

ethambutol, pyrazinamide, streptomycin, ofloxacin and moxifloxacin, and most patients with MDR had additional resistance to ethambutol, streptomycin and ethionamide. If these patients were started on MDR treatment as per revised national tuberculosis control program (RNTCP) [7], most patients would be actually getting only 2 effective drugs – cycloserine and kanamycin. This may lead to more drug resistance. Thus the place of Xpert MTB/RIF in the diagnostic algorithm, should be according to the milieu the patient comes from, and all Xpert Rif resistance positive cases should have a DST as far as possible.

We conclude that although Xpert MTB/RIF test could be a useful tool for rapid identification of rifampicin resistant *M. tuberculosis* the test results must always be confirmed by culture and DST to increase the yield of bacteriological diagnosis, and also to detect additional drug resistance.

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## Percutaneously Inserted Central Venous Catheter Tip Position in Preterm Neonates and Complications

Percutaneously inserted central venous catheter (PICC) tips are recommended to be placed in a central vein: the superior vena cava (SVC) or the inferior vena cava (IVC) [1]. There is disagreement about how central catheters fare against those with tips in non-central veins like the brachiocephalic, subclavian, axillary, iliac and femoral [2-4]. We determined the association between PICC tip location and complication rates in preterm neonates.

We collected data retrospectively from records at two tertiary-level neonatal intensive care units from July 2013

to February 2015, wherein 105 PICC were placed in preterm neonates born at  $\leq 32$  weeks of gestation or with birth weight  $\leq 1500$  g. Vygon 28G PICC (Premicath) were used in all the cases. All tip locations were confirmed by radiography. No patient had two PICC at the same time. Catheter tips were defined as ‘Central’ if in the SVC or IVC; ‘Midline’ if in the brachiocephalic, subclavian and iliac veins; and ‘Noncentral’ if located in the axillary, femoral or any other vein. Indications for insertion primarily included parenteral nutrition or dextrose concentration exceeding 12.5%. Catheter removal was carried out for all complications: leakage, extravasation, phlebitis, central line associated bloodstream infection (CLABSI), catheter occlusion, or mechanical malfunction. Analysis of variance, chi-square test and t-test were used for statistical analysis.

The mean (SD) gestational age and birth weight were 29.9 (2.5) weeks and 1198 (285) g, respectively. One hundred and five successful PICC insertions in 96 babies accounted for 890 catheter-days, with 9 re-insertions; 8

**TABLE I** COMPARISON OF DEMOGRAPHIC CHARACTERISTICS AND OUTCOMES IN RELATION TO CATHETER TIP PLACEMENT

	Central (n=43)	Midline (n=49)	Non central (n=13)	P value
Gestational age (weeks) Mean (SD)	29.8 (2.5)	30.3 (2.7)	29.6 (2)	0.560
Birth weight (g) Mean (SD)	1183 (323)	1208 (285)	1214 (192)	0.900
Median (IQR) dwell time of PICC (d)	9 (7, 11)	9 (7, 12)	8 (6, 9)	0.220
Complications*	2	3	4	0.009

\*Central vs. Midline or Midline + Noncentral,  $P>0.05$ ; Central + Midline vs. Noncentral  $P=0.002$ ; Midline vs Noncentral  $P=0.012$ ; Central vs. Noncentral  $P=0.008$ .

after complications and 1 after elective removal. Among these 8 PICC, four each were removed due to occlusions and extravasations, and one due to infection. The complication rate was 7.6 per 1000 catheter-days for mechanical complications, and 8.6 per 1000 catheter-days overall. The CLABSI rate was 1.13 per 1000 catheter-days; The organism grown was *Serratia marcescens*. Based on tip location, complications developed in 2/43 (4.6%) Central, 3/49 (6.1%) Midline and 4/13 (30.8%) Noncentral catheters ( $P=0.009$ ) (Table I).

Our complication rate was 8.5% (9/105). Other studies report rates from 2.9% to 11.6% [5,6]. Extravasations and occlusions both contributed equally towards catheter removal in our study. Tang, *et al.* [7] reported extravasation as the most common complication, while others found occlusion as the most common complication [8,9]. In our study, Central, as well as Midline catheter tip locations were associated with reduced complication rates as compared to Non-central catheter tip location. There is a paucity of such comparative data in neonates. Jain, *et al.* [10] reported higher complication rates and shorter time to complication with all non-central catheters except those in brachiocephalic veins. Thiagarajan, *et al.* [2] reported similar complication rates between central and non-central PICC, whereas others found lower complication rates with central catheters [3,4].

Midline location of PICC tip may be a viable alternative to central location in preterm neonates, and PICC can be fixed when the tips are imaged in these locations. Tips lying in axillary and femoral veins or other non-central veins should be avoided due to higher complication rates.

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