

## Original Research Article

# Role of air way stenting (Duman- silica stent) in benign stricture trachea management

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## ABSTRACT

**Background:** Tracheal strictures are known to recur after dilatation, so they need stenting to prevent recurrence. The objective was to study role of air way stenting (Duman- silica stent) in benign stricture trachea management.

**Methods:** A hospital based prospective study was carried out among 15 cases (as these cases are very rare, author could study only 15 cases) presented with various clinical features suggestive of tracheal strictures. They were examined and managed by putting tracheal stent for up to eight months period. All cases were followed at regular intervals till 14months after the stent was placed. The outcome was studied.

**Results:** The tracheal strictures have been found to be more in the age group of 25-30 years. The male to female ratio was 4:1 i.e. for everyone female case there were four male cases. Thus, the tracheal strictures have been more common among the males compared to the females. All of the patients presented with severe stridor, breathing difficulty, and poor exercise tolerance. Most common cause of tracheal stricture was prolonged mechanical ventilatory support >8 days due to organo phosphorus poisoning in past 3months and all of them were males. All cases had good outcome at the end of 14months of follow up. All cases had normal findings. No one developed foreign body reaction, nor did no one develop granuloma formation at the stent site. After stent removal flexible bronchoscopy repeated after 3<sup>rd</sup> month and 6<sup>th</sup> month.

**Conclusions:** Tracheal stenting is very useful procedure in the management of air way strictures.

**Keywords:** Air way stenting, Management, Stricture, Trachea

## INTRODUCTION

Obstruction of the trachea is caused by diseases that can be either malignant or benign. They cause symptoms like difficult breathing, stridor and infections which lead to pneumonia. Sometimes, they can cause death also due to continuous suffocation. If the tracheal obstruction is not relieved, ventilatory failure can occur. It is not easy to

manage the tracheobronchial obstructions. This is the special case in patients who are not fit for surgery.<sup>1</sup>

The solution is stent that is placed in the airway. It is a prosthesis which is made up of materials. These materials help support and also help to maintain the patency of the airway. These stents are useful in fistula of the airway in a way that they help in the healing, also prevents collapse

of the airway and prevents the compression from external side. Thus, these stents are very useful.<sup>2</sup>

Stenting of the airways is indicated in various airway diseases which also include not only benign diseases but also malignant diseases. Stenting of the airways is contraindicated if the patient has to undergo the surgery of the airway.

Thus, the surgeon has to ensure that the patient in whom he wants to put the airway stent should not be having such contraindication. Another contraindication is if the lesion is more than 4cm in length. If the patient has undergone the resection or reconstruction of the airway, then after such procedure placing the stent in the airway may lead to local swelling and injury of the mucosa and this may delay the healing of the airway.<sup>3</sup>

Stenting of the airway has few indications like to reduce the external compression of the airway due to tumors. Second indication is that external compression of the airway due to lymphadenopathy.

Another indication is to maintain the patency of the airway after removal of the tumor from bronchus. One more indication is to help healing of the airways. It can also be used after the transplantation of the lungs.<sup>4</sup>

Metallic stents of the airway should not be used as first therapy of choice especially among those patients who had obstruction of the airway due to benign disease. Metallic stents of the airway can be used only when other modalities do not work.<sup>5</sup>

Tracheal strictures are known to recur after dilatation, so they need stenting to prevent recurrence. Hence, present study was carried out to study role of air way stenting (DUMAN- silica stent) in benign stricture trachea management.

## METHODS

This was hospital based prospective study conducted in Department of Pulmonary Medicine, Malla Reddy Medical College for Women, Quthbullapur, Medchal, Telangana, India was carried out over a period of one and a half year from March 2016 to September 2018. During the study period, it was possible to include 15 patients aged 25-35years of age group.

The patients with tracheal strictures and willing to participate in the present study were included. The patients without tracheal strictures and not willing to participate in the present study were excluded.

Institutional ethics committee permission was taken, and informed consent was taken from parents of the children who were eligible to be included in the present study as per inclusion and exclusion criteria laid down for the present study.

