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BEDSIDE SELDINGER TENCKHOFF CATHETER INSERTION WITHOUT FLUOROSCOPY BY NEPHROLOGIST: A SAFE AND EFFECTIVE METHOD FOR TIMELY INSERTION AND INITIATION OF KIDNEY REPLACEMENT THERAPY

Jer Ming Low, Koh Wei Wong
Hospital Queen Elizabeth, 13a, Jalan Penampang, 88200 Kota Kinabalu, Sabah Malaysia

ABSTRACT

Introduction: Peritoneal dialysis (PD) is still underutilized despite being known as the most cost-effective dialysis modality. Until recently, our Tenckhoff catheter insertion requires the expertise of surgeon, anaesthetist, operating theater or fluoroscopic services in our center. This leads to long waiting time due to the scarcity of resources. To overcome this, we introduced bedside Seldinger Tenckhoff catheter (TC) insertion without fluroscopy. We aim to determine the safety, immediate and early complications following bedside TC insertion without fluroscopy.

Methods: This is a retrospective study conducted in Hospital Queen Elizabeth, Sabah whereby all patients aged more than 18 years old who underwent bedside Seldinger TC insertion from 1 January 2020 – 31 December 2020 will be included. Demographic data, immediate and early complications following TC insertion were collected and analysed.

Results and Conclusion: There were 152 attempts of bedside Seldinger TC insertion with 149 TC inserted. Majority were female (65%) with mean age of 45.6 years old, body mass index of 24.6kg/m2 and all TC insertion time was within 2 weeks from encounter with patient. Main primary disease of end-stage kidney disease was diabetes (42%). Exit site bleeding was the main immediate complication at 3% (n=5) where all were managed conservatively. The rates for PD catheter insertion-related peritonitis and primary catheter dysfunction following bedside TC insertion were 4.6% and 8%. To conclude, bedside TC insertion without fluroscopy allows timely insertion with low immediate and early complications. This allows patients with ESKD equitable access to kidney replacement therapy in a place with limited resources.

Keywords: *Bedside Seldinger Tenckhoff catheter insertion, peritoneal dialysis, PD catheter insertion-related peritonitis, primary catheter dysfunction, subumbilical Tenchkoff catheter insertion*

INTRODUCTION

Malaysian Dialysis and Transplant Registry (MDTR) collects information on patients with end stage kidney disease (ESKD) on kidney replacement therapy (KRT) in Malaysia. The latest report published is the 26th MDTR 2018 report (1). There were a total of 44,136 ESKD patients where 39,593 on hemodialysis (HD) and 4,543 on peritoneal dialysis (PD) in 2018 giving a prevalence rate of 1223 per million population (pmp) and 140 pmp, respectively. In 2018, there were 8,431 new ESKD patients where 85.4% opted for HD while 14.6% chose PD. Although PD is known as the most cost-effective dialysis modality in most developed countries and some developing countries (2-3), PD is still underutilized around the world (4).

**Corresponding Author:*
Jer Ming Low
Hospital Queen Elizabeth, 13A, Jalan Penampang,
88200 Kota Kinabalu, Sabah, Malaysia.
Email: lowjermingnephrohkgu@gmail.com

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There are many factors influencing selection of dialysis modalities. The criteria for selection of patients for long term PD include patient choice with other factors to consider including manual dexterity, vision, home environment, assistant, patient medical history and past abdominal surgery (5-6). The best insertion method is unknown due to the lack of randomized controlled trials, however for patients with previous significant abdominal surgery, laparoscopic or open insertion techniques that involves direct visualization of peritoneal cavity is necessary (7).

Until recently, at our center, Tenckhoff catheter (TC) was inserted via laparoscopic surgery by urologist under general anaesthesia. Since then, we introduced fluoroscopic Seldinger TC insertion in 2017 and peritoneoscopic TC insertion in 2020 for all potential PD patients. Unfortunately, all these techniques require access to scarce surgical and anaesthetic services, operating theater and fluoroscopic room services. This resulted in long waiting times and inherent delay where potential patients were exposed to HD and subsequently lost interest in PD while waiting for the procedure to be performed (8).

