ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

Original Research Article

A COMPARATIVE STUDY OF EFFECT OF SUBCUTANEOUS INFILTRATION OF NITROGLYCERIN- LIGNOCAINE VERSUS LIGNOCAINE TO FACILIATE RADIAL ARTERY CANNULATION

[1]Dr. Prabhu Dharmalingam, [2]Dr. Senthilkumar Velayutham, [3]Dr. Arul K

[1]Resident, Department of Anaesthesia, Madras Medical College, Chennai, India
[2]Assistant Professor, Department of Anaesthesia, Madras Medical College, Chennai, India
[3]Professor, Department of Anaesthesia, Madras Medical College, Chennai, India

Corresponding Author: Dr. Sangeeta Dudve
arulrk@yahoo.co.in

ABSTRACT

Background: The subcutaneous administration of nitroglycerin is a straight forward and inexpensive technique that allows a high concentration and long persistence of the vasoactive agent at the spasm site level without entering the bloodstream significantly.

Objectives: Aim of this study to compare the effect of subcutaneous infiltration of nitroglycerine-lignocaine combination versus Lignocaine alone for facilitating radial artery cannulation

Methods: This was a randomized controlled study**.** A total of 104 patients were enrolled, all the participants were allocated randomly into two groups:. Group LN (n=52): received subcutaneous injection of Nitroglycerin 100 µg (o.2ml)-Lignocaine (0.8ml) 2%. Group L (n=52): received subcutaneous injection of 2% Lignocaine (1ml) Patient age, body weight, height, BMI and baseline vital parameters were recorded. History regarding previous surgery, Anaesthesia, significant comorbities, medications and radial artery diameter before and after infiltration were recorded.

Results:Mean age and BMI in LN group was 44.0 ± 11.48 and 24.66 ± 2.74, 41.1% were males in LN group while 63.5% were males in L group. There is no statistical significant difference in terms of age, gender, BMI, co morbidities, ASA status and hemodynamic parameters. Radial artery catheterisation in the first attempt was 68.6% in LN group and 30.8% in L group, statistically significant ($p<0.05$). The palpability pulse index was better in nitroglycerine-lignocaine group compared to lignocaine group. The results are statistically significant ($p<0.05$).

Conclusion: Subcutaneous infiltration of nitroglycerin-lignocaine before radial artery cannulation improved the first-attempt success rate and reduced the overall complication rates

Keywords: Radial artery; nitroglycerin-Lignocaine, Lignocaine, Catheterization; Vasodilation

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

1. INTRODUCTION

In the emergency room, intensive care unit, and operating room, radial artery cannulation is a routine operation used for arterial blood gas analysis, invasive blood pressure monitoring, and as continuous access for frequent blood samples. Additionally, the use of radial artery cannulation for percutaneous intervention (PCI) and diagnostic coronary angiography is expanding quickly [1]. Small arterial size is frequently the cause of radial artery cannulation failure in clinical practise, and repeated attempts to cannulate the artery can lead to haemorrhage, radial artery dissection, vasospasm, development of pseudoaneurysm, discomfort, and vascular thrombosis [2-3]. The modified Allen test and/or Barbeau test to determine the arterial's patency have been used as methods for enhancing radial artery cannulation [4]. The vasodilator nitroglycerin (NTG) has been demonstrated to be beneficial in treating radial artery spasm when delivered from within the artery for radial artery catheterization during coronary angiography [5]. Others have successfully treated radial artery spasm with subcutaneous injections of NTG [6]. Nitroglycerine is a vasodilator of low cost, short half-life, and few adverse effects [7]. Administration of nitroglycerin by different routes (subcutaneous, intravenous, topical and intra-arterial) has been proven to cause vasodilatation of the radial artery [8].

Aims & objectives: Objective of this study was to compare the impact of subcutaneous infiltration of Lignocaine-Nitroglycerin mixture and Lignocaine (2%) on radial artery diameter for Radial Artery Cannulation

2. MATERIALSAND METHODS

This was a randomized controlled studyconducted in department of anaesthesia at Rajiv Gandhi Government General Hospital, Chennai for 01 years duration from December 2021 to November 2022. A total of 104 patients were enrolled in the present study.

