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Impact of Long-Term Enteral Feeding Tubes on Aspiration Pneumonia in a Tertiary Care Centre in Saudi Arabia

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Abstract: It is a retrospective Chart Study. The objectives of the study are (1) to determine the incidence of Aspiration Pneumonia (AP) before and after long term feeding tubes insertion in four types of feeding tubes: percutaneous endoscopic gastrostomy (PEG), percutaneous fluoroscopy gastrostomy (PFG), jejunostomy feeding tube (JFT) and nasogastric tube (NGT) ,(2) to find out associations between the incidence of AP in patient who have feeding tubes and age , gender, rate of feeding (continuous or boluses) ,type of formula of used feeding ,use of thickener during oral feeding , persons deliver feedings and family training how to feed patients. (3) Factors that influenced patients' outcomes. The findings of the study are: (1) No difference in incidence of AP before and after tube insertion. Feeding tubes have limited medical benefits for AP prevention. (2)Rate of feeding either continuous or bolus increase the frequency of AP. (3)No associations between the incidence of AP and age, gender, type of formula, use of thickener during oral feeding, person deliver feedings and family training about method of feeding. (4) Old age is a poor prognostic factor and HHC follow up is a good prognostic factor for outcome. (5) AP increases a patient's hospital readmission and length of stay in the hospital. There is an urgent need to have alternative strategies to reduce the cost.

Keywords: Aspiration Pneumonia, Enteral Feeding Tube, Mortality, Percutaneous Fluoroscopic Gastrostomy, Percutaneous Endoscopic Gastrostomy, Gastrojejunostomy

1. Introduction

Aspiration Pneumonia (AP) is defined as the inhalation of either oropharyngeal or gastric contents into the lower airways. This is affected by quantity and nature of the aspirated material, the frequency of aspiration, and the host factors that predispose the patient to aspiration[1]. Aspiration of bacteria from oral and pharyngeal areas causes bacterial pneumonia[2]. A 10-year review found a 93.5% increase in the number of hospitalized elderly patients diagnosed with AP[3]. The mortality rate varied from one study to another in the range 7.5% to 62%. Deaths from AP are increasing and are currently ranked 15th on the CDC list of common causes of mortality[4]. AP diagnosis was based on a clinical presentation consistent with pneumonia associated with a history of witnessed aspiration or risk factors for aspiration [5]. Almost all patients who develop AP have one or more of the predisposing risk factors for aspiration. Feeding tubes do not

completely prevent pneumonia, it is associated with a greater incidence of pneumonia and a higher mortality[6,7]. Considering how common the problem of AP is in older adults, the use of feeding tubes has continued to increase in patients at King Faisal Specialist hospital & Research Centre (KFSH&RC). There is a limited data about the use of long term feeding tubes in Saudi patients[8,9,10,11].

The main objective of this study is: 1)To determine the incidence of AP before and after long term feeding tubes insertion. 2)To find out if there are associations between incidence of AP in patients have feeding tubes and age , gender, type of tube used , rate of feeding (continuous or boluses), type of formula of feeding ,used thickener during oral feeding , persons deliver feedings and family training how to feed patients. 3) Factors that influenced patients' outcomes .To our knowledge, our study is the first study conducted in Saudi Arabia about impact of feeding tubes on AP.

2. Methods

This is a retrospective study of patients who were admitted with a diagnosis of AP to KFSH&RC from January 2002 – December 2007. Inclusion criteria: 1- adult patient (age >14 years old) , 2- patients need long term enteral feedings tube > 4 weeks, 3- feedings tube inserted at KFSH&RC, 4- aspiration confirmed either by swallowing assessment test or modified barium test or both. Exclusion criteria include patients need feedings tubes for short term 4 weeks or less because of acute illness e.g. postoperative, ICU patients and patient's terminal illness required palliative care. The study was approved by Office of Research Affair (ORA) at KFSH&RC. The diagnosis of AP was based on history of witnessed aspiration or recurrent chocking, one or more of the following symptoms: cough with or without sputum, fever or hypothermia, chest examination and chest x-ray findings confirmed a new infiltration at the day of admission .Antibiotic treatment was started for all patients at the emergency department. The patient chart was analyzed using the following parameters: demographic data of the patients (age, sex), indications for feeding tubes, frequency of AP before and after feeding tubes insertion it is defined to be less than 5times in last two years before tube insertion and more than 5 times in two years after tube insertion, dysphagia assessment by swallowing assessment test and modified barium test, types of feeding tubes (NGT, PEG, PFG or JFT). Patients may have different types of feeding tubes but we record only the first long term feeding tube inserted. Reasons to keep patients on long-term NGT feeding, rate of feeding (continuous or boluses), type of formula, use of thickener if patient is still taking oral diet, persons deliver the feeds (member of family, hospital nurse, house maid, home nurse), family training how to feed patients (training by medical staff at hospital before discharge patients or home health care service (HHC) of the hospital). Outcome: mortality from AP and factors that influenced outcomes

