinic consult time Limited number of palliative physicians Inadequate community support services 	<ul style="list-style-type: none"> Dedicated renal supportive care services with allied health involvement Multidisciplinary collaboration with other specialties such as geriatrics Development of a nephrology subspecialty track in palliative care for those with interest Expand community outreach
Cultural differences	<ul style="list-style-type: none"> Patients' dependence on family members for decision making Lack of acceptability of renal supportive care and holding of end-of-life conversations 	<ul style="list-style-type: none"> Initiate advance care planning discussions early in the course of chronic kidney disease Community education to encourage shared decision making Involve family members in advance care planning discussions
Lack of palliative care training	<ul style="list-style-type: none"> Lack of recognition and competence with managing symptoms and providing end-of-life care Lack of confidence in holding discussions on dialysis withholding and withdrawal 	<ul style="list-style-type: none"> Incorporate palliative care training in the nephrology fellowship curriculum Newer education approaches like flipped classroom or online modules

Discussion

Nephrologists, geriatricians and palliative physicians in Singapore recognise the value of renal supportive care but are faced with barriers such as inadequate clinic consultation time, patients' and family's resistance toward renal supportive care as well as inadequate palliative training. Dedicated renal supportive care services with allied health involvement and multidisciplinary collaboration with other subspecialties such as geriatric medicine can augment clinic discussions. A unique model of renal supportive care with the patient as well as family's involvement early in the decision-making process is likely to be better perceived in Asian countries². Incorporation of palliative care training in the nephrology fellowship curriculum should be considered³. Besides clinical rotations, the knowledge about palliative care in nephrology can also be imparted through other pedagogic resources like online curriculum, grand rounds and renal supportive care courses. A limitation of the study is the higher survey response rates amongst nephrologists and palliative physicians as compared to geriatricians, which could have led to bias in the study results. Further research and resources need to be invested in this area to promote uptake of renal supportive care.

References

1. Davison SN, Jassal SV. Supportive Care: Integration of Patient-Centered Kidney Care to Manage Symptoms and Geriatric Syndromes. *Clin J Am Soc Nephrol.* 2016;31(10):1882-1891.
2. Ozdemir S, Jafar TH, Choong LHL, Finkelstein EA. Family dynamics in a multi-ethnic Asian society: comparison of elderly CKD patients and their family caregivers experience with medical decision making for managing end stage kidney disease. *BMC Nephrol.* 2019;20(1):73.
3. Fulton AT, Richman K, Azar M, et al. A Novel Interprofessional Palliative Care and Geriatrics Curriculum for Nephrology Teams. *Am J Hosp Palliat Care.* 2020;37(11):913-917.

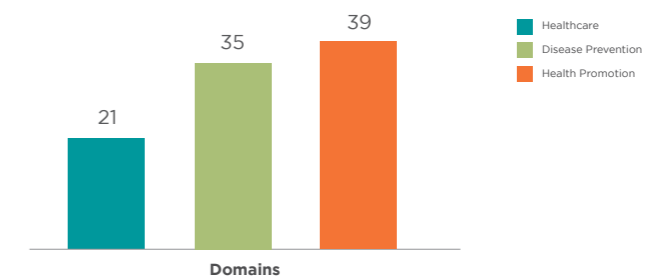


Data analysis with IBM SPSS Statistics 26 (IBM Corp, Armonk, New York) was performed. Continuous variables were presented as means with interquartile ranges [IQR (25th percentile, 75th percentile)] while categorical variables were presented as proportions. The item mean scores for the different domains were compared using the Friedman test. Comparisons between groups with and without difficulty in handling information were compared using chi square test or Mann Whitney U test as appropriate. P values <0.05 were considered statistically significant.

Results

We evaluated 71 patients with active glomerulonephritis. Figure 1 showed the proportions of patients who perceived difficulties with information in the health domains. There was significantly greater ease with handling information on healthcare [item mean score 3.2 (3.0, 3.5)] than disease prevention [3.0 (2.9, 3.5)] and health promotion [3.0 (2.8, 3.4)] ($p=0.005$). Table 1 showed the bivariate analysis for associations between sociodemographic factors and difficulty in the different domains of health literacy. Older age was significantly associated with difficulty in handling information in the domains of disease prevention and health promotion and tended to have difficulty with healthcare information. Patients with lower formal education were more likely to have difficulty with information on disease prevention. Gender, language spoken at home and at healthcare (English versus others), occupation (professional or executive versus not), personal income (>\$4,000/month versus ≤\$4,000/month), and frequent visits to healthcare institutions (four or more in the past six months versus three or fewer) were not significantly associated with difficulties in handling information in the domains of healthcare, disease prevention and health promotion.

Figure 1: Patients Who Perceived Difficulties in Health Literacy According to Domains (%)



Understanding Health Literacy Vital in Self-Managing Glomerulonephritis

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Introduction

Glomerulonephritis (GN) is one of the leading causes of chronic kidney disease worldwide. It is characterised by immune-mediated damage to the glomerulus and patients may require treatment such as lifestyle modification, potent immunosuppressants and extended follow up. Hence, a collaborative approach where patients are actively involved in shared decisions. Health literacy can generally be defined as the degree to which individuals have the capacity to obtain, process and understand basic health information and services to make decisions related to their health¹. Studies have shown that low health literacy was associated with adverse patient outcomes^{2,3}. Health literacy may be a key factor in improving patient outcomes, especially in chronic conditions where health literacy influences not only their adherence, but also their propensity to adopt healthier lifestyles. Thus, it is important for clinicians to understand patients' health literacy, but studies evaluating health literacy in patients with GN are scarce. We aimed to describe the health literacy among our patients with GN.

Methods

We utilised the data from two separate cross-sectional surveys among patients attending the ambulatory Glomerulonephritis Disease Management clinics in the Singapore General Hospital in July 2020 and June-August 2021^{4,5}. Both surveys assessed health literacy using the self-administered European Health Literacy Survey HLS-EU-Q47 survey as it is a comprehensive questionnaire to evaluate perceived competency to access, understand, appraise and apply information in the domains of healthcare, disease prevention and health promotion⁶, and its translations (including Malay and Chinese) validated in Asia⁷. Perceived difficulty was defined if the item mean score was lower than three. Socio-demographic data such as patients' occupation, spoken language, monthly income, ethnicity, and education level was obtained. Surveys with missing data in >25% of the questions were excluded.

Discussion

This study found that patients with glomerulonephritis had lower health literacy in the domains of disease prevention and health promotion compared to healthcare. Although literature on health literacy among patients with glomerulonephritis is scarce, lack of awareness and need for self-management⁸, inability to cope with health information due to inadequate knowledge and reading skills⁸, low activation i.e. willingness and readiness to manage their health, and negative emotions regarding kidney disease and treatment⁹, have been identified as barriers to kidney disease self-management. The Kidney Disease: Improving Global Outcomes (KDIGO) clinical practice guidelines for kidney disease recommend using structured self-management education to focus on patient empowerment⁹, lifestyle therapy such as sodium intake <2 g/day and moderate intensity physical activity for cumulative duration of at least 150 min per week in hypertension and/or diabetes^{9,10}, and first-line pharmacotherapy with renin-angiotensin system blockers to target standardised office systolic blood pressure target of <120 mmHg in order to reduce risks of cardiovascular disease and progression to kidney failure¹⁰.

There are several limitations in this study. The recruitment of participants from a single centre limited the generalisability of these results to populations with different socioeconomic profiles and healthcare settings. There was no information on duration of kidney disease or caregiver support. This study is also limited by its small sample size hence reducing its ability to detect significant associations and for multivariable regression. However, this study explored patients' difficulty in handling health information that can guide our future endeavours in improving health literacy in the domains of disease prevention and health promotion. It is plausible that healthcare encounters are mainly focused on information regarding disease causation, prognosis, and management, so there was limited time and discussion on disease prevention and health promotion. Interventions in patients with low health literacy have had variable success in improving patient outcomes^{11,12}, but few studies have evaluated interventions for health literacy in non-end-stage kidney disease¹². Further studies on the impact of evidence-based interventions to improve health literacy on long-term health outcomes will be required.

Table 1: Comparison by Difficulty with Information on Healthcare

	Healthcare			Disease Prevention			Health Promotion		
	No difficulty N = 56	Difficulty N = 15	P value	No difficulty N = 46	Difficulty N = 25	P value	No difficulty N = 43	Difficulty N = 28	P value
Age, years	42.3 (27.3, 59.3)	57.2 (37.6, 65.9)	0.08	39.5 (26.9, 55.8)	52.5 (39.5, 63.8)	0.03	40.1 (27.0, 54.8)	52.0 (36.3, 64.9)	0.03
Male, n (%)	22 (39.3)	5 (33.3)	0.67	19 (41.3)	8 (32.0)	0.44	19 (44.2)	8 (28.6)	0.19
English spoke n at home, n (%)	40 (71.4)	11 (73.3)	1.00	33 (71.7)	18 (72.0)	0.98	30 (69.8)	21 (75.0)	0.63
English spoken at healthcare, n (%)	47 (83.9)	14 (93.3)	0.68	39 (84.8)	22 (88.0)	1.00	36 (83.7)	25 (89.3)	0.73
Secondary school education or below, n (%)	18 (32.7)	7 (46.7)	0.32	12 (26.7)	13 (52.0)	0.03	12 (28.6)	13 (46.4)	0.13
Professional or executive, n (%)	22 (40.7)	7 (46.7)	0.68	20 (45.5)	9 (36.0)	0.44	19 (46.3)	10 (35.7)	0.38
Income above \$4000/month, n (%)	15 (35.7)	4 (30.8)	1.00	12 (34.3)	7 (35.0)	0.96	12 (34.3)	7 (35.0)	0.96
Frequent healthcare visits, n (%)	18 (32.7)	8 (53.3)	0.14	17 (37.8)	9 (36.0)	0.08	13 (31.0)	13 (46.4)	0.19

Harnessing Catheter Flow Restoration with Lytic DwELL at Community DiAlysis CentRe (CLEAR)

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References

- Sorensen K, Van den Broucke S, Fullam J, et al. Health literacy and public health: a systematic review and integration of definitions and models. *BMC public health*. 2012;12:80.
- Ko Y, Balasubramanian TD, Wong L, et al. Health literacy and its association with disease knowledge and control in patients with hypertension in Singapore. *International journal of cardiology*. 2013;168(4):e116-117.
- Fraser SD, Roderick PJ, Casey M, Taal MW, Yuen HM, Nutbeam D. Prevalence and associations of limited health literacy in chronic kidney disease: a systematic review. *Nephrology, dialysis, transplantation: official publication of the European Dialysis and Transplant Association - European Renal Association*. 2013;28(1):129-137.
- Liew ZH, Leeu JJ, Tan HZ, Mok IY, Choo JC, Lim CC. COVID-19 vaccine acceptance among patients with glomerulonephritis. *Nephrology*. 2022.
- Lim CC, Mok IY, Tan HZ, Tan C, Yeo F, Choo JC. Health literacy in glomerulonephritis and renal vasculitis attending nephrology clinics. *Glomerular Diseases*. 2021;3(3):129-134.
- Sorensen K, Van den Broucke S, Pelikan JM, et al. Measuring health literacy in populations: illuminating the design and development process of the European Health Literacy Survey Questionnaire (HLS-EU-Q). *BMC public health*. 2013;13:948.
- Duong TV, Aringazina A, Baisunova G, et al. Measuring health literacy in Asia: Validation of the HLS-EU-Q47 survey tool in six Asian countries. *Journal of epidemiology*. 2017;27(2):80-86.
- Boonstra MD, Reijneveld SA, Westerhuis R, et al. A longitudinal qualitative study to explore and optimize self-management in mild to end stage chronic kidney disease patients with limited health literacy: Perspectives of patients and health care professionals. *Patient education and counseling*. 2022;105(1):88-104.
- de Boer IH, Caramori ML, Chan JC, et al. Executive summary of the 2020 KDIGO Diabetes Management in CKD Guideline: evidence-based advances in monitoring and treatment. *Kidney international*. 2020;98(4):839-848.
- Cheung AK, Chang TI, Cushman WC, et al. Executive summary of the KDIGO 2021 Clinical Practice Guideline for the Management of Blood Pressure in Chronic Kidney Disease. *Kidney international*. 2021;99(3):559-569.
- Sheridan SL, Halpern DJ, Viera AJ, Berkman ND, Donahue KE, Crotty K. Interventions for individuals with low health literacy: a systematic review. *Journal of health communication*. 2011;16 Suppl 3:30-54.
- Boonstra MD, Reijneveld SA, Foitzik EM, Westerhuis R, Navis G, de Winter AF. How to tackle health literacy problems in chronic kidney disease patients? A systematic review to identify promising intervention targets and strategies. *Nephrology Dialysis Transplantation*. 2021;36(7):1207-1221.

Background

End-stage kidney failure (ESKF) is a global healthcare challenge. In particular, Singapore saw a growing population of patients relying on haemodialysis (HD) for survival. Tunnelled haemodialysis catheter (THC) is vital in providing vascular access to continue on life-saving HD. However, catheter dysfunction remains a frequent complication, leading to increased morbidity and healthcare costs. Studies indicated that within the first year of catheter placement, malfunction rates fluctuate between 10% and 50%.¹ Thrombosis is a common cause of THC malfunction which can be treated with lytic dwell with high success rates.² In Singapore, administration of lytic dwell to restore flow of occluded THC is traditionally performed in acute hospitals, resulting in delay in dialysis, inconvenience to patients, increase hospital bed occupancy rates and increased overall healthcare costs. Empowering community dialysis nurses to address occluded THC efficiently and safely is essential to improve patient outcomes and reduce the burden on healthcare systems.

Project Aims

1. To develop and implement a comprehensive training programme for community dialysis nurses, equipping them with skills and knowledge necessary to identify, troubleshoot and restore flow of occluded THC.
2. To reduce the number of referrals to acute hospital for occluded THC by successfully restoring the flow of occluded THC with lytic dwell.

Statement of the Problem

Being the largest dialysis provider in Singapore, The National Kidney Foundation provides haemodialysis for 4,642 patients in Singapore, of which, around 15% were on THC. The median number of cases referred to public healthcare institutions (PHIs) for occluded catheter was 48 monthly in 2022.

Methodology

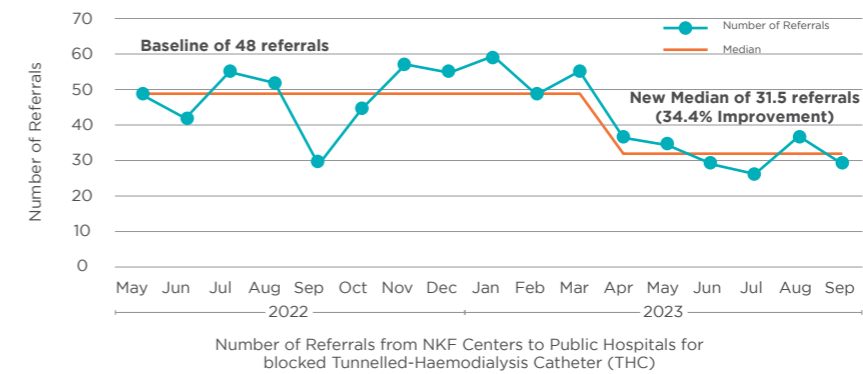
The key components of the project include:

1. Interdisciplinary Collaboration: Collaboration between community dialysis centre and seven PHIs in analysing the problem, setting common goals and missions and co-developing a shared care workflow.
2. Educational Curriculum: The creation of a structured training curriculum covering catheter anatomy, assessment of dysfunction, troubleshooting techniques, and hands-on simulation training.
3. Simulation Training and Competency Checklist: Utilisation of advanced simulators and a competency checklist to provide nurses with a realistic environment to practice various catheter restoration techniques, enhancing their confidence and competence.
4. Implementation: Implementation of lytic dwell workflow in all NKF dialysis centres in stages.
5. Data Collection and Analysis: Continuous data collection to evaluate the impact of the programme on patient outcomes.

Results

As of 30 September 2023, the workflow has been implemented in 24 dialysis centres with 50 nurses being trained and competent in administering thrombolytic agent to restore the flow of occluded THC. Lytic dwell was administered in 37 cases, with 91.9% success rate. Three cases were referred to acute hospital for further treatment following failure to restore adequate flow in THC to continue dialysis, and underwent THC change with fibrin sheath disruption. The median number of cases referred to acute hospital for occluded THC decreased from 48 to 31.5 cases monthly. (Figure 1) No infective complication was observed within 72 hours of flow restoration. Average patient satisfaction feedback score was 4.91/5.

Figure 1: Median Number of Cases Referred to Acute Hospital for Occluded THC



Discussions

Community dialysis centres play a crucial role in providing essential care for patients undergoing HD. By harnessing the specialised expertise of community dialysis nurses to adeptly manage occluded THCs, patients can continue to receive the life-sustaining treatments they need without needing to be hospitalised. Specifically, the project received positive feedback from patients suggesting that avoidance of hospitalisation enhances quality of life for individuals living with kidney failure and reduce overall healthcare costs. Successful implementation of the project depends on effective collaboration between community dialysis centres and acute hospitals as well as ongoing monitoring and adaptation to ensure best practices in patient care.

Conclusions

By empowering community dialysis nurses to perform lytic dwell for occluded THC, catheter flow can be restored effectively to prevent hospital admissions. This model of care may serve as a foundation for expanding to other areas of care for patients depending on dialysis and improving overall healthcare quality and efficiency.

Acknowledgements

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References

1. Miller LM, MacRae JM, Kiaii M, et al. Hemodialysis tunneled catheter noninfectious complications. *Can J Kidney Health Dis.* 2016;3:205435811666913. doi:10.1177/2054358116669130
2. Szymańska J, Kakareko K, Rydzewska-Rosolowska A, Głowińska I, Hryszko T. Locked away—prophylaxis and management of catheter related thrombosis in hemodialysis. *JCM.* 2021;10(11):2230. doi:10.3390/jcm10112230

An Urgent Need to Expand the Kidney Transplantation Donor Pool

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The Pressing Need for Kidney Donors

The burden of end-stage kidney disease in Singapore continues to grow. Six new patients are diagnosed with ESKD every day with more than 300 per million population (pmp) diagnosed annually. The prevalence of patients on dialysis has escalated from 1,292 per million population (pmp) in 2011 to 2,030 pmp in 2020. Kidney transplantation is the best form of treatment for patients with kidney failure with significantly improved morbidity and mortality. Deceased donor kidney transplants (DDKTs) account for about a third of all transplants that are performed in Singapore. The incidence of DDKT in Singapore was only 4.07 pmp in 2021 in comparison, this is 14-fold less than that of Spain (56.3 pmp). The low DDKT rates translate to a median wait time of nine years for ESKD in Singapore from initiation of dialysis to receiving a DDKT – in contrast, the wait time is 3.6 years in the United States. Patients on the waiting list accrue increasing morbidity, which diminishes the benefits from receiving a DDKT. Given these issues, there is a pressing need to expand our DDKT donor pool in Singapore to meet the growing burden of ESKD.

Legislation for Organ Donation in Singapore: MTERA and HOTA

The Medical (Therapy, Education and Research) Act (MTERA) was enacted in 1972 as an opt-in scheme by the Singapore government to empower adults in Singapore to pledge their bodies – encompassing all tissues and organs – after death for medical research, education, and transplantation. The Singapore government subsequently established the Human Organ Transplant Act (HOTA) in 1987 as an opt-out scheme that presumes consent for the procurement of kidneys as donation after brain-death (DBD) in donors aged 21 to 59 years old. To further expand the organ donor pool, revisions were passed in 2004 and 2008 to include all causes of deaths and, most importantly, older donors aged 60 and above – also known as expanded criteria donors or ECDs. Whilst these legislations bolstered organ donation rates, the number of deceased organ donors in Singapore remains low due to multiple factors.

Internationally, a significant proportion of deceased donors' demise is due to violent crimes, drug overdose, and/or road traffic accidents – all of which are exceedingly low in Singapore. Locally, there are cultural, emotional and religious barriers to organ donation which make broaching this topic with grieving families difficult. Ongoing efforts to address these concerns are being made by transplant providers and the National Organ Transplant Unit (NOTU) to educate the community regarding the benefits of organ donation. More information is available on the NOTU website (<https://www.liveon.gov.sg/>). While these efforts are ongoing, innovations in donor utilisation are underway to increase the donor pool.

ECD-dual Kidney Transplant and Donation After Circulatory Death

The inclusion of ECD donors to the organ pool significantly increased DDKT rates over time. However, older age is associated with increased comorbidities such as diabetes and hypertension which can affect organ quality and graft survival. Therefore, allocation of ECD donor organs was limited to recipients aged ≥ 50 years old. Additionally, to ensure organ quality was adequate for donation, a kidney biopsy is performed after donor procurement, and the renal pathology is examined by trained pathologists. Organ quality is assessed by the Remuzzi score (0-12) – a higher score is associated with increased chronic scarring and worse graft outcomes. If the Remuzzi score is low, each kidney is allocated to a single recipient. If the Remuzzi score is intermediate, both kidneys are allocated to a single recipient instead of being discarded. Kidneys with high Remuzzi scores are deemed unsuitable and declined for transplant. With this system in place, the first ECD-dual kidney transplant was performed in 2009 and many recipients have benefitted since that time.

