Original Research Article

DOI: http://dx.doi.org/10.18203/2349-2902.isj20202821

Study of percutaneous endoscopic gastrostomy compared to nasogastric tube feeding in patients requiring prolong enteral nutritional support

Manik C. Gedam¹, Yogesh D. Mankar¹, Devdas S. Samala^{2*}, Leena Y. Ingale³, Lavanya L.¹, Dhiraj D. Sagrule¹

Received: 12 March 2020 Accepted: 15 April 2020

*Correspondence: Dr. Devdas S. Samala,

E-mail: devdassamala@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The aims and objectives of this article were to compare the advantages, disadvantages associated with percutaneous endoscopic gastrostomy (PEG) and nasogastric (NG) tube and also to compare complications, to measure the outcomes in terms of hospital stay, mortality and improvement in nutritional status.

Methods: In this prospective and interventional study 25 patients were selected in each group on an alternate basis. Study was conducted on cases of traumatic brain injury and cerebrovascular accident patients admitted in Department of General Surgery, IGGMC for a period of November 2013- November 2015 with a need to provide prolonged enteral nutritional support. Each patient was assessed by a dietician and received a standard enteral feeding according to their body weight. The main outcome was measures at 4 weeks were complications (tube dislodgement, aspiration pneumonia, tube blockade and peristomal infections) and nutritional status.

Results: The anthropometric parameters (mid arm circumference, biceps skin fold thickness and triceps skin fold thickness) and serum albumin showed a rise in PEG group at 4 weeks when compared to baseline (0 week) whereas they showed a decline in NG group at follow up (4 weeks). The NG group has got higher mortality 4 (17%) when compared to PEG group 2 (7%) due to aspiration pneumonia. Hence, PEG is better tolerated with lesser complications better nutritional support as assessed by the anthropometric parameters at 4 weeks.

Conclusions: We conclude that whenever feasible percutaneous endoscopic gastrostomy (PEG) feeding is a choice over nasogastric (NG) feeding in patients requiring long term enteral support.

Keywords: NG tube feeding, PEG, Anthropometric parameters

INTRODUCTION

Poor nutritional status increases length of hospital stay and risk of complications which ultimately result in poor outcome. Enteral nutrition is the preferred choice of improving the nutritional status of patients and to maintain the integrity of gastrointestinal tract (GIT). There are two ways of delivering nutrition to the patients who cannot swallow adequately. Gastrointestinal access for short term is usually achieved through nasogastric tube (NGTs). Insertion of a nasogastric tube is easy,

quick, relatively non-invasive, requires little training and has negligible mortality however many patients find nasogastric tubes uncomfortable and repeatedly pull the tube out, resulting in interrupted feeding and a potential for aspiration and malnutrition.² If enteral feeding is to be needed for periods more than 6 weeks, most international guidelines recommend a feeding gastrostomy.³ Gastrostomy tube can be placed surgically, radiologically and commonly inserted endoscopically.⁴ The purpose of this review was to provide an overview of current knowledge and practice in the rapidly changing and

¹Department of General Surgery, ³Department of Anaesthesia, IGGMC, Nagpur, Maharashtra, India

²Department of General Surgery, RIMS, Adilabad, Telangana, India

developing field of endoscopic enteral tube feeding (ETF), covering routes of access as well as problems associated with enteral feeding and their solutions.

METHODS

A prospective and interventional study of percutaneous endoscopic gastrostomy (PEG) compared to nasogastric (NG) tube feeding in patients requiring prolong enteral nutritional support was conducted on patient admitted through Casualty/OPD/IPD, in Department of General Surgery, IGGMC for a period of November 2013-November 2015 with a need to provide prolonged enteral nutritional support.

Written consent of responsible relative was obtained after explaining pros and cons of both the procedures. In the present study, 25 patients were selected in each group on an alternate basis and the procedure was carried out alternatively, with first patient undergoing NG tube or PEG tube insertion and next patient undergoing PEG tube or NG tube insertion and so on. The patients were shifted from one procedure to another as and when required as patient is not willing or having discomfort with either of the procedure.

Inclusion criteria

All cases of traumatic brain injury and cerebrovascular accident patients who were unable to accept oral feeds and who require enteral nutrition for more than a month.

Exclusion criteria

Following patients were excluded from this study were requiring short term enteral nutrition support (less than 1 month), infants and children up to 12 years of age (as pediatric gastroscope was not available at our institute) and patients in whom gastroscopy is not possible (benign or malignant stricture of esophagus or severe oromaxillofacial injuries).

