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Comparison between Four Types of Long Term Tube Feeding Regarding Nutritional Effects, Complications and Outcomes

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Abstract: *Objective*: to compare four types of long term tube feeding regarding nutritional effects, tube-related complications and outcome. *Methods:* retrospective study. *Results:* Mean BMI at time of tube insertion is 23.3, two years later 20.3 (P= 0.0312). Patients have follow up with HHC their mean BMI at base line is 23.5, after two years 21.53 (p =0.547). No difference regarding albumin, urea, sodium, potassium, hemoglobin over 6, 12, 24 months either patient has followed up with HHC or not. High creatinine level in 12 months with jejunostomy tube (p= 0.0270). There are no major complications among the patients. No minor complications within 48 h of tube insertion in 42.18%, No complications after 48 h of tube insertion in 36.05%.The mortality rate is 56.59%. Old age is associated with a higher mortality (p 0.0018) and survival is better for patients who have HHC follow up (p <0.0001).The commonest cause of death is aspiration pneumonia with septic shock and respiratory failure 37.68 % and PFG has the highest mortality rate. *Conclusion:* 1) Patients on long-term feeding tubes don't gain weight. There is an urgent need to improve method of nutritional assessment and to have regular follow up to calculate their calories requirement and adjust their formula accordingly; 2) The nutritional status in four feeding tubes is similar except in12 months there is significant difference in creatinine in jejunostomy tube; 3) Rate of complications is low among our patients with reference to the long period of follow-up. Almost all complications have been mild and could be managed throughout adequately; 4) Tube related infection and leakage reported more in PFG. It could be because it is the commonest tube used among our patients.

Keywords: Enteral Tube Feeding, Mortality, Percutaneous Fluoroscopic Gastrostomy, Gastro Jejunostomy, Complications, Percutaneous Endoscopic Gastrostomy

1. Introduction

During the past two decades, enteral nutrition has become increasingly popular because of improved nutritional formulas, advances in catheter technology, and the development of less invasive techniques (including endoscopic and fluoroscopic) for placement of feeding tubes [1]. In western countries the number of patients on home enteral nutrition has doubled [2]. Despite the benefit of the enteral route for maintaining nutrition, complications have been reported .There has been few long terms follow up

studies. The use of feeding tubes in patients at KFSH&RC is common. Data about the use of long term feeding tubes in Saudi Arabia is limited [3,4,5,6]. The purpose of our study is to compare nasogastric tube (NGT), percutaneous endoscopic gastrostomy (PEG) tube, percutaneous fluoroscopy gastrosubetomy (PFG) tube and jejunostomy (JFT) tube regarding nutritional effects, tube-related complications and outcome. To our knowledge, our study is the first study conducted in Saudi Arabia to study these issues.

2. Methods

This is a retrospective study of adult patients on long term feeding tubes admitted to KFSH&RC from January 2002 to December 2007. Inclusion criteria: 1- adult patient (age >14 years old), 2- patients need long term tube feedings (> 4 weeks), 3- feedings tube is inserted at KFSH&RC. Exclusion criteria include patients need feeding tubes for short term for 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 medical records of all patients are analyzed using the following parameters: demographic data of the patients (age, sex), indications for feeding tubes, types of feeding tubes NGT, PEG, PFG and JFT. Reasons to keep patients on long-term NGT feeding, types of formula, nutritional effects (hemoglobin, albumin, prealbumin, urea, cretintine, sodium and potassium before and after feeding tubes insertion at baseline, 6 months .12 months and 24 months. BMI was compared at time of tube insertion and two years later. Complications were classified as major and minor. Major complications are defined as there is a need for surgical intervention. Minor complications are divided into early complication within 48 hours of tube insertion such as (diarrhoea, dehydration, abdominal bloating, vomiting and bleeding at sit of insertion) and late complications after 48 hours such as infection at site of insertion, block, malposition, leakage), Reason to change the tube . Aspiration pneumonia is not included in the complications because it was evaluated separately in other study. Outcome: Mortality rate and factors 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 on the patients' outcome. The level of statistical significance is set at $p < 0.05$.

