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Effectiveness of reinforcement program on adherence toward short peripheral catheter (SPC) care guidelines among registered nurses working in pediatric wards of a tertiary care hospital

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Abstract:

BACKGROUND: Short peripheral catheterization is the common procedure performed in every hospital with patients' admittance. It becomes challenging when it comes to children and requires more knowledge and skills. The aim of the current study was to assess the effectiveness of the reinforcement program on adherence to short peripheral catheter (SPC) care guidelines among registered nurses.

MATERIALS AND METHODS: A quasi-experimental study was conducted among 44 registered nurses by observing 96 SPC care events before and after the reinforcement program in pediatric wards of a tertiary care hospital in Eastern India. The study was conducted in a tertiary care public hospital in Eastern India in 2019, and the data collection tool included children's and nurses' socio-demographic data and an observation checklist on intravenous catheterization care. Descriptive statistics were used to explain the participant characteristics, and McNemar's test was used to identify the adherence to SPC care guidelines.

RESULTS: There was a statistically significant improvement in most steps, such as hand washing, gloving, tray preparation, documentation initiation, maintenance, and removal ($P = 0.001$). A statistically significant reduction in the early stage of phlebitis was found from 66.7% in pre-intervention to 37.5% in post-intervention ($P = 0.027$).

CONCLUSIONS: The majority of nurses adhered to SPC care guidelines after the reinforcement program. From the study findings, it is recommended that regular reinforcement related to peripheral catheter care acts as a stimulant to adhere to SPC care guidelines. The nursing administration should take initiative by conducting in-service training for the nurses, which motivates them toward practicing quality nursing care.

Keywords:

Nurse's adherence, pediatric wards, reinforcement program, short peripheral catheter care (SPC)

Introduction

Short peripheral catheter (SPC) care or catheterization is one of the most common and challenging tasks for nurses, especially pediatric patients. SPCs are

universal in the pediatric health care system to administer fluid, antibiotics, and other required treatment modalities. SPC insertion is primarily unsuccessful on the first attempt in pediatric patients and is the most painful and anxiety-producing

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experience among children.^[1,2] Intravenous therapy is so prevalent in a health care setting that it demands professional skills and experience to master it.^[3,4] Practical skill qualification is a must for a nurse to render quality care.^[5] Practical nursing skills are complex tasks involving theoretical, technical, and practical knowledge, caring intentions adjusted to both needs of the patient, and ethical and moral considerations. Acquiring practical skills is the core concept of nursing education.^[6] Still, many professional nurses lack competency in practical skills.^[7] Between 70 and 80% of the hospitalized patients require medication delivered to the vein through SPC.^[8,9] Hence, SPC is considered one of the most challenging skills faced by nurses, especially the technical part, that is, the initiation of SPC.^[10]

More than half of the children who require SPC have difficult venous access.^[11-13] Obtaining access to the peripheral venous cannula is multifaceted. It is affected by reduced procedural co-operation, increased child and parent anxiety, dark-colored skin, increased adipose tissue, and limited pediatric experience in staff.^[13] Unfortunately, up to 50% of the SPC inserted fails before the completion of treatment.^[2] SPC failure results due to various factors such as accidental removal, dislodgement, pain, phlebitis, infiltration, and infection ranging from 30% to 69%. Nurses' primary role is to initiate cannulation and maintain it to prevent discomfort and discontinuity in treatment. As a consumer in health care, adults perceive cannulation as a complex procedure to maintain, whereas it is much more difficult in children and requires more than four attempts in them.^[14]

Registered nurses must ensure knowledge and skill adequacy to manage SPC, as they are accountable for initiating, maintaining, and removing SPCs.^[15] As nurses are the primary decision-makers in health care settings, SPC care bundles are required to provide guidelines to nurses to implement evidence-based care.^[14] However, it is a challenge for all nurses to adhere to SPC guidelines, and reasons can be related to the nature of complications, lack of time, type and amount of fluid infused, drug administered, nurse-patient ratio, lack of resources, and belief of the nurses that adherence will not result in expected changes in patient's health care outcomes such as decreased rate of phlebitis and less hospital stay.^[15,16] Only a few western reports have found the effect of nurse's training programs and their outcome specific to adult patients. Moreover, there was a paucity of evidence on the effectiveness of training interventions and their outcome on SPC among children in the Indian context. To fill the gap, the current study aimed to assess the effectiveness of reinforcement programs on adherence of nurses toward peripheral venous catheter care guidelines and identify the incidence of complications associated with peripheral venous catheters.