PEG tubes (Wilson Cook silicone tube, 24 French gauge with internal diameter of 5.5 mm) were inserted by using a percutaneous approach and pull through technique. The patients were given a prophylactic dose of antibiotic intravenous ceftriaxone 1 gm one hour prior to the procedure. Patients were sedated by using intravenous midazolam 0.03 mg/kg and intravenous fentanyl 1-2 mg/kg was used for analgesia. NG tubes were passed by experienced staff in a standard fashion and their position was checked by aspirating gastric contents. Each patient in both groups was assessed by a dietician and received a standard enteral feeding according to their body weight.

The main outcome measures at 4 weeks were complications as tube dislodgement, aspiration pneumonia, tube blockade and peristomal infections (defined as erythema, increased pain or tenderness and discharge and requiring antibiotic treatment). Nutritional

status was assessed by recording anthropometric parameters as skin-fold thickness (triceps-TSFT and biceps BSFT), mid-arm circumference (MAC) and nutritional markers as serum albumin levels. Patients were assessed by baseline upper-arm skin fold thickness (biceps and triceps) and MAC and blood was drawn for serum albumin levels at recruitment and at 4 weeks follow-up.

RESULTS

The present study was conducted at tertiary care institute from November 2013 to November 2015. A total of 25 patients were included in each group i.e. PEG and NG tube feeding during specified period and evaluated prospectively and interventionally. Two patients of NG group were shifted to PEG group as they were unable to tolerate NG tube.

In the PEG group maximum patients i.e. 23 (86%) had GCS in the range of 3-5 followed by 2 (7%) patients with GCS 6-8, 2 (7%) patients with GCS 9-11 and no patients with GCS 12-15. While in NG group maximum patients i.e. 17 (74%) had GCS in range of 9-11 followed by 6 (26%) patients with GCS 6-8 and no patients with GCS 3-5 and 12-15. The mean GCS score in PEG group was 4.51±1.61 and NG group was 9.04±0.87. The p value was found to be <0.0001 which was highly significant.

Tube dislodgement was observed in 15 (65%) patients of NG group as most common complication and not seen in PEG group. The p value was <0.0001 which was highly significant. Aspiration pneumonia was more common complication in NG group as 9 (39%) patients compared to only 1 (4%) patient in PEG group and the p value was observed to be 0.003 which was highly significant. Tube blockade was more common in NG group as 15 (65%) patients compared to 2 (7%) patients in PEG group and the p value observed was <0.001 which was highly significant. In this study in PEG group peristomal infection was observed in 10 (37%) patients while peristomal infection was not a complication observed in NG group and the p value observed was 0.001 which was significant.

There were 4 deaths in NG group and 2 patients were shifted to PEG group so these 6 patients were not considered for measuring anthropometric parameters at 0 week and neither at 4 weeks. Thus, the total number of patients in NG group was 19. There were 2 deaths in PEG group and 2 patients were added to PEG group from NG group. Patients who died were not considered for measuring anthropometric parameters at 0 week and neither at 4 weeks and total number of patients in PEG group was 25.

In the present study on comparing the anthropometric parameters (MAC, BSFT and TSFT) (Table 1) in the NG group it was found that at 0 week the mean MAC was 20.97±2 with median of 19 (17-25), the mean BSFT was

found to be 7 ± 0.79 with median of 7 (6-9) while the mean TSFT was found to be 12.42 ± 1.77 with median of 12 (10-15). On follow up at 4 weeks the mean MAC was 20.65 ± 2.10 with median of 21 (17-24), the mean BSFT was found to be 6.87 ± 0.75 with median of 7 (6-8.5) while the mean TSFT was found to be 12.34 ± 1.60 with median of 12 (10-15.5). The p value for MAC was found to be 0.001 which was highly significant while that for BSFT and TSFT was found to be 1 and 0.8846 which was not significant. On comparing the anthropometric parameters

the change in MAC was found to be highly significant while that for BSFT and TSFT was not significant. In the present study the mean serum albumin levels in NG group at 0 week was found to be 36.35 ± 3.26 with a median of 35.7 (35-44). While the mean serum albumin levels 4 week was found to be 36.1 ± 2.94 with a median of 35 (32.8-42.5). On comparing serum albumin level at 0 and 4 weeks the p value was found to be 0.6936 which was not significant.

