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Original Research Article

Post-Intubation Tracheal Stenosis: Multicenter Study from 2010 to 2022

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Abstract: ***Objective:*** To study the epidemiological, clinical, paraclinical, therapeutic and evolutionary aspects of post-intubation tracheal stenosis occurring in patients admitted to intensive care units. ***Patients and methods:*** This is a multicenter, retrospective and descriptive study conducted from November 1, 2010 to June 1, 2022 in 7 intensive care units and 3 ENT departments. From medical records, we collected epidemiological data (frequency, age, sex), medical history, data relating to tracheal intubation (indication, duration, inflation pressure of the intubation tube balloon), data on post-intubation (PI) tracheal stenosis (symptoms and time to onset), paraclinical data, treatment and evolution modalities. The data collected were expressed as averages with their standard deviation. ***Results:*** During the study period, 19 patients presented with PI tracheal stenosis. The frequency ranged from 0.03% to 0.1%. The average age of the patients was 25.7 years ± 11.07 [14-38 years]. Patients had been intubated in a traumatic context in 47.37% of cases. The average duration of ventilatory support was 10.37 days ± 03.03 [4-15 days] No intubation tube cuff pressure monitoring was done for any patient. Dyspnea was the main telltale sign. Its average time to onset was 33.21 ± days 12.07 [1h-3months]. Endoscopically, the average degree of tracheal stenosis was 72.63% [50-99%]. Therapeutically, in intensive care, 5 patients (26.31%) who presented with acute respiratory failure underwent a life-saving surgical tracheostomy. Curative surgery resulted in a tracheal resection-anastomosis (73.68%) and enlargement tracheoplasty (26.32%). The outcome was favorable for 9 patients (47.37%). The recurrence of the stenosis after curative surgery was observed in 31.58% of cases. Death occured in 3 patients (15.79%). ***Conclusion:*** Over-inflation of the intubation tube cuff is the leading cause of PI tracheal stenosis. Prevention is based on the systematic monitoring of its inflation pressure.

Keywords: Post-intubation tracheal stenosis- Balloon inflation pressure- Resection-Tracheal anastomosis.

INTRODUCTION

Tracheal intubation is always a high-risk medical procedure. In resuscitation, its usually urgent nature further complicates a clinical situation dominated by the presence of respiratory distress, unstable hemodynamics and a full stomach [1]. Among the most severe complications of this gesture is tracheal stenosis, which is defined by a decrease in tracheal diameter of more than 10% in tomography [1].

In our practice, this proven iatrogenia remains largely neglected by anaesthesia, resuscitation and emergency medicine specialists.

In our regions, while otorhinolaryngology (ORL) specialists have assessed the extent of the problem of postintubation tracheal stenosis (PITS) through a few studies [2, 3], this is not the case in anesthesia-resuscitation where no studies on the subject exist to date.

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It is on this basis that we initiated this study, which aimed to study the epidemiological, clinical, paraclinical, therapeutic and evolutionary aspects of PITS that occurred in patients who stayed in a resuscitation unit.

PATIENTS AND METHOD

This is a multicentre, retrospective and descriptive study conducted from November 1st, 2010 to June 1th, 2022 in resuscitation units of the Dakar Main Hospital (HPD), the Idrissa Pouye General Hospital, the neurosurgical department of the University Hospital of Fann in Dakar. Patients also came from the regional resuscitation services of Touba, Diourbel and Kaolack. The study also included the ORL services of the University Hospital of Fann, the Dakar Main Hospital and the Idrissa Pouye General Hospital. All of the patients included in our study were identified from the hospital records of the ORL departments of the University Hospital of Fann, the Dakar Main Hospital and the Idrissa Pouye General Hospital. Patients who developed tracheal stenosis following tracheal intubation in resuscitation were included in the study. Patients with tracheal stenosis following a tracheotomy in a resuscitation stay and patients who received re-intubation were not included. The use of hospital records in these ENT departments allowed us to note the resuscitation department from patients. This exploitation of the data continued, then, at the level of the hospitalization records of these resuscitation services. From hospital records, we collected epidemiological data (age, gender); the pathological history; tracheal intubation data (indication, duration, inflation pressure of the balloon and intubation tube); PITS data (symptoms and their onset times); paraclinical data, therapeutic and evolutionary modalities of PITS. The data collected were expressed in averages with their standard deviation.