Materials and Methods

Study design and setting

The study was pediatric units of the All India Institute of Medical Sciences (AIIMS), Bhubaneswar (BBSR). AIIMS BBSR is an autonomous body established by the Ministry of Health and Family Welfare under Pradhan Mantri Swasthya Suraksha Yojana (PMSSY), with 764 beds covering super specialty departments with 24 h casualty and critical care units. Pediatric department facilities consist of the pediatric medical ward, pediatric surgery ward, neonatal intensive care unit (NICU), and pediatric intensive care unit (PICU). Pediatric medicine wards have 56 beds, NICU with 8 beds, and PICU with 5 beds functioning around the clock with comprehensive monitoring by doctors and nurses. Care guidelines among registered nurses working in pediatric units in a tertiary care hospital. The pediatric medical-surgical and PICU units were selected based on their high cannula initiation frequency.

Study participants and sampling

The sample size was calculated based on α of 0.05, power of 0.80 using the formula $n = (\sigma_1 + \sigma_2)^2 (Z_{\alpha} + Z_{\beta})^2 / d^2$. Forty-eight observations were made in each pre- and post-intervention phase. Thus, a total of 96 observations were made to assess SPC care. The present study included all pediatric nurses who had an experience of more than 6 months and excluded nurses who were on leave during data collection. A total of 44 registered nurses were observed performing SPC care. All nurses were informed about the purpose, duration, and anticipated benefits of the study. Informed written consent was obtained before participation. In addition, demographic information of the registered nurses and clinical profiles of the patients admitted to the pediatric units with SPC were collected. Registered nurses were observed for 48 SPC care events, that is, initiation, maintenance, and removal before and after reinforcement program in each pediatric unit.

Data collection tools and techniques

SPC care guidelines are a detailed written set of instructions to guide registered nurses' care on initiation, maintenance, and removal of a peripheral venous catheter. Pretested, validated guidelines based on the CDC guidelines were already present in the tertiary care hospital covering initiation (11 steps), maintenance (5 steps), and removal (8 steps) of SPC.

The tool consisted of three parts, including social-demographic information of nurses, clinical variables of children, and an observation checklist on SPC care. The observation checklist covered three domains, including initiation (11 steps), maintenance (5 steps), and removal (8 steps), which were observed and marked as performed and not performed. The Visual Infusion

Phlebitis (VIP) scale, developed by Andrew Jackson, was used to assess the SPC-related complications. It has five scores starting from 0 to 5 as follows.^[17]

Score 0 - No sign of phlebitis, and IV site appears healthy

Score 1 - Slight pain or slight redness near the IV site

Score 2 - Two of the following evident pale near IV site, erythema, swelling

Score 3 - All of the following are evident and extensive pain along the path of the cannula, erythema, and induration

Score 4 - All of the following are evident and extensive pain along the path of the cannula, erythema, induration, and palpable venous cord

Score 5 - All of the following are evident and extensive pain along the path of the cannula, erythema, induration, palpable venous cord, and pyrexia

The tool was tested for inter-rater reliability, which was 0.92. The content validity index of the tool was established by submitting the tools to the experts from the field of nursing - 3 and pediatrics -2 and found 100% agreement among the experts (CVI = 1).

Reinforcement program

The intervention consisted of a teaching session on initiation, maintenance, and removal of SPC, and a report card that introduced a VIP score sheet and posters. Once pre-reinforcement observations were completed, individual face-to-face interactive teaching sessions on the steps of SPC care guidelines for 40–45 min, followed by a group session that focused on overcoming the practical challenges of SPC care and motivating the registered nurses to adhere to SPC care guidelines at the group level were done.