Table 1: Comparison of anthropometric parameters and serum albumin levels at 0 week and 4 weeks in NG and PEG groups.

Time		MAC (mm)	BSFT (mm)	TSFT (mm)	Serum albumin
NG group					
	No. of patients	19	19	19	19
0 week	Mean	20.97±2	7±0.79	12.42±1.77	36.35±3.26
0 week	Median	19	7	12	35.7
	Range	17-25	6-9	10-15	35-44
	No. of patients	19	19	19	19
4 weeks	Mean	20.65±2.10	6.87±0.75	12.34±1.60	36.1±2.94
	Median	21	7	12	35
	Range	17-24	6-8.5	10-15.5	32.8-42.5
P value		< 0.001	1	0.8846	0.6936
PEG group					
	No. of patients	25	25	25	25
01-	Mean	20.78 ± 2.54	7.12±0.87	12.56±1.77	33.85±2.30
0 week	Median	21	7	12	33.1
	Range	16-28	6-9	10-16	29.4-39
	No. of patients	25	25	25	25
4 weeks	Mean	21.5±2.11	7.28 ± 0.82	13±1.86	34.72±2.22
	Median	21.5	7	12.5	34.3
	Range	16.5-27	6-9	10-16	30.4-40
P value		0.2813	0.5066	0.3958	0.1799

In the present study on comparing the anthropometric parameters (MAC, BSFT and TSFT) in the PEG group it was found that at 0 week the mean MAC was 20.78±2.54 with a median of 21 (16-28), the mean BSFT was found to be 7.12±0.87 with a median of 7 (6-9) while the mean TSFT was found to be 12.56±1.77 with a median of 12 (10-16). On follow up at 4 weeks the mean MAC was 21.5±2.11 with a median of 21.5 (16.5-27), the mean BSFT was found to be 7.28±0.82 with median of 7 (6-9) while the mean TSFT was found to be 13±1.86 with a median of 12.5 (10-16). The p value for MAC, BSFT and TSFT was found to be 0.2813, 0.5066 and 0.3958 which was not significant. In the present study the mean serum albumin levels in PEG group at 0 week was found to be 33.85±2.30 with a median of 33.1 (29.4-39). While the mean serum albumin levels 4 weeks was found to be 34.72±2.22 with a median of 34.3 (30.4-40). On comparing serum albumin level at 0 and 4 weeks the p value was found to be 0.1799 which was not significant

On comparing the change in the mean mid arm circumference between PEG group and NG group at 4 week and 0 weeks it was found that (Table 2), there was some improvement in MAC in PEG group (19 out of 25 patients, i.e.76%) while in NG group MAC decreased in 10 (53%) patients. The z value was found to be 1.3456 and the p value was found to be 0.049 which was significant. On comparing the change in the mean biceps skin fold thickness at 4 week and 0 weeks it was found that, there was increase in BSFT in 12 (48%) patients of PEG group whereas there was a decrease in BSFT in 7 (37%) patients of NG group. The z value was found to be 1.56 and the p value was found to be 0.0325 which was significant. On comparing the change in the mean triceps skin fold thickness at 4 week and 0 weeks it was observed that, there was increase in triceps skin fold thickness of 14 (56%) patients in PEG group while it decreased in 6 (32%) patients in NG group. The z value was found to be 2.595 and the p value was found to be 0.02165 which was significant. On comparing the change in the mean Serum albumin levels at 4 week and 0 weeks it was found that, there was increased in 23 (92%) patients of PEG group while it decreased in 2 patients. In NG group serum albumin decreased in 13 (68%) patients. The z value was found to be 2 and the p value was found to be 0.002 which was significant.

Table 2: Comparison of change in anthropometric parameters and serum albumin levels between two groups at 4 weeks.

	PEG group (N =25)	NG group (N=19)	Z value	P value
MAC	0.96±0.58	0.63 ± 0.5	1.3456	0.049
BSFT	0.16 ± 0.05	0.13 ± 0.04	1.56	0.0325
TSFT	0.68 ± 0.58	0.34 ± 0.36	2.595	0.02165
Serum albumin	1.22±0.51	0.8±0.36	2	0.002

In present study the mortality in PEG group was found to be 2 out of 27 patients (7%) while that for NG group was 4 out of 19 patients (17%). On comparing the mortality, it was found to be significant.