RESULTS

During the 12-year study period, 19 patients had tracheal stenosis following a resuscitation tracheal intubation. The PITS frequency ranged from 0.03% to 0.1%.

The average age of patients was 25.7 ± 11.07 years with extremes of 14 and 38 years. Our patient sex ratio was 1.2. The patients in our series were intubated in the resuscitation departments of the capital Dakar for the vast majority (78.94%). Patients were intubated in traumatic settings in 47.37% of cases (Table I). The average duration of ventilatory assistance was 10.37 days ± 3.03 with extremes of 4 and 15 days (Figure 1). No patient had benefited from monitoring the pressure of the intubation tube balloon.

Dyspnea was the main indicator of PITS. In 5 patients (26.31%) in resuscitation, this dyspnea had been acute and was responsible for acute respiratory failure. For 14 patients (73.68%), the revealing mode of PITS was essentially a progressive installation dyspnea worsening to the effort, appeared after the release of the resuscitation unit. The average time to onset of dyspnea was 33.21 days ± 12.07 with extremes of 1 hour and 3 months (Figure 2). Other signs were dysphonia (21.05%), cough (10.53%) and stridor (5.26%). At CT thoracic spine, PITS ranged in height from 10 to 20 mm in 12 patients (63.15%), and 20 to 30 mm in 5 patients (36.84%).

At endoscopy, for more than half of our patients (52.63%), tracheal stenosis was grade II according to the Myers-Cotton classification (reduction of more than 50% of the tracheal diameter). The mean degree of stenosis was 72.63% with extremes of 50% and 99% (Figure 3).

Therapeutically, in resuscitation, 5 patients (26.31%) with acute respiratory failure received a surgical rescue tracheotomy. In ENT departments, 14 patients (73.68%) received a sub-isthmic tracheotomy. This was a standby tracheotomy performed under local anaesthesia as part of the emergency. La chirurgie curative a porté en une résection-anastomose trachéale (73,68 %) et en une trachéoplastie d'agrandissement (26,32%). The curative surgery carried in a tracheal resection-anastomosis (73.68%) and in a magnification tracheoplasty (26.32%). All patients had benefited from the installation of a calibration stent. The evolution was favorable for 9 patients (47.37%). The recurrence of stenosis after curative surgery was the most common complication in our series. It was observed in 31.58% of cases (Table II). The progression was towards death in 3 patients (15.79%).

Table I: Distribution of patients according to indication of tracheal intubation.

Indications for tracheal intubation	Number	Percentages
Severe trauma	9	47,37%
Severe malaria	5	26,31%
Fat embolism	1	5,26%
Status epilepticus	1	5,26%
Post-operated neurosurgery	1	5,26%
EBV meningoencephalitis	1	5,26%
Organophosphate poisoning	1	5,26%
Total	**19**	**100%**