Data Collection procedure

After obtaining ethical approval and permission from the hospital authority, those nurses who fulfilled the inclusion criteria and were willing to participate by giving consent were considered study subjects. Pre-reinforcement observations were done using an observational checklist related to the initiation, maintenance, and removal of SPC and VIP score given at the time of removal of each SPC. Also, information education communication (IEC) materials were introduced to the registered nurses, including the adherence card, VIP score sheet, and posters. The adherence card was attached to each patient's case sheet, and nurses were instructed to fill it during each shift—posters were displayed in the procedure room where SPC insertion needed to be performed. Posters related to SPC care were displayed in the procedure room of pediatric wards and PICU. A VIP score sheet was introduced in the form of a report card that registered nurses need to attach to each patient's file for daily assessment in each

shift. The post-reinforcement assessment was done using the same observation checklist related to the initiation, maintenance, and removal of SPC and VIP scores given when removing SPC.

Data analysis

The collected data were coded and entered in an Excel spreadsheet, cleaned, and checked for missing values. Data were analyzed using descriptive statistics such as frequency and percentage for categorical variables. McNemar's test was used to assess the effectiveness of the reinforcement program based on the objectives of the study.

Ethical consideration

Ethical permission was obtained from Institutional Ethics Committee (IEC/AIIMS BBSR/Nursing/2018-19/16) and informed consent was obtained from the nurses and the parents. Permission to conduct the study was obtained from the hospital authority.

Results

Baseline information of children and nurses

All 44 study participants attended the reinforcement program, among which 68.8% were female, and approximately half (52.1%) were between the age group of 26 and 29 years. More than half (60.4%) of the nurses had a Baccalaureate nursing program as their educational qualification, with 58.3% having a work experience of 1–3 years. In addition, more than half of them (58.3%) pursued nursing at a government nursing college, and most (81.3%) of the study participants had worked in a government setting.

The majority of the children IV cannulated in pre-intervention were male (58.3%), whereas, in post-intervention, more than half were females (52.1%). Nearly half (47.9%) of the IV cannulated children had an age of less than 3 years, both in pre-intervention and post-intervention, with 50% of them having SPC in the right hand. The indication of SPC was found to administer IV medication both in pre-intervention (79.2%) and post-intervention 41 (85.4%). In addition, 54.2% of the SPC line had retention for 3 days in pre- and post-interventions. The majority of IV catheters selected were 24 gauge in pre-intervention 34 (70.8%) and post-intervention 44 (91.7%).

Adherence to SPC care guidelines by nurses

The reinforcement training program significantly improved the adherence to SPC initiation guidelines in the initiation steps, that is, hand washing (50.1%), tray preparation (25%, sanitizer use (47.9%), gloving (50%), recheck of patency (45.8%), documentation of location and time IV commenced (95.8%), and

documentation of size of IV cannula and the number of attempts (91.7%) (P -value < 0.05). It was found that there was clinical improvement in flush with NS (4.2%), and absence of infiltration (2.1%), but there was no statistical significance [Table 1].

The reinforcement training program significantly improved the adherence to SPC maintenance steps, that is, flush every 8 hours (27%), documentation of cannula site about free from complications (75%), cannula patency (81.3%), mentioning the date of SPC inserted (18.8%, date on IV set (25%), and replacement of IV set every 72 h (12.4%). Investigators also found there was clinical improvement in flush after every blood sampling (2.1%). However, there was no statistical significance [Table 2]. Followed by it, the reinforcement training program significantly improved the adherence to SPC removal guidelines, that is, hand washing (75%), use of sanitizer (56.3%), wearing gloves (60.5%), wet adhesive tape with 0.9% NS (41.7%), press site with cotton (12.2%), applying pressure at site and elevate IV site (12.5%), and record removal (79.2%) [Table 3].

Pre reinforcement observation found that 39.6% of SPC were initiated in the first attempt, 45.8% in the second attempt, 12.5% in the third attempt, and 2.1% in the fourth and more attempts; however, after the reinforcement program, 58.3% of SPC were initiated in the first attempt, 27.1% in the second attempt, and 8.3% in the third attempt. Clinically significant improvement was observed but not statistically significant ($P > 0.05$) [Figure 1].

Incidence of phlebitis among children

There was no incidence of phlebitis signs, advanced stage phlebitis, or advanced stage thrombophlebitis observed before and after the reinforcement program. Also, 66.7% of SPC was observed to have an early phlebitis stage, 22.9% of SPC had a possible first sign of phlebitis, and 10.4% of SPC had the medium stage phlebitis. After the reinforcement program, 52.1% of SPC had the possible first sign of phlebitis, 37.5% had the early stage of phlebitis, and 10.4% had the medium stage of phlebitis [Figure 2].

