# Central airway obstruction due to endoluminal tumors: Experience from a tertiary care center in North India

Sir,

Central airway obstruction (CAO) is defined as obstruction involving the trachea or the main bronchi. CAO can be classified as endoluminal, extraluminal or mixed.[1] Most CAO is due to malignancy, with bronchogenic carcinoma being the most common cause of malignant CAO.[1-3] While interventional bronchoscopy is the primary modality for managing malignant CAO (palliative), surgical methods are preferred for benign causes of CAO (curative). Occasionally, benign CAO may present as an emergency, requiring immediate bronchoscopic intervention.[4,5] Rigid bronchoscopy (RB) is an effective modality for CAO and provides immediate relief and palliation. Most studies reporting CAO outcomes have included all forms of CAO.[1,6] While extraluminal CAO is also managed by rigid bronchoscopic procedures such as debulking and airway stenting, multimodality bronchoscopic treatment is more commonly employed for endoluminal CAO. It would be of interest to pulmonary physicians if the aetiology and procedural outcomes of endoluminal CAO are clearly defined. Herein, we describe our experience of managing isolated endoluminal CAO by using rigid bronchoscopy.

We retrospectively reviewed our bronchoscopy database between 1st January 2013 and 30th September 2019. We included RB procedures performed for CAO exclusively due to endoluminal growth. We excluded CAO subjects due to extrinsic compression, tracheobronchial stenosis and tracheoesophageal fistula. The study protocol was approved, and the institutional ethics committee waived the need for consent due to the anonymised retrospective data. We obtained procedural consent from all the subjects prior to the intervention. We extracted the following information in a data abstraction form: (1) demographic profile; (2) site of obstruction; (3) severity of airway obstruction; (4) histopathological diagnosis; (5) presence of respiratory failure at baseline; (6) type of intervention required for the CAO (mechanical debulking, snaring, argon laser photocoagulation, cryoextraction, balloon dilatation and others); (7) type of airway stent deployed; (8) dose and drugs used by the anaesthetist during the procedure; (9) duration of procedure; (10) degree of relief of luminal obstruction; (11) whether immediately extubated after the procedure; (12) immediate outcome; (13) complications; (14) duration of follow up; and (15) the survival status of the subjects at follow-up.

We initially performed computed tomography (CT) of the thorax and a flexible bronchoscopy to assess the site and degree of obstruction. We characterised the severity of CAO as grade 1, 2, 3, 4 and 5 if the growth occluded <25%, 26%–50%, 51%–75%, 76%–90% and ≥90% of the airway lumen, respectively.[7] We performed all the rigid bronchoscopy procedures in the operating room using general anaesthesia. We performed mechanical debulking using either the bevel of the rigid bronchoscope, snare with electrocautery and balloon dilatation (using controlled radial expansion [CRE] balloon) either alone or in combination. We placed airway stents (metallic or silicone) in case the airway lumen remained compromised despite the debulking procedures. After discharge, we followed the subjects in the outpatient services. If they could not attend the outpatient clinic, we telephonically interviewed the subjects or their next of kin.

The primary outcome was the proportion of procedures with procedural success. We defined procedural success as either >70% relief in the degree of luminal obstruction or immediate relief of respiratory failure. The secondary outcomes were the complication rates and the survival status of the subject at follow-up. Descriptive data are presented as mean with standard deviation (SD) or numbers with percentages.

We performed 109 rigid bronchoscopies for pure endoluminal CAO [Table 1]. The mean age of the study population (39.4% women) was 50.1 years. We found tracheal growth in 52 (47.7%) subjects, while 26 (23.9%) had isolated involvement of one of the main bronchi. In 31 (28.4%) subjects, the growth involved both the trachea and the main bronchi. Seventy-two (66.1%) subjects had grade 4 or 5 luminal obstruction, and 28 (26%) had respiratory failure at presentation. Histopathological diagnosis was available in 102 subjects [Table 1]. We found malignant aetiology in 79 (77.5%) subjects [Table 1]. Bronchogenic carcinoma was the most common (n = 37), followed by salivary gland tumours (n = 21) and carcinoid (n = 13). Of the 13 carcinoid tumours, nine were typical and four were atypical. Inflammatory myofibroblastic tumour and glomus tumour were the common benign causes of CAO.

We used fentanyl and propofol to perform the procedures. The mean ± SD doses of fentanyl and propofol were 91.9 ± 41.4 μg and 377.4 ± 339.5 mg, respectively. The mean ± SD duration of the procedure was 49 ± 35.2 min. Mechanical debulking was the most common (68.8%) procedure, followed by snaring [Table 1]. We placed airway stents in 31 subjects following mechanical debulking. Self-expanding metallic stents were the most common stents used. Stent deployment was successful in all cases except one. In this patient with an adenoid cystic tumour, anatomical distortion precluded stent deployment.

We observed procedural success in 98 (89.9%) subjects. There was immediate relief in luminal obstruction in 97 (89%) subjects. Sixty-four (58.7%) subjects were

extubated immediately after the procedure, while the remaining were extubated within 48 h. One patient died within 24 h of the procedure due to sepsis. Nineteen (67.9%) of the 28 subjects had immediate relief from respiratory failure [Table 2]. We encountered complications in 15 (13.8%) subjects during the procedure. Three subjects had more than one complication. Nine (8.3%) subjects had transient hypoxia, four (3.7%) had airway bleeding, five (4.6%) had hypotension and one (0.92%) had arrhythmia during the procedure. All these complications were successfully managed with appropriate therapy. None of the events were life-threatening.

