



Research Article

INDICATIONS AND COMPLICATIONS RELATED IN PEDIATRIC TRACHEOSTOMY

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ARTICLE INFO

Article History:

Received 20th February, 2018
Received in revised form 20th March, 2018
Accepted 8th April, 2018
Published online 28th May, 2018

Key words:

Pediatric, Children, Tracheostomy, Airway, Intubation.

ABSTRACT

Objectives: The purpose of this study was to review the relationship between the presence of complications with the indication of tracheostomy in pediatric patients.

Methods: The charts of pediatric patients who underwent tracheostomy over a 6-years period with a 4-years follow-up were reviewed. The indications for tracheostomy were separated in airway obstruction (AO) or prolonged intubation (PI).

Results: 61 records were included in the study. The mean age was 3.6 years, 44.3% of the patients were younger than 1 year. Twenty-one complications (34.4%) occurred in 14 patients (22.9%), more frequent complications were: accidental decannulation and tracheostomy cannula obstruction. In 31 patients, tracheostomy was performed due to PI. Thirty patients underwent tracheostomy for AO. Seven complications were found in each indication group for tracheostomy. The mean age of the patients with complications was 2.7 years, there were statistically significant differences in age with no complications patients. Five patients died due to tracheostomy-related causes, all cases by accidental decannulation.

Conclusion: The indication to perform the tracheostomy in pediatric patients is not related to the presence of complications. Patients younger than 1 year have more possibilities of tracheostomy complications.

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INTRODUCTION

Tracheostomy complications in pediatric patients are more frequent than in adults^(1,2) and they may be present in about 11.2% to 44.8% of cases^(3,4). There is also higher mortality related to the procedure, reported from 6 to 71%^(5,6,7,8,9). The most common complications of tracheostomy in children are cannula obstruction, accidental decannulation, tracheoesophageal and tracheo-cutaneous fistulae, subcutaneous emphysema, pneumomediastinum and pneumothorax.^(2,4,7,8,10) The factors that have been related with the presence of complications are low birth weight and preterm patients, the presence of associated chronic diseases, anatomical abnormalities of the neck, and the experience in tracheostomy care of the surgeon, medical staff, paramedics, and family training^(7,8,11,12).

The indications for tracheostomy in pediatric patients have changed over time^(10,13), in the past decades the first indication was airway obstruction (AO) secondary to infectious diseases, now the frequency of this indication has decreased due an adequate attention, early orotracheal intubation and the application of H. influenzae and diphtheria vaccines^(2,3,4,9,10).

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Whereas the indication for the performance of the tracheostomy by prolonged intubation (PI) has increased due to improvements in the treatment and care of intensive and neonatal care units¹⁴. Principal indications for tracheostomy due to AO have been: infectious pathologies and congenital anatomical alterations, stenosis and tracheomalacia^(3,4,8,9). Other causes of tracheostomy due to PI are related to neurological, pulmonary and pathological disorders that condition prolonged use of assisted ventilation^(3,9).

The objective of this study was to assess the relationship between the presence of complications with the indication of tracheostomy in pediatric patients, to know the indications and complications of pediatric tracheostomies, as well as to know the relationship between indications for tracheostomy and the success of the decannulation.

METHOD

A retrospective study, performed in otorhinolaryngology department of the Central Hospital "Dr. Ignacio Morones Prieto", a third level hospital in San Luis Potosí, Mexico. The records of pediatric patients who underwent tracheostomy from January 2004 to December 2010 were selected and reviewed for demographic data; diagnosis of the underlying disease; the indication of surgery; presence, and type of complications. The general mortality and the relationship with the tracheostomy

procedure was evaluated. The revision was made 4 years after the last tracheostomy included, determining if during this time the patients had died due to causes related to tracheostomy or other pathology, if they remained with the cannula or if they had been successfully decannulated.

We included patients under 15 years of age, who underwent a tracheostomy, which was performed in all cases in the operating room by one of the authors, through a cervical incision, separation of the pretreacheal muscles, and with a vertical incision in the trachea in 3rd and 4th tracheal space (10,14).

Tracheostomy indications were divided into PI and AO. PI was considered in patients who indicated tracheotomy due to persistent orotracheal intubation with ventilatory support, regardless of cause, and without obstruction of upper airways. The complications were recorded and were divided into trans-operative, early complications (within the first 7 days after surgery) and late complications (occurring after 7 days of surgery).

We evaluated the relationships between the indication of the tracheostomy (for AO or PI) and the presence of complications; the relationship of age with the presence of complications (Patients were also separated by age into two groups, one group less than 1-year-old, and the second group, those with more than 1-year-old at the time of tracheostomy), and successful decannulation. Age and tracheotomy indications were compared with tracheostomy-related mortality.

