Summary

Intravascular catheters are indispensable in modern-day medical practice, particularly in intensive care units (ICUs). Although such catheters provide necessary vascular access, their use puts patients at risk for local and systemic infectious complications, including local site infection, CRBSI, septic thrombophlebitis, endocarditis, and other metastatic infections.

Pediatric patients particularly premature and those with congenital immunodeficiencies seem to be at a higher risk for vascular catheter complications especially the infectious ones. These complications have unfavorable impacts on both health and economic costs.

Biofilm formation by various microorganisms enhances the process of catheter colonization which in turn increases the risk of CRBSI. Such biofilm also affect the treatment which obligates the removal of the device which acts as a continuous seeding source for the organism.

The study was carried on 76 patients admitted to the Pediatric Department and have prolonged vascular catheterization > 12 hrs [including neonates in the neonatal intensive care unit (NICU) and patients in the intensive care unit (ICU)].

The following data were collected from each patient:

- Personal data: age, sex, weight.
- Medical data: underlying diseases.
- Data related to the catheter: circumstances at catheter insertion (septic, aseptic), number of attempts at catheter insertion, type of the catheter (peripheral, central, umbilical), Site of catheter insertion, duration of catheterization, cause of catheter removal.

The samples (tips of vascular catheters and blood samples) were collected under complete aseptic conditions then transported the Microbiology laboratory.

Vascular catheter tips were cultured using the semiquantititative culture method then stained by acridine orange followed by Gram's stain. The blood samples were cultured on Brain-heart infusion broth. The threshold of colony-forming units (c.f.u.) per plate is ≥15 to consider a catheter to be positively colonized. Bacterial identification was done using the various biochemical reactions.

Catheter related bacteremia was diagnosed when the same organism was isolated from both catheter culture and blood culture confirmed by the same antibiogram pattern and absence of apparent cause for the present bacteremia.

The biofilm production by the isolated staphylococcus strains was demonstrated by both Congo red agar method and tube method.

Out of 76 catheter tips, 45 (59.2%) were positively colonized as diagnosed by the semiquantitative method. Where as there were 22 (29%) positive blood culture results, 14 (18.4%) were catheter related and 8 (10.5%) were catheter unrelated.

By analysis of the different studied risk factors, the rate of catheter colonization decrease with increase in age and the majority of the CRBSI were found in patients < 1 month old (25%).

There was a statistical significant effect of weight on CRBSI, as its incidence increase by decreasing weight. The mean weight (kg) of cases with CRBSI (3.19 $\pm$ 3.95) was less than that of the negative cases (6.79 $\pm$ 5.91).

The CVCs have the highest colonization rate (66.7%) followed by the umbilical (58.3%) then the peripheral catheters (52%). CVCs were also

associated with the highest rate of CRBSI (33.3%) while no CRBSI occurred with peripheral catheters.

The number of attempts at insertion has a statistically significant effect of on the peripheral catheters colonization, where the percent of colonized catheters with one attempt were only 20% whereas it was 73.3% in those inserted by more than one attempt.

The duration of catheter insertion has a statistical significant effect on colonization of all studied catheter types and their related bacteremia. With CVCs the mean duration ± SD of sterile catheter was (6.1 ± 2.66 days; range 2-13 days), as compared with that of colonized catheter tips (10.1 ± 5.29 days; range 4-20 days) ($P < 0.05$) and was (12.1 ± 5.3; range 6-20 days) in cases with catheter related bacteremia compared with (6.4 ± 3.06 range 2-14 days) in negative cases ($P < 0.01$).As for the umbilical catheters the mean duration ± SD of sterile catheter was (1.7 ± 0.64 days), as compared with that of colonized catheter tips (7.2 ± 4.43 days) ($P < 0.001$) and the mean duration ± SD in cases with catheter related bacteremia was (9.4 ± 4 days) compared with (3.7 ± 3.46 days) in the negative cases ($P < 0.01$). While in the peripheral catheters the mean duration ± SD of sterile catheters was (2.5 ± .65 days; range2-4 days), as compared with that of colonized catheter tips (3.9 ± 1.21 days; range 2-6 days) ($P < 0.01$).

Catheter insertion in the lower limbs carries a higher risk for catheter colonization than the other sites for peripheral catheter insertion as (87.5%)of catheters inserted in the lower limbs were colonized.

The highest rates of catheter colonization and CRBSI were occurred in the NICU (67.6 % & 29.7% respectively). Preterm babies are at great risk for CRBSI, (88.5%) of the catheters collected from this group were positively colonized and (38.5 %) were having CRBSI.

CoNS were the most frequently isolated organism from the peripheral catheters and the most frequently isolated organism in general (33.33%) followed by Pseudomonas (15.6%). *Pseudomonas* & *Staphylococcus aureus* were the commonest isolated organism from the central catheters. Besides Pseudomonas, *Candida albicans* was also frequently isolated from the Umbilical catheters.

Pseudomonas was the commonest organism isolated from the cases of CRBSI (42.9%), followed by *Candida albicans* (14.3%) *and Staphylococcus aureus* (14.3%), while other organisms were isolated in small percentages.

Direct catheter staining by both acridine orange and Gram stains has low sensitivity (41% & 67% respectively) and sensitivity (82% & 73% respectively)

Of the 20 isolated staphylococcal strains, 15 were biofilm producers as detected by Congo red agar method and 5 were negative, whereas 14 were positive by the tube method and 6 were negative. After determining the degree of agreement between the 2 methods, there was very good agreement between them.