We have follow-up details for 69 subjects, of whom 26 are alive. Of the 54 cases with malignancy, only 16 were alive. Of the 15 subjects with benign pathologies, 10 were alive at data collation. The duration of survival post-procedure ranged from 0 to 81 months, with a mean ± SD duration of 16.4 ± 20.9 months (median: 5 months). The survival was lower in subjects with malignant (mean ± SD survival: 13.8 ± 24.1 months; median: 4.0 months) than benign aetiologies (mean ± SD survival: 26.6 ± 24.1 months; median: 25.2 months). A repeat procedure was required in four subjects (adenoid cystic carcinoma [n = 2] at 1 and 5 years, basal cell adenoma [n = 1] at 4 years and squamous cell lung carcinoma [n = 1] at 2 months).

The choice of an interventional procedure depends on the type of CAO, the institutional experience and the patient and physician preferences.[8-11] In our study, cancer was the most common cause of CAO, as previously reported.[2,3,6] Mechanical coring was the most commonly used debulking procedure in pure endoluminal CAO, similar to previous reports.[2,6,12] Airway stenting was required in a third of the cases. Contrarily, another large series of malignant CAO from India reported higher use of airway stents (57%), while mechanical debulking was performed in only 27% of the cases, possibly due to the inclusion of subjects with extraluminal CAO.[3] We achieved the primary outcome of alleviation of respiratory failure or relief in luminal obstruction in 90% of our patients, like in previous studies.[12-14] The reported median survival in CAO is about 2–6 months, like in our series.[2,3] The complication rate of RB varies from 0.9% to 20%.[3,6,15-17] We found no life-threatening complications due to RB in the current study, and there were no intraprocedural deaths. Our study has a few limitations. It is a single-centre retrospective study with a small sample size. We do not have the follow-up details of all the subjects. Moreover, we did not evaluate the effectiveness of procedures on the patient's quality of life.

In conclusion, rigid bronchoscopy is a safe intervention modality that immediately relieves CAO due to pure endoluminal obstruction.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms for performing the various

**Table 1: Baseline characteristics of the study population (*n*=109)**

| Parameter | Value |
|---|---|
| Demographics | |
| Age, years | 50.1±14.3 |
| Female sex | 43 (39.4%) |
| Site of tracheobronchial obstruction | |
| Upper trachea | 12 (11.0%) |
| Mid trachea | 24 (22.0%) |
| Lower trachea | 14 (12.8%) |
| Diffuse tracheal (more than 1 segment) | 2 (1.8%) |
| Lower trachea and main bronchus/ bronchi | 31 (28.4%) |
| Only right main bronchus | 18 (16.5%) |
| Only left main bronchus | 8 (7.3%) |
| Severity of luminal obstruction | |
| Grade 1 (<25%) | 0 (0%) |
| Grade 2 (26%-50%) | 13 (11.9%) |
| Grade 3 (51%-75%) | 24 (22.0%) |
| Grade 4 (76%-90%) | 54 (49.5%) |
| Grade 5 (>90%) | 18 (16.5%) |
| Respiratory failure at baseline | 28 (25.7%) |
| Procedural details | |
| Dose of fentanyl, micrograms | 91.9±41.4 |
| Dose of propofol, milligrams | 377.4±339.5 |
| Duration of procedure, minutes | 49.9±35.2 |
| Pathological diagnosis | 102 (93.6%) |
| Bronchogenic carcinoma | 37/102 (36.3%) |
| Salivary gland tumour | 21/102 (20.6%) |
| Carcinoid | 13/102 (12.7%) |
| Benign* | 23/102 (22.5%) |
| Others** | 8/102 (07.8%) |
| Intervention prodecures performed | |
| Mechanical debulking | 75 (68.8%) |
| Cautery and snare | 37 (33.9%) |
| Argon Plasma Coagulation | 1 (0.9%) |
| Balloon dilatation | 3 (2.8%) |
| Stent# | 31 (28.4%) |
| Straight metallic stent | 19 |
| Metallic J stent | 2 |
| Metallic Y stent | 7 |
| Straight Silicone stent | 2 |
| Silicone Y stent | 2 |

All the values are expressed as n (%) or mean±SD unless otherwise stated. SD: Standard deviation *Benign endobronchial growths included four patients each with inflammatory myofibroblastic tumour and glomus tumour. Other benign pathologies seen were enchondroma, hamartoma, lipoma, leiomyoma, myxoma, teratoma, schwannoma, basal cell adenoma, inflammatory pseudotumor and infections such as tuberculosis and aspergillosis ** Other malignant pathologies found were carcinoma oesophagus (two patients), carcinoma thyroid (three patients) and one patient each of metastatic renal cell carcinoma, plasmacytoma and synovial carcinoma #In one patient, two stents were placed (metallic straight and metal Y)

**Table 2: Outcomes**

| Parameter | Value |
|---|---|
| Successful outcome* | 98/109 (89.9%) |
| Relief in luminal obstruction ≥70% | 97/109 (89.0%) |
| Extubated on table | 64/109 (58.7%) |
| Immediate relief of respiratory failure | 19/28 (67.9%) |
| Complications | 15 (13.8%) |
| Survival after procedure (months) | 6.4±14.9 |

All the values are expressed as n (%) or mean±SD unless otherwise stated. SD: Standard deviation * Successful outcome was defined by either a≥70% relief in luminal obstruction and/or immediate relief of respiratory failure

bronchoscopic procedures. In the form, the patient(s) has/have given his/her/their consent for anonymous use of his/her/their images and other clinical information to be reported in the journal.

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## Conflicts of interest
There are no conflicts of interest.

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