4. Results

Numbers of medical records from January 2002 to December 2007 are 389. Patients excluded from the study are 244 because of 227 patients have tube feed inserted for short term which is less than 4 weeks, 7 patients their charts are missing and 10 patients their charts are in KFSH&RC-Jeddah and it is very difficult to request them. Patients who met the criteria of study are 145 patients. The main sample characteristics are presented in Table 1, (83 men and 62 women) males are predominant (57.24%), with a mean age of 65.3 ± 23.7, 85.03% are bedridden, 21.38% have tracheostomy and 37.24% have follow up with Home health care service(HHC) of the hospital. The commonest indications for enteral feeding tube are cerebrovascular accident (CVA) 49%, dementia 38.1%, inadequate oral intake 17.69%. Parkinson's disease in 6.1% of patients and it is not documented if it is associated with dementia or not. Patients who have two or more indications for feeding tubes are 29%. The commonest feeding tube used is PFG in 56.55% of patients as presented in Table 1. Patients who have NGT is 20.69 % because family refused to insert other types of feeding tubes. They don't want to expose patients to any invasive procedures and expect they will get better. The commonest type of formula used is Jevity in 56.46% of patients.

BMI when tube was inserted for the first time is known in 98 patients (72.59%) and BMI two years later are known in 38 alive patients (27.94%). The mean of BMI at time of tube insertion is 23.3 and two years later is 20.3 ($p= 0.0312$). For the patients who have follow up with HHC, their BMI mean at base line is 23.5 and after two years is 21.2 ($p= 0.547$). By using general linear model analysis (GLM) there is no difference between the four types of feeding tubes in BMI measurement two years after tube insertion ($p= 0.4409$).

As presented in table 2 there is no difference between the four types of feeding tubes regarding albumin, urea, sodium, potassium and hemoglobin over 6, 12, 24 months either patient has follow up with HHC or not. There is increased in creatinine level in 12 months as compared to baseline in patients who have JFT ($p= 0.0270$). However this not seen in other parameters likes urea, sodium and potassium. By using general linear model analysis (GLM) in12 months there is significant difference in creatinine level in JFT ($p=0.0011$). The mean creatinine level in JFT is 376 but in NGT, PEG and PFG (81.6, 97.25, 84.74) respectively.

There are no major complications found among the patients, only minor complications. There are no complications within 48 h of tube insertion in 62 patients (42.18%). As presented in table 3, minor complications are diarrhea in 8 patients (5.44%), dehydration in 4 patients (2.72%), vomiting in 3 patients (2.04%), diarrhoea+ abdominal bloating in 2 patients (1.36%), bleeding at site of insertion in 2 patients (1.36%), abdominal bloating in one patient (0.68%), high residual in one patient (0.68%)and pneumoperitoneumin in one patient (0.68%),and it resolved spontaneous without surgical intervention.

There are no complications after 48 h of tube insertion in 53 patients (36.05%). As presented in table 3, complications reported are infection at site of insertion in 25 patients (17.0%) and 6 patients (4.08%) their tube are changed, tube block in 12 patients (8.16%) and10 patients their tube are changed (6.85%), malpositionin in 4 patients (2.72%), leakage in 22 patients (14.97%) and 13 patients(8.84%) their tube are changed. There is no difference between the four tubes regarding the early complications within 48 h of tube insertion (p= 0.583). However there is a significant difference regarding the complications after 48 h of tube insertion, the infection at the site of insertion which reported more in PFG (p= 0.0066). It could be because it is the commonest tube used among our patients. There is no difference regarding tube block (p=0.175) or malpositionin (p=0.8466). There is a a significant difference regarding leakage in PFG and PFG (p= 0.0022).

Reason to change the tube is routine in70 patient (47.62 %), there is no difference regarding reason to change the tube between the four tubes (p= 0.2771) as in figure 1. The survival rate is 43.4% and the mortality rate is 56.6%. Old age is a poor prognostic factor associated with a higher mortality (p =0.0018, odds ratio 1.028) and survival is better for patients who have HHC follow up (p <0.0001, odds ratio 7.329).The commonest cause of death is aspiration pneumonia with septic shock and respiratory failure 37.68 % and PFG has the highest mortality rate and that may be because it is the commonest feeding tube used among our patients as presented in table 4, 5,6.

