

# Effectiveness of Glycerin Magnesium Sulphate Versus Heparin Benzyl Nicotinate Application Among Children with Phlebitis

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DOI: 10.3126/jnps.v40i1.28659

Submitted on: 2020-04-30

Accepted on: 2020-05-06

**Acknowledgements:** Ms. Kavita Gajurel, Bir Hospital, Mr. Bibhav Adhikari, LACHS and Ms. Muna Khatiwada, National Trauma Center

**Funding:** Nil

**Conflict of Interest:** None declared

**Permission from IRB:** Yes

**To cite this article:** Dahal AS, Tuitui R, Shrestha PD, Sharma B, Acharya S, Dahal P. Effectiveness of glycerin magnesium sulphate versus heparin benzyl nicotinate application among children with phlebitis. *J Nepal Paediatr Soc.* 2019;40(1):21-7.

## ABSTRACT

**Introduction:** Phlebitis is the most common complication of intravenous infusion therapy. Incidence of phlebitis in children receiving intravenous therapy has been reported to be as high as 71.25%. The study was done to find out the effectiveness of glycerin magnesium sulphate versus heparin benzyl nicotinate application in children with phlebitis.

**Methods:** A pre-post control group design was used. A total of 43 subjects were randomly assigned into two groups [22 in experimental (glycerin magnesium sulphate application) and 21 in control (heparin benzyl nicotinate application) group] by lottery method. Data was collected using Modified Visual Infusion Phlebitis (VIP) Score.

**Results:** The comparison between VIP score was based on observations made before the interventions and at 12, 24, 36 and 48 hours after the intervention. Independent t tests showed significant difference in reduction of VIP score in experimental and control group after 12 hours and 24 hours of intervention. The study demonstrated that there is no statistically significant difference in reduction of VIP score among the subjects in experimental and control group at 12 hours ( $p = 0.219$ ), 24 hours ( $p = 0.349$ ), 36 hours ( $p = 0.695$ ) and 48 hours ( $p = 0.424$ ) after the intervention.

**Conclusion:** The study concludes that both glycerin magnesium sulphate and heparin benzyl nicotinate can be used effectively among children with phlebitis. However, after 24 hours of phlebitis, an alternative intervention needs to be used.

**Keywords:** Glycerin; Heparin Benzyl Nicotinate; Magnesium Sulphate; Phlebitis



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## INTRODUCTION

Almost 80 to 90 percent of the patients admitted to hospitals receive some form of peripheral intravenous (IV) therapy as a part of the treatment.<sup>1</sup> One of the most common complications associated with peripheral intravenous infusions is phlebitis,<sup>2</sup> which is a frequent problem in paediatric patients.<sup>3,4</sup> The incidence of phlebitis ranges from 5.07%, 6.6% to 8.4% in different parts of the world.<sup>4-6</sup> In India, the incidence of phlebitis in children varies from 7% to 71.25% with progression to thrombophlebitis in 4%.<sup>3,7</sup>

Magnesium sulphate is hygroscopic and has been used in dehydrating boils and carbuncles. Topically, it is also used for treating aches and pains.<sup>8</sup> Heparin prevents thrombin formation, promotes fibrinolysis and absorption of superficial micro-thrombi while benzyl nicotinate boosts local absorption of heparin by vasodilation.<sup>9</sup> A study in India concluded that, magnesium sulphate paste application is very effective than magnesium sulphate crystal fomentation in reducing phlebitis and other infusion related complications in children.<sup>10</sup> Another study in similar setting stated that glycerin magnesium sulphate application and aloe vera gel are effective in reducing phlebitis in children.<sup>11</sup> Thrombophob gel and ice pack are also found to be effective in reducing intravenous infiltration in children.<sup>12</sup>

Various studies show that Glycerin magnesium sulphate and heparin benzyl nicotinate ointment are widely used in hospitals. However, there is little evidence on effectiveness of glycerin magnesium sulphate in management of phlebitis among children. In Nepal, glycerin magnesium sulphate has been widely used in the treatment of phlebitis, boils, abscess and other oedematous conditions, but the effectiveness in paediatric population is yet to be reviewed. Therefore, this study aims to find out the effectiveness of glycerin magnesium sulphate versus heparin benzyl nicotinate application in children with phlebitis.

