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International Pediatric Otolaryngology Group (IPOG): juvenile-onset recurrent respiratory papillomatosis consensus recommendations

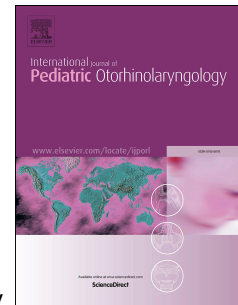
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# Journal Pre-proof

International Pediatric Otolaryngology Group (IPOG): Juvenile-onset recurrent respiratory papillomatosis consensus recommendations

Claire Lawlor, Karthik Balakrishnan, Sergio Bottero, An Boudewyns, Paolo Campisi, John Carter, Alan Cheng, Alejandro Cocciaglia, Alessandro DeAlarcon, Craig Derkay, Pierre Fayoux, Catherine Hart, Christopher Hartnick, Nicolas LeBoulanger, Eric Moreddu, Harlan Muntz, Richard Nicollas, Shazia Peer, Seth Pransky, Reza Rahbar, John Russell, Michael Rutter, Riaz Seedat, Douglas Sidell, Richard Smith, Marlene Soma, Julie Strychowsky, Dana Thompson, Jean-Michel Triglia, Marilena Trozzi, Michelle Wyatt, George Zalzal, Karen B. Zur, Roger Nuss



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## International Pediatric Otolaryngology Group (IPOG): Juvenile-Onset Recurrent

### Respiratory Papillomatosis Consensus Recommendations

Claire Lawlor<sup>a</sup>, Karthik Balakrishnan<sup>b</sup>, Sergio Bottero<sup>c</sup>, An Boudewyns<sup>d</sup>, Paolo Campisi<sup>e</sup>, John Carter<sup>f</sup>, Alan Cheng<sup>g</sup>, Alejandro Cocciaglia<sup>h</sup>, Alessandro DeAlarcon<sup>i</sup>, Craig Derkay<sup>j</sup>, Pierre Fayoux<sup>k</sup>, Catherine Hart<sup>l</sup>, Christopher Hartnick<sup>l</sup>, Nicolas LeBoulanger<sup>m</sup>, Eric Moreddu<sup>n</sup>, Harlan Muntz<sup>o</sup>, Richard Nicollas<sup>n</sup>, Shazia Peer<sup>p</sup>, Seth Pransky<sup>q</sup>, Reza Rahbar<sup>r</sup>, John Russell<sup>s</sup>, Michael Rutter<sup>i</sup>, Riaz Seedat<sup>t</sup>, Douglas Sidell<sup>u</sup>, Richard Smith<sup>v</sup>, Marlene Soma<sup>w</sup>, Julie Strychowsky<sup>x</sup>, Dana Thompson<sup>y</sup>, Jean-Michel Triglia<sup>n</sup>, Marilena Trozzi<sup>c</sup>, Michelle Wyatt<sup>z</sup>, George Zalzal<sup>a</sup>, Karen B. Zur<sup>aa</sup>, Roger Nuss<sup>r</sup>.

<sup>a</sup>Department of Otolaryngology, Children's National Health System, Washington, DC, United States

<sup>b</sup>Department of Otorhinolaryngology, Mayo Clinic, Rochester, MN, United States

<sup>c</sup>Department Pediatric Surgery, Bambino Gesù Pediatric Hospital, Rome, Italy

<sup>d</sup>Department of Otorhinolaryngology, Head and Neck Surgery, Antwerp University Hospital, Edegem, Belgium

<sup>e</sup>Department of Otolaryngology-Head and Neck Surgery, Hospital for Sick Children, University of Toronto, Toronto, Ontario, Canada

<sup>f</sup>Department of Otolaryngology, Ochsner Health System, New Orleans, LA, United States

<sup>g</sup>Department of Pediatric Otolaryngology, The Sydney Children's Hospital Network-Westmead Campus, The University of Sydney, Sydney, NSW, Australia

<sup>h</sup>Servicio de Endoscopia Respiratoria, Hospital de Pediatría Juan P. Garrahan, Ciudad Autónoma de Buenos Aires, Argentina

<sup>i</sup>Division of Pediatric Otolaryngology-Head & Neck Surgery, Cincinnati Children's Hospital Medical Center, University of Cincinnati, Cincinnati, OH, United States

<sup>j</sup>Department of Otolaryngology - Head and Neck Surgery, Eastern Virginia Medical School, Sentara Norfolk General Hospital, Norfolk, VA, United States

<sup>k</sup>Department of Pediatric Otolaryngology-Head Neck Surgery, Jeanne de Flandre Hospital-CHU Lille, Lille, France.