Descriptive statistics were used for the demographic parameters of the patients (means, range, standard deviation and percentage), for the type of indications (AO and PI indications) and for the presence of complications. We used bivariate analysis (X^2 , Fisher's exact test), and the OR were determined at 95% confidence interval. Normal variables were assessed using the Shapiro-Wilk test if not-normality was demonstrated we used Mann Whitney's U test.

Declarations of interest: None.

RESULTS

Seventy-two tracheostomies were performed in patients younger than 15 years of age in the period between January 2006 and December 2010, sixty-one records had complete data to include in the study (84.7%). The mean age was 3.6 years 4.1(minimum of 1 month and a maximum of 14 years), twenty-six patients were women (42.6%), 27 patients were less than 1 year old (44.3%) and 17 were less than 6 months old (27.8%). 43 patients underwent bronchoscopy prior to surgery (70.5%).

In 31 patients, tracheostomy was performed due to PI (50.8%), neurological pathologies were the most frequent in PI indications in 12 patients, followed by respiratory diseases in 10 patients, pulmonary immaturity in six patients and Cranial trauma in three patients. Thirty patients underwent tracheostomy for AO (49.2%). Congenital malformations were the most common indication of tracheostomy with AO indication in 9 patients (three patients with Pierre Robin syndrome, three with mucopolysaccharidoses, two with lymphangioma and one patient with a laryngeal cleft) followed by acquired laryngotracheal stenosis in 6 patients and tracheomalacia in 6 patients.

Twenty-one complications (34.4%) occurred in 14 patients (22.9%), the most frequent complication was accidental decannulation in 12 patients followed by tracheostomy cannula obstruction in 5 patients, pneumothorax in one patient, tracheomalacia in one patient and tracheal rupture in one patient. There were 13 early complications (61.9%) such as accidental decannulation and cannula obstruction, and 8 late complications (38.1%) such as accidental decannulation, obstruction, and tracheal rupture.

Seven complications were found in each indication group for tracheostomy ($p = 0 > 0.05$); no significant differences were found when comparing groups in sex, age, and tracheostomy-related mortality (Table 1).

Table 1

	IP	AO	p value
Patients (%)	31(50.8%)	30(49.2%)	
Age	4.4 ± 5.2	3 ± 2.7	p => 0.05*
Female (%)	14 (45.2%)	12 (40%)	p => 0.05¶
Male (%)	17 (54.8%)	18 (60%)	p => 0.05¶
Complications (%)	7 (22.6%)	7 (23.3%)	p => 0.05¶
< 1 year (%)	18 (58.1%)	19 (63.3%)	p => 0.05¶
Mortality (%)	1 (3.2%)	4 (13.3%)	p < 0.05¥

It shows the comparison of groups with IP and AO; mean of age, with standard deviation (sd) percentage of gender, complications and mean of age in patients < 1 year old and mortality, in both groups with p value.(* = t de Wilcoxon, ¶ = Fisher exact test, ¥ = χ^2)

There was a significant difference in average age ($p = < 0.01$) of the patients with complications (2.7 ± 3.4 years) compared to the patients with no complications (4 ± 4.1 years). There were 7 complications in the group of children under 1 year (33%), compared to 14 complications in over 1 year, this relation showed no significant difference ($p = > 0.05$). And when sex was related to the presence of complications, no significant difference was found either ($p = > 0.05$).

In the follow-up to 4 years, 24 patients died (39.3%), 5 of which were due to tracheotomy-related causes, in all cases these were by accidental decannulation. Of the 24 deaths, 17 were patients with IP tracheostomy (70.8%).

Ten patients continued with tracheostomy cannula at the time of the study (16.4%), 7 of them have IP tracheostomy (70%) and 27 patients were decannulated (44.3%), twenty of them had a tracheostomy for AO (74%). A relationship was found between the AO indication of tracheostomy and success in decannulation ($p = < 0.01$). Of the patients who have survived, there has been an overall success in the decannulation of 77.1% (Figure 1).

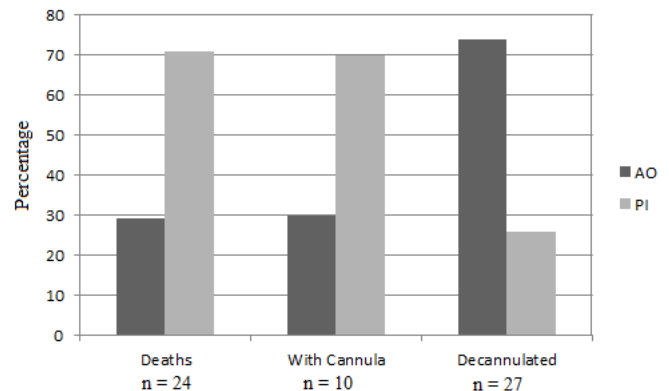


Figure 1 The follow-up of the groups that died due to non-Tracheostomy related causes, that persisted with cannula and those that were decannulated, separated in percentages of indication by PI and AO.

