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TITLE: Lung lobe torsion in adult and juvenile pugs

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**TITLE OF CASE**

Lung lobe torsion in adult and juvenile pugs.

**SUMMARY**

This cases series of thirteen pugs with lung lobe torsion (LLT) is the largest case series of pugs in the literature and the first to compare dogs presenting before and after 12 months of age. Similar to previous case series the median age of pugs with LLT was 17 months, however 6 dogs were under 12 months of age (3/13 were 11-13 weeks at presentation). There were no differences between the dogs that presented younger or older than 12 months old with respect to sex, neuter status, lung lobe affected, duration and nature of clinical signs, time alive after discharge and complications. The juvenile onset may suggest that some dogs are inherently at risk of LLT. This is intriguing and important as lung lobe torsion may not be an intuitive diagnosis in a juvenile brachycephalic animal and practitioners should be aware of this unusual presentation.

**BACKGROUND**

Lung lobe torsion (LLT) is an uncommon condition in dogs with only three clinical case series<sup>1,2</sup>, (one focussing on the juvenile presentation)<sup>3</sup> and occasional case reports in the literature. Previous studies identified that deep chested dogs and in particular Afghan hounds are overrepresented.<sup>1</sup> However, LLT can also occur in small breed dogs with male pugs being overrepresented.<sup>2-4</sup> Right middle lobe torsion is more common in large breed dogs and left cranial lobe torsion is more common in small breed dogs.<sup>1 3 5-7</sup> The aetiology of LLT is poorly understood but it can be associated with respiratory disease, trauma, thoracic surgery, neoplasia and chylothorax.<sup>1 2 4 8</sup> Chylothorax and respiratory disease could be a cause or consequence of LLT. Single case reports describe possible aetiologies such as bronchial cartilage dysplasia in a five month old Chow Chow.<sup>9</sup> however an underlying cause is often not identified. It is also unclear why certain breeds, such as pugs, seem to be predisposed.

The majority of pugs with LLT described in the literature are young adults with a median age of 1.5 years (range 4.5 months to 4 years).<sup>2</sup> A recent case series of seven juvenile dogs (<12 months old) included five male pugs.<sup>3</sup> One report has described a pug with a LLT seen at seven weeks of age.<sup>10</sup>

We have recently noticed an apparent increase in the number of pugs suffering LLT at less than 1 year of age. Our aim was to describe a case series of pugs with LLT and to compare the presentation, the affected lung lobe, the outcome and complications between dogs presenting younger and older than 12 months of age. The fact that juvenile dogs are suffering LLT could have potentially important implications for our understanding of the pathophysiology of the condition. It is also important to highlight this more extreme presentation of juvenile pugs with LLT.

#### **CASE PRESENTATION**

Thirteen pugs were surgically treated for LLT at two referral hospitals between January 2009 and June 2015. The age ranged from 11 weeks to 7.25 years (median 17 months), with three of these dogs aged 11-13 weeks old. Six dogs started showing clinical signs before 12 months of age with a median age of 14.5 weeks (range 11 weeks to 11 months). The remaining seven dogs had a median onset of clinical signs at 22 months (range 17 months to five years).

The age of onset, sex, neuter status, lung lobe affected, clinical signs, time from hospital discharge and future respiratory disease are summarised in Table 1.

Case number	Age at onset of signs	Sex and neuter status	Lung lobe affected	Duration of clinical signs prior to presentation at referral centre (days)
<i>Dogs affected with clinical sign</i>				
1	11 weeks	FE	Right cranial	0.5
2	13 weeks	ME	Left cranial	7
3	13 weeks	FE	Right cranial	2
4	4 months	ME	Left cranial	1
5	8 months	ME	Left cranial	5
6	11 months	MN	Left cranial	3
<i>Dogs affected with clinical sign</i>				
7	17 months	ME	Left cranial	3
8	19 months	ME	Left cranial	4

## INVESTIGATIONS

Thoracic computed tomography (CT) was performed in 10/13 dogs and thoracic radiography was performed in 3/13 dogs. Computed tomography revealed a vesicular pattern (9), pleural effusion (8), prematurely tapered lobar bronchus (8), enlarged lung lobe (5) and consolidated lung lobe (4). Thoracic radiographs identified a consolidated lung lobe and moderate pleural effusion in all three dogs. Eight dogs had torsion of the left cranial lung lobe and five dogs had a torsion of the right cranial lung lobe including 2 dogs aged 11 and 13 weeks. There was no difference between the lung lobe affected for dogs presenting younger or older than 12 months old.

