

## Success of cricopharyngeal myotomy for specific and non-specific cervical dysphagia

N. DeZoysa<sup>1</sup>, P. Patel<sup>2</sup>, A. Trinidad<sup>2</sup>, P. V. Vlastarakos<sup>2</sup>, P. Kothari<sup>3</sup> and G. Mochloulis<sup>2</sup>

<sup>1</sup>ENT Department, Brighton and Sussex University Hospitals, Brighton, UK; <sup>2</sup>ENT Department, Lister Hospital, Stevenage, UK; <sup>3</sup>ENT Department, Luton & Dunstable NHS Foundation Trust, Luton, UK

**Key-words.** Cricopharyngeal; myotomy; dysphagia

**Abstract.** *Success of cricopharyngeal myotomy for specific and non-specific cervical dysphagia.* **Objective:** The present study aimed to compare outcomes of cricopharyngeal myotomy (CPM) in patients with documented cricopharyngeal dysfunction (CPD) and those in whom the diagnosis is complex or in doubt.

**Materials and methods:** Retrospective comparative study of all patients undergoing CPM between 2001 and 2010 at a single UK centre. Patients were classified as having either CPD (n = 15) or non-specific cervical dysphagia (NSCD) (n = 12) based on contrast swallow results. They completed a 10-point visual analogue scale (VAS) questionnaire regarding their ability to swallow solids preoperatively and 6 months postoperatively. Scores were compared between groups, and symptom recurrence at 12 months postoperatively was also noted.

**Results:** The median VAS for all patients in both groups preoperatively was 5.5 and improved postoperatively to 8.0 (p<0.001), and median preoperative ratings between groups were similar (CPD = 6.0 vs. NSCD = 5.5; p>0.05). The CPD group scored better postoperatively compared to their NSCD counterparts (CPD = 9.0 vs. NSCD = 7.5; p<0.001). Recurrence rate at 12 months was lower in CPD (12.5%) compared to NSCD (60%) patients.

**Conclusion:** After CPM, patients with CPD showed significant improvement in swallowing solids, as did patients with NSCD, although to a lesser extent. CPD patients experienced better outcomes compared to their NSCD counterparts, including lower complication and recurrence rates. Larger studies are required before CPM can be advocated as the standard of care for NSCD patients.

### Introduction

Dysphagia, particularly at the pharyngeal level, has a complex aetiology and can be either primary, related to intrinsic disorders of the cricopharyngeus muscle,<sup>1</sup> or secondary to neurological disorders, such as Parkinson's disease or cerebrovascular accidents.<sup>2,3,4</sup> Symptoms are usually related to misdirection of the bolus during and after deglutition.<sup>5</sup> In patients with radiological evidence of cricopharyngeal dysfunction (CPD) leading to hesitation of bolus passage, division of the muscle fibres via cricopharyngeal myotomy (CPM) can provide direct therapeutic relief.<sup>6</sup> The established approach to CPM is external and involves exposure and division of the cricopharyngeus fibres. Concurrent pharyngeal diverticulae may be divided during the same procedure.

CPD can be transient or non-specific, however.<sup>7</sup> Thus, a contrast swallow, even when performed dynamically, can possibly misrepresent the degree of dysfunction.<sup>8</sup> As a result, groups of patients exist who do not have radiologically demonstrable CPD

yet would benefit from CPM to facilitate the passage of the food bolus beyond the pharyngeal stage.<sup>9</sup>

The aim of this study was to directly compare the outcomes of CPM in patients with documented CPD and those for whom the diagnosis was complex or in doubt.

### Materials and methods

A retrospective comparative study was carried out in all patients undergoing CPM, performed by senior co-author GM, in a single centre. Patients were classified as having either CPD or non-specific cervical dysphagia (NSCD) on the basis of their contrast swallow results. The radiographic signs in patients with CPD included the depiction of a prominent cricopharyngeus muscle, especially at the C5–C6 level, either due to hypertrophy or hypertonicity of the muscle, producing a notable, rounded, extrinsic impression in the posterior wall of the barium-filled oesophagus. Hold-up of the bolus was also usually present, with or without



*Figure 1*

Patient with cricopharyngeal dysfunction. A prominent cricopharyngeus muscle is seen, causing significant bolus hold-up. This arrest results in pooling in the pyriform sinuses, with penetration and slight aspiration. No pouch or further structural abnormality is identified.