3. Data Analysis

All the statistical analysis of data was done by using the software package SAS version 9.3 (Statistical Analysis System, SAS Institute Inc., Cary, NC, USA). Descriptive statistics for the continuous variables are reported as mean ± standard deviation and categorical variables are summarized as frequencies and percentages. Continuous variables are compared by Student's paired t-test while categorical variables are compared by Chi-square test. Univariate and multivariate logistic regression were used to study the effect of the different risk factors on the frequency of aspiration pneumonia after using the feeding tube and the patients' outcome. The level of statistical significance is set at $p < 0.05$.

4. Results

Numbers of patients were 389. Patients excluded from the study were 244 because of 227 patients had feeding tube inserted for short term which was less than 4 weeks, 7 patients their charts were missing and 10 patients their charts were at KFSH&RC- Jeddah and it was very difficult to be requested. Patients met the criteria of study are 145 , the main patients characteristics are presented in table 1, (83 men and 62 women) males are predominant (57.24%), with a mean age of 65.3 , bedridden patients are 85.03%, 21.38% have tracheostomy and 37.24% have follow up with HHC of the hospital. 14.97 % of patients are diabetic.The commonest indications for long term feeding tube are cerebrovascular accident (CVA) 49%, dementia 38.1%, inadequate oral intake 17.69% , it is not clear what is the underlying cause . Parkinson's disease 6.1% and it is not documented if it is associated with dementia or not. Cancer patients are all in remission and no evidence of active disease as presented in table 1.Patients have two or more indications for feeding tubes are 29%. Swallowing assessment test is positive in 62.50% and modified barium swallow test (MBS) is positive in 55.10%. Swallowing assessment test and MBS are positive in 48.30% with p value<0.0001. The combination of two tests increased the diagnostic sensitivity to identify patients with silent aspirations. The commonest feeding tube used is PFG in 56.55% of patients as presented in table 1. The frequency of AP <5 times / year is 26.73% before the tube insertion and 90.91% after the tube insertion. The frequency of AP >5 times/ year is 73.3 % before the tube insertion and 9.09 % after the tube insertion. No difference in incidence of AP before and after tube insertion (p= 0.087) as presented in table 2. AP frequency is more in PFG but it could be because it is the commonest tube used, however, there is no difference between four types of feeding tubes in incidence of AP before and after the tube insertion (p =0.2331) as presented in table 3.The frequency of AP is more in male before and after the tube insertion , however it is statistically insignificant (p= 0.9795 and p= 0.5207) as presented in table 3.The frequency of AP is more in age 66-79 years before and after the tube insertion (p= 0.483) . The commonest type of formula used is Jevity 56.46% and there are no associations between

incidence of AP and types of formula as presented in table 4. Thickener used in 9.52 % of patients and it has no effect on the incidence of AP (p= 0.1231) as presented in table 4. The rate of feeding either continuous or bolus increased the incidence of AP (p= 0.0318 and 0.0315) respectively. When we used univariate logistic regression to compare continuous and bolus of feeding, there is no difference and we conclude that they have the same effect. The persons deliver feedings are member of family38.36%, home nurse 10.96%, housemaid 9.59 % and hospital nurse6.85%. There are no associations between frequency of AP and person delivers feedings. Family training how to feed patients documented in 83 patients (56.85%). There is no association between frequency of AP and family training