<sup>l</sup>Department of Otolaryngology-Head and Neck Surgery, Massachusetts Eye and Ear Infirmary, Boston, MA, United States

<sup>m</sup>Department of Otorhinolaryngology, Hôpital Universitaire Necker-Enfants Malades, Paris, France

<sup>n</sup>Department of Pediatric Otolaryngology Head and Neck Surgery, La Timone Children's Hospital (Aix-Marseille University), Marseille, France

<sup>o</sup>Division of Otolaryngology - Head and Neck Surgery, University of Utah School of Medicine, Salt Lake City, UT, United States

<sup>p</sup>Department of Otorhinolaryngology, Red Cross War Memorial Children's Hospital, University of Cape Town, Cape Town, South Africa

<sup>q</sup>Pediatric Specialty Partners, San Diego, CA, United States

<sup>r</sup>Department of Otolaryngology & Communication Enhancement, Boston Children's Hospital, Boston, MA, United States

<sup>s</sup>Department of Otorhinolaryngology, Our Lady's Children's Hospital Crumlin, Dublin, Ireland

<sup>t</sup>Department of Otorhinolaryngology, Universitas Academic Hospital, Bloemfontein, South Africa

<sup>u</sup>Department of Otolaryngology-Head and Neck Surgery, Stanford University, Palo Alto, CA, United States

<sup>v</sup>Department of Otolaryngology -Head and Neck Surgery, Carver College of Medicine, University of Iowa Health Care, Iowa City, IA, United States

<sup>w</sup>Department of Paediatric Otolaryngology, Sydney Children's Hospital, Randwick, NSW, Australia

<sup>x</sup>Department of Otolaryngology-Head and Neck Surgery, Children's Hospital at London Health Sciences Centre, Western University, London, Ontario, Canada

<sup>y</sup>Division of Otolaryngology-Head and Neck Surgery, Ann & Robert H. Lurie Children's Hospital of Chicago, and Northwestern Feinberg School of Medicine, Chicago, IL, United States

<sup>z</sup>Great Ormond Street Hospital for Children, London, United Kingdom

<sup>aa</sup>Division of Otolaryngology, Children's Hospital of Philadelphia, Philadelphia, PA, United States

Corresponding Author:  
Claire M. Lawlor, MD  
Department of Otolaryngology  
Children's National Health System  
111 Michigan Ave, NW  
Washington, DC 20003  
USA  
(202)476-3659  
Email: [clairemlawlor@gmail.com](mailto:clairemlawlor@gmail.com)

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# International Pediatric Otolaryngology Group (IPOG): Juvenile-Onset Recurrent Respiratory Papillomatosis Consensus Recommendations

## Abstract:

Objectives: To develop consensus recommendations for the evaluation and management of juvenile-onset recurrent respiratory papillomatosis (JORRP) in pediatric patients.

Methods: Expert opinion by the members of the International Pediatric Otolaryngology Group (IPOG). The mission of the IPOG is to develop expertise-based consensus recommendations for the management of pediatric otolaryngologic disorders with the goal of improving patient care. The consensus recommendations herein represent the first publication by the group.

Results: Consensus recommendations including diagnostic considerations, surgical management, systemic adjuvant therapies, postoperative management, surveillance, and voice evaluation. These recommendations are based on the collective opinion of the IPOG members and are targeted for otolaryngologists, primary care providers, pulmonologists, infectious disease specialists, and any other health care providers that manage patients with JORRP

Conclusions: Pediatric JORRP consensus recommendations are aimed at improving care and outcomes in this patient population.

1. **Objectives:** To present consensus recommendations for the evaluation and management of patients with juvenile-onset recurrent respiratory papillomatosis (RRP).

RRP is the most common benign neoplasm of the larynx in children and the second most common cause of pediatric hoarseness. Human papillomavirus types 6 and 11 have been identified as the cause of the squamous papillomas.<sup>1</sup> Though benign, the disease is not without morbidity. Airway obstruction, recurrent pneumonias, chronic hoarseness, need for repetitive surgery, tracheotomy placement, malignant transformation, and death may occur.<sup>2</sup>

**2. Target population:** Pediatric patients with active juvenile-onset RRP.

**3. Intended users:** Otolaryngologists, primary care providers, pulmonologists, infectious disease specialists, and any other health care providers that manage patients with juvenile-onset RRP.

**4. Methods:** Expert opinion by the members of the International Pediatric Otolaryngology Group (IPOG). The mission of the IPOG is to develop expertise-based consensus recommendations for the management of pediatric otolaryngologic disorders with the goal of improving patient care. A draft of the manuscript was written by the primary authors. The primary authors compiled a survey based on a 5-point Likert scale (almost always (>90%), often (70%), sometimes (50%), rarely (30%), almost never (<10%)). A consensus recommendations was defined as >90% agreement amongst the authors on a survey question. The manuscript draft and the survey were distributed to an international group of pediatric otolaryngologists with an interest in RRP. A brief follow-up survey was distributed based on recommendations of the group. The results of the surveys were used to compile the consensus recommendations in this final publication. All authors completed the survey and approved the manuscript.

5. **Abbreviations:** RRP: recurrent respiratory papillomatosis; HPV: human papilloma virus; FFL: flexible fiberoptic laryngoscopy; CXR: chest X-ray; CT: computed tomography; DLB: direct laryngoscopy and bronchoscopy; PCR: polymerase chain reaction; PD-1: programmed cell death protein 1; SLP: speech language pathologist; RCT: randomized controlled trial.