Inclusion criteria

- Patients age group 20 to 70 yrs, both gender
- ASA physical status – 1 to 4
- Patient who provide written informed consent before participation

Exclusion criteria

- < 20 or > 70 years age group patients
- Negative modified Allen test
- Coagulopathies (INR >1.5, platelet count less than 70,000
- Peripheral arterial disease
- Hand deformities, burns, infection at the site of insertion
- Patients who not provide written informed consent

After taking ethical committee approval and informed consent among the study population, all the participants were allocated randomly into two groups:

- Group LN (n=52): received subcutaneous injection of Nitroglycerin 100µg (o.2ml)-Lignocaine(0.8ml) 2%.
- Group L (n=52): received subcutaneous injection of 2% Lignocaine (1ml)

All patients classified under American Society of Anesthesiologists physical status I to III, posted for elective surgery under general anaesthesia and meeting the inclusion criteria will be selected.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

Patient age, body weight, height, BMI and baseline vital parameters were recorded. History regarding previous surgery, Anaesthesia, significant comorbities, medications and allergy were recorded. Complete physical examination and airway assessment were done.
Heartrate (HR), and mean arterial pressure (MAP) were recorded as the fundamental patient parameters. Before and after subcutaneous infiltration, the diameter of the radial artery was measured.The time taken from skin puncture to catheter insertion was used to define the time needed to perform radial cannulation. The number of tries required to cannulate the radial artery was also recorded.The number ofretractions required before successful cannulation were recorded. Patientswere followed up for 24 hours after procedure for any complications(hematoma, spasm, infection, thrombosis)
Statistical analysis:SPSS version 22.0 was used for statistical analysis. Pearson Chi Square test was used to calculate the mean, standard deviation and p value between the 2 groups. P value <0.05 was considered statistical significant.

3. RESULTS

A total of 104 adult patients scheduled for elective surgery wasevaluated, 01 was excluded due to failed cannulation. They were randomly allocated into two groups. Group LN and Group L.
Mean age and BMI in LN group was 44.0 ± 11.48 and 24.66 ± 2.74, 41.1% were males in LN group while 63.5% were males in L group, but there is no statistical significance between both the groups (P>0.05). Among risk factors smokers and alcoholism were more in L group 42.3% and 44.3% respectively, but no significance difference (P>0.05).There is no statistical significant difference in terms of co morbiditieslike, diabetes, hypertension and bronchial asthma among LN and L group (P>0.05).Both groups are more or less similar with respect to ASA status.68.6% of the study population in LN group had catheterisation in the first attempt compared to 30.8% in L group. The results are statistically significant differ (p<0.05)

Table 1: Comparison of baseline socio-demographic Characteristics in LN and Ngroup

Baseline Characteristics	**LN group**	**L group**	**P value**
Age in Year (Mean±SD)	44.0 ± 11.48	46.33±11.26	0.302
BMI (kg/m^2)	24.66 ± 2.74	23.97± 2.35	0.175
Gender			
Male	24	33	0.115
Female	27	19	
Smoking			
Yes	15	22	0.0219
No	36	39	
Alchoholism			
Yes	17	23	0.314
No	34	29	
Diabetes Mellitus			
Yes	20	23	0.674
No	31	29	
Hypertension			
Yes	15	16	1.00

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

No	36	36	
Bronchial Asthma			
Yes	5	9	0.390
No	46	43	
ASA status			
III	50	52	0.495
IV	1	0	
Catheterisation Attempts			
1	35	16	**0.000**
2	16	19	
3	0	17	

The palpability pulse was more or less equal in both the groups before the procedure. The palpability pulse index was better (all more than 3) in LN group compared to 21.2% more than 3 in L group. The results are statistically significant ($p<0.05$).

Table 2: Comparison of pulse palpability among LN and N group

Vital parameters	**LN group**	**N group**	**P value**
Palpability of pulse before the procedure			
2	15	17	0.291
3	33	34	
4	3	1	
Palpability of pulse after the procedure			
2	0	12	**0.000**
3	0	29	
4	28	11	
5	23	0	

The Hemodynamic parameters (HR, SBP, DBP, MAP), Transverse Diameter and Longitudinal Diameter is more or less the same between both the groups and the results are also statistically not significant ($P > 0.05$).