(p= 0.554). Neither training by medical staff at hospital before discharge patient (p =1.056) nor HHC (p =0.081) nor both (p =0.456). The incidence of AP in patients who had follow up with HHC was small as compared to patients without HHC follow up but statistically it is insignificant (p 0.0561) as in figure 1. The survival rate is 43.4% and the mortality rate is 56.59% over the study period. The commonest cause of death is AP with septic shock and respiratory failure in 26 patients (37.68 %), followed by septic shock in 20 patients (28.99%), it is not clear if the cause is AP or other causes of sepsis. Malignancy was in 7 patients (10.14%), gastrointestinal bleeding with shock in 2 patients (2.90%). PFG has the highest mortality rate and it may be because it is the commonest feeding tube used among our patients as presented in table 5-6. Old age is a poor prognostic factor (p= 0.0018, odds ratio 1.028) and HHC follow up is a good prognostic factor for outcome, survival was better for patients have HHC follow up (p <0.0001, odds ratio 7.329). By using univariate and multiviate models we found old age and HHC follow up are the most significant prognostic factors, age (p= 0.0067, odds ratio 1.030), and HHC (p= <0.0001, odds ratio 8.379), however there are no association between outcome and gender (p =0.1776, odds ratio 0.614), dementia (p= 0.8254, odds ratio 1.085) and having two or more indications for feeding tubes insertion (p 0.5582, odds ratio 0.797). PFG has the highest number of death 40 (60.61%) followed by NGT14 (21.21%). Mean of length of hospital admission for AP after tube insertion per year is 22.1 days. The average cost of patient admission to medical floor per day at KFSH&RC is around 2882SR (768.5 $) in 22 days it will be 63404 SR (16907.7$). AP increases a patient's hospital readmissions, hospital stays and cost.

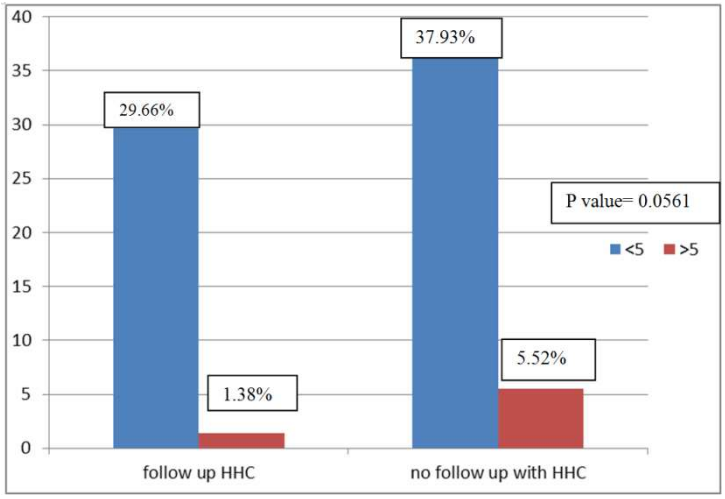

Figure 1. *HHC and Incidence of hospital admission for AP.*

< 5times in last two years before tube insertion
> 5 time two years after tube insertion

Table 1. *The demographic data of the patients.*

	frequency	**percent**
male	83	57.24%
female	62	42.76%
age		
< 65	42	29.8%
66-79	63	44.7%
>80	36	25.5%
Mean age 65.3 ± 23.7		
bedridden	125	85.03%
Tracheostomy when feeding tube inserted	31	21.38%
Diabetic patients	22	14.97 %
Indication for enteral feeding tube inserted		
cerebrovascular accident (CVA)	74	51%
Dementia	56	38.1%
Inadequate oral intake	26	17.69%

	frequency	percent
Mental retardation	15	10.20%
Parkinson's disease	9	6.1%
Nasopharyngeal cancer	4	9.8%
Myopathy ,sever dysphagia	2	4.88%
Hunter syndrome	1	2.44%
Arnold chiari malformation	1	2.44%
Cerebral palsy	1	2.44%
Multiple systemic atrophy	1	2.44%
Childhood spinal atrophy	1	2.44%
Uterine tumor	1	2.44%
Becker's muscular dystrophy/multiple sclerosis	1	2.44%
Degenerative metabolic	1	2.44%
Tounge cancer	1	2.44%
Pituitary maroadenoma with hydrochelus	1	2.44%
Pituitary adenoma	1	2.44%
Amyotrophic latral sclerosis	1	2.44%
Post brain tumor resection	1	2.44%
Low grade oligodendroglioma	1	2.44%
Woodhouse sakati	1	2.44%
Cancer of tonsil	1	2.44%
Hypopharyngeal squamous cell carcinoma	1	2.44%
Quadriplegia	1	2.44%
Cerebellar degeneration	1	2.44%
Patients have 2> indications for enteral feeding tube inserted	43	29.66%
Swallowing assessment test - Positive test	90	62.50%
Modified barium swallow test - Positive test	81	55.10%
types of feeding tubes		
NGT	30	20.69
Jejunostomy feeding tubes (JFT)	13	8.97
percutaneous endoscopic gastrostomy (PEG)	19	13.10
percutaneous fluoroscopy gastrostomy (PFG)	82	56.55
Home health care follow up	54	37.24%
- male	31	21.68%
- female	23	16.08%
Mean of length of Hospital admission for AP after tube insertion per year = 22.1		

