Treatment of postoperative tracheal granulation tissue with inhaled budesonide in congenital tracheal stenosis

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ABSTRACT

Purpose: Tracheal obstruction by granulation tissue can compromise the postoperative course in congenital tracheal stenosis (CTS). Balloon dilatation and stenting may be required. Budesonide is a corticosteroid with topical anti-inflammatory effects. In 2008, we used inhaled budesonide for treatment of postoperative granulation tissue for the first time in CTS, resulting in significant improvement. The aim of this study was to evaluate the efficacy of inhaled budesonide for treatment of postoperative granulation tissue in CTS.

Methods: Retrospective chart review was conducted. From 2004 through 2011, we performed 39 tracheoplasties. Forced stenting ± balloon dilatation (S/B) was required when airway obstruction with tissue granulation was life-threatening. We compared the requirement for S/B between the early group without budesonide (2004–Nov. 2008, Early) and the late group with budesonide (Dec. 2008–2011, Late). Statistical analysis was performed using Fisher's Exact test.

Results: Eleven of 22 in Early and 8 of 17 in Late were successfully extubated, never having had life-threatening tissue granulation. The remaining patients in each group (11 in Early and 9 in Late) required tracheostomies due to postoperative complications. Ten in Early and 5 in Late with tracheostomies developed granulation tissue. Of these patients, the 10 in Early required S/B, while none of the 5 in Late required S/B (P = .0003). Bronchoscopy demonstrated significant regression of granulation tissue in all cases treated with inhaled budesonide.

Conclusion: Inhaled budesonide is effective for treatment of tracheal granulation tissue in patients with tracheostomies after repair of CTS.

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Congenital tracheal stenosis (CTS) is a relatively rare condition with high mortality rate. Slide tracheoplasty is the procedure of choice, especially for long segment of congenital tracheal stenosis [1]. Postoperative complications include bronchotracheal malacia, recurrent stenosis, and intraluminal tissue granulation [2–4]. These complications can cause life-threatening airway obstruction. The treatment of tissue granulation requires balloon dilatation and stenting [5,6]. Balloon dilatation causes tracheal wall disruption, resulting in a need for long-term stenting [7]. Intraluminal stenting also causes tube-tip granulation, again requiring balloon dilatation or laser ablation and deeper stenting.

Inhaled budesonide is a corticosteroid with topical anti-inflammatory effect widely used as first-line therapy for asthma [8]. In 2008, we used inhaled budesonide for treatment of postoperative granulation for the first time in congenital tracheal stenosis, resulting in a significant improvement. Since then, we have routinely used inhaled budesonide for the treatment of tracheal granulation tissue. The aim of this study was to determine the efficacy of this treatment in preventing a significant cause of postoperative airway obstruction in congenital tracheal stenosis.

1. Materials and methods

With the approval of the Kobe Children's Hospital institutional review board (No.R25-1), retrospective chart reviews were conducted for surgically managed CTS in the period Jan. 2004 through Dec. 2011. A variety of surgical procedures were performed; these included tracheoplasties (standard posterior-anterior slide tracheoplasties and modified right-left slide tracheoplasties) and resection and end-to-end anastomosis. Forced stenting ± balloon dilatation was performed when airway obstruction with tissue granulation was life-threatening. From December 2008, budesonide inhalation suspension (Pulmicort Respules®, AstraZeneca) 0.25 mg twice daily was used as the treatment of first choice for the management of tissue granulation after tracheoplasty. We compared the requirement for stenting, with or without balloon dilatation, between the Early group not receiving budesonide (from 2004 to November 2008) and the Late group with budesonide (December 2008 through 2011). Statistical analysis was...
Table 1

<table>
<thead>
<tr>
<th></th>
<th>Early group (n)</th>
<th>Late group (n)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>22</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Postoperative tracheostomy</td>
<td>11</td>
<td>9</td>
<td>1.00</td>
</tr>
<tr>
<td>Tissue granulation</td>
<td>10</td>
<td>5</td>
<td>0.13</td>
</tr>
<tr>
<td>Requiring stent with or without balloon dilatation</td>
<td>10</td>
<td>0</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

To address this, we initially used systemic or intratracheal steroids in an effort to regress intraluminal granulation. However, the observed efficacy of systemic steroids was limited, and long-term administration caused significant morbidity, such as bony fractures and infections. We subsequently used inhaled budesonide as first line therapy for tracheal tissue granulation after we observed the remarkable efficacy of this treatment in the first case in 2008. In all cases subsequent to 2008, tissue granulation regressed significantly in several days, avoiding forced stenting with balloon dilatation.

Topical budesonide has been reported as an effective treatment for nasal polyps [9] and inflammatory bowel disease [10,11], with the advantage of effective local activity, minimized systemic toxicity, and limited adverse effects [12,13]. Roh et al. [14] reported the efficacy of inhaled budesonide in the treatment of intubation granulomas. Those reports suggested to us that budesonide could be an effective therapy for tissue granulation after tracheal reconstruction in patients with congenital airway stenosis.

The Airway Reconstruction Team at the Hospital for Sick Children, Toronto [15] reported that tracheoplasty patients routinely received 24 hours of postoperative intravenous dexamethasone and inhaled budesonide, and “surprisingly” none developed intraluminal granulations, supporting the efficacy of budesonide for preventing tracheal granulation tissue. Inhaled budesonide could be used as prophylaxis of tracheal granulation in the patients who have postoperative tracheostomy.

In conclusion, our experience suggests that inhaled budesonide can be effective for the treatment of tracheal granulation tissue, and may therefore provide an important option in the management of congenital tracheal stenosis.

3. Discussion

Our study shows the efficacy of inhaled budesonide for the treatment of postoperative tracheal tissue granulation in CTS. Postoperative bronchotracheal malacia and recurrent stenosis may significantly compromise the tracheal lumen and thus patient safety, requiring long-term stenting. Tracheal granulation tissue, usually arising at the tip of the stenting tube, causes life-threatening airway obstruction, which is associated with high mortality rate in congenital tracheal stenosis. We had been treating intraluminal tissue granulation by inserting a stent deeper to bypass the granulation, with or without balloon dilatation, which in turn resulted in repeated and intractable deeper tube-tip granulation.

References


Fig. 1. Child developing postoperative tissue granulation in the late group. Bronchoscopic findings before (A) and after (B) treatment with inhaled budesonide.


**Discussion**

Discussant: Mark Powis (Leeds): Is there an optimal time for giving the budesonide? Do you use it once the granulation tissue has formed or can you use it prophylactically?

Response: Dr Yokoi: Once we feel there is some obstacle at the tip of the tube then we look with bronchoscopy and if we see granulation then we start to use budesonide.

Discussant: Abelbasit Ali (Sudan): Do you have any experience of using budesonide in patients with tracheal stenosis following repair of TOF?

Response: Dr Yokoi: We are now using budesonide for tracheal granulation from all causes for example a tracheostomy for a wheeze in a mentally impaired patient or for sub-glottal stenosis. Once you see tracheal granulation budesonide is very effective.