## METHODS

A pre-post control group design was used for the study. The study was conducted for a month from July to August 2017, among all the children

admitted in a tertiary level children's hospital, located in central Nepal. Children aged three to 14 years, who developed peripheral intravenous cannula induced phlebitis were included in the study. Fifty children were randomly divided by lottery method into two groups; experimental (Glycerin Magnesium Sulphate application) and control (Heparin Benzyl Nicotinate application) group. Children with peripheral intravenous cannula induced phlebitis of upper and lower limbs were included in the study. Children with hypersensitivity to magnesium sulphate or heparin benzyl nicotinate, open wound at the site of phlebitis and who were verbally non-responsive were excluded.

In experimental group, glycerin magnesium sulphate paste of 20 gm magnesium sulphate powder mixed with 40 ml glycerin<sup>13</sup> was prepared by a pharmacist and a 5-mm thick layer of glycerin magnesium sulphate paste was spread over a gauze and applied to phlebitis site after a sensitivity test and bandaged with 2 X 2 cotton gauze and left for 12 hours. After 12 hours, the bandage was removed, phlebitis site was cleaned with tap water, dried and VIP Score was assessed. Then, glycerin magnesium paste was reapplied and bandaging was done. This process was repeated till reduction of phlebitis score to 0 or till 48 hours of application of glycerin magnesium sulphate paste.

Heparin-benzyl nicotinate refers to the ointment thrombophob (Zydus Alidac, 20g, Mfg. Lic. No. G 25/1919). In control group, after assessment of VIP score in children, a thin layer of heparin benzyl-nicotinate ointment was applied by gentle massage at the site of phlebitis. After 12 hours, the phlebitis site was cleaned with tap water, dried and VIP score was assessed. This process was repeated till reduction of phlebitis score to 0 or discharge of the child.

Independent 't' test was used to compare the significant difference in reduction of VIP score before and after intervention among same group and between groups. An ethical approval was obtained from the Institutional Review Board from the local institute. Informed written consent was obtained from the parents. None of the children of experimental group received glycerin magnesium

**Table 1.** Bio-demographic distribution of the subjects

Demographic Variables	Experimental Group (n = 22)		Control Group (n = 21)	
	Frequency	%	Frequency	%
<b>Age (years)</b>				
3 to 6	10	45.45	6	28.57
6 to 11	10	45.45	9	42.86
11 to 14	2	9.10	6	28.57
<b>Sex</b>				
Male	14	63.64	11	52.38
Female	8	36.36	10	47.62

sulphate application after 48 hours of initial application. Two participants in experimental group whose VIP score had not reduced to zero till 48 hours were treated with heparin benzyl nicotinate application after 48 hours.

## RESULTS

Table 1 depicts that the mean age in experimental group was  $6.95 \pm 3.02$  years and  $7.81 \pm 3.63$  years in control group. The male and female ratios in the groups were almost equal.

Table 2 reveals that 50% of the subjects in experimental group and 33.33% of subjects in control group had intravenous cannula in dorsal venous network. Nearly half of the subjects in experimental group and 33.33% of subjects in control group developed phlebitis after 48 to 72 hours of cannulation. Mostly, 24 G cannula was used in both groups.

Table 3 shows that there is statistically significant difference in reduction of VIP score at 12 hours ( $p < 0.001$ ) and between 12 and 24 hours of intervention ( $p = 0.002$ ) in the experimental group.

Table 4 shows that that there is statistically significant difference in reduction of VIP score at 12 hours ( $p = 0.403$ ) and between 12 and 24 hours ( $p = 0.002$ ) in the control group.

