INTRODUCTION
A remarkable reduction in the excretory function of the human kidney can be observed on chronic kidney disease (CKD) also called renal failure. Consequently, waste substances accumulate in the plasma and cause certain complications like pulmonary edema—the predictor for premature death. Unfortunately, Pakistan is a country where mortality rate on kidney diseases (majorly CKD) has touched a frightening figure of 13.5/100,000 population.

Hemodialysis (HD) is recommended as renal replacement therapy to sustain the life of the sufferer with low grade morbidity. Insertion of readily operational percutaneous double-lumen
tunneled cuffed central venous catheter (CVC) at suitable vessel e.g. internal jugular or subclavian vein is the 1st step towards efficient extracorporeal blood flow for hemofiltration. Similarly, the device acts as a bridge while switching from one type of permanent vascular access e.g. arteriovenous (AV) fistula to other type ‘AV graft’ on dysfunctioning.

The experienced practitioner inserts the device carefully using National guidelines and modern technologies. However, likelihood of short or long term CVC-related complications still exists at any of the three stages viz. insertion, stay in period, and removal (rarely). Arterial puncture or catheter-site bacterial infection usually emerges just after catheter’s placement; hence termed as early complications. However, central venous stenosis, thrombosis, mechanical kinking, or acute sepsis is observed as late catheter adverse outcome. The fear of the complications urges a patient to miss/shorten the HD sessions i.e. non-compliance with therapy. The non-adherence to therapy results in poor hemofiltration - a challenge for the HD handlers. Moreover, magnitude of the dissatisfaction on treatment increases when sufferer (or even public health sector) have to meet extra financial burden against CRCs’ management.

Open-accessed literature (with reference to Pakistan) is available on comparison between HD internal jugular vein (IJV) and subclavian vein (SCV) catheterization. However, authors of present study noticed scarcity on three areas viz. CVC-related complications (especially late), noncompliance with therapy due to patients’ feeling uncomfortable, or cost-effectiveness. To fill the gap, present work was conducted between March 2017 and April 2018 in a setting ‘The Kidney Centre’, Sialkot, Pakistan.

**Sampling of Subjects:** Consecutive patients (aged >18 years) of either sex who were recommended for urgent hemodialysis (HD), shifted from peritoneal dialysis to HD, or needed change in position of the catheter on dysfunctioning of the previous vascular access were included. However, patients with missing previous medical record, reporting prophylactic administration of antibiotics, renal carcinoma, hemodialysis frequency (<3 per week), or severe psychological/mental issues were excluded. Group IJV or SCV catheter was assigned to alternate subjects (n = 66 i.e. 33 cases/group) from computer-generated list.

**Catheter Insertion:** Pre-assessment and management of the subjects was conducted by physical examination along with laboratory work for urea/creatinine, complete blood count, serum electrolytes; ultrasonography and ECG. The raised K+ level was managed by inj. Calcium-Sandoz diluted I/V, inj. Sodabicarb 100 ml and 25% D/W 10 ml (2 ampoules) plus 6 units plain insulin I/V. Blind (i.e. without ultrasound guide) aseptic catheterization was commenced at locally anaesthetized site in vein of interest following Practice Guidelines for CV line. Moreover, issues of orthopnea were strictly addressed. The temporary subcutaneous double-lumen tunneled cuffed device remained intact for maximum six weeks i.e. till functioning of the permanent arteriovenous (AV) fistula/graft.

**Assessments:** Baseline information of the subjects e.g. duration of dialysis were recorded. The infections were identified before classification vide codes of ICD-9-CM (International Classification of Diseases, Ninth Revision, Clinical Modification). The non-adherents were asked to give response (yes/no) against a question “Do CRCs cause non-adherence?” to assess the device-related uncomformability. In each study group, the financial expenditures on management of the complications were pooled before %age estimation for cost-effectiveness.

**Ethical Considerations:** The study was conducted after getting approval from the hospital ethics committee. Moreover, participation consent was mandatory for participants.

**Statistical Analysis:** Data of age (continuous variable) was processed for mean+/−SD (range) values using statistical tool in SPSS ver. 16.0 (SPSS Inc., Chicago, IL, USA; Windows 2007). Non-adjusted odd ratio (OR) were calculated for different complications to visualize the comparative efficiency of the catheters.

**RESULTS**

Of 66 cases, 62 (93.9%) showed adherence with prescription of clinicians for hemodialysis as shown in flow sheet of subject sampling (Fig.1). Males and females were in the ratio of 3.1:1 (47 vs. 15) with mean age of 47 (SD = 14, range 24-75) years. More than 50% population was on urgent HD. However, others switched from peritoneal dialysis to HD, or on replacement of dysfunctional central venous access i.e. AV fistula/graft. On
the average, the patients held the temporary subcutaneous double-lumen tunneled cuffed device for 40 days. [Fig.1]

The heterogeneous, statistically insignificant data of early catheter-related problems is shown in Table-I. The rate of vein damage during placement of IJV catheter was higher than SCV catheter (13.9 vs. 6.5%). Similarly, likelihood of accidental artery rupturing was approximately three times more after IJV catheterization (95% CI: 0.316 – 32.741). However, no difference in cases was observed with reference to pulmonary complications (e.g. pleural rupture) or catheter site bacterial infections. [Table-I].

