

# Traumatic Laryngeal Injury in a Nine Year Old Child - The 'Padded Dash' Syndrome Revisited

S. KEEL, J. GOWARDMAN

*Intensive Care Unit, Wellington Hospital, Wellington South, NEW ZEALAND*

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## ABSTRACT

*A case is presented of a 9-year-old girl who sustained a traumatic injury to the larynx following a frontal impact motor vehicle accident. The type of injury sustained was typical of what is now called the 'padded dash' syndrome. On impact the anterior aspect of the neck strikes the car dashboard resulting in the larynx being crushed against the vertebral column. The victim is often unrestrained. The injury was detected only at extubation whereupon severe respiratory distress ensued.*

*Injury to the larynx is uncommon at all ages, even more so in children. In the paediatric age group signs and symptoms may be minimal and a high index of suspicion is required. The diagnosis and management of these injuries with special reference to childhood is discussed. (Critical Care and Resuscitation 2000; 2: 30-33)*

**Key words:** Child, airway, larynx, trauma

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In children, blunt trauma with damage to the laryngotracheal complex is rare. A case is presented of an unrestrained 9-year-old child who sustained traumatic injury to the larynx secondary to a frontal impact motor vehicle accident (MVA). Recognition of this potentially lethal injury was delayed and made only after extubation of the trachea. We discuss diagnosis and management of this injury with a review of the literature pertaining to children.

## CASE REPORT

A 9-year-old girl was an unrestrained front seat passenger in a car, which hit a lamp-post at approximately 50 kph. The accident was witnessed and following the impact, the child removed herself from the car and was able to converse before collapsing. When the ambulance crew arrived she was unresponsive and apnoeic, with a Glasgow coma score of 3. Her trachea was intubated at the scene without difficulty using an uncuffed tube size 6.0 endotracheal tube (ETT). A right-sided pneumothorax was suspected clinically so a 14 French gauge cannula was inserted into the pleura at the second intercostal space, which resulted in an initial release of air. She was treated with 200 mL of 0.9%

saline intravenously, a cervical hard collar was applied and she was transported to the hospital emergency department, remaining haemo-dynamically stable throughout with a pulse of 90 beats per minute and a mean arterial blood pressure of 70 mmHg.

On arrival at hospital, she was opening her eyes spontaneously, attempting to verbalise and withdrawing to pain. On examination, there were superficial lacerations, bruising and swelling around her left eye. The trachea was midline and there was no evidence of trauma to the neck. Subcutaneous emphysema was noted around the cannula in her right chest but extended no further. On auscultation, the heart sounds were normal and air entry was equal in both lungs. Pulse oximetry revealed an oxygen saturation (SpO<sub>2</sub>) of 100% while breathing oxygen at a concentration of 50%. The chest X-ray revealed a small bilateral pneumo-mediastinum but no pneumothorax. Cervical spinal views and pelvic x-rays revealed no fractures, however the antero-posterior cervical spine film demonstrated air located adjacent to the trachea, consistent with pneumo-mediastinum (Figure 1).

Computerised tomography (CT) of the head and abdomen were within normal limits, whereas CT of the

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*Correspondence to:* Dr J. Gowardman, Intensive Care Unit, Wellington Hospital, Private Bag 7902, Wellington South, New Zealand (e-mail: john.gowardman@wnhealth.co.nz)

chest showed an anterior right-sided pneumothorax and confirmed the presence of a pneumomediastinum. Laboratory tests including haemoglobin, electrolytes and urea were within normal limits. She was sedated with morphine and midazolam, and an indwelling urinary catheter and nasogastric tube were inserted. The diagnosis at this stage included a closed head injury and right pneumothorax.



**Figure 1.** Antero-posterior cervical spine radiograph demonstrating (arrows) air adjacent to the trachea

In the intensive care unit, a right-sided 24 French gauge intercostal tube was inserted and she remained mechanically ventilated, with peak airway pressures of less than 25cm H<sub>2</sub>O and requiring an FIO<sub>2</sub> less than 35% to maintain satisfactory arterial oxygenation. Sedation was subsequently discontinued and weaning from the ventilator was rapid and uneventful. Prior to extubation she was obeying commands and was cooperative. She indicated that she had a sore throat (which was attributed to her endotracheal tube) and headache.

