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THORACIC

The ESTS-AIR database–initial results of a multi-institutional database on airway surgery

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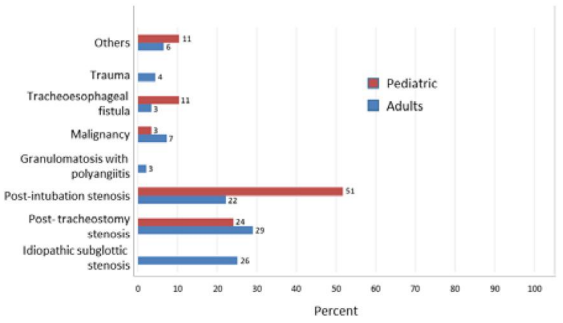
The ESTS-AIR database – initial results of a multi-institutional database on airway surgery

Summary

In 2018, an initiative was formed, which aimed to create an airway database within the framework of the ESTS database (AIR-ESTS). Five dedicated airway centers were asked to test the database in a pilot phase. A first descriptive analysis of 415 patients included in AIR-ESTS was performed.

Pilot phase – 5 airway centers
415 patients



Abstract

OBJECTIVES: Compared to lung resections, airway procedures are relatively rare in thoracic surgery. Despite this, a growing number of dedicated airway centres have formed throughout Europe. These centres are characterized by a close interdisciplinary collaboration and they often act as supra-regional referring centres. To date, most evidence of airway surgery comes from retrospective, single-centre analysis as there is a lack of large-scale, multi-institutional databases.

METHODS: In 2018, an initiative was formed, which aimed to create an airway database within the framework of the ESTS database (ESTS-AIR). Five dedicated airway centres were asked to test the database in a pilot phase. A 1st descriptive analysis of ESTS-AIR was performed.

RESULTS: A total of 415 cases were included in the analysis. For adults, the most common indication for airway surgery was post-tracheostomy stenosis and idiopathic subglottic stenosis; in children, most resections/reconstructions had to be performed for post-intubation stenosis. Malignant indications required significantly longer resections [36.0 (21.4–50.6) mm] when compared to benign indications [26.6 (9.4–43.8) mm]. Length of hospital stay was 11.0 (4.1–17.3) days (adults) and 13.4 (7.6–19.6) days (children). Overall, the rates of complications were low with wound infections being reported as the most common morbidity.

CONCLUSIONS: This evaluation of the 1st cases in the ESTS-AIR database allowed a large-scale analysis of the practice of airway surgery in dedicated European airway centres. It provides proof for the functionality of ESTS-AIR and sets the basis for rolling out the AIR subsection to all centres participating in the ESTS database.

Keywords: Airway surgery • Database • ESTS

ABBREVIATIONS

AIR-ESTS	airway database within the framework of the ESTS database
NoAAC	North American Airway Collaborative

INTRODUCTION

Airway surgery is a rare sub-specialty of thoracic surgery and even in high-volume centres, the annual case load is often limited to a hand-full of cases. This low case number together with a broad range of underlying diseases and a variety of surgical techniques results in an underrepresentation of airway surgery in the literature. Most of available studies are small case series or represent retrospective single-institutional experience [1–3]. Unlike other sub-specialties of thoracic surgery, such as lung transplantation, thymic malignancies or neuroendocrine tumours, there is a lack of multi-institutional databases, which could help to overcome this problem. To the best of our knowledge, there is currently only 1 large initiative recruiting patients suffering from airway disease. The North American Airway Collaborative (NoAAC) is a consortium founded in 2014 to provide information about the management of adult airway disorders. As NoAAC almost exclusively consists of ear, nose, and throat (ENT) surgeons, it is less useful to address topics relevant for thoracic surgeons [4].

Based on this background, an initiative was formed by thoracic surgeons to establish an airway section within the ESTS database. Its purpose was to create a scientific database as granular as possible, which can serve as a source for epidemiological and descriptive studies. Such a database should also allow outcome analysis of subgroups (paediatric patients, patients with malignancies, outcome of a specific surgical technique, etc.) and thus guide surgical decision-making.

The aim of this study was to summarize the initial experience with the ESTS-AIR database and to present 1st results.

MATERIAL AND METHODS

Ethical statement

The study protocol was submitted to the ESTS Database Committee for approval and an anonymized user file containing all patients with entries to airway database within the framework of the ESTS database (ESTS-AIR) was provided. The study was approved by the ethics committee of the Medical University of Vienna (EK-Nr.: 1953/2023).