The most commonly utilised donors in Singapore and globally are DBD. To expand the organ pool, centres around the world are increasingly procuring organs from donors who demised after circulatory death (DCD). These donors have sustained catastrophic and permanent brain injury – for example, cardiac arrest with irreversible ischemic brain injury – but do not meet strict brain death criteria. In Singapore, the practice of DCD is limited to the recovery of organs for transplantation only when death is confirmed using circulatory criteria after withdrawing life support from the donors. There was initial hesitancy given the warm ischemia time (WIT) in DCD donors – the period of low perfusion to organs from time of cardiac arrest to time of organ procurement. Prolonged WIT exposes the donor organs to ischemia and potentially significant injury and lead to poor graft survival. Given growing international data with acceptable DCD DDKT outcomes, Singapore has expanded kidney procurement to include DCD donors since 2016. A pilot programme was initiated at Tan Tock Seng Hospital (TTSH) and National University Hospital (NUH) for this purpose. Since inception, the pilot programme has been extended to all other hospitals in Singapore, and eight DCD donors have benefitted 16 kidney recipients.

Hypothermic Machine Perfusion

Procurement of donor organs is an important part of the journey for organ recipients. After kidney procurement, preservation fluid is instilled within kidneys which are subsequently placed on ice until transplantation (static cold storage). This time between preservation and transplantation is called the cold ischemia time (CIT). Prolonged CIT – and WIT in the case of DCD donors – can lead to delayed graft function (DGF), where the renal transplant fails to function immediately, and dialysis is needed in the first week after transplantation. This complication can occur in 30-50% of DDKTs and adversely affects long-term kidney survival. Advancements in organ procurement have led to the development of hypothermic machine perfusion (HMP) in which a machine pumps cold (2-10°C) preservation fluid into donor kidney(s) to improve donor organ function. This process has been shown internationally to reduce the risk of DGF and help improve the quality of marginal donor kidneys that have prolonged CIT +/-WIT compared to static cold storage. HMP has been successfully piloted at the National University Centre for Organ Transplantation (NUCOT), NUH since October 2022 with multiple recipients benefitting from this process and none experiencing DGF.

Future Directions: Normothermic Machine Perfusion, Donors with Hepatitis C, and Xenotransplantation

While HMP has improved DGF rates, research is ongoing to further improve organ preservation. The latest technique – normothermic machine perfusion or NMP – involves infusing warmed, oxygenated red-cell-based fluid – into donor organs. Clinical trials are ongoing to assess the efficacy of NMP vs HMP in solid organ transplantation. Innovations in hepatitis C (HCV) treatment has yielded cure rates of nearly 100%. Internationally, effective antiviral therapy has permitted utilisation of organs from HCV-infected donors. Recipients of organs from HCV-infected donors can be safely and effectively treated post-transplant with HCV antivirals with 100% cure rates reported in the literature. While the prevalence of HCV is low in Singapore, this development allows the consideration of HCV-infected persons as organ donors. Finally, much excitement has occurred in the field of xenotransplantation which involves transplantation of organs from gene-edited pigs. Previous experiments had failed due to overwhelming rejection of these organs. In 2023, with the consent of recipient families, researchers in the USA have successfully implanted these gene-edited organs into brain-death recipients with renal failure with kidney survival exceeding one month. This proof-of-concept study will lead to ongoing clinical trials in the coming years and xenotransplantation may be a part of clinical practice in our lifetime.

Community education, utilisation of organs from DCD donors, and HMP have benefitted organ utilisation rates in Singapore. Nevertheless, there remains more work to be done in addressing the increasing population of individuals with ESKD in Singapore. Promising advancements in expanding the donor pool through scientific research may help alleviate the persistent organ shortage.

Enhancing “Learning by Doing Approach” for Peritoneal Dialysis Patients and Caregivers

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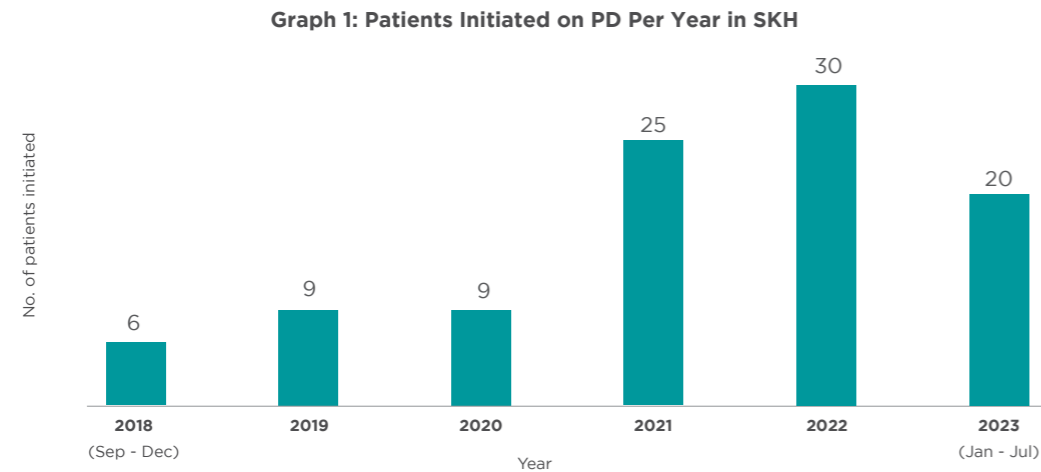


Introduction

Sengkang General Hospital's (SKH) peritoneal dialysis (PD) programme started in September 2018 and has since grown steadily to 121 patients in July 2023. There were 99 incident PD patients who had their PD catheter inserted in SKH and 22 patients who transferred in from other institutions.

The number of patients that are newly initiated on PD each month at SKH has correspondingly increased, except for 2020 during which elective services were suspended due to the COVID-19 Pandemic.

Graph 1 shows the number of patients who were initiated on PD by the year.



The International Society for Peritoneal Dialysis (ISPD) released a guide in 2016 to provide a Syllabus for Teaching Peritoneal Dialysis to Patients and Caregivers¹. The syllabus is designed as a five-day programme of about three hours per day and includes a checklist for patient assessment and PD training. The syllabus guides the trainer in educating patients and/or caregiver(s) to acquire the essential knowledge, skills, and abilities required to perform PD independently and safely at home.

We describe our four-day PD training program of about 25 hours.

SKH PD Training Practice

1. Motivation for Introducing a Modified PD Training Syllabus

When SKH's PD programme started in September 2018, the team created a four-day PD training programme, guided by ISPD's guidelines. The team had expected to serve learners who are predominantly full/part-time working individuals and anticipated that their target audience would appreciate a more succinct programme to reduce time spent in the hospital. The total number of hours dedicated to PD training is longer than ISPD's programme but it reduces the amount of time spent in the hospital.

2. Learning Objectives, Plans and Evaluation

The course is taught one-to-one by the same trainer for consistency so that undivided attention is given to the learner. The objectives and progress are shared with the learner throughout the process. The trainer typically demonstrates and supervises all procedural practices for immediate feedback to the learner. A training log tracks the progress of the learner for each day. The objectives to be met are in line with ISPD PD Training 2016 recommendations¹.

The main objectives are that the patient and/or caregiver:

- (1) can safely perform PD procedures using aseptic technique,
- (2) recognises contamination and can take appropriate follow-up action,
- (3) identifies changes in fluid balance and its relationship to hypertension/hypotension, and
- (4) can detect, report, and manage potential dialysis complications using available resources including contacting the PD unit for assistance or presenting to the emergency department appropriately for medical attention.

3. Course Description

Unlike the ISPD recommended syllabus, training starts on the day after PD catheter insertion and happens during the sessions that the patient returns to the hospital for catheter flushing and dressing change.

Table 1 is a summary of the teaching syllabus broken down into days. Each day typically starts with a debriefing session and informal evaluation of the learner's skills and knowledge retention abilities so that the course can be modified to suit each learner's abilities and needs. Training is done in the PD training centre (PDTC), an outpatient facility. Exceptions are occasionally made for patients who have undergone urgent PD catheter insertion, for inpatient training while they undergo treatment. Trainers adapt their methodology to suit patient and caregiver needs. Learning tools adopted include printed manuals and mannequins.

Table 1: Teaching Syllabus Summary

Day	Duration	Topics Taught
Introductory Phase		
Day 0 Inpatient - Post PD Catheter Insertion Day 1 - Discharge Day	1h	<ul style="list-style-type: none"> Introduction to PD Dressing care PD catheter and exit site care Daily life modifications + Integrating home life with PD: Eg. avoidance of constipation, fluid management PD Team's support information: including on call and walk-in clinic services
Day 5 Outpatient	1h	(Patient returns to PD training centre for flushing of PD catheter and exit site care on Post-Op Day 5 and 10.)
Day 10 Outpatient	1h	<ul style="list-style-type: none"> Personal/hand hygiene and aseptic technique Kidney and PD physiology Assessment of topics taught previously: Eg. exit site care
Formal Training Phase		
Day 15 Outpatient Day 1 of formal PD training	6h	<ul style="list-style-type: none"> Course overview Revision and assessment of knowledge of previous topics: Eg. Hand hygiene, PD catheter and exit site care PD exchange: Patients who choose automated peritoneal dialysis (APD) will be taught to do PD with both the cyclor and "manual" Documentation of vital signs and PD record book
Day 16 Outpatient Day 2 of formal PD training	6h	<p>Inflow and outflow issues</p> <ul style="list-style-type: none"> Contamination management Infectious complications including PD peritonitis, exit site and tunneled tract infection Fluid management Patient is also reviewed by a nephrologist to reconcile therapy plan and establish PD home regime
Day 17 Outpatient Day 3 of formal PD training	6h (Inclusive of 2h of dietician, pharmacist and vendor review)	<p>Training also includes: (Typically about 2h)</p> <ul style="list-style-type: none"> Information on financial claims/aid and logistical support information by vendor Dietary review by dietician Medication compliance and pharmacist review
Day 18 Outpatient Day 4 of formal PD training	3h	<ul style="list-style-type: none"> Review of topics Assessment of learner's ability to self-care/be a caregiver independently

4. Expectations for Learners

Learners are expected to attend each training session as scheduled and primed that there may be a need to extend the training duration, based on the trainer's assessment of their abilities. A home visit is scheduled four days after completion of PD training. Patients also return to PDTC one week later for a review of their technique and to review how they are coping.

5. Schedule

Training is done on consecutive days, with care to limit interruptions to no more than two days. One study suggested that training sessions of one to two hours per day reduces peritonitis rates², although practices in the world varies¹. In SKH, learners typically have three hours of training in the morning followed by a lunch break of one to two hours and another session of three hours in the afternoon. Short breaks are given throughout each session, and whenever requested.

Formal PD training is held 14 days after catheter implantation although exceptions are made for patients undergoing urgent start PD. One study showed that highest peritonitis rates are associated with training within the first 10 days of catheter insertion².

The trainer sets the objectives for each day and lays out the knowledge and procedural skills acquisition goal each day. Unlike the ISPD training syllabus¹, autonomy is given to the trainer to modify the objectives for each day to suit the learner's needs. For example, more topics can be covered in each session if the learner is fast and able to provide satisfactory feedback that there is sufficient knowledge and skills retention. As such, SKH's training log (Figure 1) does not break down the topics by days but allows the trainer to record down which topics are covered on each day. This allows trainers and learners to adapt to each individual needs and focus their efforts on certain segments, should they need it.

In SKH, trainers adopt a "learning by doing" approach as part of their teaching pedagogy. Trainers will first teach procedures and concepts, alternating with discussions and questions. Learners are then given the opportunity to practice, rehearse and role play if appropriate. The topics covered also gradually progress from simple tasks (such as ensuring good personal and hand hygiene) to more complex ones (like management of infectious complications).

Learners and patients also have access to a PD walk-in clinic on weekdays during working hours and a 24-hour hotline to seek advice. Retraining is not routinely scheduled. However, it can be arranged should the need arise.

Figure 1: Section of SKH's PD Training Log for Patients

Theoretical Knowledge						
Date of Training:						
Main Topic	Specific Topics	Day 1	Day 2	Day 3	Day 4	Remarks
Functions of the kidneys	<ul style="list-style-type: none"> Understand how the kidneys work Understand what happens when the kidneys fail 					
Introduction to PD	<ul style="list-style-type: none"> Understand how PD works Understand how the peritoneum acts as a filter Understand what is osmosis and ultrafiltration Understand the concept of drain, fill and dwell 					

Outcomes

Graph 2 and table 2 show the outcomes in SKH's PD programme. ISPD recommends that the overall exit site infection rate should be no more than 0.40 episodes per year at risk and peritonitis rates of less than 0.4 episodes per patient-year at risk. Our rates have consistently remained within recommendations.

Graph 2: Peritonitis and Exit Site Infection Rates

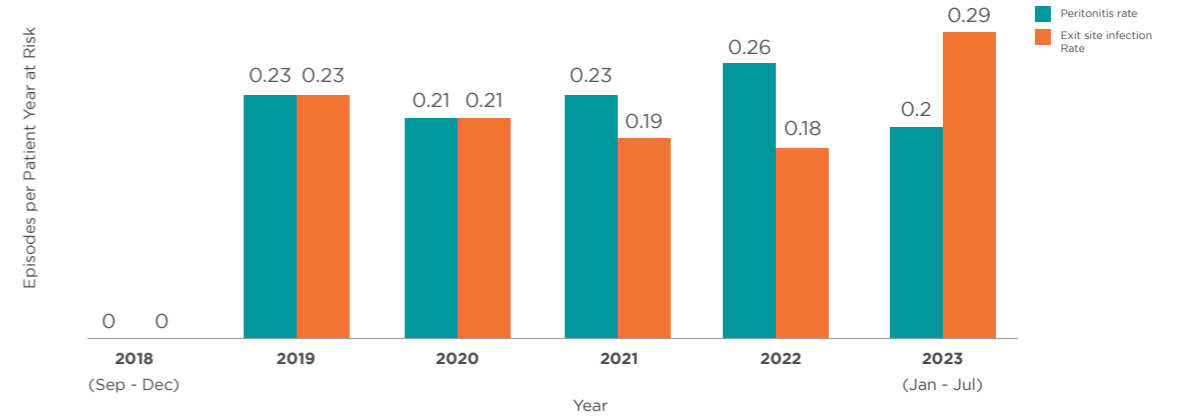


Table 2: Drop Out Rates

Year	PD Catheter Insertion (No.)	Drop Out (No.)	Conversion to HD (No.)	Death (No.)	Transplantation (No.)	Conservative (No.)	Drop Out Rate (Drop Out / Incident PD Patients %)
2018 (Sep - Dec)	5	0	0	0	0		0
2019	10	6	4 (3 PD related)	2	0		40% (6/15)
2020	8	3	1 (PD related)	2	0		17% (3/17)
2021	25	4	1 (Non-PD related)	2	0	1	10% (4/39)
2022	31	7	1 (Non-PD related)	4	2		10% (7/66)
2023 (Jan - Jul)	20	6	3 (2 PD related)	2	1		7% (6/79)

Future Directions

SKH will continue to monitor outcomes such as infectious complications and dropout rates. Further studies can be done to evaluate trainer and learner's satisfaction. Other parameters that can be monitored can include formal assessment of barriers to learning PD and knowledge retention rates after a set period of time. We will also continue to monitor peritonitis rates and assess the impact of this training pedagogy.

References

1. A Syllabus for Teaching Peritoneal Dialysis to Patients and Caregivers. Perit Dial Int. 2016;36(6):592-605. doi: 10.3747/pdi.2015.00277.
2. Figueiredo AE, de Moraes TP, Bernardini J, Poli-de-Figueiredo CE, Barretti P, Olandoski M, et al. Impact of patient training patterns on peritonitis rates in a large national cohort study. Nephrol Dial Transplant. 2015; 30(1):137-42.
3. Coleman EA. Extending simulation learning experiences to patients with chronic health conditions. JAMA. 2014; 311(3):243-4.

Show, Not Tell

- Crucial Role of Clinical Tutors

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Busy clinics often predispose overworked doctors to view medical student attachments as an unnecessary burden. Our increasingly elderly patients frequently require far more than their allotted time and long waiting times make it difficult to meet the needs of patients, their caregivers, and medical students simultaneously.

After all, the sun has set upon the verbal transmission of clinical pearls, and the significance of clinical examination is rapidly ebbing in the face of accessible and accurate imaging. Additionally, the ubiquitous mobile phone instantly places vast repositories of medical knowledge in the palm of our hands, ever ready to spew out reams of the latest guidelines from all over the world.

What then, do we still need clinical tutors for?

Firstly, information is only useful when applied correctly. This requires context, and especially so with regards to medical knowledge.

Think back on your own practice. It's not often that research papers quoted in guidelines use trial participants who are representative of the patients sitting in your clinic. Knowing when, and how to deviate from a guideline relies heavily upon clinical experience and logical extrapolation from pathophysiology. This essential skill of individualising treatment for optimal patient outcome is best learnt through discussing the rationale behind treatment decisions in a clinical setting, in particular when considering relative contraindications, patient lifestyle and financial constraints. Clinical judgement is further honed by acquisition of clinical experience coupled with reflection and discussion with the tutor upon following up on a patient's response to treatment and amending management plans if appropriate.

Secondly, information must be communicated to patients in appropriate language and timely manner. Often, we are so keen to ensure the patient makes an informed choice that we bombard them into insensibility with an endless stream of research data, a dazzling array of treatment options, pros and cons of each option and lists of side effects, both major and minor. While all these should be communicated to the patient, knowing how to present information in layman terms at a suitable pace is key to patient understanding, and hence, informed consent. Akin to performance arts, effective communication is best learnt through "live" practice, immediate feedback, and demonstration of how it could be done better with respect to those circumstances. Knowing how to choose what to say, and when to say it, cannot be discerned without being able to decipher the level of patient understanding, and to an extent, anticipate what information is uniquely important to them when they are making decisions.

Last but not least, caring for patients is not just limited to ordering necessary investigations and prescribing medication. Picking up on nonverbal cues, addressing concerns both spoken and unspoken, and striking the correct balance between providing sufficient information to allay their fears and avoiding scaremongering are all skills that require repeated demonstration by the clinical tutor, and frequent attempts by students.

Time remains our scarcest resource. A quick debrief with students to align their expectations with our clinical service constraints goes a long way in maximising the educational experience for both tutor and students. For example, the clinical tutor can identify patients that best suit the learning needs of the students and spend more time discussing relevant points. If clinic resources permit, a nearby clinic room can be made available for students to practice history taking and examination, while the clinician simultaneously sees patients with lesser learning value. Personally, I will also reduce the number of patients when I am expecting students, by means of shifting them to a make-up clinic.

The face of education is ever changing but some needs will always remain. In recognising the crucial role that we play as clinical tutors, our motivation to teach our students is renewed, enhancing the learning experience, and ultimately improving patient care for generations to come. Let's show our students how we would like to be cared for, because sometimes simply telling is not enough.

Hunting for a Genetic Cause and Prescribing Hope

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“Doctor, what would you recommend we do now?” With brows furrowed, she looked at me intently in the eye across the consultation table. I could feel her trust in me, built over many years. She was lost and she needed direction. I looked after her son, W, since he was a cheeky five-year-old. W is now a confident 14-year-old, aloof at times, wondering why he was made to see me year after year.

His is a typical story. A young child who had a urine test ordered by a fervent doctor looking for a urinary tract infection, and that uncovered microscopic blood that never went away. Multiple evaluations yielded nothing sinister, and the common conclusion is “Thin membrane disease, benign condition...”, as most doctors will tell their patients. “Not always benign”, I will always caution at every visit. “We need to monitor, because if urinary protein starts to become abnormally high, we need to consider other possibilities that may not be so benign...”

Those words had clearly resurfaced in her mind now. W has increasing amounts of urinary protein in the preceding months, and it had become clear this was not transient or orthostatic. She herself has a similar problem - urinary blood and protein for many years - and taking a daily pill to “protect the kidney”.

“Kidney biopsy or genetic testing?” A silent debate emerged in me. I remembered my boss, a well-respected clinician, saying biopsy should not be disregarded. Yet, I thought of the world experts who vehemently argued why genetic testing can and should replace kidney biopsy one day, for selected patients at least. I tended to agree with the latter for this patient, but being the diligent doctor, I faithfully described the procedures, pros and cons of kidney biopsy and genetic testing, including costs and possible insurability implications. I explained he may undergo both eventually.

“Doctor, what would you recommend we do now?”

I took a deep breath, and said slowly, “I recommend genetic testing because we may get a definite diagnosis.” I paused and then continued, “The kidney biopsy results may not be definitive.” We talked for nearly an hour. She still wanted to consider.

Then the pandemic struck, and elective procedures were cancelled. It became clear genetic testing was the way to go. I made the appointment for them to meet my genetics colleague.

Several weeks later, I received an unexpected text one morning from my geneticist colleague. “Your patient W has X-linked Alport syndrome.” A chill went down my spine. An image of the mum in shock floated to my mind. I knew her well enough to predict her response to this news.



I met W with his mum and dad two days later. W was told to wait outside the room first. Mum was silent and dad tried to ask questions. Their eyes were weary and eye bags swollen. Their wrists and fingers were likely fatigued from the endless internet searches... I could only imagine how hopeless they felt. I tried to describe how early diagnosis and early interventions can lead to better outcomes and how kidney failure does not imply the end of the world. Even with their faces behind tear-soaked masks, I knew my words are not registering.

Where do I find hope for them?

Maybe it was destined to happen. There happened to be another patient being seen by a colleague that day. He was 19 years old. He has X-linked Alport syndrome. He just received a kidney transplant. That's the hope for them.

