NON-INFLAMMATORY LARYNGEAL STRIDOR IN INFANTS

BY

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'Congenital laryngeal stridor' is merely a clinical description, and although perhaps 90% of stridors in young babies are due to an exaggerated pattern of infantile larynx, which rectifies itself with increasing age, it is not safe to assume that this is the cause of the stridor. There are other conditions causing laryngeal stridor in young babies, sometimes from birth, which are graver than the exaggerated pattern of congenital larynx as suggested by Schwartz in 1944. The larynx has a folded epiglottis so that its posterior edges with the anterior attachment of the ary-epiglottic folds are close together. These folds are lax. The whole epiglottis is apt to lean back over the entrance to the larynx. On inspiration the soft larynx collapses because of the negative pressure within it, and the epiglottis falls farther back and the now even more lax ary-epiglottic folds fall towards each other and vibrate, causing the crowing noise. On expiration the stream of air of increased pressure blows open the larynx and blows apart the ary-epiglottic folds so that expiration is easy and noiseless. These babies often have micrognathia, and the effect of the small mandibular arch is to force the tongue backwards, causing laxness of the pharyngo-epiglottic folds, and allowing the epiglottis to remain folded and fall back over the larynx. When the tongue is hooked forward by the finger the crowing inspiration often ceases. As the child grows the epiglottis becomes less folded, and the ary-epiglottic folds lie farther apart; the laryngeal cartilages become firmer so that they do not tend to collapse from the negative pressure of inspiration, and the mandible improves in shape.

Inspiratory arytenoid prolapse is suggested as the name for another type of congenital laryngeal stridor which the baby outgrows. The inspiratory noise is much coarser and often louder than the crowing of typical inspiratory laryngeal collapse, and in some cases notes the noise is described as a rattle. In these babies it is found that the ary-epiglottic folds are lax, but the epiglottis is not folded so that they are not abnormally close together. But the arytenoids are prominent and have usually a flap of soft tissue on top of them, and during inspiration they prolapse, with a sliding forward movement, into the glottic opening, and vibrate with their flaps causing a rattle. I have seen a number of such babies and on one occasion removed the soft tissue flaps immediately curing the stridor.

These abnormalities are illustrated in Fig. 2.

Inspiratory laryngeal collapse of infants is the best name for 'congenital laryngeal stridor' due to an exaggerated infantile type of larynx as suggested by Schwartz in 1944. The larynx has a folded epiglottis so that its posterior edges with the anterior attachment of the ary-epiglottic folds are close together. These folds are lax. The whole epiglottis is apt to lean back over the entrance to the larynx. On inspiration the soft larynx collapses because of the negative pressure within it, and the epiglottis falls farther back and the now even more lax ary-epiglottic folds fall towards each other and vibrate, causing the crowing noise. On expiration the stream of air of increased pressure blows open the larynx and blows apart the ary-epiglottic folds so that expiration is easy and noiseless. These babies often have micrognathia, and the effect of the small mandibular arch is to force the tongue backwards, causing laxness of the pharyngo-epiglottic folds, and allowing the epiglottis to remain folded and fall back over the larynx. When the tongue is hooked forward by the finger the crowing inspiration often ceases. As the child grows the epiglottis becomes less folded, and the ary-epiglottic folds lie farther apart; the laryngeal cartilages become firmer so that they do not tend to collapse from the negative pressure of inspiration, and the mandible improves in shape.

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These abnormalities are illustrated in Fig. 2.
In the last three or four years I have come across eight babies whose stridor has not been due to these developmental abnormalities which disappear as the baby grows older, but to localized conditions open to surgical remedy, and if not so treated likely to be fatal. Four of the babies each had a cyst in or close to the larynx, two a haemangioma in the lower part of the larynx, one a cleft larynx and one a foreign body in the larynx. As a result of these experiences, I believe it is advisable to examine the larynx of all babies with laryngeal stridor. There may be circumstances in which the services of expert laryngologists and anaesthetists are not available. Then it might be wiser and safer to observe the infant with stridor over a period of weeks or months, provided the signs and symptoms conform to the well known pattern of inspiratory laryngeal collapse and there is a tendency to improvement, with no attacks of cyanosis or dyspnoea.

