A randomised prospective comparison of percutaneous endoscopic gastrostomy and nasogastric tube feeding after acute dysphagic stroke

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Abstract

***Objective*—To compare percutaneous endoscopic gastrostomy and nasogastric tube feeding after acute dysphagic stroke.**

***Design*—Randomised prospective study of inpatients with acute stroke requiring enteral nutrition.**

***Setting*—One university hospital (Nottingham) and one district general hospital (Derby).**

***Subjects*—30 patients with persisting dysphagia at 14 days after acute stroke: 16 patients were randomised to gastrostomy tube feeding and 14 to nasogastric tube feeding.**

***Main outcome measures*—Six week mortality; amount of feed administered; change in nutritional state; treatment failure; and length of hospital stay.**

***Results*—Mortality at 6 weeks was significantly lower in the gastrostomy group with two deaths (12%) compared with eight deaths (57%) in the nasogastric group ($P<0.05$). All gastrostomy fed patients (16) received the total prescribed feed whereas 10/14 (71%) of nasogastric patients lost at least one day's feed. Nasogastric patients received a significantly ($P<0.001$) smaller proportion of their prescribed feed (78%; 95% confidence interval 63% to 94%) compared with the gastrostomy group (100%). Patients fed via a gastrostomy tube showed greater improvement in nutritional state, according to several different criteria at six weeks compared with the nasogastric group. In the gastrostomy group the mean albumin concentration increased from 27·1 g/l (24·5 g/l to 29·7 g/l) to 30·1 g/l (28·3 g/l to 31·9 g/l). In contrast, among the nasogastric group there was a reduction from 31·4 g/l (28·6 g/l to 34·2 g/l) to 22·3 g/l (20·7 g/l to 23·9 g/l) ($P<0.003$). In addition, there were fewer treatment failures in the gastrostomy group (0/16 versus 3/14). Six patients from the gastrostomy group were discharged from hospital within six weeks of the procedure compared with none from the nasogastric group ($P<0.05$).**

***Conclusion*—This study indicates that early gastrostomy tube feeding is greatly superior to nasogastric tube feeding and should be the nutritional treatment of choice for patients with acute dysphagic stroke.**

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Introduction

It has been suggested that up to 45% of all cerebrovascular accidents (strokes) are complicated by dysphagia.[1,2] Gordon has demonstrated that dysphagia complicates 35% of first episode monohemispheric strokes and has an associated mortality at six weeks of around 50%.[2] The natural history of dysphagia after an acute cerebrovascular accident, however, is poorly understood, and the time at which a swallowing deficit becomes irreversible is not clearly defined.[3,4] Consequently, it is common practice to delay enteral feeding in such patients for several weeks. In the United Kingdom most patients admitted after a cerebrovascular accident are eventually fed, at least in the initial stage, through a nasogastric tube. There are well recognised problems associated with nasogastric tube feeding,[5-7] notably the inadvertent removal of the tube with an inherent risk of pulmonary aspiration.[7,8] In addition, frequent unintentional removal of the nasogastric tube leads to a discontinuation of nutritional intake, and the amount of feed lost to the patient is often underestimated.[9] Percutaneous endoscopic gastrostomy is a relatively new method of enteral feeding[10,11] and is associated with low morbidity and mortality.[12] It can be safely performed in patients after a recent stroke[13,14] who would otherwise represent a considerable anaesthetic risk.

We performed a prospective randomised comparison of endoscopic gastrostomy versus nasogastric tube feeding after acute dysphagic stroke.

Patients and methods

Patients were recruited after an acute cerebrovascular accident with persisting dysphagia for eight or more days. Patients were recruited for a one year period commencing February 1994. At the start of the study period we circulated a request to consultant colleagues from both general medical and geriatric departments for referral of potential patients as above. Each patient was then assessed by one of the authors. We recruited the first 30 patients who fulfilled the criteria admitted to either the Nottingham City hospital (eight) or the Derbyshire Royal Infirmary (22) during this period. Twenty five out of 30 patients had computed axial tomography of the brain to confirm the diagnosis of stroke, but in all cases a firm diagnosis could be made on clinical grounds. All patients had clinical evidence of a severe stroke, primarily dense hemiplegia, and were unconscious at the time of admission. At the time of recruitment patients were assessed by using the Barthel activities of daily living index (range 0-20), which is an assessment of disability after a stroke and a guide to how much care a patient is likely to require.[15] Dysphagia was demonstrated by the absence of a normal gag reflex or the inability to swallow 50 ml of sterile water easily without choking, or both. Each patient by this stage was in a stable condition and enteral feeding considered appropriate by the referring clinician. Those patients with a previous history of gastrointestinal disease which would preclude siting a gastrostomy tube or who were unfit for upper gastrointestinal endoscopy and intravenous sedation were excluded. If patients fulfilled the above criteria informed consent was obtained from the next of kin after a full explanation. Patients were randomly allocated by closed envelopes at 14 (plus or minus 3)