DISCUSSION

The indications for performing the tracheostomy in pediatric patients were not related to the occurrence of complications, but the mortality of these complications is related to the AO indication, because, in the case of decannulation in a patient with OA, they have more possibilities of life-threatening complication than in the case of a PI indication, who have a patent airway.

It has been seen that patients who undergo PI tracheostomy have more associated chronic diseases and this represents a higher risk for tracheostomy-related complications across the time⁽¹⁴⁾, however, in this study, the complications were not higher than in the case of indication by AO.

All surgeries were performed in the operating room and in a controlled environment; there was no "emergency or salvage" surgery, a factor that has been related to perioperative and early postoperative complications in patients who underwent AO tracheostomy^(2,7,14). With the change in indications over time, the type of complications has changed: during the decade of 1995 to 2004 the main complications were related to surgery: pneumomediastinum, pneumothorax, and stenosis. Currently, the complications such as accidental decannulation and cannula obstruction are higher^(7,14), in our study they occurred mostly during the seven days after the operation.

Some studies have considered the formation of granuloma as a complication^(14,15). In this study, it was not considered a complication because it can be seen as an expected outcome of the tracheostomy^(9,16). The most common complication in our study was accidental decannulation, which has been mentioned by others, among the most frequent cause of complication^(3,14,17). It has been seen that accidental decannulation is a complication that is increasing, as long as the patient remains with the tracheostomy^(3,14). In the study, accidental decannulation was the cause of mortality related to tracheostomy 100% of the time. The PI indication for tracheostomy was found to be related to non-tracheostomy-related mortality and to the persistence of tracheostomy, due to the greater presence of chronic comorbidities and the need of tracheostomy over time.

At follow-up over four years, non-tracheostomy-related mortality was 39.3%, mostly in patients with tracheostomy due to PI indication (70.7%), because this indication is related to the presence of chronic diseases and the persistence of tracheostomy over time, with a greater possibility of accumulating complications^(14,18).

In our study the main complication was accidental decannulation of the cannula, however, it has been observed that with the passing of the decades complications such as accidental decannulation and cannula obstruction have been decreasing, possibly due to the experience that has been acquired and improvements in care in the patient with tracheostomy, While complications such as tracheal stenosis and cutaneous tracheal fistula have been increasing progressively⁽¹⁴⁾.

Over time, the average of age of the tracheostomy has decreased. In different series, patients less than 1-year-old was found to be up to 50% of the total^(4,9,19,17). Complications are more frequent in this age group because the persistence of tracheostomy is higher on average than in patients older than 1

year and the size of the cannula can increase both accidental decannulation and obstruction^(18,20).

The study has as limitations to be retrospective and could not have recorded complications in the files, causing an underestimation; other is the limited amount of patients. The definition of the IP indication is different according to the different articles that were reviewed^(10,13,20). There is no description of the standardized indications to perform the tracheostomy in pediatric patients⁽²⁰⁾. We consider the tracheostomy due to the persistence of prolonged intubation, regardless of whether it was due to neurological, cardiac, pneumological pathology, etc., as PI indication.

In our study, we only revised the state of the patient at four years of the last tracheostomy included, the time from the surgery to de death or decannulation was not analyzed, so it was not possible to perform a survival curve.

Previous studies have found that the presence of associated chronic diseases has led to the persistence of tracheostomy and the presence of a greater number of complications, these patients are eventually managed out-of-hospital and in many cases, the patient doesn't have sufficient economic resources or support of health services for adequate home care⁽¹²⁾.

Although the training of doctors and nurses in tracheostomized patient care could reduce complications during hospital stay⁽²¹⁾, adequate parental training before the patient is discharged and the creation of multidisciplinary modules for continuing education and care of parents is an important way to avoid extra hospital complications^(4,11,20). The creation and maintenance of clinics that training medical and nursing staff for tracheostomy care, have been useful to avoid the complications in the postoperative period⁽²²⁾.

CONCLUSIONS

The indication to perform the tracheostomy in pediatric patients is not related to the presence of complications, if the complication was fatal, it was related to the indication of tracheostomy by AO. The average age of patients with complications was lower than those who did not present them. It is therefore important to develop outpatient tracheostomy care clinics to avoid out-of-hospital mortal complications.

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How to cite this article:

Victor Román Sánchez-Balderas et al (2018) 'Indications And Complications Related in Pediatric Tracheostomy', *International Journal of Current Advanced Research*, 07(5), pp. 12706-12709.
DOI: <http://dx.doi.org/10.24327/ijcar.2018.12709.2243>