DISCUSSION

The first percutaneous endoscopic gastrostomy was performed on a child on June 12, 1979 at the Rainbow Babies and Children's Hospital, University Hospitals of Cleveland. Dr. Michael W.L. Gauderer, pediatric surgeon, Dr. Jeffrey Ponsky, endoscopist, and Dr. James Bekeny, surgical resident, performed the procedure on a 4 1/2-month-old child with inadequate oral intake.⁵ It has nearly replaced the surgical gastrostomy (Witzel gastrostomy, Stamm gastrostomy, Janeway gastrostomy) except in total dysphagia which was associated with a markedly higher rate of complications. The advantages of this procedure in comparison to operative insertion are that it requires only local anaesthesia, takes only 15-20 minutes to insert and can be performed at the patient's bedside if required. Several studies have demonstrated the safety of this technique. 6-12

In this present study total 50 patients were included, (Table 3) while Hamidon et al, only 22 and Sobani et al, 32 patients which was less as compared to us.^{13,14} Our study group was small as compared to Cory et al (105),

and Youssef et al (90).15-17 In this present study the median age in PEG group was 37 which was less as compared to Hamidon et al (65), June Cory et al (59), Youssef et al (78) and Mekhail et al (59). 13-18 The median age in NG group in the present study was 35 which was less as compared to Hamidon et al (72), Cory et al (61), Youssef et al (81) and Mekhail et al (61). 13,15-18 The combined p value in the present study was 0.1616 which was comparable with Cory et al (0.10) while the p value in study conducted by Hamidon et al and Youssef et al was 0.766 and 0.231 respectively. 13,15-17 In the present study M:F ratio in the PEG group was 5.75:1 while for Hamidon et al it was 1:1, Cory et al 2.2:1 and Youssef et al 1.82:1. While in NG group the M:F ratio was 1.3:1 while for Hamidon et al 1:1, Cory et al 3.56:1 and Youssef et al 1.62:1.13,15-17

On comparison of complications, (Table 4) out of 27 patients in PEG group no patient had tube dislodgement as a complication which is comparable with Magne et al (0%), Sobani et al (0%) and Youssef et al (0%), while it was significantly less as compared to Sadasivan et al 8% and Cory et al 19%. 14-17,19,20 In the present study out of 23 patients of NG group 15 (65%) had tube dislodgement while in a study by Magne et al it was 16 (36%), Cory et al it was 45 (62%), Sobani et al it was 2 (12.5%), Sadasivan et al it was 27 (68%) and Youssef et al it was 20 (48%). 14-17,19,20 The p value in present study was found to be <0.0001 which was comparable with Cory et (<0.001) and Youssef et al (0.0001). 15-17 Aspiration pneumonia was significantly low in PEG group as compared with Youssef et al 7 (14.6%), Cory et al 10 (31%). 15-17 We found that aspiration in NG group was similar with Youssef et al (33.3%) but more as compared with Cory et al (25 %). 15-17 The p value for aspiration pneumonia in both groups was found to be 0.003 which was significant and was comparable with Youssef et al (33.3%).¹⁷ On comparing tube blockade in both groups it was 2 (7%) for PEG group and 15 (65%) for NG group which was higher than Hamidon et al 0 (0%) for PEG group and 2 (17%) for NG group. 13 In present study the p value was found to be <0.01 which was significant. In the present study, in NG group no patient had infection at the site of NG tube insertion which was comparable with study conducted by Cory et al (0%) and Youssef et al (0%). 15-17 In PEG group 10(37%) patients had peristomal infection which was comparable with study conducted by Cory et al (41%) while peristomal infection was seen in 3 (6%) patients in study conducted by Youssef et al. 15-17

Table 3: Patient distribution.

	Total nu patients		Median	age		Gender				
	PEG	NG	PEG	NG	P value	PEG (M:F ratio)	NG (M:F ratio)			
Hamidon et al ¹³	10	12	65	72	0.766	1:1	1:1			
Cory et al ^{15,16}	32	73	59	61	0.10	2.2:1	3.56:1			
Sobani et al ¹⁴	16	16								
Youssef et al ¹⁷	48	42	78	81	0.213	1.82:1	1.62:1			
Mekhail et al ¹⁸			59	61	NA					
Present study (2015)	27	23	37	35	0.1616	5.75:1	1.3:1			

Table 4: Comparison of complications.