6. **Disclaimer:** Members of the International Pediatric ORL Group (IPOG) prepared this report. Consensus recommendations are based on the collective opinion of the members of this group. Any person seeking to apply or consult the report is expected to use independent medical judgment in the context of individual patient and institutional circumstances. Finally, the members of our group responded to the survey based on resources available to them in their practice setting, as not all of the diagnostic and treatment modalities mentioned in this document are widely available; readers of this document are advised to do the same.

7. **Recommendations and justifications:** The recommendations are outlined in the following subheadings:

7.1: Diagnostic Considerations

Referral

Urgent Evaluation

Evaluation by Pediatric Otolaryngology

Consultations

7.2: Surgical Management

Anesthetic considerations

Pathologic evaluation

Surgical techniques



Intralesional adjuvant therapies

Tracheotomy

7.3: Systemic Adjuvant Medical Management

7.4: Postoperative Management

7.5: Surveillance

7.6: Voice Evaluation

7.1. Diagnostic Considerations.

7.1.1. Referral: The most common presenting symptoms in juvenile-onset RRP are progressive hoarseness, stridor, and respiratory distress.<sup>3</sup> History and physical examination findings consistent with this triad should prompt referral to a pediatric otolaryngologist. Though chronic hoarseness is sometimes overlooked by parents or discounted by primary care providers, referral to pediatric otolaryngology should be considered to rule out neoplasia. Less commonly, RRP may present with symptoms of asthma/wheezing, chronic cough, recurrent pneumonia, dyspnea, hemoptysis, dysphagia, failure to thrive, and apneic events.<sup>4</sup>

7.1.2. Urgent Evaluation: Consider urgent evaluation by pediatric otolaryngology for children with signs of airway obstruction including worsening stridor, tachypnea, accessory muscle use, cyanosis, or desaturations. This may necessitate sending the patient to the emergency department. Children presenting with signs of progressive airway obstruction, difficulty feeding, failure to thrive, recurrent pneumonias should preferably be referred to a pediatric otolaryngologist (when not available, referral to a Pediatric Surgeon or General Otolaryngologist with Pediatric airway expertise) to exclude RRP (or any other airway pathology).

96

97           7.1.3. Initial Evaluation by Pediatric Otolaryngology: RRP is diagnosed by flexible  
98 laryngoscopy and confirmed by direct laryngoscopy and bronchoscopy with a pathologic evaluation.<sup>5</sup>  
99 An algorithm meant to guide the initial evaluation of a patient with hoarseness, stridor, and/or  
100 respiratory distress is presented in Figure 1. For each diagnostic test, the indications and frequency  
101 of use by the IPOG members is presented in Table 1. The algorithm may vary depending on the  
102 practice setting. Consensus recommendations included the use of FFL as a diagnostic tool in  
103 patients with hoarseness, stridor, and/or respiratory distress (94%), as well as the use of DLB in  
104 patients with clinical signs of RRP or patients without evidence of RRP (100%) on FFL but whose  
105 clinical presentation is concerning for possible tracheal lesions (94%).

106

107           7.1.4. Consultations: Findings on physical examination, CXR and/or CT concerning for  
108 pulmonary involvement of RRP should prompt referral to pulmonary medicine. Patients with  
109 pulmonary RRP may demonstrate intratracheal or intrabronchial lesions, post-obstructive atelectasis,  
110 or solid or cavitated pulmonary nodules on chest radiographs.<sup>6</sup> Helical CT is the imaging modality of  
111 choice for further evaluation of pulmonary RRP and can be considered prior to pulmonary referral.  
112 Providers that practice in high-risk populations may consider evaluation for other infectious diseases  
113 (e.g. human immunodeficiency virus, HIV; tuberculosis, TB) once the diagnosis of RRP is made.  
114 Referral to infectious disease may follow if indicated.