days to receive enteral nutritional support via either a fine bore nasogastric tube (Flocare 500) or a gastrostomy tube (12 French gauge Fresenius or 24 French gauge Wilson Cook). Nasogastric tubes were passed by experienced senior nursing staff from the ward on which the patient was being cared for. Gastrostomy tubes were inserted by using a percutaneous approach and pull through technique.[10] Sedation was induced by using 5-10 mg of diazepam, and a prophylactic antibiotic (cefuroxime 750 mg intravenously) was administered at the same time. Patients in both groups were assessed by a dietitian and received a standard enteral feed (Nutrison). The feeds were administered by using a Flocare 500 system, and the rate of delivery of the feed was 50 ml per hour for the first 24 hours gradually increasing to an average of 100 ml per hour for both groups of patients. Patients were fed in a semirecumbent position.

Treatment efficacy was assessed by several methods. The principal outcome measures were mortality at six weeks after initiation of feed and changes in nutritional state during this period. Nutritional state was assessed by recording anthropometric data including weight, upper arm skin fold thickness, mid-arm circumference, and concentrations of haemoglobin, serum total protein, and serum albumin at the start of the trial and weekly during the trial. Nursing staff on the ward where the patients were being cared for were asked to keep a record of any tube resitings, the number of days on which feed was administered or omitted with reasons, and the development of any complications. Treatment failure was defined as failure to site the feeding tube or recurrent displacement of the feeding tube in those patients in whom it was thought inappropriate to persevere with treatment. The length of hospital stay was monitored in the two groups. Results were expressed as means, and differences between the two groups were compared by using the χ^2 test with Yates's correction for continuity. Changes in nutritional state were assessed by using the Mann-Whitney U test. P values less than 0·05 were regarded as significant.

Results

Thirty patients (11 men, 19 women; mean age 77 years) were recruited to the study. Sixteen patients (seven men, nine women; mean age 76 years) received gastrostomy feeding and 14 patients (four men, 10 women; mean age 79 years) received nasogastric feeding. Assessment with the Barthel activities of daily living index did not show a significant difference in residual disability. The two groups scored a mean value of less than 3 at the time of recruitment. Table 1 illustrates the six week mortality for each group together with the causes of death and the length of survival after the procedure for those patients who died within six weeks. There were two deaths (12·5%) in the gastrostomy group compared with eight (57%) in the nasogastric group. The χ^2 analysis demonstrated a significant difference in mortality at six weeks between the two groups ($P<0·05$).

Each patient in the gastrostomy group required only one tube insertion compared with a mean of six (range 1 to 10) in the nasogastric fed group. There were no instances of omitted feed among the gastrostomy patients whereas 10 (71%) of the nasogastric fed group lost at least one day's feed due to delay in resiting of the tube (range 1 to 10 days with a mean of 5 days; $P<0.001$). This represented a mean loss of 22% (95% confidence interval 6% to 37%) of the total prescribed feed for this group of nasogastrically fed patients. Table 2 shows the mean changes in nutritional state for each category. Follow up laboratory data were not available for one patient from the gastrostomy group and four patients from the nasogastric fed group because of either early abandonment of the study or death. It was not possible for medical reasons to obtain weights in three patients from each group. Table 2 demonstrates the mean values for various nutritional parameters for each group at recruitment and after a period of follow up of at least one week.