Both families agreed to be introduced that day. Despite language barriers, they connected through translators and gestures. They talked about the diagnosis, kidney dialysis and transplant, hearing loss, school, friends, teachers, medications, disappointment, and life lessons learnt.

The meeting took only 30 minutes, and yet, it was magic and the experience indelible in their hearts.

Genetics has invaded the field of nephrology. The prevalence of monogenic kidney diseases is ~30% in children with chronic kidney disease (CKD) and 5 - 30% in adults.¹ Among adults with CKD of “unclear etiology”, 17% have monogenic kidney diseases.² There is no difference in genetic diagnostic yield between adult- and childhood-onset CKD¹. The diagnostic yield can be as high as 79%,¹ especially in those with family history, consanguinity and extrarenal manifestations.

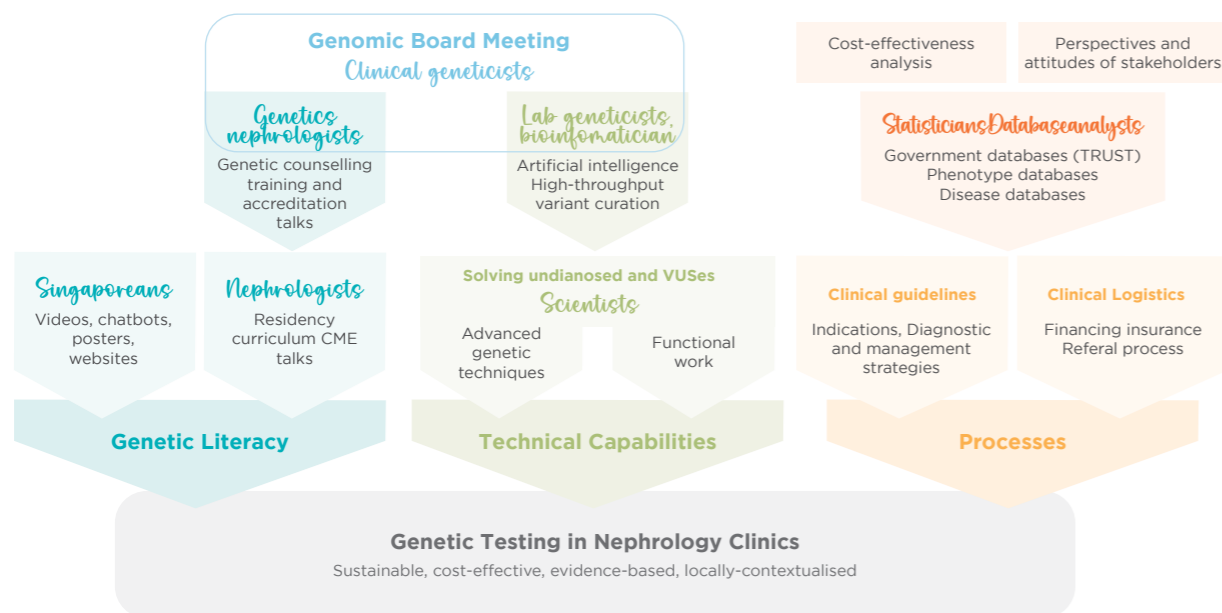
A genetic diagnosis can have a significant impact on clinical management, noted in 73% of adults with CKD.^{2,3} These include changes in therapeutic strategies, reproductive options, avoidance of further investigative tests.

Despite known benefits, genetics testing is hardly performed in Singapore. Reasons include high costs, poor accessibility to genetic tests, lack of standard clinical algorithms, poor genetic literacy, lack of genetic training among nephrologists, lack of genetic counselling expertise and lack of expertise among clinicians in variant interpretation.⁴⁻⁶

To overcome these hurdles, we have set up a multi-institutional multidisciplinary Renal Alliance for Precision Diagnosis in Singapore (RAPIDS) study (Figure 1) in 2020 led by myself and Professor David Matchar as Principal Investigators (PI). This study is one of five Clinical Implementation Pilots funded by Precision Health Research, Singapore (PRECISE), which oversees Phase 2 of Singapore’s three-phase National Precision Medicine programme.

The overall long-term aim of RAPIDS which is currently underway, is to sustainably implement genomic testing in the nephrology clinics in Singapore, according to best practice guidelines, local regulations, and healthcare financing as well as local attitudes and beliefs. The RAPIDS framework is anchored on three branches: (1) increase genetic literacy, (2) expand technical capabilities, and (3) streamline work processes (Figure 1).

Figure 1



(Patient details are changed to protect the identity of the patients and families)

References

- Connaughton DM, Hildebrandt F. Personalized medicine in chronic kidney disease by detection of monogenic mutations. *Nephrol Dial Transplant*. Mar 1 2020;35(3):390-397. doi:10.1093/ndt/gfz028
- Groopman EE, Marasa M, Cameron-Christie S, et al. Diagnostic Utility of Exome Sequencing for Kidney Disease. *N Engl J Med*. Jan 10 2019;380(2):142-151. doi:10.1056/NEJMoa1806891
- Jaysinghe K, Stark Z, Kerr PG, et al. Clinical impact of genomic testing in patients with suspected monogenic kidney disease. *Genet Med*. Jan 2021;23(1):183-191. doi:10.1038/s41436-020-00963-4
- Berrios C, Hurley EA, Willig L, et al. Challenges in genetic testing: clinician variant interpretation processes and the impact on clinical care. *Genet Med*. Dec 2021;23(12):2289-2299. doi:10.1038/s41436-021-01267-x
- Bland A, Harrington EA, Dunn K, et al. Clinically impactful differences in variant interpretation between clinicians and testing laboratories: a single-center experience. *Genet Med*. Mar 2018;20(3):369-373. doi:10.1038/gim.2017.212
- Gradishar W, Johnson K, Brown K, Mundt E, Manley S. Clinical Variant Classification: A Comparison of Public Databases and a Commercial Testing Laboratory. *Oncologist*. Jul 2017;22(7):797-803. doi:10.1634/theoncologist.2016-0431



Delving into the Risk Factors for Exit Site Granulomas in Peritoneal Dialysis Patients

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Introduction

Exit site granulomas (ESG) are a known complication of Peritoneal Dialysis (PD). These ESG, otherwise also known as “proud flesh”, are due to an excess of granulation tissue developing at the PD catheter exit site. ESG formation is traditionally thought to be related to mechanical abrasion. The presence of ESG has also been associated with chronic exit site infections (ESI), though it is unclear if the ESG is the cause or the complication of the ESI¹.

There is currently limited data on the risk factors for ESG formation and ESG treatment.

Treatment options for ESG, discussed in the latest 2023 International Society of Peritoneal Dialysis (ISPD) guidelines², include silver nitrate cauterisation and topical chlorhexidine application³. In our centre, to mitigate its contribution to ESI risk, all patients presenting with ESG undergo chemical cauterisation with silver nitrate. Patients who present with concomitant ESG and ESI, will have their ESI treated first, before cauterisation is done.

As part of our clinical practice, it was observed that some patients were developing recurrent ESG, despite complete cauterisation. Some patients were also developing ESI within four weeks post-ESG-cauterisation, despite sterile precautions and appropriate dressing care. In view of the limitations of current literature and our own observations, our unit set out to audit our ESG cauterisations to identify possible risk factors for multiple ESG formation and post-cauterisation-ESI.

The two main objectives of our audit were to, firstly, identify the risk factors associated with multiple ESG formation and, secondly, identify any specific risk factors associated with ESI occurrence post-ESG-cauterisation.

Methods

We conducted a retrospective audit of prevalent PD patients who had undergone ESG cauterisation at our outpatient PD unit between 1 May 2019 to 30 June 2021.

Unit specific cauterisation records and electronic medical records were reviewed to identify the episodes of ESG cauterisation and patient baseline characteristics.

Categorical risk factors were compared with Chi-squared and Fischer's-Exact test, while continuous risk factors were compared with t-test.

Results

A total of 49 episodes of ESG formation and cauterisation were observed during this period. Three were excluded due to missing data, leaving 46 episodes for analysis. 31 unique patients accounted for the 46 observed episodes, of which only 21 patients had 1 ESG while 10 had > 1 ESG (Figure 1).

Figure 1: Study Populations

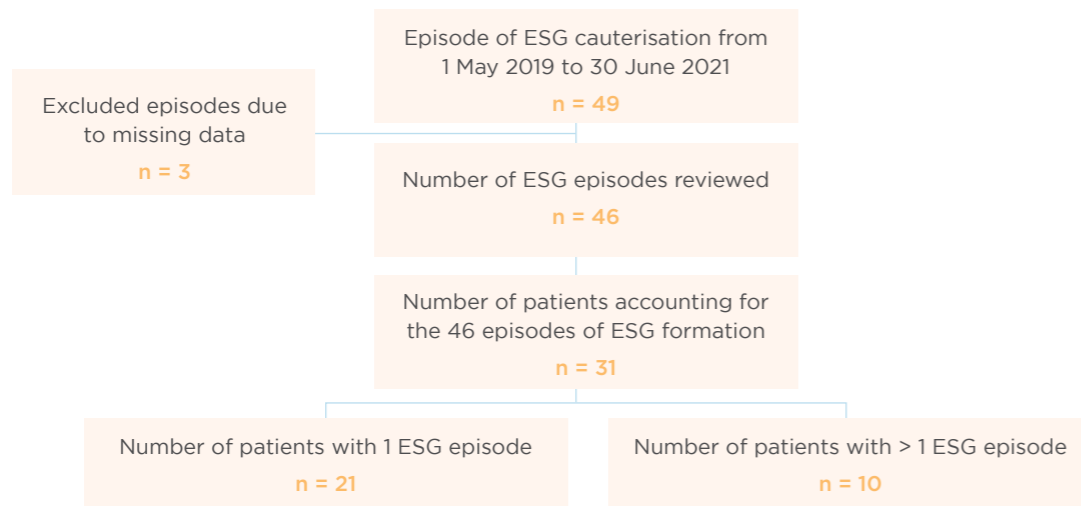


Table 1: Baseline Characteristics of Patient

	Patients with 1 ESG (n = 21)	Patients with >1 ESG (n = 10)	P Value
Mean age	61.3 ± 11.7 years	64.4 ± 12.9 years	0.552
Mean time on PD until first Granuloma	1328.5 days	632.9 days	0.043
% with Diabetes Mellitus	47.6% (10/21)	70.0% (7/10)	0.280
% with prior ESI	61.9% (13/21)	50.0% (5/10)	0.530
% with anchoring issues	38.1% (8/21)	80.0% (8/10)	0.054
% on CAPD	33.3% (7/21)	90.0% (9/10)	0.006

Patients with >1 ESG episode were more likely to be on continuous ambulatory PD (CAPD), 90.0% vs 33.3% (p=0.006). They were also more likely to develop their first granuloma earlier, 632.9 vs 1328.5 days (p=0.043). A larger proportion of those with >1 ESG also reported anchoring issues (80.0% versus 38.1%). However, this approached but did not reach statistical significance (Table 1). Possible contributing factors reviewed such as, Diabetes Mellitus (DM), age, self-care, and history of ESI were not found to be significant (Table 1).

All 46 episodes of ESG cauterisation were retrospectively reviewed for post-cauterisation-ESI. 13 episodes of post-cauterisation-ESI occurred in 12 unique patients. One patient had two separate episodes of granuloma cauterisation which resulted in post-cauterisation-ESI (Figure 3).

Median time to post-cauterisation-ESI was nine days (1-18 days). Six out of 13 ESI were associated with Staphylococcus Aureus, the remaining had no bacterial growth but were managed as ESI due to symptoms at presentation (Figure 4).

Figure 3: Proportion of Post-ESG-Cauterisation Resulting in ESI

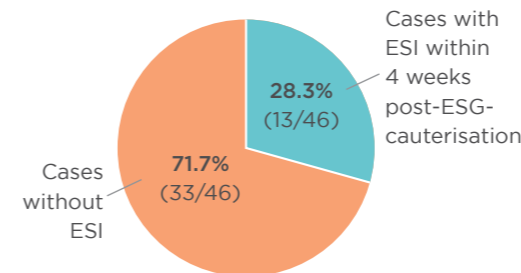
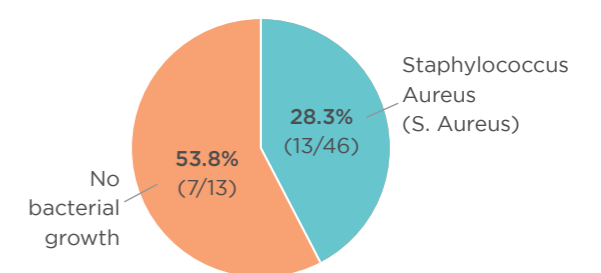


Figure 4: Microbiology Cause of Post-ESG-Cauterisation ESI



The reviewed risk factors; concomitant or recent ESI within four weeks of cauterisation, Diabetes Mellitus, older age or history of multiple ESG formation, were all not significant risk factors for post-cauterisation-ESI (Table 2).

Table 2: Characteristic of Post Cauterisation Patients With and Without ESI

	Post Cauterisation (n = 13)	Without Post Cauterisation ESI (n = 33)	P Value
Mean age of patients	68.7 ± 12.4 years	60.4 ± 11.2 years	0.057
% Patients with Diabetes Mellitus	46.2% (6/13)	69.7% (7/10)	0.136
% ESI within 4 weeks prior to cauterisation	46.2% (6/13)	39.4% (5/10)	0.675
Patient with >1 ESG	38.5% (5/13)	60.6% (8/10)	0.205

Discussion

This single centre retrospective audit demonstrated that CAPD appears to be a significant risk factor for multiple ESG formation. This is possibly due to multiple exchanges per day resulting in repeated catheter movement and concomitant mechanical irritation of the exit site. Patients who develop >1 ESG also seem to do so earlier, though the reason for this is currently unclear.

Furthermore, though ESG cauterisation is done to mitigate ESI risk, post-cauterisation-ESI still remains significant at 28.3% of cauterisations. It is therefore prudent to continue close monitoring for ESI after granuloma cauterisation. Given the 46.2% risk of Staphylococcus Aureus infections should an ESI occur, any empiric antibiotics prescribed for post-cauterisation-ESI should include Staphylococcus Aureus cover.

Given the audit findings, patients in our centre are reminded to remain vigilant for post-cauterisation-ESI and their exit sites are reviewed by a PD nurse two to three days after cauterisation, to ensure they are ESI free.

Future Direction

As this study is limited by its small sample size and its retrospective nature, a more detailed prospective audit, with particular review of ESG size and characteristic can be considered. A better understanding of risk factors for multiple ESG formation and post-cauterisation-ESI will likely facilitate better risk stratification for exit site monitoring and peri-cauterisation prophylactic antibiotics.

References

- Hui et al. Treating peritoneal dialysis catheter exit-site granulomas with chlorhexidine swabstick: A pilot study. J Ren Care. 2020;1-10.
- Chow ET. AL. ISPD Catheter-related Infection Recommendations: 2023 update. Perit Dial Int. 2023 May;43(3):201-219.
- M. Matinfar et al. Successful treatment of peritoneal dialysis catheter exit site granuloma with silver ion-based dressing. The Journal of Vascular Access. 2020;1-2.

Away from Targets, Towards the Patient - Dialysing Older Adults

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Background

The demographics of the end stage kidney disease population are changing, especially in developed countries with more older adults now being offered kidney replacement therapy. Singapore Renal Registry data showed that patients aged above 70 years contributed to almost 35% of prevalent dialysis population in 2021¹. Sessional Kt/Vurea is a widely used marker of dialysis dosing with most national and international clinical guidelines recommending a minimum target to be attained². However, these guidelines do not consider the role of ageing or frailty in defining the minimum Kt/Vurea target. In this article, we aim to discuss the limitations of Kt/Vurea as a routine marker for dialysis dosing in the elderly.

Limitations of Kt/Vurea in Elderly

Traditionally, dialyser urea clearance has been used as a surrogate marker for dialysis treatment adequacy. To adjust for differences in patient size, urea clearance is indexed to the volume of urea distribution as Kt/Vurea. Sessional Kt/Vurea is typically calculated using the Gotch equation, which is dependent on urea generation rate, volume of urea distribution, total body water and water compartmental distribution. These parameters are affected in elderly patients. Physiological changes of ageing in terms of reduced muscle mass affect the generation of uraemic toxins. As muscle is biologically more active compared to fat, loss of muscle mass leads to reduced appetite and decreased metabolism thus leading to reduced toxin generation and dialysis requirement. Reduced protein intake in the frail and elderly adds to decreased urea generation rate. Total body water usually decreases progressively with ageing. Due to change in body composition, the assessments of the volume of urea distribution using the standard anthropometric measurements are inaccurate in elderly. Apart from these inaccuracies of Kt/V, other factors including hypotension, arrhythmias, cardiovascular instability, catheter use and lower blood flow affect attainment of Kt/V targets. Similarly, due to lower rate of generation of uremic toxins, a lower dialysis dose can attain adequate solute clearance.

The main proposition to support the continued use of Kt/Vurea as adequacy of dialysis has been related to observational reports demonstrating an association between delivering lower sessional Kt/Vurea and increased mortality³ though lower Kt/Vurea was predominantly consequent on shorter dialysis sessions. These findings have not been reproduced in the older age group. On the other hand, observational data in a dialysis cohort with a mean age of 70 years showed worse survival in those with higher Kt/Vurea⁴. This can potentially be explained by more rapid loss of residual renal function with aggressive dialysis in attempts to optimise Kt/V. Recent studies, which have centred on patients, rather than treatment deliverables, have shown that for older adults, longevity is not the main priority. Instead, other outcomes, including the ability to maintain function, reducing pain and other symptoms, are more important⁵.

Rethinking the Utility of Kt/Vurea in Clinical Practice

Despite its limitations, sessional Kt/Vurea is easy to measure. Being a widely used tool in practice that can help guide management of dialysis treatment in older adults, it should not be completely disregarded. When treating the very elderly, the limitations of Kt/Vurea should be kept in mind when using this measure as an adequacy of dialysis, such that a low sessional Kt/Vurea in an older frail adult should not necessarily lead to an automatic increase in dialysis dose, without considering residual kidney function and the individual care preferences of the patient. In the ageing multimorbid dialysis population, there is a need for individualised dialysis dosing focusing on patients' care preferences rather than blanket targets. The nephrology community in Singapore has a role to play in effecting this practice change. Training curriculum for physicians as well as allied health providers involved in care of dialysis patients should move away from a urea-centric model, especially in older adults. Dialysis centres which do not achieve the targets of Kt/V in this population should not be penalised. Future research should focus on strategies to incorporate patients' care preferences and patient reported outcome measures (PROMs) while deciding on dialysis dose⁶.

References

1. Health Promotion Board, National Registry of Diseases Office. Singapore Renal Registry Annual Report 2021
2. KDIGO Clinical Practice Guideline for Haemodialysis Adequacy: 2015 Update.
3. Singh S, Choi P, Power A, et al. Ten-year patient survival on maintenance haemodialysis: association with treatment time and dialysis dose. *J Nephrol.* 2013;26(4):763-770.
4. Pérez-García R, Jaldó M, Alcázar R, et al. Unlike Kt, high Kt/V is associated with greater mortality: The importance of low V. *Nefrologia (Engl Ed).* 2019;39(1):58-66.
5. Ramer SJ, McCall NN, Robinson-Cohen C, et al. Health Outcome Priorities of Older Adults with Advanced CKD and Concordance with Their Nephrology Providers' Perceptions. *J Am Soc Nephrol.* 2018;29(12):2870-2878.
6. Flythe J. Integrating PROMs in Routine Dialysis Care: The Devil Is in the (Implementation) Details. *Clin J Am Soc Nephrol* 2022 Nov;17(11):1580-1582

Exploring Renal Nurses' Needs in Delivering Palliative Care at an Acute Setting

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Introduction

Patients with end-stage renal disease (ESRD) require immense palliative care support in view of the illness trajectory combined with various physical and psychological complications (Davison, 2016). Patients who are undergoing dialysis faced significantly high symptom burden. According to one study, patients who were subjects of the study and chose to discontinue dialysis died within a month (Moss, 2011). Renal nurses play a vital role in the end-of-life care for these patients as they spend more time handling the patients in their final moments and giving support for their families. Nurses have the ethical and moral obligation to relieve pain and suffering and to promote the dignity and autonomy of dying patients in their care (Sarfo et al., 2016). Given these vitally important responsibilities, nurses must be adequately prepared to provide sensitive quality care for patients at the end of their life journey.

Provision of palliative care to patients with advanced kidney disease is often met with hindrance by its evolving nature and heterogeneity. Current medical technology in conjunction with advancement in medical interventions such as dialysis is allowing people with ESRD to live past 65 years of age (Rak et al., 2017). This expanding older group of patients warrants an increasing need for palliative care taking into account the poorer functional capacity of aged patients on dialysis.

To-date, there is insufficient literature pertaining to renal nurses' attitudes towards palliative care in an acute hospital setting. Several research studies on nurses in delivering palliative care focused on oncology settings. While they provide essential information, they were bounded by patients with terminal oncological diagnoses (O'Shea, 2014). In a research conducted in the United States by White and Coyne (2011), it was noted that "educational gaps exist in end-of-life care". Likewise, a research paper conducted locally (Chuah et al., 2017) emphasises the importance of investigating the encounters of nurses involved in providing palliative care, even though the study was primarily focused on oncology nurses. There is, however, scant evidence of the perceptions and educational needs of renal nurses towards palliative care. Moir et al. (2015) suggest that nurses across various discipline areas would benefit from palliative education in developing their skill and comfort in caring for these patients.

