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By

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ABSTRACT

Background: Dysphagia refers to feeding or swallowing disorders characterized by challenges with the placement, reception, maintenance, and transmission of food and liquids from the oral cavity to the esophagus and stomach.

Purpose: To evaluate the socioeconomic and medical impact of percutaneous endoscopic gastrostomy in children suffering from neurological digestive disorders.

Patients & methods: This was a follow up prospective study performed on thirty children who had neurological swallowing difficulties that was predetermined at the Outpatient Clinic of the Pediatric Gastroenterology Unit and the Inpatient of the Pediatric department, Faculty of Medicine, Al-Azhar University Hospitals, from January 2022 to January 2024.

Results: Our results showed that regarding demographic data of the studied group. The patients age was 7.25 ± 4.290 years. Male were 17 while female were 13. Distribution of studied sample according to manifestations it shows that 21 had Intractable convulsions, 13 with Frequent choking, 11 patients complaining from recurrent pneumonia, regarding to complications of PEG Major Complications show that one patient had Buried bumper syndrome. Minor Complications 12(40.0%) had Local infection, 9(30.0%) had Accidental removal, 1(3.3%) had Leakage and 1(3.3%) had Fistula formation. Our study revealed, significant decrease in all medical outcomes except neurological signs, Also, there was statistically significant improvement of family social impact of PEG and it shows that 25(83.3%) had good family's satisfaction, 30(100.0%) of caregiver had no difficulties in finding a place to feed outside the home, Also there was significant positive economic impact where the majority of patients had reduce the costs of repeatedly hospitalizing.

Conclusion: PEG had a positive medical improvement for children with neurological swallowing difficulties and a positive socioeconomic impact on both the child and the caregiver.

Key words: percutaneous endoscopic gastrostomy (PEG); Neurological swallowing Difficulties; Medical and socioeconomic impact

INTRODUCTION

Dysphagia is the difficulty in feeding or swallowing, which can cause problems with the movement, reception, retention, and passage of food and liquids from the mouth to the esophagus and stomach. Ignoring these disorders can result in serious consequences like malnutrition, social isolation, compromised breathing, and aspiration pneumonia. (*Malandrak et al., 2014*)

Tube feeding is an extremely prevalent enteral nutrition method for patients who are incapable of eating or drinking independently. Prior to the widespread adoption of novel systems, such as PEG. This necessitates more investigation for existing approaches.

However, the potential efficacy of a PEG is highly dependent on the underlying disease and cannot be evaluated with a single result in mind. (*Dodril et al., 2015*)

Feeding & swallowing in children may be hindered by a variety of factors, such as sensorimotor function impairments, insufficient achievement of typical eating and feeding milestones and the necessary sub skills associated with each; and disturbances in eating pragmatics, or the social behaviors required while eating. Children who experience such disturbances may develop malnutrition, stunted growth and development, and deteriorating health. (*Dodril et al., 2015*)

This makes Gastrostomy is recommended for individuals who require artificial enteral nutrition for a duration exceeding two to three weeks. (*Macchini, et al., 2018*) And children with digestive disorders require prolonged use of parenteral fluids and nutritional supplementation. (*Merli, et al., 2016*)

PEG has long facilitated enteral nutrition in infants who are incapable of orally meeting their nutritional requirements. (*Fernandes, et al.2018*)

The child's enhanced physical and mental well-being facilitated increased engagement in community activities, even autonomously from the immediate family. (*Gosa, et al.,2020*).

Gastrostomy allowed consistent feeding and medication delivery, with direct improvements in child QOL in relation to physical health (*Jacoby et al., 2020*). Caregivers also described their child's mood as more stable, possibly associated with being more alert, active and healthier, with reduced negative emotions, possibly associated with less hunger and feeding challenges. These

improvements to physical and mental health allowed the child greater capacity to participate in the community, sometimes independently from the immediate family (*Glasson et al., 2020*).

The aim of this study

To evaluate the socioeconomic and medical impact of percutaneous endoscopic gastrostomy in children suffering from neurological digestive disorders.