## **TREATMENT**

Lateral thoracotomy at the 5th intercostal space was performed in 12/13 dogs on the ipsilateral side to the LLT. A median sternotomy was performed in one dog to allow further management of concurrent pyothorax. No other abnormalities were reported at surgery in any other pugs. The affected lung lobe was removed in all dogs. Lung lobectomy was performed with a stapling device in nine dogs and with suture ligation in three. Suture ligation was performed in 2 dogs  $\leq$  13 weeks old and the one case with a concurrent pyothorax which was 19 months old.

Pulmonary histopathology was performed in 11/13 dogs. Findings were consistent with LLT and infarction in all cases and included necrosis (11), haemorrhage (9) and granulation tissue (6). One biopsy had evidence of acute inflammation however pulmonary tissue culture was negative.

## **OUTCOME AND FOLLOW-UP**

One dog (13 weeks old) suffered cardiopulmonary arrest intra-operatively due to an unknown cause and resuscitation attempts were unsuccessful. All other dogs underwent surgery without complications. Eleven out of twelve dogs were managed with a post-operative thoracostomy tube for 12-72 hours (median 19 hours). Hospitalisation period ranged from 3-8 days (median 5 days). Twelve dogs survived to be discharged from the hospital. Eleven dogs were known to be alive at the time of writing with a median time from discharge of 15 months (range 1 week to 33 months). Two dogs had respiratory signs post-operatively (19 and 20 months old); one was diagnosed with aspiration pneumonia four months post-operatively which was managed medically and resolved. One dog had a staphylectomy and rhinoplasty seven months post-operatively due to brachycephalic obstructive airway syndrome.

## **DISCUSSION**

We report a case series of lung lobe torsion in pugs, including six that were less than 12 months of age at the start of their disease process. Similar to previous case series the overall median age of pugs with LLT was 17 months.<sup>2</sup> However, six dogs were less than 12 months of age at the onset of clinical signs and three of these dogs were between 11-13 weeks old. The juvenile presentation

of lung lobe torsion in pugs has been highlighted recently<sup>3</sup> and our case series gives more evidence that juvenile pugs can suffer LLT more frequently than previously reported. This is important as lung lobe torsion may not be an intuitive diagnosis in a juvenile brachycephalic animal and practitioners should be aware of this unusual presentation. This case series highlights a potentially unexplored area of research into an aetiology of juvenile LLT in pugs. Due to the absence of perinatal mortality reported with LLT a congenital defect is considered unlikely.

Our case series also highlights there were no differences between the dogs that presented younger than 12 months of age with respect to the sex, neuter status, lung lobe affected, duration and nature of clinical signs, time alive after discharge and future respiratory disease. The small number of dogs in this case series may have prohibited finding any significant differences between the two groups.

In the human paediatric literature there are nine reports of LLT in infants (aged between two days to 13 years). Reported aetiologies include trauma, previous thoracic surgery, haemothorax, pneumothorax and pulmonary anatomical abnormalities. Three out of four paediatric cases aged  $\leq$  2 months old had anatomical abnormalities (the other case was traumatic in origin). Anatomical abnormalities included a complete interlobar fissure, the absence of any parenchymal bridges between contiguous lobes and an absent inferior pulmonary ligament.<sup>11 12</sup> Due to the aetiologies proposed in the paediatric literature critical evaluation of the pulmonary parenchyma particularly in juvenile dogs is warranted.

In previous studies reporting LLT in pugs the majority had torsion of the left cranial lobe with only 2/14 dogs having torsion of the right cranial lung lobe (although one dog with left cranial torsion subsequently developed a right cranial torsion).<sup>2 4 5 7 8 10</sup> Whilst the left cranial lung lobe was more commonly affected in the current study (8/13), a significant proportion of dogs (5/13 – 38.5%) had torsion of the right cranial lobe. This highlights the fact that pugs can suffer torsion of the right cranial lobe as well as the left.

The prognosis of pugs with LLT was good; 12/13 dogs survived to discharge and 11/13 dogs were alive at the time of writing (range one week to 33 months) this is similar to previous studies.<sup>2 3</sup>

There is one previous case report of recurrence of spontaneous LLT in a pug more than two years after the initial presentation<sup>8</sup>, however recurrence was not documented in the current study. Long term follow up was not achieved in all dogs and therefore the survival time and future respiratory disease are likely to be underestimated.

#### **LEARNING POINTS/TAKE HOME MESSAGES**

- Pugs can present with lung lobe torsion at a very young age (11-13 weeks old).
- There are no obvious differences in sex, neuter status, lung lobe affected, duration and nature of clinical signs, time alive after discharge and complications when comparing the dogs that presented younger and older than 12 months of age.
- Although the left cranial lung lobe was the most commonly affected nearly 40% of pugs had torsion of the right cranial lung lobe.
- The outcome of pugs with lung lobe torsion managed with lung lobectomy is good.

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**FIGURE/VIDEO CAPTIONS**