*Figure 2*

Patient in the non-specific cervical dysphagia group. The study is radiographically normal (no bolus hold-up, no oesophageal indentation, no pouch or other structural abnormality present).

pooling of the contrast in the pyriform sinuses (Figure 1). Patients in the NSCD group typically lacked the aforementioned radiographic signs (Figure 2). Data including patient gender, age at operation, complications, indications, and diagnosis were also collected.

Patients were contacted and asked to fill in a questionnaire about their experiences. The questionnaire included a 10-point visual analogue scale (VAS) rating of their ability to swallow solids pre-operatively and 6 months postoperatively (1 = complete dysphagia to solids and 10 = normal swallowing). Visual analogue scoring of dysphagia to solids was also compared between patient groups. Recurrence of dysphagia at 12 months of follow-up was recorded. Related entries in patient medical records were reviewed and cross-matched to patient answers to further ensure reliability, and time since the operation was also noted.

Data were tabulated and analysed using the Graphpad Prism® statistical package. The VAS rating of dysphagia to solids before and after the CPM was compared using a two-tailed Wilcoxon matched-pair test. The respective comparisons between patients with a diagnosis of CPD and patients with a diagnosis of NSCD were performed using a

two-tailed Mann-Whitney U test. A level of 0.05 was set as indicating statistical significance.

#### *How we do it*

The patient is placed in a supine position with a sandbag under the shoulders and a head ring, and the incision site is marked. The incision lies on the anterior border of the sternocleidomastoid muscle, from 1 cm superior to the sternoclavicular joint inferiorly, to the level of the hyoid bone. Local anaesthetic is injected along the site of the incision. The head and neck is draped leaving the mouth exposed.

A standard pharyngoscope is inserted into the cervical oesophagus, followed by the placement of a 32 French gauge bougie. The skin, subcutaneous fat and platysma are then incised with a N° 10 blade. The carotid sheath is identified and gently retracted laterally. The tendon of omohyoid muscle is divided with cutting diathermy, and the left thyroid lobe identified medially. The middle thyroid vein is identified and divided. The assistant rotates the laryngeal skeleton medially, exposing the posterior aspect of the pharynx. Using a N° 15 blade, the fibres of the cricopharyngeus muscle are carefully

divided vertically along its posterior aspect. Great care should be taken to avoid cutting through the oesophageal mucosa. A gauze pledget can be used to gently separate the muscle fibres as we are dividing them.

Meticulous haemostasis is followed by insertion of a size 12 suction drain. The surgical wound is closed in layers, with staples to the skin, and tegaderm transparent dressing. The oesophageal bougie is removed at the end of the procedure.

## Results

A total of 31 external-approach CPMs were carried out between 2001 and 2010. There were two mortalities: one because of aspiration pneumonia as a delayed complication of the operation, and the other from causes independent of the procedure. Of the 29 remaining patients, 27 were contactable and returned the completed questionnaire.

The median age at operation was 69 years with a range of 48 to 80 years. Of the total patient population, 55% ( $n = 15$ ) were men and 44% ( $n = 12$ ) women. The median time from listing the patient for surgery to performing the operation was 6 months. The most common complications were regurgitation (7.4%), perforation (7.4%), wound infection (7.4%), and aspiration (3.7%), for an overall complication rate of 15%. The mortality rate was 3.7%.

Diagnoses at the time of listing for the procedure included 15 cases of cricopharyngeal spasm/tightness, as demonstrated by contrast swallow or endoscopy (55%); 4 pharyngeal pouch patients (deemed too small for stapling) (15%); 9 with pharyngeal dysphagia not otherwise specified (33%); and one patient with inclusion body myositis (acquired myopathy of unclear pathogenesis) (3.7%). Two patients with a preoperative diagnosis of pharyngeal pouch did not return the completed questionnaire and were excluded from further analysis. Two patient groups were formed, one consisting of all patients with cricopharyngeal tightness/spasm (CPD group) and the other consisting of all other patients (NSCD group).