In order to reduce the waiting time for TC insertion in PD patients, we selected patients without history of intraperitoneal surgery for percutaneous bedside Seldinger TC insertion without fluoroscopy. Bedside Seldinger Tenckhoff catheter insertion was first introduced at our center in December 2019. Percutaneous bedside Seldinger TC insertion technique has been previously described and is safe with high success rate (9-12). This allows for easier access for TC insertion in potential PD patients with reduced resource requirements leading to reduction in patients being placed on temporary HD support, which is limited in our setting.

In this study, we aim to report our experience with Bedside Seldinger TC insertion without fluoroscopy for our ESKD patients. To our knowledge, this is the first study that describes the insertion of bedside Seldinger TC insertion and look into the safety, immediate and early complications associated with bedside Seldinger TC insertion without fluoroscopy in ESKD patients in Malaysia.

METHODOLOGY

This is a retrospective study conducted in Hospital Queen Elizabeth (HQE), Kota Kinabalu, Sabah.

INCLUSION CRITERIA

All patients age more than 18 years old who had underwent a bedside Seldinger TC insertion without fluoroscopy from 1 January 2020 – 31 December 2020 will be enrolled into the study.

EXCLUSION CRITERIA

Patients under the age of 18 years old on the date of TC insertion will be excluded.

DEFINITION

PD catheter insertion-related peritonitis was defined as an episode of peritonitis that occurs within 30 days of PD catheter insertion (13) while PD peritonitis is diagnosed when at least two of the following are present: clinical features consistent with peritonitis, dialysis effluent white cell count > 100/uL with 50% polymorphonuclear leukocytes (PMN) or positive dialysis effluent culture.

Primary catheter dysfunction was defined as inflow or outflow obstruction that prevented normal dialysis within 1 month of catheter placement.

ANALYSIS

Demographic data, baseline blood investigations prior to TC insertion were collected.

Hemoglobin level, blood urea and serum electrolytes, albumin and creatinine were obtained when patient initially presented to us. Estimated glomerular filtration rate (eGRF) was calculated using the CKD-EPI creatinine equation and reported in ml/min/1.73m^2. Blood results parameters and eGFR were reported in mean value while serum creatinine was reported in median. Primary disease of ESKD, immediate and early complications were reviewed and recorded in the data collection form.

The data was analyzed using the SPSS version 24.

ETHICAL APPROVAL

This study is registered with the National Medical Research Register (NMRR ID-22-00457-ZTC). The institutional review board reviewed and approved the study design and approval was also obtained from the Medical Research & Ethics Committee (MREC)

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PATIENT SELECTION

Patients without any prior intraperitoneal abdominal surgery was scheduled for bedside Seldinger TC insertion by a trained nephrologist.

TECHNIQUE OF BEDSIDE SELDINGER TENCKHOFF CATHETER INSERTION WITHOUT FLUOROSCOPY

Patients scheduled for bedside Seldinger TC insertion will have their bowels cleared with oral lactulose and will be admitted to Nephrology ward at least 1 day prior to the planned procedure. The attending nephrologist will obtain informed consent and patient examined again whereby the insertion, tunnel and exit site together with patient's belt line were marked on their skin (Fig 1).

Prophylactic antibiotics (intravenous cefuroxime 1.5g) prior to procedure will be administered together with conscious sedation (midazolam and fentanyl).

On the day of the scheduled procedure, abdominal region is cleaned with chlorhexidine 70% and surgical field draped. Local anaesthetic (lignocaine 2%) is given over the insertion site region (2cm below the umbilicus – Subumbilical approach). A 19-gauge introducer needle is inserted over the subumbilical marked region until a 'give' is felt signifying that the tip of needle is in the peritoneum. Guide wire will then be inserted through the introducer needle (Fig 2).

Introducer needle is then removed leaving the guide wire in situ. A small 1-2cm horizontal incision is made alongside the guide wire and subcutaneous tissue dissected via artery forceps until visualization of linea alba.

We then use a 16F dilator to dilate the tract and introduce the peel away sheath via the dilator subsequently (Fig 3). The peel away sheath is directed towards the suprapubic region and the dilator and guide wire removed while leaving the peel away sheath insitu.

Tenckhoff catheter is then straightened via a stylet. The tip of the Tenckhoff with the stylet is inserted in via the peel away sheath directing the TC towards the suprapubic region until resistance if felt (Fig 4). Stylet is then removed and the sheath is peeled off leaving the TC insitu.