Data in Table-II reveal late catheter-related complications observed during a period between catheter insertion and removals i.e. stay in time. The higher rate of stenosis (25.8%) was found in the patients of IJV catheter compared to matching SCV catheter group. Moreover, 3.21 times more dysfunctioning of IJV catheter (95% CI: 316 – 32.741) was noticed on account of thrombus formation or stenosis. In both the groups, the infections were identified as exit site or tunneled infections. Luckily, severe blood stream infection (BSI) was not reported in any case. [Table-II]

Comparatively higher numbers of patients from IJV group showed non adherence to the therapy through missing (n=6, 19.6%) or shortening (n=7, 12.9%) of HD sessions than SCV group (Table-III). All such subjects gave positive response (i.e. yes) against a question “Do CRCs cause the non-adherence?” However, almost same frequency of patients (reporting uneasiness in handling of device in daily life) was seen in both sides. The only plus point in the IJV side was lesser rate of mechanical kinking of the device compared to SCV (3.2 vs. 12.9%).

Evidently higher percentage i.e. 69% of the total financial burden on management of the CRCs was recorded against IJV group. In this group, the data of frequency of CRCs [No. of patients] was found, as: 1[9], 2[8], 3[4], 4[2], and 0 [8].

**DISCUSSION**

Unpleasant experience of HD urges a sufferer to decline any research-oriented activity unless otherwise confidence building is ensured. Similarly, chance to leave the activity, as observed in present study can be expected from a hopeless person.

Dominance of male population (47 out of 62) is in good agreement to demographic pattern of previously published data on HD patients. The sex-specific differences in HD prevalence.

| Variable                  | SCV catheter | IJV catheter | OR (95% CI)         |
|---------------------------|--------------|--------------|---------------------|
| Vein damage; % (f)        | 6.5 (2)      | 13.9 (4)     | 2.15 (0.364 – 12.693) |
| Artery rupture            | 3.2 (1)      | 9.7 (3)      | 3.21 (0.316 – 32.741) |
| Pulmonary complications    | 3.2 (1)      | 3.2 (1)      | 1.0 (0.060 – 16.737)  |
| Bacterial infection*      | 6.5 (2)      | 6.5 (2)      | 1.0 (0.132 – 7.587)   |

*exit-site infection; p >0.05 (after chi-squared/Fisher’s exact test) against all variables.

| Variable                  | SCV catheter | IJV catheter | OR (95% CI)         |
|---------------------------|--------------|--------------|---------------------|
| Device dysfunctioning; % (f) | 3.2 (1)      | 9.7 (3)      | 3.21 (0.316 – 32.741) |
| Thrombus formation*       | 3.2 (1)      | 3.2 (1)      | 1.0 (0.060 – 16.737)  |
| Central vein stenosis      | 19.4 (6)     | 25.8 (8)     | 1.45 (0.436 – 4.814)  |
| Bacterial infection        | 16.1 (5)     | 32.3 (10)    | 2.48 (0.733 – 8.369)  |
| Infection-based replacement | 12.9 (4)     | 25.8 (8)     | 2.35 (0.645 – 8.814)  |

*managed through catheter removal and systemic anticoagulation.
may be interpreted in terms of physiological differentiation, and social pros and cons about HD facility. Similarly, fair correspondence in age variable \((M = 47, \text{range } 24-75)\) years and an Indian study\(^{15}\) advocates the commonalities in life style especially health care issues and aptitude towards regular checkup. The catheters remained intact for 40 days (on the average) i.e. 14 days more than reported (26 days) by Subramayam and Vakrani\(^9\) on similar cases. The reason behind prolongation would be some lacunae in underlying procedures and/or related complications.

Survival of the patient lies in successful HD for patients awaiting/not awaiting kidney transplant.\(^{16}\) Complication-free insertion of CVC for HD increases confidence of the patient on the professional’s competency even after switching from peritoneal dialysis\(^{17}\) on worst outcome. However, likelihood of vascular perforation\(^{18,19}\) by experience clinicians is a matter of great concern. Higher rate of damage to IJV than SCV in catheter placement procedure shows resemblance with a published data\(^3,20\) on same lines. Here, form/structure of the catheter is responsible for perforation ruling out any mistake by experienced clinician(s).

Catheter dysfunctioning is referred to failure in extracorporeal blood flow \((Q_b)\) of 300 mL/minute. The reasons behind the problem include mechanical issues and/or thrombosis.\(^{21}\) More incidence towards IJV than SCV in catheter placement procedure shows resemblance with a published data\(^3,10,19\) on same lines. Here, form/structure of the catheter is responsible for perforation ruling out any mistake by experienced clinician(s).

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**CONCLUSION**

Subclavian vein is a better site for HD catheterization as it involves comparatively lesser likelihood of device-related complications, patients’ feeling uncomfortable and cost-effectiveness than internal jugular vein. The patients’ compliance with renal transplant therapy is comfort dependent. However, patient’s consent should also be respected while deciding the placement site. Randomized trials on mega level are needed before rational decision-making approach about suitable place for the device insertion.

| Variable                          | Population | OR (95% CI) |
|-----------------------------------|------------|-------------|
|                     | SCV catheter | IJV catheter |       |
| Missing of dialysis sessions; % \((f)\) (Noncompliance with dialysis) | 6.5 (2)   | 19.4 (6)    | 3.48 (.644 – 18.850) |
| Shortening of dialysis sessions (Noncompliance with dialysis) | 12.9 (4)   | 22.6 (7)    | 1.969 (.512 – 7.563) |
| Uneasiness* in daily life         | 6.5 (2)   | 9.7 (3)     | 1.554 (.241 – 10.010) |
| Kinking of device                 | 12.9 (4)   | 3.2 (1)     | 0.225 (.024 – 2.139) |

*due to handling.
Site-related demerits of hemodialysis catheters

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