Table 5 shows that there is similar reduction of VIP score in experimental and control group. However, in experimental group, it can be seen that after 24 hours, there is a decrease in more than half of the

**Table 2.** Cannulation details of the subjects

Cannulation Details	Experimental Group (n = 22)		Control Group (n = 21)	
	Frequency	%	Frequency	%
<b>Site of Cannulation</b>				
Dorsal venous network	11	50.00	7	33.33
Cephalic vein	4	18.18	7	33.33
Medial vein of forearm	4	18.18	2	9.52
Median cubital Vein	1	4.55	3	14.29
<b>Duration of Cannulation</b>				
Less than 24 hours	0	0.00	3	14.29
24 to 48 hours	6	27.27	8	38.09
48 to 72 hours	10	45.45	7	33.33
More than 72 hours	6	27.27	3	14.29
<b>Size of Cannula</b>				
22 G	1	4.55	2	9.52
24 G	21	95.45	18	85.71
26 G	0	0.00	1	4.76

subjects as compared to that of control group. This is due to reduction of VIP score to 0.

## DISCUSSION

Independent t tests showed significant difference in reduction of VIP score in experimental group after 12 hours ( $p < 0.001$ ) and 24 hours ( $p < 0.002$ ). A similar study among 30 children in India also shows that saturated glycerin magnesium fomentation is effective in treatment of phlebitis ( $p < 0.01$ ).<sup>17</sup> Another study in Punjab, India showed a significant reduction in VIP score among children after glycerin magnesium sulphate application. Comparison on application of hot fomentation, glycerin magnesium sulphate paste and icchthammol glycerin, icchthammol glycerin was found most effective in reduction of VIP score followed by glycerin magnesium sulphate paste.<sup>18</sup>

**Table 3.** Effectiveness of Glycerin Magnesium

VIP Score		N	Mean	SD	t value	p value
Before Intervention and at 12 hours	Before Intervention	22	2.95	0.79	4.57	<0.001*
	At 12 hours	22	1.82	0.85		
At 12 and 24 hours	At 12 hours	22	1.82	0.85	3.29	0.002*
	At 24 hours	22	0.82	1.14		
At 24 and 36 hours	At 24 hours	22	0.82	1.14	-0.15	0.885
	At 36 hours	9	0.89	1.36		
At 36 and 48 hours	At 36 hours	9	0.89	1.36	-0.36	0.706
	At 48 hours	4	1.25	1.89		

\*p value statistically significant at  $\leq 0.05$

Another study reveals a significant reduction in intravenous medication induced phlebitis after 12, 24, 36, 48 and 60 hours of observation after glycerin magnesium sulphate application among children aged one to three years. The phlebitis reduction was measured in terms of decrease of pain, edema, erythema and palpable venous cord.<sup>19</sup>

Glycerin magnesium sulphate paste is effective in reduction of phlebitis among children,<sup>20</sup> especially in reducing mild and moderate phlebitis with mean hour of 14.40 and 21.20 respectively.<sup>11</sup> Other various studies also agree that there is a significant decrease in post test score after magnesium sulphate application in the treatment of phlebitis in adults.<sup>13-15,21,22</sup> Another study in China, showed similar findings that phlebitis was significantly reduced by external application of magnesium sulphate.<sup>16</sup>

The study shows a significant difference in reduction of VIP score at 12 hours ( $p = 0.403$ ) and 24 hours ( $p = 0.002$ ) in the control group. The findings are consistent with studies in India which revealed a significant effect of heparin benzyl