**INSPIRATORY LARYNGEAL COLLAPSE**

Expiration  
Inspiration

**INSPIRATORY ARYTMENOID PROLAPSE**

Expiration  
Inspiration

**Cysts Causing Stridor**

Fig. 3 is a drawing showing the position of these cysts, two in the ary-epiglottic fold, one derived from the ventricle of the larynx and one lying on the back of the tongue and causing obstruction of the laryngeal aperture.
Ary-epiglottic Fold Cysts.—One was in a boy who had difficulty in breathing from birth and was nursed in an oxygen tent for stridor and cyanosis. He had to have tracheotomy at 14 days old at his local hospital, and at 3 weeks old the surgeon there could see that the right ary-epiglottic fold was thick. At 2 months old I could see that there was a cyst in the fold and aspirated clear fluid from it. I removed a piece of the cyst then and upon two subsequent occasions. It was lined with pseudo-stratified columnar ciliated epithelium. At 4 months old there was a reasonably good aperture to the larynx, the tracheotomy tube was removed and the baby went home. After two months at home he developed laryngo-tracheitis with spasm and a tracheotomy was made and he returned to my ward. The trachea above the tracheotomy collapsed, and although he had a good laryngeal aperture after the laryngitis settled, it took 18 months and the same number of operations, including splitting the upper trachea open with a wire bridge, before he could breathe without the tube. At 4½ years he was strong and well with a good voice.

The other ary-epiglottic cyst was also in a boy, aged 2 months, who was admitted to my ward at the request of Dr. George Newns. He had had stridor since birth, causing indrawing of the ribs, and increasing progressively. Feeding had become more and more difficult. He developed an upper respiratory infection five days before admission (there were colds in the family), and his difficulty in breathing had become worse in these days. The diagnosis on admission was inspiratory laryngeal collapse, with superadded laryngitis, but the physician suspected that there might be another abnormality of the larynx. The baby was given oxygen and aureomycin, and his condition was maintained. Four days later laryngoscopy was performed under general anaesthesia, and a rounded cyst was seen occluding the anterior half of the laryngeal opening, superficial to the cords. Its origin could not be determined, but as much as possible of the cyst was seized in biting forceps and removed. The bleeding was not great, and breathing was immediately easier. The blood was sucked out repeatedly during the next few hours while the baby lay in the theatre with all hands standing by. He settled into quiet respiration, and thereafter made uneventful progress, taking his feeds well. He left hospital in a week, and the larynx was examined a month later. It was normal but for a small

![Diagram of ary-epiglottic fold cysts](https://example.com/diagram.png)

**Fig. 3.**—Cysts causing laryngeal stridor in infants.
raised pink scar at the junction of the right ary-epiglottic fold with the epiglottis. Section showed the cyst to be lined with flattened respiratory columnar epithelium, and covered with squamous epithelium, presumably derived from that of the epiglottis. This ary-epiglottic fold cyst had been removed, fortunately and almost completely, at one operation without tracheotomy. The baby enjoyed great advantages over others who had to overcome the dangers of tracheotomy with collapse of the upper trachea and many operations and a prolonged stay in hospital.

In a following paragraph the troubles of tracheotomy in very young babies are discussed.

Cyst Derived from the Laryngeal Vestibule.—This type of cyst was in a baby girl 1 year old under the care of my colleague Mr. Henry Sharp. She was in hospital with pylorospasm, and was found to have laryngeal stridor which rapidly became worse, so that after two weeks tracheotomy was necessary. A large thin-walled cyst was found to rise up from the side of the larynx and overlap its entrance. Thin grey fluid was aspirated and a large part of the cyst wall removed; it was lined with stratified squamous epithelium. Thereafter the aperture of the larynx looked adequate, but the baby could not be brought to breathe through it because the trachea above the tracheotomy tube collapsed. She died a few weeks later during an operative procedure.

These three cysts are representative of the usual type of cyst found in the infant larynx. Ahlén and Ranström (1944) report one and refer to 20 others, and Holinger and Steinmann (1947) report two. With the three described here there are 26 laryngeal cysts in the infant on record, and 17 died. Theoretically they were all open to surgical cure.