The internal cuff of the Tenckhoff catheter is situated directly above the linea alba. Using the tunneler provided in the set, we tunnel the TC from the insertion site to the marked exit site, leaving the exit site 2cm subcutaneously from the exit site (Fig 5).

We subsequently flush the Tenckhoff catheter using 200-300cc Baxter peritoneal fluid solution 1.5% to ensure good in and outflow. Skin was then closed via non-absorbable suture and dressing was done via aseptic technique.

Immediate complications (within 24 hours) such as bleeding or pain were documented and assessed appropriately.

We will monitor the patient overnight in our nephrology ward and discharge patient home the following day if uneventful. Our nurse will give an appointment to review in our PD unit in 5 days time for wound inspection and initiation of training at day 10-14 depending on clinical condition

RESULTS

In 2020, there were a total of 152 attempts at bedside Seldinger TC insertion where 149 of them were successful with a success rate of 98%. Three attempts were unsuccessful due to failure to advance guide wire following the insertion of introducer needle. The characteristic of the 149 cases is shown in Table 1. All bedside Seldinger TC insertion in our center was inserted within 2 weeks of encounter with patient.

Table 1: Demographics, patient characteristics and outcome

	n (%)
Total number of bedside Seldinger procedures attempted	152
Successful insertion of catheter	149 (98%)
Gender	
- Male	52 (35%)
- Female	97 (65%)
	Mean (SD)
Age, years	45.6 (15.6)
Height, cm	161 (9)
Weight, kg	62.9 (14.3)
Body Mass Index, kg/m^2	24.6 (4.51)
Hemoglobin, g/dL	7.9 (1.7)
Platelet, 10^3/µL	247 (92)
Albumin, g/L	28.1 (6.2)
Urea, mmol/L	29.1 (10.3)
Sodium, mmol/L	138 (3.7)
Potassium, mmol/L	4.5 (0.7)
eGFR, ml/min/1.73m^2	5.8 (2.5)
	Median (IQR)
Creatinine, µmol/L	977 (517)
	n (%)
Primary disease	
- Diabetes mellitus	62 (42%)
- Hypertension	33 (22%)
- Unknown	33 (22%)
- Others	21 (14%)
Immediate complications	
- Exit site bleeding	5 (3%)
- Rectus hematoma	1 (1%)
- Viscus perforation	0 (0%)
Early complications	
- PD catheter insertion-related peritonitis	7 (4.6%)
- Exit site leaking	5 (3.3%)
- Primary catheter dysfunction	12 (8%)

eGFR, estimated glomerular filtration rate

Our cohort consists of mainly female patients (n=97, 65%) with a mean age of 45.6 years old and body mass index of 24.6kg/m2. The mean hemoglobin, sodium, potassium and albumin were 7.9g/dL, 138mmol/L, 4.5mmol/L and 28g/L respectively. The median creatinine was 977µmol/L with a mean eGFR of 5.8ml/min/1.73m^2. Majority of the ESKD is due to diabetes mellitus (n=62, 42%).

IMMEDIATE BLEEDING COMPLICATIONS

Majority of the patients had no immediate complications following TC insertion (n = 143, 96%). The commonest immediate complications were exit site bleeding (n = 5, 3%). One patient (1%) had rectus hematoma following insertion of the catheter. All the immediate complications were managed conservatively. There was no bowel perforation complication noted.

EARLY COMPLICATIONS (WITHIN 1 MONTH)

There were 7 cases (4.6%) of bacterial PD catheter insertion-related peritonitis as defined earlier. Six cases were treated successfully whereby peritoneal dialysis initiated and continued subsequently. Unfortunately one had the catheter removed and converted to hemodialysis. Five cases of exit site leaking occurred after 2 weeks of catheter implantation. These were managed conservatively with additional 1-week rest and prophylactic oral cefuroxime for 5 days. All the 5 patients with exit site leaking subsequently were able to commence on PD training following the 1-week rest. Twelve catheters (8%) failed to function within 1 month after insertion (primary catheter dysfunction) (Table 1). Out of the 12, 1 could be salvaged under fluoroscopy guide wire maneuver, 7 catheters were removed and new catheter reinserted under fluoroscopy guidance during the same setting while 4 patients were converted to haemodialysis citing loss of interest in peritoneal dialysis.