Steps of initiation

The idea of establishing a European database of airway surgery arose in the year 2018 based on the unmet need of a high quality, well-maintained, multi-institutional database in airway surgery. Such a database should allow for (i) large-scale analysis of airway surgery as well as (ii) in-depth analysis of rare subgroups. The plans of a novel airway database were presented to the ESTS Database Committee and the ESTS Board of Directors and it was eventually decided that a dedicated airway section should be established within the framework of the ESTS database (ESTS-AIR). This would be the 5th subsection of the ESTS database (thymoma section, mesothelioma section, neuroendocrine tumor (NETs) section, chest wall section, airway section). A steering committee was founded including members of the ESTS (Michele Salati, W. Klepetko, Konrad Hoetzenecker) and the Brazilian Society of Thoracic Surgery (R. Terra, Benoit Bibas, Paulo Cardoso), which had previously established a multi-institutional database for airway surgery in Brazil [5]. Building upon the already available architecture of the Brazilian dataset, the structure of ESTS-AIR was created and fed into the ESTS database framework by KData, the company responsible for maintaining the ESTS database. Based on a steering committee meeting in 2019, it was decided to 1st open the database only for a small number of centres, all of which had a distinct reputation in airway surgery and agreed to upload all of their airway cases with exhaustive, high-quality data imputation. ESTS-AIR finally went live on March 2019 including the following sites: Medical University of Vienna (local coordinator: Thomas Schweiger), Sapienza Università di Roma (local coordinator: Erino Rendina), Ruhrlandklinik Essen (local coordinator Clemens Aigner), Radboud University Medical Center Nijmegen (local coordinator: Ad Verhagen) and University of Sao Paulo (local coordinator: Benoit Bibas).

Design of the database

The ESTS-AIR database is an on-line registry maintained in the same web platform as the global ESTS Registry. It has been built using the same architecture as the ESTS Registry, representing one of its 5 satellite datasets as previously reported. The data

upload procedure is clearly defined, repetitive and uniform for any contributor. It is constantly and on-line available for ESTS members by accessing the ESTS Registry web site (https://ests.kdataclinical.it/) hosted within the ESTS web page (https://www.ests.org/).

The ESTS-AIR database collects more than 300 items to describe the wide spectrum of airway surgery practice. The variables are organized in 5 different sections (I: demographic data; II: preoperative section; III: perioperative section; IV: operative section; V: postoperative section; VI: follow up), each one containing specific subsections (total of 40 subsections). The interval of follow-up visits were left to the discretion of each contributing airway programme. At each visit, imaging data as well as functional analysis can be entered in ESTS-AIR. Besides this distribution of the variables, in order to facilitate the upload of data, the structure of the dataset provides for the presence of splitting queries that obscure some branches of the database and enable the editing of some others.

More than 90% of the items are collected in a structured format in order to facilitate the following procedures of data quality assessment, data extraction and data analysis, minimizing the post-imputation transformation of data. Within all the items, 40 core variables are labelled, representing the minimum dataset to extract basic knowledge from the collected data. These 40 core variables are also used for performing data quality analysis, based on a list of strictly defined formulas assessing completeness and accuracy for each of them.

Moreover, specific dashboards are available within the initial ESTS-AIR database web page once accessing the registry. These dashboards are automatically and constantly updated reporting the level of contribution and the quality of data for each contributor.

Data extraction for this study was performed by KData, the company that manages the entire ESTS Registry. The procedures of data cleaning and data analysis have then been performed by the authors of this study.

This analysis included all data entries into ESTS-AIR between 1 March 2019 and 3 June 2022 from the airway programmes of the Medical University of Vienna, the Sapienza Università di Roma, the Ruhrlandklinik Essen, the Radboud University Medical Center Nijmegen and the University of Sao Paulo. A descriptive analysis was performed using the complete data set (Supplementary Material, Table S1). For comparative analysis, patients were grouped into adults (≥18 years old) and children (<18 years old) as well as malignant and benign indications. Missing values were excluded from the analysis. As follow-up intervals and the completeness of follow-up varied between the contributing centres, an analysis beyond the index hospital stay was not performed. Complications were defined as 'any deviation from the normal postoperative course' according to the classification of Clavien–Dindo [6].

Statistical analysis

Analysis was performed using SPSS 21 (SPSS Inc., Chicago, USA) and GraphPad Prism 6 (GraphPad Software Inc., California, USA). Chi-squared test and Fisher's exact test were used to compare dichotomous variables. Student's *t*-test was used to compare means of 2 independent groups. Mann–Whitney *U*-tests were used when distribution of continuous variables were not normal. Values were expressed as mean and standard deviation or median and interquartile range. All tests were two-sided. *P*-values ≤0.05 were considered as statistically significant.

RESULTS

At the time of analysis, the ESTS-AIR database included 415 patients. The 40 subsections had an 84.4% completion rate (Fig. 1). A total of 29 paediatric patients and 29 patients with malignant aetiology were included.