The mean initial weight at randomisation was 58·8 kg (51·0 kg to 66·7 kg) for the gastrostomy fed patients and 60·4 kg (54·2 kg to 66·6 kg) for those fed by nasogastric tube (a non-significant difference). At follow up 10/13 (77%) of the patients fed by gastrostomy had gained weight, with a mean increase of 2·2 kg (−0·6 kg to 5·2 kg). Only one of the eight (12%) nasogastric fed patients showed any weight gain with a mean at follow up of 57·8 kg (49·4 kg to 66·2 kg), which represents an average deficit of 2·6 kg (−5·1 kg to 0·38 kg) per patient. This difference in weight gain was significant ($P<0·03$). In the gastrostomy group there was an overall modest reduction in haemoglobin concentration, and a similar pattern was observed in

Table 1—*Mortality at six weeks in patients with acute dysphagic stroke randomised to receive gastrostomy (n=16) or nasogastric (n=14) tube feeding**

Group	Sex	Age (years)	Cause of death	Time of death (days after procedure)
Gastrostomy:				
1	M	76	Initial cerebrovascular accident	27
2	M	85	Bronchopneumonia	23
Nasogastric:				
1	F	80 years†	Initial cerebrovascular accident	13 (2-25)†
2	F		Initial cerebrovascular accident	
3	M		Initial cerebrovascular accident	
4	M		Initial cerebrovascular accident	
5	F	79 years†	Bronchopneumonia	24 (13-37)†
6	F		Bronchopneumonia	
7	F		Bronchopneumonia	
8	M		Bronchopneumonia	

*χ^2 for numbers alive/dead according to group, $P<0·05$.
†Mean or mean (range).

Table 2—*Measurement of nutritional state at week 0 and at follow up of at least one week for patients with acute dysphagic stroke randomised to receive gastrostomy or nasogastric tube feeding*

	Weight (kg)				Haemoglobin (g/l)*				Albumin (g/l)†				Mid-arm circumference (cm)			
Group	No of patients	Mean (SD) weight	95% Confidence interval	No (%) of patients improved	No of patients	Mean (SD) value	95% Confidence interval	No (%) of patients improved	No of patients	Mean (SD) value	95% Confidence interval	No (%) of patients improved	No of patients	Mean (SD) value	95% Confidence interval	No (%) of patients improved
Gastrostomy:																
Week 0	13	58·8 (13·0)	51·0 to 66·7		16	127 (12)	121 to 133		16	27·1 (4·9)	24·5 to 29·7		16	25·3 (4·0)	23·2 to 27·4	
Follow up	13	61·0 (11·0)	54·4 to 67·6	10/13 (77%)‡	15	123 (12)	116 to 130	4/15 (27%)	15	30·1 (3·6)	28·3 to 31·9	9/15 (60%)§	13	26·3 (5·3)	23·1 to 29·5	6/13 (46%)‖
Nasogastric:																
Week 0	11	60·4 (9·2)	54·2 to 66·6		14	130 (26)	115 to 145		14	31·4 (4·9)	28·6 to 34·2		14	26·8 (2·7)	25·2 to 28·4	
Follow up	8	57·8 (10·0)	49·4 to 66·2	1/8 (12%)	10	119 (20)	105 to 133	2/10 (20%)	10	22·3 (2·2)	20·7 to 23·9	1/10 (10%)	8	23·8 (1·8)	22·3 to 25·3	0/8 (0%)

*Normal range 135-180 g/l for men; 115-165 g/l for women.
†Normal range 30-45 g/l.
‡$P<0·03$ compared with nasogastric group.
§$P<0·003$ compared with nasogastric group.
‖$P<0·03$ compared with nasogastric group.

the nasogastric group with no significant difference observed between the two. Six out of 13 patients in the gastrostomy group showed a mean improvement in anthropometric measurements at follow up. In contrast, almost all the patients (7/8) in the nasogastric fed group showed a fall in anthropometric measurements ($P<0.03$). There was a clear difference in mean serum albumin concentration at follow up between the two groups. The gastrostomy fed group (n=15) achieved an increase of 2·7 g/l (−0·1 g/l to 5·6 g/l) whereas those fed nasogastrically (n=10) showed a mean reduction of 9·5 g/l (−13·6 g/l to −5·4 g/l) ($P<0.003$). One patient in the gastrostomy (24 French gauge Wilson Cook) fed group developed a peristomal infection that resolved with antibiotics and continuation of feeding. All other gastrostomy placements were without complications. There were no treatment failures in the gastrostomy fed group but three in the nasogastric fed group (inability to resite the nasogastric tube in one patient and recurrent removal of the tube in two patients). This difference was not significant.