115

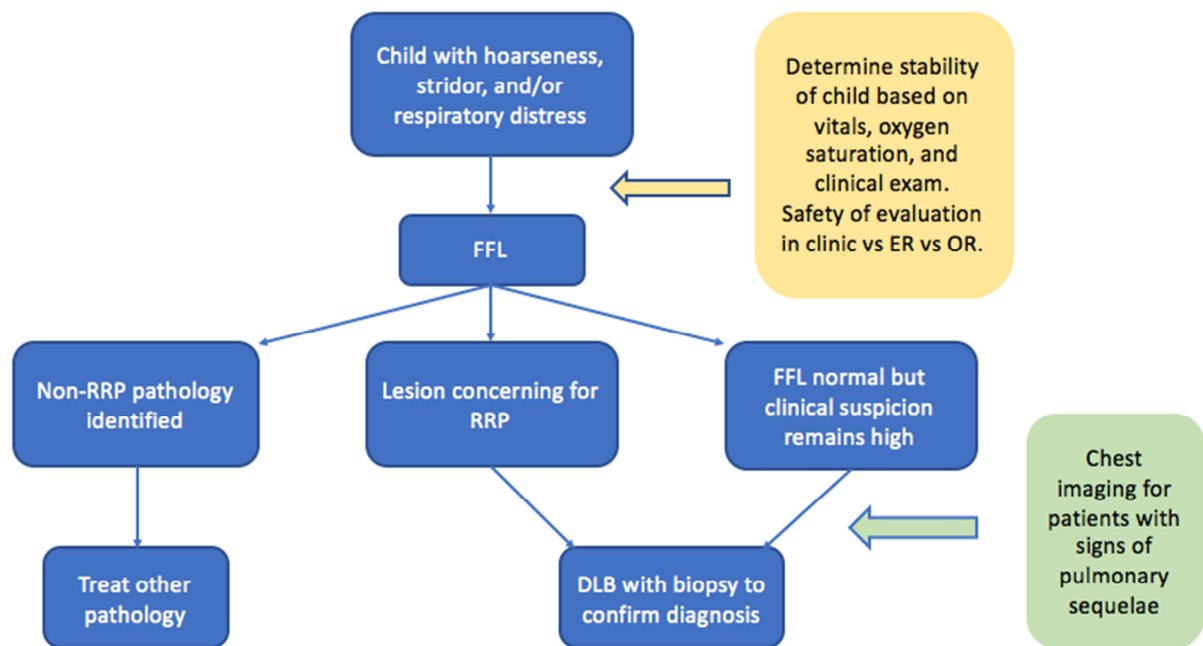


Figure 1. Algorithm for the initial evaluation of a pediatric patient presenting with hoarseness, stridor, and/or respiratory distress.

Table 1. IPOG consensus regarding diagnostic considerations.

Diagnostic Tool	Question	Group Consensus
• FFL	• Performed in patients with hoarseness, stridor, and/or respiratory distress	<ul style="list-style-type: none"> <li>• Almost always (94%)</li> <li>Often (3%)</li> <li>Sometimes (3%)</li> <li>Rarely (0%)</li> <li>Almost never (0%)</li> </ul>
• Chest imaging	• Modality	<ul style="list-style-type: none"> <li>• CXR (0%)</li> <li>CT chest (48%)</li> <li>CXR followed by CT chest if indicated (52%)</li> </ul>
	• Performed in patients with clinical signs of RRP	<ul style="list-style-type: none"> <li>• Almost always (23%)</li> <li>Often (6%)</li> <li>Sometimes (26%)</li> <li>Rarely (23%)</li> <li>Almost never (23%)</li> </ul>
	• Performed in patients with clinical signs of RRP and whose clinical presentation is suggestive of pulmonary sequelae	<ul style="list-style-type: none"> <li>• Almost always (84%)</li> <li>Often (3%)</li> <li>Sometimes (3%)</li> <li>Rarely (3%)</li> <li>Almost never (6%)</li> </ul>

	<ul style="list-style-type: none"> <li>• Performed before initial DLB</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (13%)</li> <li>Often (13%)</li> <li>Sometimes (19%)</li> <li>Rarely (23%)</li> <li>Almost never (32%)</li> </ul>
	<ul style="list-style-type: none"> <li>• Performed after DLB</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (10%)</li> <li>Often (3%)</li> <li>Sometimes (19%)</li> <li>Rarely (19%)</li> <li>Almost never (48%)</li> </ul>
• DLB	<ul style="list-style-type: none"> <li>• Performed in patients with clinical signs of RRP</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (100%)</li> <li>Often (0%)</li> <li>Sometimes (0%)</li> <li>Rarely (0%)</li> <li>Almost never (0%)</li> </ul>
	<ul style="list-style-type: none"> <li>• Performed in patients without evidence of RRP on FFL but whose clinical presentation is concerning for possible tracheal lesions</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (94%)</li> <li>Often (3%)</li> <li>Sometimes (0%)</li> <li>Rarely (0%)</li> <li>Almost never (3%)</li> </ul>
• Disease staging	<ul style="list-style-type: none"> <li>• Use of Derkay Score</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (33%)</li> <li>Often (4%)</li> <li>Sometimes (0%)</li> <li>Rarely (22%)</li> <li>Almost never (41%)</li> </ul>

RRP: recurrent respiratory papillomatosis; FFL: flexible fiberoptic laryngoscopy; CXR: chest X-ray; DLB: direct laryngoscopy and bronchoscopy. Rounding performed on percentages to eliminate decimals.  
 Almost always: >90% agree; Often: 70% agree; Sometimes: 50% agree; Rarely: 30% agree; Almost never: <10% agree.

## 7.2. Surgical Management.

The primary treatment modality for RRP is surgery.<sup>7-9</sup>

7.2.1. Anesthetic Considerations: Depending on the patient's condition, respiratory status, and the experience of the surgeon and the anesthesiologist performing the case, the DLB with removal of RRP may be performed with the patient spontaneously ventilating, with apneic oxygenation, jet ventilation, or with an endotracheal tube in place (standard or laser-safe). In-office procedures have also been described for the treatment of RRP; it is important to consider the age of

the patient when considering these approaches as most in-office therapeutic procedures are not suitable for young children. The operative preferences of IPOG members are detailed in Table 2. Consensus recommendations included support of the use of spontaneous ventilation (94%) and recommended against the use of jet ventilation (94%), laser-safe endotracheal tubes (90%), and in-office under light or no sedation (90%).