Despite the growth in awareness of palliative care, renal nurses are uncomfortable in initiating a palliative care plan and discussing death and dying process with the patients and their families. A study done by Coffey et al. in 2016 reported that nurses' confidence in end of life care was associated with greater self-perception of palliative care knowledge and practical experience. However, in that study, most nurses reported that they lack confidence when nursing patients in their final moments, even with prior experience, which may be linked to lack of education or knowledge about patient's wish. There appears to be a relationship between education in palliative care and confidence in providing of care. Therefore, it is necessary to identify the educational needs of nurses with regards to palliative care (Coffey et al., 2016). A study conducted in Taiwan by Chang et al. (2016) uncovered six factors pertaining to the programme

needs for in-service education about palliative care for nurses: handling symptoms and pain relief, ethical issues concerning terminal patients, and teamwork, preparation and care before death, concept of palliative care, communication and counselling, and cultural and spiritual considerations.

In summary, a demand exists for a stepped-up measure in providing palliative care education for renal nurses. It is essential to carry out this research to explore the perceptions of renal nurses in providing palliative care in an acute care setting to determine the barriers faced by these nurses.

Methods

The cross-sectional study was conducted using a questionnaire survey based on the Evaluation Tool 2.1 Palliative Care Providers and 2.5 Health Professionals Not Working in Palliative Care Services (Eagar et al., 2004), which is a validated survey. The Evaluation Tool developed by Eagar et al. (2004) was a component of The Palliative Care Evaluation Tool Kit which helps assessments in palliative care projects.

This study was approved by the Singapore General Hospital's Centralised Institutional Review Board (CIRB). Each participant was provided with a full written disclosure of the study aims and procedures, and a voluntary research participation consent form, prior to taking part in the study.

Out of 74 questionnaires distributed, 65 completed questionnaires were returned (87.8%). Data was analysed using the SPSS version 19.0. Descriptive statistics were performed to evaluate demographic variables, nurses' confidence level towards palliative care, and their views on death and dying. Cronbach's alpha was used to measure internal consistency ($\alpha > 0.70$). Pearson correlation was used to determine correlation between variables. The level of statistical significance was set as $P < 0.05$.



Results

Participants' demographics

A total of 65 completed questionnaires were collected, with females comprising 89.2% of the participants in this study. The majority (50.8%) fell within the age bracket of 21 to 29 years, followed by those aged 30 to 39 years (32.3%). The prevailing length of clinical experience among participants was commonly within the range of one to five years.

Participants were queried about their experience with palliative-related training, their self-assessed proficiency in palliative care, and their caregiving experiences for patients at the end of life. They were also prompted to indicate if they had ever provided care for someone in the dying process, their confidence levels in doing so, and whether they felt adequately supported in this role. Most participants (61.5%) indicated minimal training, marking "No training at all" in 'Palliative Care Training' section. However, only a small percentage of participants expressed high confidence levels in caring for someone who is dying, with 3.1% indicating 'Confident all the time' and 32.3% stating 'Confident most of the time.' Additionally, 26% of participants affirmed having enough support to undertake this caregiving role.

Reacting to and coping with limited patient decision-making capacity

Concerning the clinical symptoms under consideration, respondents demonstrated confidence in addressing various topics or situations, with the exception of 'Reacting to and coping with limited patient decision-making capacity' (Mode = 2). At least sixty-six percent (n = 43) acknowledged that they require 'Need further basic instruction' (24.6%) or 'Confident to perform with close supervision/coaching' (41.5%) in this particular aspect.

Answering patients' questions about the dying process

The majority (75.4%) of the participants expressed uncertainty in answering patients' questions about the dying process with results rating "Need further basic instruction" (33.8%), "Confident to perform with close supervision/coaching" (41.5%) respectively. This result coincides with the belief in some Asian context that positive thinking promotes health and disclosing bad news can somewhat shorten the lives of individuals (Germain et al., 2011).

Informing people of the services available

The results showed a predominantly low response in one topic i.e., "Informing people of the services available" (mode = 1), signifying that the nurses felt less confident in providing the palliative care services available. In order to perform these mentioned topics confidently, the nurses must possess a basic knowledge of the palliative services available. A larger proportion (63%) of the participants rated "Need further basic instruction" or "Confident to perform with close supervision/coaching".

Discussing patients' wishes for after their death

Cognitive decline can impact decision-making towards the end of life. The outcomes reveal a remarkable percentage of respondents (81%) in the 'Discussing patient's wishes for after their death' category, with 33.8% expressing a need for additional basic instruction and 47.7% feeling confident to perform with supervision/coaching. It is essential for discussions to be encouraging of patients' preferences and devoid of pressure, enabling thoughtful and well-considered decisions to be reached.

Discussing different environmental options

A significant number of respondents lacked confidence in discussing different environmental options, which include alternative care areas such as hospice or community hospital. Only 24% of respondents (n = 16) acknowledged confidence with minimal guidance or independently. Providing information on various alternative supportive facilities would require a substantial background of the knowledge of such services.

Discussing death & dying

The study examines the comfort level of respondents in discussing death and dying with patients' families. The average score of 2.9 indicates a slight discomfort among respondents when engaging in conversations about death with families. Introducing conversations about death and allowing patients to articulate their feelings about their illnesses can redefine the concept of death, moving away from being solely perceived as a medical failure (Balaban, 2000).

In terms of perspectives on death and dying, a majority of respondents either 'Strongly Agree' (24.6%) or 'Agree' (53.8%) that families possess the right to decline medical treatment, even if such treatment extends life. As death approaches, the primary goals of both patients and families align, focusing on minimising pain and avoiding unnecessary procedures to enhance comfort levels (Balaban, 2000).

Respondents seek future education courses in areas of palliative care such as pain assessment and management, communication skills required for end-of-life discussion, spirituality and cultural aspects, and end-of-life ethics. Most participants (89.2%) feel communication skills are essential in managing palliative patients. The other highly chosen topics are Ethics (75.4%) and Spirituality and cultural aspects (61.5%).

Discussion

This study finding is dependable. Results such as symptom management, answering patients' questions about the dying process and discussing patients' wishes for after their death, have been consistently ranked as the top-rated palliative care competencies (White & Coyne, 2011). Participants consistently felt that there was a lack of confidence in these mentioned areas, particularly more towards patient and family interactions, such as 'Informing people of the support services available'. This result is congruent with other studies that justify not all clinicians are competent in palliative care management (Monterosso et al, 2016).

Participants believe that families have the right to refuse treatment aimed at prolonging life. They are not comfortable with talking to families about death and thus seek to learn the communication skills required for end-of-life discussion. Meticulous education is required to boost confidence in staff on providing palliative care in ESRD patients. Most participants felt that these communication skills are essential in managing patients on palliative care. Effective communication skills and nursing-patient relationship are vital in managing palliative care patients (Johnston & Smith, 2006).

Conclusion

This study identifies the areas of concerns whereby renal nurses working in an acute setting lack confidence in when caring for patients who are dying. The respondents highlighted key areas which require improvement such as managing limited patient decision-making capacity, answering about the dying process and the services available, discussing patient's wishes for after their death and different environmental options.

In addition, it is noteworthy to emphasise the significance of exploring the perceptions of nurses within the community dialysis setting. This environment, characterised by patients who are generally more stable, allows for frequent and consistent contact between healthcare providers and patients undergoing dialysis. The nature of this setting fosters the establishment of rapport between nurses and patients, creating an environment conducive to open and meaningful discussions on various subject matters, including those related to palliative care. Therefore, investigating the perspectives of nurses in this specific context can provide valuable insights into their experiences, challenges, and potential areas for improvement in delivering palliative care within the community dialysis setting.

References

- Balaban, R. B. (2000). A physician's guide to talking about end-of-life care. *Journal of General Internal Medicine*, 15(3), 195-200. doi: 10.1046/j.1525-1497.2000.07228.x
- Chang, H. J., Hsu, L. L., Hsieh, S. L., Chu, T. L., Yu, W. P. (2016). Development of a needs scale for nurses receiving in-service palliative care education. *Cancer Nursing*, 39(3), E22 - 31. doi: 10.1097/NCC/0000000000000277.
- Chuah, P. F., Lim, M. L., Choo, S. L., Woo, G. Y., To, H. K., Lau, K. Y., Chen, J., & Lian, S. B. (2017). A qualitative study on oncology nurses' experiences of providing palliative care in the acute care setting. *Proceedings of Singapore Healthcare*, 28(1), 18-25.
- Coffey, A., McCarthy, G., Weathers, E., et al (2016). Nurses' knowledge of advance directives and perceived confidence in end-of-life care: a cross sectional study in five countries. *International Journal of Nursing Practice*, 22(1), 247-257. Retrieved from <https://doi.org/10.1111/inj.12417>.
- Davison, S. N. (2016). Supportive care for patients with advanced chronic kidney disease. In *Textbook of palliative medicine and supportive care*. (2nd Ed.). Boca Raton: CRC Press.
- Eagar, K., Senior, K., Fildes, D., Quinsey, K., Owen, A., Yeatman, H., Gordon, R., & Posner, N. (2004). The palliative care evaluation tool kit: A compendium of tools to aid in the evaluation of palliative care projects. Centre for Health Service Development. Retrieved on 19 Dec 2016 from <http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1004&context=chsd>
- Germain, M. J., Davison, S. N., & Moss, A. H. (2011). When enough is enough: The nephrologist's responsibility in ordering dialysis treatments. *American Journal of Kidney Disease*, 58(1), 135-143. Retrieved on 5 June 2017 from <https://www.ncbi.nlm.nih.gov/pubmed/21601331>
- Johnston, B., Smith, L.N. (2006). Nurses' and patients' perceptions of expert palliative nursing care. *Journal of Advanced Nursing*, 54(6), 700-709. Retrieved from <https://doi.org/10.1111/j.1365-2648.2006.03857.x>
- Monterosso, L., Ross-Adjie, G. M., Rogers, I. R., Shearer, F. M., & Rogers, J. R. (2016). How well do we understand health care professionals' perceptions and needs in the provision of palliative care? A mixed methods study. *Journal of Palliative Medicine*, 19(7), 720 - 727. Doi: 10.1089/jpm.2015.0421
- Rak, A., Raina, R., Suh, T. T., Krishnappa, V., Darusz, J., Sidoti, C. W., & Gupta, M. (2017). Palliative care for patients with end-stage renal disease: Approach to treatment that aims to improve quality of life and relieve suffering for patients (and families) with chronic illnesses. *Clinical Kidney Journal*, 10(1), 68 - 73. doi: 10.1093/ckj/sfw105
- Sarfo, L.A., Opare, M., Awuah-Peasah, D., Asamoah, F. (2016). Knowledge and perception of nurses on palliative care. A case study at Agogo Presbyterian Hospital. *Applied Research Journal*, 1(4), 39-43. Retrieved from <https://www.arj.presbyuniversity.edu.gh/index.php/ARJ/article/download/46/18>.
- White, K. R., & Coyne, P. J. (2011). Nurses' perceptions of educational gaps in delivering end-of-life care. *Oncology Nursing Forum*, 38(6), 711- 717.



Revitalising Paediatric Peritoneal Dialysis Care

- Structured Re-training to Reduce Peritonitis

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Introduction

Peritonitis is a significant complication of peritoneal dialysis (PD) as it increases morbidity and mortality^{1,2}. PD-related peritonitis is often related to incorrect techniques or inadequate knowledge of PD³. Therefore, adequate training of the patient and caregivers by specialist dialysis nurses is critical in reducing PD-related peritonitis rates⁴⁻⁶. A comprehensive and adequate PD training programme for newly initiated patients and families can decrease peritonitis rates⁷⁻⁸. However, over time, many patients become less adherent to the correct dialysis techniques and take shortcuts⁹⁻¹¹. Here, we describe our efforts in a single paediatric centre to reverse a worrisome trend of increasing peritonitis rates over the years 2012 to 2014. We conducted a systematic root cause analysis and identified potential contributing factors. Based on these findings, we designed and implemented an intensive PD re-training programme from 2015 to 2018. We aimed to study the effect of this structured re-training programme on peritonitis rates among our paediatric PD patients.

Methods

With a notable increase in peritonitis rates from 0.32 to 0.52 episodes per patient-year from 2012 to 2014, a task force was formed with the aim to decrease the peritonitis rates. A systematic root cause analysis was performed using the Fishbone diagram technique (Figure 1)¹². Factors contributing to peritonitis were related to the decline in knowledge and skills previously taught. HA structured PD Re-Education Programme (PD-REP) that included both practical and theoretical components was designed. Structured re-training was conducted from January 2015 to December 2018. The PD-REP curriculum covered 4 topics: (1) exit site care, (2) hand hygiene, (3) knowledge on peritonitis, and (4) PD setup and troubleshooting (Table 1). The PD-REP sessions were conducted during routine monthly outpatient visits by our paediatric dialysis nurses. Skill assessments related to handwashing were conducted during clinic visits as part of the hand hygiene module, while skills related to exit site care and set up of PD were conducted during re-training home visits which were scheduled for each patient at least once yearly. Standardised checklists were used for skill assessments and home visits.

Figure 1: Fishbone diagram depicting the root cause analysis for peritonitis episodes in 2014. Each episode of peritonitis in 2014 was studied in detail. The identified causes of peritonitis were divided into 5 domains, namely, exit site care, hand hygiene, peritonitis knowledge, peritoneal dialysis setup and troubleshooting, and technical issues related to the Tenckhoff catheter.

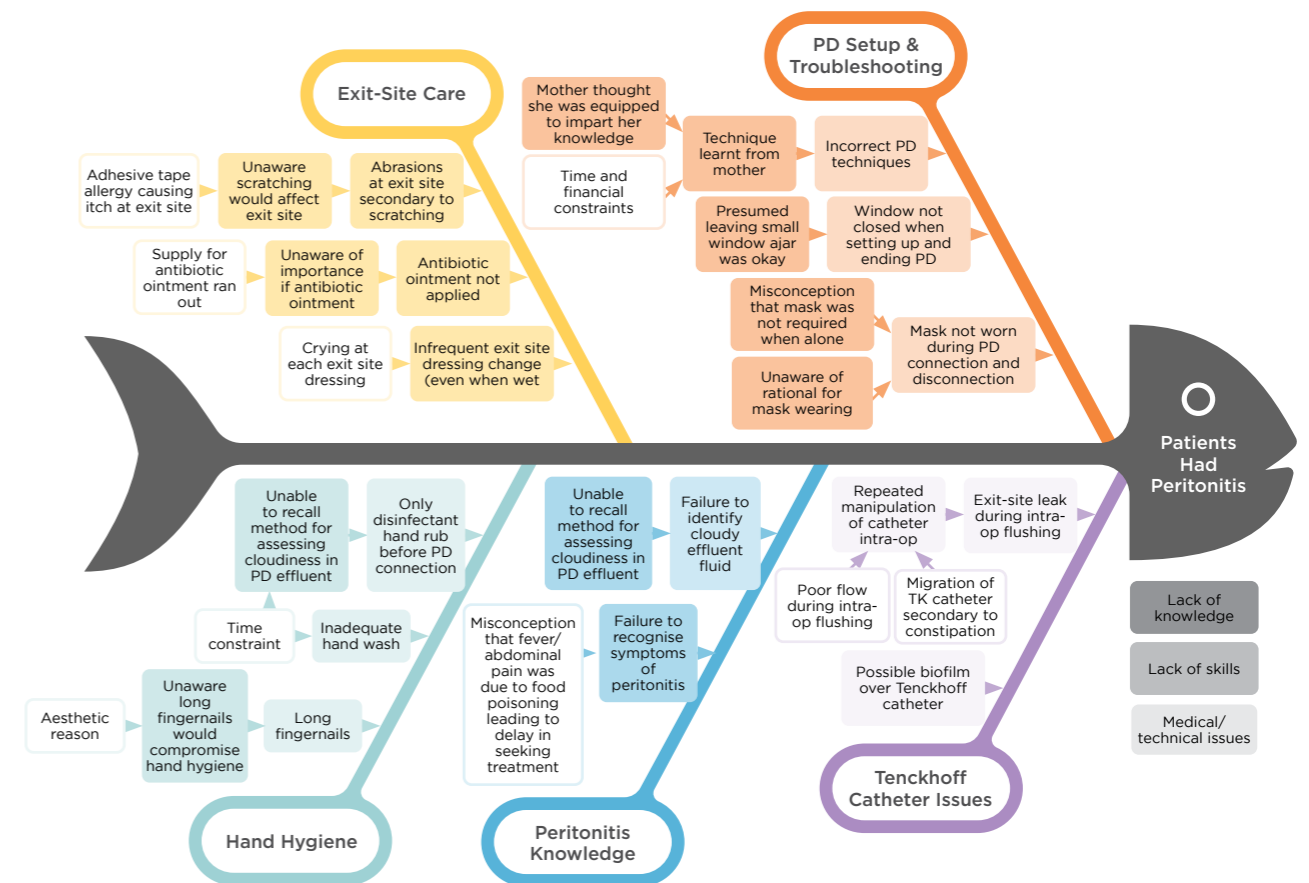


Table 1: Curriculum of the 4 Modules Within Each Cycle and the Home Visit

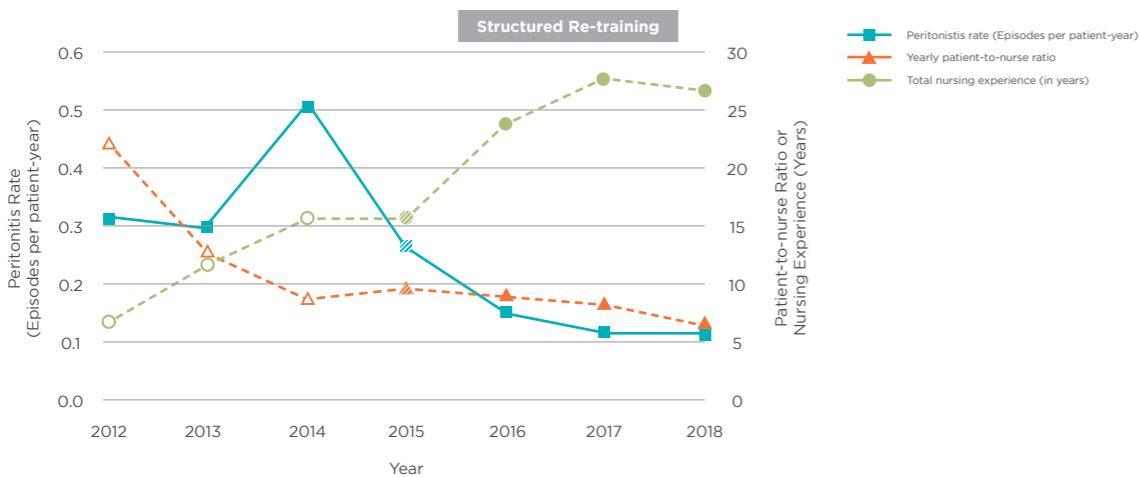
Modules	Aims and Curriculum	Examples of Questions
Exit site care	Aim: Review methods of exit site assessment, exit site care, and signs of infected exit site. <ul style="list-style-type: none"> Exit site knowledge Exit site care* 	<ul style="list-style-type: none"> What are the signs of exit site infection? What will you do if the dressing at the exit site is wet?
Hand hygiene	Aim: Emphasize the importance of hand hygiene and review handwashing techniques <ul style="list-style-type: none"> Nail hygiene and skin integrity (visual inspection) Handwashing technique* Handwashing knowledge 	<ul style="list-style-type: none"> What is the minimum duration of a medical hand wash? When do you need to do a medical hand wash?
Peritonitis	Aim: Recognize signs of peritonitis and the implications of peritonitis <ul style="list-style-type: none"> Peritonitis knowledge Recognizing the cloudy effluent 	<ul style="list-style-type: none"> What are the signs of peritonitis? What are the consequences of peritonitis?
PD setup and troubleshooting	Aim: Review the APD machine, troubleshooting of the APD alarms, and management of fluid, diet, and weight <ul style="list-style-type: none"> Care of APD machine Machine and dialysate preparation Machine alarms and troubleshooting Fluid and weight management 	<ul style="list-style-type: none"> How many clamps are there in a 4-prong Baxter Homechoice® cassette? During or after the initial drain, your machine display screen blanks out. You realize it is a power failure. What would you do?
Home Visit	Aim: Observing patient in the home environment <ul style="list-style-type: none"> PD prescription knowledge Hand hygiene*, exit site care*, and PD machine setup* 	

*Practical skills

Results

Peritonitis rates were analysed in 2 phases: Phase 1 (2012-2014) when no re-training was performed and Phase 2 (2016-2018) after re-training was instituted. Fifty-nine patients were included. Of these, 45 patients were in Phase 1, 32 in Phase 2, and 18 in both phases. Peritonitis rates decreased from 0.37 to 0.13 episodes per patient-year in Phase 2 (Figure 2). After adjusting for age at kidney failure onset, PD vintage, years of nursing experience, and the average patient-to-nurse ratio over the study period for each patient, the adjusted peritonitis rates decreased by 0.38 episodes per patient-year (95% CI, 0.09 to 0.67, p = 0.011) from Phase 1 to Phase 2. Gram-positive bacteria were the commonest cause of peritonitis in both phases, accounting for 41% in Phase 1 and 43% in Phase 2. Gram-negative bacteria and fungi accounted for 34% and 9% of the peritonitis episodes, respectively, in Phase 1 but none in Phase 2.