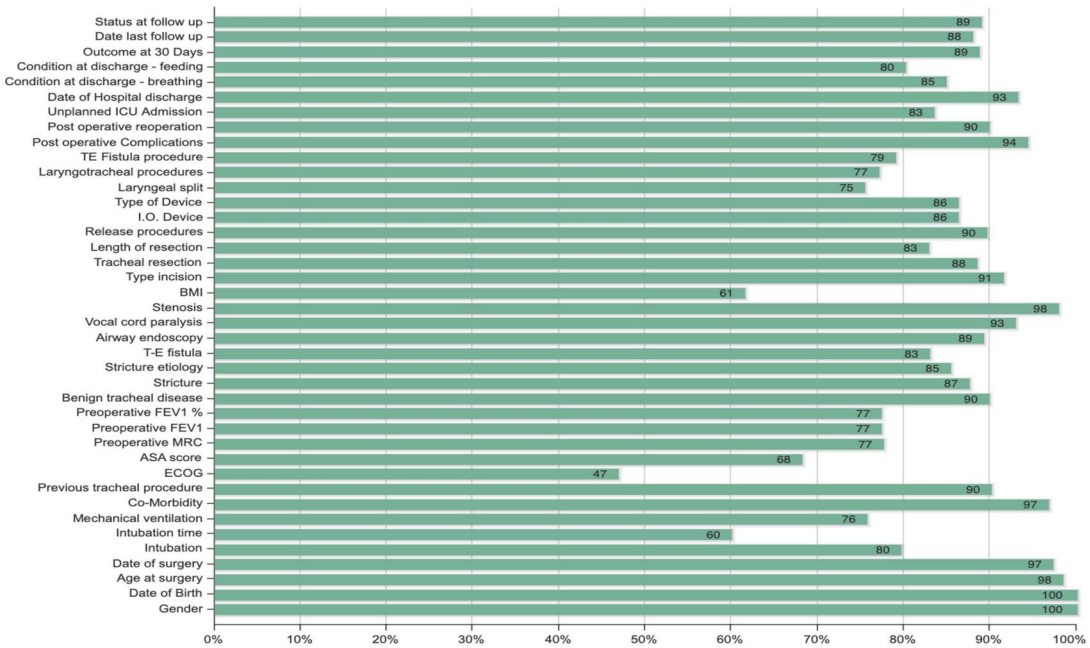


Figure 1: This depicts the % completeness of the 40 subsections of all cases uploaded to ESTS-AIR. ESTS-AIR: airway database within the framework of the ESTS database.

Preoperative characterization

The median age of patients included in ESTS-AIR was 52.9 (37.0–68.8) years for adults and 7.8 (0.9–14.7) years for paediatric patients. The proportion of female patients was higher in the adult group (female versus male: 60.6% vs 39.4%) as opposed to more male patients in the paediatric group (female versus male: 41.4% vs 58.6%). For adults, the most common indication for airway surgery was post-tracheostomy stenosis and idiopathic subglottic stenosis; in children, most resections/reconstructions had to be performed for post-intubation stenosis. Of note, resections for malignancies were more common in adults and repair of trachea-oesophageal fistula was more common in children, although the overall case load of both groups was rather low (Fig. 2A). A detailed characterization of the extent and severity of laryngotracheal stenosis is summarized in Table 1. Naturally, length of stenosis was shorter in paediatric patients; however, a higher proportion of children presented with a dynamic component of their stenosis (24.1% vs 78%). Preoperative vocal fold movement was impaired in 11.1% of adults and 3.4% of children. Incomplete preoperative glottis closure was slightly more common in paediatric patients (8% vs 10.3%). A detailed preoperative work-up of voice and swallowing is shown in Table 1.

Surgery and postoperative results

Most patients were operated through a cervicotomy, whereas a sternotomy or a thoracotomy was rarely needed (Fig. 2B). Tracheal resection was the most common type of airway procedure (Fig. 2C). Based on the high percentage of idiopathic subglottic stenosis in adults, cricotracheal resections (standard, + dorsal mucosal flap, + lateral cricoplasty) were more prevalent in this group. The mean length of resection was 27.2 (15.2–34.2) mm in adults and 11.7 (6.1–17.3) mm in children. Post-operative utility tracheostomy was necessary in 1 out of 4 patients, most of whom had received a high cricotracheal resection or a single-stage laryngotracheal reconstruction before. The majority of both, adults and children, were transferred to an intensive care unit for surveillance after the procedure and stayed there for a mean length of 2.0 (0.0–5.5) and 5.7 (1.3–11.1) days. Length of hospital stay for airway surgical cases was reported as 11.0 (4.1–17.3) and 13.4 (7.6–19.6) days. Overall, the rates of complications were low with wound infections being reported as the most common morbidity. Of note, anastomotic dehiscence was only seen in 2.8% and 3.4% of patients. Given the frequent complexity of airway surgery and the high prevalence of comorbidities, hospital mortality was low with only 1.8% in adults 0% in children. Detailed results of functional outcomes are presented in Table 2. In general, voice and swallowing functions were comparable to the preoperative examinations.