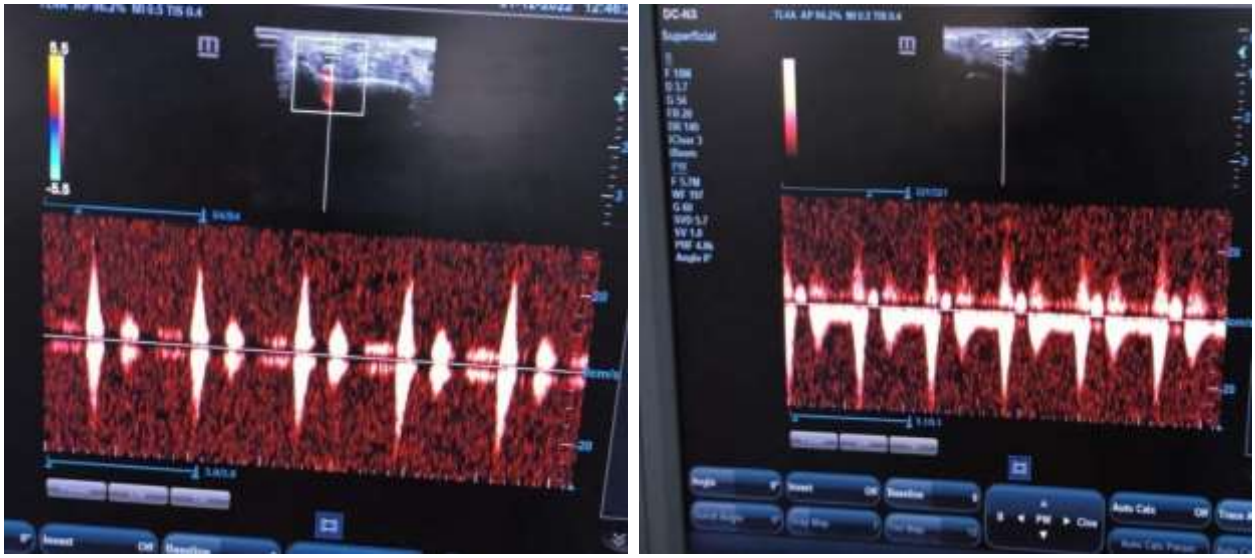
Table 3: Comparison of Hemodynamic parameters and radial artery diameter among LN and N group

Hemodynamic parameters	**LN**		**L**		**PValue**
	Mean	**SD**	**Mean**	**SD**	
HR 0	82.73±	12.81	82.27	12.10	0.853
SBP 0	114.75	19.60	112.85	19.02	0.619

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

DBP 0	71.00	13.16	70.02	13.11	0.706
MAP 0	84.80	14.81	83.85	14.27	0.739
Transverse diameter (mm)	1.84	0.47	1.98	0.42	0.121
Longitudinal diameter (mm)	1.87	0.42	2.02	0.41	0.073
HR 1 Min	81.43	12.37	82.69	10.88	1.261
SBP 1 Min	113.04	17.88	113.83	17.88	0.788
DBP 1 Min	70.18	11.99	70.29	11.15	0.112
MAP 1 Min	84.59	13.63	84.79	12.51	0.200
Transverse diameter (mm)	3.33	0.46	2.21	0.51	1.118
Longitudinal diameter (mm)	3.41	0.40	2.27	0.53	1.135
Cannulation time (min)	18.29	3.51	48.12	29.32	0.821

Figure 1: Showing end diastolic volume in radial artery before and after infiltration



ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

4. DISCUSSION

During trans-radial surgeries, nitroglycerine subcutaneous infiltration was combined with Lignocaine has been frequently used to either prevent or alleviate radial artery spasm. Various delivery methods, such as intra-arterial injection, topical treatment, subcutaneous infiltration, and sublingual tablets, were used. These studies were conducted mostly during coronary angiographic procedures [9].

There is growing evidence that radial artery catheterization is a safe and effective alternative to femoral artery catheterization for diagnostic coronary angiography and PCI. Radial artery catheterization can be carried out successfully in anticoagulated patients, lower incidence of access site complications and lower procedure-associated costs [10].

In our study no statistically significant difference between NTG-L and Lignocaine group in terms of hemodynamic parameters (HR, MAP, SBP AND SDP), consistent finding also reported by Kumar R, et al [11].

Multiple puncture attempts are the leading cause for radial artery spasm and may be a specific issue in the teaching environment, also the administration of local anesthetics such as lidocaine has vasoconstrictive properties16 and the radial artery has a relatively small diameter and a relatively thicker tunica media of smooth muscle cells, which leads to a high receptor-mediated vasomotion compared to other muscular arteries [12-13].

Nitroglycerine-Lignocaine group had catheterisation in the first attempt compared to Lignocaine group, difference was statistically significant ($p<0.05$), our results comparable with the Jang, et al [14] and Chen, et al [15]

According to our findings, subcutaneous infiltration of NTG causes the radial artery to significantly dilate. This was linked to enhanced palpability and a decreased incidence of arterial spasm, in agreement to the Babu, et al [16] andEzhumalai et al [17].

Although sublingual, intravenous, or intra-arterial systemic injection of nitroglycerin may improve cannulation conditions, it is also associated with headache, tachycardia, and hypotension [18].

Overall subcutaneous infiltration of nitroglycerine combined with the Lignocaine has better effect on radial artery dilatation as compared to Lignocaine alone.