Figure 2: Peritonitis Rates (As Episodes per Patient-Years), Dialysis Patient-to-Nurse Ratios, and Nursing Clinical Experience (As Years) Over the Years 2012 to 2018



Discussion

The implementation of a tailored and structured re-training programme in a tertiary paediatric dialysis centre can reduce the overall dialysis-related peritonitis rates in patients on automated PD. Our re-training programme was unique as it was designed based on the findings of a root cause analysis performed for increasing peritonitis rates.

Re-training programmes vary greatly in terms of frequency, curriculum, teaching pedagogies, and setting (in-centre versus home). Currently, there is no concrete evidence supporting the ideal structure of re-training programmes in children. The 2011 ISPD Peritonitis Prevention Guidelines recommended that PD patients should be re-trained on dialysis techniques and knowledge on peritonitis signs and the proper response to it, at least once yearly¹³. Our re-training programme, conducted during monthly clinic visits, was tailored based on a root cause analysis. This initial survey underscored a decline in skills and knowledge, which typically occurs over time after initial training^{7,10,11,14}. The deficiencies identified formed the basis for the module structure in our curriculum. Another striking and important feature of our re-training programme was that the curriculum and pedagogies were continuously reviewed and revised by our dialysis nurses. Our first cycle was based on written questionnaires. After feedback from the trainees, we invented more creative and engaging pedagogical methods in the later cycles using card games and interactive games on touchscreen tablets. Our root cause analysis, which included home visits, identified deviations in the home environment that would not have been picked up during sessions in the dialysis centre. This prompted our strong emphasis on follow-up home visits in our re-training programme, a component that differed prominently from the SCOPE follow-up care bundles¹⁵⁻¹⁶. Home visits have been shown to be important in re-training efforts in previous studies^{13,17}. With the establishment of the re-training programme at the beginning of 2015, the peritonitis rate in 2015 almost halved from 0.52 episodes per patient-year in 2014 to 0.27 by the end of 2015. With the continued implementation of the re-training programme, a steady continued decline in peritonitis rates was observed in the subsequent years, suggesting the importance of maintaining skill and knowledge proficiency, on top of increased awareness.

Conclusion

Our data suggest that a structured intensive re-training programme conducted during routine centre visits can significantly reduce peritonitis rates in paediatric patients on home automated PD. The key to success was a dedicated team of experienced nurses who not only tailored the programme according to our identified deficiencies and manpower resources but also continuously reviewed the curriculum and pedagogies to ensure continued engagement.

References

- Warady BA, Sullivan EK, Alexander SR (1996) Lessons from the peritoneal dialysis patient database: a report of the North American Pediatric Renal Transplant Cooperative Study. *Kidney Int Suppl* 53:S68-S71
- Chadha V, Schaefer FS, Warady BA (2010) Dialysis-associated peritonitis in children. *Pediatr Nephrol* 25:425-440. <https://doi.org/10.1007/s00467-008-1113-6>
- Figueiredo AE, Moraes TP, Bernardini J, Poli-de-Figueiredo CE, Barretti P, Olandoski M, Pecoito-Filho R (2015) Impact of patient training patterns on peritonitis rates in a large national cohort study. *Nephrol Dial Transplant* 30:137-142. <https://doi.org/10.1093/ndt/gfu286>
- Bernardini J, Price V, Figueiredo A, Riemann A, Leung D (2006) International survey of peritoneal dialysis training programs. *Perit Dial Int* 26:658-663
- Bernardini J, Price V, Figueiredo A (2006) Peritoneal dialysis patient training, 2006. *Perit Dial Int* 26:625-632
- Ersoy FF (2009) Improving technique survival in peritoneal dialysis: what is modifiable? *Perit Dial Int* 29(Suppl 2):S74-S77
- Gadola L, Poggi C, Poggio M, Saez L, Ferrari A, Romero J, Fumero S, Ghelfi G, Chifflet L, Borges PL (2013) Using a multi-disciplinary training program to reduce peritonitis in peritoneal dialysis patients. *Perit Dial Int* 33:38-45. <https://doi.org/10.3747/pdi.2011.00109>
- Zhang L, Hawley CM, Johnson DW (2016) Focus on peritoneal dialysis training: working to decrease peritonitis rates. *Nephrol Dial Transplant* 31:214-222. <https://doi.org/10.1093/ndt/gfu403>
- Segal JH, Messana JM (2013) Prevention of peritonitis in peritoneal dialysis. *Semin Dial* 26:494-502. <https://doi.org/10.1111/sdi.12114>
- Dong J, Chen Y (2010) Impact of the bag exchange procedure on risk of peritonitis. *Perit Dial Int* 30:440-447. <https://doi.org/10.3747/pdi.2009.00117>
- Russo R, Manili L, Tiraboschi G, Amar K, De Luca M, Alberghini E, Ghiringhelli P, De Vecchi A, Porri MT, Marinangeli G, Rocca R, Paris V, Ballerini L (2006) Patient re-training in peritoneal dialysis: why and when it is needed. *Kidney Int Suppl* 70:S127-S132. <https://doi.org/10.1038/sj.ki.5001929>
- Iedema RA, Jorm C, Long D, Braithwaite J, Travaglia J, Westbrook M (2006) Turning the medical gaze in upon itself: root cause analysis and the investigation of clinical error. *Soc Sci Med* 62:1605-1615. <https://doi.org/10.1016/j.socscimed.2005.08.049>
- Piraino B, Bernardini J, Brown E, Figueiredo A, Johnson DW, Lye WC, Price V, Ramalakshmi S, Szeto CC (2011) ISPD position statement on reducing the risks of peritoneal dialysis-related infections. *Perit Dial Int* 31:614-630. <https://doi.org/10.3747/pdi.2011.00057>
- Mawar S, Gupta S, Mahajan S (2012) Non-compliance to the continuous ambulatory peritoneal dialysis procedure increases the risk of peritonitis. *Int Urol Nephrol* 44:1243-1249. <https://doi.org/10.1007/s11255-011-0079-7>
- Neu AM, Miller MR, Stuart J, Lawlor J, Richardson T, Martz K, Rosenberg C, Newland J, McAfee N, Begin B, Warady BA (2014) Design of the standardizing care to improve outcomes in pediatric end stage renal disease collaborative. *Pediatr Nephrol* 29:1477-1484. <https://doi.org/10.1007/s00467-014-2891-7>
- Neu AM, Richardson T, Lawlor J, Stuart J, Newland J, McAfee N, Warady BA (2016) Implementation of standardized follow-up care significantly reduces peritonitis in children on chronic peritoneal dialysis. *Kidney Int* 89:1346-1354. <https://doi.org/10.1016/j.kint.2016.02.015>
- Chang JH, Oh J, Park SK, Lee J, Kim SG, Kim SJ, Shin DH, Hwang YH, Chung W, Kim H, Oh KH (2018) Frequent patient retraining at home reduces the risks of peritoneal dialysis-related infections: a randomised study. *Sci Rep* 8:12919. <https://doi.org/10.1038/s41598-018-30785-z>



Breaking Boundaries in Medtech

- Advancing Wearable Peritoneal Dialysis Systems

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Introduction

The incidence of patients receiving chronic dialysis is on the rise, both in Singapore¹ and worldwide², driven by factors such as metabolic disease and an ageing population. Globally, dialysis remains the main mode of kidney replacement therapy for kidney failure patients. Peritoneal dialysis (PD) is a well-established mode of dialysis therapy and is available in most countries. PD offers several advantages, including better preservation of residual kidney function, improved quality of life, greater therapy flexibility, and enhanced patient autonomy. Additionally, PD is a simple, cost-effective, needleless, home-based dialysis. Despite its advantages, the adoption of PD remains low across the world³. One of the challenges is the requirement for frequent PD exchanges during the daytime for continuous ambulatory PD therapy or connection to a bulky PD machine overnight for automated PD therapy, restricting patient mobility. Efforts are underway to address these limitations, with the development of miniaturised versions of the PD machines⁴.

Advancements in Wearable PD Systems Worldwide

Researchers and clinicians worldwide have been exploring the development of wearable PD systems, with many focusing on sorbent-based technology^{5,6}. This approach utilises substances like activated carbon, resin, or zirconium compounds to eliminate uremic toxins. The dialysate is recycled by adding electrolytes and osmotic agents (glucose), before returning it to the peritoneal cavity through a single or dual-lumen PD catheter. These systems require only a small amount of dialysate to move in and out of the peritoneal cavity simultaneously or alternately. Various wearable PD systems are in development globally. One of the earliest wearable systems, developed in Vicenza, is Vicenza Wearable Artificial Kidney (ViWAK).⁶ However, it faced challenges as the system was unable to replace osmotic agents and some electrolytes and was only subjected to in vitro testing. Another wearable PD system is Carry Life® PD from Sweden. This wearable PD system was tested on four PD patients. However, there has been an absence of subsequent developments or updates regarding this device since its last publication in 2018. The company also introduced the Carry Life® UF, a system designed to generate ultrafiltration using glucose without a sorbent, with a primary focus on the process of ultrafiltration.⁷ The Renart-PD is another wearable PD

system currently under development in Russia. The system uses sorption purification and electrochemical methods to remove uremic toxins.⁸ Another wearable PD device currently in development in Singapore is the Automated Wearable Artificial Kidney (AWAK) system.

Automated Wearable Artificial Kidney (AWAK) System

The AWAK system is one of the few wearable systems (Figure 1) that has undergone pre-clinical trials in animals and a preliminary study involving 15 stable PD patients at Singapore General Hospital.⁵ Despite encountering some technical challenges in the initial stages, the system underwent modifications to address these issues. The key finding from the study was the absence of serious adverse effects observed with the AWAK therapy. The study highlighted a reduction in serum uremic toxins including urea, creatinine, phosphate, and β 2-microglobulin levels, with daily use of three cartridges of 7-hour AWAK therapy for three consecutive days. Although a considerable number of participants experienced abdominal discomfort, these symptoms spontaneously resolved in most cases. Suboptimal ultrafiltration, particularly among patients with residual kidney function, was also observed. The lessons learned from the preliminary study have prompted further refinements to the AWAK system to enhance outcomes.

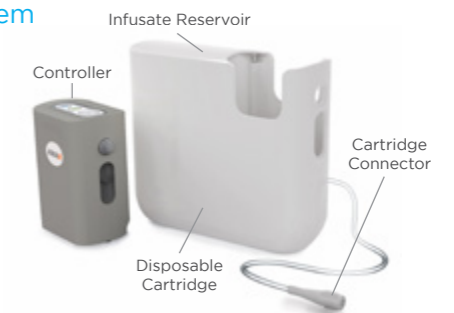


Figure 1: Automated Wearable Artificial Kidney (AWAK) Peritoneal Dialysis device (prototype)

In the previous investigation, participants utilised three AWAK cartridges daily. To alleviate the treatment burden, modifications were made to the device, enabling it to operate with a single sorbent cartridge over an extended duration of seven to nine hours per day. This adaption aims to enhance the autonomy and mobility of patients undergoing PD therapy. The revised AWAK system underwent evaluation in a subtotal nephrectomized pig. The animal was initially stabilised using the standard automated PD system (Baxter system) for five days before transitioning to a daily seven to nine hours of AWAK therapy for a period of 30 days. Throughout the animal study, key indicators such as serum urea, creatinine, β 2 microglobulin, phosphate levels, and electrolytes (sodium, potassium, bicarbonate, chloride, calcium, and magnesium) remained stable. Inflammatory markers in the serum, including C-reactive protein (CRP), tumour necrosis factor (TNF)-alpha, interleukin (IL)-6, and total white cell counts in both serum and drain dialysate, did not exhibit an increase during the entire 30-day AWAK therapy.

A previous study of the AWAK device in PD patients revealed a potential for enhancement in ultrafiltration. Subsequently, modifications were made to the AWAK device, enabling clinicians to titrate various glucose settings to achieve the desired level of ultrafiltration. The updated AWAK system underwent recent testing in a porcine model, demonstrating improved ultrafiltration with the adjustment of glucose settings. Additionally, the system has undergone adjustments to address potential adverse effects, particularly mitigating abdominal discomfort. These modifications will be subject to evaluation in a subsequent feasibility study in human subjects. Currently, the refined AWAK system is undergoing evaluation in a prospective, single-arm study to assess the feasibility of AWAK PD therapy in stable adult PD patients at Singapore General Hospital (SGH).

In summary, PD is an established kidney replacement therapy, but current PD systems face limitations. Researchers globally are developing wearable PD devices to overcome these shortcomings. The AWAK PD device stands out among wearable PD systems, having conducted a preliminary study with PD patients. Following this, the device underwent modifications including improvements in ultrafiltration and sorbent modifications to enhance its performance, displaying promising results in an animal study. The revised AWAK device is currently ongoing feasibility testing with PD patients at SGH. Through the dedication and efforts of researchers and clinicians, wearable PD devices are anticipated to emerge as a viable option for patients undergoing PD in the foreseeable future.

References

1. Khor L, Ghim A, Ms S, Cai G, Ng M, Nyunt W, et al. Singapore Renal Registry Annual Report 2020 National Registry of Diseases Office Acknowledgement National Registry of Diseases Office Registry Coordinators. Annual Data Report | USRDS [Internet]. [cited 2022 Sep 18]. Available from: <https://adr.usrds.org/2021/end-stage-renal-disease/1-incidence-prevalence-patient-characteristics-and-treatment-modalities>
2. Cho Y, Bello AK, Levin A, Lunney M, Osman MA, Ye F, et al. Peritoneal Dialysis Use and Practice Patterns: An International Survey Study. Am J Kidney Dis [Internet]. 2021 Mar 1 [cited 2022 Sep 25];77(3):315-25. Available from: <https://pubmed.ncbi.nlm.nih.gov/33800844/>
3. Foo MWY, Htay H. Innovations in peritoneal dialysis. Nat Rev Nephrol 2020 16(10) [Internet]. 2020 Apr 16 [cited 2022 Sep 18];16(10):548-9. Available from: <https://www.nature.com/articles/s41581-020-0283-8>
4. Htay H, Gow SK, Jayaballa M, Oei EL, Chan CM, Wu SY, et al. Preliminary safety study of the Automated Wearable Artificial Kidney (AWAK) in Peritoneal Dialysis patients. Perit Dial Int [Internet]. 2022 Jul 1 [cited 2022 Sep 18];42(4):394-402. Available from: <https://journals-sagepub-com.libproxy1.nus.edu.sg/doi/full/10.1177/08968608211019232>
5. Ronco C, Fecondini L. The Vicenza Wearable Artificial Kidney for Peritoneal Dialysis (ViWAK PD). Blood Purif [Internet]. 2007 Sep [cited 2022 Sep 14];25(4):383-8. Available from: <https://www.karger.com/Article/FullText/107775>
6. Samuelsson O, Heijdenberg L, de Leon C, Meinander NM, Persson E, Wranner L. Su0014PERITONEAL DIALYSIS WITH THE NEW PORTABLE CARRY LIFE® SYSTEM. Nephrol Dial Transplant [Internet]. 2018 May 1 [cited 2022 Sep 18];33(suppl_1):1621-1621. Available from: https://academic-oup-com.libproxy1.nus.edu.sg/ndt/article/33/suppl_1/1621/4998768
7. Bazaev NA. Wearable Artificial Kidney Renart-PD. Biomed Eng 2020 542 [Internet]. 2020 Jul 14 [cited 2022 Sep 18];54(2):83-7. Available from: <https://link.springer-com.libproxy1.nus.edu.sg/article/10.1007/s10527-020-09979-1>

Tackling the Challenges in Nurse-Led Chronic Kidney Disease Care Delivery

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At an estimated prevalence of 13.4% globally, chronic kidney disease (CKD) is increasingly recognised as a growing public health concern¹. CKD is the third-fastest growing cause of death worldwide and ranks as the highest of any disease group in the World Bank's analysis of health expenditure². Our local census reflects a similar pattern compared to that observed internationally. In Singapore, the incidence of CKD stage 5 increased by 31% from 2010 to 2018, while the prevalence of ESKD patients on dialysis doubled from 1,218 per million population (pmp) in 2010 to 1,925.9 pmp in 2019³. How we deliver CKD care will very likely influence the trajectory of kidney disease and its impact on resource utilisation within our healthcare system.

Challenges to CKD Care Delivery

Is the current care model still relevant? To answer this, we first identified three significant challenges that limit adequate care provision for CKD patients. The first challenge is that the size of the CKD population alone is too large for effective mitigation of cardiovascular risk factors and slowing of progression of CKD to be managed by nephrologists alone. Surveys from the International Society of Nephrology Global Kidney Health Atlas reveal a global shortage of nephrologists for kidney disease care⁴. Task shifting, which involves training primary care providers and nurses to provide kidney care, is one solution.

The second challenge is the burden of multimorbidity in CKD patients. In a cohort study of patients with advanced CKD, isolated CKD was rare – only 4% of the cohort had no comorbidity other than CKD⁵. CKD is frequently associated with hypertension, anaemia, heart failure, atrial fibrillation, myocardial infarction and mineral bone disease⁶. As CKD progresses towards ESKD, the number of comorbidities increases, with care involving multiple healthcare providers from multiple subspecialties, hence leading to fragmentation of care⁷. There is a compelling need to develop cost-effective and streamlined care delivery pathways for patients with CKD.

The third challenge is that current models of care for CKD management are more disease-centric than 'patient-centric' or 'person-centred'. Effective and sustainable CKD management could be achieved if patients are enabled and empowered to self-manage their conditions. CKD patients have limited understanding of their illness and poor self-care due to poor health literacy⁸. CKD patients are often asymptomatic at an early stage, leading to poor compliance to treatment without good counselling and education. Much needs to be done to support these patients.

The Role of Nurses in CKD Care

Care models that incorporate nurse practitioners are increasingly deployed in many parts of the world to manage chronic diseases such as congestive heart failure and diabetes mellitus⁹. Nurse-led clinics have emerged as a model for ambulatory delivery of care, especially in community settings, with an aim to increase patients' ability to self-care. Nurses who lead the care in these clinics are primarily nurse practitioners with advanced clinical competency and skills. Care models incorporating nurse practitioners have also been tested out in CKD care and compared to physician-led care models, nurse-led or nurse-coordinated models reported improvement in patient satisfaction scores and quality of life¹⁰⁻¹³. Few studies have examined the effect of a synergistic partnership and the effects of varying the balance of professional roles between physicians and nurses.



Integrated Care Approach to Deliver CKD Care – Alexandra Hospital

In Alexandra Hospital, our team piloted an integrated, collaborative workgroup that comprises an Advanced Nurse Practitioner (APN) who has had substantial clinical training in providing care to patients with CKD, a dedicated nephrologist supporting the APN, and a team of community-based nurses (Alexandra Hospital's Nurses-In-Community). Recognising that optimal management of cardiovascular risk factors like hypertension and diabetes mellitus are of paramount importance in keeping kidney disease progression at bay, we designed a virtual network of nurse-led support through a customised telemonitoring platform to oversee these self-monitored parameters, with care tailored to each CKD patient's needs. At the centre of this model, the nephrology APN drives the patient's care, emphasising education, disease counselling, and advising on self-management skills and health literacy. The nephrologist attached to the APN continues to provide crucial and consistent oversight of the intricacies of clinical care to support the APN.

A longer-term goal of this multidisciplinary care model is the creation of an ecosystem of care that devotes as much attention to the psychosocial aspects of patients' well-being as it has traditionally dedicated to the achievement of clinical targets in CKD care. Expanding CKD care provision to physician extenders like nurse practitioners will help relieve the burden of CKD care, spreading it beyond nephrologists. Supporting CKD patients through a team-based approach also creates opportunities and the capacity for consolidation of care – streamlining care pathways, rationalising the number of care providers, and developing the concept of one care team – a much-needed enhancement that could greatly reduce care fragmentation.

References

- Hill NR, Fatoba ST, Oke JL, et al. Global Prevalence of Chronic Kidney Disease – A Systematic Review and Meta-Analysis. *PLoS One* 2016;11:e0158765.
- Levin A, Okpechi IG, Caskey FJ, et al. Perspectives on early detection of chronic kidney disease: the facts, the questions, and a proposed framework for 2023 and beyond. *Kidney Int* 2023;103:1004-08.
- Khan BA, Singh T, Ng ALC, et al. Health economics of kidney replacement therapy in Singapore: Taking stock and looking ahead. *Annals of the Academy of Medicine, Singapore* 2022;51:236-40.
- Osman MA, Alrukhami M, Ashuntantang GE, et al. Global nephrology workforce: gaps and opportunities toward a sustainable kidney care system. *Kidney Int Suppl* (2011) 2018;8:52-63.
- Hawthorne G, Lightfoot CJ, Smith AC, et al. Multimorbidity prevalence and patterns in chronic kidney disease: findings from an observational multicentre UK cohort study. *Int Urol Nephrol* 2023.
- Corsoneo A, Fabbietti P, Formiga F, et al. Chronic kidney disease in the context of multimorbidity patterns: the role of physical performance – The screening for CKD among older people across Europe (SCOPE) study. *BMC Geriatr* 2020;20:350.
- Sloan CE, Zhong J, Mohottige D, et al. Fragmentation of care as a barrier to optimal ESKD management. *Semin Dial* 2020;33:440-48.
- Curtin RB, Walters BA, Schatell D, et al. Self-efficacy and self-management behaviors in patients with chronic kidney disease. *Adv Chronic Kidney Dis* 2008;15:191-205.
- Senior PA, MacNair L, Jindal K. Delivery of multifactorial interventions by nurse and dietitian teams in a community setting to prevent diabetic complications: a quality-improvement report. *Am J Kidney Dis* 2008;51:425-34.
- Hu Q, Yang X, Wang W, et al. Analysis of the Effectiveness of the Nurse-Led "Outpatient-Ward-Home" Management Model in Chronic Kidney Patients. *Evid Based Complement Alternat Med* 2022;2022:4229436.
- Xu H, Mou L, Cai Z. A nurse-coordinated model of care versus usual care for chronic kidney disease: meta-analysis. *J Clin Nurs* 2017;26:1639-49.
- Peeters MJ, van Zuijlen AD, van den Brand JA, et al. Nurse practitioner care improves renal outcome in patients with CKD. *J Am Soc Nephrol* 2014;25:390-8.
- Chen CC, Chen Y, Liu X, et al. The Efficacy of a Nurse-Led Disease Management Program in Improving the Quality of Life for Patients with Chronic Kidney Disease: A Meta-Analysis. *PLoS One* 2016;11:e0155890.