Comparison of benign and malignant indications

In a separate set of analyses, we aimed to compare benign ($n = 358$) and malignant indications ($n = 29$) (Table 3). Seventy-two percent of patients in the malignancy group had primary airway malignancies and 28% suffered from tumours not originating from the airways (Supplementary Material, Fig. S1). In the first group, the most common tumour types were adenoid cystic carcinomas and primary squamous cell cancers; the latter mainly comprised of thyroid or oesophageal cancers infiltrating the airway. Malignant indications required significantly longer resections [36.0 (21.4–50.6) mm] when compared to benign indications [26.6 (9.4–43.8) mm; Fig. 3]. Despite the need for more extended procedures in malignant indications, the perioperative and postoperative outcome was comparable to benign indications. Two out of the 29 patients (7.1%) died, 1 due to multi organ failure and 1 due to myocardial infarction.

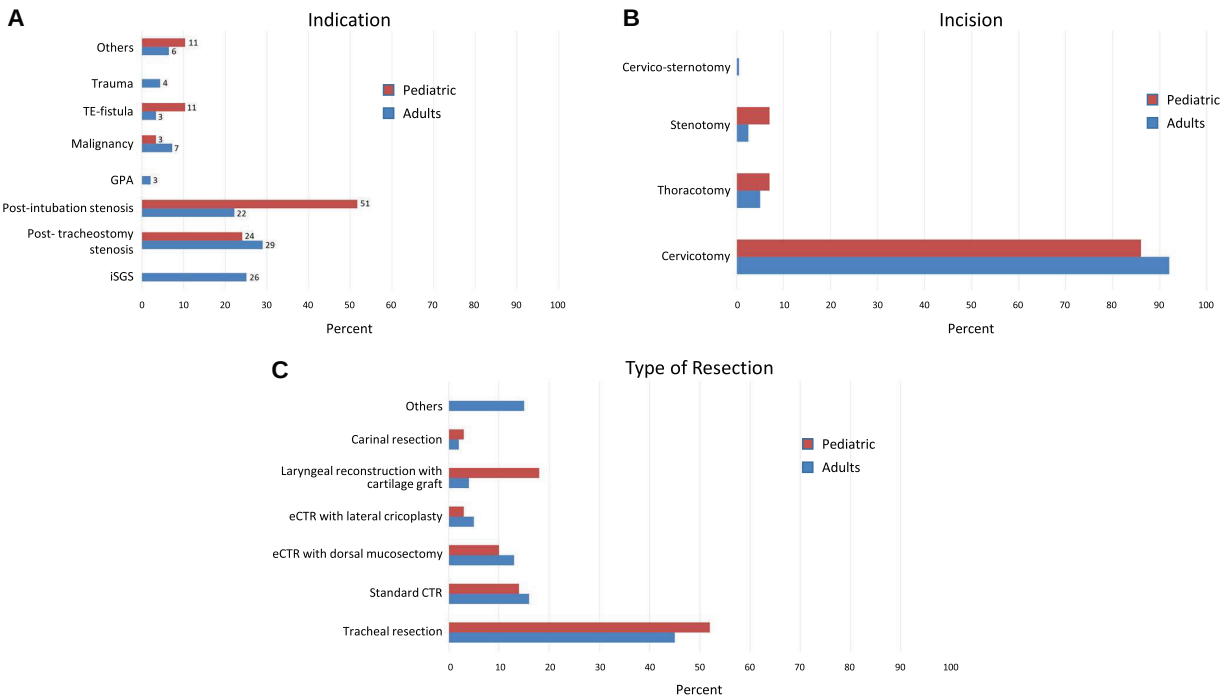


Figure 2: The indications for airway resections in adults and paediatrics are shown in (**A**). (**B**) highlights the type on incisions, and surgical techniques are shown in (**C**).

Table 1: Descriptive data of patients in the database (adult versus children)