	Tube o	lislodgeme	ent	Aspiratio	n pneumo	nia	Tube	blockade	:	Peristomal infection			
	PEG (%)	NG (%)	P value	PEG (%)	NG (%)	P value	PEG (%)	NG (%)	P value	PEG (%)	NG (%)	P value	
Magne et al ¹⁹	0 (0)	16 (36)	NA										
Cory et al ^{15,16}	6 (19)	45 (62)	< 0.001	10 (31)	18 (25)	NA				13 (41)	0 (0)	NA	
Sobani et	0 (0)	2 (12.5)	NA										
Sadasivan et al ²⁰	4 (8)	27 (68)	NA										
Youssef et al ¹⁷	0 (0)	20 (48)	0.0001	7 (14.6)	14 (33.3)	0.029				3 (6)	0 (0)	NA	
Hamidon et al ¹³							0 (0)	2 (17)	NA				
Present study (2015)	0 (0)	15 (65)	<0.0001	1 (4)	9 (39)	0.003	2 (7)	15 (65)	<0.01	10 (37)	0 (0)	0.001	

Table 5: Comparison of anthropometric parameters.

		MAC	BSFT TSFT						Serum albumin								
		PEG		NG		PEG		NG		PEG		NG		PEG		NG	
		Present study	Hamidon et al ¹³														
	No. of patient	25	8	19	10	25	8	19	10	25	8	19	10	25	8	19	10
0 week	Median	21	31. 1	19	28.6	7	11. 2	7	7.8	12	19. 4	12	12. 4	33. 1	37	35. 7	41
	Range	16- 28	24- 37	17- 25	24- 38		4.8- 12		4.8 -17		8.8- 34		11- 33		31- 41		33- 46
	No. of patient	25	8	19	10	25	8	19	10	25	8	19	10	25	8	19	10
4 weeks	Median	21.5	31. 4	21	27.8	7	10. 3	7	7.4	12. 5	20. 1	12	12. 7	34. 3	39. 5	35	36
	Range	16.5- 27	22- 36	17- 24	21- 37		4.8- 13		4.4 -15		9.6- 34		9.8- 32		36- 44		31- 45
P value		0.28 13	0.6 74	<0.0 01	0.14 1	0.5 066	0.8 65	1	0.3 99	0.3 958	0.1 41	0.8 846	0.3 12	0.1 799	0.0 24	0.6 936	0.04 7

In present study the median (Table 5) MAC in PEG group at 0 week was found to be 21 (16-28) which was less 31.1 (24-37) when compared to Hamidon et al while median mid arm circumference in PEG group at 4 week was found to be 21.5 (16.5-27) which was less 31.4 (22-36) when compared to Hamidon et al. ¹³ Median MAC in NG group at 0 week was found to be 19 (17-25) which was less 28.6 (24-38) when compared to Hamidon et al while median MAC in NG group at 4 weeks was found to be 21 (17-24) which was less 27.8 (21-37) when compared to Hamidon et al. ¹³ Study conducted by Sadasivan et al the PEG group performed better than the NG group in terms of MAC at the end of first week (p<0.01), 6 weeks (p<0.0001) and 6 months (p=0.09)

after tube insertion.²⁰ Cory et al did not demonstrate significant effects of the method of enteral feeding on MAC (p= 0.90) between the two groups within first week of feeding tube insertion and even at 6 months post treatment.^{15,16} In present study the p value in PEG group was found to be 0.2813 which was comparable with p value (0.674) in study conducted by Hamidon et al and the p value in NG group was found to be <0.001 which was less when compared to p value (0.141) in study conducted by Hamidon et al.¹³

In present study the BSFT in PEG group at 0 week was found to be 7 which was less 11.2 (4.8-12) when compared to Hamidon et al while BSFT in PEG group at 4 week was found to be 7 which was less 10.3 (4.8-13)

when compared to Hamidon et al.¹³ The BSFT in NG group at 0 week was found to be 7 which was comparable 7.8 (4.8-17) with Hamidon et al while BSFT in NG group at 4 weeks was found to be 7 which was comparable 7.4 (4.4-15) with Hamidon et al.¹³ The p value in PEG group was found to be 0.5066 which was comparable with p value (0.865) in study conducted by Hamidon et al and the p value in NG group was found to be 1 which was more when compared to p value (0.399) in study conducted by Hamidon et al.¹³