Discussion

The reinforcement program was an effective way to improve the adherence of RNs toward SPC care. The reinforcement program improved the initiation,

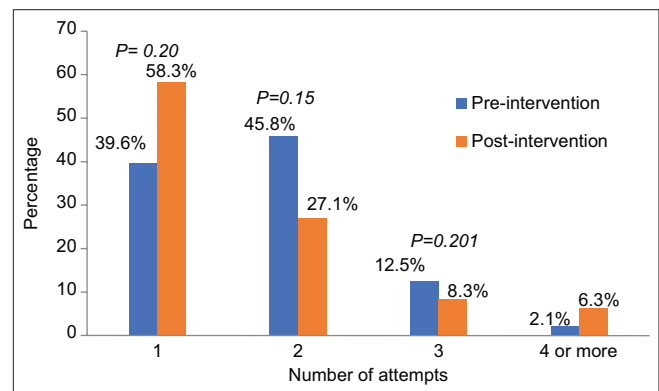


Figure 1: Percentage distribution of the number of SPC attempts. McNemar's test, level of significance P value <0.05*

Table 1: Frequency and percentage distribution of RN's adherence toward SPC care guidelines (initiation steps) (n=96)

Steps	Pre-intervention observation (n=48)		Post-intervention observation (n=48)		P
	Performed F (%)	Not performed F (%)	Performed F (%)	Not performed F (%)	
Hand washing	20 (20.8%)	38 (79.2%)	35 (72.9%)	13 (27.1%)	0.00*
Tray preparation	35 (72.9%)	13 (27.1%)	47 (97.9%)	1 (2.1%)	0.00*
Sanitizer use	25 (52.1%)	23 (47.9%)	48 (100%)	0 (0%)	0.00*
Gloving	24 (50%)	24 (50%)	48 (100%)	(0%)	0.00*
Identification of site	45 (93.8%)	3 (6.2%)	48 (100%)	0 (0%)	0.25
Site preparation					
Spirit	48 (100%)	0 (0%)	48 (100%)	0 (0%)	0.25
Povidone iodine	2 (4.2%)	46 (95.8%)	0 (0%)	48 (100%)	0.50
Patency check					
Visible blood	48 (100%)	0 (0%)	48 (100%)	0 (0%)	0.50
Flush 0.1-0.2 mL 0.9% NS	46 (95.8%)	2 (4.2%)	48 (100%)	0 (0%)	1
Infiltration absent	47 (97.9%)	1 (2.1%)	48 (100%)	0 (0%)	
Fix with tape	48 (100%)	0 (0%)	48 (100%)	0 (0%)	
Recheck of patency	19 (39.6%)	29 (60.4%)	41 (85.4%)	7 (14.6%)	0.00*
Documentation					
Location	1 (2.1%)	47 (97.9%)	47 (97.9%)	1 (2.1%)	0.00*
Time IV commenced	1 (2.1%)	47 (97.9%)	47 (97.9%)	1 (2.1%)	0.00*
Size of IV cannula	3 (6.2%)	45 (93.8%)	47 (97.9%)	1 (2.1%)	0.00*
No. of attempts	3 (6.2%)	45 (93.8%)	47 (97.9%)	1 (2.1%)	0.00*

McNemar's test, level of significance $P < 0.05^*$

Table 2: Frequency and percentage distribution of RN's adherence toward SPC care guidelines (maintenance steps) (n=96)