There was a significant difference in discharge rates at six weeks. Six patients fed by gastrostomy were discharged within six weeks (all to nursing homes) compared with none from the nasogastric fed group ($P<0.05$). A further six patients from the gastrostomy fed group were discharged within a three month period compared with none from the nasogastric fed group. Two additional patients from each group have now died (all secondary to bronchopneumonia as the terminal event) within six months of the initial procedure. Three patients from the gastrostomy fed group can now swallow normally and have had their tubes removed. No patients from the nasogastric fed group have regained normal swallowing.

Discussion

We believe this study to be the first to compare prospectively the efficacy of gastrostomy tube feeding with nasogastric tube feeding at such an early stage after acute dysphagic stroke. The two study groups were well matched in terms of age, sex, and residual disability. The most striking difference was in mortality, and we have shown that early gastrostomy feeding produced a significant reduction in mortality at six weeks. There was one early death (at two days) in the nasogastric fed group, and it could be reasonably assumed that this patient would have been unlikely to survive regardless of which feeding method was used. Even if we exclude this patient, however, the difference in mortality between the two groups remains significant. The difference in mortality is probably a reflection of the superiority of gastrostomy feeding over nasogastric feeding after acute dysphagic stroke. Several factors might account for this. It is well recognised that a major cause of death after a dysphagic stroke is bronchopneumonia.[7] Several studies have shown that enteral tube feeding is associated with an increased risk of pulmonary aspiration and pneumonia, which under these conditions has a mortality of over 50%.[7 12 13 16 17] Patients fed by a nasogastric tube are at greater risk of pulmonary aspiration, which is inherent on recurrent removal and resiting of the nasogastric tube and which will clearly increase proportionately with the number of times this occurs. We have demonstrated that even over a short time period patients in the nasogastric group frequently removed their feeding tubes. In contrast there were no instances of inadvertent removal of a gastrostomy tube. The final recorded terminal event for most of the patients in the nasogastric fed group was bronchopneumonia.

At the time of randomisation patients from both groups had evidence of poor nutritional state, reflected in below average body weight and low mean albumin concentration. This is in keeping with other studies that have indicated that undernutrition in hospital inpatients is common and has an associated increase in mortality.[18] This study has shown that gastrostomy feeding has the advantage of more certain provision of adequate continuous nutritional support. Those in the gastrostomy fed group enjoyed the benefit of uninterrupted feeding whereas 71% of the nasogastric fed group missed at least one day's feed with a mean loss of 22% of their total prescribed feed. Patients fed through a gastrostomy showed a greater overall improvement in nutritional state compared with the nasogastric group (table 2). This difference was most clear in the measurement of serum albumin at follow up. Those patients in the gastrostomy group showed a mean increase of 3 g/l compared with the nasogastric group who had a mean reduction of almost 10 g/l. Although some phenomena such as the distinct reduction in serum albumin concentration may represent a separate effect—that is, a fall secondary to pneumonia or other acute illness—the changes in the various parameters suggest a global impairment of nutritional state in the nasogastric group compared with the gastrostomy group.

There were no treatment failures in the gastrostomy group. Other benefits of gastrostomy feeding were reflected in discharge rates, with six patients discharged within six weeks compared with none from the nasogastric fed group. Furthermore, in our areas, nursing homes will more readily accept patients who are fed via a gastrostomy rather than a nasogastric tube. This is because gastrostomy tubes tend to be much easier to manage in the community. The improved prospects of earlier discharge for gastrostomy fed patients has obvious financial benefits for the NHS as a whole.

Malnutrition among hospital inpatients is a common problem which contributes to mortality and morbidity.[18] It must be recognised that the provision of adequate nutrition is an integral part of management at least as important as giving specific treatment. This is not widely appreciated. A recent article giving a 15 point guide to ideal stroke management failed to mention nutritional support at all.[19] It is incumbent on all health workers to change attitudes toward nutrition and to recognise it as an essential and basic part of patient care. Patients who are already severely ill who are then deprived of adequate nutrition are much more likely than well nourished patients to develop complications and have a reduced survival rate.