Variable	Adult ($n = 386$) *n* (%)	Paediatric ($n = 29$) *n* (%)	*P*-value
Sex			
Male	152 (39.4)	17 (58.6)	0.042
Female	234 (60.6)	12 (41.4)	
Median age at surgery (range)	52.9 (37.0–68.8)	7.8 (0.9–14.7)	<0.001
Body mass index (BMI)	27.2 (20.3–34.1)	18.7 (12.5–24.9)	<0.001
Smoking history			
Current smoker	17 (4.4)	–	<0.001
Past smoker (>1 month)	103 (26.7)	–	
Never smoked	145 (37.5)	27 (93.1)	
Unknown	121 (31.4)	2 (6.9)	
History of intubation	198 (51.3)	22 (75.9)	0.023
Intubation time (days)	11.9 (0.8–23.5)	9.6 (3.3–15.9)	0.552
Persistent tracheostomy	72 (18.6)	11 (37.9)	0.017
Endoscopic pretreatment	98 (25.4)	6 (20.7)	0.589
Aetiology			
Idiopathic	97 (25.1)	–	
Post-intubation w/ tracheostomy	112 (29.0)	7 (24.2)	
Post-intubation w/o tracheostomy	86 (22.3)	15 (51.7)	
Malignant	28 (7.3)	1 (3.5)	0.005
Tracheoesophageal-fistula (TEF)	13 (3.4)	3 (10.3)	
Trauma	17 (4.4)	–	
Granulomatosis with polyangiitis	8 (2.1)	–	
Others	25 (6.5)	3 (10.3)	
Previous chemotherapy	27 (7.0)	–	0.141
Previous radiotherapy	14 (3.6)	–	0.296
Length of stenosis (mm)	20.9 (9.0–32.8)	16.1 (3.6–28.6)	0.145
Remaining lumen (mm)	6.1 (0.0–11.2)	3.2 (0.1–6.3)	0.088
Distance of stenosis to vocal cords (mm)	18.8 (0.0–38.0)	11.1 (0.0–23.9)	0.132
Total length of trachea (mm)	114.8 (87.4–132.2)	85.0 (64.8–105.2)	<0.001
Tracheal wall instability	30 (7.8)	7 (24.1)	0.009
Myer–Cotton grading			
Grade I (0–50%)	–	–	
Grade II (50–70%)	86 (22.3)	7 (24.1)	0.973
Grade III (71–99%)	107 (27.7)	9 (31.0)	
Grade IV (100%)	10 (2.6)	1 (3.4)	
Preoperative vocal cord movement			
Reduced	31 (8.0)	1 (3.4)	0.491
Immobile	12 (3.1)	–	0.615
Preoperative incomplete glottic closure	31 (8.0)	3 (10.3)	0.721
RBH score			
Preoperative roughness			
Grade 0	69 (17.9)	3 (10.3)	
Grade 1	67 (17.4)	3 (10.3)	
Grade 2	28 (7.2)	1 (3.4)	0.637
Grade 3	7 (1.8)	–	
N/A	215 (55.7)	22 (76.0)	
Preoperative breathiness			
Grade 0	88 (22.8)	4 (13.8)	
Grade 1	50 (13.0)	1 (3.4)	
Grade 2	22 (5.7)	2 (6.9)	0.860
Grade 3	11 (2.8)	–	
N/A	215 (55.7)	22 (76.0)	
Preoperative hoarseness			
Grade 0	77 (19.9)	3 (10.3)	
Grade 1	57 (14.8)	2 (6.9)	0.753
Grade 2	30 (7.8)	2 (6.9)	
Grade 3	7 (1.8)	–	
N/A	215 (55.7)	22 (76.0)	
Preoperative phonation time (s)	14.4 (7.3–21.5)	–	–
Preoperative dysphagia			
Aspiration	8 (2.1)	–	0.658
Retention	13 (3.4)	–	0.612
Preoperative dysphagia self-rating 1–7	1.8 (1.0–3.1)	1.0 (1.0–1.57)	0.119
Preoperative FEV1 (%)	74.3 (49.3–99.3)	61.8 (27.8–95.8)	0.214
Comorbidities			
Hypertension	117 (30.3)	–	<0.001
Coronary artery disease	26 (6.7)	–	0.240

Continued

Table 1: Continued

Variable	Adult ($n = 386$) *n* (%)	Paediatric ($n = 29$) *n* (%)	*P*-value
Previous cardiac surgery	9 (2.3)	3 (10.3)	0.044
Cardiac arrhythmia	28 (7.3)	2 (6.9)	0.944
Congenital cardiac disease	29 (7.5)	5 (17.2)	0.076
Diabetes mellitus	29 (7.5)	–	0.155
Chronic kidney disease	20 (5.1)	–	0.382
COPD	33 (8.5)	–	0.150
Connective tissue disease	2 (0.5)	2 (6.9)	0.026
Previous malignancy	32 (8.3)	–	0.152
Gastroesophageal reflux	22 (5.7)	–	0.252
HIV	2 (0.5)	–	0.703
Obesity (BMI >36)	36 (9.3)	–	0.095
Type of incision			
Cervicotomy	334 (86.5)	23 (79.2)	0.403
Thoracotomy	19 (4.9)	2 (6.9)	0.650
Sternotomy	9 (2.3)	2 (6.9)	0.175
Cervico-sternotomy	2 (0.5)	–	0.702
Intraoperative ECMO	7 (1.8)	2 (6.9)	0.125
Procedures			
Tracheal resection	175 (45.3)	15 (51.7)	0.564
Standard cricotracheal resection	62 (16.1)	4 (13.8)	0.803
Extended CTR + dorsal mucosal flap	48 (12.4)	3 (10.3)	0.787
Extended CTR + lateral cricoplasty	21 (5.4)	1 (3.4)	0.726
Laryngeal reconstruction + cartilage graft	14 (3.6)	5 (17.2)	0.007
Carinal resection	8 (2.7)	1 (3.4)	0.626
Others	58 (15.0)	–	0.022
Length of resection (mm)	27.2 (15.2–34.2)	11.7 (6.1–17.3)	0.012

COPD: chronic obstructive pulmonary disease; CTR: cricotracheal resection; ECMO: extracorporeal membrane oxygenation; FEV1: forced expiratory volume in one second; HIV: human immunodeficiency virus; RBH: roughness [R]; breathiness [B]; hoarseness [H].