DISCUSSION

To date, peritoneal dialysis is still underutilized in both developed countries like USA and developing countries like Malaysia (4,8,14). This is despite CAPD was first introduced in Malaysia in 1981 (8). In Sabah, there were a total of 596 per million population (pmp) undergoing dialysis where majority of them (401 pmp) are reliant on the public sector for dialysis support which is in stark contrast to West Malaysia where majority of the dialysis patients were supported by the private or non-government organization (NGO) center (1). This places a huge healthcare economic burden in Sabah. With limited government and private/NGO HD centers available in Sabah as well as the ever-growing population of ESKD compounded by the COVID-19 pandemic, home-based peritoneal dialysis therapy may be the preferred option in the future.

Many reasons have been cited for the reasons for the poor penetration of PD as a modality of KRT in Malaysia. One major factor is the long waiting time associated with the insertion of the Tenckhoff catheter resulting in potential PD patient being exposed to HD and eventually loses interest in PD. In this retrospective review, with careful selection of patients without prior intraperitoneal abdominal surgery, we showed that bedside Seldinger TC insertion is a safe procedure with waiting time of less than 2 weeks.

This method of insertion can easily be done by a trained nephrologist in procedure room equipped with basic suturing set with minimal immediate and early complication rates comparable to previous studies (11-12). One of the common early complication is post-operative exit site bleeding. This could be due to subcutaneous tunneling. Comparing to other studies utilizing bedside percutaneous TC seldinger insertion method that has been reported, our exit site bleeding rate (3%) is slightly higher compared to study by Johnny (11) and George (12) at 1%. However all exit site bleeding were managed conservatively and resolved uneventfully.

Apart from that, our primary catheter dysfunction rate stands at 8%, which is comparable to other studies ranging from 11-20% (11-12). It must be noted that our PD catheter insertion-related peritonitis rate was 4.6%, which is within the target <5% as outlined in the ISPD guidelines on creating and maintaining optimal PD access in the adult patient (9,13).

Besides that, from our own local data, despite COVID-19 pandemic causing numerous cancellations on the elective surgical procedures, bedside Seldinger TC insertion was still being consistently performed throughout 2020 compared to other method of TC insertions (Graph 1). This ensures that patients suffering from advanced chronic kidney disease are able to get timely renal replacement therapy.

We believe that with the correct selection of patients without any history of intraperitoneal surgery, bedside Seldinger TC insertion without fluoroscopy by nephrologist is going to be a critical component to increase the popularity of PD treatment not only in Sabah, but also in Malaysia. It is a safe insertion method with low immediate and early complications including primary catheter dysfunction despite it being a *blind* procedure.

CONCLUSION

Home-based PD therapy as the first or preferred mode of dialysis allows patients with ESKD equitable access to KRT, especially in a place with limited resources, such as Sabah. Together with the PD team, nephrologists here take part in every stage of care of the CKD stage 5 patients from counseling for KRT to insertion of the Tenckhoff catheter and further management of the peritoneal dialysis. Not only that, Bedside TC insertion without fluroscopy allows timely PD catheter access and dialysis initiation for patients with ESKD. With this, it is hoped that the patient and caregivers will feel more secure, motivated and keen to start PD as their first choice of dialysis modality.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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Case Report Open Access

SUCCESSFUL TREATMENT OF SEVERE COVID-19 IN A KIDNEY TRANSPLANT RECIPIENT WITH TOCILIZUMAB

Jing Ling Choe, Xue QI Tan, Soon Leng Lee, Lik Wee Ee, Wen Jiun Liu
Hospital Sultanah Aminah ,Jalan Persiaran Abu Bakar Sultan , Johor Bahru, Malaysia

ABSTRACT

We report a case of severe COVID-19 in a deceased donor kidney transplant recipient (KTR) who was successfully treated with Tocilizumab. She presented with COVID-19 symptoms and tested positive by reverse transcription real-time polymerase chain reaction (RT-PCR) of nasopharyngeal swab. The patient was admitted on day 5 of illness with chest radiography (CXR) suggestive of bronchopneumonia. Blood investigations showed leucocytosis with normal lymphocyte count and raised C-reactive protein (CRP). We closely monitored her condition as she was able to maintain saturation under room air. She deteriorated further on day 9 of illness, requiring withholding of immunosuppressive medications, increasing dose of oxygen therapy and dexamethasone. Tocilizumab was started for lymphopenia, raised lactate dehydrogenase (LDH) and persistence of alveolar opacities. Complications include acute kidney injury (AKI) and transaminitis. Her symptoms of pneumonia gradually improved, was able to be discharged on day 20 of illness, with complete resolution of AKI.