7.2.2. Pathologic Evaluation: At the time of the diagnostic DLB, a lesion concerning for RRP should be biopsied and sent for pathologic evaluation. Pathology can distinguish a papilloma from other airway pathology, confirming the diagnosis of RRP. If sufficient specimen is sent for pathology, many institutions will perform DNA analysis by PCR to determine the viral subtype (HPV 6, 11), which may help to predict the aggressiveness of the lesions.<sup>10,11</sup> Pathology should also be used to assess for malignant transformation. Consensus recommendations were to send a specimen to confirm the diagnosis of papilloma (97%).

7.2.3. Surgical Techniques: Direct laryngoscopy and bronchoscopy with the use of suspension, endoscopes, and/or operating microscopes is used to expose the lesions. The papillomas are then removed using cold steel, laryngeal microdebrider, laser, or radiofrequency ablation, depending on the surgeon's preference. The aim of surgery is the removal of pathologic lesions with maximal preservation of anatomic structures. Care should be taken to avoid opposing raw mucosal surfaces, which can lead to web and scar formation.<sup>12,13</sup> The only consensus recommendation that was met recommended against the use of pulsed dye laser (94%). This may reflect the lack of availability of the laser in many institutions, rather than make a statement about the effectiveness of this particular wavelength of laser.

7.2.4. Intralesional Adjuvant Therapies: Several intralesional adjuvant therapies have been described in the treatment of RRP. Cidofovir and bevacizumab are the most frequently used agents although their use is off-label.<sup>7-9,14-16</sup> Cidofovir is a cytosine nucleotide analog that blocks the replication of DNA viruses by inhibiting viral DNA polymerase. The mechanism of action against HPV and RRP is not well understood, but is thought to augment the immune system and/or induce apoptosis. In 2012, a Cochrane review identified a single randomized controlled trial of intralesional cidofovir in RRP that did not demonstrate benefit; however, the dosage administered in this study was substantially lower than typically utilized.<sup>17</sup> Cidofovir is generally well-tolerated but there is a possible association with its use and dysplastic change within RRP lesions, though this evidence is controversial.<sup>18</sup> The use of cidofovir as adjuvant treatment for RRP is off-label. Strict criteria for its use have been published and parents should provide informed consent after full discussion of potential benefits and side effects.<sup>6</sup> Bevacizumab is a recombinant monoclonal humanized antibody that blocks angiogenesis by inhibiting the human vascular endothelial growth factor A (VEGF-A). While there are no RCTs to date, published data have been promising and without significant side effects.<sup>6,9,15</sup> There were no consensus recommendations met regarding intralesional adjuvant therapies.

7.2.5. Tracheotomy: Tracheotomy was one of the first described interventions for RRP and may still be required in RRP patients with obstructive or disseminated disease. There is concern that tracheotomy placement provides an additional site for seeding of RRP lesions and can promote distal spread of the disease.<sup>15</sup> This concern, however, is controversial and not proven. For instance, only patients with the most severe, obstructive cases of papilloma would potentially undergo a tracheostomy. Such aggressive and advanced disease may seed the trachea with or without tracheotomy.

181

182 Table 2. IPOG consensus regarding operative considerations.

Surgical Technique	Question	Group Consensus
• Anesthesia	• Spontaneous ventilation	<ul style="list-style-type: none"> <li>• Almost always (94%)</li> <li>Often (3%)</li> <li>Sometimes (0%)</li> <li>Rarely (0%)</li> <li>Almost never (3%)</li> </ul>
	• Apneic	<ul style="list-style-type: none"> <li>• Almost always (6%)</li> <li>Often (0%)</li> <li>Sometimes (6%)</li> <li>Rarely (19%)</li> <li>Almost never (68%)</li> </ul>
	• Jet ventilation	<ul style="list-style-type: none"> <li>• Almost always (3%)</li> <li>Often (0%)</li> <li>Sometimes (3%)</li> <li>Rarely (0%)</li> <li>Almost never (94%)</li> </ul>
	• Laser-safe endotracheal tube	<ul style="list-style-type: none"> <li>• Almost always (0%)</li> <li>Often (0%)</li> <li>Sometimes (3%)</li> <li>Rarely (6%)</li> <li>Almost never (90%)</li> </ul>
	• In-office, light or no sedation	<ul style="list-style-type: none"> <li>• Almost always (10%)</li> <li>Often (0%)</li> <li>Sometimes (0%)</li> <li>Rarely (0%)</li> <li>Almost never (90%)</li> </ul>
• IV steroids	• Dosed intraoperatively	<ul style="list-style-type: none"> <li>• Almost always (37%)</li> <li>Often (7%)</li> <li>Sometimes (15%)</li> <li>Rarely (0%)</li> <li>Almost never (41%)</li> </ul>
• Pathologic evaluation	• Send a specimen to confirm papilloma	<ul style="list-style-type: none"> <li>• Almost always (97%)</li> <li>Often (0%)</li> <li>Sometimes (3%)</li> <li>Rarely (0%)</li> <li>Almost never (0%)</li> </ul>
	• Send specimen for viral PCR	<ul style="list-style-type: none"> <li>• Almost always (68%)</li> </ul>