DISCUSSION

The ESTS-AIR database is the 1st comprehensive multi-institutional database world-wide, covering the full spectrum of airway surgery. Following its launch in 2019, 5 institutions have tested its framework and have successfully added over 400 cases to the database. This 1st analysis of the database shows that the data quality of reported cases is high (84% of data completeness) and a broad range of indications and surgical techniques coupled with a consistent outcome reporting is covered. Despite the still relatively low overall number of cases in ESTS-AIR, subgroups of rare indications could be formed even in an initial report such as this one.

After the successful completion of the pilot phase of the database, inevitably the question arises how to proceed. The ESTS-AIR steering committee has extensively discussed this issue together with members of the ESTS database committee and it was decided that the next logical step would be to open the database to all centres accredited to participate in the ESTS database. However, such an opening must not dilute the quality of ESTS-AIR and the high data quality of reported cases must be maintained [7]. A measure to ensure that the quality remains high is the implementation of a minimal set of variables, which need to be entered for each section in order to allow to upload patient data to ESTS-AIR. These variables include overall patient characteristics, comorbidities, risk factors, pretreatment, aetiology, surgical details, anaesthesia, postoperative outcome, morbidity, mortality and status at discharge. The steering committee of ESTS-AIR together with the ESTS working group of airway disease will periodically analyse the database and change the threshold of minimal set of variables if necessary. Once the database has been rolled out to the thoracic surgical community, selected Departments of Otolaryngology or Head and Neck Surgery could be invited to participate. This is relevant to expand the number of subglottic resections, which are primarily performed by ENT (ear-nose-throat) surgeons in some countries. Another question of debate is whether a threshold of the number of airway cases performed each year should be implemented. With airway surgery being rarely performed in most centres, the authors of this work believe that a volume threshold would exclude a large number of cases performed in Europe and thus would distort the real landscape of airway surgery. However, as in most complex procedures, high-volume centres perform better than low volume centres [8, 9], one of the future projects of ESTS-AIR would be to address the question of centre-volume effect in airway surgery.

To the best of our knowledge, ESTS-AIR is the 1st airway database covering all aspects of airway surgery. We are only aware of 2 other approaches. The Airway Intervention Registry (PI: Adam Sims, Newcastle upon Tyne) is a NHS initiative to enable a UK-wide data collection of ENT respiratory procedures conducted on children [10]. The database opened in 2015 and to the best of our knowledge, 2 projects have been pursued: the results of 59 children with airway stenosis treated by balloon dilatation has been published in 2019. A 2nd initiative looking at the effect of different treatment options for recurrent respiratory papillomatosis has been proposed (https://trialbulletin.com/lib/entry/ct-03465280).

Table 2: Outcome analysis (adult versus children)

Variable	Adult ($n = 386$) *n* (%)	Paediatric ($n = 29$) *n* (%)	*P*-value
Postoperative utility tracheostomy	92 (23.8)	8 (27.5)	0.654
Postoperative ICU	209 (54.1)	20 (68.9)	0.174
ICU stay (days)	2.0 (0.0–5.5)	5.7 (1.3–11.1)	< 0.001
Hospital stay (days)	11.0 (4.1–17.3)	13.4 (7.6–19.6)	0.647
Complication			
Anastomotic dehiscence	11 (2.8)	1 (3.4)	0.855
Prolonged ventilation >48 h	6 (1.6)	1 (3.4)	0.400
Multiorgan failure	3 (0.8)	–	0.638
Myocardial infarct	2 (0.5)	–	0.702
Pneumonia	5 (1.3)	2 (6.9)	0.079
Pulmonary embolism	2 (0.5)	–	0.702
Recurrent nerve palsy	4 (1.0)	–	0.585
Re-intubation	6 (1.6)	–	0.501
Wound infection	14 (3.6)	1 (3.4)	0.962
Bleeding >200 ml	4 (1.0)	–	0.585
Subcutaneous emphysema	9 (2.3)	2 (6.9)	0.175
Laryngeal oedema	6 (1.6)	3 (10.3)	0.019
Re-operation during hospital stay	32 (8.3)	3 (10.3)	0.725
Discharge with tracheostomy	31 (8.0)	7 (24.1)	0.011
Hospital mortality	7 (1.8)	–	0.467
30-days mortality	1 (0.3)	–	0.791
Postoperative vocal cord movement			
Reduced	31 (8.0)	2 (6.9)	0.829
Immobile	21 (5.4)	1 (3.4)	0.726
Postoperative incomplete glottic closure	21 (5.4)	–	0.384
RBH score			
Postoperative roughness			
Grade 0	67 (17.4)	4 (13.8)	
Grade 1	65 (16.8)	6 (20.7)	0.341
Grade 2	20 (5.2)	2 (6.9)	
Grade 3	4 (1.0)	1 (3.4)	
N/A	230 (59.6)	16 (55.2)	
Postoperative breathiness			
Grade 0	104 (26.9)	9 (2.3)	
Grade 1	37 (9.6)	3 (10.3)	
Grade 2	10 (2.6)	1 (3.4)	0.856
Grade 3	5 (1.3)	–	
N/A	230 (59.6)	16 (55.2)	
Postoperative hoarseness			
Grade 0	65 (16.8)	6 (20.7)	
Grade 1	64 (16.6)	4 (13.8)	
Grade 2	18 (4.7)	2 (6.9)	0.984
Grade 3	9 (2.3)	1 (3.4)	
N/A	230 (59.6)	16 (55.2)	
Postoperative phonation time (s)	13.4 (9.8–17.8)	–	–
Postoperative dysphagia			
Aspiration	5 (1.3)	–	0.540
Retention	12 (3.1)	–	0.615
Postoperative dysphagia self-rating 1–7	1.8 (1.0–3.1)	1.0 (1.0–1.57)	0.124
Postoperative FEV1 (%)	80.9 (58.7–103.1)	–	–

