

Original Research Article

Intracath in neonates- does size matter?

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ABSTRACT

Background: Intravenous cannulation, though a first line procedure is very challenging in new-born patients. Improving its longevity will prevent frequent resisting and complications and help the baby and doctor immensely. This study analyses parameters that are likely to affect the longevity of intravenous cannula on same. This study analyses the parameters likely to affect the longevity of intravenous cannulas and effect of gauge on the same. The objectives considered are to determine the ideal gauge of cannula for peripheral vein catheterization, evaluate the complications necessitating its removal and to find the best possible peripheral vein for such cannulation; if any.

Methods: This is a hospital based prospective observational study in 500 intravenous cannulas studied from point of insertion to removal. Results were tabulated and analysed based on Chi-square test and Kaplan Meir slopes were plotted. Main outcome measure- effect of cannula site on its in-situ life.

Results: Term infants showed increased life span as gauge size increased (maximum with 20 G). Pre-terms had best longevity with 22 gauge. Most common cause warranting removal of cannulas were local swelling and erythema. Prick site complications leading to serious morbidity occurred in <5%.

Conclusion: Gauge 22 is best suited for iv access in neonates. Gestational age and site of cannulation are strong determinants of gauge size and longevity. Intravenous cannulas in neonatal intensive care unit (NICU) should be selected considering factors for maximum lifespan of the catheter.

Keywords: Complication, Neonatal intensive care unit, Neonatal intravenous cannulation

INTRODUCTION

Intravenous cannulation (IC) is a procedure for insertion of a plastic catheter terminating in the lumen of a peripheral vein for gaining vascular access to administer fluids, drugs and other intravenous medications. It is a first line procedure for primary management of NICU admissions. A large number of multi-specialty centers have highly specialized teams for such catheterizations. However, this duty is still carried out by on duty doctors in most Neonatal intensive care units (NICUs). A comprehensive assessment of the patient should be undertaken before an intravenous cannula is inserted to ensure that reasons for insertion are based on patient needs.

Despite the routine nature of this procedure, cannula insertion is more difficult in neonates than adult patients due to the relative uncooperative nature of the patient and smaller, more fragile vessel anatomy. Owing to such factors, repeated resisting of ICs and consequent interruptions in treatment and prick site complications are common improved longevity is thus, a boon for doctors and patients alike.

Most doctors rely on skills developed during their residency from seniors and personal experience and thus, the expertise of IC placement becomes exposure dependent. There are very few studies in literature giving guidance to medical personnel as to the most appropriate and successful means of doing this.¹ This study intends to

provide a platform to build guidelines for evidence-based decisions for better device outcome.

METHODS

This study was conducted from January 2020 to March 2020 in a tertiary care NICU at CU Shah Medical College and Hospital in 500 cannulas inserted in admitted neonates. All cannulations were carried out by on duty resident doctors. Data entry with respect to gestational age, weight at birth, day of life, cannula gauge and site was done immediately on catheterization. Patients were followed up till the removal of the catheter when duration, intravenous fluid rate, reason for removal, complication and other co-morbid conditions were noted. The devices used throughout the study including cannulas, extension lines and secure dressing were standard, uniform and available in the in-hospital pharmacy. Splints were not used to fix any cannulas.

Inclusion criteria

Infants with intravenous catheters in situ were included in the study.

Exclusion criteria

Exclusion criteria was as follows: catheter used to transfuse anything other than intravenous fluids and cannulas inserted anywhere other than upper limb.

Statistical calculations were made prior to commencing the study which concluded that 465 observations needed to be made for a $p < 0.05$. We have studied 500 catheters for the purpose of this study.

Comparison was done based on Chi-square analysis. Kaplan Meir curves were plotted with respect to gauge number and longevity.

RESULTS

A total 500 cannulas of 20, 22, 24 and 26 gauge inserted 53.2% pre-terms and 46.8% term infants. The cannulas showing maximum longevity with fluid rates less than 15 ml/hour was based on gestational age of the neonate, 22-gauge catheters for term babies (70 hours) and 24 gauge for preterm infants (80 hours). However, for rates more than 15 ml/hour, the 20-gauge cannula had best result (60 hours).

Table 1: Incidence of complications among various size cannulas.

Gauge of cannula	Thrombophlebitis (%)	Phlebitis grade II (%)	Local swelling and erythema (%)	No longer needed (%)	Leak (%)
22	10.40	6.67	43.80	22.40	16.67
24	12	5.50	41.50	28.50	22.50
20	14	4	56	28	8
26	5	7.50	42.50	30	15

Maximum cannulas were removed due to local swelling and erythema (43%). Other causes for removal included leak in the cannula (18%), thrombophlebitis of the vein proximal to catheter insertion (11%), clinical signs of grade II phlebitis (6%) and when catheters were no longer needed (22%).

Clinically significant complications including grade II phlebitis, abscess, prick site infection and local part necrosis was seen occasionally (<10%). Local site complications like swelling, erythema and peripheral vein thrombophlebitis were seen to increase with gauge size, viz. 20 gauge having maximum local site erythema and swelling (56%) and thrombophlebitis (14%). Minimum complications were seen with gauge 26 with 5% cannulas having thrombophlebitis and 42% with local swelling and erythema.

The average lifespan of an in-situ cannula was 67 hours. For 24-gauge catheters, the average lifespan was 61 hours while that of 22 gauge was 65 hours. 26-gauge catheters had life up to 57 hours while 20-gauge cannula serves for

71 hours. The results obtained are depicted through these plots and gauge size notability with respect to duration of cannula survival is evident.

Neonates considered under this study had cannulas inserted in the dorsum of hand, forearm and elbows. The most common site for cannula insertion in neonates is the cephalic vein (26%), in terms and preterms. For cannula inserted in dorsum of hand, the cephalic vein was most common (46%) followed by the basilic vein (26%), the 2nd metacarpal vein (15%) and the others (13%).