Keywords: *COVID-19, Kidney Transplant, Tocilizumab*

TITLE

A case of successful treatment of severe COVID-19 in kidney transplant recipient with Tocilizumab, an interleukin-6 receptor monoclonal antibody.

INTRODUCTION

The World Health Organization declared the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreak a pandemic on 11th March 2020. Coronavirus disease (COVID-19) pneumonia in kidney transplant recipients (KTR) represents a new challenge for nephrologists as they are considered a high-risk population for severe infection. COVID-19 is transmitted via droplets or direct contact and infects the respiratory tract resulting in pneumonia in most cases and acute respiratory distress syndrome (ARDS). ARDS in COVID-19 infection is related to a "cytokine storm" (CS) with large interleukin-6 (IL-6) release. Tocilizumab is a humanized antibody against the receptor of IL-6. In the setting of transplantation, Tocilizumab has been used to treat chronic antibody-mediated rejection. (1) Since ARDS in severe COVID-19 is an inflammatory response, Tocilizumab appears as a reasonable drug to target the presumed CS triggered by the virus. Thus, we share our experience with a successful KT recipient with severe COVID-19 infection treated with Tocilizumab.

CASE

A 40 years old woman who is a deceased donor KTR performed on 2nd July 2019, with stable graft function on maintenance immunosuppressive treatment of Everolimus 0.75mg BD, Prednisolone 10mg OD and Tacrolimus 2mg OD. Her baseline serum creatinine was 188µmol/L, 4 months before the COVID-19 infection. She has completed 2 doses of COVID-19 vaccination (Pfizer) on 15th July 2021. The primary renal disease was unknown.

On 19th October 2021, she experienced the onset of sore throat, cough, ageusia, anosmia, headache, and rhinorrhoea. COVID-19 recent infection was confirmed by reverse

*Correspondence:
Jing Ling Choe
Hospital Sultanah Aminah,
Jalan Persiaran Abu Bakar Sultan,
80100 Johor Bahru, Malaysia.
Email : jl_choe@hotmail.com

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transcription real-time polymerase chain reaction (RT-PCR) with CT value of RDPR=27.32; N-NA; E=25.79. Therefore, she was admitted to the COVID isolation ward on 23rd October 2021.

She admitted on day 5 of illness (23rd October 2021), her vital signs were: afebrile, blood pressure 145/92mmHg, and heart rate of 120beats/minute, respiratory rate of 20breaths/minute, oxygen saturation of 96% under room air. Chest radiography (CXR) showed bilateral lower zone multifocal alveolar opacities suggestive of bronchopneumonia. Laboratory tests showed raised white cell count (WBC) 12.7X10^9 /L without lymphopenia, C-reactive protein (CRP) 250.1mg/L, and ferritin 157.20µg/L. On day 6 of illness, she had new onset of fever with a temperature of 37.8°C. IV Piperacillin-tazobactam 2.25g three times a day was initiated after blood culture and urine culture were obtained. On day 7 of illness, she developed exertional hypoxia (saturation dropped from 95% to 92%). We started oxygen supplementation through a nasal prong (3 L/min) and administered IV Dexamethasone 8mg daily.

On day 9 of illness, patient's saturation dropped further and required a venturi mask of 60% to maintain oxygen saturation >95%. Laboratory tests showed an increased in WBC to 17.1X10^9/L, neutrophil-lymphocyte ratio (NLR)=18, with lymphopenia = 0.9X10^9/L and lactate dehydrogenase (LDH) = 527U/L. She developed non-oliguric AKI (serum creatinine raised from 244µmol/L to 291µmol/L) and transaminitis (alanine transferase from 75U/L to 92U/L and aspartate aminotransferase from 37U/L to 148U/L). (Table 1). Repeated CXR remained unchanged, we commenced Tocilizumab 400mg and increased IV Dexamethasone to 24mg daily. Her immunosuppression therapies were discontinued as her creatinine and Tacrolimus drug level were rising (Tacrolimus drug level : 4.31ng/ml to 5.97ng/ml).