Steps	Pre-intervention observation		Post-intervention observation		P
	Performed f (%)	Not performed f (%)	Performed f (%)	Not performed f (%)	
Visual inspection for					
Phlebitis	48 (100%)	0 (0%)	48 (100%)	0 (0%)	
Infiltration	48 (100%)	0 (0%)	48 (100%)	0 (0%)	
Pain	48 (100%)	0 (0%)	48 (100%)	0 (0%)	
Redness	48 (100%)	0 (0%)	48 (100%)	0 (0%)	
Patency check with 0.5 mL 0.9% NS	48 (100%)	0 (0%)	48 (100%)	0 (0%)	
Flush after every blood sampling	11 (22.9%)	37 (77.1%)	12 (25%)	36 (75%)	1
Flush every 8 h	2 (4.2%)	46 (95.8%)	15 (31.2%)	33 (68.8%)	0.00*
Documentation					
Cannula site free from complication	5 (10.4%)	43 (89.6%)	41 (85.4%)	7 (14.6%)	0.00*
Cannula patency	6 (12.5%)	39 (92.9%)	45 (93.8%)	3 (6.2%)	0.00*
Date when SPC inserted	35 (72.9%)	13 (27.1%)	44 (91.7%)	4 (8.3%)	0.00*
Date of IV set	32 (66.7%)	16 (33.3%)	44 (91.7%)	4 (8.3%)	0.00*
Replacement of IV set every 72 h	33 (68.8%)	15 (31.2%)	39 (81.2%)	9 (18.8%)	0.00*

McNemar's test, level of significance $P < 0.05^*$

Table 3: Frequency and percentage distribution of RN's adherence toward SPC care guidelines (removal steps) (n=96)

Steps	Pre-intervention observation (n=48)		Post-intervention observation (n=48)		P
	Performed f (%)	Not performed f (%)	Performed f (%)	Not performed f (%)	
Hand washing	8 (16.7%)	40 (83.3%)	44 (91.7%)	4 (8.3%)	0.00*
Use sanitizer	18 (37.5%)	30 (62.5%)	45 (93.8%)	3 (6.2%)	0.00*
Wear gloves	15 (31.2%)	33 (68.8%)	44 (91.7%)	4 (8.3%)	0.00*
Wet adhesive tape with NS	24 (50%)	24 (50%)	44 (91.7%)	4 (8.3%)	0.00*
Gently remove tape	44 (91.7%)	4 (8.3%)	44 (91.7%)	4 (8.3%)	1
Press site with cotton	38 (79.2%)	10 (20.8%)	44 (91.7%)	4 (8.3%)	0.00*
Apply pressure at site and elevate IV site	38 (79.2%)	10 (20.8%)	44 (91.7%)	4 (8.3%)	0.00*
Record removal	6 (12.5%)	42 (87.5%)	44 (91.7%)	4 (8.3%)	0.00*

McNemar's test, level of significance $P < 0.05^*$

maintenance, and removal steps of SPC care. In initiation steps, SPC care was statistically improved in post-intervention observations specific to hand washing in which 47 (72.9%) ($P = 0.00$) nurses adhered in post-intervention, which was only 20 (20.8%) in pre-intervention. This finding was inconsistent with another study, in which only 10% followed hand washing during IV infusion probably because of the high nurse–patient ratio.^[18] Neopane also revealed that hand washing is an inevitable step and highly reduces the risk of thrombophlebitis in the peripheral venous catheter.^[17] Nearly all nurses (97.9%) adhered to tray preparation of SPC care, which comes in similarity with Keogh's study, in which 100% compliance was observed. Steps of gloving were 100% adhered to in the initiation and 91.7% in removal steps, which was d inconsistent with Keogh's study, in which it was compiled by 42%.^[18]

Preparing the IV site with the spirit was an essential step of SPC care, which was 100% adhered to in the pre- and post-intervention phases. It was supported by the shreds of evidence, which states that a significant reduction in complications related to SPC was observed, such

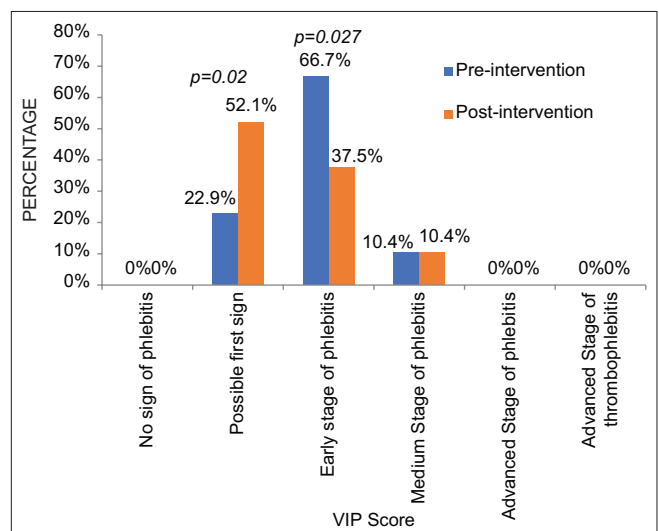


Figure 2: Percentage distribution of incidence of SPC complication as per VIP score. McNemar's test, level of significance P value $< 0.05^*$

as possible bacterial bloodstream infection, phlebitis, and extravasation.^[12-14] This supports the statement by the World Health Organization (WHO) that alcoholic

chlorhexidine is a suitable substance to be used as disinfection before a device is inserted to minimize the hazard of contamination.^[19]