In conclusion, this study has demonstrated that early gastrostomy feeding after acute dysphagic stroke is associated with a significant reduction in mortality at six weeks. The use of a gastrostomy results in improved nutritional state compared with nasogastric

Key messages

- Gastrostomy tube feeding is associated with a reduction in six week mortality compared with nasogastric feeding
- Patients fed through a gastrostomy are more likely to receive more of their prescribed feed and show a greater improvement in nutritional state
- Gastrostomy tube feeding is associated with fewer treatment failures
- Patients fed through a gastrostomy are more likely to be discharged earlier from hospital
- Gastrostomy feeding is superior to nasogastric tube feeding after acute dysphagic stroke

feeding and will improve the prospects of early hospital discharge. We are carrying out further work to determine the effects on long term quality of life in such patients, and our preliminary results have so far been encouraging. In addition, further work is required to determine the ideal timing at which to institute gastrostomy feeding after an acute dysphagic stroke.

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Prenatal and postnatal prevalence of Turner's syndrome: a registry study

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Abstract

***Objective*—To study prevalence of Turner's syndrome in Denmark and to assess validity of prenatal diagnosis.**

***Design*—Study of data on prenatal and postnatal Turner's syndrome in Danish Cytogenetic Central Register.**

***Subjects*—All registered Turner's syndrome karyotypes (100 prenatal cases and 215 postnatal cases) during 1970-93.**

***Main outcome measures*—Prevalence of Turner's syndrome karyotypes among prenatally tested fetuses and Turner's syndrome among liveborn infants.**

***Results*—Among infant girls, prevalence of Turner's syndrome was 32/100 000. Among female fetuses tested by amniocentesis, prevalence of Turner's syndrome karyotypes was 176/100 000 (relative risk of syndrome, 6·74 compared with prevalence among untested pregnancies). Among female fetuses tested by chorion villus sampling, prevalence of syndrome karyotypes was 392/100 000 (relative risk, 16·8). We excluded prenatal tests referred because of results of ultrasound scanning: among fetuses tested by amniocentesis revised relative risk was 5·68, while revised relative risk among fetuses tested by chorion villus sampling was 13·3. For 29 fetuses with prenatal diagnosis of possible Turner's syndrome, pregnancy was allowed to continue and 24 children were live born. Thirteen of these children were karyotyped postnatally, and diagnosis of Turner's syndrome had to be revised for eight, seven being normal girls and one boy. This gives tentative predictive value of amniocentesis in diagnosing Turner's syndrome of between 21% and 67%. There was no significant relation between mother's age and risk of Turner's syndrome.**

***Conclusions*—Discrepancy between prenatal and postnatal prevalence of Turner's syndrome challenges specificity of prenatal examination in diagnosing Turner's syndrome.**

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Introduction

Turner's syndrome is a disorder of female patients that is typically associated with the absence of one sex chromosome (45,X), although structural abnormality of one sex chromosome or mosaicism may also be responsible. The prevalence of Turner's syndrome at birth has been studied, so far, only in large scale chromosome surveys of children. In white populations it has been estimated to be 25-55 per 100 000 females[1-3] and in Japanese populations to be 70-210 per 100 000.[4] The high prevalence of 210 per 100 000 was found in a small study of only 2400 females. It has recently been suggested that advanced maternal age may be a risk factor for giving birth to a child with Turner's syndrome,[5] while other workers have found that maternal age is inversely related to the occurrence of monosomy X (45,X) in offspring.[6-8]

All cytogenetic laboratories in Denmark report all prenatal and postnatal karyotype examinations to the Danish Cytogenetic Central Registry. The register is excellent for studying epidemiological aspects of Turner's syndrome. There has recently been a rise in the numbers of fetuses with prenatally diagnosed Turner's syndrome in Denmark. We used data from the Danish Cytogenetic Central Register to try to estimate whether this reflected a true rise in the prevalence of Turner's syndrome; if it was simply a reflection of the increased use of amniocentesis, chorion villus sampling, and ultrasonography; or if it was related to other factors.

Subjects and methods

In Denmark seven laboratories perform postnatal karyotyping, and four of these also perform prenatal karyotyping. All results are reported to the Danish Cytogenetic Central Register. The register includes information on maternal age, whether prenatal results were obtained by amniocentesis or chorion villus sampling, if amniocentesis or chorion villus sampling was preceded by ultrasonography (information about