		Often (6%) Sometimes (13%) Rarely (3%) Almost never (10%)
	• Send all specimen removed to assess for malignant transformation	• Almost always (35%) Often (6%) Sometimes (13%) Rarely (19%) Almost never (26%)
	• After papilloma confirmed, send only concerning lesions to assess for malignant transformation	• Almost always (68%) Often (0%) Sometimes (19%) Rarely (3%) Almost never (10%)
• Surgical technique	• Cold steel	• Almost always (26%) Often (13%) Sometimes (10%) Rarely (16%) Almost never (35%)
	• Laryngeal microdebrider	• Almost always (65%) Often (36%) Sometimes (3%) Rarely (3%) Almost never (3%)
	• CO2 laser	• Almost always (0%) Often (6%) Sometimes (6%) Rarely (19%) Almost never (68%)
	• Pulsed dye laser	• Almost always (3%) Often (0%) Sometimes (0%) Rarely (3%) Almost never (94%)
	• KTP laser	• Almost always (10%) Often (13%) Sometimes (0%) Rarely (6%) Almost never (71%)

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	• Radiofrequency ablation	• Almost always (11%) Often (7%) Sometimes (4%) Rarely (7%) Almost never (70%)
• Intralesional adjuvant therapies	• Cidofovir	• Almost always (3%) Often (6%) Sometimes (26%) Rarely (16%) Almost never (48%)
	• Bevacizumab	• Almost always (7%) Often (13%) Sometimes (13%) Rarely (10%) Almost never (57%)

IV: intravenous; PCR: polymerase chain reaction; CO2: Carbon dioxide; KTP: potassium-titanyl-phosphate. Rounding performed on percentages to eliminate decimals.

Almost always: >90% agree; Often: 70% agree; Sometimes: 50% agree; Rarely: 30% agree; Almost never: <10% agree.

### 7.3. Systemic Adjuvant Medical Management.

Systemic medical management is available as an adjunct to surgical treatment of RRP.

Bevacizumab, a vascular endothelial factor (VEGF) inhibitor, dosed intravenously has demonstrated benefit in patients with RRP poorly controlled by surgery and other adjuvant regimens. It has shown significant promise in patients with pulmonary disease, leading to improvement or stabilization in disease progression. Use of bevacizumab is still being studied; at the time of this publication, its use in RRP is off-label. Short term side effects were mild.<sup>19-21</sup>

Additional therapies include the quadrivalent HPV recombinant vaccine, interferon, programmed cell death protein 1 (PD-1), celecoxib, indole-3-carbinol, heat shock protein, and systemic antivirals such as ribavirin and acyclovir.<sup>2,14,15,19-21</sup> Other agents have been described less frequently. Additionally, it has been proposed that concomitant gastroesophageal reflux disease (GERD) may be associated with more aggressive RRP, though the evidence is inconclusive. GERD management can be considered in patients with RRP and evidence of GERD.<sup>22</sup> The use of systemic adjuvant medical therapies by members of the IPOG are detailed in Table 3. Consensus

201 recommendations were met recommending against the use of PD-1 (90%), celecoxib (100%), and  
 202 heat shock protein E7 (100%).

203 Table 3. IPOG consensus regarding systemic adjuvant therapies.

Question	Group Consensus
<ul style="list-style-type: none"> <li>• When do you consider systemic adjuvant therapy?</li> </ul>	<ul style="list-style-type: none"> <li>• &gt;4 surgical procedures/year</li> <li>• Almost always (35%)</li> <li>Often (19%)</li> <li>Sometimes (13%)</li> <li>Rarely (16%)</li> <li>Almost never (16%)</li> </ul>
<ul style="list-style-type: none"> <li>• Distal spread of disease</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (55%)</li> <li>Often (16%)</li> <li>Sometimes (13%)</li> <li>Rarely (10%)</li> <li>Almost never (6%)</li> </ul>
<ul style="list-style-type: none"> <li>• Rapid regrowth with airway compromise</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (35%)</li> <li>Often (23%)</li> <li>Sometimes (16%)</li> <li>Rarely (16%)</li> <li>Almost never (10%)</li> </ul>
<ul style="list-style-type: none"> <li>• When your patient needs systemic adjuvant therapy, which have your patients been prescribed?</li> </ul>	<ul style="list-style-type: none"> <li>• Bevacizumab</li> <li>• Almost always (7%)</li> <li>Often (4%)</li> <li>Sometimes (7%)</li> <li>Rarely (33%)</li> <li>Almost never (48%)</li> </ul>
<ul style="list-style-type: none"> <li>• Interferon</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (3%)</li> <li>Often (6%)</li> <li>Sometimes (6%)</li> <li>Rarely (13%)</li> <li>Almost never (71%)</li> </ul>
<ul style="list-style-type: none"> <li>• Quadrivalent HPV recombinant vaccine</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (45%)</li> <li>Often (3%)</li> <li>Sometimes (19%)</li> <li>Rarely (3%)</li> <li>Almost never (29%)</li> </ul>
<ul style="list-style-type: none"> <li>• PD-1</li> </ul>	<ul style="list-style-type: none"> <li>• Almost always (0%)</li> <li>Often (0%)</li> <li>Sometimes (3%)</li> <li>Rarely (6%)</li> </ul>