PATIENTS AND METHODS

This was a follow up prospective study performed on thirty children suffering from neurological digestive disorders that was predetermined at the Outpatient Clinic of the Pediatric Gastroenterology Unit, and the Inpatient Units of the Pediatric department Faculty of Medicine, Al-Azhar University Hospitals (Al-Hussein & Sayed Galal Hospitals); and referrals from other medical facilities, From January 2022 to January 2024.

Ethical consideration:

- Approval by the ethical committee of the pediatrics department at the faculty of Medicine at Al-Azhar University under the registration number was obtained before the study.
- Patients were enrolled in the study after getting informed oral and written consent from their parents.
- Patient data confidentiality was preserved during all study procedures.
- The patient and parents have the right to withdraw at any time.
- There was no conflict of interest regarding the study or publication.
- There is no financial support or sponsorship.

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Sample size equation:

The sample size was calculated according to study carried out by (Locher, J. L.—Bell, sample size required for this study was estimated to be 23 considering a 95% confidence level, with a power of 80%. will use Cochran's Formula to calculate sample size (Charan and Biswas, 2013).

$$\text{Sample Size} = \frac{Z_{1-\alpha/2}^2 P(1-P)}{d^2}$$

d= absolute error (0.05)

P= prevalence of tube replacement was 12%.

$Z_{1-\alpha/2} = 1.96$

$$\text{Sample Size} = \frac{1.96^2 * 0.0169(1 - 0.13)}{0.05^2} = 23$$

Thus, the sample size was increased to 30 subjects to assure adequate power during follow up

Inclusion criteria:

Age from 1 to 18 years.

Sex both sexes will be involved.

Any patient with neurological swallowing difficulties with one or more of the following:

- failure to thrive
- Recurrent aspiration pneumonia.
- feeding difficulty requiring nasogastric feeding.
- frequent choking, refusal of feeding or vomiting
- Intractable convulsion

Exclusion criteria:

Any child with one or more of the following:

- Severe gastroesophageal reflux
- Unfavorable gastrointestinal anatomy, and limited life expectancy.
- Severe skeletal deformity kyphosis or scoliosis.
- Life threatening condition as serious coagulation disorder, hemodynamic instability, sepsis, severe ascites, peritonitis and gastric outlet obstruction.

Study procedure

All the studied cases were subjected to the following:

- I. Full detailed History e.g., name, age, sex, underlying neurological manifestations documented by pediatric neurologist.
- II. Full clinical examination focusing on:
 - a) General examination: Measurement of body weight and length will be recorded 1 day before PEG tube placement and at least 6 months after the insertion.
 - b) Local: neurological examination.

III. Laboratory investigations: done before and after PEG insertion.

- a) CBC (Hb ,WBC and PLt.)
- b) CRP
- c) Liver function tests (SGPT,SGOT and S. Albumin)
- d) Urea and creatinine
- e) Bilirubin total and direct

IV. PEG procedure; All patients received intravenous sedation or general anesthesia during the procedure. We used 20 Fr Standard Percutaneous Endoscopic Gastrostomy (PEG) Kit Cook and Boston Pull PEG kit with pull technique. The procedure performed using the pull method and requiring 2 physicians. One for endoscopic guidance and the other was for percutaneous interventions. The patient placed in a supine position and the head will be raised 45 degrees to keep the colon below the stomach. Skin sterilization will be performed before the introduction of the scope to avoid excessive air, which could have dilated the colon to cross in front of the stomach. After sterilization, the percutaneous entrance will be implemented in the epigastric region after considering the light of the endoscope on the skin and the fluctuation sensed by the fingers. To maximize post-operative pain control, PEG tube incision site was infiltrated during the procedure with Bupivacaine (duration of action: 2e8 h).After performing a diagnostic esophagogastroduodenoscopy, the stomach will be fully inflated to push the liver, spleen, and colon away from the gastrostomy puncture site.

The ideal position of gastrostomy is the anterior wall of the middle or lower body. A dose of prophylactic antibiotics, generally first-generation cephalosporin, will be administered 30 minutes before the procedure. Three doses will be subsequently administered. 8 hours after the insertion of the PEG tube, the newly inserted gastrostomy tube was used for clean water feeding and later for a liquid diet, if there were no complications.