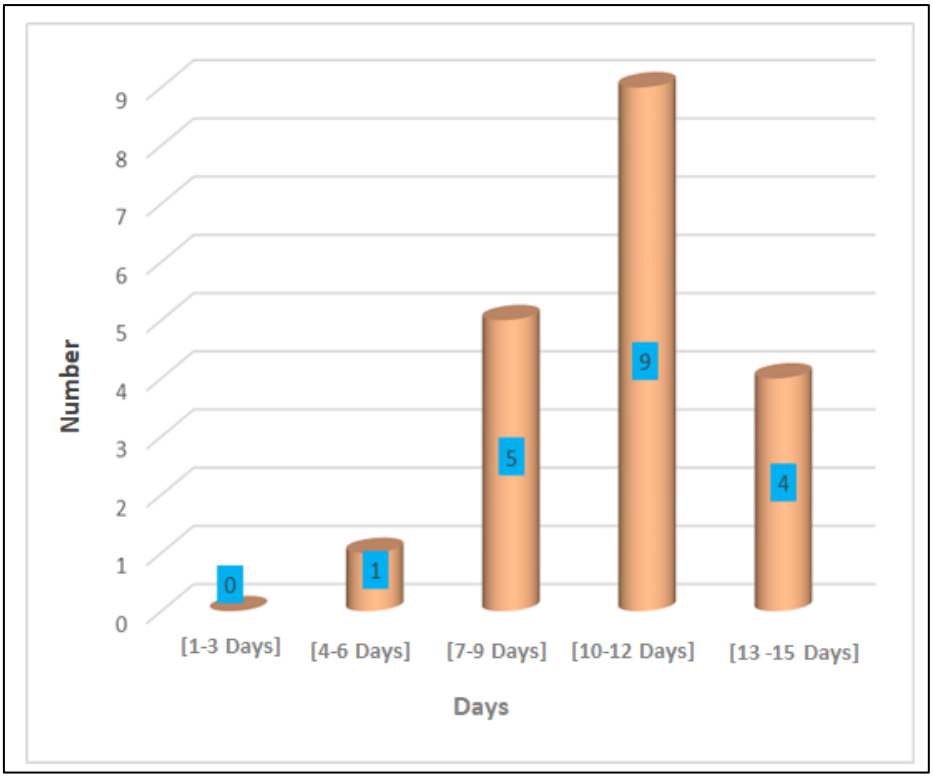

Figure 1: Distribution of patients according to duration of mechanical ventilation

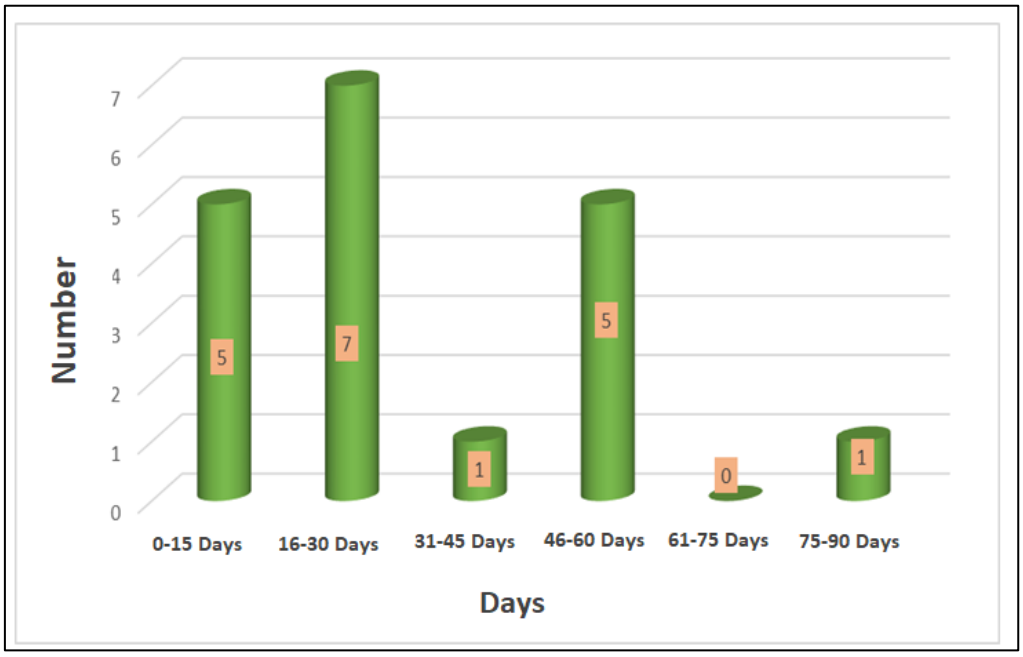

Figure 2: Distribution of patients according to time to onset of dyspnea.

Table II: Distribution of patients according to the postoperative complications presented and according to the type of surgery

Complications	Number		Percentages
	Tracheal resection-anastomosis	Enlargement tracheoplasty	
Recurrence of stenosis	5	1	31,58%
Inflammatory granuloma	3	0	15,79%
Migration of calibration equipment	1	0	5,26%
Pulmonary infection	1	1	5,26%