In a research study, the number of attempts of more than one among children was recorded as 24%–54%.^[20] In the present study, the number of SPC cannulation attempts in children was less than half in pre-intervention at the first attempt (39.6%), second attempt (45.8%), and third attempt (12.5%), and 2.1% in the fourth or more attempts. However, after the reinforcement program, it was observed that more than half (58.3%) of cannulation was successful in the single attempt and more than one-fourth (27.1%) in the second attempt without a statistically significant difference ($P = 0.48$). Inconsistent with this, the success rate of initiating SPC in pediatric patients was found to be 42.8% for the first trial, 39.7% for the second trial, 37.5% for the third trial, and 38.8% for the second trial. Innovation is required to increase cannulation success in the first attempt, as with the increase in attempts, pain and anxiety increase in children.^[21-23] Non-alterable factors mentioned in socio-demographic data such as age, sex, and skin color do not contribute to SPC failure. However, researchers marked down the possibility that females with dark skin or extreme age impede obtaining access; the reason specified results from the smaller caliber of veins and difficulty visualizing veins.^[24-29]

In the maintenance of SPC care, 100% of nurses adhered to visual inspection of SPC and patency check with 0.5 mL normal saline in both pre- and post-intervention observations. Contrary to the study by Sriupayo, compliance related to regular assessment of SPC need and patency improved from 58.6% to 77.3% ($P < 0.001$).^[30] More than one-fourth (15, 31.2%) of nurses adhered to steps such as flush every 8 h in post-intervention, which was less than one-fourth (2, 4.2%) in pre-intervention; however, only one-fourth of nurse's non-adherence was observed in both (11, 22.9%) pre-intervention and (12, 25%) post-intervention phase for flush after every blood sampling. This comes contrary to Keogh's study, where 100% compliance was observed.^[18]

In the initiation, maintenance, and removal steps, nearly all nurses adhered to documentation. In initiation, 97.9% of adherence related to documentation about the site and size of SPC, time of IV cannulation, and the number of attempts. Ahlqvist *et al.*^[31] studied documentation and found that 60–70% documented any information related to SPC, that is, date, size, site, and the reason for removal; 46% of nurses recorded regarding insertion of SPC, and only 6% completed the documentation. The reason for non-adherence was found that nurses did not inspect daily but inspected in time when patients complained of discomfort. This contrasts with Yagnik's study, where the

documentation in progress notes did not improve (pre 37% vs. post 31.6%), but documentation in SPC label and nursing care plan improved up to 50%.^[32] This is supported by research evidence, which represents that detailed intravenous documents have been associated with fewer complications.^[33]

Limitations and recommendations

The researcher made direct observations on the SPC practice of nurses. All pediatric nurses were included in the reinforcement program and practice of the VIP scale. The study's limitation was that less observation was performed in pre (48) and post (48). In addition, follow-up of SPC care practice was not done due to a shortage of period in the present study.

Implications

This study demonstrated that reinforcement program leads to improvement in the practice of registered nurses in peripheral venous care insertion, maintenance, and removal skills. Also, frequent reinforcement programs act as a stimulus for registered nurses to learn and update their knowledge and skills, reduce phlebitis scores, and increase child and parent satisfaction.

Conclusion

Despite having proper theoretical, practical, and technical knowledge, nurses do not always adhere to SPC guidelines; hence, regular reinforcement related to SPC care acts as a stimulant to adhere to SPC care guidelines. However, other factors, such as nurses' workload, illness conditions, and availability of resources, should also be considered for a better outcome. Future studies also could be conducted using a different methodology (RCT-control and experimental group, mixed methodology), and compared with different populations (adult and pediatric) and settings (wards and critical care units).

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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