Fifteen minutes after extubation she developed inspiratory stridor which was treated with nebulised

1:1000 adrenaline (4 mg), causing it to settle. However, the stridor recurred after 10 minutes and was unresponsive to a further dose of nebulised adrenaline. The SpO<sub>2</sub> decreased to 92% despite 10 L/min of oxygen via a Hudson mask. Her level of consciousness subsequently deteriorated and a decision to reintubate using propofol and suxamethonium to facilitate intubation was made. With pre-oxygenation the SpO<sub>2</sub> increased to 99%.

On initial laryngoscopy the larynx looked abnormal. The epiglottis and vocal cords were clearly seen with a large 'flap' of grey tissue extending beyond the glottis making intubation of the trachea difficult. A diagnosis of laryngotracheal injury was made and further attempts at intubation were abandoned. With the return of muscle power the patient was allowed to breathe spontaneously assisted with an ambubag. The SpO<sub>2</sub> remained at 99%. An emergency call was made to the Ear Nose and Throat service as tracheostomy was anticipated. However, profound arterial desaturation (SpO<sub>2</sub> < 70%) subsequently occurred, and an attempt at translaryngeal intubation was performed using an uncuffed size 5.0 ETT which was passed with some difficulty using a bougie. She was then immediately transferred to the operating theatre for open exploration of her larynx.

At operation a grossly disrupted larynx with bilateral arytenoid dislocation, fractured thyroid cartilages, and partial cricothyroid separation with the glottis displaced inferiorly was found. An open repair of the larynx with a stent and a tracheostomy were performed. The stent was removed at day 26. However, she subsequently developed laryngeal stenosis and currently a tracheostomy remains in place to manage her airway.

## DISCUSSION

Traumatic injury to the larynx and cervical trachea are rare in all age groups, although the true incidence is unknown as some victims die at the scene of the accident. However, the majority of those who present to a medical service will survive.<sup>1,2</sup> Early recognition of laryngeal damage is the key to successful management.<sup>3,4</sup> Blunt trauma to the neck remains the most common cause in all age groups. Motor vehicle accidents are a more frequent cause in adult patients, whereas falls and bicycle accidents are more common in children.<sup>2,4-6</sup> In childhood, the injury is more common at school age with a higher incidence occurring in males.<sup>1,6,7</sup>

The case we present is typical of the 'padded dash' syndrome which was first described in 1968.<sup>8</sup> In the majority of cases this is due to a frontal impact MVA where the victim who is usually unrestrained, is thrown forward onto the windscreen. During impact the victim's head is forced back, the neck is hyperextended (in a typical 'whiplash' pattern), the exposed larynx hits the

edge of the dashboard and is crushed against the cervical spine. As the car dashboard edge is usually blunt, lacerations and external signs of injury are often not seen, although laryngeal disruption can be severe. Other classic injury patterns, particularly in children, include the 'clothesline' injury where the victim hits a cable or wire suspended at neck height, and the 'handlebar' injury where the victim falls off a pushbike and strikes the anterior neck against the handlebar.<sup>9</sup>

In diagnosing the disorder the history is important which includes the mechanism of injury, change of voice and respiratory status.<sup>7</sup> These features provide the medical attendant with important clues to enable an early diagnosis. In our case, the upper airway integrity was initially preserved but the glottis subsequently dislocated, obstructing the patient's airway causing respiratory arrest. As the glottis was mobile at differing times an improved view via laryngoscopy was possible thus accounting for the ease of intubation at the scene with a greater difficulty later in seemingly more expert hands. Other important symptoms and signs are listed in Table 1,<sup>10</sup> the most important of these being subcutaneous emphysema and signs that signal airway compromise including dyspnoea and stridor. In the child, external signs of trauma may be absent or trivial, and a patient with an endotracheal tube already inserted should not be assumed to have a normal airway<sup>11,12</sup> (as illustrated graphically by our case).