		Almost never (90%)
	• Celecoxib	<ul style="list-style-type: none"> <li>• Almost always (0%)</li> <li>Often (0%)</li> <li>Sometimes (0%)</li> <li>Rarely (0%)</li> <li>Almost never (100%)</li> </ul>
	• Indol-3-carbinol	<ul style="list-style-type: none"> <li>• Almost always (7%)</li> <li>Often (3%)</li> <li>Sometimes (7%)</li> <li>Rarely (7%)</li> <li>Almost never (77%)</li> </ul>
	• Heat shock protein E7	<ul style="list-style-type: none"> <li>• Almost always (0%)</li> <li>Often (0%)</li> <li>Sometimes (0%)</li> <li>Rarely (0%)</li> <li>Almost never (100%)</li> </ul>
	• Systemic antivirals	<ul style="list-style-type: none"> <li>• Almost always (0%)</li> <li>Often (0%)</li> <li>Sometimes (3%)</li> <li>Rarely (10%)</li> <li>Almost never (87%)</li> </ul>
• Do you refer to other providers for systemic adjuvant therapy?	• Infectious disease	<ul style="list-style-type: none"> <li>• Almost always (22%)</li> <li>Often (16%)</li> <li>Sometimes (3%)</li> <li>Rarely (6%)</li> <li>Almost never (52%)</li> </ul>
	• Immunology	<ul style="list-style-type: none"> <li>• Almost always (3%)</li> <li>Often (10%)</li> <li>Sometimes (13%)</li> <li>Rarely (19%)</li> <li>Almost never (55%)</li> </ul>
• Use of bevacizumab	• For aggressive laryngeal lesions	<ul style="list-style-type: none"> <li>• Almost always (7%)</li> <li>Often (4%)</li> <li>Sometimes (15%)</li> <li>Rarely (41%)</li> <li>Almost never (33%)</li> </ul>
	• For pulmonary lesions	<ul style="list-style-type: none"> <li>• Almost always (41%)</li> <li>Often (0%)</li> </ul>

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		Sometimes (19%) Rarely (19%) Almost never (22%)
• Which patients with RRP do you treat for GERD?	• Every RRP patient	• Almost always (6%) Often (6%) Sometimes (23%) Rarely (29%) Almost never (35%)
	• Only those with clinical signs of GERD	• Almost always (35%) Often (26%) Sometimes (26%) Rarely (0%) Almost never (13%)
	• Only those with proven GERD	• Almost always (53%) Often (13%) Sometimes (13%) Rarely (3%) Almost never (17%)

RRP: recurrent respiratory papillomatosis; HPV: human papilloma virus; PD-1: Programmed cell death protein 1;  
GERD: gastroesophageal reflux disease. Rounding performed on percentages to eliminate decimals.  
Almost always: >90% agree; Often: 70% agree; Sometimes: 50% agree; Rarely: 30% agree; Almost never: <10% agree.

#### 7.4 Postoperative Management.

There is a dearth of evidence regarding postoperative adjuvant treatment for RRP. Depending on the extent of disease and surgery, patients can be managed as outpatients, with brief inpatient observation, or in the ICU. Short courses of GERD therapy and/or antibiotics are sometimes prescribed by surgeons to protect the surgical site from reflux or infection. Voice rest is also recommended by some providers in the postoperative period, though strict voice rest can be very difficult to achieve in the pediatric population. The consensus of the IPOG regarding postoperative management is detailed in Table 4. One author encourages patients to follow a cruciferous vegetable diet. There were no consensus recommendations met regarding postoperative management.

Table 4. IPOG consensus regarding postoperative management in patients with RRP.

Question	Group Consensus	
• Which medications do you treat RRP patients with postoperatively?	• None	• Almost always (23%) Often (10%) Sometimes (6%) Rarely (26%) Almost never (35%)
	• Proton pump inhibitor (PPI)	• Almost always (6%) Often (6%) Sometimes (32%) Rarely (13%) Almost never (42%)
	• Duration	• <1 week (0%) 1-2 weeks (23%) 2-4 weeks (31%) >4 weeks (46%)
	• H2 receptor blocker	• Almost always (3%) Often (0%) Sometimes (10%) Rarely (13%) Almost never (74%)
	• Duration	• <1 week (0%) 1-2 weeks (25%) 2-4 weeks (25%) >4 weeks (50%)
	• Antibiotic	• Almost always (6%) Often (0%) Sometimes (6%) Rarely (6%) Almost never (81%)
	• Duration	• <1 week (67%) 1-2 weeks (33%) 2-4 weeks (0%) >4 weeks (0%)
	• Other	• Oral steroids; inhaled steroids; indol-3-carbinol; acetaminophen (paracetamol); ibuprofen