IV Meropenem 500mg BD was started due to rising WBC and rising NLR.

RESULTS

Three days following the initiation of Tocilizumab, her clinical condition improved with reducing CRP (42mg/L) and LDH (455U/L); CXR showing partial resolution. The patient was discharged after 2 weeks with serum creatinine returned to baseline (165 µmol/L).

Her transplant clinic follow-up in December 2021 showed a normal CXR without residual respiratory symptoms.

Table 1: Clinical and laboratory data before and after Tocilizumab injection.

Day of Illness	Day 5	Day 6	Day 7	Day 9	Day 10	Day 11	Day 12	Day 13	Day 16	Day 20
Day of Admission	Day 1	Day 2	Day 3	Day 5	Day 6	Day 7	Day 8	Day 9	Day 12	Day 16
White Cell Count (X10^9/L)	12.7	13.0	8.8	17.1		9.7	7.6	5.9		9.4
Absolute Lymphocyte Count (X10^9/L)	2.07	0.9	0.9	0.9		0.6	0.5	0.4		1.8
Urea (mmol/l)	8.8	11.4	13.3	11.6	13.1	15.3	16	16.7	16.8	11.4
Creatinine (µmol/l)	244	297	262	291	243	218	209	201	171	165
EGFR (mL/min/1.73m^2)		16	19	17	21	24	25	26	32	33
ALT (U/L)	75	45	43	92		65	48	42		54
AST (U/L)	37	44		148			26	26		
LDH (U/L)	280	335		527			455	427		
CRP (mg/L)		250.1		139.5			42		6.0	1.7
Ferritin (µg/l)		157.20								
Oxygen Requirement	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
P/F Ratio (norm >300)				162	145	117	185	260	312.5	

Tocilizumab

ALT: Alanine transaminase; AST: Aspartate aminotransaminase; LDH: Lactate dehydrogenase; CRP: C-reactive protein; VM: Venturi mask; P/F Ratio: Partial Oxygen / Fractional Inspired Oxygen Ratio

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DISCUSSION

KTR is categorized as high-risk group for COVID-19 infection due to chronic immunosuppression. There is no clear guideline on the timing of immunosuppression cessation during acute COVID-19 infection. Some experts recommended should continue to receive their CNIs and prescribed dose of glucocorticoids but their antiproliferative drugs should be stopped. In the minority of KTR with severe COVID-19 infection requiring ICU admission and mechanical ventilation, CNIs and antiproliferative drugs should be immediately withdrawn and glucocorticoid doses should likely be increased. (2) A genome-wide analysis of protein-protein interactions between COVID-19 and human host proteins identified both cyclophilin family members and FK506 binding proteins as interaction partners for COVID-19 proteins. In addition, both FK506 treatment and knockdown of FK506-binding proteins 1A and 1B inhibited SARS-CoV-2 replication in vitro. There is a suggestion that tacrolimus, may have inhibitory potential in COVID-19 viral replication. Although studies did not advocate the use of these drugs for their potential antiviral properties, these findings may support their continuing use as the preferred maintenance immunosuppressant in transplant recipients with COVID-19 infection. (3)On day 9 of illness, we discontinued her immunosuppression therapy as her creatinine and Tacrolimus drug level were rising.

The safety and efficacy of Tocilizumab for treatment of severe COVID-19 infection remained inconclusive, especially among KTR. Tocilizumab initiation was due to worsening clinical conditions, requirement of venturi mask 60%, lymphopenia, without resolution of CXR opacities. Immunosuppression was continued on the day of admission while she remained in stable clinical state.

CONCLUSIONS

Tocilizumab is used in moderate and severe cases of COVID-19 pneumonia where a hyperinflammatory state or CS is present (3). Data related to the use of Tocilizumab are limited but encouraging as no side effect has been reported so far(4,5). More evidence is needed to confirm benefit of Tocilizumab in KTR with severe COVID-19 infection.

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