

## Peer Review File

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Comment 1: I don't like using the word "Right" for "right patient" or "right access". Would use another word, such as “appropriate”? Otherwise, great review and very practical, well-written manuscript.

Reply 1: Changes made to “appropriate”, including the title.

Comment 2: This paper reviewed the indications and places to insert HD catheter. In general, the topic itself is clinically relevant and easy to read, however, relatively obvious matters were discussed. Additionally, although the issues regarding extraordinary high rate of catheter use to start dialysis was discussed in the Introduction section, this review did not provide an answer.

Overall, the Introduction section is interesting and easy to read. However, as described above, this review did not provide an answer to the issues raised in the Introduction section. This review only illustrated the appropriate use of HD catheter. I recommend to rewrite the Introduction and subsequent sections to ensure consistency.

Reply 2: In the introduction, comments added to address the fact that these multifactorial challenges do not have easily solutions. The comments regarding the challenges are made in order to frame why HD catheters are the default choice, and likely to remain so for a long time. However, these concerns are addressed by changes in KDOQI guidelines, and this was added to the introduction: “The multifactorial challenges described above are part of the rationale of changing from the “fistula first” approach of the 2006 guidelines, with a new emphasis on evaluating “what’s next” for patients to anticipate future needs and thereby reduce the dependence upon HD catheters. Whether these guidelines translate to improved outcomes is yet to be clear.”

Comment 3: Page 7, lines 10 – The time for AVF to mature, about 3–4 months, seems too long. It seems different from other countries like Japan. Please discuss more about how to shorten this maturation time. Actually, multiple interventions raised in the manuscript (including angioplasty, processing to collateral veins) can be performed at the time of operation.

Reply 3: Timing of AVFs to overall maturation is taken from Allon et al (doi:10.1053/j.ajkd.2017.10.027) where Figure 1 shows median Overall Maturation at 125 days from surgery. Section is expanded to including a likely cause of delayed maturation, specifically half of surgically created AVFs require additional interventions.

Comment 4: Considering the process necessary to create AVF and AVG, the authors should discuss appropriate timing to create this vascular access. Or, generally, do the authors consider HD catheter should be used at first?

Reply 4: The authors believe AVFs and AVGs should be considered as part of the ESKD Life-Plan guidelines from the KDOQI. Added a sentence clarifying appropriate timing: “For example, most patients with CKD and progressive decline in renal function should be referred for vascular access evaluation when eGFR is 15-20 mL/min/1.73 m<sup>2</sup>.” However, the authors acknowledge that for a variety of reasons as discussed, HD catheters become the default and only choice due to various challenges surrounding the timing.

Comment 5: Additionally, authors should mention the cardiac overload associated with the creation of AVF or AVG. The appropriate patients for HD catheter should also be discussed in this perspective.

Reply 5: Modified sentence to include the appropriate clinical considerations: “The HD catheter serves as a safe, reliable and indispensable AV access option for many clinical situations, particularly in patients susceptible to the high output cardiac failure associated with AVFs and AVGs”.

Comment 6: As well as the economic impact, what is the impact of starting dialysis with a catheter on hospital stays?

Reply 6: Phrase “and hospitalization” removed to limit the discussion per reviewer C comment #10 to decrease length of the section.

Comment 7: The risks associated with insertion of tunneled HD catheter compared to that of non-tunneled HD catheter should be discussed, with specific risk values, if possible.

Reply 7: Added two sentences to the paragraph on placement of TDCs in the ICU setting, specifically “Our initiative to place TDCs and not NTDCs was driven by prior studies reporting similarly low peri-procedural complications, but higher overall complications (mechanical and positive cultures) in patients with NTDCs (relative risk 13.6)”.

Comment 8: Page 3, line 108 – HVPD (36–44 liters) ... please clarify the liter per session, which is also important to consider the inverse effect on mechanical ventilation.

Reply 8: Author requests clarification on specific line. Unable to locate “HVPD” or other mentions to peritoneal dialysis in context of volume.

Comment 9: In the Ideal prescribed dialysis dose section. Page 3, lines 9 “The incidence of primary maturation ...”– Generally, as Figure 2 described, AVG needs more procedures to maintain long-term patency compared with AVF. Therefore, this sentence is confusing.

Reply 9: Added “prior to first cannulation” for clarification. AVGs require more procedures to maintain long term patency, but AVGs have a lower rate of primary maturation failure (failure within 3 months of placement). Thus AVGs have better short term outcomes.

Comment 10: Page 10 – Section 2 and 3 convey the similar contents. Please consider putting these sections together.

Reply 10: Author believes reference is to sections 3 and 4 (limited lifespan scenarios and palliative use). Heading for section 3 is changed to “elderly patients” to specifically address the supporting references and studies in elderly patients. Greater emphasis is given to the role of age as a risk factor leading to worse outcomes in AVGs and AVFs.

Comment 11: Table 2 and Table 3 should be replaced with Figure 2 and Figure 3, respectively, in the manuscript.

Reply 11: All instances of Table changed to Figure.

Comment 12: The management of ESKD patients on hemodialysis is a major clinical challenge and Sharma and colleagues have done a good job at writing this genuinely interesting review addressing part of this pressing issue.