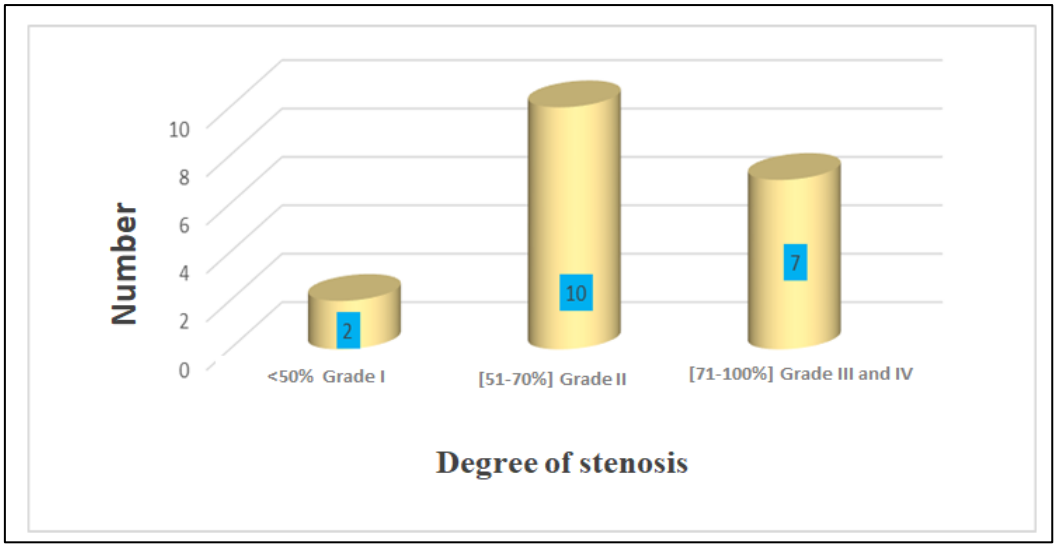

Figure 3: Distribution of patients according the degree of tracheal stenosis at endoscopy

DISCUSSION

Epidemiology

The frequency of PITS in resuscitation services in our study remains low, ranging from 0.03% to 0.1%. In the literature, stenosis responsible for significant functional shrinkage are rare. Their frequency is about 1% [4]. Data from the literature report even lower frequencies, of the order of 1 per thousand hospitalizations in resuscitation [5]. Nordin et al explained this low incidence by the use of high-volume, low-pressure balloon intubation probes [6]. In addition, systematic monitoring of the inflation pressure of the intubation tube balloon in the resuscitation services has contributed to a significant decrease in PITS cases [1]. Although the incidence of PITS is very low, it is nonetheless iatrogenic and medico-legal.

Indications for tracheal intubation

In our study, tracheal intubation most affected patients with traumatic pathology (47.37%). Our results are consistent with those found in Cuisnier's work or traumatic pathologies indicating tracheal intubation had concerned 35% of patients [7]. Traumatized patients may have one or more life-threatening conditions indicating tracheal intubation. In case of neurological distress tracheal intubation helps to protect the airways from bronchial inhalation and to ensure optimal gas exchanges thus avoiding hypercapnia factor of SBASO (secondary brain aggression of systemic origin) notorious. Tracheal intubation also allows the initiation of sedation, one of the major axes of the management of neurological suffering. In case of hemodynamic and respiratory distress, tracheal intubation ensures good tissue oxygenation. In the literature, the etiological profile of post-intubation tracheal stenosis usually shows a predominance of severe traumatized patients [7, 8].

The duration of the tracheal intubation

The average duration of tracheal intubation in our series was 10.37 days, with extremes of 4 and 14 days. This average duration is close to those found in the Harzallah and Cuisnier studies, which were respectively 11 and 13.1 days [9, 7]. In the Mribat series, the mean duration of tracheal intubation was longer: 16 days [6].

The duration of tracheal intubation is well identified as a risk factor for PITS occurrence [5]. For Whited, the risk of developing PITS is 12% when intubation is greater than 10 days [10]. However, literature data have shown that very short intubations can be complicated by scar stenosis [4, 5]. Yang reported a case of 18-hour tracheal intubation that became complicated by PITS a month later [11].

The current context of the Covid-19 pandemic has brought the issue of intubation and mechanical ventilation to the fore. For Piazza, it is not to be excluded, in the coming months, a considerable increase in cases of laryngotracheal stenosis related to tracheal intubation in the long-term [12].

The balloon inflation pressure

Maintaining sufficient pressure in the balloon of the intubation probe is fundamental. Ideally, the pressure should be kept within narrow limits between 25 and 30 cm H_2O. Below, the risk is inhalation, and beyond, that of ischemia of the tracheal mucosa. It is therefore necessary to control the pressure of the balloon precisely and regularly [13].

No patient in our series had received objective monitoring of the balloon inflation pressure per pressure gauge. The assessment of inflation pressure was subjective through palpation. Balloon overpressure is considered to be the primary cause of an PITS event. When the pressure exerted by the balloon on the

mucous membrane exceeds 30 cm H_2O, ischemic tracheal lesions develop. Ischemic phenomena will worsen with prolonged intubation, low infusion pressure or high ventilation pressure [14].