Transformative Innovation in Dialysis Access

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Background

Haemodialysis access is one of the greatest challenges faced by end stage renal failure patients treated with haemodialysis (HD). HD access complications can include infection and mechanical complications that are related to frequent use. Arteriovenous fistula (AVF) is considered the preferred permanent HD access given its lower complication rates compared to HD catheters. However, not all AVF created will mature, with 28% to 53% never becoming functional for dialysis.¹ About three in 10 patients may eventually have to explore other options such as an arteriovenous graft (AVG).²⁻⁵

In Singapore, pre-dialysis AVF creation remains low with only 19.5% of incident end stage renal disease (ESRD) patients.³ Local data shows that majority of patients (up to 63%) are still using a HD catheter as their initial access for HD.⁶

Gaps in Current Standard of Care in Vascular Access

Over the last five decades, open surgery is the standard of care to create an AVF which requires an incision at the elbow or wrist. The high primary failure and prolonged maturation rates observed in surgically created AVF has prompted a need for innovations such as endoAVF. EndoAVF is a type of AVF created at mid-forearm using endovascular techniques, which involves a minimally invasive approach (Table 1). The day-case procedure requires small needle punctures to introduce two thin devices with magnets or one device under ultrasound guidance and create a connection between an artery and a vein using radiofrequency or heat energy. This option thus strategically and logistically precludes the need for limited operating theatre slots and anaesthetists. There are currently two endoAVF systems available on the market: the WavelinQ® (BD) and the Ellipsys® (Medtronic) system (Table 2).

Table 1: Difference Between Surgical AVF and EndoAVF

	Surgical AVF	EndoAVF
Anastomosis	Forearm and upper arm	Forearm
Surgical scar	Yes	No
Outflow vessels	Single	Multiple
Cannulation site	Single vein	Multiple veins (including cubital veins)
Look	More visible	Less visible, multiple veins may dilate
Feel	Strong thrill, harder vessel	Weak thrill, soft vessel
Listen	Stronger bruit	Softer bruit

Table 2: Comparison of Currently Available EndoAVF Creation System

	WavelinQ® (BD)	Ellipsys® (Medtronic)
Catheter	Dual	Single
Energy	Radiofrequency	Thermal resistance
Controller	Electrocautery unit	Microprocessor
Imaging guidance	Fluoroscopy	Ultrasound
Contrast use	Yes	No
Positioning	Magnets	Ultrasound
Anastomosis	Precise slit	Tissue fusion
Inflow artery	Ulnar or radial	Proximal artery

Advantages of Minimally Invasive Solutions

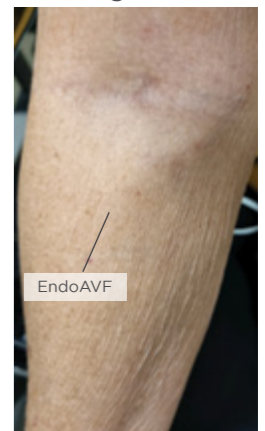
No visible scar, faster recovery

As the EndoAVF procedure is minimally invasive, it typically involves smaller incisions which confers reduced post-procedural pain and quicker recovery times. Additionally, there is minimal or no scar visible (Figure 1). For these reasons, an endoAVF is an attractive option for patients who are hesitant or reluctant to have a AVF created because of the risks involved and stigma associated with fistula due to visible surgical scar.

Comparable success and maturation rates to surgical AVF

EndoAVF can be created by trained doctors equipped with endovascular skills (i.e. interventional nephrologists, vascular surgeons and interventional radiologists). A recent systematic review shows that it has a comparable 12-month primary and secondary patency rates of 62% and 87% when compared to surgical AVF.⁷ Moreso, a high procedure success rate of 98% and maturity rate of eight or nine in 10 patients have been reported.⁷ Procedure-related complications were reported to be low at 7% from the same systemic review.⁷ Additionally, in a published report from Singapore, EndoAVF was successfully created in 89% of patients, with maturation rate at 94.5%, suggesting that this is a feasible and effective option for local ESRD patients.⁸

Figure 1:



Right endoAVF. No visible scar seen.

Expanding options to address patient needs

The introduction of endoAVF technologies allows physicians to create autogenous AVFs in patients who are otherwise ineligible for a forearm AVF due to suboptimal distal vein calibre, preserving more vein real estate for future more downstream options such as brachiocephalic or brachio basilic AVF. This can be beneficial in local ESRD population in whom dialysis vintage may be long due to the low transplant transition rate.

Other Advantages of EndoAVF

Multiple cannulation options

Unlikely surgical AVF of the upper arm, the connection of an artery and vein only allows a single superficial vein conduit to mature, endoAVF offers multiple cannulation options (Figure 3). This is because being created near or a perforator vein, that directs blood to flow from the deep vessels into all superficial vessels of the arm (Figure 4). The endoAVF thus may have two outflow veins (cephalic vein and basilic vein) rather than single outflow vein. The cannulation zone is frequently no longer in the upper arm but at the antecubital cephalic (median cubital) and basilic vein (Figure 2). Recirculation is unlikely long as the 'A' and 'V' needle are inserted in two different superficial veins.

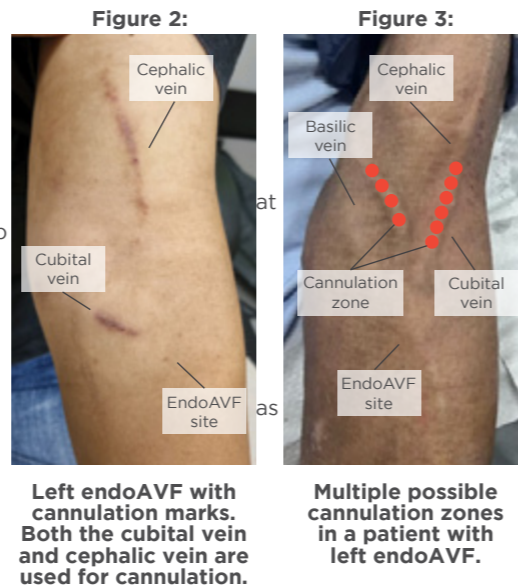
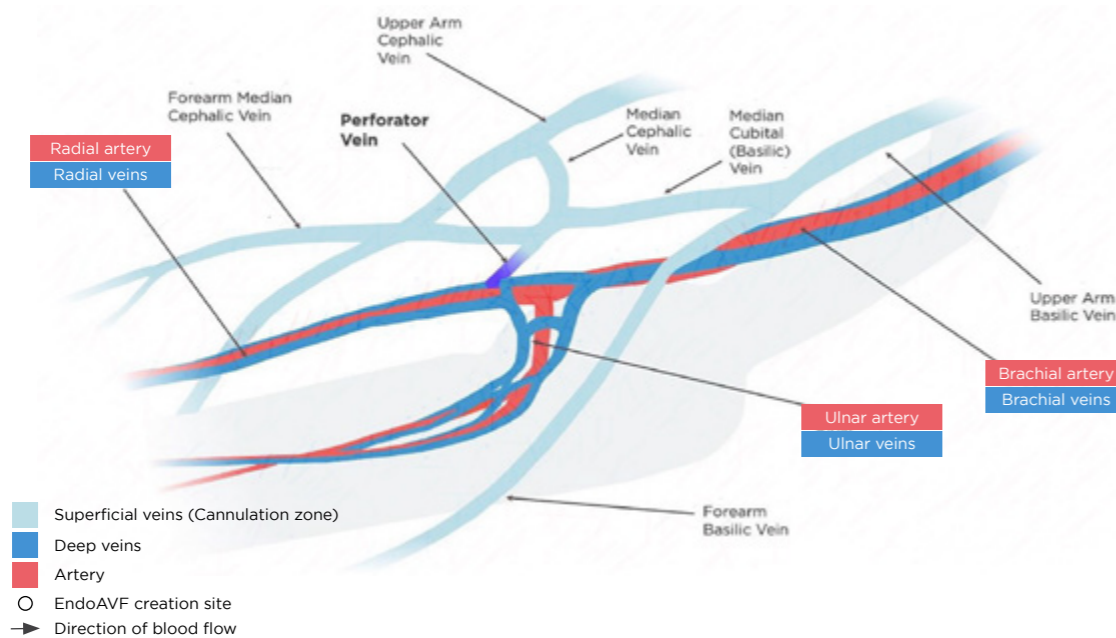


Figure 2: Left endoAVF with cannulation marks. Both the cubital vein and cephalic vein are used for cannulation.

Figure 3: Multiple possible cannulation zones in a patient with left endoAVF.

Figure 4: Relationship of the arteries, deep veins, superficial veins and perforator vein of the arm in endoAVF.



Fewer incidence of vessel stenosis or thrombosis in the future

Narrowing of blood vessels (stenosis) in patients with AVF is common. Sixty per cent of these patient visit hospitals, some more frequent than others, for a procedure known as angioplasty to dilate their narrowed blood vessels. A reduced blood flow through the fistula affects the quality of dialysis and increased risk of thrombosis and reliance on catheters. Overseas studies suggest lower stenosis rates in endoAVF and thus lower intervention rates of between 0.59 and 0.74 per patient year, compared to rates of between 3.43 and 7.22 in surgical AVFs.⁹⁻¹⁰

Limitations of EndoAVF

Additional interventions to assist endoAVF maturation

Additional intervention might be required to assist maturation by improving blood flow into the cephalic vein to allow easier cannulation. Examples include coiling of the deep brachial vein using endovascular technique and/or banding of the basilic vein which are both minimally invasive procedures. However, variably surgical superficialization of the basilic vein may be offered to allow cannulation if all minimally invasive options fail. There is always a theoretical risk of forearm vein congestion and hyperflow if coil embolization and ligation are not performed, but this is not often observed in clinical practice.

Cannulation

From our own experience, cannulation seems to be the most challenging aspect of endoAVF use. As many endoAVFs have two outflows, they may appear different and feel softer when compared to surgical AVFs. The antecubital cephalic and basilic veins are often used for cannulation. The dialysis unit personnel thus need to be educated regarding the use of tourniquet before cannulation, changing the needle angle according to vessel depth and ensuring proper arm positioning. A "cannulation map", which covers the cannulation sites with delineation of the designated target vessels, blood-flow direction, and vessel depth, can be made and is helpful prior to cannulation (Figure 5).



Figure 5: Cannulation map - cannulation sites with delineation of the designated target vessels, blood-flow direction, and vessel depths.

Cost Saving

Registry data from the United States reported potential cost saving when comparing endoAVF with surgical AVF due to a lower number of reintervention rate in endoAVF.¹¹ However, this has yet to been verified in controlled studies. In addition, there are major differences between reimbursement systems in different countries that dictate practice patterns/preferences, thus making cost-effectiveness less comparable. A local cost effectiveness study is anticipated in the future.

EndoAVF in Singapore

Singapore General Hospital (SGH) is leading a three-year pilot programme, offering endoAVF to 200 eligible patients from SGH, Changi General Hospital, Sengkang General Hospital, and National University Hospital since 2021. The programme is collaborating with the two largest community dialysis providers (The National Kidney Foundation and Fresenius Medical Care in Singapore) to ensure the community dialysis nurses performing endoAVF cannulation are well-trained.

Conclusion

We recall the hesitancy and criticism laparoscopic and robotics surgery received before they became the standard of care. Yesterday's science fiction has proven to be tomorrow's reality. Creating an AV fistula using new medical device and technique is now available in Singapore. While the endoAVF offers several advantages, they may not be suitable for all patients. The choice between endoAVF and surgical AVF creation will be made after a thorough evaluation of the patient's medical condition, vascular anatomy, and individual needs and preferences. Healthcare providers, including vascular access specialists and nephrologists, will work closely with kidney patients to determine the most appropriate method for establishing vascular access for HD.

References

- Asif A, Roy-Chaudhury P, Beathard GA. Early arteriovenous fistula failure: a logical proposal for when and how to intervene. Clin J Am Soc Nephrol. 2006;1:332-339.
- Allon M, Lok CE. Dialysis fistula or graft: the role for randomized clinical trials. Clin J Am Soc Nephrol. 2010; 5:2348-2354.
- Lee, Kian Guan & Chong, Tze Tec & Goh, Nicholette & Achudan, Shaam & Tan, Yi-Liang & Tan, Ru-Yu & Choong, Lina & Tan, Chieh Suai. (2016). Outcomes of Arteriovenous Fistula (AVF) Creation, Effect of Preoperative vein mapping and Predictors of Fistula Success in Incident Hemodialysis Patients - A Single-center Experience. Nephrology, 22. n/a-n/a. 10.1111/nep.12788.
- Farber A, Imrey PB, Huber TS, et al. Multiple preoperative and intraoperative factors predict early fistula thrombosis in the Hemodialysis Fistula Maturation study. J Vasc Surg. 2016;63:163-170.e6.
- Al-Jasbi AA, Oliver MJ, Thomas SM, et al. Patency rates of the arteriovenous fistula for hemodialysis: a systematic review and meta-analysis. Am J Kidney Dis. 2014;63:464-478.
- Leo CCH, Chan GC. Global Perspectives in Dialysis: Singapore. Kidney360. 2020 Sep 18;1(11):1306-1309. doi: 10.34067/KID.0004382020
- Sun JB, Liu CC, Shen X, Chen Q, Xu CL, Cui TL. Percutaneous endovascular arteriovenous fistula: A systematic review and meta-analysis. Front Cardiovasc Med. 2022 Sep 6;9:978285. doi: 10.3389/fcvm.2022.978285. PMID: 36148078; PMCID: PMC9486211.
- Kok Pan Loo, Ru Yu Tan, Chee Woon Tan, Tze Tec Chong, Kiang Hiong Tay, Hsien Tsung Tay, Kun Da Zhuang, Apoonya Gogna, Chieh Suai Tan. #4066 EARLY EXPERIENCE OF ENDOVASCULAR CREATION OF ARTERIOVENOUS FISTULA IN SOUTHEAST ASIA. Nephrology Dialysis Transplantation, Volume 38, Issue Supplement_1, June 2023, gfa063c. 4066, https://doi.org/10.1093/ndt/gfa063c. 4066 9.
- Arnold R JG, Han Y, Balakrishnan R. Comparison between surgical and endovascular hemodialysis arteriovenous fistula interventions and associated costs. J Vasc Interv Radiol. 2018;29(11):1558-156600.
- Yang S, Lok C, Arnold R, Rajan D, Glickman M. Comparison of post-creation procedures and costs between surgical and an endovascular approach to arteriovenous fistula creation. J Vasc Access. 2017;18 02:8-14
- Arnold R.J.G., Han Y., Balakrishnan R., Layton A., Lok C.E., Glickman M., Rajan D.K. Comparison between Surgical and Endovascular Hemodialysis Arteriovenous Fistula Interventions and Associated Costs. J. Vasc. Interv. Radiol. 2018;29:1558-1566.e2. doi: 10.1016/j.jvir.2018.05.014.

Analysing In Depth Prostate-Specific Antigen Screening in Renal Transplant Patients

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Introduction

Renal transplant recipients (RTRs) are at increased risk of malignancies due to various factors such as impaired immunosurveillance, reactivation or acquisition of oncogenic viral infections and direct effects of immunosuppressants. Common malignancies that are associated with solid organ transplant recipients include lymphoproliferative diseases and skin malignancies such as squamous cell carcinoma and basal cell carcinoma. Other malignancies include solid organ tumours in the genitourinary tract, respiratory and gastrointestinal system^{1,2}, with prostate cancer (CaP) being one of the most common non-skin solid organ malignancies among male RTRs³, although it is noted to be on a decline trend⁴. In addition to the inherent increased risk of malignancies, improvements in immunosuppressant agents, optimisation of antibiotics and antifungal therapies have dramatically increased the half-life of renal allografts and consequently, the life expectancy of RTRs⁵. The longer life expectancies are accompanied by an increase in the incidence of malignancies.

Data on the incidence of CaP in the renal transplant population has proved to be conflicting thus far. Studies done in the USA⁶, Australia, New Zealand⁷ and Sweden⁸ shows similar incidences to general population; while studies from Ireland⁹ and Switzerland¹⁰ reports significant increased incidence in RTRs. Variations in patient population, study methodology, screening practices and immunosuppression regimes may account for the differences in conclusion amongst the various studies. As such, guidelines for CaP screening in transplant recipients remain a point of contention. The recommendations of annual prostate specific antigen (PSA) measurement and digital rectal exam, put forth by both the American Society of Transplantation¹¹ and European Expert Group on Renal Transplantation¹² have yet been validated in a prospective large-scale study.

The role of PSA as a screening tool for CaP in the general population has been a topic of much debate in recent times. Balancing the benefits of early detection, management leading to improvements in morbidity and mortality of CaP against subjecting patients to unnecessary prostate biopsies, exposing them to potential procedure-related complications as well as negative effects on their psychosocial health. In the unique population of immunocompromised RTRs, its role is even more poorly defined. There is a paucity of literature reporting results of standardised CaP screening protocols in RTRs. In our study, we attempt to evaluate the results of our screening protocol and comment on the safety and efficacy of using PSA as a screen tool for CaP in RTRs of an Asian country such as Singapore.

Materials and Methods

After receiving ethical approval from the Institutional Review Board (2018/00358), we performed a retrospective review of all adult male renal transplant recipients in our institution from January 1983 to December 2017. Clinical demographic data was collected along with data with regards to PSA levels, prostate biopsies, and the occurrence of prostate carcinoma.

Institutional protocol for PSA screening in renal transplant recipients

In our institution, PSA screening is performed within one month from transplant if patients were within the at-risk age group - which is defined as age 50 years old and above or with family history. PSA levels are then repeated on an annual basis. Ultrasound guided prostate biopsies (non-targeted 12-core or MRI-ultrasound fusion targeted plus systematic biopsies) are performed if they have two consecutive raised PSA levels, defined by 4ng/ml and above. All patients were covered with prophylactic antibiotics for the biopsy. Patients who are diagnosed with CaP are then subsequently evaluated with the relevant cross-sectional imaging and isotope bone scintigraphy, following which the decision for treatment is discussed in a multidisciplinary tumour board.

Statistical analysis

All data were presented on a spreadsheet and imported into SPSS Statistics (IBM, 2015) for our statistical analyses.

Results

Records of 421 male renal transplant recipients were reviewed for this study. Of which, 293 (69.6%) underwent PSA screening and were included, the rest did not undergo PSA screening as they did not fulfil the criteria of screening (as detailed above). There were no patients who declined screening. The mean age at transplant of patients who underwent screening is 46.1 (SD 10.7), the mean age at the latest follow-up for these patients is 57.5 (SD 9.8). The mean follow-up period for these patients is 136 months (SD 89.5). Amongst those who were screened, a majority (71.7%) were Chinese, 12.3% were Malays, 7.8% were Indians and the remaining 8.1% were other races. All of the patients had normal PSA test prior to transplant. The clinical demographics data are detailed in Table 1.

Sixteen patients had raised PSA levels with a mean of 10.25ng/ml (range 4.78-20.8) and underwent either non-targeted systematic transrectal ultrasound biopsies (TRUS) under local anaesthesia or robotic MRI-ultrasound fusion targeted plus systematic transperineal biopsies under general anaesthesia. Prophylactic antibiotics were given to patients undergoing all biopsies (oral ciprofloxacin 500mg BD for 3-5 days with intramuscular gentamicin for TRUS biopsies or one dose of intravenous ceftriaxone 2gm for Robotic transperineal biopsies). There were no post-biopsy sepsis or related complications. Six patients were subsequently confirmed to be CaP. This accounts for 1.4% of all male recipients. (Figure 1).