Table 2. *The Incidence of AP before and after feeding tubes insertions in all feeding tubes.*

Frequency of hospital admission for AP	**Before feeding tube insertion**		**After feeding tube insertion**		**P value**
	frequency	percent	frequency	percent	
<5 time	27	26.73	100	90.91	
>5 times	74	73.3	10	9.09	
					0.087
age group					
<65					
<5 time	7	7.1	25	23.4	
>5 times	18	18.4	7	6.5	
66-79					
<5 time	9	9.2	45	42.1	
>5 times	33	33.7	1	0.93	
>80					
<5 time	10	10.2	27	25.2	
>5 times	21	21.4	2	1.9	
					0.483
Gender					
<5 time					
Male	16	16	58	53.2	
Female	11	11	41	37.6	
					0.9795
>5 times					
Male	42	42	4	3.7	
Female	31	31	6	5.5	
					0.5207

< 5times in last two years before tube insertion , > 5 time two years after tube insertion

Table 3. *The incidence of AP before and after feeding tubes insertions in different feeding tubes.*

Incidence of AP	NGT		JFT		PEG		PFG		P value
	frequency	%	frequency	%	frequency	%	frequency	%	
Before feeding tube insertion									
<5 time	3	3.1	4	4.1	00	00	20	20.6	
>5 times	10	10.3	6	6.2	13	13.4	41	42.3	
after feeding tube insertion									
<5 time	16	14.9	7	6.5	17	15.9	57	53.3	
>5 times	2	5	00	00	1	1	7	6.5	
									0.2331

Jejunostomy feeding tubes (JFT), percutaneous endoscopic gastrostomy (PEG), percutaneous fluoroscopy gastrostomy (PFG)

Table 4. *Factors may affect the incidence of AP.*

	Frequency	%	P value	Odds Ratio	95% confidence limits
Rate of feeding					
Continuous	36	24.49%	0.0318	2.435	1.081 - 5.458
Bolus	86	58.50%	0.0315	0.435	0.204 – 0.929
Unknown	26	17.69 %			
Compare Continuous and Bolus			0.2911	1.711	0.631 – 1.461
			0.2455	0.576	0.227 – 1.461
Type of formula					
Jevity	83	56.46%	0.0632	0.489	0.230 – 1.040
Plumocare	5	3.40 %	0.0946	4.765	0.764 – 29.708
Insure	14	9.52 %	0.3339	0.467	0.099 – 2.190
Glucerna	22	14.97 %	0.1944	1.892	0.722 – 4.954
Peptamen	00	00	00	00	00 00
Alitraq	00	00	00	00	00 00
Nepro	3	2.04 %	0.1402	6.227	0.548 – 70.755
Suplena	4	2.72 %	0.2687	3.086	0.419 – 22.725
Unknown	24	16.33 %	0.9937	0.991	
oral diet after tube insertion					
Puried	23	15.65 %	0.9122	1.059	0.383 – 2.923
Liquid	3	2.05%	0.9803	< 0.001	< 0.001- >999.999
Regular	3	2.05%	0.9804	< 0.001	< 0.001- >999.999
Unknown	95	64.63 %			
Thickener used	14	9.52 %	0.1231	0.278	0.055 – 1.415
Person deliver feedings					
Member of family	56	38.36%	0.2143	0.602	0.270 – 1.341
Home nurse	16	10.96%	0.9700	<0.001	< 0.001- >999.999
Housemaid	14	9.59 %	0.1336	0.205	0.026 – 1.625
Hospital nurse	10	6.85%	0.6887	0.722	0.146- 3.561
unknown	58	39.73%			
Family training	83	56.85%	0.1235	0.554	0.261 – 1.175
Family education by medical staff at hospital before discharge	51	34.93%	0.8918	1.056	0.481 – 2.318
Family education by HHC	5	3.42 %	0.800	0.081	0.081 – 6.937
Both	50	34.25 %	0.0785	0.456	0.190 – 1.094
unknown	37	25.34%			