Patients in the CPD group did not differ significantly from the NSCD group ( $p > 0.05$ ) for age, number of co-morbidities, postoperative time elapsed at date of contact, or preoperative dysphagia score. The median VAS rating for all patients in both groups preoperatively was 5.5 and had im-

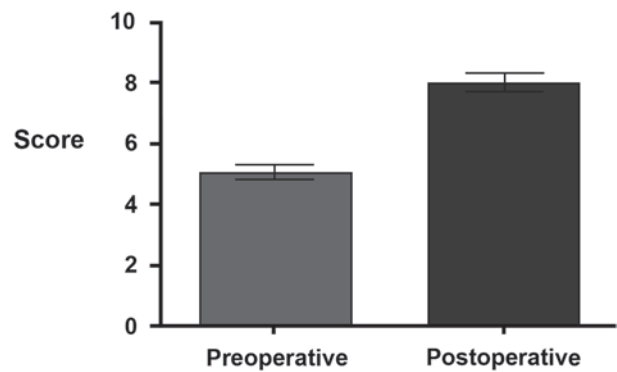


Figure 3

VAS dysphagia ratings pre- and post-intervention across all patients.

proved postoperatively to a median value of 8.0 ( $p < 0.001$ ). The median was used instead of the mean because the values were non-parametrically distributed and because of the subjective nature of the data and the small sample size (Figure 3).

The median preoperative VAS rating in patients with CPD was 6.0 and did not differ significantly from that of their NSCD counterparts (VAS = 5.5;  $p > 0.05$ ). Postoperatively, the groups differed in the median swallowing score (CPD = 9.0 and NSCD = 7.5;  $p < 0.001$ ).

Over a 12-month period, the recurrence rate was 22%. This rate was lower in the CPD group (12.5%) compared to the NSCD group (60%) (Table 1).

## Discussion

External-approach CPM is a well-described technique with a plethora of indications based on varying levels of evidence. Hence, it is perhaps unsurprising that the reported success of the procedure varies.<sup>5,10-12</sup> To some degree, this variability may be caused by differences in the patient populations undergoing the procedure. In well-selected patient cohorts, such as those with oculopharyngeal muscular dystrophy, success rates of up to 90% have been reported.<sup>13</sup> Symptomatic recurrence of dysphagia remains dependent on the underlying pathology treated with CPM. Recurrence rates are reported as highest in patients with dysphagia secondary to inclusion body myositis within the cricopharyngeus muscle.<sup>14</sup> This study is the first, to our knowledge, to directly compare the outcomes of CPM in patients with documented cricopharyngeal

Table 1  
Outcome data of patients undergoing cricopharyngeal myotomy broken down by cause of dysphagia

Diagnosis	Number	Recurrence	Aspiration	Regurgitation	Wound infection	Oesophageal perforation	Salivary fistula
CPM spasm	15	3	1	2		1	1
Dysphagia NOS	9	5				1	
Pharyngeal pouch	2	1			2		
Inclusion body myositis	1		1				

dysfunction and those with more complex diagnosis of muscular dysfunction.

Our data suggest that patients with CPD seem to derive more benefit from CPM than do patients with NSCD. The CPD patients also appear to have a lower rate of recurrence. Indeed, only 12.5% of these patients had recurrence of dysphagia at one year postoperatively versus 60% of their NSCD counterparts.

Of interest, however, swallowing score seemed to have improved significantly in the NSCD group, from a median preoperative VAS of 5.5 to a postoperative rating of 7.5 ( $p < 0.001$ ) at 6 months, although this increase was not as large as that in the CPD group (median VAS 6 and 9, respectively;  $p < 0.001$ ). The latter observation lends support to the notion that cervical dysphagia is a multifaceted problem in which neuropathic, myopathic, and idiopathic factors may synergistically act to produce symptoms in those patients in whom no structural cause can be identified. It also suggests that these patients may still benefit from CPM thanks to facilitation of the opening of the upper oesophageal sphincter, and hence swallowing, even when sphincter dysfunction is not the primary cause of the dysphagia. Finally, this finding raises the question of whether current methods of determining the cause of pharyngeal dysphagia are sensitive and/or specific enough.