- V. follow up after 6 months: including:
 - . Measurement of weight and height
 - Number of vomiting per day
 - Number of convulsions per week
 - Number of pneumonia per month
 - Number of hospital admissions
 - Lengths of hospital stay

impact of living with your child’s PEG feeding.

Statistical analysis of the data ⁽¹⁾

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) ⁽²⁾ Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean and standard deviation. Significance of the obtained results was judged at the 5% level.

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Kirkpatrick LA, Feeney BC. A simple guide to

- Major complications include death, peritonitis, hemorrhage necrotizing fasciitis, tumor implantation, and aspiration pneumonia after percutaneous endoscopic gastrostomy insertion, Buried bumper syndrome. Minor complications include leakage, local infection, fistula formation, ulcers, and accidental removal. Laboratory investigations: done before and after PEG insertion.

VI. Socioeconomic impact:

By evaluation of socioeconomic impact and quality of life of patients with inserted PEG tube an original survey was used, where parents/caregivers answered questions about the quality of life for both, the family and the patient, gastrostomy handling and rehabilitation. Parent questionnaire developed from the findings of study done at 2007 by Brotherton, et al: the

The used tests were

1 - Chi-square test

For categorical variables, to compare between different groups

2 - Student t-test

For normally quantitative variables, to compare between two studied groups

4 - Mann Whitney test

For abnormally quantitative variables, to compare between two studied groups

IBM SPSS statistics for version 20.0. Student ed. Belmont, Calif.: Wadsworth, Cengage Learning; 2013

.RESULTS

Our results will be demonstrated in the following tables:

Table (1): Distribution of studied patients according to demographic data.

	Number	Percent
Age (years)		
1 – 5	10	33.3
5 – 10	12	40.0
10 – 15	8	26.7
Mean±S.D.	7.25±4.290	
Sex		
Male	17	56.7
Female	13	43.3

Table (1) shows demographic data of the studied group

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Table (2): Distribution of studied sample according to underlying disease.

	Number	Percent
Cerebral palsy	19	63.3
Spastic quadriplegia	16	53.3
Atonic	2	6.7
Post meningitis quadriplegia	1	3.3
Neurodegenerative	8	26.7
Metachromatic Leukodystrophy	4	13.3
Ceroid neuronal lipofuscinosis	2	6.7
Krabbe disease	1	3.3
Adrenoleukodystrophy	1	3.3
Down syndrome	2	6.7
Autism	1	3.3
Total	30	100

Table (2) shows the underlying neurological disease of the studied group .

Table (3): Comparison of clinical outcome and medical impact before and after PEG insetion in studied patients.

	Treatment				Test of Sig.	P value
	Before		After			
	No.	%	No.	%		
No. of vomiting / day						
Mean ±S.D.	2.24±2.824		0.03±0.186		T=4.277	<0.001
No. of convulsions / week						
Mean ±S.D.	10.87±14.282		0		T=4.168	<0.001
No. of pneumonia / month						
Mean ±S.D.	0.73±1.081		0		T=3.698	<0.001
No. of hospitalization / month						
Mean ±S.D.	1.23±1.194		0.10±0.305		T=5.022	<0.001
Duration of hospitalization						
No	9	30.0	28	93.3	X ² = 25.698	<0.001*
1 week	15	50.0	2	6.7		
1-2 weeks	2	6.7	0	0		
2 weeks	2	6.7	0	0		
3 weeks	1	3.3	0	0		
4 weeks	1	3.3	0	0		
Weight (kg)						
Mean±S.D.	12.05±2.291		14.81±3.635		T= 3.518	<0.001
Height (cm)						
Mean±S.D.	100.70±21.202		101.50±20.879		T= 0.147	0.883
BMI (kg/m²)						
Mean±S.D.	12.05±2.291		14.81±3.635		T= 3.518	<0.001

Table (3) there is significant improvement of all clinical and medical outcome after PEG insertion in studied patients.

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Table (4): Distribution of studied sample according to Socioeconomic Impact before and after PEG..