- |   |  |   |
|---|--|---|
| <ul style="list-style-type: none"> <li>• Do you recommend voice rest for patients after surgery for RRP?</li> </ul> | <ul style="list-style-type: none"> <li>• All RRP patients</li> </ul>                                       | <ul style="list-style-type: none"> <li>• Almost always (3%)</li> <li>Often (17%)</li> <li>Sometimes (17%)</li> <li>Rarely (13%)</li> <li>Almost never (50%)</li> </ul>  |
|   | <ul style="list-style-type: none"> <li>• Only those with severe disease on the true vocal folds</li> </ul> | <ul style="list-style-type: none"> <li>• Almost always (13%)</li> <li>Often (6%)</li> <li>Sometimes (16%)</li> <li>Rarely (13%)</li> <li>Almost never (52%)</li> </ul>  |
|   | <ul style="list-style-type: none"> <li>• Duration</li> </ul>   | <ul style="list-style-type: none"> <li>• 1 day (10%)</li> <li>&lt;1 week (27%)</li> <li>1-2 weeks (17%)</li> <li>&gt;2 weeks (0%)</li> <li>N/A (47%)</li> </ul>         |
| <ul style="list-style-type: none"> <li>• Do you perform a formal voice evaluation on patients with RRP?</li> </ul>  |  | <ul style="list-style-type: none"> <li>• Almost always (19%)</li> <li>Often (19%)</li> <li>Sometimes (26%)</li> <li>Rarely (15%)</li> <li>Almost never (22%)</li> </ul> |
| <ul style="list-style-type: none"> <li>• Do you refer patients with RRP for SLP for voice therapy?</li> </ul>       |  | <ul style="list-style-type: none"> <li>• Almost always (12%)</li> <li>Often (31%)</li> <li>Sometimes (27%)</li> <li>Rarely (12%)</li> <li>Almost never (19%)</li> </ul> |

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RRP: recurrent respiratory papillomatosis; SLP: speech language pathology. Rounding performed on percentages to eliminate decimals.  
 Almost always: >90% agree; Often: 70% agree; Sometimes: 50% agree; Rarely: 30% agree; Almost never: <10% agree.

## 7.5 Surveillance.

RRP is a chronic disease with no known cure. The clinical course may vary from spontaneous regression to rapidly progressive fatal disease. Aggressive disease is generally considered when requiring greater than three to four procedures per year. The most common staging system for RRP, the Derkay score, can be used to assess severity and document the location and size of individual lesions to facilitate endoscopic assessment and surveillance.<sup>23</sup> RRP requires frequent office visits to assess for worsening clinical symptoms. Surveillance endoscopies with

debulking of disease are often scheduled at set intervals, unless the patient condition changes rapidly. Repeat pathologic evaluation may also be indicated for progressive disease and/or new suspicious lesions. The frequency of office visits and surveillance endoscopy should be based on the individual patient's disease severity. Chest imaging may need to be repeated if clinical concern arises, for example, if there are tracheal lesions, or to follow known pulmonary lesions. The surveillance methods of members of the IPOG are detailed in Table 5. There were no consensus recommendations met regarding surveillance of RRP.

Table 5. IPOG consensus regarding surveillance of RRP.

Question		Group Consensus
• When do you perform surveillance DLB?	• At a scheduled interval, eg. 4 months	• Almost always (23%) Often (26%) Sometimes (29%) Rarely (10%) Almost never (13%)
	• When indicated based on clinical findings	• Almost always (62%) Often (20%) Sometimes (16%) Rarely (3%) Almost never (0%)
• When do you repeat biopsies and pathologic evaluation?	• Annually	• Almost always (30%) Often (7%) Sometimes (26%) Rarely (33%) Almost never (4%)
	• Only for suspicious lesions	• Almost always (67%) Often (7%) Sometimes (19%) Rarely (4%) Almost never (4%)
	• Other	• Every 6 months; every 5 years

before age 15 years; parental request; rapid/aggressive growth, spread to trachea or bronchi, prior to adjuvant therapies, refractory respiratory infections

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RRP: recurrent respiratory papillomatosis; DLB: direct laryngoscopy and bronchoscopy. Rounding performed on percentages to eliminate decimals.  
Almost always: >90% agree; Often: 70% agree; Sometimes: 50% agree; Rarely: 30% agree; Almost never: <10% agree.

## 7.6 Voice Evaluation

Many patients with RRP have fluctuating voice quality, varying from mild roughness, strain, hoarseness, and breathiness to near aphonia.<sup>24</sup> Formal voice evaluation may assist in the diagnosis and management of dysphonia in these patients, which can be very debilitating.<sup>25</sup> IPOG members recommend consideration of voice therapy by a speech language pathologist (SLP) with expertise in voice disorders.

**8. Conflict of interest:** Author Alan Cheng worked with Merck Sharpe and Dohme in a previous project looking at vaccination trend for HPV vaccination, however he did not receive any personal financial payments.

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