5. CONCLUSION

Subcutaneous nitroglycerin combined with Lignocaine before cannulation increased the first attempt success rate of radial artery cannulation and decreased the cannulation times. It also facilitate the cannulation process by reduce radial artery spasm and increases the procedure success rate with no detected side effects. It is a useful tool for those anesthesiologists with less experience in radial artery cannulation

6. REFERENCES

1. Rao SV, Ou FS, Wang TY, et al. Trends in the prevalence and outcomes of radial and femoral approaches to percutaneous coronary intervention: a report from the National Cardiovascular Data Registry. JACC CardiovascInterv 2008; 1(4):379-86.
2. Dandekar VK, Vidovich MI, Shroff AR. Complications of transradial catheterization. CardiovascRevasc Med 2011.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

3. Kanei Y, Kwan T, Nakra NC, et al. Transradial cardiac catheterization: a review of access site complications. Catheter CardiovascInterv 2011; 78(6):840-6.
4. Barbeau GR, Arsenault F, Dugas L, Simard S, Lariviere MM. Evaluation of the ulnopalmar arterial arches with pulse oximetry and plethysmography: comparison with the Allen's test in 1010 patients. Am Heart J 2004; 147(3):489-93.
5. Kiemeneij F, Vajifdar BU, Eccleshall SC, Laarman G, Slagboom T, van der Wieken R. Evaluation of a spasmolytic cocktail to prevent radial artery spasm during coronary procedures. Catheter CardiovascInterv 2003; 58(3):281-4.
6. Pancholy SB, Coppola J, Patel T. Subcutaneous administration of nitroglycerin to facilitate radial artery cannulation. Catheter CardiovascInterv 2006; 68(3):389-91.
7. Kiani R, Alemzadeh-Ansari M, Sanati H et al. (2017): Periarterial Injections of Nitroglycerin Facilitate Radial Artery Cannulation. Iran. Hear. J., 18(4): 6–11.
8. Chen Y, Ke Z, Xiao J et al.(2018): Subcutaneous injection of nitroglycerin at the radial artery puncture site reduces the risk of early radial artery occlusion after trans-radial coronary catheterization: a randomized, placebo-controlled clinical trial. Doi: 10.1161/ circinterventions.118.006571.
9. Kim EH, Lee JH, Song IK, Kim JT, Lee WJ, Kim HS (2017)Posteriortibial arteryas analternative to the radial artery for arterial cannulation site in small children: a randomized controlled study. Anesthesiology127 (3):423–431
10. Jolly SS, Yusuf S, Cairns J, et al. Radial versus femoral access for coronary angiography and intervention in patients with acute coronary syndromes (RIVAL): a randomised, parallel group, multicentre trial. Lancet 2011;377(9775):1409-20
11. Dr. Rajeev Kumar, Dr. Praveen Kumar Singh, Use of topical nitroglycerin and lidocaine in locally vasodilating the radial artery, Journal of Cardiovascular Disease ResearchISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022
12. Fukuda N, Iwahara S, Harada A, et al. Vasospasms of the radial artery after the transradial approach for coronary angiography and angioplasty. Jpn Heart J. 2004; 45:723-731.
13. Abe S, Meguro T, Endoh N et al. Response of the radial artery to three vasodilatory agents. Catheter CardiovascInterv. 2000; 49:253-256
14. Young-Eun Jang, Sang-Hwan Ji,Eun-Hee Kim, Ji-Hyun Lee, Hee-Soo Kim, Emad B. Mossad,Jin-Tae Kim, Subcutaneous Nitroglycerin for Radial Arterial Catheterization in Pediatric Patients, Anesthesiology 2020; 133:53–63
15. Yequn Chen, PhD* ZhiquanKe, MB* Jiaxin Xiao, MB* Mengyue Lin, MB Xiru Huang, MB Chunyin Yan, MB Shu Ye, MD PhD Xuerui Tan, PhD, Subcutaneous Injection of Nitroglycerin at the Radial Artery Puncture Site Reduces the Risk of Early Radial Artery Occlusion After Transradial Coronary Catheterization, CircCardiovascInterv. 2018; 11:e006571. DOI: 10.1161/CIRCINTERVENTIONS.118.006571
16. BabuEzhumalai, SanthoshSatheesh, BalachanderJayaraman,Effects of subcutaneously infiltrated nitroglycerin on diameter, palpability, ease-of-puncture and pre-cannulation spasm of radial artery during transradial coronary angiography,Indian Heart JournalVolume 66, Issue 6, November–December 2014, Pages 593-597
17. Ezhumalai B, Satheesh S, Jayaraman B (2014) Effects of subcutaneously infiltrated nitroglycerin on diameter, palpability, ease-of-puncture and pre-cannulation spasm of radial artery during transradial coronary angiography. Indian Heart J 66:593–597

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

18. Pancholy SB, Coppola J, Patel T. Subcutaneous administration of nitroglycerin to facilitate radial artery cannulation. Catheter CardiovascInterv. 2006 Sep; 68(3):389-91. doi: 10.1002/ccd.20881. PMID: 16892435