**Table 1. Symptoms and signs of laryngeal or cervical tracheal injury**

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Pain over the anterior neck  
 Shortness of breath  
 Stridor  
 Inability to tolerate supine position  
 Inability to tolerate head extension  
 Hoarse, weak or absent voice  
 Haemoptysis  
 Bruising, lacerations or haematoma over the neck  
 Subcutaneous emphysema

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Plain X-rays are not helpful in visualising the laryngeal cartilages, but can provide information about the position of the airway and oesophagus, and may also reveal a pneumomediastinum, suggesting a breach of either the central airway or oesophagus (Table 2).<sup>13</sup> Elevation of the hyoid bone on lateral cervical spine x-ray is a particularly important sign, as it indicates airway transection.<sup>14</sup>

In a stable patient, if laryngeal injury is suspected, direct fiberoptic laryngoscopy is often advocated as the initial investigation. This is usually followed by

panendoscopy (i.e. oesophagoscopy, laryngoscopy and bronchoscopy) in theatre, with or without a prior CT scan.<sup>1,15</sup> Computerised tomography scanning is the imaging modality of choice although some would reserve it for those in whom it is unclear whether or not a surgical repair is required. Others consider it useful to demonstrate the anatomical derangement and advocate it in all suspected cases.<sup>7,16</sup>

**Table 2. Radiological signs of laryngeal or cervical tracheal injury.**

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Subcutaneous emphysema  
 Air tracking into the soft tissues of the neck around the trachea  
 Loss of tracheal air column  
 Hyoid bone elevation (transection of the airway)  
 Pneumomediastinum  
 Pneumothorax  
 Cervical spine injury

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The majority of children have low-grade injuries and conservative management with humidified oxygen, antibiotics, and observation is often all that is required. Steroids and anti-reflux medication may also have a role.<sup>4</sup> Children need to be kept calm and disturbing procedures should be kept to a minimum. With a breached airway, crying can entrain more air into the subcutaneous tissues and the mediastinum, further compromising ventilation.<sup>17</sup> In a patient who has multiple injuries, definitive investigation and treatment of the laryngeal injury may have to wait until other urgent investigations or surgery are complete. Notwithstanding, prior to establishment of a definitive airway, all personnel and equipment required to secure an airway urgently should always be present.

In the patient with a compromised airway, tracheotomy under local anaesthetic is advocated in most adult series.<sup>1,18</sup> The literature relating to children however is less definite. In a Medline review from 1966 to 1999, we found 127 cases of blunt laryngeal or cervical tracheal trauma in children (i.e. 18 years old or younger). In approximately 50% of these cases, after the diagnosis had been made, the patients were treated conservatively with no further airway intervention being required. Immediate airway management was reported in 63 children.<sup>2,5-7,9,10,19,20</sup> Translaryngeal intubations were successful in securing the airway in 70% and would appear to be indicated before tracheostomy in all patients in whom airway compromise is imminent. In those in whom intubation is unsuccessful, surgical access to the trachea will need to be performed using

either cricothyrotomy<sup>20</sup>, (although this is generally contraindicated in the child<sup>15,21</sup>) or tracheotomy (rather than a formal tracheostomy) through a vertical incision, which may be 'done quickly, efficiently and with minimal risk to surrounding structures'.<sup>15</sup> More innovative techniques have also been described including guiding of the ETT into position under neck exploration and the siting of a tracheostomy with the aid of a rigid bronchoscope.<sup>6,22</sup>

Older children may be able to tolerate procedures such as tracheotomy performed under local anaesthetic, but younger children will usually require general anaesthesia. An inhalational induction similar to that used in epiglottitis is advocated.<sup>23</sup> Overall children tend to do well in the long term in relation to voice and airway patency but this will depend on extent of injury and whether the injury was detected and treated at an early or late phase.<sup>4</sup>

In conclusion, injuries to the larynx are rare. They can present with symptoms and signs which are subtle, and may appear trivial, however they can be life threatening. In the context of blunt trauma especially with other significant injuries laryngeal damage may be missed or detected late. The mechanism of injury may provide diagnostic clues. Management of these patients requires specialist input early, with better outcomes reported in patients in whom injuries were detected and treated early rather than late.

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