In present study the TSFT in PEG group at 0 week was found to be 12 which was less 19.4 (8.8-34) when compared to Hamidon et al while TSFT in PEG group at 4 week was found to be 12.5 which was less 20.1 (9.6-34) when compared to Hamidon et al.13 The TSFT in NG group at 0 week was found to be 12 which was comparable 12.4 (11-33) with Hamidon et al while TSFT in NG group at 4 weeks was found to be 12 which was comparable 12.7 (9.8-32) with Hamidon et al. 13 Cory et al did not demonstrate significant effects of the method of enteral feeding on BSFT (p=0.96) between the two groups within first week of feeding tube insertion and even at 6 months post treatment. 15,16 In present study the p value in PEG group was found to be 0.3958 which was comparable with p value (0.141) in study conducted by Hamidon et al and the p value in NG group was found to be 0.8846 which was comparable with p value (0.312) in study conducted by Hamidon et al.¹³

In present study the serum albumin in PEG group at 0 week was found to be 33.1 which was less 37 (31-41) when compared to Hamidon et al while serum albumin in PEG group at 4 week was found to be 34.3 which was less 39.5 (36-44) when compared to Hamidon et al. 13 The serum albumin in NG group at 0 week was found to be 35.7 which was less 41 (33-46) when compared to Hamidon et al while serum albumin in NG group at 4 weeks was found to be 35 which was comparable 36 (31-45) with Hamidon et al.¹³ Sadasivan et al study indicated that there was no significant difference in serum albumin level from the base line in two groups.²⁰ In present study the p value in PEG group was found to be 0.1799 which was more when compared with p value (0.024) in study conducted by Hamidon et al and the p value in NG group was found to be 0.6936 which was more when compared with p value (0.047) in study conducted by Hamidon et al.13

In present study 2 (7%) deaths occurred in PEG group while Hamidon et al reported 2(20%) deaths and Youssef et al reported 4 (8.3%) deaths in PEG group while in NG group we had 4 (17%) deaths while Hamidon et al reported 2 (17%) deaths and Youssef et al reported 8 (18.2%) deaths in NG group. ^{13,17} In a study conducted by Rustom et al 4% (3 patients out of 78) mortality was reported in PEG group while Ehrsson et al reported a mortality of 5% (7 patients out of 156) in PEG group. ^{21,22}

CONCLUSION

For enteral feeding PEG is superior to NG feeding. Tube dislodgement, tube blockade and aspiration pneumonia are significant complications of NG feeding while peristomal infection is main complication of PEG feeding. PEG tube insertion requires expertise, instrumentation and PEG kit costs more but still PEG feeding is superior to NG feeding hence long term nutritional support is better given with PEG than NG. The NG group has got higher mortality when compared to PEG group due to aspiration pneumonia hence PEG is better tolerated with lesser complications better nutritional support as assessed by the anthropometric parameters (MAC, BSFT, TSFT) at 4 weeks. We conclude that whenever feasible percutaneous endoscopic gastrostomy (PEG) feeding is a choice over nasogastric (NG) feeding in patients requiring long term enteral support.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- Chao KC, Deasy JO, Markman J, Haynie J, Perez CA, Purdy JA, et al. A prospective study of salivary function sparing in patients with head-and-neck cancers receiving intensity-modulated or threedimensional radiation therapy: initial results. Int J Radiat Oncol Biol Phys. 2001;49:907-16.
- Shah FZ, Suraiya HS, Poi PH, Tan KS, Lai PS, Ramakrishnan K, et al. Long-term nasogastric tube feeding in elderly stroke patients- an assessment of nutritional adequacy and attitudes to gastrostomy feeding in Asians. J Nutr Health Aging. 2012;16(8):701-6.
- Gomes Jr CA, Andriolo RB, Bennett C, Lustosa SA, Matos D, Waisberg DR, et al. Percutaneous endoscopic gastrostomy versus nasogastric tube feeding for adults with swallowing disturbances. Cochrane database Syst Rev. 2010;11:cd008096.
- 4. Vanek W. Ins and outs of enteral access: part 2-long term access esophagostomy and gastrostomy. Nutr Clin Pract. 2003;18:50-74.
- Gauderer MWL, Ponsky JL, Izant RJ Jr. Gastrostomy without laparotomy: A percutaneous endoscopic technique. J Pediatr Surg. 1980;15:872-5.
- 6. Ponsky JL, Gauderer MW, Stellato TA. Percutaneous endoscopic gastrostomy. Review of 150 cases. Arch Surg. 1983;118:913-4.
- 7. Strodel WE, Lemmer J, Eckhauser F, Botham M, Dent T. Early experience with endoscopic percutaneous gastrostomy. Arch Surg. 1983;118:449-53.
- Larson DE, Fleming CR, Ott BJ, Schroeder KW. Percutaneous endoscopic gastrostomy. Simplified