Of the patients who were diagnosed with CaP, the median age of transplantation was 50.5 (range 45-53; IQR 5.75) and median age of diagnosis was 60 (range 52-68; IQR 8.5). Three (50.0%) underwent robotic prostatectomy (RP) and the remaining three (50.0%)

Table 1: Details of Recipients Who Underwent PSA Screening

Recipients with PSA screening (n=293)	
	Mean (SD)
Age of transplant (years)	46.1 (10.7)
Age of latest follow-up (years)	57.5 (9.8)
Mean follow-up period (months)	136 (89.5)
Race	No (%)
Chinese	210 (71.7)
Malay	36 (12.3)
Indian	23 (7.8)
Others	24 (8.1)
Number of prostate biopsies	16 (5.46)
Number of confirmed CaP	6 (2.04)

PSA - prostate specific antigen; CaP - Prostate cancer

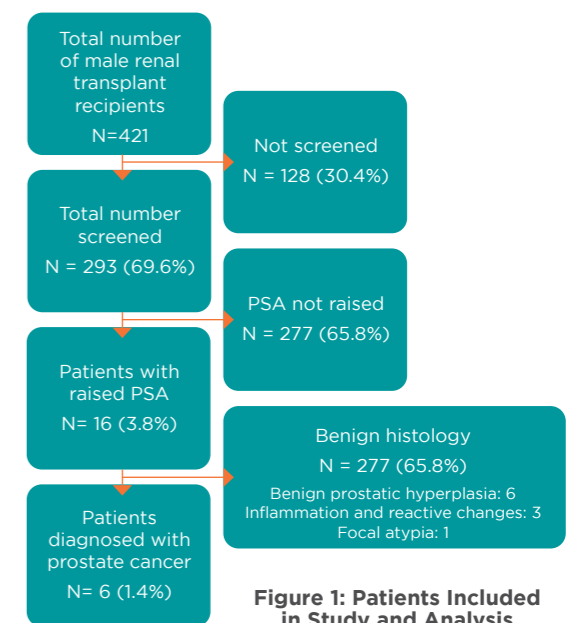


Figure 1: Patients Included in Study and Analysis

had radiotherapy plus androgen deprivation therapy (RT + ADT). One of the patients (patient no. 2) underwent RP in year 2010 despite having localised, gleason 3+3 CaP as evidence for active surveillance at that time was still developing. One patient (patient no 5) who underwent robotic prostatectomy experienced complications of transplant ureteric injury which was successfully managed by construction of a Boari flap¹⁵. Median follow-up period for CaP patients after diagnosis was 65 months (range 17-84, IQR 63.25), overall survival and graft survival rate within this period was 83.3% and 100% respectively. One patient passed away 13 years after transplantation and 4.5 years after being diagnosed with CaP from pancreatic cancer, with no biochemical or clinical recurrence of CaP. Another patient had raised PSA levels on follow-up and had to undergo salvage RT, leading to a 5-year biochemical progression free rate of 83.3%. Only one patient had a change in immunosuppressant regime from MMF 250mg BD to 500mg BD after diagnosis of CaP, and the rest did not have a change in immunosuppressant regimes. Details of the patients are shown in Table 2 and Table 3.

Table 2: Characteristics of Patients at Diagnosis of Prostate Cancer

Patient	Age at renal transplant (years)	Age at CaP diagnosis (years)	Stage of CaP at diagnosis	Gleason score	PSA at diagnosis (ng/ml)	Time from transplant to CaP diagnosis (years)	Treatment of CaP	Complications of treatment
1	48	60	T2aNOMO	4+3	18.6	28	RT + ADT	Nil
2	53	55	T2cNOMO	3+3	3.3	2	RP (pT2c, focal right lateral margin involvement)	Nil
3	45	52	T2aNOM1b	3+4	6.7	7	RT + ADT	Nil
4	53	60	T2cNOMO	4+3	20.3	7	RT + ADT	Nil
5	50	61	T3bNOMO	5+4	5.8	11	RP and left pelvic lymph node dissection (pT3b, right anterior circumferential and bladder neck margin involvement) + salvage RT (no ADT)	Ureteric injury to transplant kidney
6	51	68	T2aNOMO	3+4	7.85	17	RP (pT2a, posterior circumferential margin involvement)	Nil

CaP - Prostate cancer; RT - Radiotherapy; ADT - Androgen Depression Therapy; RP - Robotic Prostatectomy

Table 3: Transplant and Follow-up Details of Patients

Patient	Type of transplant	Immuno-suppressive regimen	Graft failure, requiring renal replacement therapy	BCR at last follow-up (latest PSA level, if BCR is positive)	Follow-up period after CaP (months)	Alive
1	Living donor	Cyclosporin + MMF	No	No	74	Yes
2	Living donor	Cyclosporin + MMF	No	No	84	Yes
3	Deceased donor	Cyclosporin + MMF	-	No	56	No (Died of pancreatic cancer)
4	Deceased donor	Cyclosporin	No	No	81	Yes
5	Deceased donor	Tacrolimus + MMF [†]	No	Yes (1.5)	17	Yes
6	Deceased donor	Cyclosporin + MMF	No	No	19	Yes

[†]Up-titrated MMF from 250mg BD to 500mg BD after diagnosis of CaP; MMF - Mycophenolate mofetil

Discussion

Our study reports the results of institutional standardised PSA screening of RTRs in a major transplant centre in Singapore, with a median follow-up period of 10 years. The results suggest that PSA screening is safe and treatments for CaP diagnosed in RTRs have relatively good success rates, providing patients with long periods of disease-free survival.

PSA screening of the general population has always been one of the most controversial topics in modern urological literature¹⁴. The proposed benefits of population screening such as improvement of overall survival and decrease in metastases rates require a long follow-up duration due to the biological nature of CaP. These benefits have to be balanced by negative effects of screening such as over-treatment, biopsy and treatment-related complications. Biopsy related complications range widely from minor (e.g. pain, temporary haematuria, haematochezia, haemoejaculate) to major complications (e.g. sepsis, persistent lower urinary tract symptoms (LUTS), erectile dysfunction). A meta-analysis¹⁵ shows that the rate of sepsis-related requiring hospitalisation ranges around 0-6.3%, <2% risks of persistent LUTS. The Prostate Biopsy Effects (ProBE) cohort study¹⁶ reports 64.6% (95% CI: 61.6% - 67.8%), 31.8% (95% CI: 28.8% - 35.1%) and 1.4% (95% CI: 0.8% - 2.4%) of men experienced minor, moderate and major complications respectively. Our study did not explore minor complications following prostate biopsy but there were no major biopsy-related complications reported. In addition, prophylactic antibiotics were given to all patients, which has been proven to be effective in preventing infectious complications after transrectal prostate biopsy¹⁷. Historical rates of infection in our institution were significant (23-25%, with serious ones quoted at 2-7%)¹⁸, but these rates were not reflected in our study. The difference in the rates of infections are likely due to changes in the precautions taken prior to biopsy such as prophylactic antibiotics, ensuring negative urine cultures. Technological advancements such as Magnetic Resonance Imaging (MRI) scan-guided targeted biopsies and move towards performing biopsies via the transperineal approach of the prostate aim to further enhance the safety of prostate biopsies.

In our study, most patients diagnosed with CaP were found to have localised disease on diagnosis and all of them were treated successfully. There was no comparison with non-RTRs in our study, but a study by Bratt et al shows that CaP in RTRs does not significantly differ from non-RTRs in terms of stage and grade at diagnosis⁸. There was only one mortality 56 months after diagnosis of CaP from pancreatic cancer, with no biochemical (latest PSA 0.72) or clinical evidence of CaP recurrence at time of death. As of the time of preparing this manuscript, all the grafts are functioning well. This data suggests that treatment of CaP in renal transplant recipients is effective and renders minimal risk to the pelvic graft. Management of CaP in renal transplant patients are inherently different due to increased risks during wound healing¹⁹ and infections²⁰ due to immunosuppressive regimes. Location of transplanted kidney in the iliac fossa and pelvic tissue scarring from previous transplant surgery poses additional challenges to both surgical and radiation management of CaP in order to prevent graft failure, which will dramatically reduce patient survival²¹. Our data contributes to the growing evidence that treatment of CaP in RTRs does not seem to have worse oncological outcomes or higher complication rates compared to non-RTRs with CaP²². Perhaps another important point related to treatment, which was not within the scope of our study is the quality of life to these patients after treatment.

Incidence of CaP among RTRs is an important consideration when considering screening protocols. Although it was thought that the risk of CaP is higher among RTRs due to several mechanisms. It has been thought that a healthy immune system is essential to inhibit growth of CaP cells²³ and being immunosuppressed itself increases the risk of developing CaP. Studies in men with HIV on various immunosuppression regimes show that these patients have increased incidence of CaP and develop them at a younger age compared to general population^{24,25}. In addition, immunosuppressive medications such as calcineurin inhibitors^{26,27}, azathioprine²⁸ can also potentially increase the risk of CaP.

The incidence rate of CaP based on our screening protocol in a predominantly Chinese population is only 1.4%. This is much lower than the cumulative incidence rate of 6.4% reported in the screening arm of European Randomized Study of Screening for Prostate Cancer (ERSPC) trial²⁹. Difference in incidence rate, other than RTR vs non-RTR population, is likely due to several other factors such as geography and ethnicity. Studies which compare incidence of CaP directly between RTR and non-RTR also have varied results⁶⁻¹⁰; however, many of them are limited as patients with high PSA or evidence of subclinical CaP are historically excluded from receiving a transplant. A recent paper by Aminsharifi et. al.³⁰ appeals to shorten the wait time to renal transplant after CaP treatment in potential recipients who are diagnosed with low-risk CaP, stating the difference in 5-year mortality of patients with end stage renal disease (ESRD) versus that of prostate cancer (36% vs 1.1%, respectively). Adopting a revised transplant criteria will be a step towards investigating the true incidence of CaP in RTRs, which will build towards the evidence of PSA screening in RTRs.

The literature for PSA screening in other solid organ transplant recipient is severely limited. A recent retrospective study by Waeckel et. al.³¹ presented data of PSA screening in renal, hepatic and cardiac transplant patients with median follow-up of 85.2 months. There was no significant difference among all three transplant groups in terms of incidence, age of diagnosis and CaP-related mortality. They also compared standard incidence ratio (SIR) of CaP from their study with other studies which reported CaP incidence and concluded that there is indeed a higher SIR in organ transplant recipients as compared to general population. However, they observed that despite the high SIR from picking up low-risk CaP from screening, CaP-related mortality has not decreased. They concluded their study by recommending against PSA screening in transplant recipients.

As improvements are made in immunosuppressive therapies and anti-microbial/anti-fungal therapies, life expectancy of RTRs continues to improve, with it reaching almost 20 years if recipients of >50 years old^{32,33}. The ERSPC trial²⁹ shows a decreasing amount of number needed to invite (NNI) to avert one CaP and number needed to detect (NND) over the increased years of follow-up. PSA screening in RTRs, if established, will also likely experience similar long-term benefits.

Our study is limited inherently by its retrospective nature and it being a non-comparative study from a single centre. Despite the long follow-up period of 11 years, our patient population is still fairly young (mean of 46 years old) which is not yet the preferred age for prostate cancer. We were also unable to make a comparison between RTRs and non-RTRs, hence, we do not know if our findings are unique to the RTR population.

Results from our study suggests that PSA screening in RTRs is safe and treatment after diagnosis of CaP is effective; however, the utility and true effectiveness of PSA screening is still unknown. Further studies on true incidence of RTRs compared to general population and prospective trials of PSA screening in RTR population are still needed. Additionally, other crucial impacts of adopting PSA screening such as impact of prostate biopsies, CaP treatment on patients' psychology and quality of life should not be ignored.

Conclusion

In conclusion, the minimal morbidity rates following diagnosis and treatment for renal transplant recipients with prostate carcinoma suggest that screening may be safely implemented with appropriate precautions. Our data suggests that whilst PSA screening in transplant recipients may be safe, the utility of screening has yet to be proven.

References

- Penn I. The problem of cancer in organ transplant recipients: an overview. Vol. 4, Transplantation science. Transplant Sci; 1994. p. 23-32.
- Penn I. Posttransplant malignancies. In: Transplantation Proceedings. Elsevier; 1999. p. 1260-2.
- Siegel R, Ma J, Zou Z, Jemal A. Cancer statistics, 2014. CA Cancer J Clin. 2014 Jan;64(1):9-29.
- Blosser CD, Haber G, Engels EA. Changes in cancer incidence and outcomes among kidney transplant recipients in the United States over a thirty-year period. Kidney Int. 2021 Jun;99(6):1430-8.
- Hariharan S, Israni AK, Danovitch G. Long-Term Survival after Kidney Transplantation. N Engl J Med. 2021 Aug 19;385(8):729-43.
- Engels EA, Pfeiffer RM, Fraumeni JF, Kasiske BL, Israni AK, Snyder JJ, et al. Spectrum of cancer risk among US solid organ transplant recipients. JAMA - Journal of the American Medical Association. 2011 Nov 2;306(17):1891-901.
- Vajdic CM, McDonald SP, McCredie MRE, Van Leeuwen MT, Stewart JH, Law M, et al. Cancer incidence before and after kidney transplantation. J Am Med Assoc. 2006 Dec 20;296(23):2823-31.
- Bratt O, Drevin L, Prütz KG, Carlsson S, Wennberg L, Stattin P. Prostate cancer in kidney transplant recipients - a nationwide register study. BJU Int. 2020 May 1;125(5):679-85.
- Haroon UH, Davis NF, Mohan P, Little DM, Smyth G, Forde JC, et al. Incidence, management, and clinical outcomes of prostate cancer in kidney transplant recipients. Experimental and Clinical Transplantation. 2019 Jun 1;17(3):298-303.
- Lengwiler E, Stampf S, Zippelius A, Salati E, Zaman K, Schäfer N, et al. Solid cancer development in solid organ transplant recipients within the Swiss Transplant Cohort Study. Swiss Med Wkly. 2019;149(19-20).
- Kasiske BL, Vazquez MA, Harmon WE, Brown RS, Danovitch GM, Gaston RS, et al. Recommendations for the Outpatient Surveillance of Renal Transplant Recipients. 2000.
- European best practice guidelines for renal transplantation. Section IV: Long-term management of the transplant recipient. IV.6.2. Cancer risk after renal transplantation. Skin cancers: prevention and treatment. Nephrol Dial Transplant. 2002;17 Suppl 4:31-6.
- Wang Z, Tay WK, Tan LGL, Tiong HY. The utilization of Boari flap vesicocystostomy for salvage repair of kidney transplant ureteric injury after robotic radical prostatectomy. American Journal of Transplantation. 2018 Apr 1;18(4):1035-6.
- Etzioni R, Gulati R, Cooperberg MR, Penson DM, Weiss NS, Thompson IM. Limitations of basing screening policies on screening trials: The US Preventive Services Task Force and Prostate Cancer Screening. Med Care. 2013 Apr;51(4):295-300.
- Loeb S, Vellekoop A, Ahmed HU, Catto J, Emberton M, Nam R, et al. Systematic review of complications of prostate biopsy. Vol. 64, European Urology. Elsevier; 2013. p. 876-92.
- Rosario DJ, Lane JA, Metcalfe C, Donovan JL, Doble A, Goodwin L, et al. Short term outcomes of prostate biopsy in men tested for cancer by prostate specific antigen: Prospective evaluation within ProtecT study. BMJ (Online). 2012 Jan 21;344(7840).
- Zani EL, Clark OAC, Rodrigues Netto Jr N. Antibiotic prophylaxis for transrectal prostate biopsy. Cochrane Database of Systematic Reviews. 2011 May 11;(5).
- Ho Yee T, W F WM, M SE, Y SW, Y TH. Incidence of complications after transrectal ultrasonography-guided biopsy of the prostate in a local tertiary institution.
- Boctun R. Effects of immunosuppressive therapy on wound healing. Int Wound J. 2013 Feb;10(1):99-104.
- Säemann M, Hörli WH. Urinary tract infection in renal transplant recipients. Vol. 38, European Journal of Clinical Investigation. Eur J Clin Invest; 2008. p. 58-65.
- Ojo AO, Wolfe RA, Agoda LY, Held PJ, Port FK, Levey SF, et al. Prognosis after primary renal, transplant failure and the beneficial effects of repeat transplantation: Multivariate analyses from the United States renal data system. Transplantation. 1998 Dec 27;66(12):1651-9.
- Marra G, Dalinasso E, Agnello M, Mungato S, Bosio A, Sedigh O, et al. Prostate cancer treatment in renal transplant recipients: a systematic review. Vol. 121, BJU International. Blackwell Publishing Ltd; 2018. p. 327-44.
- Hsieh TC, Xu W, Chiao JW. Growth regulation and cellular changes during differentiation of human prostatic cancer LNCaP cells as induced by T lymphocyte-conditioned medium. Exp Cell Res. 1995;218(1):137-43.
- Crum NF, Spencer CR, Amling CL. Prostate carcinoma among men with human immunodeficiency virus infection. Cancer. 2004 Jul 15;101(2):294-9.
- Levinson A, Nagler EA, Lowe FC. Approach to management of clinically localized prostate cancer in patients with human immunodeficiency virus. Urology. 2005 Jan;65(1):91-4.
- Hojo M, Morimoto T, Maluccio M, Asano T, Morimoto K, Lagman M, et al. Cyclosporine induces cancer progression by a cell-autonomous mechanism. Nature. 1999 Feb 11;397(6719):530-4.
- Dantal J, Hourmant M, Cantarovich D, Giral M, Blanco G, Dreno B, et al. Effect of long-term immunosuppression in kidney-graft recipients on cancer incidence: Randomised comparison of two cyclosporin regimens. Lancet. 1998 Feb 28;351(9103):623-8.
- Kleinclauss F, Gigante M, Neuzillet Y, Mouzin M, Terrier N, Salomon L, et al. Prostate cancer in renal transplant recipients. Nephrology Dialysis Transplantation. 2008 Jul;23(7):2374-80.
- Hugosson J, Roobol MJ, Månsson M, Tammela TLJ, Zappa M, Nelen V, et al. A 16-yr Follow-up of the European Randomized study of Screening for Prostate Cancer(Figure presented.). Eur Urol. 2019 Jul 1;76(1):43-51.
- Aminsharif A, Simon R, Polascik TJ, Robertson CN, Sudan DL, Collins BH, et al. Evaluation and active treatment versus active surveillance of localized prostate cancer in renal transplant patients in the era of low and very low risk prostate cancer. Vol. 202, Journal of Urology. Lippincott Williams and Wilkins; 2019. p. 469-74.
- Waeckel T, Alt S, Said K, Altieri M, Belin A, Doerfler A, Tillou X. Over-diagnosed prostate cancer in solid organ recipients: lessons from the last 3 decades. Int Urol Nephrol. 2020 Feb 1;53(2):241-8.
- Saran R, Li Y, Robinson B, Abbott KC, Agodoa LYC, Ayanian J, et al. US Renal Data System 2015 Annual Data Report: Epidemiology of Kidney Disease in the United States. Vol. 67, American Journal of Kidney Diseases. W.B. Saunders; 2016. p. A7-8.
- Kramer A, Pippas M, Stel VS, Bonthuis M, Diez JMA, Afentakis N, et al. Renal replacement therapy in Europe: A summary of the 2013 ERA-EDTA Registry Annual Report with a focus on diabetes mellitus. Clin Kidney J. 2016 Jun 1;9(3):457-69.

Transition Care Clinic: A Pivotal Gateway to Better Haemodialysis Care

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It is well known that patients on haemodialysis (HD) have high mortality. The risk of death during the first three months after initiation can be significant. According to the Singapore Renal Registry data published in 2021, the 1-year survival of HD patients is 91.7%, whereas their 5-year survival is 60.9%.¹ The first 90 days after HD initiation is called the 'heightened period'. It has been observed that in the second week of HD, an incident patient is 2.86 times more likely to die than someone who has been on HD for more than a year.² This higher mortality risk is largely contributed by cardiovascular factors and infection.



What is Transition Care Clinic and Why Do Our Patients Need It?

The last 20 years have seen a remarkable succession of programmes to enhance clinical outcomes and improve quality of life for patients with end-stage kidney disease (ESKD). The use of “fistula first” policy is one such initiative taken to reduce the risk of infection associated with the use of vascular catheters. In Singapore, pre-emptive access creation among ESKD patients has been low, with up to 80% of incident dialysis patients being commenced on HD via a dialysis catheter.³ Sengkang General Hospital (SKH) is no exception with only 20% of the HD patients initiating with a definitive access. Ensuring that patients who have initiated HD have definitive vascular access is an important consideration in their journey towards improved health outcomes. In addition, there are other crucial areas such as referral for transplantation in suitable cases and medication reconciliation. Many of the patients do not fully understand dialysis and feel that they are forced to cope with a diagnosis of ESKD. Such patients need emotional support to help them to accept and adapt to their condition. They also need to be educated about ESKD and haemodialysis to empower them to take ownership of their dialytic therapy and to ensure compliance. To achieve all this, meticulous care coordination and a multifaceted approach is required. This realisation is what led to the inception of transition care clinic (TCC) at SKH.

How Is It Done Elsewhere?

Several peri dialysis clinics have been in practice in the world since the late 20th century. The first documentation of such clinics, known as HD orientation clinics, dates from 1983 when they were set up in the USA to increase the uptake of home HD. The components of such a programme have been modified over the years to achieve better outcomes for the incident HD patients through patient and caregiver education.

Some of the TCC programmes around the world include:

1. “Right start unit” in Grand River Hospital, Ontario, Canada: Patients, typically those who are crash landers needing dialysis, are comprehensively educated about kidney diseases in general and the dialytic modalities in particular. Patients in this study group experienced 22 per cent reduction in mortality risk and eight per cent reduction in hospital readmissions than a matched cohort.⁴
2. Coaching for Actions, Results and Empowerment programme (RVCARE) developed by Renal Venture management in 2010, focuses on education, definitive access, volume management, nutritional status, and transitioning patients to the dialysis modality of their choice within the first 120 days of initiation of dialysis. There was a four-fold increase in peritoneal dialysis therapy uptake and reduction in mortality in this cohort.⁵
3. The transitional care unit (TCU), national forum of networks, USA. This programme is spread across a four-week period. The first week is about getting to know the patients and their support group. Support is provided to patients to cope with the changes in their lifestyle in addition to assessment of their medical needs. The focus is on emotional and psychological support. The second week focuses on teaching the patients about dialytic therapy. The third week builds on patients’ knowledge and addresses any gaps. The fourth week prepares patients to transition out of the programme.⁶

How Is It Done at SKH?