Thyro-glossal Duct Cyst.—This cyst was not in the larynx itself, but on the back of the tongue and compressed the larynx causing stridor. It also caused difficulty in feeding and it was for this reason that the baby girl of 6 weeks came into hospital. The physician looking after her, Dr. Wilfrid Sheldon, put his finger in her mouth and remarked that there was not enough room low down in the pharynx for her to swallow easily, and he thought that there must be a cyst there. I saw a large thin-walled cyst, and aspirated some fluid which digested starch. A large piece of cyst wall was removed and section showed it to be lined with stratified squamous epithelium with a few acini of salivary glands in the connective tissue. It was thought to be the dilated upper end of the thyro-glossal duct. After the operation the baby made rapid progress, with easy feeding and no stridor.

Haemangioma Causing Stridor

Both of the patients with haemangioma were boys who developed inspiratory stridor at about 3 months of age. The one who died had attended a hospital where a diagnosis of 'congenital laryngeal stridor' had been made, and the mother told that 'he had a small larynx and would grow out of his trouble.' But he did not. He got worse, and when Dr. P. R. Evans saw the baby he noted that the stridor did not improve when he pulled the tongue for-ward, and that there were several haemangiomata on the skin, and wrote in his out-patient notes: 'there might be a laryngeal angioma or something of that sort.' On laryngoscopy and bronchoscopy a rounded swelling was seen protruding from a broad base on the posterior wall of the larynx about a quarter of an inch below the vocal cords. The airway was narrow but had proved to be adequate so far. Impressed with the difficulties I had experienced with the other similar baby, I decided to treat this haemangioma by x rays and the child went back to the medical ward. He died 36 hours later. Figs. 4, 5 and 6 show this tumour.

The other baby boy came to us at 4½ months from another hospital for investigation, having had inspiratory
stridor and attacks of pallor since he was 3 months old. The laryngoscope and bronchoscope showed a rounded swelling on the posterior wall of the larynx about half an inch below the vocal cords. A tracheotomy was made and a fortnight later the larynx was split by laryngo-fissure operation and the rounded tumour, which was faintly blue, was cut out. The larynx was sewn up and the baby recovered from the operation quickly. Section of the tumour showed it to be a capillary haemangioma with very few formed vessels. It was not possible to get the baby to breathe through the larynx, because yet again the trachea above the tracheotomy collapsed. In addition, three months later, the angioma became evident again. He was given two treatments by deep x ray at four months' interval, but it was not until he was 15 months old that we were able to get him to breathe through the larynx. He has been very well for the last year, and a recent examination showed only a small pale raised scar, with a good airway.

Suehs and Herbut (1940) describe one and refer to seven other examples of haemangioma in the infant larynx, and Ferguson (1944) records one. With these two added there are 11, of whom five recovered.

Cleft Larynx Causing Stridor

The cleft larynx baby was a member of a family of five children, the first four of whom were described by Finlay (1949). Three of her sisters died in the same sort of way as she did, at about 3 or 4 months old, from ulcerative tracheitis or infection of the lungs. I examined the larynx of this baby girl when she was 3 months old and in hospital under Dr. George Newns for inspiratory stridor and feeding difficulty. I did not notice the cleft between the arytenoids. It seemed to me to be a larynx of the 'inspiratory laryngeal collapse' type. But at necropsy Dr. M. Bodian found a cleft between the arytenoids. Finlay had noticed a cleft in one of the sisters and it seems that the two others who died probably also had clefts.

I believe Dr. Bodian has found two other examples of what he calls 'cleft larynx' apart from the members of this family. Now that one is aware that such a condition exists, a careful inspection of that part of the larynx on laryngoscopy should, sooner or later, enable a diagnosis to be made during life. Then perhaps oesophageal feeds will prevent the fatal consequences of food getting into the lungs, and a baby may reach a size when surgical repair of the cleft is possible.