FEV1: forced expiratory volume in one second; ICU: intensive care unit; RBH: roughness [R]; breathiness [B]; hoarseness [H].

This database is restricted to UK-based hospitals and it is limited to paediatric patients, therefore only covering a niche of airway surgery.

Table 3: Comparison adult non-malignant indications versus malignancies

Variable	Benign ($n = 358$) *n* (%)	Malignant ($n = 28$) *n* (%)	*P*-value
Length of resection (mm)	26.6 (9.4–43.8)	36.0 (21.4–50.6)	< 0.001
Postoperative utility tracheostomy	86 (24.0)	6 (21.4)	0.843
Postoperative ICU	192 (53.6)	17 (60.7)	0.240
ICU stay (days)	1.9 (0.0–5.5)	2.6 (0.0–7.5)	0.511
Hospital stay (days)	11.0 (4.1–17.3)	10.8 ± (6.2–20.3)	0.962
Complication			
Anastomotic dehiscence	10 (2.8)	1 (3.6)	0.784
Prolonged ventilation >48 h	5 (1.4)	1 (3.6)	0.354
Multiorgan failure	2 (0.5)	1 (3.6)	0.195
Myocardial infarct	1 (0.3)	1 (3.6)	0.135
Pneumonia	5 (1.4)	–	0.540
Pulmonary embolism	2 (0.5)	–	0.702
Recurrent nerve palsy	3 (0.8)	1 (3.6)	0.252
Re-intubation	6 (1.7)	–	0.501
Wound infection	14 (3.9)	–	0.298
Bleeding >200 ml	3 (0.8)	1 (3.6)	0.252
Subcutaneous emphysema	9 (2.5)	–	0.408
Laryngeal oedema	6 (1.7)	–	0.501
Re-operation during hospital stay	30 (8.4)	2 (7.1)	0.866
Discharge with tracheostomy	29 (8.1)	2 (7.1)	0.904
Hospital mortality	5 (1.4)	2 (7.1)	0.079
Thirty-day mortality	1 (0.3)	–	0.998

ICU: intensive care unit.

The 2nd interesting initiative is the NoAAC [4]. This is an ENT-led approach to connect physicians and surgeons with the aim to develop and exchange information concerning the treatment of adult airway disease. Although the collaboration does not harbour its own database, several important studies have been published by this group based on project-based data sharing agreements between participating centres [11–14]. Despite the vast majority of centres being located in North America, there are also contributors from the UK and Australia. Several, highly cited articles have been published by the NoAAC including a land-mark paper, which for the 1st time benchmarked endoscopic treatments (balloon dilatation, laser enlargements) to surgical options for patients suffering from idiopathic subglottic stenosis. In this large-scale study including >1000 patients, the superiority of a surgical repair over endoscopic attempts has been highlighted [15].