## Procedure

Author selected 15 cases of tracheal narrowing (tracheal stricture). Air way stenting was considered to be a rarely performed intervention in the field of pulmonology. Requiring training and expertise to perform the procedure was only approved intervention to manage air way strictures. After informed consent, author did rigid bronchoscopy (Storz 10 no barrel) with 4mm Storz Hopkins. Stricture site identified, at stricture site lumen of trachea was 3 to 6mm (normal should be 14 to 16mm). Radial incisions given with electrocautery knife to stricture site and stricture site dilated with CRE BALLONS (Compressed Radial Expanding Ballons) until tracheal lumen becomes 15mm. After dilatation trachea becomes lax and goes into tracheomalacia-to maintain lumen patent author inserted 14mm diameter and 6cm length, silicon tracheal stent-DUMAN STENT. Author used customized Storz stent applicator for stent placement in trachea. After stenting in 48hours cases were discharged and advised to come for follow-up in outpatient once in 4weeks and advised for 0.9% NS, nebulization every 6<sup>th</sup> hourly.

Acceptance of stent monitored in every 4weeks duration, all of them accepted stent very well no reported reactions to stent flexible bronchoscopic inspection done at stent site once in 4 weeks, these cases followed for 6 months. At 8months period, stents are removed and these cases followed for next 6months for recurrence of stricture.

## RESULTS

Table 1 shows distribution of study subjects as per age. There were nine i.e. 60% cases in the age group of 25-30years. There were six i.e. (40%) cases in the age group of 31-35 years of age. There was neither a single case below the age of 25 years of age nor a single case above the age of 35years of age. Thus, the tracheal strictures have been found to be more in the age group of 25-30 years.

**Table 1: Distribution of study subjects as per age.**

Age group (years)	Number	%
25-30	09	60%
31-35	06	40%
Total	15	100%

**Table 2: Distribution of study subjects as per sex.**

Sex	Number	%
Male	12	80%
Female	03	20%
Total	15	100%

Table 2 shows distribution of study subjects as per sex. There were 12 i.e. 80% of the cases who were males. There were three i.e. 20% of the cases who were females.

The male to female ratio was 4:1 i.e. for every female case there were four male cases. Thus, the tracheal strictures have been more common among the males compared to the females.

Table 3 shows distribution of study subjects as per clinical presentation. There were 15 i.e. 100% cases who presented to the hospital with severe stridor. There were 15 cases i.e. 100% who presented with breathing difficulty. There were 15 cases i.e. 100% who presented with poor exercise tolerance. Thus, all of the patients

presented with severe stridor, breathing difficulty and poor exercise tolerance.

**Table 3: Distribution of study subjects as per clinical presentation.**

Clinical presentation	Number	%
Severe stridor	15	100
Breathing difficulty	15	100
Poor exercise tolerance	15	100

**Table 4: Distribution of study subjects as per the causes of tracheal stricture.**

Causes of tracheal stricture	Male		Female		Total	
	Number	%	Number	%	Number	%
Prolonged mechanical ventilatory support >8days due to organo phosphorus poisoning in past 3months.	08	66.7%	0	0	08	53.3%
Stridor due to sub glottic stenosis	0	0	2	66.7%	02	13.3%
Mid-tracheal stricture due to post tracheostomy	04	33.3%	1	33.3%	05	33.4%
Total	12	80%	3	20%	15	100%

Table 4 shows distribution of study subjects as per the causes of tracheal stricture. Eight cases developed due to prolonged mechanical ventilatory support >8days due to organo phosphorus poisoning in past 3months and all of them were males. Two cases were due to stridor due to sub glottic stenosis and all of them were females. Five cases were due to mid tracheal stricture due to post tracheostomy and out of them, four were males and one was female.

Table 5 shows clinical findings at the end of 14months of follow up. All 15 cases i.e. 100% had very good symptomatic relief immediately after stenting. All 15 cases i.e. 100% had stridor disappeared. All 15 cases i.e. 100% had exercise capacity increased. All 15 cases i.e. 100% had breathing difficulty subsided. Thus, all cases had good outcome at the end of 14 months of follow up.

**Table 5: Clinical findings at the end of 14months of follow up.**

Clinical findings at the end of 14months of follow up	Number	%
Very good symptomatic relief immediately after stenting	15	100%
Stridor disappeared	15	100%
Exercise capacity increased	15	100%
Breathing difficulty subsided	15	100%

Table 6 shows distribution of study subjects as per outcome at 8<sup>th</sup> month when stent was removed. All cases had normal findings. No one developed foreign body reaction nor did no one develop granuloma formation at

the stent site. After stent removal flexible bronchoscopy repeated after 3<sup>rd</sup> month and 6<sup>th</sup> month. Patients were asymptomatic in 6months follow-up after stent removal. Bronchoscopy findings in 3<sup>rd</sup> month and 6<sup>th</sup> month were normal, no recurrence of stricture noted.