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%
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%

Table 2. *Difference between the four types of feeding tubes regarding albumin, urea, creatinine, sodium, potassium and hemoglobin*

Duration	Albumin <=30 mg/dl	prealbumin	Urea 2.5-7.5 mmol/l	Creatinine 46-96 µmol/l	Hemoglobin 11-16 g/dl	Sodium 135-147mmol/l	Potassium 3.5-5 mmol/l
6 months	P=0.4393	00	P=0.1777	P=0.1634	P=0.3213	P=0.9291	P=0.9989
12 months	P=0.6458	00	P=0.2862	P=0.0270	P=0.2218	P=0.8020	P=0.3022
24 months	P=0.3421	00	P=0.6889	P=0.5207	P=0.3333	P=0.3329	P=0.2193

Table 3. *Complications of feeding tube*

Complications	Frequency	%
Early (48 h)		
No complications	62	42.18%
Diarrhoea	8	5.44%
Dehydration	4	2.72%
Abdominal bloating	1	0.68%
High residual	1	0.68%
Vomiting	3	2.04%
Diarrhoea+ Abdominal bloating	2	1.36%
Pneumo peritoneum	1	0.68%
Bleeding at sit of insertion	2	1.36%
Unknown	61	41.50%
Late after 48 h		
No complications	53	36.05%
infection at site of insertion	25	17.0%
Block	12	8.16%
Malposition	4	2.72%
Leakage	22	14.97%
Unknown	33	22.45%

Table 4. *Outcome*

	alive	died	P value
Total	56 43.4%	73 56.59%	
Gender			
Male	28 22.1%	44 30.56%	0.1764
Female	28 22.1%	27 18.75 %	
age group			
<65	23 16.43%	14 10%	
66-79	24 17.14%	33 23.57%	0.0195
>80	7 5 %	24 17.14%	
follow up with Home health care	36 25%	14 9.72%	0.0001
no follow up with Home health care	20 13.89%	57 39.58 %	

Table 5. *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%)

Table 6. *Prognostic factors affecting outcome*

	P value	odds ratio
Age	0.0018	0.028
Gender	0.1776	0.614
Dementia	0.8254	1.085
Have 2 or more indications for feeding tubes	0.5582	0.797
HHC follow up	<0.0001	7.329
Albumin 6 months	0.5595	1.038
Albumin 12 months	0.1145	0.916
Creatinine 6 months	0.6286	0.999
Creatinine 12 months	0.5252	1.003
Urea 6 months	0.2978	1.035
Urea 12 months	0.9339	1.005
Sodium 6 months	0.3092	0.953
Sodium 12 months	0.4813	1.032
Potassium 6 months	0.5114	0.790
Potassium 12 months	0.7288	1.222
Haemoglobin 6 months	0.7691	1.00
Haemoglobin 12 months	0.4754	0.992