In a prospective, multicentre study evaluating techniques for assessing balloon inflation pressure and tracheal intubation tube pressure in anaesthesia, in a series of 198 patients, Bah showed that 95% of anesthesiologists used palpation to assess balloon pressure. The mean balloon inflation pressure was 71.86 cm H_2O with 29 and 120 cm H_2O extremes. For 99% of patients, the inflation pressure was greater than 30 cm H_20 [15]. Bah also showed that seniority did not protect from over-inflation because both senior anesthesiologists and doctors in training overinflated the balloon of the intubation tube. The lack of balloon pressure monitoring in our patients is due to the unavailability of pressure gauges in the resuscitation units. An awareness of the usefulness of this equipment has begun so that some resuscitation units have recently equipped themselves with it.

Clinical aspects

Dyspnoea was the telling mode of PITS in all our patients. It was acute in 26.32% of cases and in 73.68% of cases it was a dyspnea of progressive installation worsening to the effort, appeared after the exit of the resuscitation unit. In many studies, dyspnea remains the master symptom of PITS. It may be dyspnea at rest or dyspnoea aggravated by exertion [7]. The diagnosis is often easy with dyspnea in a patient with a history of intubation or tracheotomy. However, diagnosis can be more difficult, as PITS manifests itself in a respiratory distress panel with bronchial congestion. It should also be noted that a patient may have asymptomatic tight stenosis at rest, only showing up at exertion when ventilation minute increases. Baugnée recommends not to ignore the other causes of dyspnoea following extubation [5]. These include bronchospasm, acute decompensation of chronic respiratory failure, pulmonary embolism and bronchial congestion.

Delay in onset of symptoms

In our series, the average time of onset of symptoms was 33.21 days with extremes of 1 day and 3 months. This average time was close to that of the Harzallah series which was 29 days [9]. The timing of tracheal stenosis is variable in the literature, ranging from 5 days to 3 months []. But longer delays have been reported. In a series of 46 cases of PITS, Papla reported a free interval of 3 weeks to 2 years with an average delay of 24 weeks between intubation and diagnosis [16]. In tracheal stenosis, the late onset of symptoms is explained by the non-linear relationship between air flow resistance in the duct and its diameter. The appearance of clinical signs will depend on the gas flow in the airways and the degree of obstruction. Thus, at low ventilatory flow, stenosis becomes symptomatic only when it is tight. As soon as the ventilatory flow increases, a tight stenosis can become symptomatic. As a result, patients who have had limited physical activity because of their resuscitation stay will experience dyspnea upon resumption of normal activity [9].

The type of tracheal stenosis

For 73.68% of our patients, tracheal stenosis was complex. It was short in 26.32% of cases. The predominance of complex tracheal stenosis has also been observed in different series [6, 17]. Excessive inflation of the balloon creates ischemia of all components of the tracheal wall, with cartilage necrosis. The lesions are more complex in addition to an inflammatory reaction with granulomatosis. They extend the full height of the balloon (3-4 cm) [18].

The degree of tracheal stenosis

According to the Myers-Cotton classification, tracheal stenosis in our patients was grade II (51-70% obstruction) in 52.63% of cases and grade III and IV (71-100% obstruction) in 36.84% of cases. In the Elsayed study population, PITS was grade III and IV in 86.7% of cases [17]. Tight, Grade III and IV stenosis is characterized by louder symptomatology and shorter onset time as noted by Chang in a series of 83.3% patients with Grade III and IV tracheal stenosis [19].

Therapeutic aspects

Laryngotracheal endoscopy is a critical time to explore PITS. She has a diagnostic and therapeutic interest. All patients in our series have benefited from endoscopic exploration by an ENT specialist. It made it possible to specify the location, the extent, and the nature of the lesions; appreciate their complexity and check the laryngeal mobility. In addition to this diagnostic interest, endoscopy also allows to practice sessions of endoscopic dilations or the installation of prostheses until the organization and stabilization of the lesions. In the emergency before acute dyspnea, the practice of endoscopic dilation allows to lift the emergency. It mainly helps to avoid resorting to the tracheotomy which will further complicate the surgery and surgical suites. Unfortunately, the 5 emergency tracheotomy patients in our series did not benefit from this endoscopic technique. This could be explained by the impossibility of moving the endoscopic material and by the severe nature of the respiratory distress that could trigger a vital prognosis and require urgent tracheotomy. Similarly, patients initially treated with ENT services could not benefit from endoscopic dilation because the tracheal stenosis had already reached the fibrosis stage, which is a contraindication. Another therapeutic means is surgery. Fourteen patients (73.68%) benefited from a tracheal anastomosis - resection associated with the placement of a calibration stent. The success rate in our series was 50%. This surgical action affected 46.65 and 93% of the patients in the respective Cuisnier and Harzallah series, with a respective success rate of 91 and 89% [7, 9]. Resection-