Cannulas in the forearm and elbow had maximum prevalence in the anterior ulnar vein (31%) followed by median cubital vein (26%), basilic vein (15%), cephalic vein (9%), accessory cephalic vein (8%), median vein (6%) and other peripheral veins (5%).

Maximum lifespan was shown with median vein in the forearm while least with basilic vein in the wrist. In terms of life span, cannulas inserted at the wrist (57.6 hours) or elbow (57 hours) had lesser life span as compared to dorsal

hand (61.3 hours) and forearm (68 hours). Owing to increased movement at joint site, cannula life is less with more incidence of phlebitis like complications.

Table 2: Anatomical location, preference of cannula gauge and average duration of in situ life.

Vein	20	22	24	26	Average duration (hours)
Basilic vein wrist	10	26	33	5	57.6
Cephalic vein wrist	12	55	55	8	61.2
2nd Metacarpal vein	3	18	20	5	61.4
Basilic vein forearm	2	15	9	6	67.30
Cephalic vein forearm	4	8	7	1	62.45
Median vein forearm	0	4	7	2	70.38
Median cubital vein	5	27	20	5	68.14
Anterior ulnar vein	8	24	29	4	65.7
Accessory cephalic vein	4	9	5	0	64.5

The most significant factors influencing longevity are gestational age and cannula size. The commonest complication warranting device removal is local site and erythema while the gravest are local site infection and necrosis. 20G cannula had longest life of 71 hours with maximum incidence of complications. Cannula site for longest life was the forearm (68 hours) while median vein in the forearm has the longest life of 71 hours.

DISCUSSION

The commonplace of this procedure is in contrast to the extremely limited literature available for the subject. This study is done to simplify various aspects of neonatal intravenous cannulation and provide some verification to existing assumptions. Guidelines to increase longevity with minimal associated complications can be formulated based on these observations.

Intravenous cannulation is a skill acquired in an apprentice system and the technique of catheter placement is hugely dependent on individual habits formed during early training or may be specialty specific. The results of this study are therefore dependent on individual's choice of vein, cannula size and skills of insertion.

Due to the paucity of literature on this subject, the reference data remains confined to, "Factors that affect longevity of intravenous cannulas: a prospective study", done at the St. Vincent's Private Hospital, Ireland.¹

This is based on adult cannulation techniques and while there are many similarities among adult and neonatal patients, significant differences in size, anatomy, physiology and susceptibility for sepsis and other related complications need to be considered. The consequences of such catastrophic events have more severe outcome and may lead to long term morbidity for the patients.

Our study goes in favour of the findings proved in Ireland when longevity is considered with gauge size.

However, bigger gauge size has more complications in neonates in contrast to adults where they were relatively safer.

The centre for disease control (CDC), United States of America has recommended that cannulas be changed voluntarily after 72 hours of insertion to reduce the chances of phlebitis and other related complication. The Irish study has not backed this proposal as they have concluded that removal of the first cannula in order to site a second one may in itself, increase the risk of phlebitis. Moreover, the rate of phlebitis day by day is linear, not exponential. Also, most of neonatal cannulas have lifespan of <72 hours, rendering this proposal void.

Gestational age has proved to be a significant factor for determining the cannula size and subsequent complication prevention. Similar results were obtained where Malach et al and Monreal et al.^{2,20} who analysed age with respect to phlebitis and found similar results.

A study conducted in a neonatal setup in 1988 studied weight, age, type and rate of fluid administration, and type of medication (except pancuronium bromide) and a discernible effect on the functional life span of intravenous cannulas.³ No such co relation could be established then. We concluded that the gestational age, cannula size and rate of fluid administration has a significant effect on the same.

Doctors from Hiranandani hospital, Powai have concluded that site selection, cannula size, indwelling time, cannula material, vein selection, and others account for a measurable variation in the incidence of phlebitis and other cannula related complications.⁴

'Phlebotomy Essentials (5th edition) by McCall and Tankersley' states that the most accessible veins in children below 2 years tend to be at the antecubital fossa.⁵ While the basilic vein is better visualised, it tends to slip deeper on attempting cannulation. So, the cephalic vein reins superiority. For the neonates considered under us, median vein in the forearm had the longest cannulation time.

CONCLUSION

Most important factor for neonatal cannulation remains the skill of the doctor for IC placement. Efforts to provide

evidence-based guidance for device insertion; especially in patients with compromised venous access are needed to make quality decisions regarding the same.

Intravenous cannulas in neonates need careful monitoring to prevent complications. Gestational age, fluid rate, site of venous access and size of cannula are significant determinants of in situ life, related complications and associated morbidity.

We sincerely believe that the data presented here is of value to formulate guidelines for doctors to improve neonatal outcome by convenience of fluid and medication administration to all the babies.

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REFERENCES

1. Dillon MF, Curran J, Martos R. Factors that affect longevity of intravenous cannulas: a prospective study. QJM. 2008;101(9):731-35.
2. Malach T, Jerassy Z, Rudensky B. Prospective surveillance of phlebitis associated with peripheral intravenous catheters. Am J Infect Control. 2006;34:308-12.
3. Gupta P, Rai R, Basu S, Faridi MA. Life span of peripheral intravenous cannula in a neonatal intensive care unit of a developing country. Journal of Pediatric Nursing 2003;18(4):287-92.
4. Pankaj P. A study to assess the effectiveness of infusion experts on the nursing interventions of peripheral intravascular devices among patients admitted to a tertiary care hospital of the city. 2009;4:171-5.
5. Nicola B. Intravenous cannula site management. Nursing Standard. 2016;30:53-63.

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