At SKH, TCC has been operational since 2019. The clinic has a multidisciplinary approach with a nephrologist and renal coordinator (RC) taking centre stage. All newly initiated HD patients are referred to this clinic which is run bi-monthly by two nephrologists with interest in HD. The patients are seen within four to six weeks of their discharge from the hospital.

Medical needs are assessed by the nephrologist. RC provides the education and psychological support. Education in areas of vascular access, importance of compliance with dietary and fluid restriction, blood pressure control and compliance with HD are covered. Referral for kidney transplantation is an integral component of our programme. In addition, patients have the option of attending a pharmacist-led medication reconciliation clinic. Medical social workers and dietitians are involved where required.

A total of 256 patients have been seen in TCC so far. Even though the one-year mortality of the patients seen in TCC will seem much lower at two per cent as compared to the national one-year mortality figure of 8.3 per cent for HD patients, it may not be a fair comparison especially considering the confounders. For example, patients who do not attend TCC are generally sicker and may be hospitalised at that time.

Here is a summary comparing the transitional clinic at SKH with some of the other transition clinics mentioned above:

TCC Location	Personnel Involved	Factors Addressed	Frequency and Duration
Right start unit, Grand River Hospital, Ontario, Canada	Physician, dialysis nurses, medical social worker, pharmacist, dietitian	Education about haemodialysis to patient and caregivers, dietary counselling, psychosocial support	Three times a week for first three weeks after haemodialysis initiation
Coaching for Actions, Results and Empowerment programme (RVCARE) developed by Renal Venture management, USA	Dialysis nurses	Education regarding haemodialysis, nutrition, fluid management, coordination of care amongst healthcare specialists	Three times a week for first 120 days after haemodialysis initiation
Transitional dialysis care units, USA	Physician, dialysis nurses, social worker, dietitian	Education about haemodialysis and peritoneal dialysis, coordination of care amongst other specialities especially vascular surgery, dietary education	Three times a week for first four weeks after haemodialysis initiation
Sengkang General Hospital, Singapore	Physician, renal coordinator	Education about haemodialysis, care coordination with other specialities especially vascular surgery, clinical parameters	Once, within one month of haemodialysis initiation

What Does the Future Hold?

Artificial intelligence (AI) has the potential to change the way we practice nephrology. It seems to have the ability to play a significant role in the care and transition process for individuals with ESKD transitioning to HD. Predictive models can help nephrologists identify patients who may benefit from early intervention. AI driven educational content can be tailored to the level of health literacy, preferred communication style, and language of the patient. Management of fluid balance can be improved through AI powered applications that track fluid intake and provide real-time feedback to the patients. In essence, AI can improve the way we run our TCC leading to improved patient care and outcomes, provided we find the regulatory framework conducive to its use in our healthcare setting.

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References

1. Singapore renal registry annual report 2021
2. Kevin E Chan, Frank W Maddux, Nina Tolkooff- Rubin: Early outcomes among those initiating chronic dialysis in the United States: Clin J Am Soc Nephrol 6: 2642-2649, 2011
3. Suh Chien Pang, Ru Yu Tan, Jia Liang Kwek: Current state of vascular access in Singapore: Journal of vascular access. <https://doi.org/10.1177/1129729819878595>
4. Singh, Namita: Transitional care units: How successful in increasing home dialysis? Seminars in Dialysis, vol. 34, no. 1, 2020, pp3-4. <https://doi.org/10.1111/sdi.12910>
5. Reddy N, Brooks K, Schmidt L: A Crucial Lifeline: Reducing Mortality in the First 120 Days: Nephrol News Issues. 2012;26
6. Robert Lockridge, Brendan Bowman, Marsha Dodd: https://media.esrdnetworks.org/documents/APM2548_Rev_C_TDC_Operational_G

The Growing Need for Kidney Supportive Care

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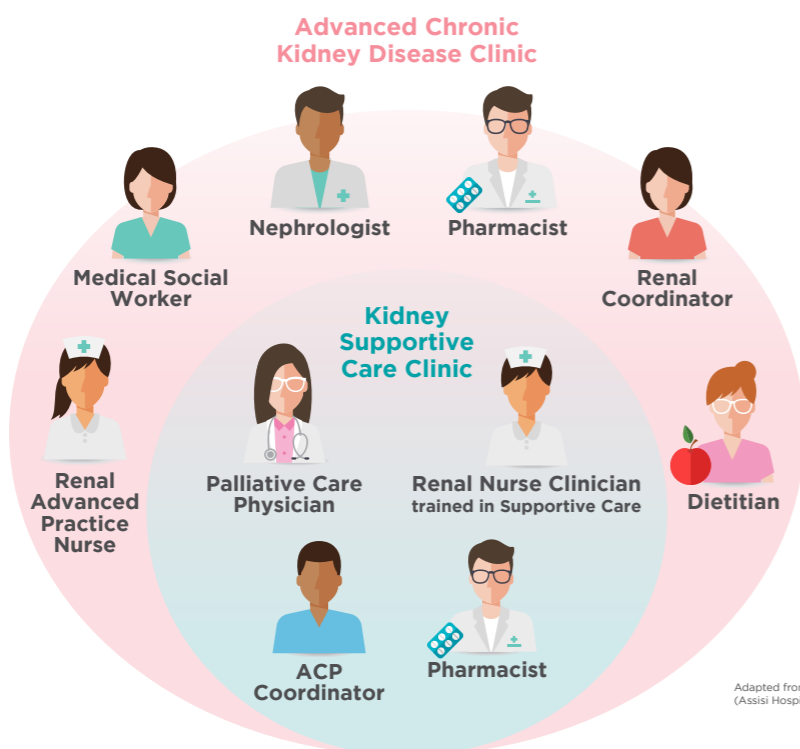
Introduction

Singapore is facing a 'chronic kidney disease (CKD) tsunami' with the prevalence of CKD projected to increase to 24.3% by 2035¹. Driven by a rapidly ageing population, the incidence rate of stage 5 CKD in patients aged 60 years or older is increasing and the median age of initiating dialysis has correspondingly increased from 62.5 years old in 2011 to 65.5 years old in 2021². However, the rate of patients ever started on dialysis is growing at a much slower rate compared to the rate of incidence stage 5 CKD after 70 years old, suggesting that more elderly patients have either passed away prior requiring dialysis or declined initiating of dialysis². Facing with a more elderly and frail population reaching kidney failure, there has been a shift in the nephrologist's management focus away from the traditional options of kidney transplantation and kidney replacement therapy (KRT) [haemodialysis (HD) and peritoneal dialysis (PD)] to the alternative option of kidney supportive care instead. In addition, with an ageing prevalent dialysis and kidney transplant population, kidney supportive care option needs to be included as one of the available options when their current therapies start to fail.

The Beginning

In August 2016, Singapore General Hospital (SGH) department of renal medicine recognised the increasing need for kidney supportive care, and, in collaboration with the palliative physicians from National Cancer Centre and SGH department of internal medicine, a comprehensive kidney supportive care clinic [the 'Renal Supportive Care (RSC) Clinic'] was set up, embedded within the multidisciplinary care clinic for patients with advanced CKD [the 'Low Clearance Clinic (LCC)'] (Figure 1).

Figure 1: Embedded Multidisciplinary Kidney Supportive Care Clinic Model in Advanced Chronic Kidney Disease Clinic in Singapore General Hospital



Adapted from slide courtesy of Dr Alethea Yee (Assisi Hospice, NCCS)



The aims of RSC were to (1) maintain or improve quality of life for kidney patients who opted for kidney supportive care, (2) honour patients' wishes and care preferences through shared decision-making and advanced care planning (ACP), (3) conversion from hospital-based to community-based care by streamlining care transition and supporting and empowering patients and caregivers with knowledge and skills for home-based care. The RSC team, comprising of palliative care physicians, renal nurse clinician (trained in supportive care), medical social worker, ACP coordinator and pharmacist, managed patients in a shared care model with the primary nephrologist. RSC consultation consisted of (1) symptom assessment and management, (2) chronic disease management, (3) psychosocial assessment and support for patients and caregivers, (4) medication reconciliation, review and deprescribing, and (5) discussion of ACP. The RSC team participated in the regular weekly LCC multidisciplinary meeting to identify high-risk patients who require further supportive care interventions and care coordination. The RSC team collaborated with Assisi Hospice since January 2018 and Singhealth community nursing since July 2019 to ensure a seamless care transition of deteriorating kidney patients.

The Journey

From August 2016 to June 2023, 419 patients were reviewed in RSC clinic. By the end of June 2023, 318 (73.9%) had either died [259/318 (81.4%)] or converted to KRT [59/318 (18.6%), 52 (12.4%)] had either discharged back to primary nephrologists or lost to follow-up, and 49 (11.7%) continued active follow-up with RSC.

Between April 2018 to October 2022, ACP discussion was completed in 121 (51.9%) of the 233 RSC patients, ACP discussion was ongoing for 59 (25.3%), while 51 (21.9%) had ACP initiated but not ready to complete the discussion. Among patients who completed ACP, 59 (48.8%) opted for comfort care, 60 (49.6%) opted for trial of limited intervention and 2 (1.7%) opted for full treatment as their goals of care. Seventy (57.9%) of them opted for home as their preferred place of care and death and the remaining 51 (42.1%) opted for other settings³.

By the end of 2020, 126 patients were referred to the community palliative care provider, of which 83 (66%) died, 20 (16%) were discharged, and 23 (18%) remained on active follow up. Of the 83 patients who died, 40 (48%), 24 (29%) and 17 (20%), died at home, in the hospital, and the hospice respectively. Of the 20 discharged patients, 15 (75%) had stable disease and 5 (25%) were admitted to community hospital, hospice, or acute hospital⁴.

In addition to the care of advanced CKD patients, the RSC clinic started to accept dialysis patients for supportive care since January 2020. The RSC team collaborated with SGH PD team to derive the PD withdrawal workflow for suitable PD patient identified by the nephrologists in December 2020. Since January 2021, palliative physician was embedded in the inpatient HD round for complex HD patients to provide palliative-related advice. In 2023, the palliative team is reviewing new workflow to proactively screen hospitalised CKD patients for supportive care needs.

The Outlook

Further expansion of supportive care to prevalent dialysis patients is urgently needed. In order to understand patients' care preferences, ACP discussion needs to be started early at every setting and opportunity. HD and PD patients spend a significant amount of their time undergoing their dialytic therapies in community dialysis centres and own homes respectively. One possible option is to have ACP discussion, including serious illness conversation, initiated by trained personnel or staff in community dialysis centres or by visiting medical staff in patients' own homes, rather than in a hospital setting. Further down the trajectory, prevalent dialysis patients, who are failing therapy, declining to continue with therapy or have supportive care needs, will require multidisciplinary care involving hospital and community healthcare providers to better plan the patient care journey.

Supportive care service is a labour-intensive endeavour, and it faces challenges in upscaling the service sustainably. There is a need for the coming together of the healthcare institutions to effect policy change from ground up to increase adoption of supportive care in the kidney population. This will include (1) the sharing and optimising of community resource to cover the needs of kidney patients on supportive care, (2) the addition of medical home care services and primary healthcare services to complement community nursing and community hospice services in providing the basic supportive care for patients that require mild-moderate symptoms management and medications titration but not severe enough to require hospice services yet, and (3) the increase of manpower and upgrade of skillset of interested nephrologists and renal allied healthcare groups with adequate funding to provide the basic supportive care for their patients.

Acknowledgement

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Insights into Ceftriaxone-induced Encephalopathy Treated with Haemoperfusion in a Dialysis Patient

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Introduction

Ceftriaxone is a third-generation cephalosporin commonly used to treat bacterial infections. It is eliminated via both urinary and biliary excretion and dose reduction is usually not required in patients with renal impairment. However, there have been case reports of ceftriaxone neurotoxicity in patients with end-stage renal disease (ESRD).^{1,2} Ceftriaxone is poorly dialysed due to its high protein binding, with one prior case report of haemoperfusion for the treatment of ceftriaxone-induced neurotoxicity.³ We report a case of ceftriaxone neurotoxicity successfully treated with haemoperfusion.

Case Report

A 73-year-old man with ESRD from diabetes mellitus on regular automated peritoneal dialysis (PD) was admitted for *Streptococcus gallolyticus* peritonitis with ileus. He had been on PD for seven years prior to the admission. He had comorbidities of hypertension, hyperlipidemia, peripheral vascular disease and group 2 pulmonary hypertension.

He was started on intravenous ceftriaxone 2g/day based on culture sensitivity. A computed tomography imaging of the abdomen and pelvis showed possible encapsulating peritoneal sclerosis. He was converted to haemodialysis (HD), and he underwent the first HD session without issues. Three days later, on day 4 of ceftriaxone administration, he was noted to be confused before his second HD session and subsequently he developed focal seizures one hour into HD, with jerking movements of left arm and face and left sided gaze deviation. His haemodynamics were otherwise stable prior to the onset of seizure without evidence of intradialytic hypotension. Dialysis was terminated and the seizure self-aborted after two minutes.

References

1. Wong LY, Liew AST, Weng WT, Lim CK, Vathsala A, Toh MPH. Projecting the Burden of Chronic Kidney Disease in a Developed Country and Its Implications on Public Health. *Int J Nephrol*. 2018 Jul 4;2018:5196285. doi: 10.1155/2018/5196285.
2. Singapore Renal Registry Annual Report 2021. <https://www.nrdo.gov.sg/publications/kidney-failure>. (Last accessed 4 September 2023)
3. Wang X, Loh SE, Sim AGH, Rong WH, Lim AEL, Phua GLG, Woong LN, Lee G. Integrating Advance Care Planning (ACP) in Renal Supportive Care (RSC) clinic as part of comprehensive palliative care consultation. Poster presentation at the 8th Singapore Palliative Care Conference 2023.
4. Woong LN, Lee G, Choo JCJ, Kwek JL, Lim AEL, Wang XP, Sim AGH, Rong WH, Shi CZ, Tan M, Umami HAK, Lim LWW, Sim MH, Chan JMG, Phua GLG, Yee ACP. The Renal Supportive Care clinic - Experience in a multidisciplinary shared care model for patients with advanced chronic kidney disease. Poster presentation at the 15th Asia Pacific Hospice Palliative Care Conference 2023.

Laboratory investigations did not reveal significant hypoglycemia, electrolyte abnormalities or worsening infection. Magnetic resonance imaging of the brain was unremarkable. Electroencephalogram showed mild diffuse encephalopathy, but no epileptiform activity seen.

Neurology was referred and the patient was initiated on levetiracetam 500mg twice a day. The impression was acute encephalopathy, with differentials including ceftriaxone neurotoxicity. Ceftriaxone was stopped immediately. However, the patient developed a second episode of focal seizure the next day that self-aborted after two minutes. The patient underwent another round of dialysis with haemodiafiltration in view of the high suspicion of ceftriaxone neurotoxicity. However, after 1.5 hours into dialysis, the patient was confused with asymmetrical pupil size, and dialysis was terminated.

The patient was brought to intensive care unit for continuous renal replacement therapy (CRRT) with post-filter haemoperfusion (blood flow rate 150 ml/min, Jaftron HA 330 cartridge, regional citrate anticoagulation) to clear ceftriaxone. He underwent 30 hours of CRRT-haemoperfusion and tolerated well. His altered mental status resolved completely with no recurrence of symptoms.

Discussion

Ceftriaxone is a third-generation cephalosporin with broad antimicrobial spectrum. It is widely used to treat common bacterial infections. Ceftriaxone neurotoxicity has been increasingly reported, especially in patients with severe renal impairment or ESRD on regular dialysis.¹⁻⁵

The therapeutic dose of ceftriaxone is usually 1-2g/day. It can be increased up to 4g/day for severe infections. It is usually not necessary to adjust ceftriaxone dose in patients with renal impairment,⁶ as approximately half of the dose will be excreted via the biliary system. However, ceftriaxone clearance is delayed in ESRD patients on dialysis.^{7,8} Although the half-life of ceftriaxone is 6 - 9 hours in patients with normal renal function, the half-life was found to double from 8 - 16 hours in HD patients.⁸ Hence it can be argued that the dose of ceftriaxone should be decreased in ESRD patients. Recent case reports showed that in ESRD patients who developed neurotoxicity after administration of high dose of ceftriaxone (≥ 2 g/day), there were increased ceftriaxone levels in plasma and cerebrospinal fluid,^{1,2} indicating that high dose ceftriaxone may cause drug accumulation in ESRD patients leading to neurotoxicity. We did not manage to send test for plasma ceftriaxone level for our patient as this test was not available in our hospital.

Moreover, while most of cephalosporins are highly dialysable, ceftriaxone is not dialysed as it is highly protein-bound (90% - 95%),⁹ which may contribute to the sustained neurotoxicity in ESRD patients despite regular dialysis. In our patient, HD and haemodiafiltration did not improve his mental status. This observation was consistent with previous reports.^{1,5}

While HD is suitable for the removal of toxic agents with low molecular weight, low distribution volume, and low protein binding rate,¹⁰ it is not so effective for the removal of ceftriaxone given its high protein-binding rate. One report¹ showed that serum ceftriaxone level did not reduce after HD.

In contrast to HD, haemoperfusion can remove lipid-soluble drug more efficiently. During haemoperfusion, blood is passed through a cartridge containing adsorbent particles. Most commonly, the adsorbent particles are activated charcoal or resin. The activated charcoal or resin in the cartridge will compete with plasma proteins for the drug, adsorb the drug and thereby remove it from the circulation. Hence, haemoperfusion can be a useful alternative in the treatment of toxicity of high protein-bound drugs, such as ceftriaxone.

Onogi et al³ first reported two cases with ceftriaxone neurotoxicity, where both patients were successfully treated with haemoperfusion. In both patients, the consciousness level recovered remarkably during haemoperfusion, and returned to a normal state on the following day. In present case, our patient regained normal mental status immediately after haemoperfusion with no recurrence of symptoms or signs thereafter.

Based on previous reports, symptoms and signs of neurotoxicity can last 2 - 7 days following discontinuation of ceftriaxone. With haemoperfusion, the time to recovery of consciousness has shortened within hours, which can potentially shorten ICU and hospital stay, reducing overall hospitalisation cost.

References

1. Inoue Y, Doi Y, et al. Three cases of hemodialysis patients receiving high-dose ceftriaxone: serum concentrations and its neurotoxicity. *Kidney Int.* 2017;2(5):984-7
2. Suzuki S, Naito S, et al. Encephalopathy induced by high plasma and cerebrospinal fluid ceftriaxone concentrations in a hemodialysis patient. *Internal Med.* 2019;58(12):1775-79
3. Onogi C, Osada A, et al. Two cases of ceftriaxone-induced encephalopathy treated by hemoperfusion in hemodialysis patients. *Hemodialysis Int.* 2022;26: E27-30
4. Jadot L, Judong A, et al. Ceftriaxone-induced Encephalopathy: A Pharmacokinetic Approach. *Eur J Case Rep Intern Med.* 2021; 8(11): 003011
5. Kim KB, Kim SM, et al. Ceftriaxone-induced neurotoxicity: case report, pharmacokinetic considerations, and literature review. *J Korean Med Sci* 2012; 27:1120-23
6. Aronoff GR, Bennett WM, et al. *Drug Prescribing in Renal Failure: Dosing Guidelines for Adults and Children.* 5th ed. Philadelphia, PA: American College of Physicians. 2007; 61, 153
7. Simon N, Dussol B, et al. Population pharmacokinetics of ceftriaxone and pharmacodynamic considerations in haemodialysed patients. *Clin Pharmacokinet.* 2006; 45:493-501
8. Cohen D, Appel GB, et al. Pharmacokinetics of ceftriaxone in patients with renal failure and in those undergoing hemodialysis. *Antimicrob Agents Chemother.* 1983;24(4):529-32
9. Patel IH, Sugihara JG, et al. Ceftriaxone pharmacokinetics in patients with various degrees of renal impairment. *Antimicrob Agents Chemother* 1984; 25: 438-42
10. Garella S. Extracorporeal techniques in the treatment of exogenous intoxications. *Kidney Int.* 1988;33(3):735-54



Heartfelt Congratulations from Singapore Society of Nephrology

On behalf of the Singapore Society of Nephrology (SSN), our warmest congratulations on the momentous release of NKF's special edition of Renal Outlook in celebration of your 55th anniversary!

Your unwavering commitment to advancing kidney care and the evolution of Renal Outlook as a platform for fostering dialogue and inspiring innovation truly exemplify the dedication crucial for progress within the kidney care community.

As we commemorate World Kidney Day, the theme "Kidney Health for All" resonates deeply with the shared mission of NKF and SSN. It underscores the importance of collaborative efforts within the kidney care community to navigate the intricate challenges across the continuum of kidney care, aiming for transformative changes and breakthroughs in kidney health.

SSN keenly anticipates continuing collaboration and knowledge sharing, recognising our collective responsibility in addressing the dynamic changes in kidney care. As we continue working closely together, we wish NKF continued growth and impactful contributions toward excellence and advancement in kidney health within the broader kidney care community.

Warm regards,
Dr Yeo See Cheng
Vice President
Singapore Society of Nephrology