anastomosis is the preferred treatment of complex tracheal stenosis with usually simple sequences [7]. It must be done on clean, non-evolutionary lesions, hence the interest of good preparation so that the resections are cleaner and economic. Surgery on infected and inflammatory lesions increases the risk of failure [9]. In the literature, success rates after tracheal resection-anastomosis range from 86.6 to 98% [20].

Evolution

Following a resection-anastomosis, the most severe complication is restenosis. It involved 5 patients (35.71%) of our series. Harzallah and Cuisnier reported 7.69% and 4.76% restenosis [9, 5] respectively.

Anastomotic complications following a tracheal resection-anastomosis are rare, but are responsible for severe morbidity. These complications include restenosis, granulomas at the anastomotic site, anastomotic release and fistulas with surrounding structures (tracheobronchial fistula and tracheo-innominate fistula) [21]. The presence of a tracheotomy before surgery is an independent risk factor for post-operative complications. This is because a traumatized airway is more susceptible to bacterial colonization, inflammation, and poor healing. This stoma placed away from the stenosis site may also cause malacy in this segment of the trachea, or cause a second stenosis [22].

Post-operative positive pressure ventilation can put pressure on the anastomosis and increase the risk of complications. Hence the interest of an optimal anaesthetic management in per-operative to allow extubation on surgical table and avoid mechanical ventilation in post-operative.

Mortality

In the evolution we noted the death of 3 patients. This corresponds to an overall mortality rate of 15.7%. This rate was 3.3% and 4.76% respectively in the Elsayed and Cuisnier series [5, 17]. Mortality from PITS surgery in the literature ranges from 1.8% to 5% according to different authors [4, 7, 18].

In our series, a death in surgery was closely linked to a difficulty in managing the airway after opening the trachea. It thus appears that the surgical procedure must be performed by a surgical and anesthetic team trained and equipped with all the means to allow optimal ventilatory assistance.

CONCLUSION

Excessive inflation of the intubation tube balloon is by far the leading cause of tracheal stenosis in resuscitation. Prevention involves systematic monitoring of the inflation pressure of the balloon of the intubation probe. The availability of endoscopy equipment in intensive care units, would make it possible to carry out urgently an endoscopic tracheal dilation, thus avoiding tracheotomy and surgery which constitute secondary aggressions.

REFERENCES

1. Nseir, S. (2011). Prévention des micro-inhalations et de l'ischémie trachéale liées à l'intubation : rôle de la régulation continue de la pression du ballonnet. Médecine humaine et pathologie. Mémoire Réanimation Médicale. Université du Droit et de la Santé - Lille II.
2. Bisson, A., Bonnette, P., El Kadi, N. B., Leroy, M., Colchen, A., Personne, C., ... & Herzog, P. (1992). Tracheal sleeve resection for iatrogenic stenoses (subglottic laryngeal and tracheal). *The Journal of Thoracic and Cardiovascular Surgery*, *104*(4), 882-887.
3. Baugnee, P. E., Marquette, C. H., Ramon, P., Darras, J., & Wurtz, A. (1995). Traitement endoscopique des sténoses trachéales post-intubation: À propos de 58 cas. *Revue des maladies respiratoires*, *12*(6), 585-592.
4. Nordin, U. (1977). The tracheal and cuff-induced tracheal injury. Acta Otolarngol, (suppl 345), 7-56.
5. Cuisnier, O., Righini, C., Pison, C., Ferretti, G., & Reyt, E. (2004, January). Prise en charge chirurgicale et/ou endoscopique des sténoses trachéales acquises non tumorales de l'adulte. In *Annales d'Otolaryngologie et de Chirurgie Cervico-faciale* (Vol. 121, No. 1, pp. 3-13). Elsevier Masson.
6. 6- Mribat Meriem. Sténose trachéale post-canulation. Traitement chirurgical. Thèse médecine. Rabat 2019, N°146.
7. Bonnette, P., Colchen, A., Leroy, M., & Bisson, A. (1998). Résection-anastomose trachéale pour sténose iatrogène: Une expérience de 340 cas. *Revue des maladies respiratoires*, *15*(5), 627-632.
8. Junien-Lavillauroy, C., Roux, O., Dumas, G., & Charachon, R. (1980). Les sténoses de la trachée après réanimation respiratoire: indication et résultats des résections anastomoses. *JFORL*, *29*, 227-234.
9. Abdelkefi, M., Belcadhi, M., Ben Ali, M., Bouslama, M., Bouzouita, K., Fdhila, R., ... & Zeglaoui, I. (2008). Stenose tracheale post-intubation. *Journal Tunisien d'ORL et de Chirurgie Cervico-Faciale*, 24, 8-13.
10. Whited, R. E. (1984). A prospective study of laryngotracheal sequelae in long-term intubation. *The Laryngoscope*, *94*(3), 367-377.
11. Yang, K. L. (1995). Tracheal stenosis after a brief intubation. *Anesthesia & Analgesia*, *80*(3), 625-627.
12. Piazza, C., Filauro, M., Dikkers, F. G., Nouraei, S. R., Sandu, K., Sittel, C., ... & Peretti, G. (2021). Long-term intubation and high rate of tracheostomy in COVID-19 patients might determine an unprecedented increase of airway stenoses: a call to action from the European Laryngological Society. *European Archives of Oto-Rhino-Laryngology*, *278*, 1-7.
13. Nazari, R., Boyle, C., Panjoo, M., Salehpour-Omran, M., Nia, H. S., & Yaghoobzadeh, A. (2020). The changes of endotracheal tube cuff