	No		Yes		X ²	P value
	No.	%	No.	%		
Social effect						
Has the family's satisfaction increased after the installation of the gastric tube?	5	16.7	25	83.3	26.6	<0.001
Do you experience difficulties finding a place to feed outside the home?	30	100	0	0	60	<0.001
Has the family's communication with relatives and friends increased after the installation of the gastric tube?	3	10.0	27	90.0	38.4	<0.001
Did you find it difficult to deal with the gastric tube?	28	93.3	2	6.7	45.06	<0.001
Does PEG feeding restrict your ability to go out?	30	100	0	0	60	<0.001
Did the gastric tube make the child's physical rehabilitation difficult?	26	86.7	4	13.3	32.26	<0.001
Did the gastric tube make the child's life difficult?	28	93.3	2	6.7	45.06	<0.001
Economic effect						
Did installing a gastric tube reduce the costs of repeatedly hospitalizing the child?	5	16.7	25	83.3	26.66	<0.001
Did installing a gastric tube reduce the costs of medications for treating the child?	3	10.0	27	90.0	38.4	<0.001
Did inserting a gastric tube save parents time to work and earn money?	1	3.3	29	96.7	52.26	<0.001

Table (4) there is significant improvement of social and economic effect after PEG in studied patients.

Table (5): Distribution of studied sample according to complications(outcome after PEG).

	Number	Percent
Major Complications	1	3.3
Buried bumper syndrome	1	3.3
Death	0	0
Peritonitis	0	0
Hemorrhage	0	0
Necrotizing fasciitis	0	0
Tumor implantation	0	0
Aspiration pneumonia	0	0
Mainor Complications	22	73.3
Local infection	12	40.0
Accidental removal	9	30.0
Leakage	1	3.3
Fistula formation	1	3.3
Ulcers	0	0

Table (5) Shows that Major 1patient (3.3%) had Buried bumper syndrome. Minor Complications show that 12(40.0%) had Local infection, 9(30.0%) had Accidental removal, 1(3.3%) had Leakage and 1(3.3%) had Fistula formation.

DISCUSSION

Our study showed that the participants' ages varied from 1 to 15 years, with a mean of 7.25±4.290 years. There were 17 male (56.7%) and 13 female (43.3%). Our results showed that the underlying disease of the studied group,were 19 (63%) had Cerebral palsy, 16(53.3%) had Spastic quadriplegia, 2 (6.7%) Atonic and 1(3.3%) had Post meningitis quadriplegia; while, 8(26.7%) had neurodegenerative disease, 4(13.3%) had Metachromatic Leukodystrophy, 2(6.7%) had Ceroid neuronal lipofuscinosis, 1(3.3%) had Krabbe disease and 1(3.3%) had Adrenoleukodystrophy and 2(6.7%) with down syndrome and 1(3.3%) with autism.

Similar data was presented by(*Alsaggaf et al.,2013*) who reported that the majority of patients (77%) were diagnosed with cerebral palsy, and the vast majority of patients (97%) had severe physical and mental disabilities. Severe pseudobulbar palsy was the most prevalent indication, observed in 22 cases (73%), characterized by inadequate oral intake, recurrent choking, and/or chest infections in all patients.

Also, our findings showed that 21 patients (70.0%)

hadIntractable convulsions, 13(43.3%) had Frequent choking, 11(36.7%) had Recurrent pneumonia, 10(33.3%) had Recurrent Vomiting, 9(30.0%) complaining from Failure to gain wt., 8(26.7%) with Refusal of feeding and 5(16.7%) had Replacement. According to (*Wu et al.,2013*) out of the 17 patients studied, 9 out of 67 experienced neurological dysfunction. Additionally, two of them had gastrointestinal diseases, with one having gastric volvulus and the other having ineffective esophageal motility disorder. Furthermore, five patients had metabolic disorders, including two with persistent hyperinsulinemia & hypoglycemia of infancy, Indications for PEG insertion (according to Saddah.2012) included; inability to swallow, most frequently neurologically impaired kids, Chronic illnesses with inadequate caloric intake, Unpalatable medication & Permanent enteral access & gastric decompression.