Contrast and fluoroscopic swallow assessments are the current gold standards in the investigation of dysphagia from both structural and functional points of view. These investigations are considered highly accurate in determining the underlying diagnosis of well-documented pathologies such as strictures, webs, achalasia, and bulbar palsies and are also cost effective and widely available.<sup>15,16</sup> However, they are largely operator dependent, which has implications for quantifying any dysfunction in an objective way, whereas the decision for

surgical intervention is usually based on the impact of the dysfunction on a patient's quality of life (qualitative assessment). If the dysphagia is complex or its cause unclear, then the aforementioned quantification of specific aspects of swallowing becomes crucial.

CPM, however, is not without risks.<sup>17</sup> The loosened oesophageal inlet is more likely to reflux proximally, leading to a risk of aspiration, particularly in the immediate postoperative period. Other complications include perforation of the oesophagus/pharynx, salivary fistula, haematoma formation, recurrent nerve palsy, wound infection, poor nutrition, and pneumonia.<sup>10,11,17</sup> The overall complication rate in our series was 15%, which is comparable to rates mentioned in the literature.<sup>17</sup>

The risk of postoperative aspiration and pneumonia is a well-recognised complication reported in 3-13% of patients undergoing CPM.<sup>10, 11</sup> Careful selection using manometric criteria in association with radiological swallow studies has been suggested to reduce risk and results in marked improvement in dysphagia for these patients.<sup>18</sup> However, catheter motion during swallowing can lead to spurious results.<sup>11</sup> Finally, prior to giving consent to the procedure, patients need to be informed that dysphagia can recur in one fifth of cases at 12 months postoperatively, based on the results of the present study.

In addition, the morbidity that can be associated with CPM is almost certainly affected by the population of patients who undergo the procedure. CPD and achalasia reach peak incidence in the 6<sup>th</sup> and 7<sup>th</sup> decades of life,<sup>5,12</sup> and with an increasingly ageing population, prevalence is expected to continue to rise. The median age in our study was 69 years. Advanced patient age itself can have a major influence on the quality of outcome following CPM (e.g., quality of tissues) and the respective anaesthetic risk. Furthermore, gastroesophageal reflux remains

a feature of patients with cervical dysphagia, but conclusive evidence that CPM causes or exacerbates it is lacking.<sup>19</sup>

In the last decade, cricopharyngeal electromyography (CP-EMG) has become available. The pattern of CP-EMG abnormalities correlates closely with the underlying aetiology.<sup>19</sup> In addition, this modality of investigation provides repeatable, quantifiable assessment of muscular function. Whether this method is more sensitive for demonstrating dysfunction than traditional approaches is unclear. It is likely to identify abnormalities specific to the cricopharyngeus muscle or its innervation. However, a study has not yet been performed to establish the positive predictive value of CP-EMG based on a comparison between this method and conventional contrast or fluoroscopic swallows in the same cohort of patients.

### Limitations

This study is retrospective and is thus susceptible to recall bias and confounding demographic factors. However, patients in the CPD group did not differ significantly for age, number of co-morbidities, postoperative time elapsed at date of contact, or preoperative dysphagia score compared to the NSPD group. Any recall bias associated with the study design can be negated only by a further prospective study.

In addition, because of the retrospective nature of the study, VAS questionnaires were only completed postoperatively. However, given that both study groups underwent the same type of surgery, the possibility of a placebo effect on the respective scores is considered unlikely. In addition, the follow-up entries in the patient medical records were also reviewed and cross-matched to patient answers to further ensure reliability.

### Conclusion

The results of the present study show a significant improvement in swallowing solids after CPM in patients with CPD and a significant improvement in patients with NSCD. However, CPD patients experienced better long-term outcomes compared to their NSCD counterparts and had lower complication and recurrence rates. By one year post-CPM, some degree of recurrence was apparent in the majority of patients with NSCD. Larger studies are

required before CPM can be advocated as the standard of care for NSCD patients.

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Petros V. Vlastarakos  
Wetherby Close 33  
SG1 5RX Stevenage, Hertfordshire  
United Kingdom  
Tel.: 00441438488837  
Mobile: 00447774567429  
Fax: 00302109714870  
E-mail (preferred type of communication):  
pevlast@hotmail.com or pevlast@yahoo.gr  
Hospital: Coreys Mill Lane  
SG1 4AB Stevenage, Hertfordshire  
United Kingdom