pressure during manual and intermittent controlling in intensive care units. *Iranian Journal of Nursing and Midwifery Research*, *25*(1), 71-75.
14. Conférence de consensus de la SFAR (2002). Prise en charge des voies aériennes en anesthésie adulte à l'exception de l'intubation difficile. Ann Fr Anesth Réanim, 22, 3-17.
15. Moulay Cherif Ould Moulaye Ely. (2016). Evaluations des techniques d'appréciation de la pression de gonflage du ballonnet de la sonde d'intubation trachéale en anesthésie chez l'adulte. Mémoire Anesthésie-Réanimation, UCAD, n° 19.
16. Papla, B., Dyduch, G., Frasik, W., & Olechnowicz, H. (2003). Post-intubation tracheal stenosis-morphological-clinical investigations. *Pol J Pathol*, *54*(4), 261-266.
17. Hidehiko, Y., Kohno, M., Nito, M., Aruga, N., Oiwa, K., Nakagawa, T., ... & Iwazaki, M. (2020). Postintubation tracheal stenosis 35 years after neonatal resuscitation. *International Journal of Surgery Case Reports*, *71*, 378-381.
18. Elsayed, H., Mostafa, A. M., Soliman, S., Shoukry, T., El-Nori, A. A., & El-Bawab, H. Y. (2016). First-line tracheal resection and primary anastomosis for postintubation tracheal stenosis. *The Annals of The Royal College of Surgeons of England*, *98*(6), 425-430.
19. Grillo, H. C., & Donahue, D. M. (1996, October). Post intubation tracheal stenosis. In *Seminars in thoracic and cardiovascular surgery* (Vol. 8, No. 4, pp. 370-380).
20. Chang, E., Wu, L., Masters, J., Lu, J., Zhou, S., Zhao, W., ... & Ma, D. (2019). Iatrogenic subglottic tracheal stenosis after tracheostomy and endotracheal intubation: A cohort observational study of more severity in keloid phenotype. *Acta Anaesthesiologica Scandinavica*, *63*(7), 905-912.
21. Couraud, L., Jougon, J., Velly, J. F., & Klein, C. (1994, January). Iatrogenic stenoses of the respiratory tract. Evolution of therapeutic indications. Based on 217 surgical cases. In *Annales de Chirurgie* (Vol. 48, No. 3, pp. 277-283).
22. Wright, C. D., Grillo, H. C., Wain, J. C., Wong, D. R., Donahue, D. M., Gaissert, H. A., & Mathisen, D. J. (2004). Anastomotic complications after tracheal resection: prognostic factors and management. *The Journal of thoracic and cardiovascular surgery*, *128*(5), 731-739.
23. Auchincloss, H. G., & Wright, C. D. (2016). Complications after tracheal resection and reconstruction: prevention and treatment. *Journal of thoracic disease*, *8*(Suppl 2), S160-167.

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