Our study showed that Major Complications occurred in one patient 1(3.3%) had Buried bumper syndrome. Mainor Complications show that 12(40.0%) had Local infection, 9(30.0%) had Accidental removal, 1(3.3%) had leakage, 1(3.3%)

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had Fistula formation,

The findings of our study align with those of (*Brewster et al.2012*) who found that out of the 92 patients with complete data, 82 (89%) did not experience any problems. No instances of procedure-related mortality, problems during surgery, peritonitis, bleeding, or organ damage were detected. A total of 13 problems were detected in 10 cases, resulting in a complication rate of 14%. The distribution of overall problems were 5 instances of dislodgment or migration seen in 5.4% of patients. Additionally, there were 6 cases of infection in 6.5% of patients & 2 occurrences of unexpected operations in 2.2% of patients.

According to (*Vervloessem, et al.2009*), the incidence of significant complications ranging from Our results showed that Social Impact of the studied group and it show that 25(83.3%) had family's satisfaction increased, 30(100.0%) caregiver had no difficulties in finding a place to feed outside the home, 2(6.7%) had difficult to deal with the gastric tube, 4(13.3%) the gastric tube make the kid's physical rehabilitation difficult and 2(6.7%) the gastric tube make the kid's life difficult,30(100.0%) PEG feeding not restrict ability to go out for caregiver , while Economic effect show that the majority of patients had reduce the costs of repeatedly hospitalizing the child, reduce the costs of medications for treating the child and save parents time to work and earn money.

Our results are consistent with (*Brewster et al 2012*), who reported that Complication rates associated with PEG in minors have decreased in comparison to historical PEG literature, and the data suggest a safety profile comparable to contemporary LAP-G procedures. PEG continues to be a secure and efficient technique for establishing enteral nutrition access in pediatric patients.

Conclusion

PEG is safe and useful way to feed children with neurological swallowing difficulties. It provides the appropriate amounts of food for normal growth and improves their general condition, thus increasing weight and increasing muscle mass and body mass index.

PEG had positive impact on social aspect of children, their relative and caregivers, had no difficulties to feed outside, PEG improved the economic aspect for children, caregiver the majority

complications necessitating unanticipated endoscopic or surgical intervention, nonprophylactic antibiotic usage, or blood transfusion, to those culminating in mortality, was approximately 12.6% to 17.5% .

Our outcomes indicated that there was significant variance among studied patient before & after PEG regarding to Hb, TLC and CRP.

Our results supported with (*Barbosa, et al 2016*), who reported that there was statistically significant difference regarding before & after treatment according to CRP, the patients who died during follow-up had lower levels of hemoglobin ($p < 0.001$), greater values of leucocytes ($p = 0.005$) and higher CRP values ($p = 0.008$)

of patients had reduced the costs of repeatedly hospitalizing the child, and the costs of medications for treating the child and save parents time to work and earn money

Recommendations

- ❖ PEG is safe and useful way to feed children with neurological swallowing difficulties. It provides the appropriate amounts of food for normal growth and improves their general condition, thus increasing weight and increasing muscle mass and body mass index.
- ❖ PEG insertion in children with neurological swallowing difficulties as early as possible to avoid complication of this problem (aspiration pneumonia, vomiting, malnutrition, recurrent hospitalization and intractable convulsion)
- ❖ Spreading a culture of PEG use among doctors and relatives of children with neurological swallowing difficulties
- ❖ Raising awareness of its benefits from a medical, economic, and social impacts compared to the problems facing doctors and families from a medical perspective, such as frequent illness, malnutrition, frequent hospitalization for long periods, and the accompanying exposure to repeated infections and family instability, in addition to high financial expenses.

Limitation

- ❖ Teaching relatives more about how to use the tube, care of it, cleaning it, and monitoring this well due to the differences in the level of education and culture among them to avoid problems infection, dislodgement.
- ❖ Further studies on larger sample size and on large geographical scale to emphasize our conclusion to discuss and searching about complications (causes, how to minimize)
- ❖ Further studies on larger sample size and on large geographical scale to emphasize our conclusion to social aspect in terms of differences in education, residence, work of the father and mother, the family's relationship with each other, and the assessment of the psychological state of all family members and their acceptance of the child's medical condition.
- ❖ Further studies on larger sample size and on large geographical scale to emphasize our conclusion to economic impact taking into account differences in income, spending rate, level of living, number of working individuals, and nature of work and residency.

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