Foreign Body causing Stridor

My last example of non-inflammatory laryngeal stridor is a very obvious one, after the event. But this baby boy of 11 months had a cold for a few days, developed sudden stridor and difficulty in breathing, and was taken to a London teaching hospital where a diagnosis of laryngo-tracheo-bronchitis was made. There was not a cot for him so he was transferred to The Hospital for Sick Children with that diagnosis, which set our admission officer off on the wrong foot. An accurate history might have corrected the error, but the parents were Italian with very little English, and our admission officer English with very little Italian. Laryngoscopy of this baby with very severe respiratory difficulty and laryngeal stridor, in the early hours of the morning, revealed a large piece of bone jammed between the vocal cords, and there was a rapid recovery after it was removed. The necropsy was not upon the child, but upon the history of his illness, when it was elicited that the attack of respiratory difficulty had
come on suddenly when the baby was drinking soup—Italian soup with bone in it.

These examples are from the writer’s own experience in the last few years, but they do not cover all the causes of laryngeal stridor in infants. For instance, a considerable number of cases of webs in the infant larynx have been described.

**Tracheostomy in Young Infants**

Tracheostomy tubes had to be kept in position in two of the babies here described for a year and a half before they could be removed although the original cause of the laryngeal obstruction, which had necessitated the tracheostomy, had been overcome in the first few months. A third baby died during an operative procedure to overcome tracheal obstruction following tracheostomy.

The trachea of an infant up to a few months old collapses above a tracheostomy if the tube is kept in for more than a few days. This seems to be due to loss of strength of the trachea after one or two of its soft rings have been divided, and to the negative pressure in the larynx and upper trachea which is present during inspiration (Fig. 1). This negative pressure is less above the tracheostomy than below, but the tracheostomy tube props open the lower trachea. The collapse of the upper trachea prevents the baby from resuming normal breathing even when the larynx itself has a good lumen. In two of the babies described here, numerous operations, and various modifications of tracheostomy tube, including varieties with a tube passing up as well as down, failed to hold the collapsed upper trachea open. The passage of time and growth of the child eventually succeeded where all our efforts had failed. The trachea enlarges and the rings become firmer. There is also a very important mental element. The baby finds it easy to breathe through the tracheostomy tube, and seems to lose the natural ability or inclination to breathe through the larynx. When he is about a year and a half old it is possible to educate him to breathe through the larynx again by taking out the tube for short periods, and blocking the tracheostomy with the finger. At this stage it may be possible to dispense with the tube, with the tracheostomy closed, for hours or days at a time if the baby is put in an oxygen tent, whereas in ordinary air he becomes cyanosed. The lesson that has been learnt from all this is that a tracheostomy tube should only remain in a young baby for a very few days if at all possible. For instance a tracheostomy should not be made and at a subsequent date the obstruction in the larynx removed. Both should be done at the same time. It is better still to remove the laryngeal abnormality without a tracheostomy. The last of the ary-epiglottic cysts displays the enormous advantages to the baby if this can be done. He was only a week in hospital, and had only one operation compared with 18 months in hospital and a similar number of operations suffered by the other ary-epiglottic cyst case which had a tracheostomy. The one operation of the fortunate baby required great skill and experience on the part of the anaesthetist at least. A general anaesthetic is necessary to examine or operate on an infant’s larynx, and this baby with laryngeal obstruction and cyanosis came straight out of an oxygen tent to the theatre. The operation was followed by some anxious moments during the recovery period when the baby lay in the theatre with everyone in attendance. He left hospital in a week and when seen a month later was in every respect a normal baby.

**Summary**

‘Congenital laryngeal stridor’ is a clinical description and should not be used to denote the specific entity of inspiratory laryngeal collapse of infants. This condition is described, and also another developmental abnormality the baby outgrows, which the writer calls inspiratory artenoid prolapse.

Case records are given of eight babies with laryngeal stridor due to localized conditions in the larynx open to surgical treatment, and if not so treated likely to prove fatal. Four of the babies had a cyst, two a haemangioma, one a cleft larynx and one a foreign body.

The literature reveals a high mortality in similar cases.

The larynx of a baby with stridor should be inspected to establish the cause.

The difficulties and dangers of tracheostomy in young infants are discussed.

**References**


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