Line 55-56 “...about 280 patients start dialysis everyday with a catheter...” is redundant and should be removed because it is the same as the preceding statement in line 53 (i.e 80% of 350 = 280). It should probably read: “About 80% of the new patients starting hemodialysis start dialysis with a catheter, thus adding over 100,000 new catheter insertions per year in the U.S. alone (1).

Reply 12: Specified changes made to reduce redundancy.

Comment 13: Please consider reformulating the statement in lines 57-59 to better convey its message. It could read something like: “As per the USRDS 2019 report, the proportion of patients who initiate dialysis and remain catheter dependent at 3 months, 6 months, 12 months and 18 months account for 70%, 46%, 22% and 18% of the population, respectively (1).

Better still, the authors could present just one meaningful figure. Ex: As per the USRDS 2019 report, 46% of patients initiating dialysis remain catheter dependent at 6 months.

Reply 13: Specified changes made to only include 6-month percentage.

Comment 14: Lines 61 – 69: The two references cited seem to only address late referral to nephrologists. Please provide references for the other challenges mentioned.

Reply 14: Reference (#4) replaced, and challenges updated.

Comment 15: Line 73: “The problem is not limited to the U.S. and has been reported universally from other developed countries.” Any reference for this?

Reply 15: New reference #4 is a review which includes European studies. Removed “universally”.

Comment 16: Line 85: “Vascular stenosis” is a less specific term and should be changed to “central venous stenosis”.

Reply 16: Changed vascular to central venous.

Comment 17: Line 91: The abbreviation “PD” is being used for the first time in the paper. My guess is peritoneal dialysis but please state what it stands for. There are other abbreviations throughout the manuscript which were not defined. Please correct those as well.

Reply 17: Defined PD, AVG, AVF, AV, BMI, CKD, TDC, NTDC.

Comment 18: \*Line 114: A HD catheter is technically not an “AV” access (because no connection between artery and vein). Please change the heading.

Reply 18: Heading changed to vascular access.

Comment 19: Lines 115-117: Provide the reference for the definition of an ideal AV access.

Reply 19: Citation added (KDOQI 2019 Guidance 4).

Comment 20: Line 120: Again, CVC is technically not an AV access, so I would prefer the term “hemodialysis access” or “vascular access”.

Reply 20: Changed to hemodialysis access.

Comment 21: When is a catheter the right AV access? The information provided in the introductory part of this section, although interesting, is all too lengthy and seemed more like a comparison of AVF to AVG which is not the goal here. Please consider shortening the intro portion to get straight to the point.

Reply 21: Section shortened – particularly many specific numbers were removed including specific costs and specific outcomes. Multiple sentences in paragraph 2 removed. A sentence is removed from paragraph 1.

Comment 22: Side selection should be changed to “Site selection”; CVCs are not only limited to the upper torso. In addition, the reader would benefit from a figure depicting the hierarchization of CVC access sites (i.e right IJ >> left IJ>> right SCV.....>>femoral vein etc) as stated later in line 316.

Reply 22: Changed Side to Site. Figure 4 added.

Comment 23: Lines 254-256: I would change “subclavian veins are no longer preferred” to “... subclavian veins are less preferred to internal jugular.” We still do see a lot of right SCV catheterization.

Reply 23: Changed to less preferred.

Comment 24: Catheter length selection: Given the confounding factors associated with the Peres formula, and given that a lot of HDs catheters are now placed under fluoroscopic guidance where accurate measurements can be easily made, is there still a role for the proposed formula? In other words, do the authors use this formula in their practice?

Reply 24: The beginning of the section addresses the use of fluoroscopic guidance, stating that these formulae are most commonly used in settings where intermittent fluoroscopic guidance is not available. Added sentence regarding the authors’ use of formula, to ensure the estimated length catheter is immediately available in the room.

Comment 25: Non-conventional TDC placement: Authors should please comment on the role of the novel Surfacer Catheter Access system which has been designed to achieve right-sided CVC placement through occluded veins. Also comment on the HeRO graft.

Here are some references:

<https://doi.org/10.1177/1129729820937121>

<https://doi.org/10.1016/j.jvsv.2022.06.013>

<https://doi.org/10.1055/s-0042-1742391>

Reply 25: Surfacer Inside-Out device included in mention of salvage therapies along with sharp recanalization. However, further discussion regarding salvage techniques may be somewhat outside the scope of this review. The HeRO graft was deliberately excluded from the discussion as the distal venous component is placed similar to a TDC, with the outflow tract in the right atrium, and therefore represents a salvage technique for AVF/AVGs (rather than TDCs) in the upper extremity in patients with distal central or peripheral venous stenosis (rather than occlusion). If the central veins can accommodate the 19F venous component of a HeRO graft, the central veins can also accommodate a 19F TDC and thus no alternative sites would be required. Wording in the Non-conventional TDC placement section changed from “central venous stenosis” to “central venous occlusion” to better reflect the rationale for the exclusion of the

HeRO graft. If reviewer deems it appropriate, discussion can be added to include the HeRO graft.