Table 5. *outcome.*

	alive		died		P value
Total	56	43.4%	73	56.59%	
Gender					
Male	28	22.1%	44	30.56%	
Female	28	22.1%	27	18.75 %	
age group					
<65	23	16.43%	14	10%	
66-79	24	17.14%	33	23.57%	
>80	7	5 %	24	17.14%	
					0.0195
follow up with Home health care	36	25%	14	9.72%	
no follow up with Home health care	20	13.89%	57	39.58 %	
					0.0001

Table 6. *Cause of death and long term feeding tubes.*

Cause of death	JFT	NGT	PEG	PFG	total
Acute renal failure	0	0	0	1	1 (1.52%)
Heart failure	0	0	0	1	1 (1.52%)
malignancy	0	3	1	3	7 (10.61%)
Septic shock	3	3	4	10	20 (30.30%)
Septic shock + Acute renal failure	0	0	0	1	1 (1.52%)
Septic shock+ gastrointestinal bleeding	0	0	0	2	2 (3.03%)
Septic shock + Acute respiratory failure/acute respiratory distress syndrome + Aspiration pneumonia	1	6	2	16	25 (37.88%)
Total	4 6.06%	14 21.21%	8 12.12%	40 60.61%	
Unknown	0	2	1	6	9 (13.64%)

5. Discussion

In our study the incidence of AP is 62 % before tube insertion and 76 % after tube insertion. It is similar to other study finding of 64.3%[12]. The commonest indication for feeding tube in our study is CVA. Dysphagia after a stroke is the most common cause of PEG tubes insertion in more than 121,000 Medicare recipients in the United States [1]. A systematic review reported that stroke patients with dysphagia demonstrate ≥3-fold increase in pneumonia risk with an 11-fold increase in pneumonia risk among patients with confirmed aspiration. Pneumonia is accounting for nearly 35% of post-stroke deaths[13].The second commonest indication in our study is dementia. Despite lack of evidence that feeding tubes benefit patients with dementia, patients with dementia who have difficulty swallowing or reduced food intake often receive feeding tubes[14]. In US nursing homes, one third of residents with advanced dementia are tube fed[15]. We did not find any association association between AP incidence and patients have two or more indications for feeding tube. The commonest feeding tube used in our study is PFG. Previous studies found that PFG has proved to be efficient and safe: the rate of successful tube placement is 98% to 100%; PFG has a slightly higher success rate compared with PEG[16].

In our study 20.69 % of patients had long term NGT because family refused to insert other types of feeding tubes. They don't want to expose patients to any invasive procedures and thought that may be the patients will get better. JFT is uncommon to be used among our patients and it is not clear if there was a trial to insert other types of tubes before decision was made to insert JFT.

In our study there is no difference in incidence of hospital admission for AP before and after tube insertion. The frequency is more in PFG but it could be because it is the commonest tube used. When we compared the incidence of readmissions among different types of tubes, it is statistically insignificant. This enforces the facts that while feeding tubes are initiated to prevent AP, it does continue to occur. It was reported that the aspiration of oropharyngeal contents will continue and the risk of pneumonia remains high in patients on feeding tube[17]. In other studies, age and demented nursing home patients on long-term enteral feeding experienced significantly more episodes of AP compared with those nursing home patients who were not tube fed[18]. The literature review of the effect of feeding tubes in AP showed variation in rate of AP. Incidence of AP is 22.9% in gastrostomy tube fed nursing home patients in a retrospective review[19] and 15.9% in jejunostomy-fed patients, so jejunostomy feedings do not offer effective protection against AP[20]. PEG was associated with a lower incidence of AP as compared to NGT[21, 22]. Direct percutaneous endoscopic jejunostomy (D-PEJ) was associated with lower incidence of AP as compared to percutaneous endoscopic gastrostomy-jejunostomy (PEGJ)[23]. AP occurs less frequently with PFG than with PEG[24]. However most of studies showed no difference between the different feeding tubes which is similar to our findings[25,26,27,28,29,30,31].

The commonest type of formula used was Jevity. It is a calorically dense formula that has unique fiber blends which provides balanced and complete nutrition. It helps patients to maintain their weight. Glucerna is used in 22 patients (14.97 %) it is a reduced-carbohydrate, modified-fat, fiber-containing formula designed for people with diabetes. This means 14.97 % of patients in the study were diabetic. There are no associations between incidence of AP and type of formula and any type of feeding tubes. Thickener used has no effect on the incidence of AP. There is no relationship between incidence of AP and type oral diet on long-term enteral feeding patients. The reason of combination of oral diet and feeding tubes because of inadequate oral intake which documented in 17.69% of patients based on calories counting. The use of thickened liquids is one of the most frequently used compensatory interventions in hospitals and long-term care facilities. Only little evidence suggests that thickened liquids result in significant positive health outcomes with regards to nutritional status or pneumonia. Despite the overall lack of evidence supporting the use of thickened liquids, this strategy continues to be a cornerstone in dysphagia management in many facilities[13].