- access for enteral nutrition. Mayo Clin Proced. 1983;58:103-7.
- 9. Thatcher BS, Ferguson DR, Paradis K. Percutaneous endoscopic gastrostomy: a preferred method of feeding tube gastrostomy. Am J Gastroenterol. 1984;79:748-50.
- 10. Russell TR, Brotman M, Norris F. Percutaneous gastrostomy. A new simplified and cost-effective technique. Am J Surg. 1984;148:132-7.
- 11. Ponsky JL, Gauderer MW, Stellato TA, Aszodi A. Percutaneous approaches to enteral alimentation. Am J Surg. 1985;149:102-5.
- 12. Kirby DF, Craig RM, Tsang TK, Plotnick BH. Percutaneous endoscopic gastrostomies: a prospective evaluation and review of the literature. J Parenter Enteral Nutr. 1986;10:155-9.
- 13. Hamidon BB, Abdullah SA, Zawawi MF, Sukumar N, Aminuddin A, Raymond AA. A prospective comparison of percutaneous endoscopic gastrostomy and nasogastric tube feeding in patients with acute dysphagic stroke. Med J Malaysia. 2006;61(1):59-66.
- Sobani ZA, Ghaffar S, Ahmed BN. Comparison of outcomes of enteral feeding via nasogastric versus gastrostomy tubes in post-operative patients with a principle diagnosis of squamous cell carcinoma of the oral cavity. J Pak Med Assoc. 2011;61:1042-5.
- 15. Corry J, Poon W, Mc Phee N, Milner AD, Cruickshank D, Porceddu SV, et al. Prospective study of percutaneous endoscopic gastrostomy (PEG) versus nasogastric tubes for enteral feeding in head and neck cancer patients treated with (chemo) radiation. Head Neck. 2009;31(7):867-76.
- 16. Corry J, Poon W, McPhee N, Milner AD, Cruickshank D, Porceddu S, et al. Randomized study of percutaneous endoscopic gastrostomy versus nasogastric tubes for enteral feeding in head and neck cancer patients treated with (chemo) radiation. J Med Imag Radiation Oncol. 2008;52(5):503-10.

- 17. Youssef GY, Alnajjar A, Elsherbiny M. A comparison of percutaneous endoscopic gastrostomy and nasogastric tube feeding in prolonged dysphagic stroke patients. Advanced Arab Acad Audio-Vestibul J. 2015;2(1):14-8.
- 18. Mekhail TM, Adelstein DJ, Rybicki LA, Larto MA, Saxton JP, Lavertu P. Enteral nutrition during the treatment of head and neck carcinoma: is a percutaneous endoscopic gastrostomy tube preferable to a nasogastric tube? Cancer. 2001;91(9):1785-90.
- 19. Magné N, Marcy PY, Foa C, Falewee MN, Schneider M, Demard F, et al. Comparison between nasogastric tube feeding and percutaneous fluoroscopic gastrostomy in advanced head and neck cancer patients. Eur Arch Oto-Rhino-Laryngol. 2001;258(2):89-92
- Sadasivan A, Faizal B, Kumar M. Nasogastric and percutaneous endoscopic gastrostomy tube use in advanced head and neck cancer patients: a comparative study. J Pain Palliat Care Pharmacother. 2012;26:226-32.
- 21. Rustom IK, Jabreel A, Tayyab M, England RJA, Stafford ND, percutaneous endoscopic, radiological and surgical gastrostomy tubes: a comparison study in head and neck cancer patients. J Laryngol Otol. 2006;120:463-6.
- 22. Ehrsson YT, Langius-Eklof A, Bark T, Laurell G. percutaneous endoscopic gastrostomy (PEG)- a long term follow up study in head and neck cancer patients. Clinical Otolaryngol. 2004;29:740-6.

Cite this article as: Gedam MC, Mankar YD, Samala DS, Ingale LY, Lavanya L, Sagrule DD. Study of percutaneous endoscopic gastrostomy (PEG) compared to nasogastric (NG) tube feeding in patients requiring prolong enteral nutritional support. Int Surg J 2020;7:2201-7.