**Table 4.** Effectiveness of Heparin Benzyl Nicotinate on VIP Score

VIP Score		N	Mean	SD	t value	p value
Before Intervention and at 12 hours	Before Intervention	21	2.62	0.59	2.12	0.0403*
	At 12 hours	21	2.14	0.85		
At 12 and 24 hours	At 12 hours	21	2.14	0.85	3.28	0.002*
	At 24 hours	21	1.14	1.11		
At 24 and 36 hours	At 24 hours	21	1.14	1.11	0.17	0.869
	At 36 hours	13	1.08	0.86		
At 36 and 48 hours	At 36 hours	13	1.08	0.86	1.19	0.249
	At 48 hours	10	0.60	1.08		

\*p value statistically significant at  $\leq 0.05$

nicotinate application on Thrombophlebitis.<sup>12,14,15</sup> Topical heparin jelly has been found to be an effective method to reduce intravenous cannula induced phlebitis in children.<sup>17</sup> A study among adults evaluated the efficacy of QPS heparin in preventing incidence of thrombophlebitis. Heparin QPS was found to be effective in prevention of phlebitis in adult patients requiring postoperative intravenous cannulation for 72 hours.<sup>23</sup>

The study demonstrates that there is no statistically significant difference in reduction of VIP score among the subjects in experimental and control group at 12 hours ( $p = 0.219$ ), 24 hours ( $p = 0.349$ ), 36 hours ( $p = 0.695$ ) and 48 hours ( $p = 0.424$ ) after the intervention. A quasi experimental study among 45 adults in India depicted no significant difference in reduction of infiltration and extravasation between heparin, glycerin magnesium sulphate and moist heat application ( $p = 0.497$ ).<sup>24</sup> Differing to this, a quasi-experimental study by Das et al., among 30 children aged three to twelve years showed that magnesium sulphate fomentation was more effective in reduction of severity of phlebitis than heparin jelly ( $p < 0.05$ ).<sup>17</sup> However, in the study by Das et al., magnesium sulphate fomentation and heparin jelly were used once a day, which is less, compared to this study. Also, contrary findings can be seen in other studies, which

**Table 5.** Comparison of the effectiveness of glycerin magnesium sulphate and heparin benzyl nicotinate application on VIP Score

VIP Score	Experimental Group			Control Group			t value	p value
	N	Mean	SD	N	Mean	SD		
Before Intervention	22	2.95	0.79	21	2.62	0.59	1.58	0.122
At 12 hours	22	1.82	0.85	21	2.14	0.85	-1.25	0.219
At 24 hours	22	0.82	1.14	21	1.14	1.11	-0.95	0.349
At 36 hours	9	0.89	1.36	13	1.08	0.86	-0.39	0.695
At 48 hours	4	1.25	1.89	10	0.60	1.08	0.83	0.424

suggests that glycerin magnesium sulphate is most effective in reducing phlebitis.<sup>14,15,25,26</sup> This difference may likely be due to the discrepancy between age group of subjects in the studies, difference in duration and dose of glycerin magnesium sulphate and heparin benzyl nicotinate.

In Nepal, an experimental study among adults demonstrated a significant difference in phlebitis score after magnesium sulphate and glycerin dressing and heparinoid ointment application. Nevertheless, the reduction of mean VIP score was more after magnesium sulphate and glycerin dressing as compared to heparinoid ointment ( $p < 0.05$ ).<sup>27</sup>

Though various studies are available, a highly similar study among children with consistent dosage and technique of application of glycerin magnesium sulphate and heparin benzyl nicotinate

is needed for comparison. The study is limited to a small sample size and had no control over extraneous variables like immunity, nutritional status, hygiene, etc., so a similar study in a larger sample and with control over these variables are recommended to draw more definite conclusions. However, the findings of this study can be utilised to reduce further complications of phlebitis through timely management using either glycerin magnesium sulphate or heparin benzyl nicotinate.

## CONCLUSIONS

Both glycerin magnesium sulphate and heparin benzyl nicotinate can be effective in reducing phlebitis among children up to 24 hours of its application, but more applications do not provide much benefit. Thus, an alternative method needs to be identified to treat phlebitis lasting or that seems to be lasting for over a day.

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