**Table 6: Distribution of study subjects as per outcome at 8<sup>th</sup> month when stent was removed.**

Clinical findings	Number	%
No foreign body reaction	15	100%
No granuloma formation at stent site	15	100%

## DISCUSSION

Authors found that tracheal stents are very useful. Authors observed 100% success rate in the outcome at 8months and 14 months follow up.

Karush JM et al, studied 63 patients. 71% of the cases were found to have tracheal stenosis. 11% of them had tracheomalacia. 17% of the cases had both conditions. The authors had to place a total of 243 stents in these 63 patients. 94 of these 243 stents were of 12mm size, 96 were of size 14mm. 60 of these stents were of length 30mm and 77 were of 40mm length. In cases of tracheomalacia, 14mm size were found to be better than the size of 12mm. The authors concluded that "rigid bronchoscopy with silicone airway stenting is a safe and effective option for the management of benign central airway obstruction." This conclusion was in accordance with the conclusion of the present study.<sup>6</sup>

Saueressig MG et al, studied 35 cases. Out of them, 14 had benign disease and 21 had stenosis of the trachea which was malignant. They used the silicone stent. On an average, the stent was kept for 457 days in cases of the benign disease. In two cases of tracheomalacia, cure was achieved after stent removal. On an average, the stent was kept for 162 days in cases of the malignant disease. Among the malignant cases, 12 patients died even when the stent was there. The authors found that two patients with malignant disease were lost to follow up and three were alive. The authors concluded that HCPA-1 stent was safe, effective and this conclusion was in accordance with the conclusion of the present study.<sup>7</sup>

Musani AI et al, placed seven silicone stents in cases with “benign proximal tracheal obstruction” which could not be operated using rigid bronchoscope. There were no complications while placing the stent. But over the period of time, there was localized cellulitis and breakage of the suture. It took two weeks to remove stents from two patients as these two patients were not able to tolerate it. The authors concluded that silicone stents can be easily placed in the proximal trachea and it is useful in preventing stent migration. This conclusion was in accordance with the findings of the present study.<sup>8</sup>

Ho CY et al, used “the computational fluid dynamics method”, this method helps to estimate the drop in the pressure of the airway before putting the stent and after removal of the stent. The authors studied seven healthy persons which were controls for their study and cases were 14 patients. They divided the 14 patients into two groups. One group of the patients was having stenosis of the trachea. Another group of the patients were having stenosis of the bronchus. They found that “the pressure drops after tracheal stent implantation became significantly smaller. For bronchial stent implantation cases, the airway resistance improved insignificantly.”<sup>9</sup>

Brigger MT et al, from their review found that stenosis of the trachea and sub glottis region in children can be managed by endoscopic techniques but the authors cautioned that if the child is having a mature scar or if he is having stenosis of the high grade or if he is having the stenosis of long segment then there is requirement of the “open airway reconstructive procedure.”<sup>10</sup>

Karapantzios I et al, presented one case report of the 65year man who developed stenosis of the trachea which was benign.<sup>11</sup> This condition was due to 15days intubation. The author treated the cases using “cryotherapy, electrocautery-knife, balloon dilation and semi-rigid bronchoscopic technique”. The authors recommended that choice of the therapy depends upon the treating physician and it depends upon the skill he possesses, equipment he has and the extent of the damage of the tissue.<sup>11</sup>

Tsakiridis K et al, treated two patients using Dumon silicone stents. These stents were inserted using the rigid

bronchoscope under general anesthesia. One patient was a female who was 39years old. She had failure of the first surgery and there was relapse. Another patient was a man who was 20 years old. His neurological condition was not good. He had long stricture in the trachea. There was swelling at the tracheostomy site. At follow up, the authors found that patency of the lumina was maintained, there was no migration of the stent. In the male patient, the swelling subsided. The respiratory function was good in both the patients. These findings of the authors are in accordance with the finding of the present study where author also found that silicone stent was 100% useful and successful.<sup>12</sup>

## CONCLUSION

Tracheal stenting is very useful procedure in the management of air way strictures. Duman silica stent is well accepted by patients-no stent rejection reported. Good symptomatic relief after stenting-maintained for 8months. There was no recurrence of stricture after stent removal in follow up of 6months duration in benign tracheal strictures.

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