Compared to these 2 existing databases, ESTS-AIR has several advantages: First, it provides a full-scale of surgical airway procedures including benign and malignant indications, paediatric and adult cases, laryngotracheal and carinal reconstructions. Second, one of its emphases is on the functional outcome after surgery. This is of eminent importance, in order to educate patients about the benefits and risks of a surgical approach compared to endoscopic treatment alternative [16–18]. Third, as the database addresses thoracic surgeons, a full-scale of all procedures (not only surgery restricted to the laryngotracheal region) are captured. Forth, by opening the database to all 180 units of thoracic surgery within the ESTS database, research on current

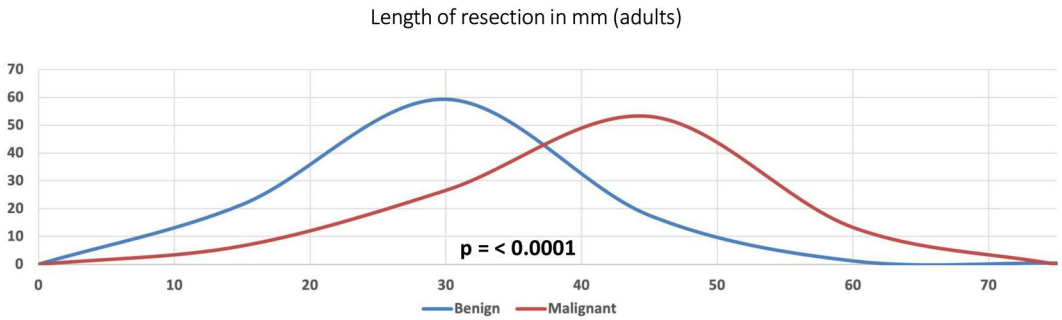


Figure 3: This depicts the resection length of surgery for malignant and benign indications.

practice can be performed that will improve quality of care and future practice guidelines.

In general, the quality of databases is highly dependent on the number of cases, the completeness of data entry, the accuracy of entered data and the validation of collected data. Similar to the general ESTS Registry, a group of mandatory variables defined for each section of the ESTS-AIR Registry. These defined 40 core variables can be used to validate the quality the data collected. In addition, an evaluation of completeness for each variable, for each contributor and for the entire registry, is automatically performed by the system any time a new case is uploaded within the registry. As a consequence, the data quality of the registry is constantly updated. For the current version of ESTS-AIR, a minimum data entry is not defined. Data analysis of ESTS-AIR will be regularly performed by the AIR steering committee in compliance with the ESTS rules for publications (https://www.ests.org/_userfiles/pages/files/ests_rules_for_publications_and_presentations_for_website.pdf). An overview of ESTS-AIR entries including updates of the data dictionary will be performed on an annual basis and published in the ESTS Database Annual Report-Silver Book.

Limitations

This preliminary report of ESTS-AIR has several limitations. First, the analysis is prone to all biases associated with a retrospective database analysis. Although all variables are defined in a supplemental document, it cannot be ruled out that some parameters are miscoded. Second, functional follow-up is not available for every patient, as some of the contributing centres perform a detailed evaluation of voice and swallowing only in patients that receive laryngotracheal resections. Third, due to the fact that cases have only been prospectively collected since 2020, long-term follow-up cannot be provided at the moment. This, however, is especially important for subgroups such as paediatric patients or patients with a malignant indication. Finally, we are aware that the quality of the database has to be periodically evaluated in order to allow meaningful analysis. In a recent analysis, the ESTS database has been shown to be quite robust using an aggregate data quality score analysis [7].

CONCLUSION

In this preliminary study, the ESTS-AIR database allowed a large-scale descriptive analysis of over 400 airway cases. It provides proof for the functionality of ESTS-AIR and sets the basis for rolling out the AIR subsection to all centres participating in the ESTS database.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *EJCTS* online.

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DATA AVAILABILITY

The data underlying this article will be shared on reasonable request to the corresponding author.

Author contributions

Thomas Schweiger: Data curation; Methodology; Supervision; Writing—original draft; Writing—review and editing. **Matthias Evermann:** Data curation; Formal analysis; Writing—review and editing. **Erino Rendina:** Data curation; Writing—original draft; Writing—review and editing. **Giulio Maurizi:** Data curation; Writing—review and editing. **Federico Venuta:** Writing—review and editing. **Clemens Aigner:** Data curation; Writing—review and editing. **Alexis Slama:** Data curation; Writing—review and editing. **Stephane Collaud:** Data curation; Writing—review and editing. **Ad Verhagen:** Conceptualization; Data curation; Writing—review and editing. **Simone Timman:** Data curation; Writing—review and editing. **Benoit Bibas:** Conceptualization; Data curation; Writing—review and editing. **Paulo Cardoso:** Conceptualization; Resources; Writing—review and editing. **Stefano Passani:** Formal analysis; Resources; Software; Validation; Writing—review and editing. **Michele Salati:** Conceptualization; Data curation; Methodology; Validation; Writing—original draft; Writing—review and editing. **Isabelle Opitz:** Conceptualization; Resources; Writing—review and editing. **Zalan Szanto:** Conceptualization; Project administration; Resources; Writing—review and editing. **Konrad Hoetzenecker:** Conceptualization; Formal analysis; Methodology; Supervision; Validation; Writing—original draft; Writing—review and editing.

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