We found a connection between incidence of AP and rate of feeding either continuous or bolus. Both have increased frequency of AP and have the same effect. This is similar to the finding of three randomized trials compared the two approaches and found that they have the same effect[32, 33, 34] which is similar to other studies[35, 36].

In our study, there are no relationships between the incidence of AP and person delivers feedings .This did not

change whether training was done by medical staff at hospital before discharge patient or HHC of the hospital or both. Other studies have shown that by the time of discharge, caregivers should be adequately trained on the various aspects of the tube feeding system, to ensure safe and effective feeding at home [37]. Interestingly, we found that the incidence of AP in patients who were followed up with HHC after discharge was less than patients without follow up.

To our knowledge, few studies have described the survival rate with such a long-term follow-up. Survival rate of patients have follow up with HHC was better as compared to no follow up with HHC. Over 6 years in our study, 56 patients (43.4%) survived. Long-term survival of geriatric patients in Japan treated with PEG showed 75% survived more than 6 months; 66% survived more than 1 year[38]. Others, found, survival after PEG insertion at 1, 6, 12, and 24 months were 90.5%, 52%, 42%, and 35%, respectively[39]. Other study of 68 cases (88%) showed that the 1-year survival rate was 64.0%, and the 2-year survival rate was 55.5 %[40]. Patients who receive a percutaneous feeding tube have a 30-day mortality risk of 18%–24% and a 1-year mortality risk of 50%–63%[41]. The largest report focused on 80,000 Medicare patients who had undergone PEG or surgical gastrostomy, the overall in-hospital mortality rate was 15%. In other report mortality at one and three years was 63 and 81 %, respectively[42].

In our study the commonest cause of death is AP with septic shock and respiratory failure. PFG has highest mortality rate may be because it is the commonest feeding tube used among our patients.

Old age is a poor prognostic factor associated with a higher mortality (p= 0.0018, odds ratio 1.028) and survival was better for patients have HHC follow up (p <0.0001, odds ratio 7.329). By using multiviate model we found age and HHC follow up are the most significant prognostic factors, age (p= 0.0067, odds ratio 1.030), and HHC (p <0.0001, odds ratio 8.379), however there are no association between outcome and gender (p= 0.1776, odds ratio 0.614), dementia (p= 0.8254, odds ratio 1.085) and having two or more indications for feeding tubes insertion (p= 0.5582, odds ratio 0.797).No randomized clinical trials (RCTs) have been done about enteral tube feeding , considerable evidence from studies of weaker design strongly suggest that tube feeding does not reduce the risks of death, AP, pressure ulcers, other infections, or poor functional outcome [14, 43].

Mean of length of hospital admission for AP after tube insertion per year is 22.1. AP increases a patient's hospital readmissions, the length of stay in the hospital is long and the cost is high. There are limited data on the economic costs of patient's hospital readmissions due to AP. The cost of managing a patient with a feeding tube (PEG) is reported to average over $31,000 per patient per year. The main components of this cost include the initial PEG procedure, enteral formula, and hospital charges for major complications[44]. There is urgent need to have strategies to reduce the cost.

This study has some limitations. It is a retrospective chart review where some missing data are expected and poor documentation was common during data collections. Since this study was performed at tertiary care hospital, generalizability may be limited due to small sample size. However, the size and diversity of the patient sample should help to reduce the potential effects of that limitation. Despite these limitations, this study finding is: (1) Comparison of four types of long-term enteral feeding showed no difference in incidence of AP before and after tube insertion. (2) Feeding tubes have limited medical benefits for AP prevention. Rate of feeding either continuous or bolus increase the frequency of AP. (3) No associations between the incidence of AP and age, gender, type of formula , thickener used, person deliver feedings and family training about method of feeding. (4) Old age is a poor prognostic factor and HHC follow up is a good prognostic factor for outcome. (5) AP increases a patient's hospital readmissions and length of stay in the hospital. There is an urgent need to have alternative strategies to reduce the cost.

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