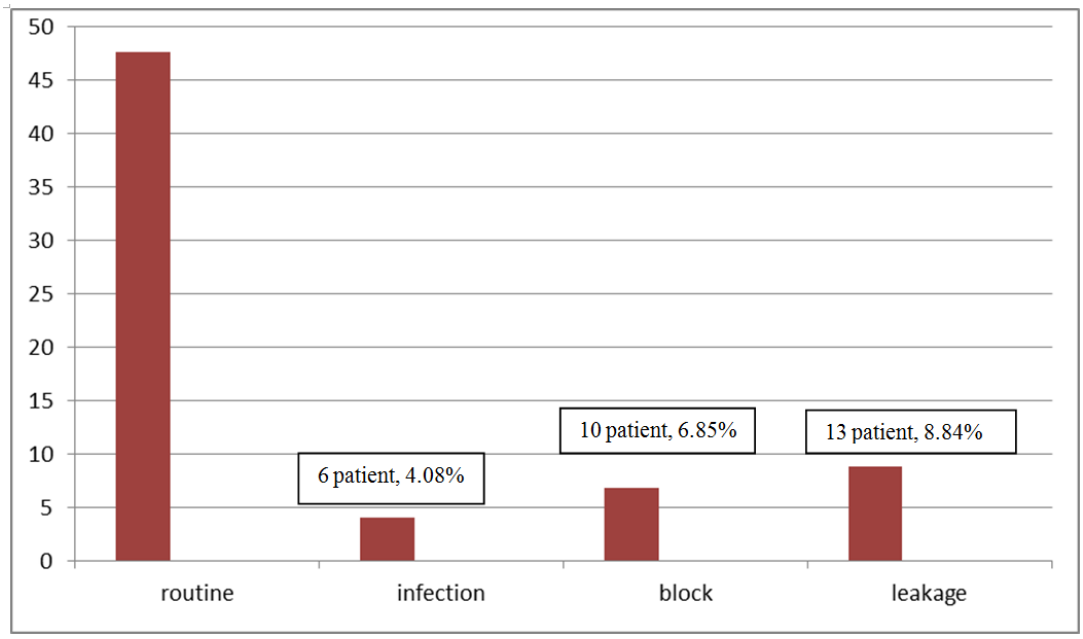

Figure 1. *Reason to change the tube*

5. Discussion

There is a failure to gain weight after tube insertion; actually there is evidence of loss weight. This could be because of inadequate nutritional support and the patients are not taking enough caloric requirements; there is no follow up from a dietarian for nutritional assessment. These patients continue to have the same amount of feeding formula without any adjustment. Or it may be as a result of multiple comorbidities in elderly patients which may affect their nutritional status.

Either a patient has follow up with HHC or not, the nutritional status in four feeding tubes is similar in 6 months, 12 months and 24 months. There is an increase in creatinine level in 12 months as compared to baseline in patients who have JFT. This could be related to inadequate fluid intake during feeding which cause dehydration or may occur as a result of multiple comorbidities among elderly which may affect the renal function in addition to medications like diuretic. JFT is uncommon to be used among our patients. We don't know the baseline creatinine in patients who have JFT which could be already high and not related to JFT insertion.

Prealbumin has never been recorded in any patients. It is clear that prealbumin is not used in our clinical practice to assess the nutritional status of the patients.

In literature review PEG is more effective than NGT in improving the nutritional status.[3,4,5,6] A study showed that the usage of PEG cause stabilization of weight and an increase in serum albumin within two months of beginning PEG tube feedings[7]. Another study showed that within six months 50 % of the patients had gained weight, while 31 % had no change in their weight.[8]

Despite the attractiveness of the enteral route for maintaining nutrition, complications have been reported. There are no major complications found among our patients, only minor complications. Major complications are gastric perforation, gastrocolic fistula, internal leakage, dehiscence, peritonitis, aspiration pneumonia, subcutaneous abscess and buried bumper syndrome (migration of the internal bumper of the PEG tube into the gastric or abdominal wall) Minor [9,10,11] complications are blockages, dislodgements, degradation, external leakage, and unplanned removal and site infection. There are no complications within 48 h of tube insertion and all complications reported are minors. Rate of complications related to feeding tube is low among our patients. While the literature reports minor complications for PEGs range from 0% to 27.1% and ranging from 23% to 46% for PFGs, the methods of reporting complication rates were inconsistent[13]. There is a study which showed that pneumoperitoneum on routine imaging is not unexpected and slowly resolves over 1-3 days [14]. Pneumoperitoneum was a common finding after PGJ tube placement. Conservative management of pneumoperitoneum after PGJ is warranted [15]. There is a study which showed that deep stomal infection is more frequent in PEG than in PFG because tube is passed through the mouth/oropharynx and can be contaminated by oral flora, resulting in wound infection. Prophylactic antibiotics is needed in PEG, however, prophylactic antibiotics is not a routine practice for PFG. Complications have been reported in 2%-12% of patients in whom jejunostomy tubes were placed. [1,16.20]

In our patients the most significant prognostic factors are age and HHC .Old age is a poor prognostic factor associated with a higher mortality and survival is better for patients who have HHC follow up. The commonest cause of death is aspiration pneumonia with septic shock and respiratory failure and PFG has the highest mortality rate and that may be because it is the commonest feeding tube used among our patients.

In conclusion, this study has some limitations. It is a retrospective chart review where some missing data are expected and poor documentation was noticed during medical records data collections. Since this study was performed at tertiary care hospital, generalizability may be limited due to the small sample size. However, the diversity of the patients sample should help to reduce the potential effects of that limitation.

Due to the retrospective nature of the study, we could collect only basic clinical information but functional status, quality of life and the patients' cognitive status at the time of tube insertion are not included in our data because they have never been documented in patient charts. Despite these limitations; this is the first study in Saudi Arabia to compare feeding tubes regarding nutritional effects, complications and outcomes. There is an urgent need to improve method of nutritional assessment and to have regular follow up for patients on long term feeding tubes. Rate of complications related to feeding tube is low among our patients (majority are elderly) with reference to the long period of follow-up. Almost all complications have been mild and could be managed throughout adequately. Further studies should include longer follow up periods, more patients and additional questions regarding quality of life.

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